TRANSMOUNTAIN

Trans Mountain Expansion Project

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VIA ELECTRONIC SUBMISSION

September 4, 2014

National Energy Board
517 – 10th Avenue SW
Calgary, Alberta T2P 0A8

To: Ms. Sheri Young, Secretary National Energy Board

Dear Ms. Young:

Re: Trans Mountain Pipeline ULC
Trans Mountain Expansion Project Application
Hearing Order OH-001-2014
Technical Update #3

Trans Mountain Pipeline ULC (Trans Mountain) hereby submits Technical Update #3 for the Trans Mountain Expansion Project (the Project), which contains additional information Trans Mountain committed to filing with the National Energy Board (NEB) in response to NEB and intervenor information requests (IR) and intervenor IR motions. A concordance table identifying which commitments have been met with Technical Update #3 is provided in the Overview section.

Yours truly,

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TRANS MOUNTAIN EXPANSION PROJECT TECHNICAL UPDATE #3 OVERVIEW

Introduction

Trans Mountain's Technical Update #3 contains additional information that Trans Mountain committed to filing with the National Energy Board in replies to various Information Requests (IRs), and in response to Intervenor motions on Trans Mountain's responses to Intervenor IR #1.

In the response to NEB IR 2.039 (Filing ID A3Z4T9), Trans Mountain committed to meeting with Environment Canada in July or August 2014 to discuss potential development of a long-term marine bird monitoring program and provide an update prior to September 4, 2014. To date, Trans Mountain has been unable to secure a meeting with Environment Canada staff to discuss a marine bird monitoring program and is therefore, unable to provide an update. Trans Mountain will continue to pursue these discussions and will provide an update to the National Energy Board once the meeting is held.

The following table provides a cross-reference of how Trans Mountain has met certain commitments to provide additional information in Technical Update #3.

TECHNICAL UPDATE #3 COMMITMENT CONCORDANCE TABLE

Reference	Commitment	Where Addressed in Technical Update #2
NEB 2.112e (Filing ID A3Z4T9)	• Trans Mountain to submit to NEB on August 22, 2014, an engineering assessment of the existing operating TMPL segments to demonstrate they are suitable for operation under the new hydraulic profiles, flow and pressure regimes of the proposed Line 1 resulting from the completion of TMEP.	Part 1, Section 1.2
CPAWS IR No. 1.2.3.3 (Filing ID A3X5X8)	• Trans Mountain's Stage 2 BC Parks Boundary Adjustment application will be posted online at www.transmountain.com and will be available for public comment for a period agreed to in conjunction with BC Parks.	Part 4
City of Vancouver IR No.1.06.01f (Filing ID A3Y2G6);	• A response to this request will be filed in August 2014. (IR: Please describe for each of the —handfulll of hazards identified the nature, size, and scope of the intervention.)	Part 5
NEB IR No. 2.001a (Filing ID A3Z4T9)	• Trans Mountain will file in August 2014 the requested list and copies of existing legal instruments Trans Mountain is seeking to amend or revoke, and the Project components applicable to each.	Part 6
NEB IR No. 2.001b (Filing ID A3Z4T9)	• Trans Mountain will file in August 2014 the requested list and copies of existing legal instruments that would remain in force and applicable to Lines 1 or 2 that Trans Mountain is not seeking to amend or revoke.	Part 6
NEB IR No. 1.80 (Filing ID A3W9H9)	• During the detailed engineering and design phase, Trans Mountain will develop a horizontal direction drill specification and provide it to the NEB by September 30, 2014.	Part 7
NEB IR No. 2.101e (Filing ID A3Z4T9)	• A master watercourse crossing table will be created by combining the Fish Habitat list and the Hydrology list to ensure that all watercourses have been captured and accounted for and submitted as part of Technical Update No. 2 on August 22, 2014.	Part 8

PART 1:

TRANSFER OF ACTIVE PIPE SEGMENTS TO LINE 2 SERVICE
NPS 36 HINTON TO HARGREAVES AND
NPS 30 DARFIELD TO BLACK PINES:
ENGINEERING ASSESSMENT

ACTIVE TMPL NPS 24 AND NPS 30 SEGMENTS TO BE
INCORPORATED INTO TMEP LINE 1 SERVICE:
ENGINEERING ASSESSMENT

TMEP Engineering Assessment - Transfer of Active Pipe Segments to Line 2 Service
NPS 36 Hinton to Hargreaves and NPS 30 Darfield to Black Pines

Trans Mountain Expansion Project

Transfer of Active Pipe Segments to Line 2 Service
NPS 36 Hinton to Hargreaves and NPS 30 Darfield to Black Pines

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Engineering Assessment

August, 2014

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1.0 EXECUTIVE SUMMARY

To meet increasing demand from customers Trans Mountain has proposed twinning the Trans Mountain Pipeline (TMPL), which runs from Edmonton to Burnaby. Upon completion of this project, the existing NPS 24 line, which currently handles batches ranging from refined product to heavy crude, will be designated as Line 1 and will be used to transport lighter crude oil and crude oil products. The larger diameter NPS 36/30 line will be designated as Line 2 and will primarily transport heavy products. The majority of this Line 2 will be newly constructed pipeline with the exception of two existing pipeline segments: the NPS 36 Hinton to Hargreaves, and the NPS 30 Darfield to Black Pines. Collectively, the above elements of the pipeline expansion project are known as the Trans Mountain Expansion Project (TMEP).

Kinder Morgan Canada (KMC) completed this Engineering Assessment (EA) to demonstrate that the NPS 36 pipeline segment between Hinton, AB and Hargreaves, BC, and the NPS 30 pipeline segment between Darfield, BC and Black Pines, BC are fit for service and can continue to operate safely in Line 2 service within the specified flow rates provided throughTMEP.

The engineering assessment (EA) was prepared in accordance with section 10.3.7 of CSA Z662-11 “Oil and Gas Pipeline Systems” and is composed of the following:

- Review of pipeline design, materials, construction and operation specifications;
- Review of integrity management and maintenance records; and
- Fitness for Service (FFS) assessments of corrosion, cracking, and mechanical damage.

Key conclusions from the engineering assessment indicate that the pipe segments being transferred to Line 2 heavy crude service are safe to operate under the proposed operating pressures and volumes proposed by the project. This conclusion is based on the following:

- The pipeline segments have a historically safe record, with no recent in-service failures and no hydrostatic test failures.
- The segments have been consistently monitored through regular ILI tool runs and will continue to be monitored for the life of the pipeline.
- The Integrity Management Program has been effective at maintaining the pipeline in a condition to operate up to the licensed maximum operating pressure (MOP).
- The factor of safety for the remaining metal loss features ranges from 1.41 to 3.83 relative to the licensed MOP and 1.88 to 59.71 relative to the proposed operating profile.
- The factor of safety for the remaining crack-like features in the Darfield to Black Pines section of line ranges from 1.28 to 2.18 relative to the licensed MOP and 3.21 to 6.46 relative to the proposed operating profile.
- KMC has a comprehensive program for third party damage prevention and continues to monitor third party damage through the use of its damage prevention programs and in-line inspection.

2.0 PROJECT INFORMATION

2.1 Project Background

The Trans Mountain Expansion Project (TMEP) includes the proposed looping of the existing Trans Mountain Pipeline (TMPL) system with the exception of the Hinton to Hargreaves and the Darfield to Black Pines pipeline segments. The expanded TMPL system will consist of two independently operated pipelines from Edmonton Terminal to Burnaby Terminal. The “Line 1” pipeline will consist of NPS 24 and NPS 30 pipeline segments that are currently part of the existing TMPL system and will include two reactivated NPS 24 pipeline segments. The “Line 2” pipeline will consist of 987 km of new NPS 36 pipeline and two NPS 30 and NPS 36 pipeline segments that are currently part of the existing TMPL system.

The 1,147 km Line 1 pipeline will consist of:

- the existing 229 km of NPS 24 and 89 km of NPS 30 pipeline segments from Edmonton to Hinton;
- a reactivated 150 km of NPS 24 pipeline segment from Hinton to Hargreaves;
- the existing 273 km of NPS 24 pipeline segment from Hargreaves to Darfield;
- a reactivated 43 km of NPS 24 pipeline segment from Darfield to Black Pines; and
- the existing 325 km of NPS 24 and 38 km of NPS 30 pipeline segments from Black Pines to the Burnaby Terminal.

The 1,180 km Line 2 pipeline will consist of:

- approximately 339 km of new NPS 36 pipeline from Edmonton to Hinton;
- the existing 150 km of NPS 36 pipeline segment from Hinton to Hargreaves (built in 2008);
- approximately 279 km of new NPS 36 pipeline from Hargreaves to Darfield;
- the existing 43 km of NPS 30 pipeline segment from Darfield to Black Pines (built in 1957); and
- approximately 368 km of new NPS 36 pipeline from Black Pines to the Burnaby Terminal.

The expanded Line 1 pipeline will be capable of transporting an annual average of 55,640 m^3/d (350,000 bbl/d) and will provide a batched transportation service for refined products and light crude oils. Line 1 will also be capable of transporting heavy crude oil at a reduced rate.

The new Line 2 pipeline will be capable of transporting an annual average 85,850 m^3/d (540,000 bbl/d) of heavy crude oils and will be capable of transporting light crude oils, if necessary.

Construction on the NPS 36 Hinton to Hargreaves section of line, referred to as the “Anchor Loop”, was completed in 2008, and has been in continuous service since that time. The NPS 30

Darfield to Black Pines line was built in 1957. In 1984, flow was rerouted through the existing NPS 24 line (constructed in 1953) and the NPS 30 line between Darfield and Black Pines was deactivated. In 2004, as part of the Capacity Upgrade Project, the NPS 30 line was reactivated and the NPS 24 line was deactivated.

The focus of this engineering assessment is to verify that the NPS 36 Hinton to Hargreaves and NPS 30 Darfield to Black Pines pipeline segments will be safe to operate under the hydraulic profile and throughputs associated with the Line 2 service. Engineering assessments for the reactivation of the NPS 24 line segments for Line 1 service are addressed in a separate report.

2.2 Engineering Assessment

This Engineering Assessment (EA) was prepared in accordance with section 10.3.7 of CSA Z662-11 "Oil and Gas Pipeline Systems" and is composed of the following:

- Review of pipeline design, materials, construction, and operation specifications;
- Review of integrity management and maintenance records; and
- Fitness for Service (FFS) assessments of corrosion, cracking, and mechanical damage.

The review of basic pipeline specifications included the design, materials, construction, testing of the line segments, and the conditions under which these lines segments are operated and the properties of the transported fluids. The FFS assessments were based on the following integrity management records:

- Metal loss inspections conducted in 2011 and 2012 for Darfield to Black Pines and 2013 for Hinton to Hargreaves pipeline segments;
- Cathodic Protection Annual Test Lead Survey conducted in 2012 for both line segments;
- Crack inspections conducted in 2013 for Darfield to Black Pines segment; and
- Third Party Damage Prevention Programs implemented for both pipeline segments.

3.0 PIPELINE RECORDS

This section includes the specifications and properties for the pipeline segments that will be transferred to Line 2 between Hinton to Hargreaves and Darfield to Black Pines. Operating information is also provided for current operations and planned operations. Further operations and maintenance information is also provided regarding hydrostatic tests, leaks, and in-line inspection (ILI) history.

3.1 Pipeline Specifications

Table 3.1 provides the pipe properties for both the Hinton to Hargreaves and Darfield to Black Pines pipeline segments. The information summary was extracted from KMC's system data records on pipe material properties.

Table 3.1 Pipeline Specifications

Pipeline Segment	Hinton to Hargreaves	Darfield to Black Pines
Diameter	NPS 36 (914 mm)	NPS 30 (762 mm)

Wall Thickness, length and percentage	11.8 mm – 111.21 km (73%) 12. 7 mm – 0.01 km (<1%) 13.1 mm – 37.38 km (25%) 14.3 mm – 2.22 km (1%) 20.8 mm – 0.61 km (<1%)	7.92 mm – 12.81 km (29%) 8.74 mm – 2.84 km (6%) 9.52 mm – 10.66 km (24%) 11.13 mm – 17.47 km (40%) 12.7 mm – 0.29 km (1%)
Grade	API 5L X70 (483 MPa)	API 5L X52 (359 MPa)
Construction Date	2008	1957 (deactived in 1984, reactivated in 2004)
Weld Type	Long Seam - DSAW	Long Seam - DSAW
Manufacturer	Nippon	Kaiser
Pipe Length	~150 km	~44 km
Coating	ARO-30 – 35.95 km (24%) ARO-40 – 2.14 km (1%) FBE – 112.87 km (75%) Protal 7250 – 0.45 km (<1%)	Coal Tar – 44.07 km (100%)
Range of MOP	9,930 kPa to 10,875 kPa	3660 kPa to 8,233 kPa

3.2 Operating Information

TMPL currently operates as a batched system transporting a wide range of products from light to heavy petroleum blends. As part of the Trans Mountain Expansion Project the Hinton to Hargreaves and Darfield to Black Pines pipeline segments will be incorporated into Line 2 service and will transport heavy petroleum blends, with the ability to transport lighter crude oils. Table 3.2 compare product properties and operating condition ranges for current operations versus proposed service.

Table 3.2 Operating Conditions and Crude Properties Comparison

Operating Mode	Current (TMPL)	Proposed (TMEP Line 2)
Flow Rate	1,250 m^3/hr – 2,770 m^3/hr	3,765 m^3/hr
Density	680 kg/m^3 – 940 kg/m^3	680 kg/m^3 - 940 kg/m^3
Temperature	0°C – 38°C	0°C – 38°C
Viscosity @ 15C	1 cSt – 350 cSt	1 cSt – 350 cSt

Note that the flow rate specified by Table 3.2 for the proposed Line 2 service is the maximum limit of the flow rate range. Trans Mountain is still investigating the location of control valves which will determine the minimum flow rate across the pipeline system.

3.2.1 Historical Operating Pressures

In accordance with NEB IR No. 2.134c, the historical operating pressures vs time are included below for the pipeline segments that are moving to Line 2 service including:

- Daily maximum pressures for the last 90 days;
- Daily maximum pressures for the last year;
- Monthly maximum pressures for the last three years; and,
- Monthly maximum pressures since the operation started.

3.2.1.1 Daily Maximum Pressures for the Last 90 Days

Operating data has been provided in chart form in Figure 3.1 and Figure 3.2. The data was gathered from the TMPL SCADA system between April 8, 2014 and July 7, 2014 (the date the NEB information request was processed).

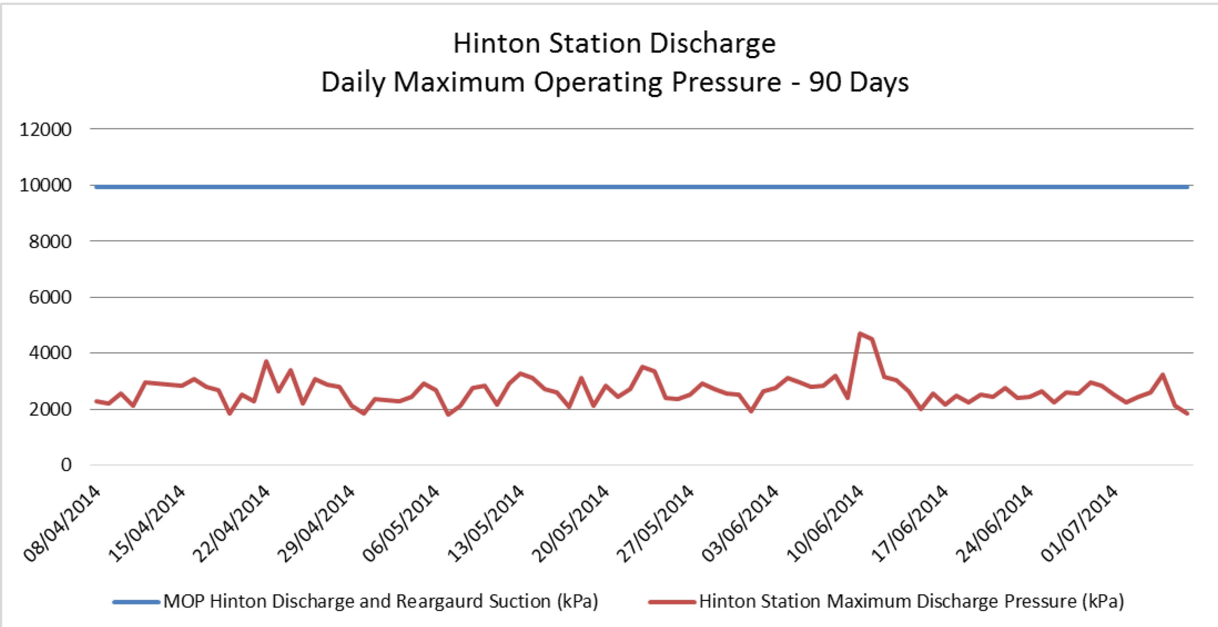


Figure 3.1 Hinton Station Discharge – Daily Maximum Pressure – 90 Days

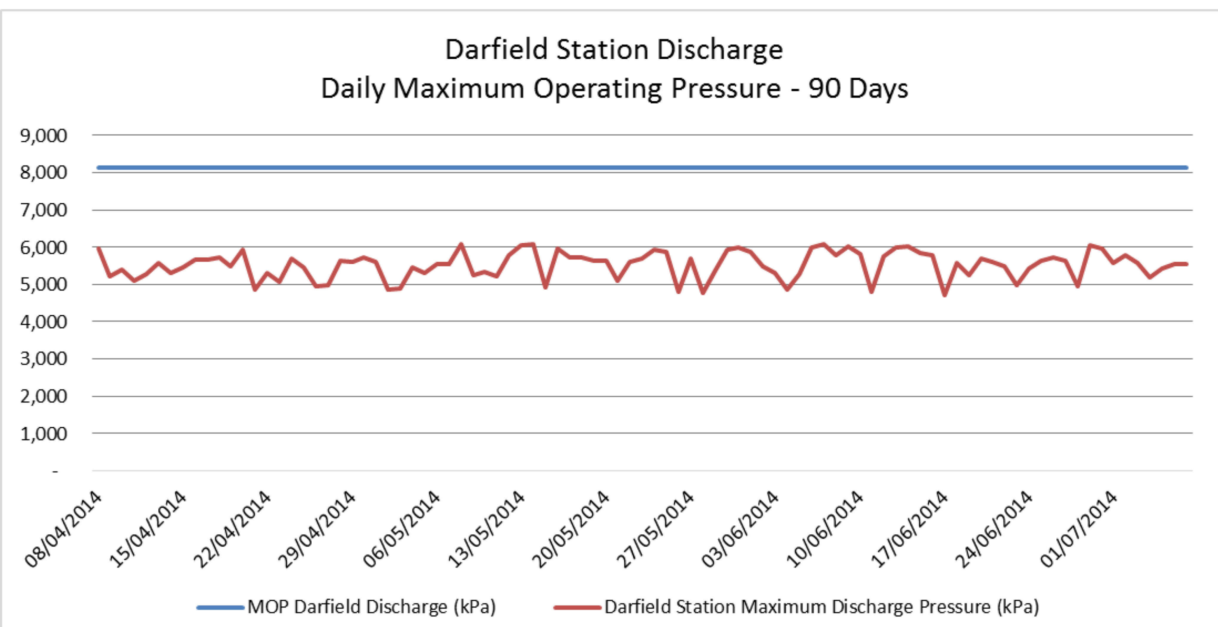


Figure 3.2 Darfield Station Discharge – Daily Maximum Pressure – 90 Days

3.2.1.2 Daily Maximum Pressures for the Last Year

Operating data has been provided in chart form in Figure 3.3 and Figure 3.4. The data was gathered from the TMPL SCADA system between July 7, 2013 and July 7, 2014 (the date the NEB information request was processed).

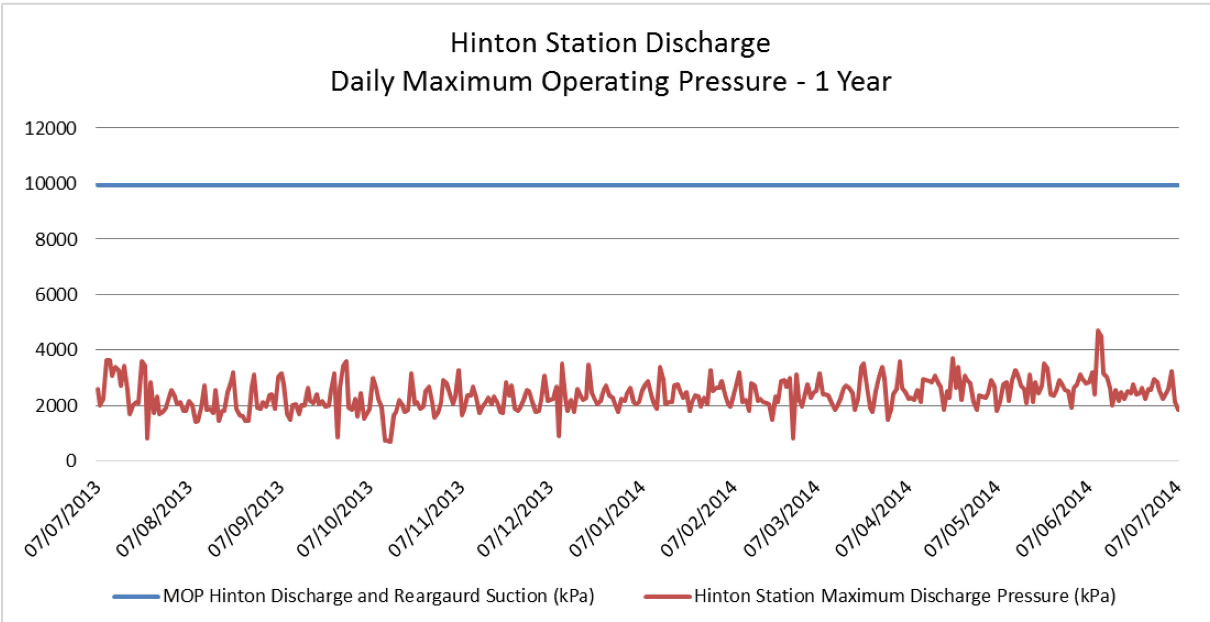


Figure 3.3 Hinton Station Discharge – Daily Maximum Pressure – 12 Months

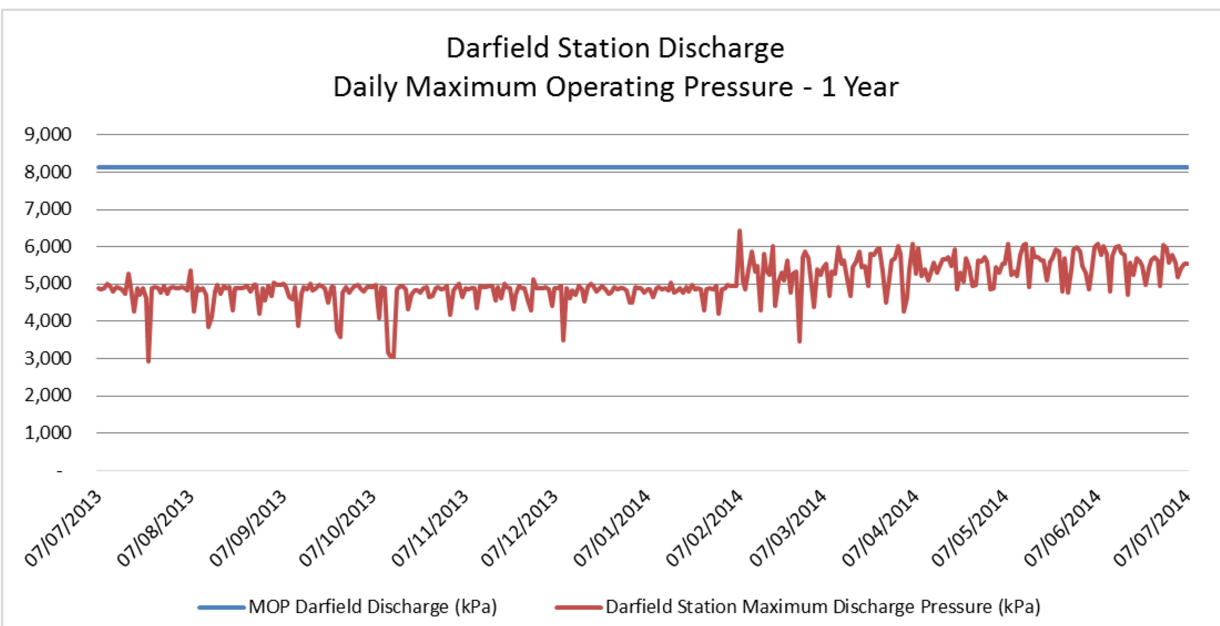


Figure 3.4 Darfield Station Discharge – Daily Maximum Pressure – 12 Months

3.2.1.3 Monthly Maximum Pressure for the Last 3 Years

Operating data has been provided in chart form in Figure 3.5 and Figure 3.6. The data was gathered from the TMPL SCADA system between July 2011 and July 2014 (the date the NEB information request was processed).

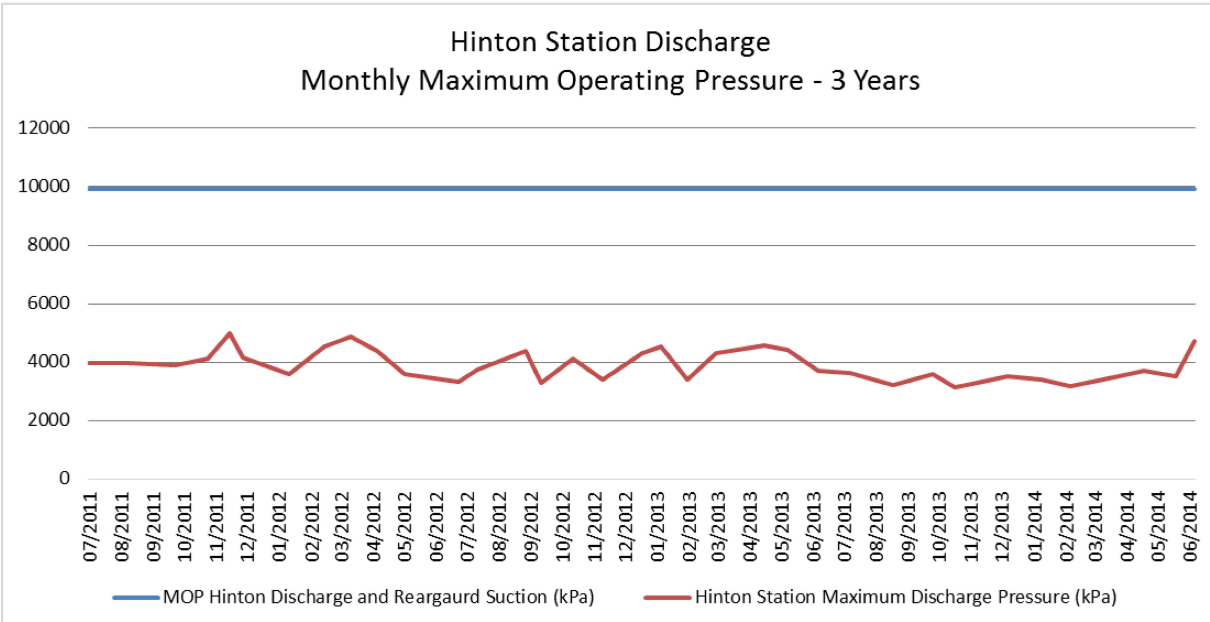


Figure 3.5 Hinton Station Discharge – Monthly Maximum Pressure – 3 Years

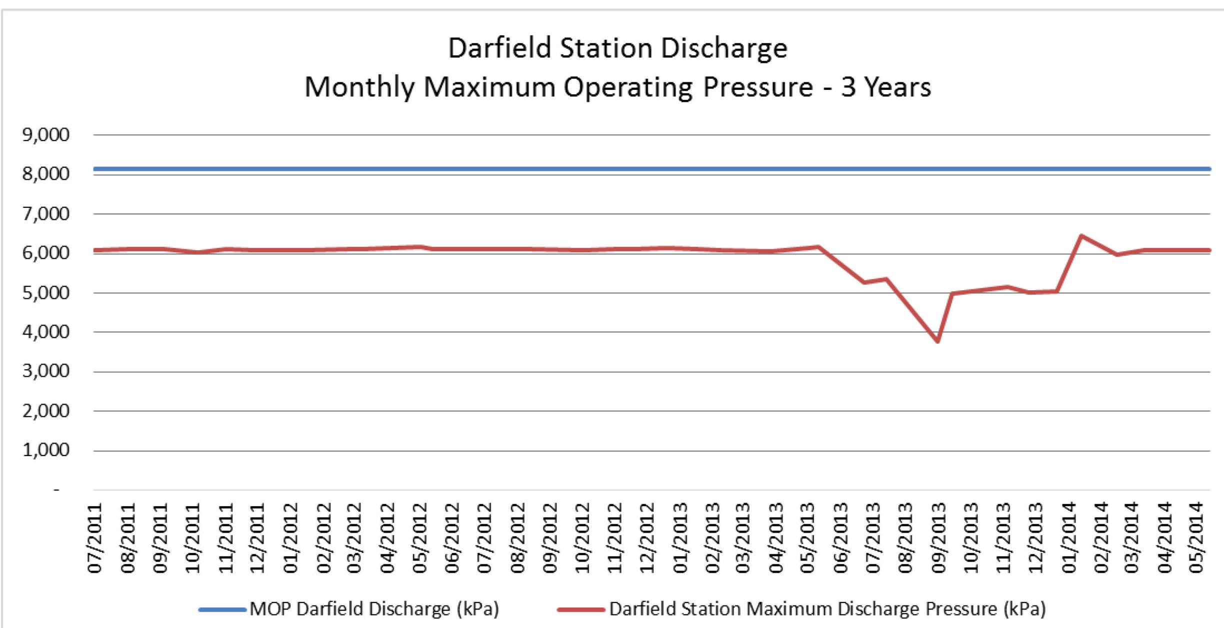


Figure 3.6 Darfield Station Discharge – Monthly Maximum Pressure – 3 Years

3.2.1.4 Monthly Maximum Operating Pressure – Historical

Operating data has been provided in chart form in Figure 3.7 and Figure 3.8. The NEB requested the monthly maximum pressures since the beginning of operation; however, operating pressure on the TMPL system is only retained for approximately 5 years. As a result, maximum monthly pressure for the Hinton pipeline segment is only available from November 2008 and for the Darfield pipeline segment from September 2009.

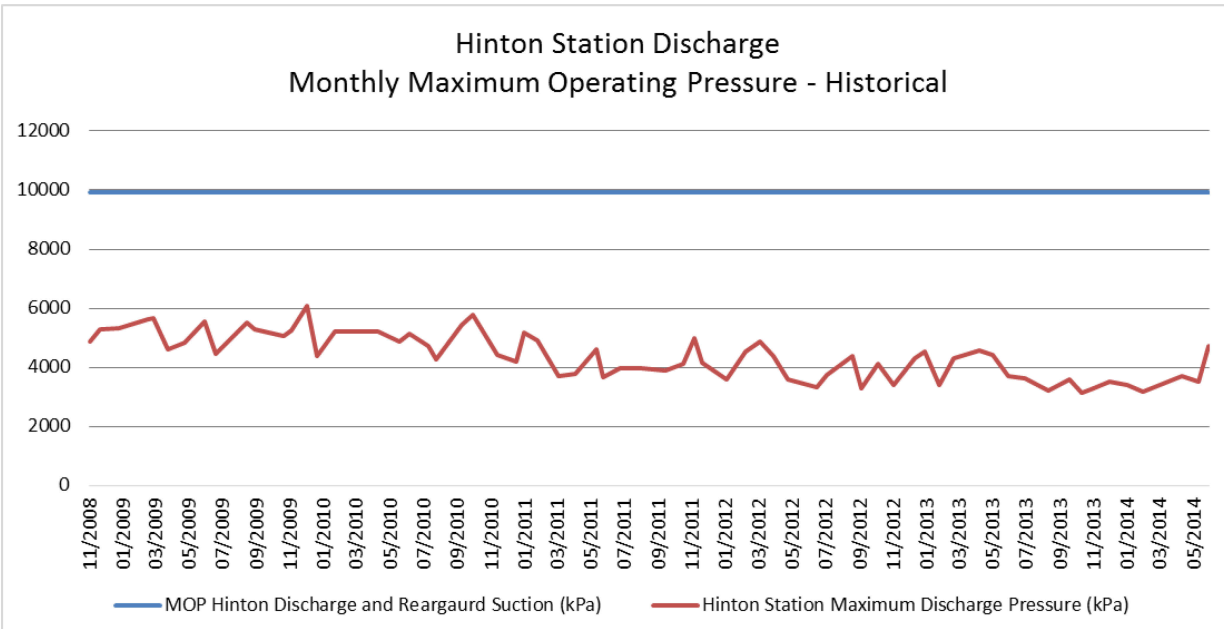


Figure 3.7 Hinton Station Discharge – Monthly Maximum Pressure – Historical

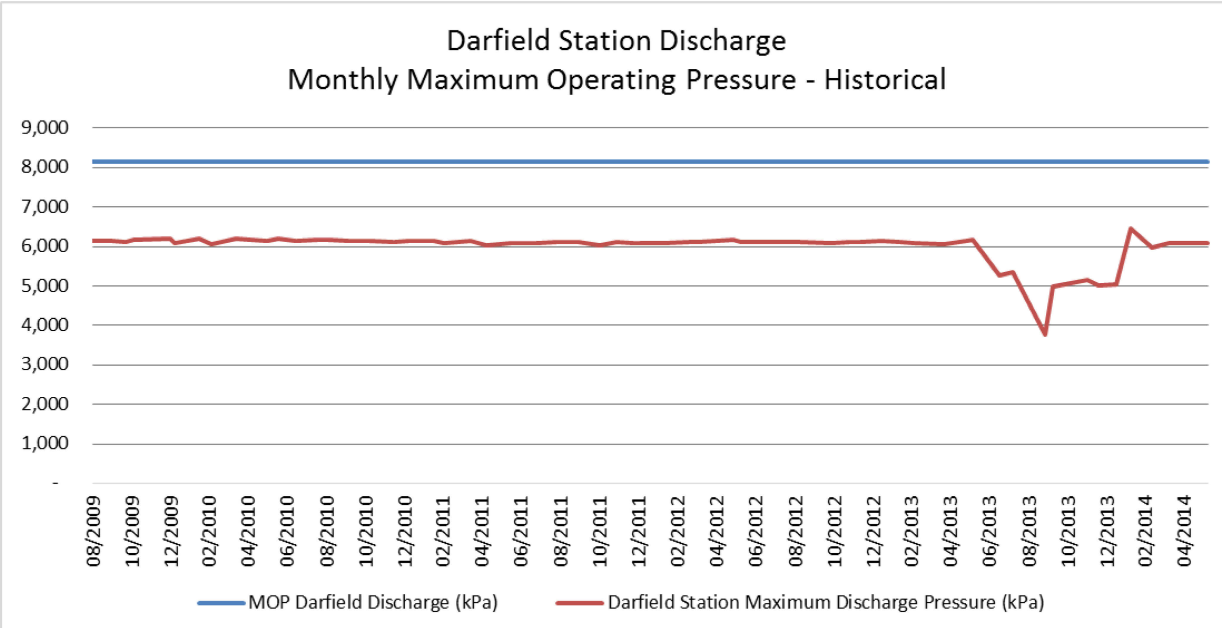


Figure 3.8 Darfield Station Discharge – Monthly Maximum Pressure – Historical

The pressure charts show that the pipeline segments have been operating within a consistent operating range with the exception of 2013. During 2013 the pipeline system was operating at a reduced operating pressure while KMC completed baseline assessments for crack-like defects on the pre-1970s pipeline segments. See section 4.2 and 5.2 for additional details on the cracking fitness for service assessments.

3.2.2 Proposed Hydraulic Profile

Figure 3.9, provides a graphical output for the proposed hydraulic profile for Line 2 once it is placed in heavy crude service. The hydraulic profile is based on a static study of the operation of the pipeline system using the Stoner pipeline simulation model. The study outputs information in the form of a head / elevation plot that can be used to compare the elevation profile, hydraulic profile, and the maximum allowable operating head profile in metres of head.

The pipeline segments that are moving from the currently active TMPL to Line 2 service are the Hinton to Hargreaves NPS 36 segment and the Darfield to Black Pines NPS 30 segment.

Hydraulic studies are continuing and will continue to be updated as the route is finalized and control system design is completed during the detailed design phase of the project. To ensure that this engineering assessment provides sufficient information regarding the ability of the pipeline segments that are being transferred to Line 2 service, the engineering assessment assesses the factors of safety relative to both the maximum licensed operating pressures and the proposed operating pressures (the proposed hydraulic profile). Changes to the proposed hydraulic profile will result in a change to the factor of safety calculations for the hydraulic profile but will not impact the factor of safety calculations relative to the maximum allowable operating pressures that are currently established and licensed through the National Energy Board.

To complete the fitness for service assessments, the maximum allowable operating head and the hydraulic profile provided in Figure 3.9 have been converted to pressures (see section 3.2.3). The conversion was completed using the density for the proposed operation as outlined in Table 3.2. These are then compared to the predicted rupture pressure of the in-line inspection features that are remaining in the pipeline following the most recently completed inspection and repair programs. Results of the fitness for service assessment and methodology are provided in Section 5.0 Fitness for Service Assessments.

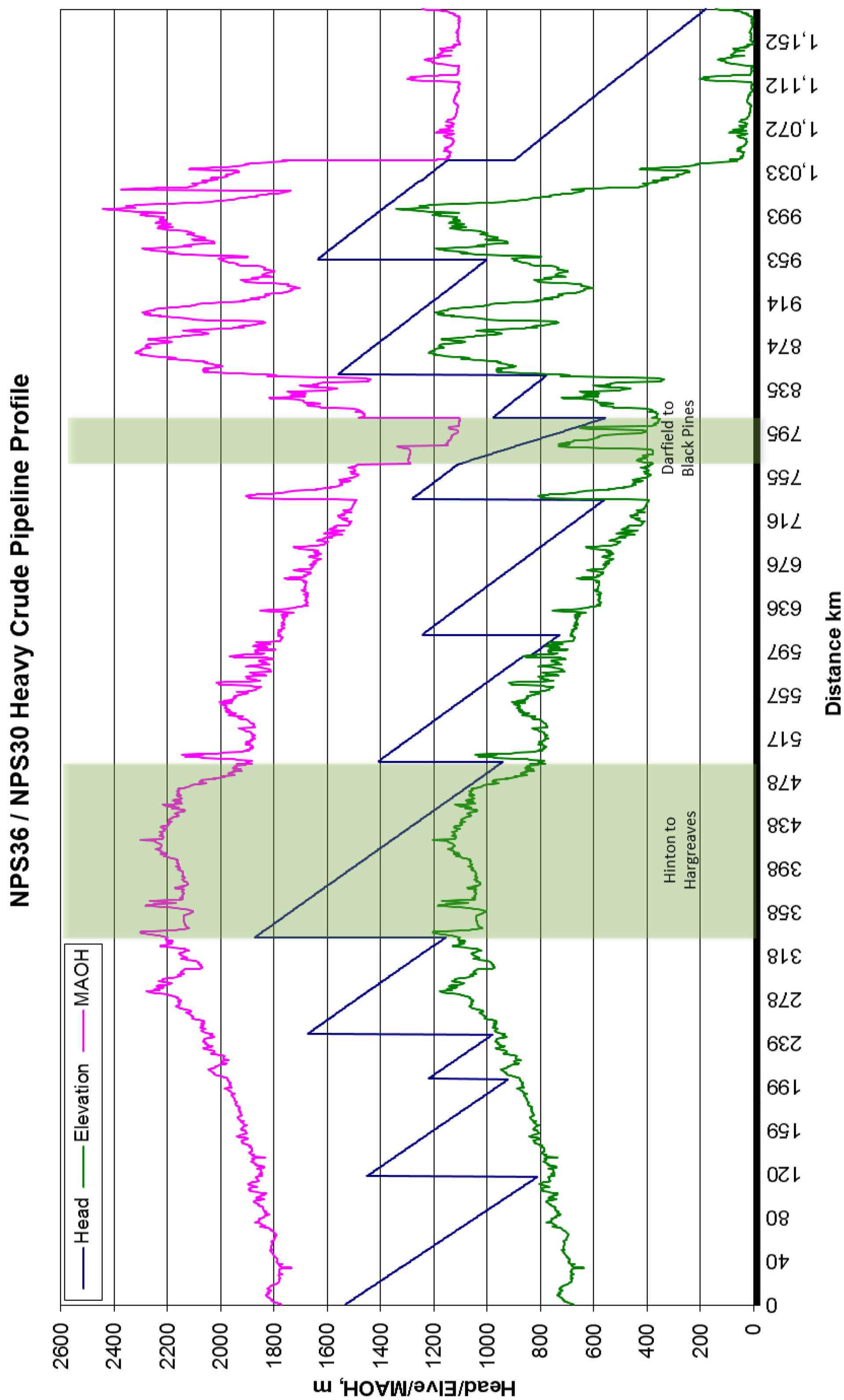


Figure 3.9 Line 2 Hydraulic Profile

3.2.3 Historical vs Future Operation

To assess the difference between the proposed future operations of the pipeline relative to the historical operation of the pipeline, the proposed hydraulic profile was converted to a pressure profile diagram. The historical operating pressure was then overlayed to provide a graphical representation of how the historical and proposed operation of the pipe segments will differ in Line 2 service. The sections below provide a description of the methodology and data used to complete the assessment.

3.2.3.1 Historical Normal Maximum Pressures

To assess the impact of the hydraulic profile for Line 2 versus how the pipeline segments have operated in the last several years, the maximum historical pressure is calculated by utilizing SCADA minute-by-minute daily pressure reports ranging for the sample calendar year of 2011. 2011 was chosen as the sample year as it was fully representative of normal TMPL operating conditions.

The pressure reports are available for suction and discharge pressures of every station in the TMPL system. Operating pressures between the suction and discharge of the stations were completed by interpolating the pressures between these stations. Interpolation points were selected with the following criteria: intervals of 5,000 m in chainage, or elevation changes greater than or equal to 50 m, or changes in the pipe's wall thickness. Minute-by-minute pressure was calculated for each interpolation point using the following equation:

$$P_x = \left[P_1 - P_2 + k(h_1 - h_2)\right]\left(\frac{L_2 - L_x}{L_2 - L_1}\right) - K(h_x - h_2) + P_2$$

Where:

P_x = Pressure at the interpolation point, kPa
P_1 = Pressure at the upstream station, kPa
P_2 = Pressure at the downstream station, kPa
K = Metres Head: Pressure Conversion (0.92)*9.79 kPa/m
L_1 = Chainage at the upstream station, m
L_2 = Chainage at the downstream station, m
L_x = Chainage at the interpolation point, m
h_1 = Elevation at the upstream station, m
h_2 = Elevation at the downstream station, m
h_x = Elevation at the interpolation point, m

After a year of minute-by-minute pressure data is calculated at all interpolation points, the maximum pressure for each point is recorded and tabulated by chainage to make up the actual maximum pressure curve.

3.2.3.2 Maximum Operating Pressure

The existing 151 km of NPS 36 pipeline segment from Hinton, AB to Hargreaves, BC that will become part of the Line 2 pipeline is already licenced to operate at 9,930 kPa with a short section at 10,875 kPa. This pipeline segment was tested in multiple sections, each tested up to a maximum of 110% SMYS. The known elevation and specific gravity was then used to determine the applied pressure along the whole segment. In accordance with Clause 4.3.5 of CSA Z662, the MOP was chosen based on the lesser of 80% of the lowest hydrostatic test pressure or 80% of the Specified Minimum Yield Strength.

Similarly, the Darfield to Kamloops segment (which includes Black Pines) was hydrotested in August 2004 as part of the reactivation of this segment. Hydrostatic tests were completed in three separate sections, which were pressurized to maximum stresses corresponding to 98.1% SMYS, 99.2% SMYS and 96.1% SMYS. The elevation and specific gravity was then used to calculate the tested pressure along the entire segment, and then a factor of 0.8 was applied to obtain the MOP.

3.2.3.3 Predicted Operating Pressure

KMC established and maintains a hydraulic model for the existing TMPL system. This model has been created using the Stoner pipeline hydraulic model which matches the existing pumps arrangement and capabilities with the known physical configuration of the pipeline and includes modelling of the properties of the products shipped through the line.

As part of the planning for the Trans Mountain Expansion Project, KMC created a similar hydraulic model to simulate Line 2 expected operating parameters based on the proposed route, pump arrangement, and heavy crude service. This model allows for the simulation of head and pressure along the line; from the model, the predicted operating pressure for the Hinton to Hargreaves and Darfield to Black Pines segments has been extracted to be included in the charts.

3.2.3.4 Hinton to Hargreaves

To determine the impact of the transfer of the pipeline segment to Line 2 service, the MOP, historical normal maximum operating pressures and the predicted operating pressure for Line 2 service were overlayed in Figure 3.10.

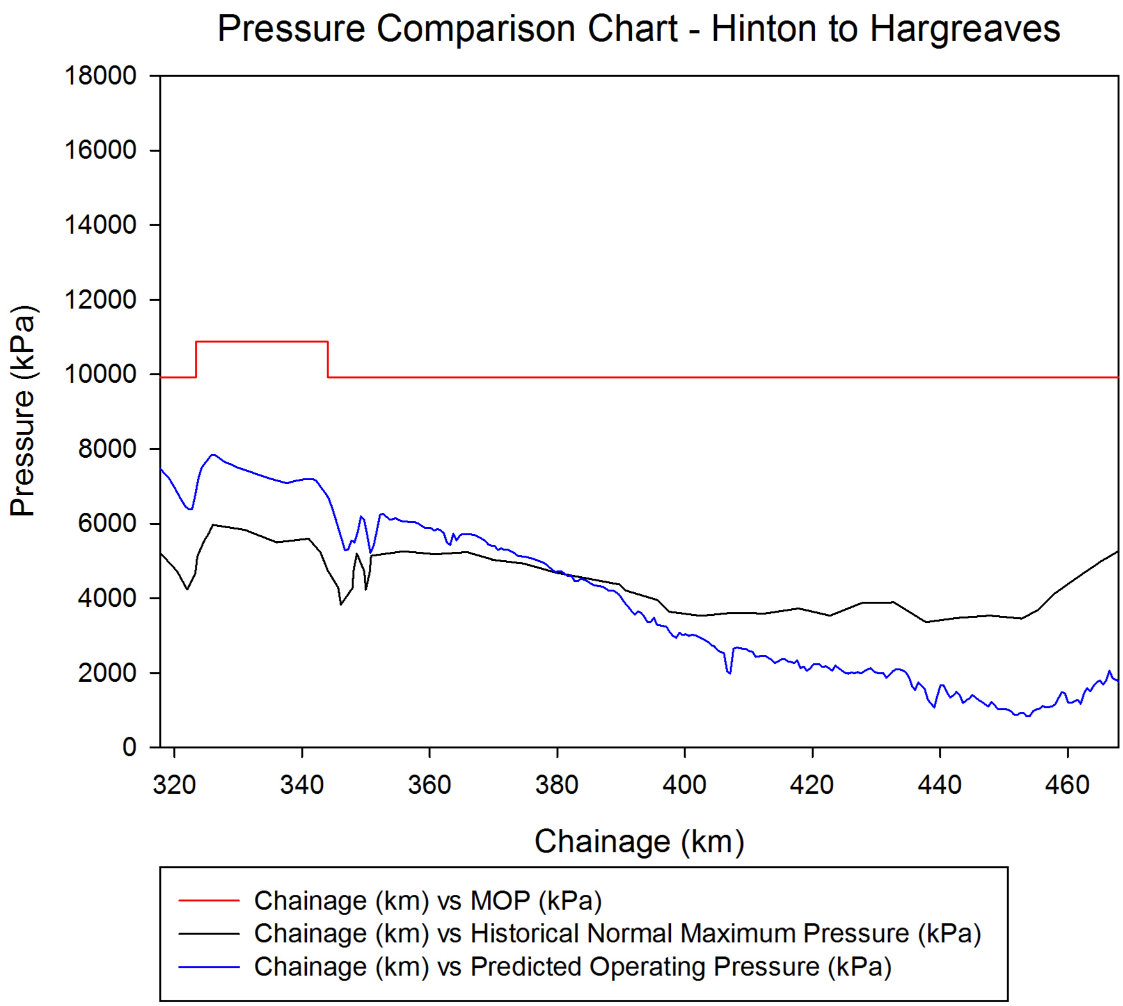


Figure 3.10 Pressure Comparison Chart – Hinton to Hargreaves

The profile shown in Figure 3.10 shows that the predicted operating pressure is expected to be approximately 2000 kPa higher at the discharge of the Hinton Station. This pressure is also approximately 2000 kPa below the maximum operating pressure that was established during the 2008 hydrostatic test.

The predicted operating pressures at the suction side of Hargreaves are expected to be approximately 3000 kPa lower than the current operating pressures. This steeper pressure profile is consistent with the expected higher head losses resulting from the higher flow rates proposed to be transported by Line 2 compared to the existing TMPL.

This Line 2 pipeline segment is expected to operate well below the established MOP. The pipeline segment is also expected to operate at pressures below the historical operating pressure of the pipeline for approximately 60% of the pipeline segment length with higher operating pressures expected for the first 60 km of the line segment.

To assess the impacts of the higher operating pressures at the discharge of Hinton, an assessment of the factor of safety of the pipeline was completed and is included in Section 5.0 – Fitness for Service Assessments.

3.2.3.5 Darfield to Black Pines

To determine the impact of the transfer of the pipeline segment to Line 2 service, the MOP, historical normal maximum operating pressures and the predicted operating pressure for Line 2 service were overlayed in Figure 3.11.

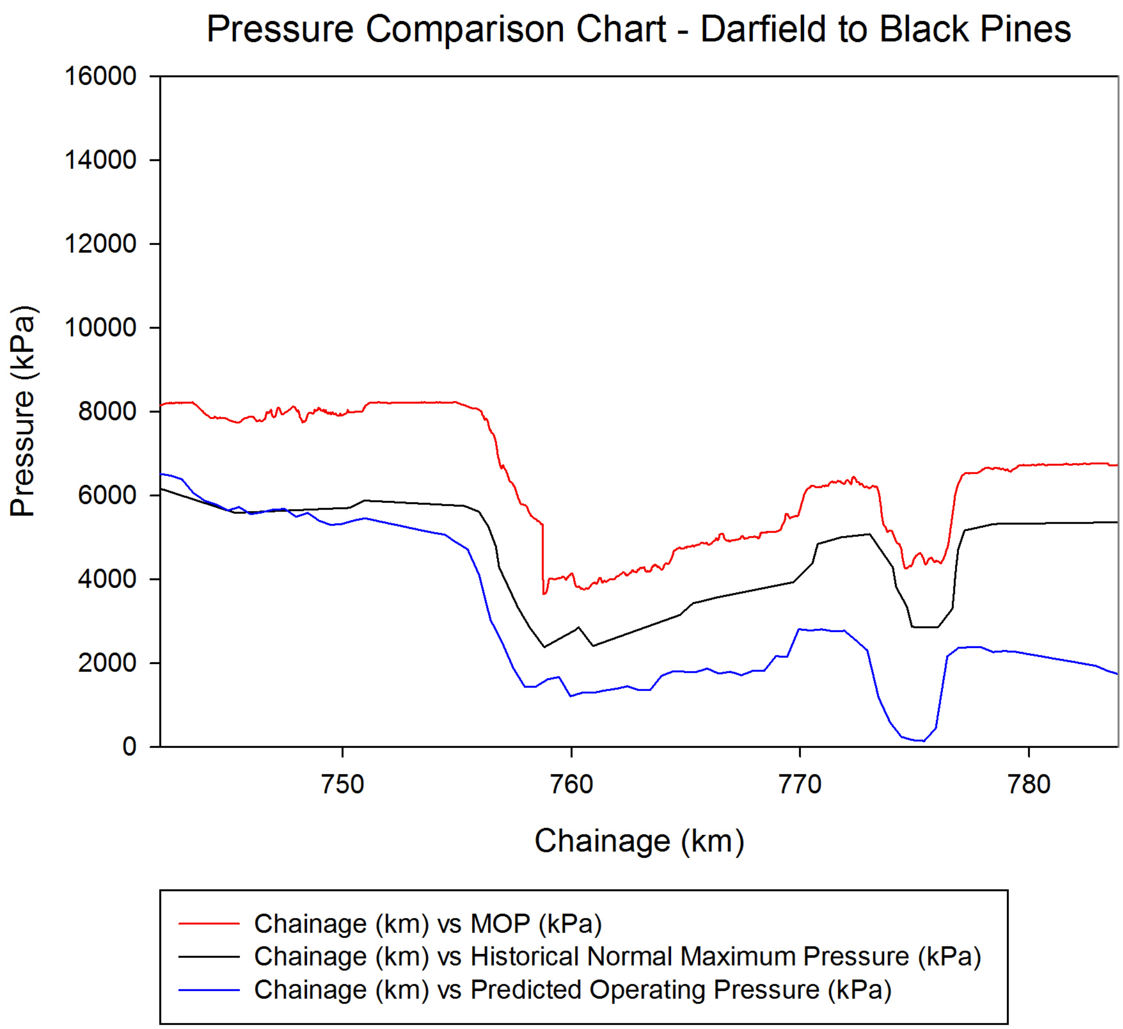


Figure 3.11 Pressure Comparison Chart – Darfield to Black Pines

The pressure profile shown in Figure 3.11 shows that the predicted operating pressure at Darfield is expected to be similar to the operating pressures that currently occur on the line segment.

The proposed operating pressures at Black Pines is expected to be approximately 3000 to 4000 kPa lower than the current maximum operating pressures.

As indicated in Figure 3.11, a large portion of the pipeline segment is expected to operate at lower pressures than the historical maximum operating pressure for the pipeline segment. This steeper pressure profile is consistent with higher pressure losses resulting from higher flows proposed to be transported by Line 2 than existing TMPL, and a reduced pump station spacing with the construction of the new pump station at Blackpines.

An assessment of the factor of safety of the pipeline is included in Section 5.0 – Fitness for Service Assessments.

3.3 Operating and Maintenance Records

3.3.1 Hydrotest Failures

A Hydrostatic test was performed on the Hinton to Hargreaves Anchor Loop before it was put into service in March of 2008. The hydrostatic test was successfully completed with no leaks or ruptures.

A Hydrostatic test was performed on the Darfield to Kamloops NPS 30 Line when it was reactivated in 2004. The hydrostatic test was successfully completed with no leaks or ruptures.

3.3.2 In-Service Leaks and Ruptures

There have been no leaks or ruptures on the NPS 36 line between Hinton and Hargreaves. The NPS 30 line between Darfield and Black Pines has not experienced any leaks or ruptures since being brought back into service in 2004. During previous service, from 1957 to 1984, two leaks occurred. The first was on August 1st, 1958 and was caused by operator error while installing a valve at KP 768.0 and 30 bbls were spilled. The second leak occurred on December 8th, 1960 when the mainline was pierced by a backhoe from a third party at KP 784.0 and 25 bbls were released.

Due to two leaks on the Kamloops to Sumas section of the TMPL, a pressure restriction was put in place during the summer of 2013 equal to 80% of the highest pressure recorded in the last 90 days. The 80% pressure reduction was voluntarily implemented on June 14, 2013 following the repair of the first of 2 leaking defects discovered in the Kamloops to Sumas pipe segment as listed below:

- A release of less than 1 m^3 of blended crude oil was detected during a planned integrity investigation on TMPL, just upstream of the Kingsvale Station at Kilometer Post 923.567 on June 12, 2013. The cause of the of the leak was determined to be due to cracking that initiated inside of a gouge that was attributed to 3rd party damage.
- On June 26, 2013 a second release of approximately 18 m^3 was discovered during planned integrity excavations between Kingsvale and Hope at KP 966.89. The cause of the leak was determined to be a manufacturing flaw adjacent to the inside seam weld.

On August 2, 2013, the NEB issued order SO-T260-005-2013 which directed KMC to maintain the pressure restriction already in place equivalent to 80% of the highest pressure experienced during the last 90 days of unrestricted operation prior to June 13, 2013 on all portions of the pre-1970s TMPL pipeline. The pressure restriction was to remain in effect until all of the commitments outlined in KMC's Integrity Assurance Plan (dated July 9, 2013) had been fulfilled. This included filing an engineering assessment that demonstrates that the pipeline is fit for service at its MOP.

The pressure restriction on the NPS 30 Darfield to Kamloops segment was lifted on February 6th, 2014 after KMC submitted Engineering Analyses to the NEB proving that it was safe to do so. The pressure restriction on the NPS 36 segment between Hinton to Hargreaves was lifted on March 19, 2014.

3.3.3 In-Line Inspection History

The high resolution in-line inspection (ILI) histories of the Hinton to Hargreaves and Darfield to Kamloops pipeline segments are summarized in Table 3.3 and Table 3.4 respectively. Table 3.3 documents the inspection history of the NPS 36 line since its construction in 2008, while Table 3.4 lists inspections performed since the NPS 30 line was reactivated in 2004. The difference in inspection frequency is due to the relative age of the two lines; the Hinton to Hargreaves segment, which was installed in 2008, has only been in service for one inspection cycle versus the Darfield to Kamloops section of line which was installed in 1957. Future inspection intervals are outlined in Section 5 and will be modified as required based on the processes included in Kinder Morgan's Integrity Management Program.

TABLE 3.3 ILI HISTORY (HINTON TO HARGREAVES)

Hinton – Hargreaves NPS 36		
Date	**Vendor**	**Tool**
2013	Baker Hughes	MFL + Caliper

TABLE 3.4 ILI HISTORY (DARFIELD TO KAMLOOPS)

Darfield – Kamloops NPS 30		
Date	**Vendor**	**Tool**
2004	BJ	Geopig
	PII	MFL
2011	Baker Hughes	MFL
2012	Rosen	AFD
2013	Rosen	EMAT
2014	GE	USCD

KMC uses a variety of tools in order to gain a complete picture of the integrity of its pipelines. Each type of ILI tool is specifically designed to detect certain types of features. The primary feature detection capabilities of each type of tool are as follows:

- Caliper and Geopig: Pipeline geometry (dents, wrinkles, buckles)
- Magnetic Flux Leakage (MFL): Metal loss (corrosion) and weld defects
- Axial Flaw Detection (AFD): Narrow, longitudinal defects (grooves, gouges, cracks, crack-like features, channeling corrosion)
- Electro-Magnetic Acoustic Transducer (EMAT): Cracks, crack-like features, and external coating disbondment
- Ultra Sonic Crack Detection (USCD): Cracks and crack-like features

4.0 KMC INTEGRITY MANAGEMENT PROGRAM

The Integrity Management Program (IMP) fulfills the regulatory requirements of both the NEB and the OGC. It also meets the requirements for a Safety and Loss Management System outlined in CSA Z662-11 with regard to the pipeline assets. A separate Facility Integrity

Management Program (FIMP) fulfills the Safety and Loss Management System requirements for assets that do not extend beyond facility fence lines. The change in product mix from the current batched products (ranging from refined to heavy crude to the proposed heavy products for these segments) does not affect the IMP.

4.1 Corrosion Management Approach

4.1.1 ILI Monitoring

The TMPL is monitored for corrosion with various scheduled metal loss ILI tools. The tools below have been run recently on the sections of interest.

TABLE 4.1 COMPLETED ILI RUNS FOR METAL LOSS

Year	Line	Vendor and Tool
2004	Darfield - Kamloops	PII MFL
2011	Darfield - Kamloops	BH Vectra MFL
2012	Darfield – Kamloops	Rosen AFD
2013	Hinton - Hargreaves	BH Vectra MFL
2013	Darfield - Kamloops	ROSEN EMAT

The next proposed metal loss inspections are provided in the table below:

TABLE 4.2 FUTURE PROPOSED ILI RUNS FOR METAL LOSS

Year	Line	Vendor and Tool
2016	Darfield - Kamloops	BH Vectra MFL
2018	Hinton - Hargreaves	BH Vectra MFL

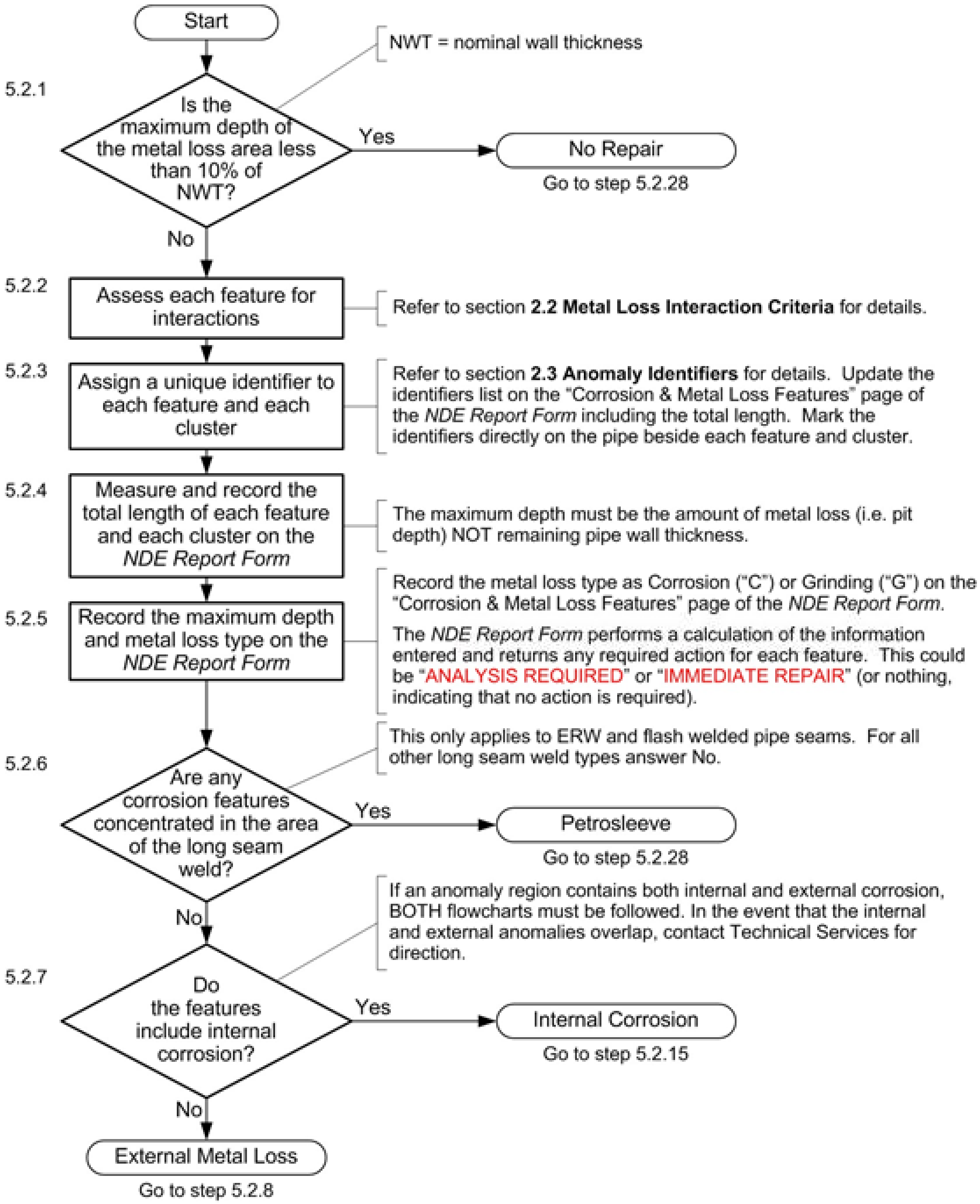
4.1.2 Excavation and Repair Criteria for Metal Loss Features

KMC has strict guidelines governing when an investigative dig must be issued based on information received from ILI runs. A 180 Day Condition dig is issued when the predicted burst pressure (using the effective area method) is less than the calculated pressure at 100% SMYS. This corresponds to an RPR less than 1. All metal loss conditions that must result in a 180 day dig are:

- RPR < 1
- Metal loss exceeding 0.5 WT with widespread circumferential corrosion
- Metal loss exceeding 0.5 WT at a girth weld
- Corrosion concentrated in the seams of ERW or flash welded pipe
- Corrosion interacting with a gouge or groove

In addition to 180 Day Digs, KMC issues Immediate Repair Digs when metal loss is greater than 80% nominal WT or when the predicted burst pressure (using the effective area method) is less than the maximum operating pressure at the location of the anomaly. Immediate Repair Digs result in pressure restrictions until the dig is completed and NDE is performed at the location of the anomaly. All features that have been identified by prior metal loss ILI runs to meet these criterions have been excavated and repaired.

KMC uses flow charts to determine the repair requirements for a defect. The flow chart below is for assessing corrosion and metal loss. Similar flow charts exist for laminations and inclusions, dents, linear indications, ripples, wrinkles and buckles, weld defects and weld fill in.



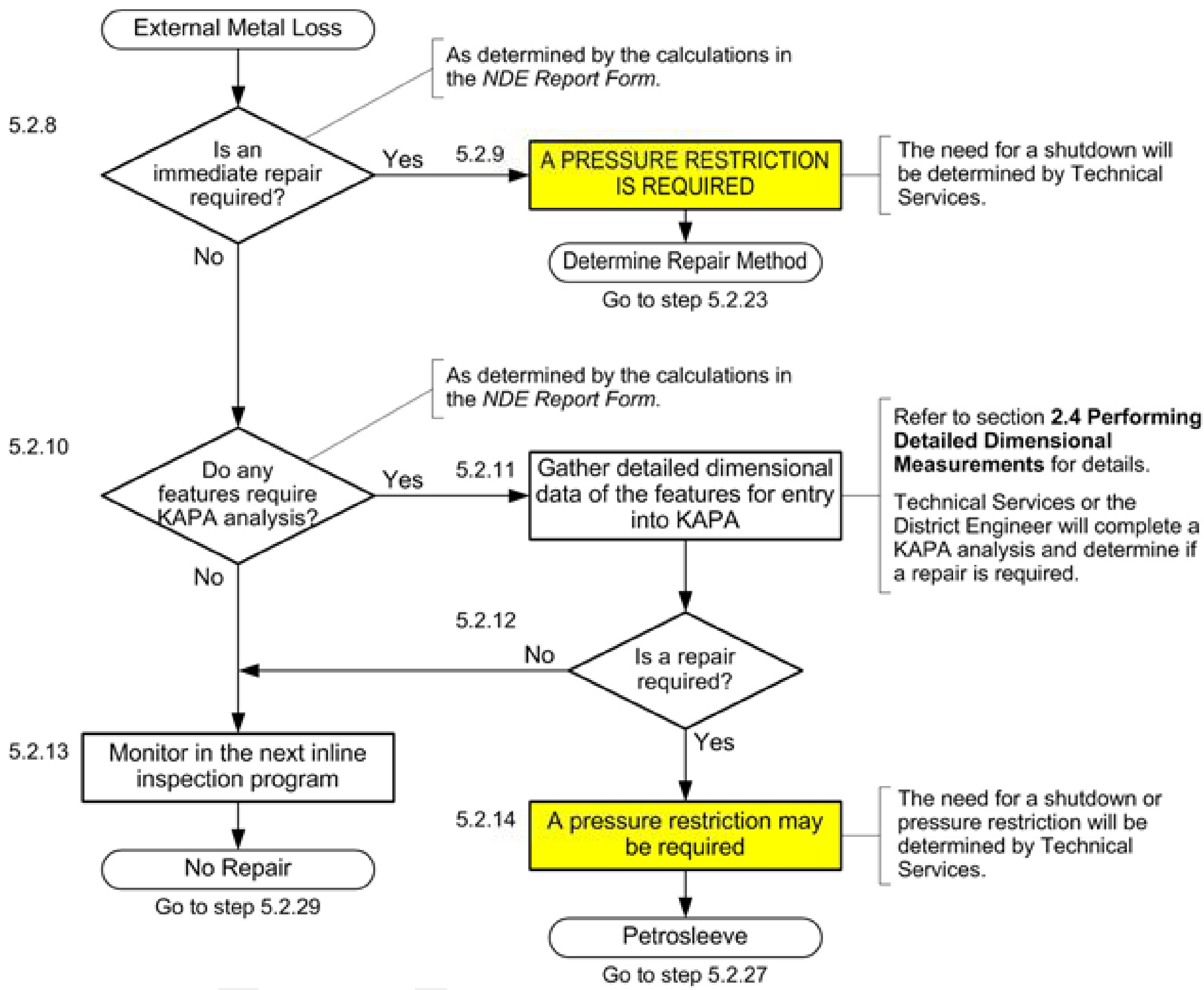


Figure 4.1 Corrosion and Metal Loss Repair Flow Chart

4.2 Crack Management Approach

KMCs crack management program includes inspection and assessment for all body and seam weld crack-like features. The crack program includes regular in-line inspections of the pipeline system, fatigue analysis, and field investigation and repair programs.

Kinder Morgan Canada's Stress Corrosion Cracking (SCC) Integrity Management Program was originally implemented and integrated in June 1997. It was updated in May 1999 and more recently in 2011 to reflect the activities and incidences of SCC.

The program is based on the recommended practices of the Canadian Energy Pipeline Association (CEPA) SCC Recommended Practices (2nd Edition – 2007) and also follows the recommendations proposed in the NEB report of the Public Inquiry Concerning Stress Corrosion

Cracking on Canadian Oil and Gas Pipelines (NEB MH-2-95). The primary objectives of the program are to identify areas where SCC may potentially be found by conducting susceptibility analysis, investigative digs, as well as SCC integrity assessments. Any identified areas with potential or confirmed SCC are subsequently managed by developing mitigation activities, as required, and condition monitoring.

4.2.1 ILI Monitoring

TMPL is monitored for cracking with various scheduled crack detection ILI tools. The tools below have been run recently on the sections of interest.

TABLE 4.3 COMPLETED ILI RUNS FOR CRACK-LIKE ANOMALIES

Year	Line	Vendor and Tool
2012	Darfield – Kamloops	ROSEN AFD
2013	Darfield - Kamloops	ROSEN EMAT

The next proposed crack detection inspections are provided in the table below.

TABLE 4.4 FUTURE PROPOSED ILI RUNS FOR CRACK-LIKE ANOMALIES

Year	Line	Vendor and Tool
2014	Darfield - Kamloops	GE USCD
2015	Hinton - Hargreaves	TFI
2015	Hinton - Hargreaves	USCD or EMAT
2017	Darfield - Kamloops	TFI

4.2.2 Crack Severity Levels for Reassessment

KMC analyzes all linear anomaly data produced by ILI tools for predicted burst pressure as well as for fatigue life due to pressure cycling on the TMPL to determine inspection intervals.

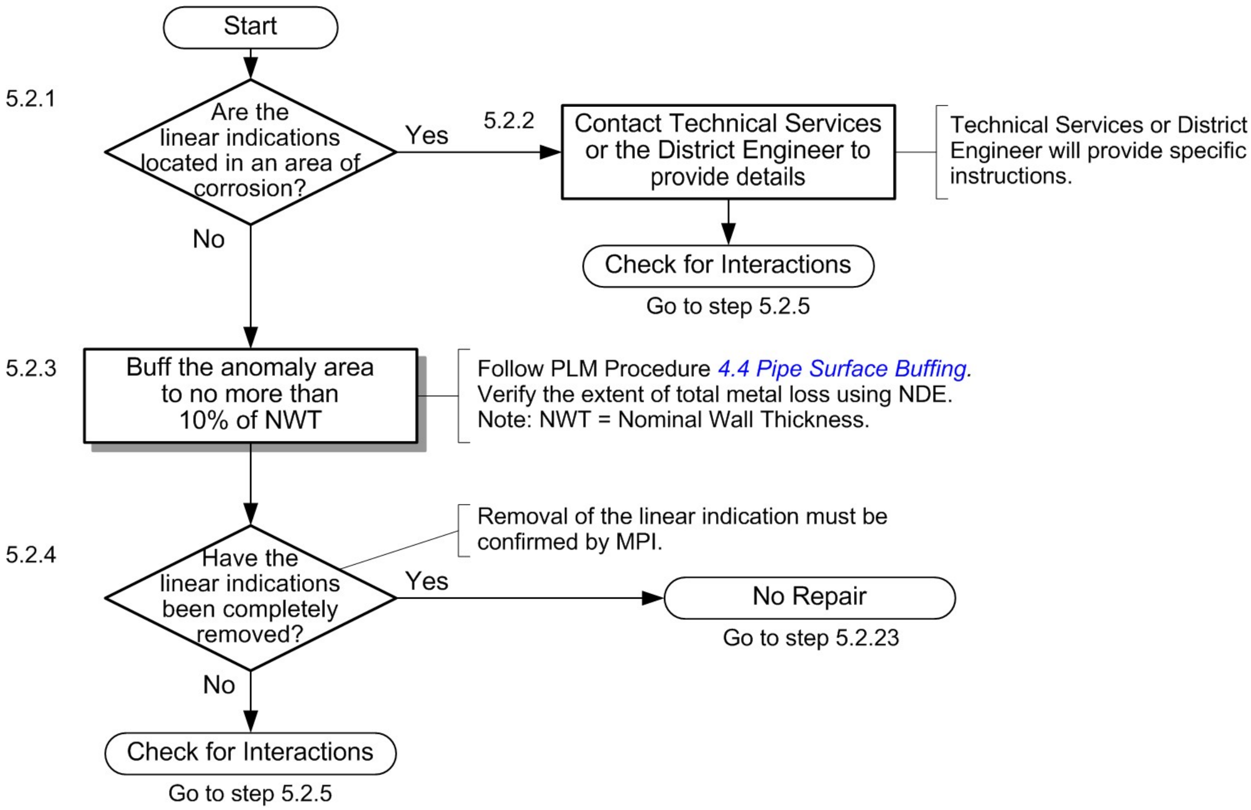
Burst pressure is typically calculated using Kiefner and Associates' KAPA software. Fatigue life is determined by interpolating pressure spectra using data between stations utilizing the pipe's elevation profile and suction and discharge pressure SCADA reports. The interpolated pressure spectra are processed through a third-party data analysis tool (BMT Fleet's FlawCheck) to calculate the normalized number of cycles per year and fatigue life.

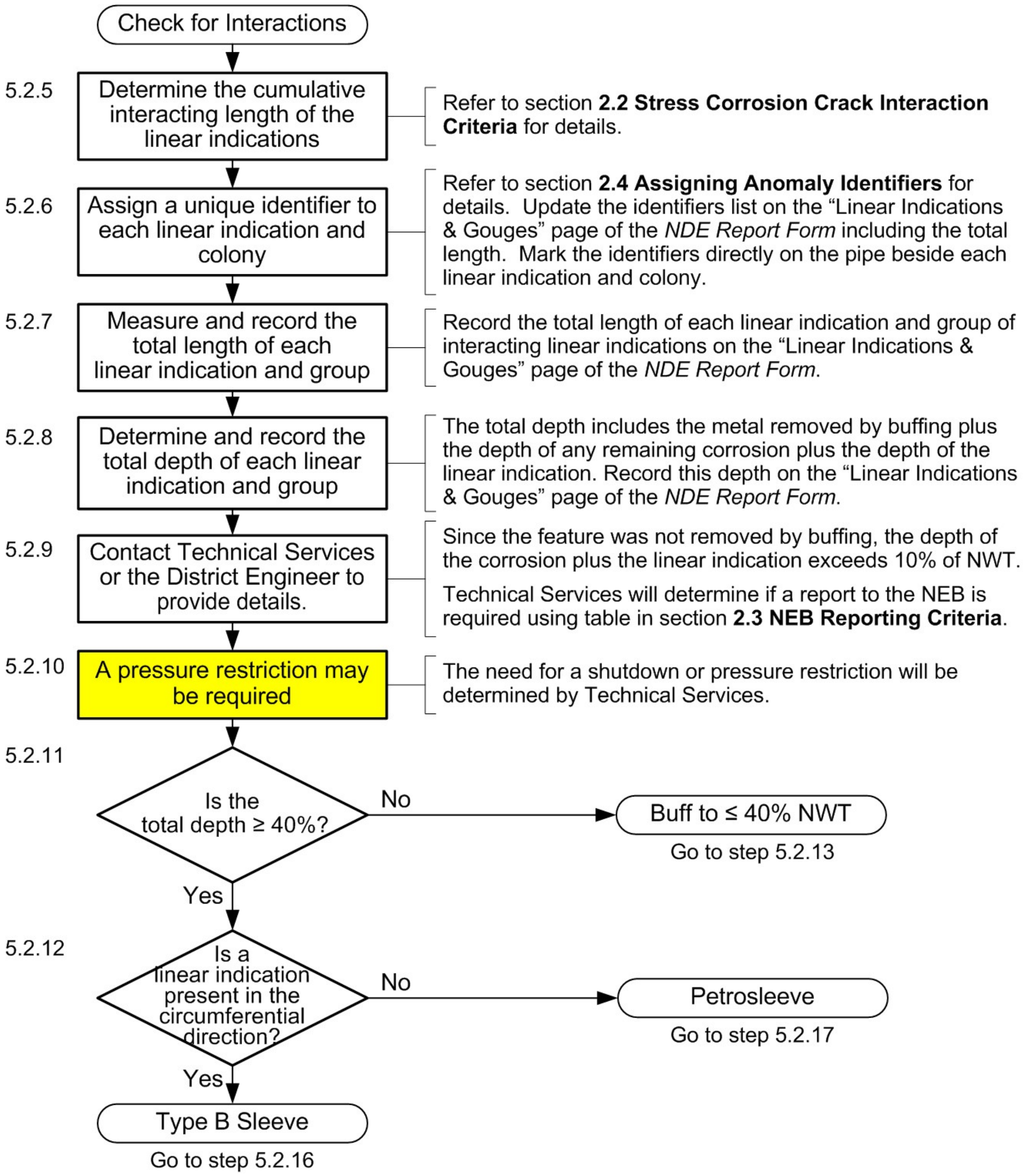
4.2.3 Excavation and Repair Criteria for Crack-Like Anomalies

An immediate dig is issued when there is probable cracking where a calculation of the remaining strength of the pipe shows a predicted burst pressure (by NG18 In secant method) is less than the established maximum operating pressure at the location of the anomaly.

A 180 day dig is issued when there is a probable crack in the pipe body with a calculated burst pressure (by NG18 In secant method) less than the pressure at 100% SMYS or any probable crack exists in a seam weld. All features that have been identified by prior crack detection ILI runs to meet these criteria have been excavated and repaired once they were confirmed by NDE.

KMC uses flow charts to determine the repair requirements for a defect. The flow chart below is for assessing linear indications.




Check for Interactions
5.2.5
Determine the cumulative interacting length of the linear indications
Refer to section **2.2 Stress Corrosion Crack Interaction Criteria** for details.
5.2.6
Assign a unique identifier to each linear indication and colony
Refer to section **2.4 Assigning Anomaly Identifiers** for details. Update the identifiers list on the "Linear Indications & Gouges" page of the *NDE Report Form* including the total length. Mark the identifiers directly on the pipe beside each linear indication and colony.
5.2.7
Measure and record the total length of each linear indication and group
Record the total length of each linear indication and group of interacting linear indications on the "Linear Indications & Gouges" page of the *NDE Report Form*.
5.2.8
Determine and record the total depth of each linear indication and group
The total depth includes the metal removed by buffing plus the depth of any remaining corrosion plus the depth of the linear indication. Record this depth on the "Linear Indications & Gouges" page of the *NDE Report Form*.
5.2.9
Contact Technical Services or the District Engineer to provide details.
Since the feature was not removed by buffing, the depth of the corrosion plus the linear indication exceeds 10% of NWT.
Technical Services will determine if a report to the NEB is required using table in section **2.3 NEB Reporting Criteria**.
5.2.10
A pressure restriction may be required
The need for a shutdown or pressure restriction will be determined by Technical Services.
5.2.11
Is the total depth ≥ 40%?
No
Buff to ≤ 40% NWT
Go to step 5.2.13
Yes
5.2.12
Is a linear indication present in the circumferential direction?
No
Petrosleeve
Go to step 5.2.17
Yes
Type B Sleeve
Go to step 5.2.16

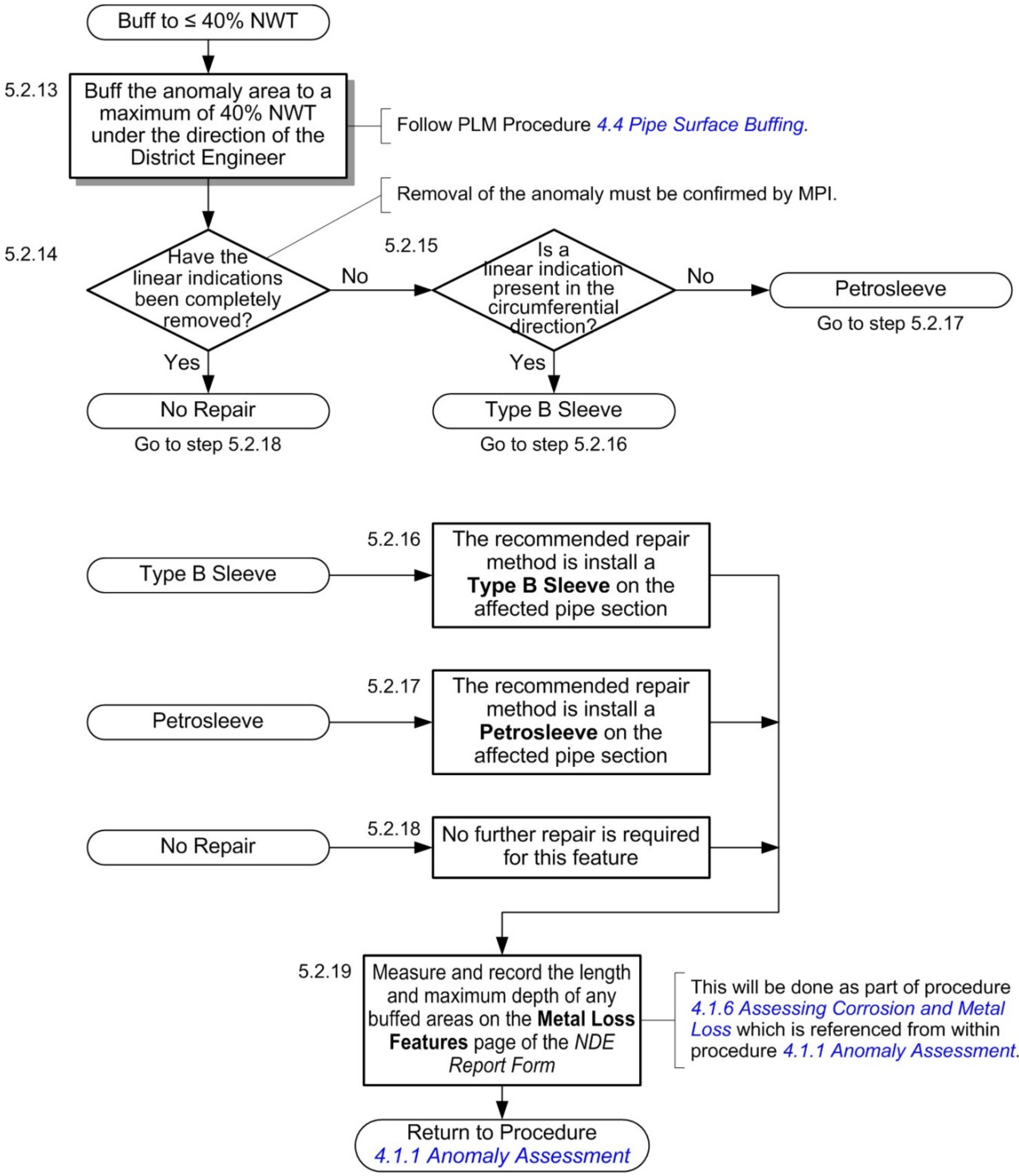


Figure 4.2 Linear Indication Repair Flow Chart

5.0 FITNESS FOR SERVICE ASSESSMENTS

5.1 Metal loss

5.1.1 External Corrosion Control

The NPS 30 line from Darfield to Black Pines was coated with Coal Tar Enamel during original installation in 1957. The NPS 36 from Hinton to Hargreaves was coated primarily with Fusion Bond Epoxy (75%) during the installation of the line in 2008. There are also some sections of pipeline that are near water features and are coated with ARO-30 and ARO-40 (24-25%). Induction bends and field welds are coated with Protal 7250 (<1%).

All pipeline systems are protected with impressed current cathodic protection (CP) systems. Approximately 11 rectifiers are utilized on the Hinton to Hargreaves sections and 6 from Darfield to Black Pines to impress DC current on the pipelines to minimize corrosion growth rates. All rectifiers are monitored at least monthly to ensure that the DC current outputs are maintained within a given range. Remote monitoring units (RMU) have been installed on most rectifiers to allow constant monitoring of the rectifiers. This ensures that Kinder Morgan can react immediately if there is an issue with a rectifier or groundbed and ensures minimal downtime if a rectifier is not operating. As added security, Kinder Morgan has also installed devices on the rectifier doors that send an alarm through the RMU if the rectifier door is opened. This ensures that the company can follow up immediately if a rectifier door is opened for an unknown reason.

Voltage levels are measured annually at all available test points. Cathodic test points include test stations, valves and other above ground connections to the underground structures.

In addition, an ON/OFF Close Interval Survey (CIS) is performed on a portion of the pipeline system annually to obtain voltage readings on the pipeline system at closer intervals (generally 3m). This survey allows Kinder Morgan to address areas where there may be inadequate CP potentials that may otherwise not be apparent during the Annual Test Lead Survey. A 2012 CIS was performed from Hinton to Hargreaves which indicated general good cathodic protection. All areas with low OFF readings were mitigated. A CIS was carried out in 2013 from Darfield to Kamloops with similar results.

To maintain effective CP of the pipeline system, KMC targets a minimum value of -850 mV off-potential. This is consistent with the Canadian Gas Association Recommended Practice OCC-1 (incorporated by reference in the CSA Z662-11 Standard), and with Canadian Energy Pipeline Association published recommendations for protection of the pipeline from initiation and growth of stress corrosion cracking.

Upon completion of a cathodic protection survey, a remedial action plan is put in place to address each of the reported deficiencies. This plan allows for investigation of high and low potentials, interference testing, adjustment of rectifiers and if required, upgrading or addition of supplemental cathodic protection systems to ensure criteria is met at all locations along the pipelines. All deficiencies from the 2012 test lead survey have either been mitigated or are planned to be mitigated based on their priorities as shown below.

Locations which are found to have high OFF potentials (more electro-negative than -1.200V) are the given first priority. Rectifier outputs in the area are reduced until the OFF potentials are more electro-positive than -1.200 volts.

The next priority to be addressed is those locations that did not meet the minimum polarized potential of -0.850V. Since there may be locations that fall below the -0.850V criteria after adjustments have been made to deal with the high OFF potential areas, a depolarization survey is performed which includes turning off rectifiers to allow the pipeline to depolarize. Static potentials are then collected at those locations identified in the data. Re-energization of the rectifiers then takes place to allow re-polarization of the pipe to occur and, after a short period of time, another interrupted survey is completed. The difference in the Static potential and the OFF potential, will determine if the pipeline meets the alternative 100mV shift criteria. De-polarization surveys are completed once every two years.

Test stations that require minor repairs are fixed at the time of the surveys by the CP contractor. Repairs or replacements that require ground disturbance activities are completed by KMC Pipeline Maintenance crews.

Interference testing is completed at each location identified in the survey. As each case is unique, they are handled on a case-by-case basis using applicable and acceptable techniques for identifying and controlling interference.

The 2012 Annual Test Lead Survey found that CP is generally in good shape on both the NPS 36 and NPS 30 loops. The 2012 survey of the 158 km NPS 36 Anchor Loop resulted in 28 deficiencies as follows:

- Nineteen locations indicated low “OFF” readings. The suspected cause for the low potentials is the presence of shorted casings in the area. Depolarization surveys could not be completed as part of the 2012 survey due to the close interval survey being completed through the same area. A depolarization survey will therefore be completed in 2014 and shorted casings, if any, will be investigated.
- One damaged test station was reported. Minor test station repairs are completed by the CP contractors, while repairs requiring pipeline exposure are added to the PLM dig list and completed by the PLM crews. This test station was damaged by rainfall washout and was repaired between the 2012 and 2013 test lead surveys.
- Four locations reported to have HIGH ‘OFF’ potentials, which can have detrimental effects on the pipeline coatings. Rectifier outputs were adjusted until the ‘OFF’ potentials were more electro-positive than -1.200 volts.
- Two test stations could not be located by the survey crew and therefore no readings were taken during the 2012 survey. Both of these test stations were located and found to have acceptable cathodic protection in 2013.

The 2012 survey of the 80 km Darfield to Kamloops section of line resulted in 33 deficiencies as follows:

- Twenty six locations indicated low readings. Depolarization surveys were completed as part of the 2012 survey, and all but one of the readings indicated adequate protection under the alternate criteria. This location is downstream of Black Pines and the 2013 test lead survey indicates good protection at this location.
- Four locations indicated HIGH ‘OFF’ potentials. Rectifier outputs were adjusted until the ‘OFF’ potentials were more electro-positive than -1.200 volts.
- There were three shorted casing readings that were identified. Casing shorts will

be remediated based on priority, as determined in the Shorted Casing Program. These three readings were all from the same casing (upstream, downstream and a casing vent) at KP 746.189. Readings on the pipe both upstream and downstream show that the pipe within the casing is still cathodically protected to KMC standards and ILI runs show that there are no corrosion features of concern within the crossing. For these reasons, the shorted casing is very low on the casing repair priority list and there are no immediate plans for repair. This site will continue to be monitored by both ILIs and annual test lead surveys to determine when remediation is necessary.

5.1.2 Metal Loss Incidence Charts

The charts provided in this section show the remaining metal loss features along the pipeline segments. The metal loss data for the Hinton to Hargreaves segment were obtained from the 2013 Baker Hughes VECTRA™ Magnetic Flux Leakage (MFL) in-line inspection (ILI). The data for the Darfield to Black Pines segment were obtained from the 2011 Baker Hughes VECTRA™ MFL and 2012 Rosen Axial Flaw Detection (AFD) ILIs.

As per KMC's corrosion management approach, two 180 days digs were issued to investigate metal loss on the Hinton to Hargreaves segment based on the 2013 MFL results. Both sites were repaired through the use of petro sleeves.

Similarly, two digs were issued to investigate metal loss on the Darfield to Black Pines segment based on the 2011 MFL results. All sites were repaired with petro sleeves.

The metal loss charts provide a comparison between the historical normal maximum pressures, the licensed maximum operating pressure, and the predicted operating pressure after the segments are transferred Line 2 heavy crude service. The predicted burst pressure for the reported metal loss features is also included in the charts. The difference between the operating pressures and the features' burst pressure allows for a visual representation of the factor of safety in the segments' operation.

Reference metal loss indications for the charts below are as follows:

DMA – Detected Metal Loss Anomalies (BH Vectra)

CLS – Cluster Metal Loss Anomalies (BH Vectra)

Clusters – Cluster Metal Loss Anomalies (Rosen AFD)

Metal Loss Corrosion (Rosen AFD)

Metal Loss GWA – Metal Loss Girth Weld Affecting (Rosen AFD)

5.1.2.1 Charts

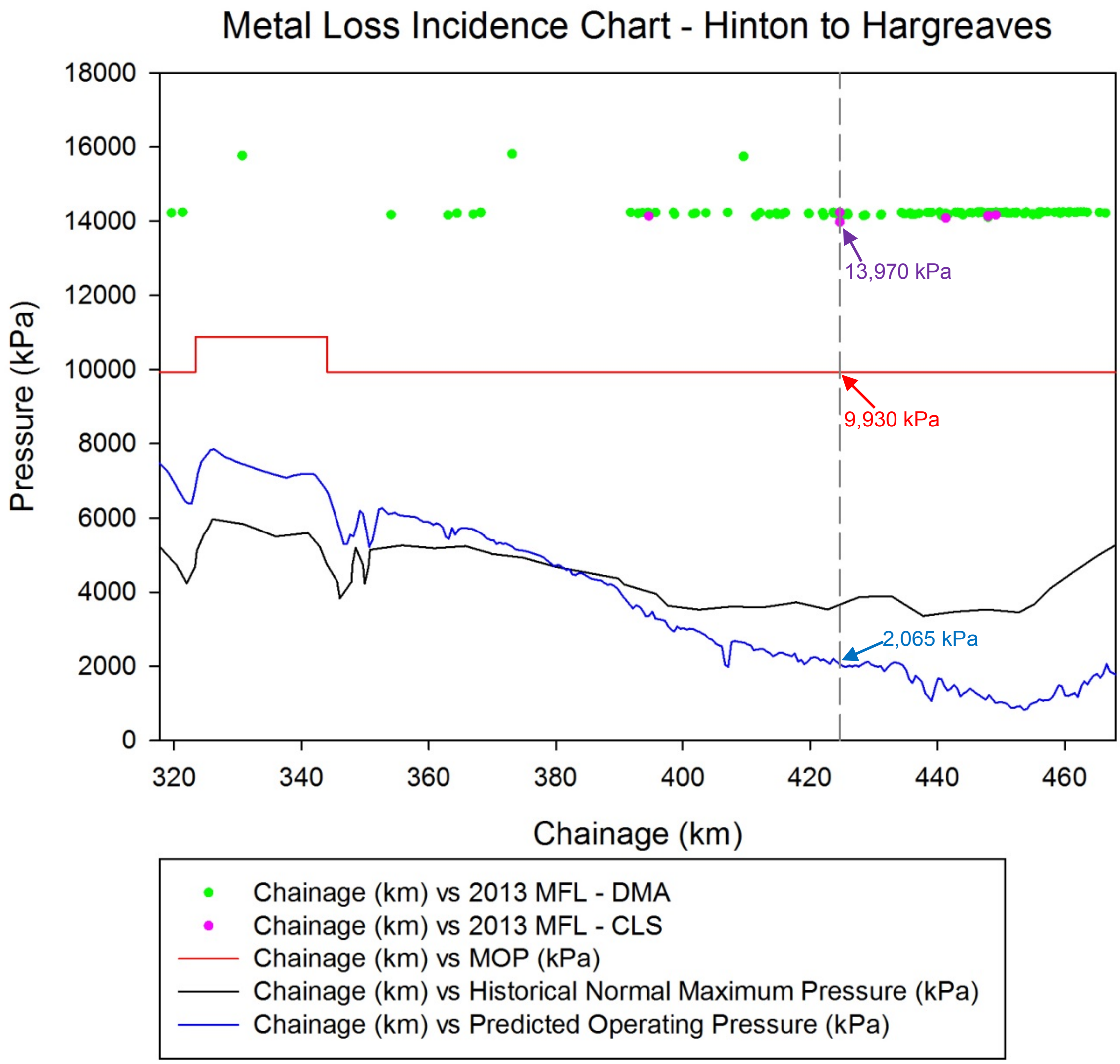


Figure 5.1 Metal Loss – Hinton to Hargreaves

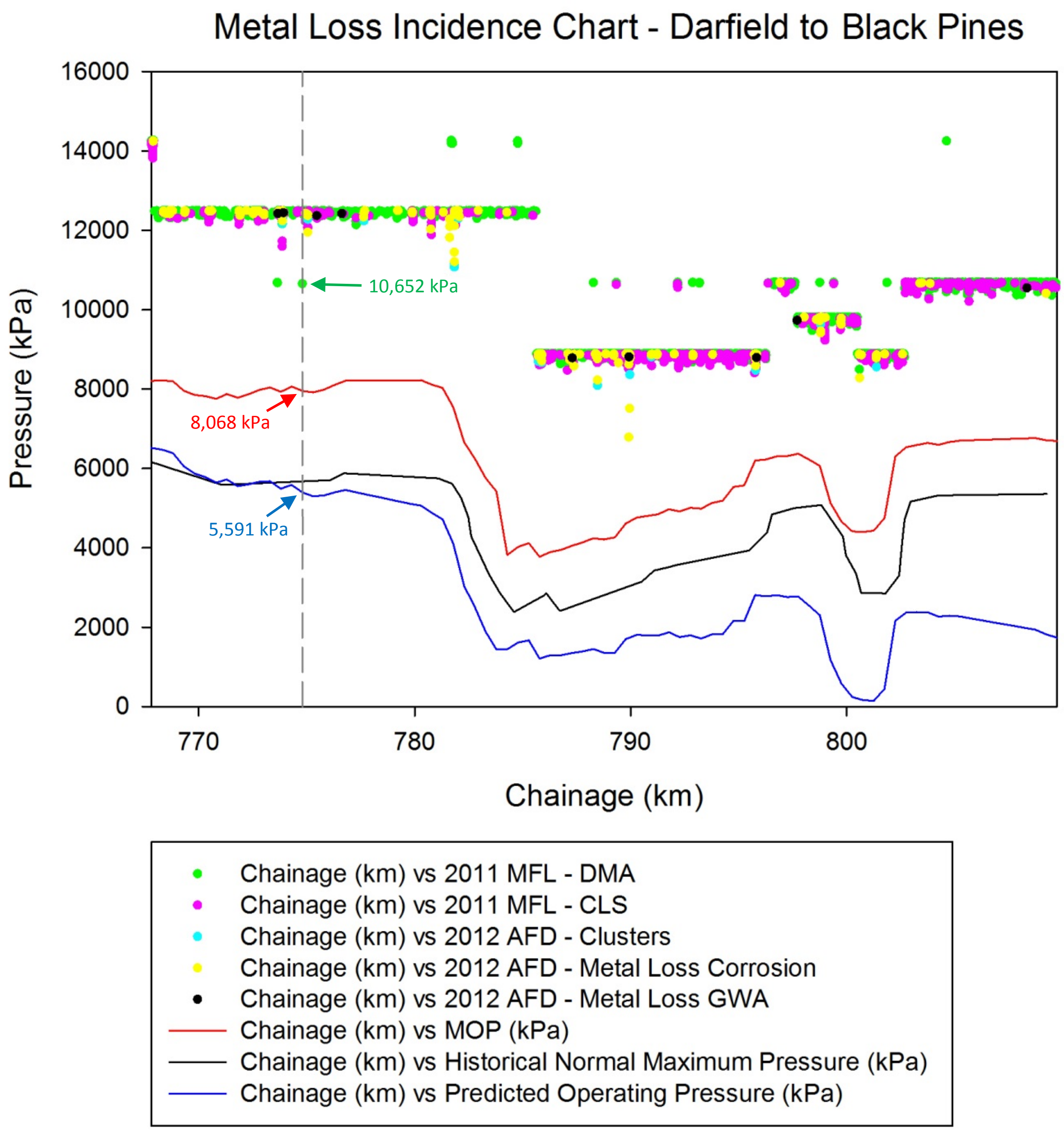


Figure 5.2 Metal Loss – Darfield to Black Pines

5.1.2.2 Factor of Safety

The dashed lines in Figure 5.1 and Figure 5.2 correspond to the chainage with the lowest difference between the MOP and the feature's rupture pressure. It can be seen that the rupture pressure for all features identified in each segment falls above the predicted operating pressure and the maximum operating pressure. These two buffers serve as factors of safety that can be quantified by applying the following equation:

$$FS = \frac{P_{\text{Rupture}}}{P}$$

Where:

FS = Factor of safety for either MOP or Predicted Pressure

$P_{Rupture}$ = Rupture pressure of a specific feature, kPa

P = Base pressure (either MOP or Predicted Pressure), kPa

The factor of safety charts are created by applying the above equation at each feature to compare its rupture pressure to both the Predicted Pressure and the MOP.

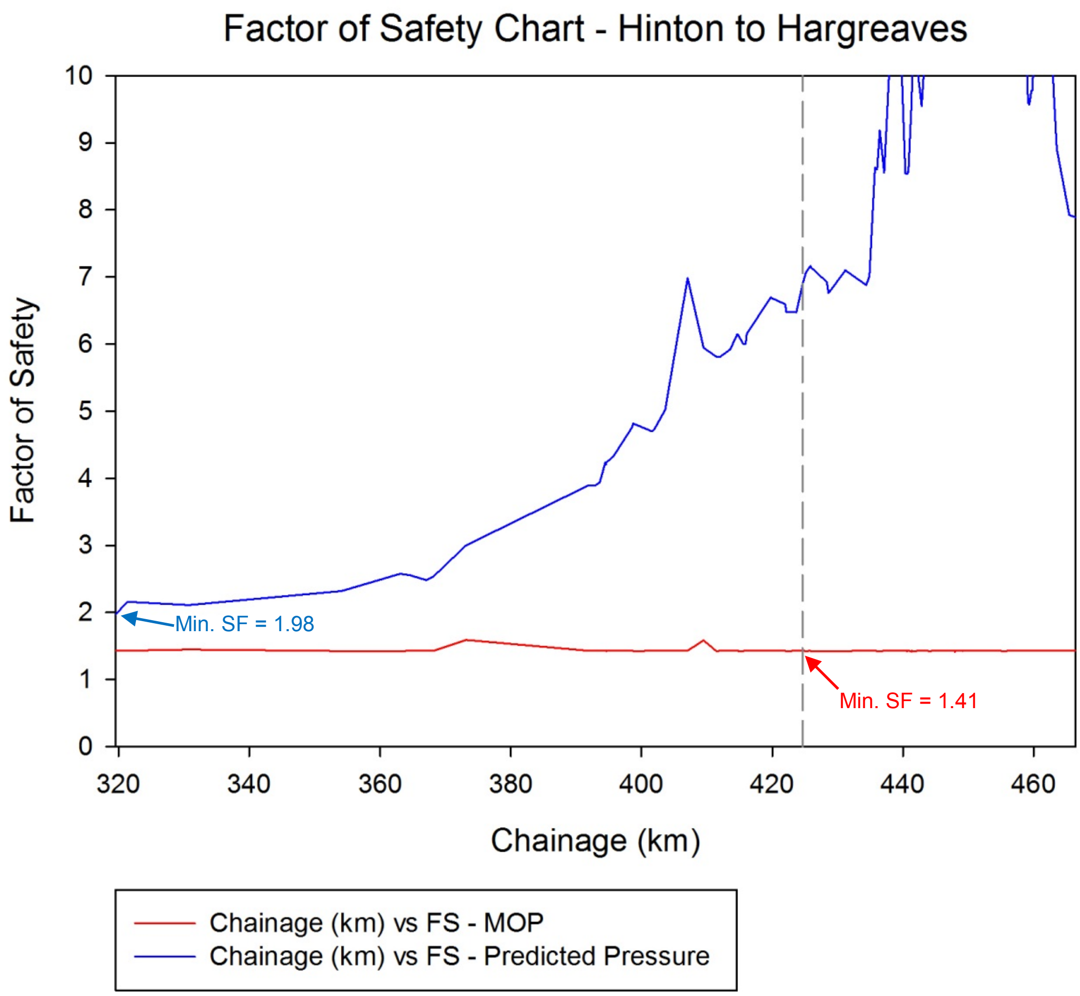


Figure 5.3 Factor of Safety – Hinton to Hargreaves

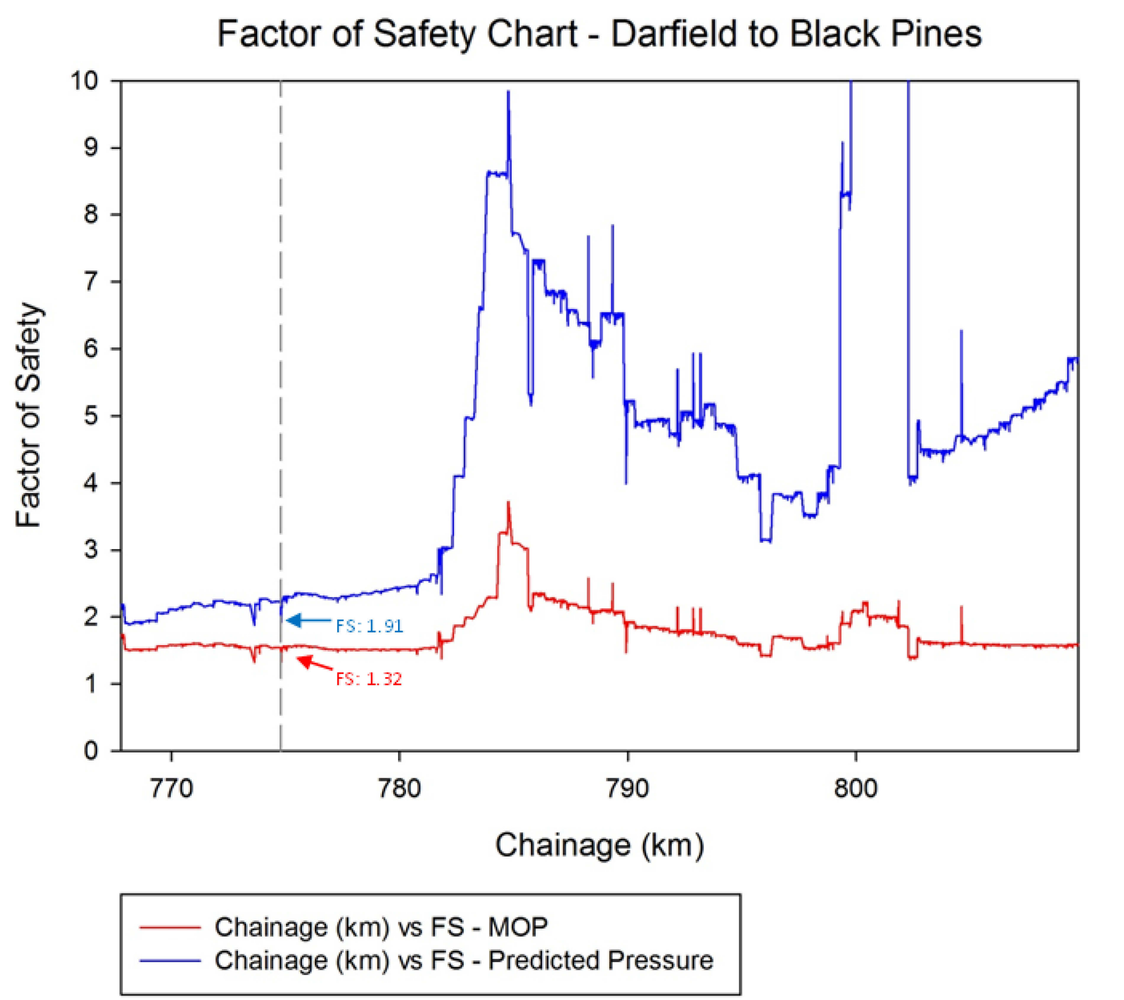


Figure 5.4 Factor of Safety – Darfield to Black Pines

From Figure 5.3 and Figure 5.4 the respective factors of safety for each segment can be summarized in the following table:

TABLE 5.1 FACTOR OF SAFETY SUMMARY

Segment	Hinton to Hargreaves		Darfield to Black Pines	
Reference	MOP	Predicted Pressure	MOP	Predicted Pressure
Average	1.43	9.09	1.80	8.76
Mean	1.43	9.18	1.74	4.80
Minimum	1.41	1.98	1.32	1.88
Maximum	1.59	17.08	3.83	59.71

Figure 5.5 through Figure 5.8 display all the calculated factor of safety data points arranged in order of decreasing value. These charts provide a comparison of the incidence of magnitudes of all calculated factor of safety.

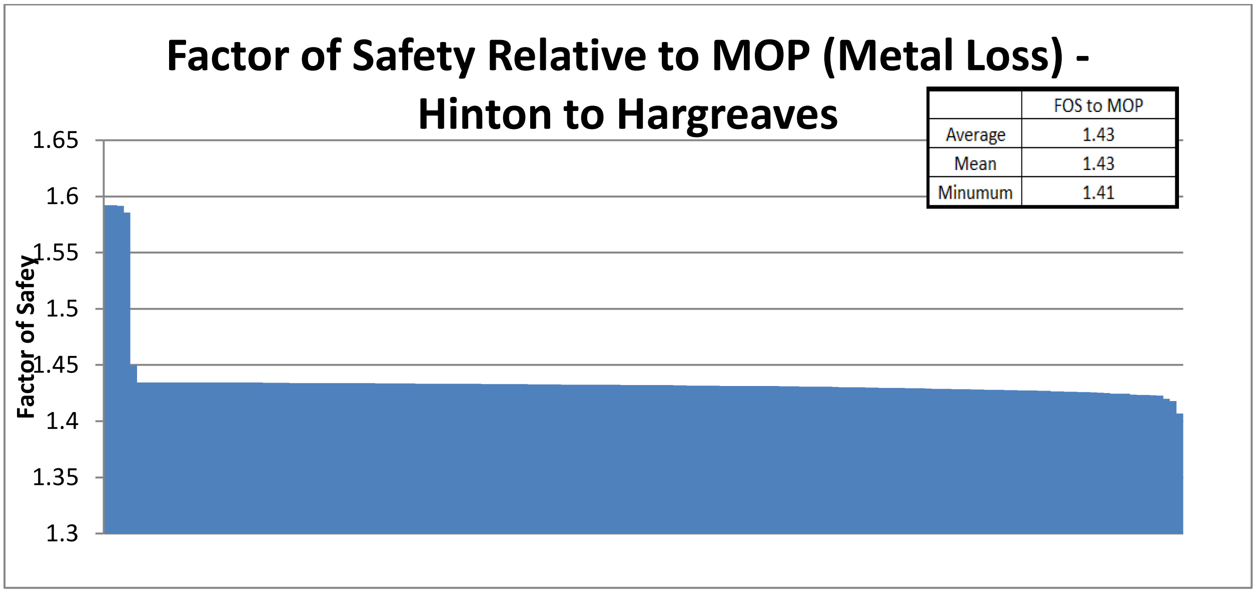


Figure 5.5 Factor of Safety Relative to MOP (Metal Loss) – Hinton to Hargreaves

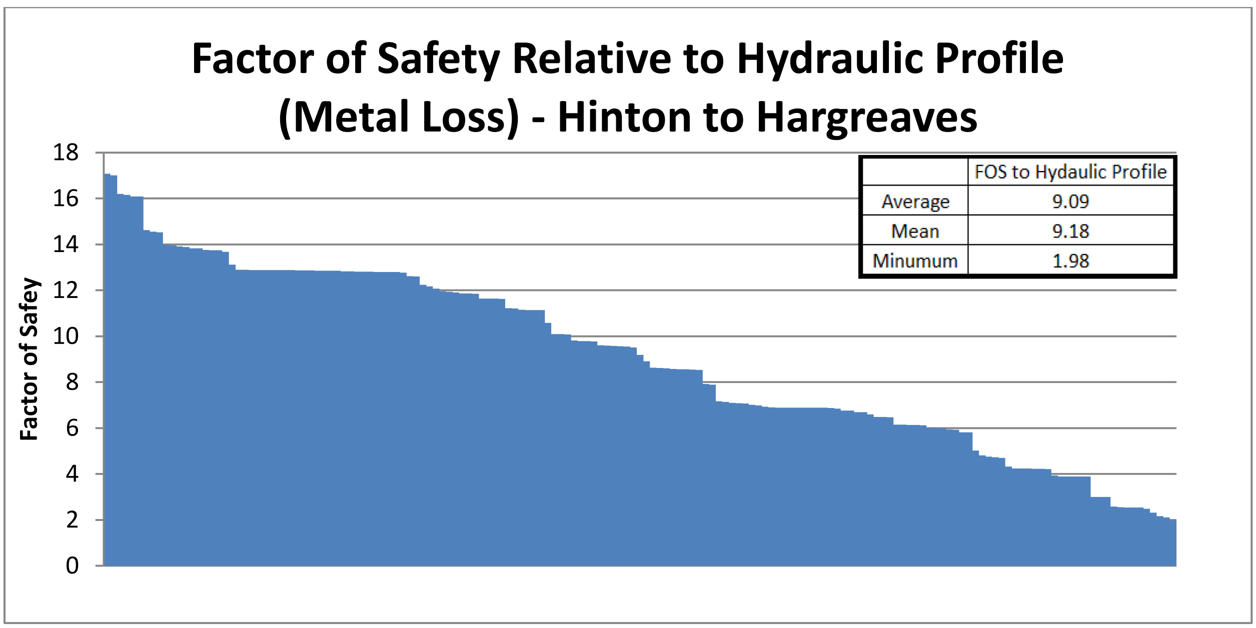


Figure 5.6 Factor of Safety Relative to Hydraulic Profile (Metal Loss) – Hinton to Hargreaves

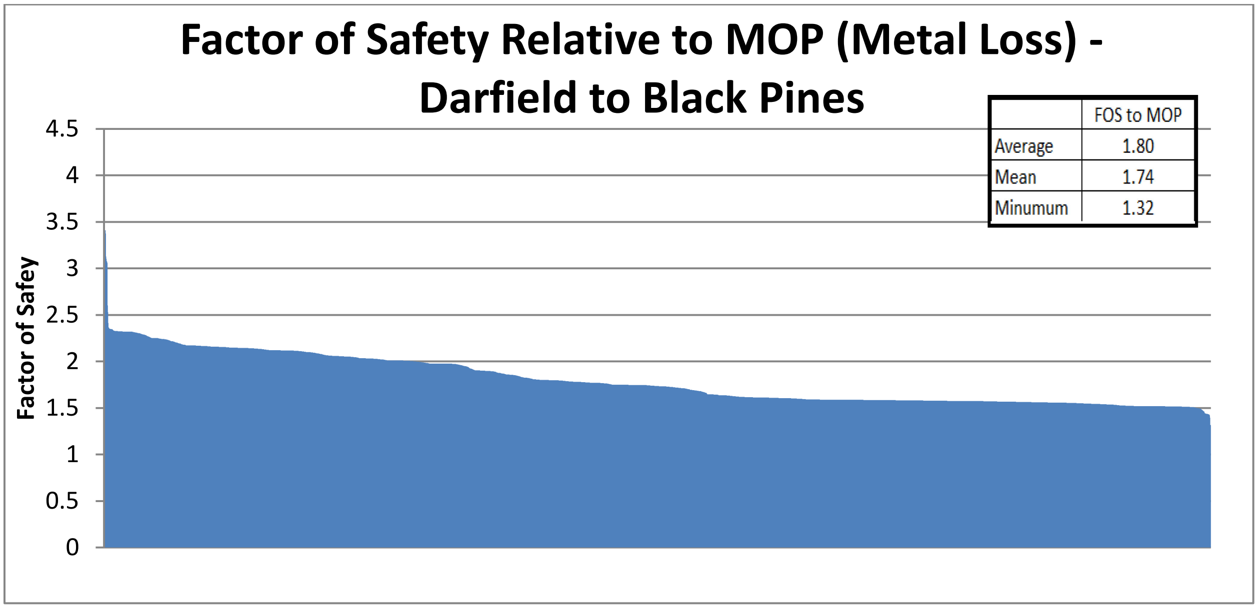


Figure 5.7 Factor of Safety Relative to MOP (Metal Loss) – Darfield to Black Pines

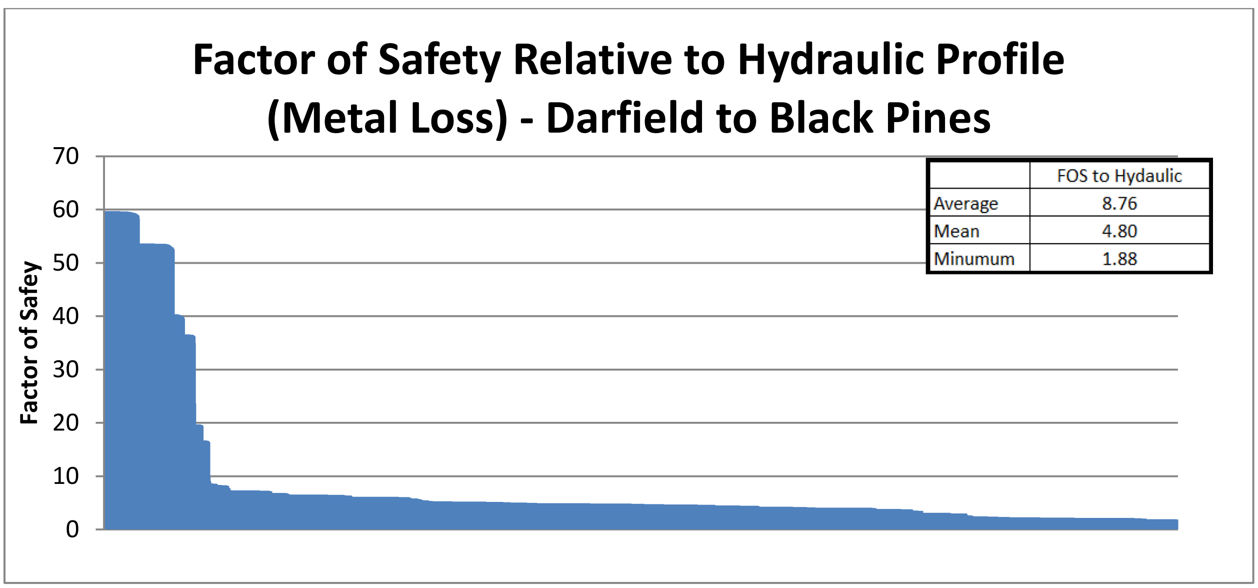


Figure 5.8 Factor of Safety Relative to Hydraulic Profile (Metal Loss) – Darfield to Black Pines

5.1.3 Corrosion Growth Rates

Corrosion growth rates (CGRs) are calculated on all KMC pipelines. They are calculated by taking the difference in corrosion depth between two metal loss ILI runs and dividing that by the amount of time between runs. This gives the average rate at which corrosion pits are growing in millimeters per year. A standard deviation of the data is also produced, which allows more conservative CGRs to be used in prediction calculations. If there has not been two metal loss tool runs on a particular segment then the corrosion rate is calculated by assuming that it began growing halfway through the pipes life in order to be conservative. In this case, both lines must be calculated this way because they have not had two metal loss ILI runs from the same tool vendor. The table below summarizes the CGRs.

TABLE 5.2 CORROSION GROWTH RATES

Line	Average CGR	Standard Deviation
Hinton - Hargreaves	0.145 mm/year*	0.0126 mm/year*
Darfield – Kamloops	0.027 mm/year	0.0170 mm/year

**The corrosion growth rate for the NPS 36 line from Hinton to Hargreaves may not be accurate. The Baker Hughes MFL run was completed only five years after the pipeline was installed and did not find any metal loss greater than 10% WT. The CGR will be calculated much more accurately in 2018 after the next proposed Baker Hughes tool run.*

For reference, the Industry Standard CGRs are as follows:

TABLE 5.3 INDUSTRY STANDARD CORROSION GROWTH RATES

Feature Depth Range	External Corrosion Growth Rate (mm/year)	Internal Corrosion Growth Rate (mm/year)
0 - 20% NWT	0.10	0.10
20 – 40% NWT	0.20	0.15
> 40% NWT	0.30	0.25

More established lines (i.e. TMPL lines that have been in service longer) have shown that the CGRs on the TMPL are well below industry standard CGRs. It is expected that the Hinton to Hargreaves and Darfield to Kamloops lines will have similar CGRs over a longer timeframe.

TABLE 5.4 TYPICAL CORROSION GROWTH RATES ON TMPL

Segment	MFL ILI		Int. CGR (mm/yr)		Ext. CGR (mm/yr)	
	Previous	Recent	Mean	Std Dev	Mean	Std Dev
Edmonton - Edson	2004	2009	0.0179	0.0441	0.0207	0.0459
Hargreaves - Blue River	2007	2012	0.0136	0.0327	0.0012	0.0496
Blue River - Darfield	2006	2012	0.0036	0.0362	0.0008	0.0363
Kamloops - Sumas	2003	2010	0.0159	0.0379	0.0132	0.0366
Sumas - Burnaby	2005	2011	0.0017	0.0456	0.0037	0.0372
Sumas - Tank Farm	2005	2012	0.0085	0.0504	0.0042	0.0187
Westridge Lateral	2008	2012	0.0208	0.0675	0.0007	0.0420

5.2 Cracking

As stated in sections 3.3.1 and 3.3.2 of this document, the NPS 36 Hinton to Hargreaves and NPS 30 Darfield to Black Pines segments have never experienced a failure, leak or rupture, caused by crack-like features. This section provides background information on KMC's crack management program along with compiled crack study results for both segments.

5.2.1 Crack Management Results

The charts found in this segment serve to represent the incidence of the seam weld anomalies and crack-like features along with their severity. Data is not available for the Hinton to Hargreaves segment as the only ILI performed for this segment was for metal loss. The feature data for the Darfield to Black Pines segment were obtained from a 2013 Rosen Electro-Magnetic Acoustic Transducer (EMAT).

A dig list was prepared to address three crack-like features found in the Darfield to Kamloops segment. Two of the features were located downstream of Black Pines and one of the features was found in the Darfield to Black Pines segment (located in the vicinity of a dent). The anomaly was repaired through the use of a petro sleeve.

The crack-like anomaly charts provide a comparison between the historical normal maximum pressures, the maximum operating pressure, and the predicted operating pressure after the segments are reactivated for Line 2 heavy crude service. The rupture pressure for the remaining seam weld anomalies and crack-like features is included in the charts, the difference between the operating pressures and the features' rupture pressure allows for a visual representation of the factor of safety in the segments' operation.

The maximum operating pressure, historical maximum operating pressures, and the proposed operating pressures for Line 2 service were determined in accordance with the methods outlined in section 3.2.3.

5.2.1.1 Charts

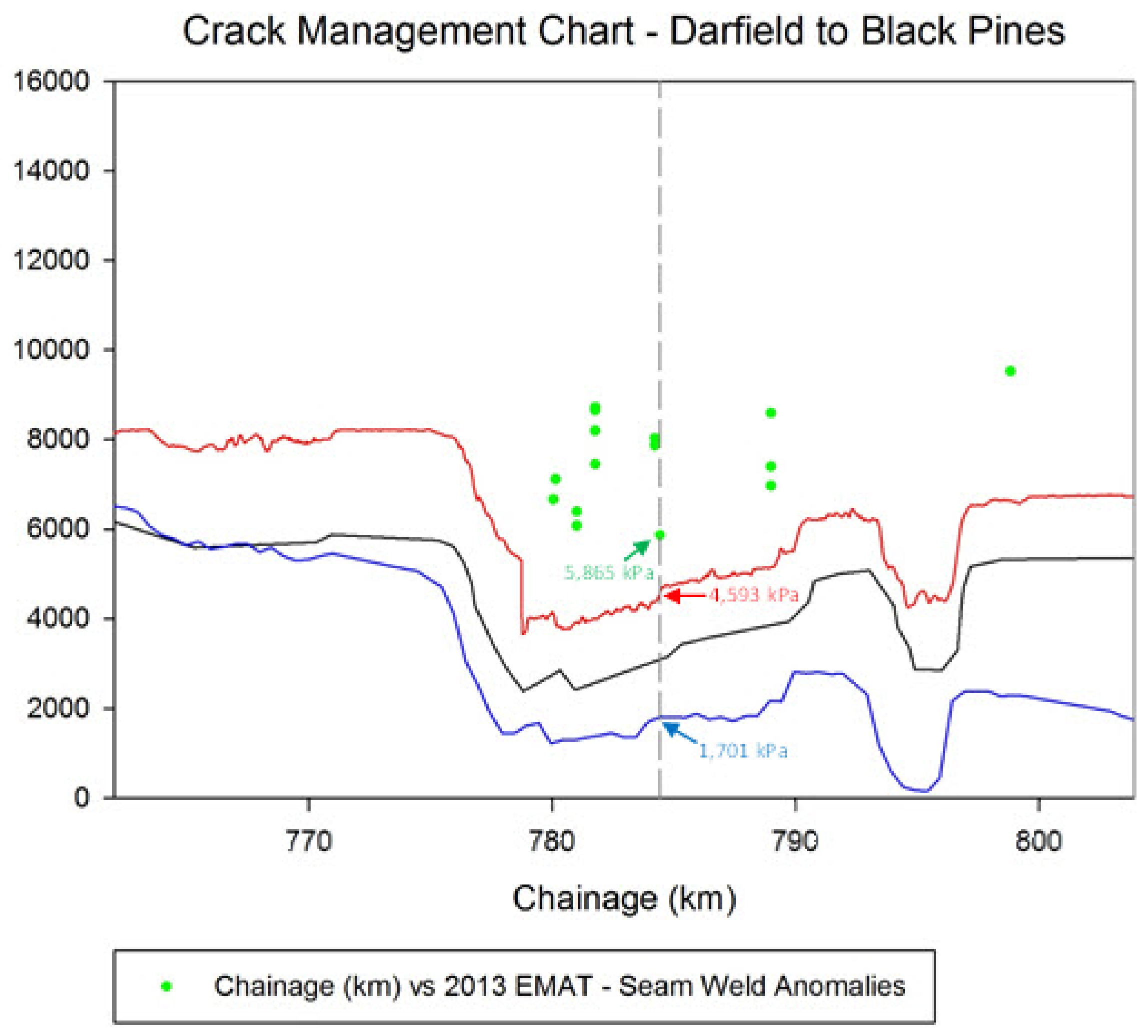


Figure 5.9 Crack-Like Anomalies – Darfield to Black Pines

5.2.1.2 Factor of Safety

The dashed line in Figure 5.9 corresponds to the chainage with the lowest difference between the MOP and the feature's rupture pressure. It can be seen that the rupture pressure for all features identified in each segment falls above the predicted operating pressure and the maximum operating pressure. These two buffers serve as factors of safety that can be quantified by applying the following equation:

$$FS = \frac{P_{\text{Rupture}}}{P}$$

Where:

$FS =$ Factor of safety for either MOP or Predicted Pressure

P_{Rupture} = Rupture pressure of a specific feature, kPa

P = Base pressure (either MOP or Predicted Pressure), kPa

The Factor of safety charts is created by applying the above equation at each feature to compare its rupture pressure to both the Predicted Pressure and the MOP.

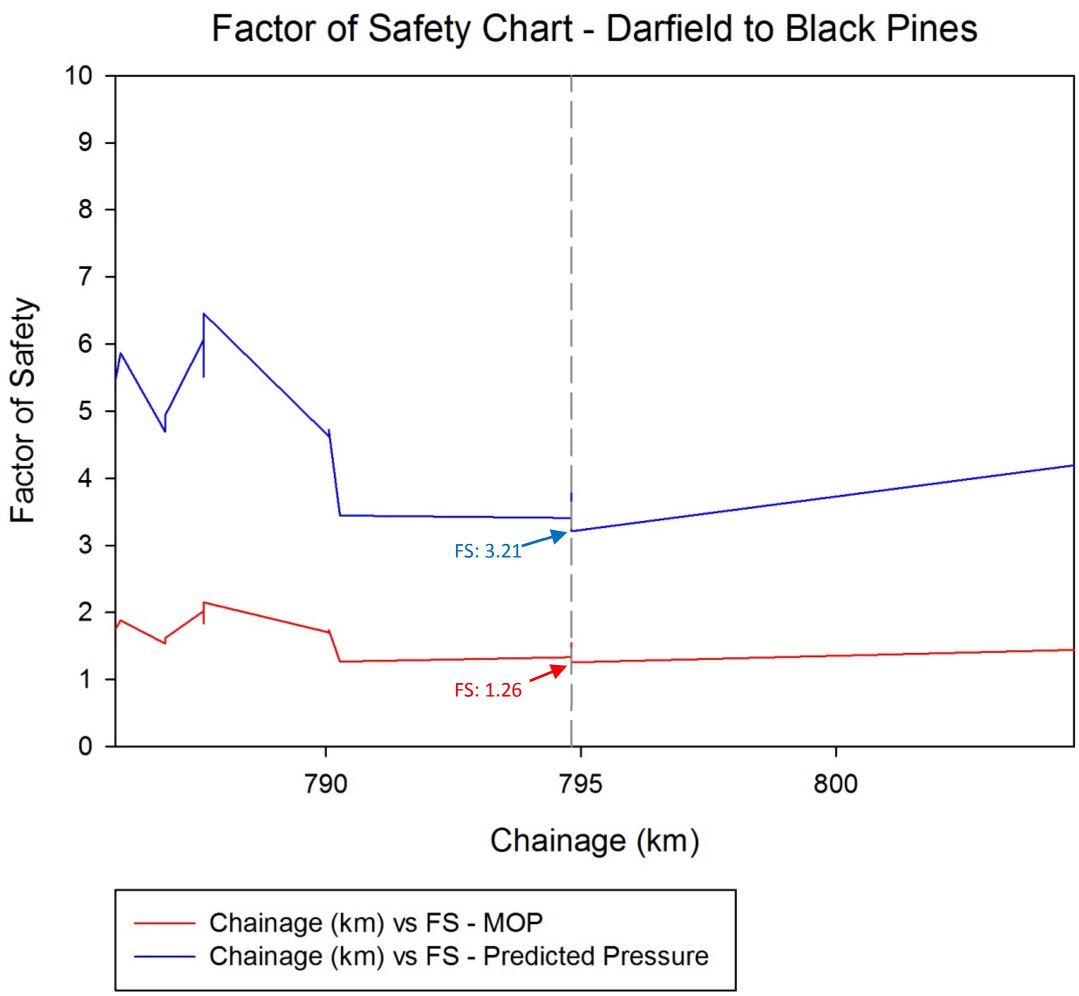


Figure 5.10 Factor of Safety for Crack-Like Anomalies – Darfield to Black Pines

From Figure 5.10 the Factor of Safety for crack-like anomalies for the segment can be summarized in the following table:

TABLE 5.5 FACTOR OF SAFETY SUMMARY FOR CRACK-LIKE ANOMALIES

Segment	Darfield to Black Pines	
Reference	MOP	Predicted Pressure
Average	1.71	4.87
Median	1.67	4.72
Minimum	1.28	3.21
Maximum	2.18	6.46

Figure 5.11 and Figure 5.12 display the calculated Factor of safety data points arranged in order of decreasing value. This chart provides a comparison of the incidence of magnitudes of all calculated Factor of safety.

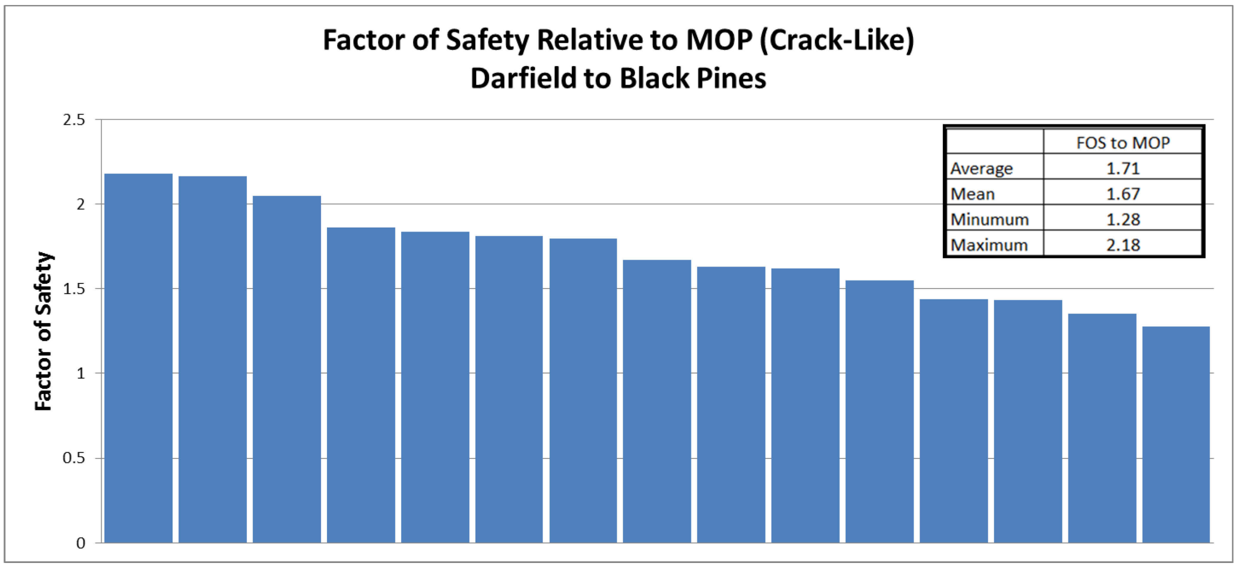


Figure 5.11 Factor of Safety Relative to MOP for Crack-Like Anomalies – Darfield to Black Pines

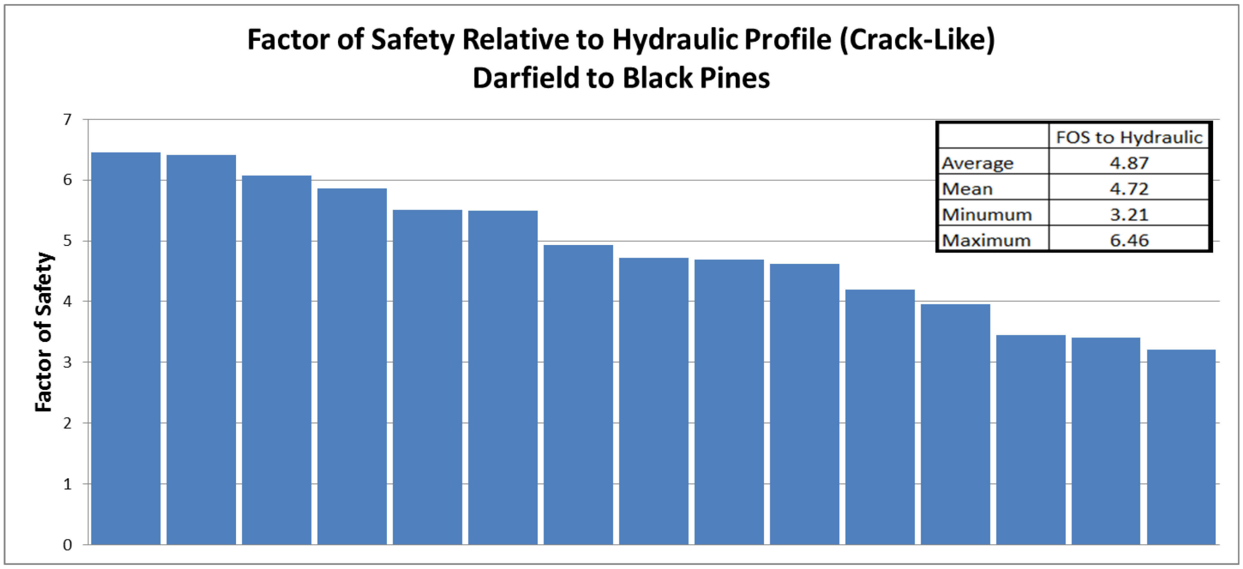


Figure 5.12 Factor of Safety Relative to the Hydraulic Profile for Crack-Like Anomalies for Darfield to Black Pines

5.3 Mechanical Damage

5.3.1 Third Party Damage Prevention

KMC considers third-party damage a threat to pipeline integrity. A number of active and passive programs are in place to minimize the likelihood of accidental third-party damage to any part of the KMC network.

- **Public Awareness Program**: The KMC Public Awareness Program (PAP) is designed to inform and educate the public and contractors about pipeline safety, damage prevention, emergency preparedness and maintenance projects through mail-outs, personal visits, open houses, emergency response committee initiatives and the company website.
- **Signage**: KMC's ROWs are clearly marked with signs in accordance with CSA Z662 that specifically identify the hazard as a liquid petroleum pipeline and provide an emergency contact number. The signs are posted by Pipeline Protection Technicians at strategic locations, which include road, rail, water, and utility crossings; subdivision developments; construction sites; and high population areas.
- **Right of Way Surveillance**: Regularly scheduled aerial patrols of the ROW are conducted to monitor for encroachments and visible threats to pipeline integrity, which are classified as third party encroachments, natural hazards, or advisories. Aerial patrols are performed once per month for both the Hinton to Hargreaves and Darfield to Kamloops line segments. During the summer, there are two aerial patrols per month from Hinton to Hargreaves and one per week from Darfield to Kamloops. Pipeline Protection Technicians and their Supervisors are notified of all observations and are responsible for further investigation and reporting. In addition to aerial patrols, KMC staff also conducts day-to-day routine surveillance of the ROW during the performance of regular duties and report potential or existing encroachments.

- **Crossing Requests**: All crossing requests are processed by the Crossings Technologist, who will involve Technical Services if the crossing involves metallic pipelines, power lines over 50kV, major utilities, roads, parking lots or railway crossings. Any activity within areas identified as containing potentially susceptible soils is also reviewed. All approved crossings are documented and processed by Drafting to update relevant drawings.
- **One-Call Systems**: KMC has membership in both the Alberta and B.C. one-call systems. These two agencies serve as a clearinghouse for planned ground disturbances in close proximity to or across the pipeline, and notify KMC of the location, timing, and contact information of all such activities. If required, KMC dispatches Pipeline Protection Technicians to identify the location of the pipeline and monitor activities related to ground disturbance or crossing of the line by mechanical equipment as per the NEB's Pipeline Crossing regulations.

6.0 PLANNED ACTIVITIES

Table 6.1 and Table 6.2 list the next proposed inspections in Trans Mountain's ILI Multi Year Plan for the NPS 36 and NPS 30 line segments, respectively.

TABLE 6.1 PROPOSED ILI SCHEDULE (HINTON TO HARGREAVES)

Hinton – Hargreaves NPS 36		
Date	**Vendor**	**Tool**
2015	TBD	TFI
2015	TBD	USCD or EMAT
2018	Baker Hughes	MFL + Caliper
2023	Baker Hughes	MFL + Caliper

TABLE 6.2 PROPOSED ILI SCHEDULE (DARFIELD TO KAMLOOPS)

Darfield – Kamloops NPS 30		
Date	**Vendor**	**Tool**
2014	GE	USCD
2016	Baker Hughes	MFL + Caliper
2017	Rosen	AFD
2019	TBD	Pipe body crack tool

In addition to these inspections, the following activities will also be conducted before the NPS 36 and NPS 30 line segments are incorporated into Line 2:

- Install a new groundbed at KP 464.857 in 2015 to increase low cathodic protection (CP) levels; and
- Extend the groundbeds at KP 791.1 and KP 795.1 by extending the existing linear anodes.

7.0 CONCLUSION

The Engineering Assessment demonstrates that the NPS 36 Hinton to Hargreaves and NPS 30 Darfield to Black Pines segments of the TMPL can safely operate in Line 2 heavy crude service. This conclusion is based on the following:

- The pipeline segments have a historically safe record, with no recent in-service failures and no hydrostatic test failures.
- The segments have been consistently monitored through regular ILI tool runs and will continue to be monitored for the life of the pipeline.
- The Integrity Management Program has been effective at maintaining the pipeline in a condition to operate up to the licensed MOP.
- The factor of safety for the remaining metal loss features ranges from 1.41 to 3.83 relative to the licensed MOP and 1.88 to 59.71 relative to the proposed operating profile.
- The factor of safety for the remaining crack-like features in the Darfield to Black Pines section of line ranges from 1.28 to 2.18 relative to the licensed MOP and 3.21 to 6.46 relative to the proposed operating profile.
- KMC has a comprehensive program for third party damage prevention and continues to monitor third party damage through the use of its damage prevention programs and in-line inspection.

TMEP Engineering Assessment 3 - Active TMPL NPS 24 and NPS 30 Segments to be Incorporated into TMEP Line 1 Service

Trans Mountain Expansion Project

Active TMPL NPS 24 and NPS 30 Segments to be Incorporated into TMEP Line 1 Service

Engineering Assessment

August, 2014

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1.0 EXECUTIVE SUMMARY

To meet increasing demand from customers Trans Mountain has proposed twinning the Trans Mountain Pipeline (TMPL), which runs from Edmonton to Burnaby. Upon completion of this project, the existing operating NPS 24 pipeline segments and a section of the NPS 30 pipeline segments in TMPL, which currently handles batches ranging from refined product to heavy crude, along with the NPS 24 reactivation segments will be designated as Line 1 and will be used to transport lighter crude oil and crude oil products. The NPS 36 segment and a portion of the NPS 30 segments of TMPL will be incorporated into Line 2 and will primarily transport heavy products. The majority of this Line 2 will be newly constructed pipeline with the exception of two existing pipeline segments: the NPS 36 Hinton to Hargreaves, and the NPS 30 Darfield to Black Pines. Collectively, the above elements of the pipeline expansion project are known as the Trans Mountain Expansion Project (TMEP).

Kinder Morgan Canada (KMC) completed this Engineering Assessment (EA) to demonstrate that the operating NPS 24 and NPS 30 pipeline segments between Edmonton, AB and Burnaby, BC can continue to operate safely in Line 1 service within the specified flow rates provide through TMEP.

The engineering assessment (EA) was prepared in accordance with section 10.3.7 of CSA Z662-11 “Oil and Gas Pipeline Systems” and is composed of the following:

- Review of pipeline design, materials, construction and operation specifications;
- Review of integrity management and maintenance records; and
- Fitness for Service (FFS) assessments of corrosion, cracking, and mechanical damage.

Key conclusions from the engineering assessment indicate that the existing NPS 24 and NPS 30 pipeline segments are safe to operate in Line 1 service under the operating pressures and volumes proposed by the project. This conclusion is based on the following:

- The segments have been consistently monitored through regular ILI tool runs and will continue to be monitored for the life of the pipeline.
- The Integrity Management Program has been effective at maintaining the pipeline in a condition to operate up to the licensed MOP.
- The factor of safety for the remaining metal loss features ranges from 1.26 to 4.59 relative to the licensed MOP and 1.66 to 213.66 relative to the proposed operating profile.
- All crack-like anomalies discovered by the AFD and EMAT crack inspections have been repaired with the exception of three features in the Hargreaves to Darfield section of pipeline.
- The factor of safety for the remaining crack-like features in the Hargreaves to Darfield section of line ranges from 1.26 to 1.31 relative to the licensed MOP and 2.04 to 3.63 relative to the proposed operating profile.
- KMC has a comprehensive program for third party damage prevention and continues to monitor third party damage through the use of its damage prevention programs and in-line inspection.

2.0 PROJECT INFORMATION

2.1 Project Background

The Trans Mountain Expansion Project (TMEP) includes the proposed looping of the existing Trans Mountain Pipeline (TMPL) system with the exception of the Hinton to Hargreaves and the Darfield to Black Pines pipeline segments. The expanded TMPL system will consist of two independently operated pipelines from Edmonton Terminal to Burnaby Terminal. The "Line 1" pipeline will consist of NPS 24 and NPS 30 pipeline segments that are currently part of the existing TMPL system and will include two reactivated NPS 24 pipeline segments. The "Line 2" pipeline will consist of 987 km of new NPS 36 pipeline and two NPS 30 and NPS 36 pipeline segments that are currently part of the existing TMPL system.

The 1,147 km Line 1 pipeline will consist of:

- the existing 229 km of NPS 24 and 89 km of NPS 30 pipeline segments from Edmonton to Hinton;
- a reactivated 150 km of NPS 24 pipeline segment from Hinton to Hargreaves;
- the existing 273 km of NPS 24 pipeline segment from Hargreaves to Darfield;
- a reactivated 43 km of NPS 24 pipeline segment from Darfield to Black Pines; and
- the existing 325 km of NPS 24 and 38 km of NPS 30 pipeline segments from Black Pines to the Burnaby Terminal.

The 1,180 km Line 2 pipeline will consist of:

- approximately 339 km of new NPS 36 pipeline from Edmonton to Hinton;
- the existing 150 km of NPS 36 pipeline segment from Hinton to Hargreaves (built in 2008);
- approximately 279 km of new NPS 36 pipeline from Hargreaves to Darfield;
- the existing 43 km of NPS 30 pipeline segment from Darfield to Black Pines (built in 1957); and
- approximately 368 km of new NPS 36 pipeline from Black Pines to the Burnaby Terminal.

The expanded Line 1 pipeline will be capable of transporting an annual average of 55,640 m^3/d (350,000 bbl/d) and will provide a batched transportation service for refined products and light crude oils. Line 1 will also be capable of transporting heavy crude oil at a reduced rate.

The new Line 2 pipeline will be capable of transporting an annual average 85,850 m^3/d (540,000 bbl/d) of heavy crude oils and will be capable of transporting light crude oils, if necessary.

Construction on the NPS 36 Hinton to Hargreaves section of line, referred to as the "Anchor Loop", was completed in 2008, and has been in continuous service since that time. The NPS 30 Darfield to Black Pines line was built in 1957. In 1984, flow was rerouted through the existing NPS 24 line (constructed in 1953) and the NPS 30 line between Darfield and Black Pines was deactivated. In 2004, as part of the Capacity Upgrade Project, the NPS 30 line was reactivated and the NPS 24 line was deactivated.

The focus of this engineering assessment is to verify that the existing operating NPS 24 and NPS 30 pipeline segments between Edmonton, AB to Burnaby, BC will be safe to operate under the hydraulic profile and throughputs proposed for Line 1 service. Engineering assessments for the reactivation of the NPS 24 line segments for Line 1 service are addressed in a separate report.

2.2 Engineering Assessment

This Engineering Assessment (EA) was prepared in accordance with section 10.3.7 of CSA Z662-11 "Oil and Gas Pipeline Systems" and is composed of the following:

- Review of pipeline design, materials, construction, and operation specifications;
- Review of integrity management and maintenance records; and
- Fitness for Service (FFS) assessments of corrosion, cracking, and mechanical damage.

The review of basic pipeline specifications included the design, materials, construction, testing of the line segments, and the conditions under which these lines segments are operated and the properties of the transported fluids. The FFS assessments were based on the following integrity management records:

- Metal loss inspections conducted between 2009 and 2012;
- Cathodic Protection Annual Test Lead Surveys;
- Crack inspections conducted between 2011 and 2013; and
- Third Party Damage Prevention Programs implemented for both pipeline segments.

3.0 PIPELINE RECORDS

This section includes the specifications and properties for the pipeline segments that will be remain in Line 1 between Edmonton, AB, and Burnaby, BC. Operating information is also provided for current operations and planned operations. Further maintenance information is also provided regarding hydrostatic tests, leaks, and in-line inspection (ILI) history.

3.1 Pipeline Specifications

Table 3.1. provides the pipe properties for both the Edmonton, AB, to Burnaby, BC, pipeline segments (excluding the Hinton to Hargreaves and Darfield to Black Pines segments – refer to the engineering assessment for detail on the reactivation segments). The information summary was extracted from KMC's system data records on pipe material properties.

TABLE 3.1 Pipeline Specifications

Diameter	NPS 24 Segments (610 mm)	NPS 30 Segments (762 mm)
Wall Thickness, length and percentage	6.35 mm – 127.0 km (15.4%) 7.14 mm – 22.4 km (2.7%) 7.93 mm – 520.7 km (63.0%) 8.73 mm – 76.4 km (9.2%) 9.53 mm – 60.8 km (7.3%) 11.11 mm – 6.5 km (0.8%) 12.7 mm – 13.3 km (1.6%)	7.93 mm – 74.8 km (58.9%) 8.73 mm – 25.5 km (20.1%) 9.53 mm – 7.3 km (5.7%) 9.8 mm – 7.5 km (5.9%) 10.9 mm – 0.2 km (0.2%) 11.11 mm – 9.9 km (7.8%) 12.7 mm – 1.8 km (1.4%)
Grade	API 5L X42 (290 MPa) – 0.7% API 5L X46 (317 MPa) – 0.9% API 5L X48 (331 MPa) – 2.0% API 5L X52 (359 MPa) – 96.3% API 5L X70 (483 MPa) – <0.1%	API 5L X52 (359 MPa) – 93.9% CSA Z245.1 X70 (483 MPa) – 6.1%
Construction Date	1953	1956/1957/2008
Weld Type	Long Seam - SAW	Long Seam - DSAW
Manufacturer	A.O. Smith (7.2%) Consolidated Western Steel (53.0%) Kaiser Steel Corp (39.8%) Nippon (<0.1%)	Nippon Steel (6.1%) Kaiser Steel Corp (93.9%)
Pipe Length	827 km	127 km
Coating	Coal Tar Enamel	Coal Tar Enamel (91.3%), FBE (6.1%)
Range of MOP	2811 kPa – 9960 kPa	2830 kPa – 9930 kPa

3.2 Operating Information

TMPL currently operates as a batched system transporting a wide range of products from light to heavy petroleum blends. As part of the Trans Mountain Expansion Project the Hinton to Hargreaves and Darfield to Black Pines pipeline segments will be incorporated into Line 2 service and will primarily transport heavy petroleum blends. Table 3.2 compare product properties and operating condition ranges for current operations versus proposed service.

TABLE 3.2 Operating Conditions and Crude Properties Comparison

Operating Mode	Current (TMPL)	Proposed (TMEP Line 1)
Flow Rate	1,250 m^3/hr to 2,770 m^3/hr	~2320 m^3/hr*
Density	680 kg/m^3 to 940 kg/m^3	680 kg/m^3 to 940 kg/m^3
Temperature	0°C to 38°C	0°C to 38°C
Viscosity @ 15C	1 cSt to 350 cSt	1 cSt to 350 cSt

* *Based on sustainable annual average throughput*

3.2.1 Proposed Hydraulic Profile

Figure 3.1, provides a graphical output for the proposed hydraulic profile for Line 1 service. The hydraulic profile is based on a static study of the operation of the pipeline system using the Stoner pipeline simulation model. The study outputs information in the form of a head /

elevation plot that can be used to compare the elevation profile, hydraulic profile, and the maximum allowable operating head profile in metres of head.

Hydraulic studies are continuing and will evolve based on reliability assessments and as the control system design is completed during the detailed design phase of the project. To ensure that this engineering assessment provides sufficient information regarding the ability of the pipeline segments to continue to operate safely in Line 1 service, the engineering assessment includes the factors of safety relative to both the maximum licensed operating pressures and the proposed operating pressures (the proposed hydraulic profile). Changes to the proposed hydraulic profile will result in a change to the factor of safety calculations for the hydraulic profile but will not impact the factor of safety calculations relative to the maximum allowable operating pressures that are currently established and licensed through the National Energy Board.

To complete the fitness for service assessments, the maximum allowable operating head and the hydraulic profile provided in Figure 3.1 have been converted to pressures (see section 3.2.2). The conversion was completed using the density for the proposed operation as outlined in Table 3.2. These are then compared to the predicted rupture pressure of the in-line inspection features that are remaining in the pipeline following the most recently completed inspection and repair programs. Results of the fitness for service assessment and methodology are provided in Section 5.0 Fitness for Service Assessments.

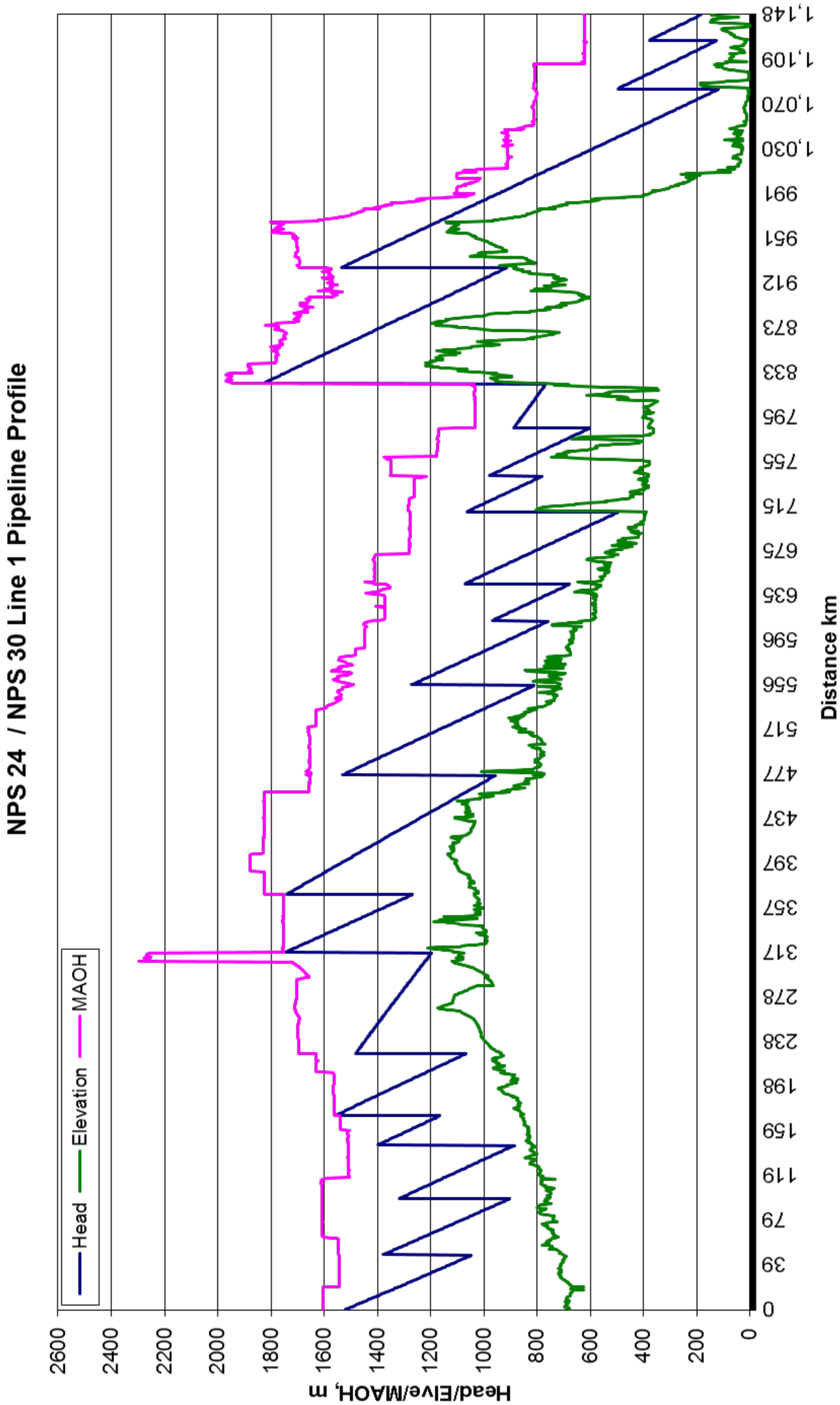


Figure 3.1 Line 1 Hydraulic Profile

3.2.2 Historical vs Future Operation

To assess the difference between the proposed future operations of the pipeline relative to the historical operation of the pipeline, the proposed hydraulic profile was converted to a pressure profile diagram. The historical operating pressure was then overlayed to provide a graphical representation of how the historical and proposed operation of the pipe segments will differ in Line 1 service. The sections below provide a description of the methodology and data used to complete the assessment.

3.2.2.1 Historical Normal Maximum Pressures

To assess the impact of the hydraulic profile for Line 1 versus how the pipeline segments have operated in the last several years, the maximum historical pressure is calculated by utilizing SCADA minute-by-minute daily pressure reports ranging for the sample calendar year of 2011. 2011 was chosen as the sample year as it was fully representative of normal TMPL operating conditions.

The pressure reports are available for suction and discharge pressures of every station in the TMPL system. Operating pressures between the suction and discharge of the stations were completed by interpolating the pressures between these stations. Interpolation points were selected with the following criteria: intervals of 5,000 m in chainage, or elevation changes greater than or equal to 50 m, or changes in the pipe’s wall thickness. Minute-by-minute pressure was calculated for each interpolation point using the following equation:

$$P_x = \left[P_1 - P_2 + k(h_1 - h_2)\right]\left(\frac{L_2 - L_x}{L_2 - L_1}\right) - K(h_x - h_2) + P_2$$

Where:

P_x = Pressure at the interpolation point, kPa
P_1 = Pressure at the upstream station, kPa
P_2 = Pressure at the downstream station, kPa
K = Metres Head: Pressure Conversion (0.92)*9.79 kPa/m
L_1 = Chainage at the upstream station, m
L_2 = Chainage at the downstream station, m
L_x = Chainage at the interpolation point, m
h_1 = Elevation at the upstream station, m
h_2 = Elevation at the downstream station, m
h_x = Elevation at the interpolation point, m

After a year of minute-by-minute pressure data is calculated at all interpolation points, the monthly maximum pressure for each point is recorded and tabulated by chainage. The average of the monthly maximum pressures were used to make up the historical normal maximum pressure curve.

3.2.2.2 Maximum Operating Pressure

The TMPL pipeline system was hydrostatically tested following construction between 1953 and 1957. In the original hydrostatic test the pipeline was pressured to between 77% and 92% of the specified minimum yield strength (SMYS) of the pipe at the low points in the test sections. The number of test failures were not documented during the initial post construction hydrostatic tests.

In the 1970's through the early 2000's the pipeline segments were retested to requalify the pipeline to a higher pressure rating. In these tests the pipeline was pressured to between 86% and 101.8% of the SMYS of the pipe at the low point in the test sections. The elevation and specific gravity was then used to calculate the tested pressure along the entire segment, and then a factor of 0.8 was applied to obtain the MOP.

3.2.2.3 Predicted Operating Pressure

KMC established and maintains a hydraulic model for the existing TMPL system. This model has been created using the Stoner pipeline simulation which matches the existing pumps arrangement and capabilities with the known physical set-up of the pipeline and the properties of the products shipped through the line.

As part of the planning for the Trans Mountain Expansion Project, KMC created a similar hydraulic model to simulate Line 1 expected operating parameters based on the proposed route, pump arrangement, and light crude oil and products service. This model allows for the simulation of head and pressure along the line; from the model, the predicted operating pressure for the Edmonton, AB to Burnaby, BC segments has been extracted to be included in the charts (excluding the Hinton to Hargreaves and Darfield to Black Pines segments which are inactive and do not have historical operating pressure data available).

3.2.2.4 Edmonton to Edson

To determine the impact of the change to Line 1 service, the MOP, historical normal maximum operating pressures and the predicted operating pressure for Line 1 service were overlayed in Figure 3.2.

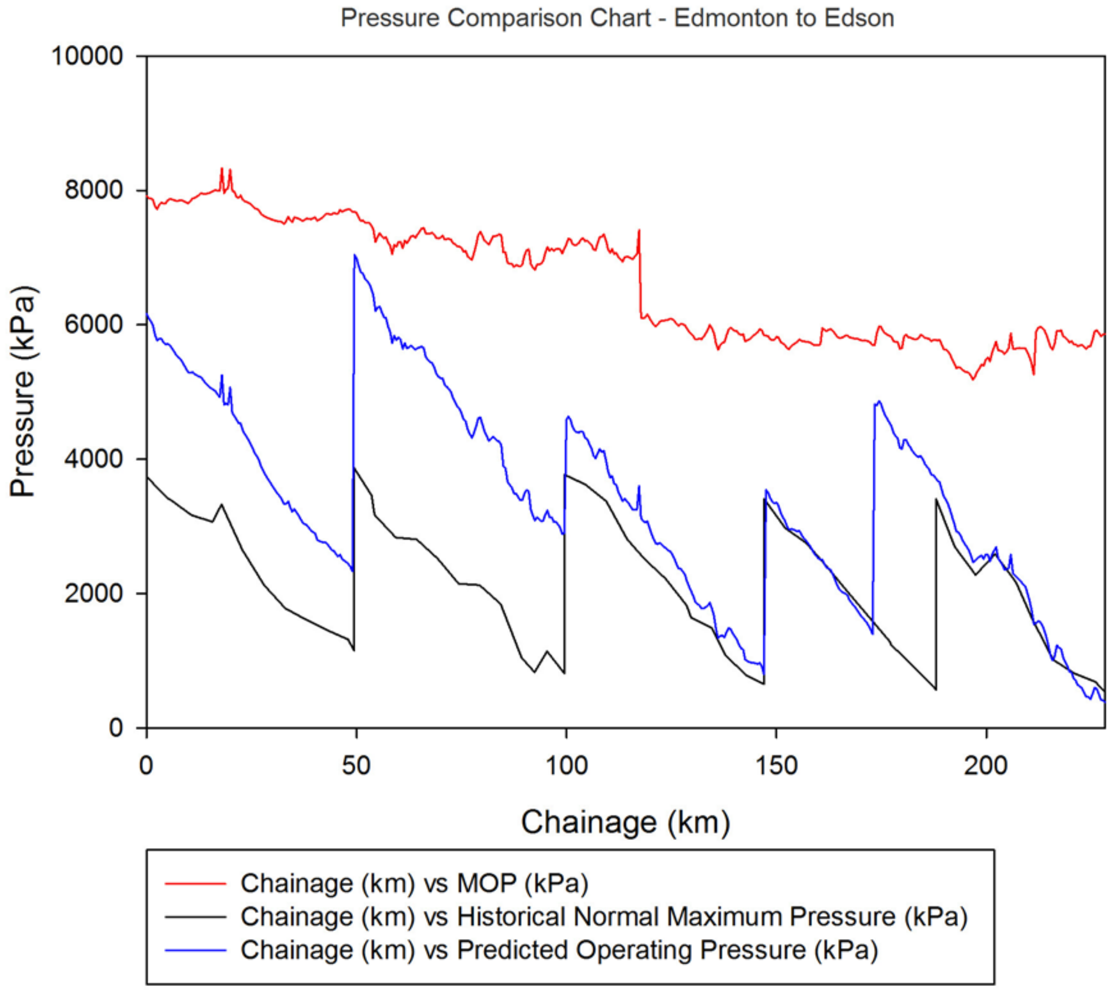


Figure 3.2 Pressure Comparison Chart – Edmonton to Edson

The profile shown in Figure 3.2 shows that the predicted operating pressure is expected to be higher along most of the pipeline segments with the largest increase ocurring at the discharge of the Stony Plain pump station near KM 50.

The operating pressures between KM 150 to KM 180 and KM 190 and KM 230 are expected to be similar to the historical normal maximum pressures.

To assess the impacts of the higher operating pressures, an assessment of the factor of safety of the pipeline was completed and is included in Section 5.0 – Fitness for Service Assessments.

3.2.2.5 Edson to Hinton

To determine the impact of the change to Line 1 service, the MOP, historical normal maximum operating pressures and the predicted operating pressure for Line 1 service were overlayed in Figure 3.3.

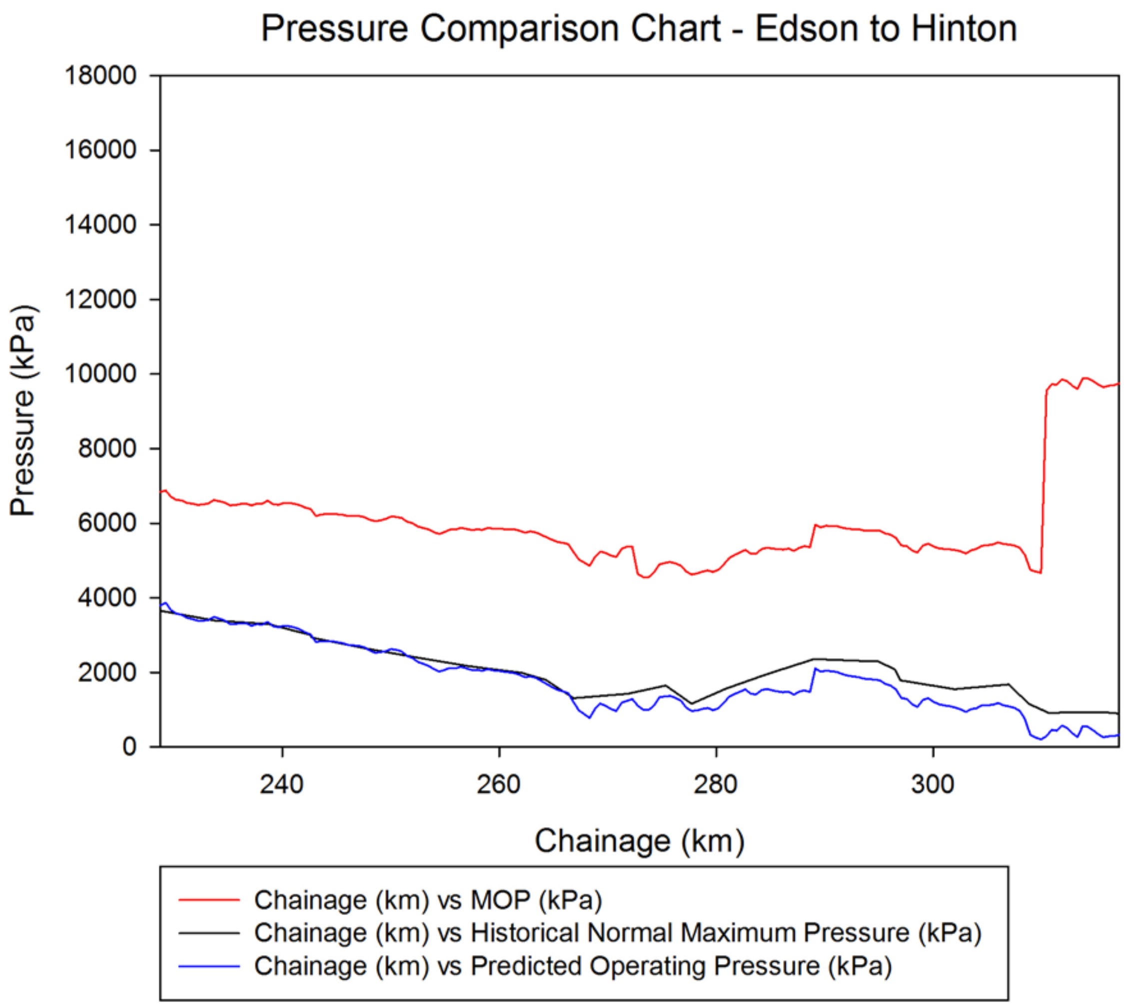


Figure 3.3 Pressure Comparison Chart – Edson to Hinton

The pressure profile shown in Figure 3.3 shows that the pipeline is expected to operate at pressures consistent with the historical normal maximum pressures and at pressures approximately 2500 kPa below the licensed MOP.

An assessment of the factor of safety of the pipeline is included in Section 5.0 – Fitness for Service Assessments.

3.2.2.6 Hargreaves to Darfield

To determine the impact of the change to Line 1 service, the MOP, historical normal maximum operating pressures and the predicted operating pressure for Line 1 service were overlayed in Figure 3.4.

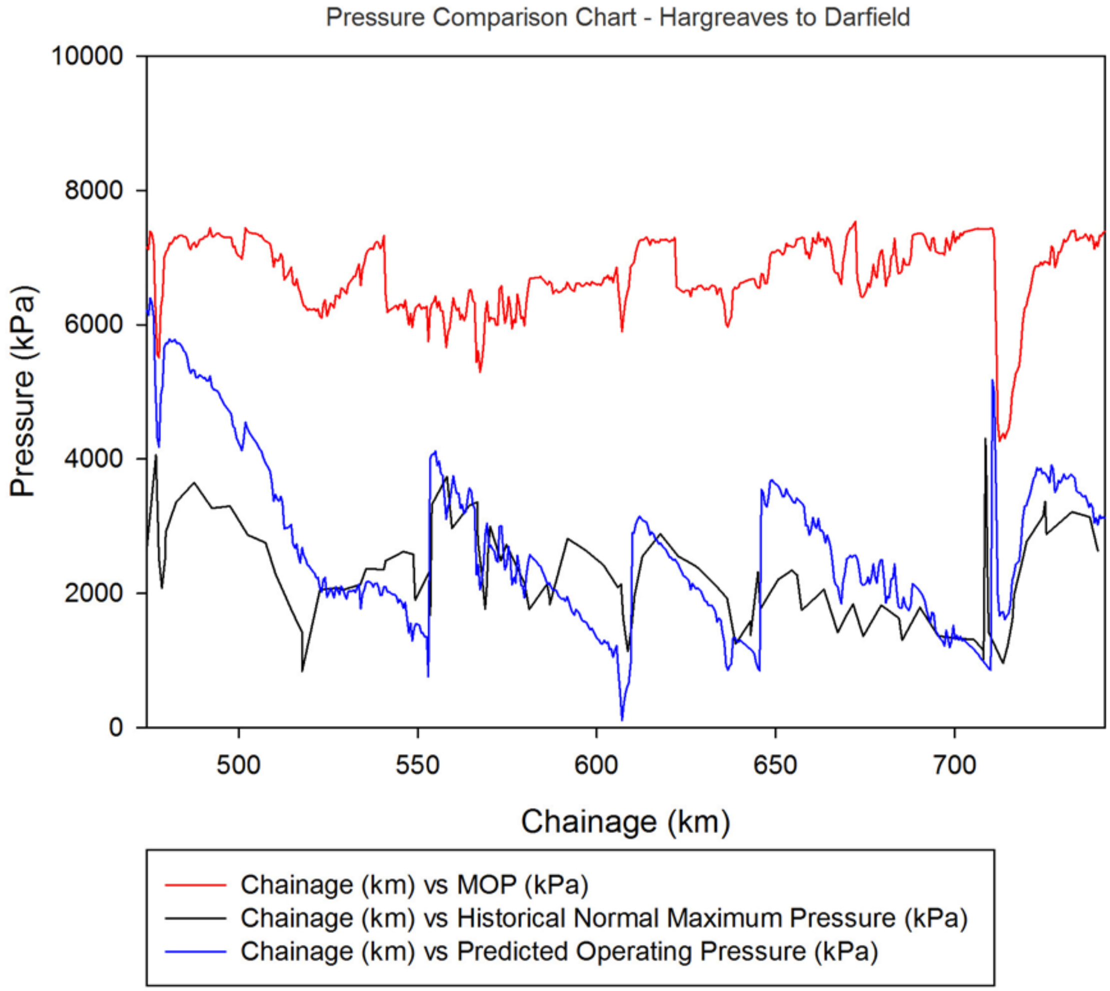


Figure 3.4 Pressure Comparison Chart – Hargreaves to Darfield

The operating pressures at Hargreaves is expected to be approximately 3000 kPa higher than the historical normal maximum pressures and approximately 1000 kPa lower than the licensed MOP.

Starting at KM 525 the operating pressures in Line 1 service are similar to the historical normal maximum pressures. The majority of the pipeline segment between Hargreaves to Darfield is expected to operate at 3000 kPa or more below the licensed MOP of the pipeline.

To assess the impacts of the proposed operating pressures, an assessment of the factor of safety of the pipeline was completed and is included in Section 5.0 – Fitness for Service Assessments.

3.2.2.7 Black Pines to Kamloops

To determine the impact of the change to Line 1 service, the MOP, historical normal maximum operating pressures and the predicted operating pressure for Line 1 service were overlayed in Figure 3.5.

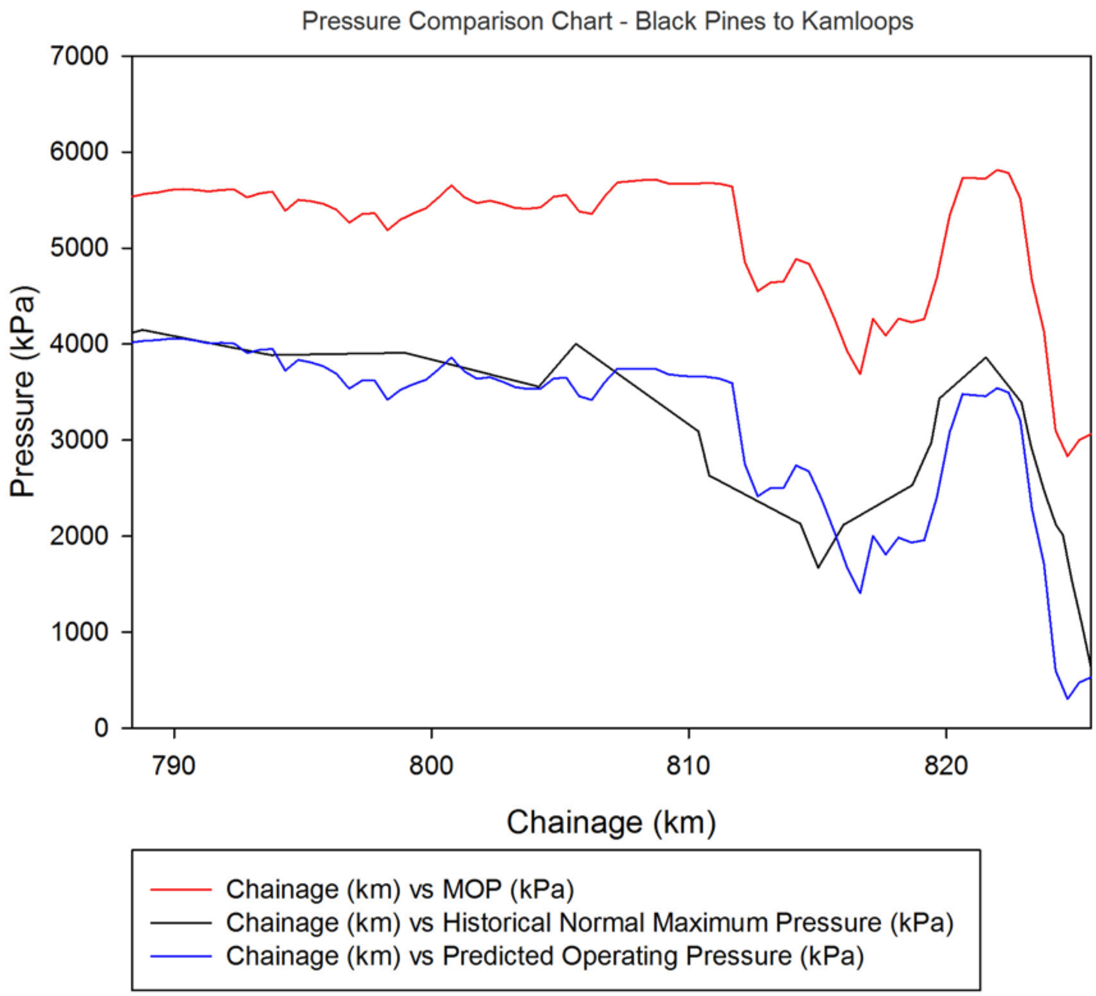


Figure 3.5 Pressure Comparison Chart – Black Pines to Kamloops

The operating pressures for the Black Pines to Kamloops section of Line 1 are expected to operate at pressures consistent with the historical normal maximum pressures and approximately 1500 kPa below the MOP.

To assess the impacts of the proposed operating pressures, an assessment of the factor of safety of the pipeline was completed and is included in Section 5.0 – Fitness for Service Assessments.

3.2.2.8 Kamloops to Sumas

To determine the impact of the change to Line 1 service, the MOP, historical normal maximum operating pressures and the predicted operating pressure for Line 1 service were overlayed in Figure 3.6.

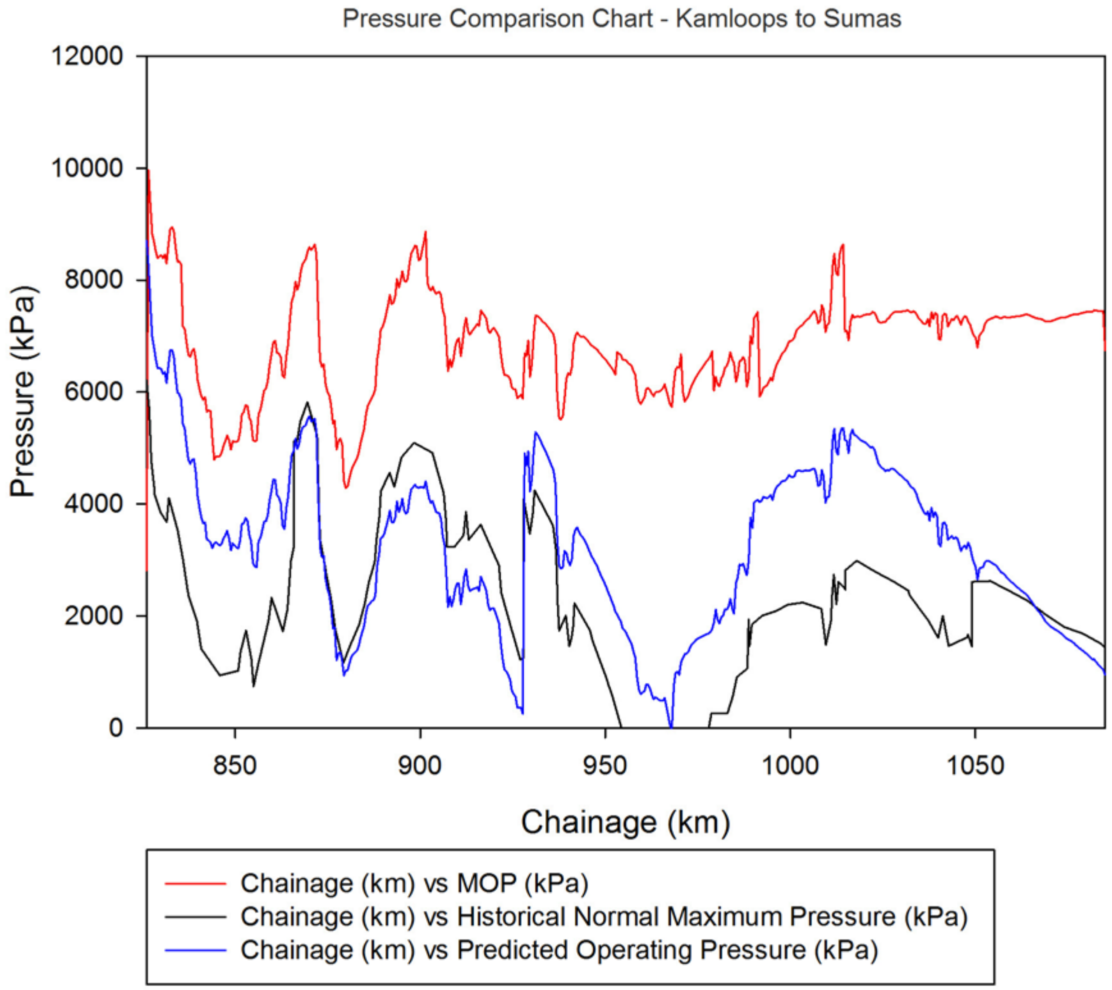


Figure 3.6 Pressure Comparison Chart – Kamloops to Sumas

The discharge pressure at Kamloops is expected to operate approximately 2500 kPa higher than the historical normal maximum pressures. The section of pipeline between KM 980 and KM 1075 is also expected to operate a pressures higher than the historical normal maximum pressures for the pipeline segment.

Between KM 870 and KM 930 the pipeline is expected to operate at pressures consistent with the historical normal maximum pressures.

To assess the impacts of the proposed operating pressures, an assessment of the factor of safety of the pipeline was completed and is included in Section 5.0 – Fitness for Service Assessments.

3.2.2.9 Sumas to Burnaby

To determine the impact of the change to Line 1 service, the MOP, historical normal maximum operating pressures and the predicted operating pressure for Line 1 service were overlayed in Figure 3.7.

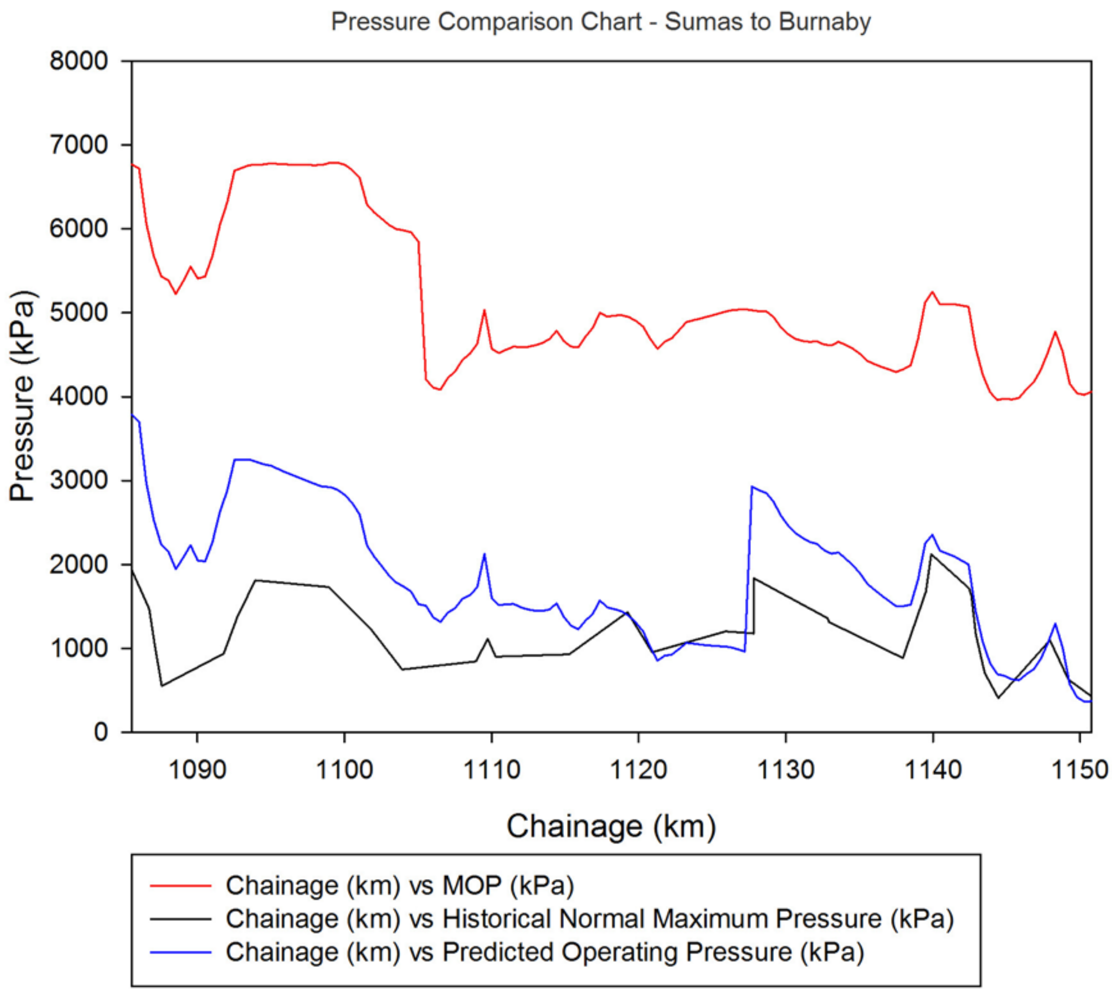


Figure 3.7 Pressure Comparison Chart – Sumas to Burnaby

The pipeline is expected to operate approximately 2000 kPa higher than the historical normal maximum pressure at Sumas and approximately 3000 kPa lower than the licensed MOP. Overall the pipeline segment will operate well below the licensed MOP for the pipeline.

Starting at KM 1120, the pipeline is expected to operate similarily to the historical normal maximum pressures.

To assess the impacts of the proposed operating pressures, an assessment of the factor of safety of the pipeline was completed and is included in Section 5.0 – Fitness for Service Assessments.

3.3 Operating and Maintenance Records

3.3.1 Hydrotest Failures

The TMPL pipeline system was hydrostatically tested following construction between 1953 and 1957. In the original hydrostatic test the pipeline was pressured to between 77% and 92% of the specified minimum yield strength (SMYS) of the pipe at the low points in the test sections. The number of test failures were not documented during the initial post construction hydrostatic tests.

In the 1970's through the early 2000's the pipeline segments were retested to requalify the pipeline to a higher pressure rating. In these tests the pipeline was pressured to between 86% and 101.8% of the SMYS of the pipe. On the tests conducted in the 1970's through early 2000's there were 7 hydrostatic test failures on the currently active pipeline segments (for test failure on the reactivation pipe see the engineering assessment for the reactivation sections). Table 3.3 provides a listing of the test failure locations. The number and causes of the hydrostatic test failures is not well documented and the data included in Table 3.3 is based on the available information and records.

TABLE 3.3 Hydrostatic Test Failures

Date	Approximate KM	Cause of Failure
June 21, 2001	650	Mechanical damage likely due to original construction
June 13-15, 1978	740	Mechanical damage likely due to original construction
July 22-23, 1982	989	Manufacturing defect - lamination
November 3-4, 1977	1040	Failed at a repaired weld on the ID from original manufacture
July 18-21, 1978	1044	Failed at a repaired weld on the ID from original manufacture
November 1-2, 1977	1064	Failed at a repaired weld on the ID from original manufacture
November 1-2, 1977	1080	Cause not provided

3.3.2 In-Service Leaks and Ruptures

A listing of pipeline leaks and ruptures on the TMPL system is provided on the TransMountain web site at the following location:

http://www.transmountain.com/uploads/pages/1406228835-2014-06-30_NEBSpillChart_Web.pdf

Between August, 1961 and January 2014, there have been a total of 25 leaks or ruptures on the TMPL mainline pipe.

In 2013 two leaks occurred on the Kamloops to Sumas section of the TMPL, a pressure restriction was put in place during the summer of 2013 equal to 80% of the highest pressure recorded in the last 90 days. The 80% pressure reduction was voluntarily implemented on June 14, 2013 following the repair of the first of 2 leaking defects discovered in the Kamloops to Sumas pipe segment as listed below:

- A release of less than 1 m^3 of blended crude oil was detected during a planned integrity investigation on TMPL, just upstream of the Kingsvale Station at Kilometer Post 923.567

on June 12, 2013. The cause of the of the leak was determined to be due to cracking that initiated inside of a gouge that was attributed to 3rd party damage.

- On June 26, 2013 a second release of approximately 18 m³ was discovered during planned integrity excavations between Kingsvale and Hope at KP 966.89. The cause of the leak was determined to be a manufacturing flaw adjacent to the inside seam weld.

On August 2, 2013, the NEB issued order SO-T260-005-2013 which directed KMC to maintain the pressure restriction already in place equivalent to 80% of the highest pressure experienced during the last 90 days of unrestricted operation prior to June 13, 2013 on all portions of the pre-1970s TMPL pipeline. The pressure restriction was to remain in effect until all of the commitments outlined in KMC's Integrity Assurance Plan (dated July 9, 2013) had been fulfilled. This included filing an engineering assessment that demonstrates that the pipeline is fit for service at its MOP.

The pressure restrictions on the TMPL system were lifted in 2014 after KMC completed crack inspections on all pre-1970s pipeline segements and submitted Engineering Analyses to the NEB proving that it was safe to do so.

3.3.3 In-Line Inspection History

The most recent high resolution in-line inspection (ILI) histories from 1998-2014 for the six piggable segments between Edmonton, AB, and Burnaby, BC are summarized in the tables below. Note that the Hargreaves – Darfield segment shown in Table 3.6 only became a single piggable segment upon completion of the Trans Mountain Pump Station Expansion (TMPSE) project in 2007. Prior to this, a pig trap was located between Hargreaves and Darfield at the Blue River pump station. When the Blue River station was upgraded during TMPSE, this pig trap was removed, creating a single piggable segment from Hargreaves to Darfield. For this reason, ILI runs conducted before or during 2007 inspected either the Hargreaves – Blue River or Blue River – Darfield segments, while ILI runs conducted after 2007 inspected the entire Hargreaves – Darfield segment, as indicated in the "Inspected Segment" column of Table 3.6. Future inspection intervals are outlined in Section 5 and will be modified as required based on the processes included in Kinder Morgan's Integrity Management Program.

TABLE 3.4 ILI HISTORY (EDMONTON TO EDSON)

Edmonton - Edson NPS 24		
Date	**Vendor**	**Tool**
2004	BJ	Geopig + MFL
2009	BJ	MFL
2011	Rosen	AFD
2013	Rosen	EMAT

TABLE 3.5 ILI HISTORY (EDSON TO HINTON)

Edson - Hinton NPS 30		
Date	**Vendor**	**Tool**
2005	BJ	Geopig
2010	Baker Hughes	MFL
2012	Rosen	AFD
2013	Rosen	EMAT

TABLE 3.6 ILI HISTORY (HARGREAVES TO DARFIELD)

Hargreaves - Darfield NPS 24			
Date	**Vendor**	**Tool**	**Inspected Segment**
1998	PII	UT	Hargreaves - Blue River
2001	BJ	Geopig	Hargreaves - Blue River
2003	BJ	Geopig	Blue River - Darfield
2006	BJ	MFL	Blue River - Darfield
2007	BJ	MFL	Hargreaves - Blue River
2011	Rosen	AFD	Hargreaves - Darfield
2012	Baker Hughes	MFL	Hargreaves - Darfield
2013	Rosen	EMAT	Hargreaves - Darfield
	GE	USCD	Hargreaves - Darfield

TABLE 3.7 ILI HISTORY (DARFIELD TO KAMLOOPS)

Darfield - Kamloops NPS 30		
Date	**Vendor**	**Tool**
2004	BJ	Geopig
	PII	MFL
2011	Baker Hughes	MFL
2012	Rosen	AFD
2013	Rosen	EMAT

TABLE 3.8 ILI HISTORY (KAMLOOPS TO SUMAS)

Kamloops - Sumas NPS 24		
Date	**Vendor**	**Tool**
2003	BJ	Geopig + MFL
2010	Baker Hughes	MFL
2012	Rosen	AFD + EMAT
	GE	USCD

TABLE 3.9 ILI HISTORY (SUMAS TO BURNABY)

Sumas - Burnaby NPS 24		
Date	**Vendor**	**Tool**
2000	BJ	Geopig
2005	BJ	MFL
2011	Baker Hughes	MFL
2012	Rosen	AFD
2013	Rosen	EMAT
2014	GE	USCD

KMC uses a variety of tools in order to gain a complete picture of the integrity of its pipelines. Each type of ILI tool is specifically designed to detect certain types of features. The primary feature detection capabilities of each type of tool are as follows:

* Caliper and Geopig: Pipeline geometry (dents, wrinkles, buckles)
* Magnetic Flux Leakage (MFL): Metal loss (corrosion) and weld defects
* Axial Flaw Detection (AFD): Narrow, longitudinal defects (grooves, gouges, cracks, crack-like features, channeling corrosion)
* Electro-Magnetic Acoustic Transducer (EMAT): Cracks, crack-like features, and external coating disbondment
* Ultra Sonic Crack Detection (USCD): Cracks and crack-like features

4.0 KMC INTEGRITY MANAGEMENT PROGRAM

The Integrity Management Program (IMP) fulfills the regulatory requirements of both the NEB and the OGC. It also meets the requirements for a Safety and Loss Management System outlined in CSA Z662-11 with regard to the pipeline assets. A separate Facility Integrity Management Program (FIMP) fulfills the Safety and Loss Management System requirements for assets that do not extend beyond facility fence lines. The change in product focus from the current mix of batched products (ranging from refined to heavy crude to the proposed lighter crude oil and products for these segments) does not affect the IMP.

4.1 Corrosion Management Approach

4.1.1 ILI Monitoring

The TMPL is monitored for corrosion with various scheduled metal loss ILI tools. The tools below have been run recently on the Line 1 pipeline segments.

TABLE 4.1 COMPLETED ILI RUNS FOR METAL LOSS

Year	Line	Vendor and Tool
2004	Edmonton – Edson	BJ MFL
2009	Edmonton – Edson	BJ MFL
2013	Edmonton – Edson	ROSEN EMAT
2010	Edson – Hinton NPS 30	BH MFL
2013	Edson – Hinton NPS 30	ROSEN EMAT
2007	Hinton – Hargreaves NPS 24	BJ MFL
2007	Hargreaves – Blue River	BJ MFL
2006	Blue River – Darfield	BJ MFL
2012	Hargreaves – Darfield	BH MFL
2013	Hargreaves – Darfield	ROSEN EMAT
2003	Kamloops – Sumas	BJ MFL
2010	Kamloops – Sumas	BH MFL
2012	Kamloops – Sumas	ROSEN EMAT
2005	Sumas – Burnaby	BJ MFL
2011	Sumas – Burnaby	BH MFL
2013	Sumas – Burnaby	ROSEN EMAT

The next proposed metal loss inspections are provided in the table below:

TABLE 4.2 FUTURE PROPOSED ILI RUNS FOR METAL LOSS

Year	Line	Tool
2014	Edmonton – Edson	MFL/Caliper
2015	Edson – Hinton	MFL/Caliper
2016	Hargreaves – Darfield	MFL/Caliper
TBD	Black Pines – Kamloops NPS 24	TBD
2015	Kamloops – Sumas	MFL/Caliper
2016	Sumas – Burnaby	MFL/Caliper

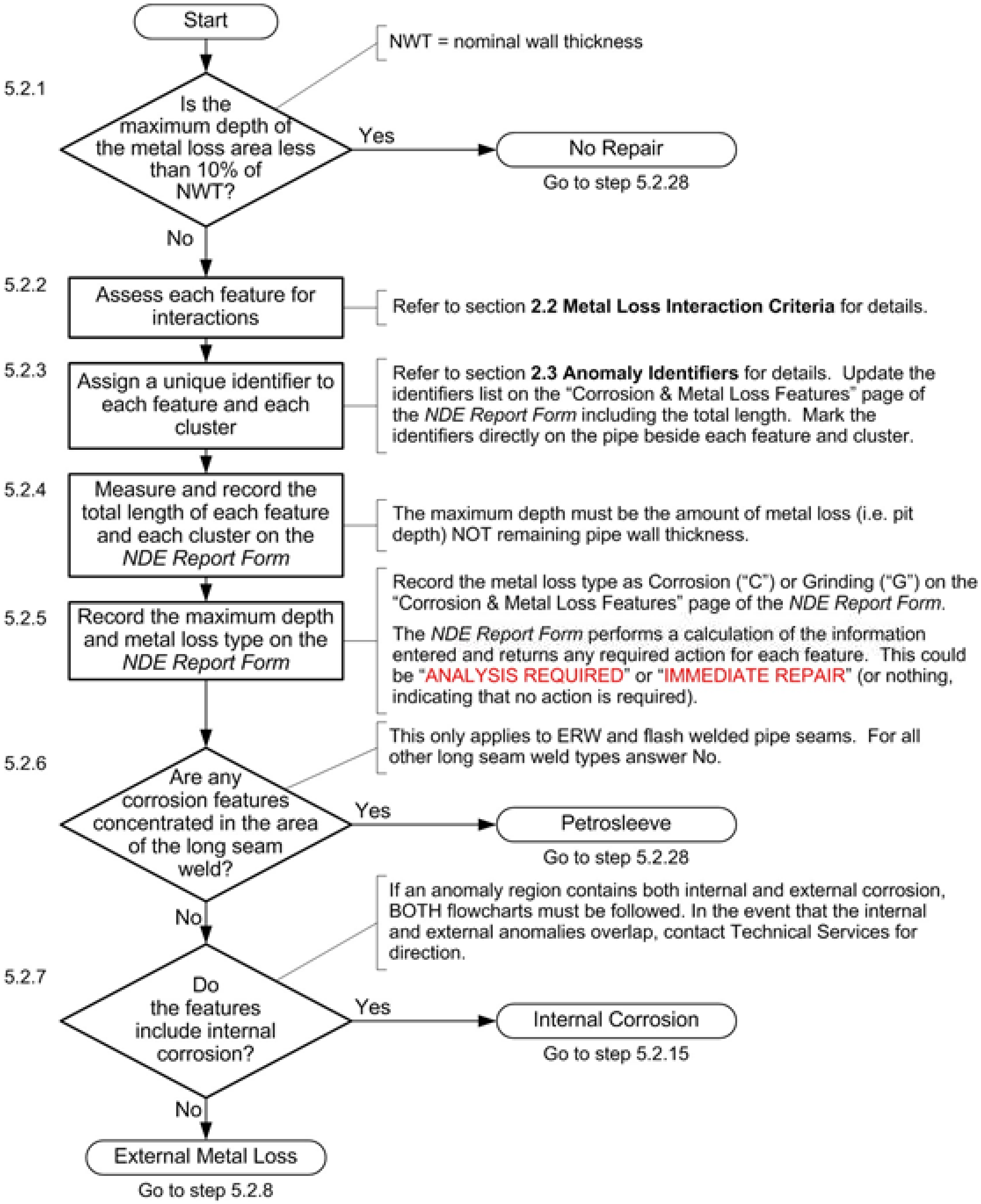
4.1.2 Excavation and Repair Criteria for Metal Loss Features

KMC has strict guidelines governing when an investigative dig must be issued based on information received from ILI runs. A 180 Day Condition dig is issued when the predicted burst pressure (using the effective area method) is less than the calculated pressure at 100% SMYS. This corresponds to an RPR less than 1. All metal loss conditions that must result in a 180 day dig are:

- RPR < 1
- Metal loss exceeding 0.5 WT with widespread circumferential corrosion
- Metal loss exceeding 0.5 WT at a girth weld
- Corrosion concentrated in the seams of ERW or flash welded pipe
- Corrosion interacting with a gouge or groove

In addition to 180 Day Digs, KMC issues Immediate Repair Digs when metal loss is greater than 80% nominal WT or when the predicted burst pressure (using the effective area method) is less than the maximum operating pressure at the location of the anomaly. Immediate Repair Digs result in pressure restrictions until the dig is completed and NDE is performed at the location of the anomaly. All features that have been identified by prior metal loss ILI runs to meet these criterions have been excavated and repaired.

KMC uses flow charts to determine the repair requirements for a defect. The flow chart below is for assessing corrosion and metal loss. Similar flow charts exist for laminations and inclusions, dents, linear indications, ripples, wrinkles and buckles, weld defects and weld fill in.


Start
NWT = nominal wall thickness
5.2.1
Is the maximum depth of the metal loss area less than 10% of NWT?
Yes
No Repair
Go to step 5.2.28
No
5.2.2
Assess each feature for interactions
Refer to section **2.2 Metal Loss Interaction Criteria** for details.
5.2.3
Assign a unique identifier to each feature and each cluster
Refer to section **2.3 Anomaly Identifiers** for details. Update the identifiers list on the "Corrosion & Metal Loss Features" page of the *NDE Report Form* including the total length. Mark the identifiers directly on the pipe beside each feature and cluster.
5.2.4
Measure and record the total length of each feature and each cluster on the *NDE Report Form*
The maximum depth must be the amount of metal loss (i.e. pit depth) NOT remaining pipe wall thickness.
5.2.5
Record the maximum depth and metal loss type on the *NDE Report Form*
Record the metal loss type as Corrosion ("C") or Grinding ("G") on the "Corrosion & Metal Loss Features" page of the *NDE Report Form*.
The *NDE Report Form* performs a calculation of the information entered and returns any required action for each feature. This could be "ANALYSIS REQUIRED" or "IMMEDIATE REPAIR" (or nothing, indicating that no action is required).
This only applies to ERW and flash welded pipe seams. For all other long seam weld types answer No.
5.2.6
Are any corrosion features concentrated in the area of the long seam weld?
Yes
Petrosleeve
Go to step 5.2.28
No
If an anomaly region contains both internal and external corrosion, BOTH flowcharts must be followed. In the event that the internal and external anomalies overlap, contact Technical Services for direction.
5.2.7
Do the features include internal corrosion?
Yes
Internal Corrosion
Go to step 5.2.15
No
External Metal Loss
Go to step 5.2.8

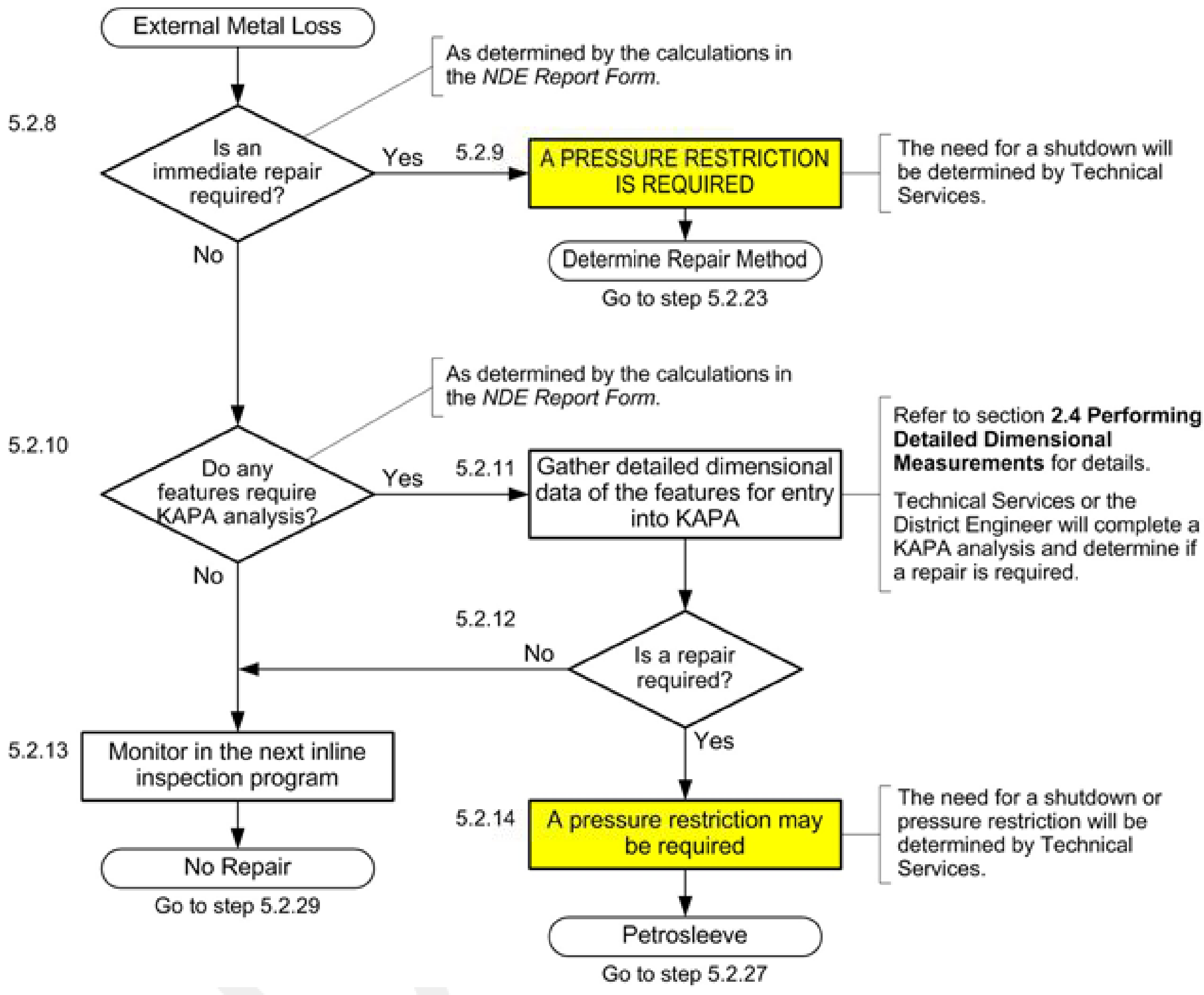


Figure 4.1 Corrosion and Metal Loss Repair Flow Chart

4.2 Crack Management Approach

KMCs crack management program includes inspection and assessment for all body and seam weld crack-like features. The crack program includes regular in-line inspections of the pipeline system, fatigue analysis, and field investigation and repair programs.

Kinder Morgan Canada's Stress Corrosion Cracking (SCC) Integrity Management Program was originally implemented and integrated in June 1997. It was updated in May 1999 and more recently in 2011 to reflect the activities and incidences of SCC.

The program is based on the recommended practices of the Canadian Energy Pipeline Association (CEPA) SCC Recommended Practices (2nd Edition – 2007) and also follows the recommendations proposed in the NEB report of the Public Inquiry Concerning Stress Corrosion Cracking on Canadian Oil and Gas Pipelines (NEB MH-2-95). The primary objectives of the program are to identify areas where SCC may potentially be found by conducting susceptibility analysis, investigative digs, as well as SCC integrity assessments. Any identified areas with potential or confirmed SCC are subsequently managed by developing mitigation activities, as required, and condition monitoring.

4.2.1 ILI Monitoring

TMPL is monitored for cracking with various scheduled crack detection ILI tools. The tools below have been run recently on the sections of interest.

TABLE 4.3 COMPLETED ILI RUNS FOR CRACK-LIKE ANOMALIES

Year	Line	Vendor and Tool
2011	Edmonton – Edson	ROSEN AFD
2013	Edmonton – Edson	ROSEN EMAT
2012	Edson – Hinton	ROSEN AFD
2013	Edson – Hinton	ROSEN EMAT
2011	Hargreaves – Darfield	ROSEN AFD
2013	Hargreaves – Darfield	ROSEN EMAT
2013	Hargreaves – Darfield	GE USCD
2012	Darfield – Kamloops (NPS 30)	ROSEN AFD
2013	Darfield – Kamloops (NPS 30)	ROSEN EMAT
2012	Kamloops - Sumas	ROSEN AFD + EMAT
2012	Kamloops - Sumas	GE USCD
2012	Sumas - Burnaby	ROSEN AFD
2013	Sumas - Burnaby	ROSEN EMAT

The next proposed crack detection inspections are provided in the table below.

TABLE 4.4 FUTURE PROPOSED ILI RUNS FOR CRACK-LIKE ANOMALIES

Year	Line	Vendor and Tool
2014	Edmonton – Edson	USCD
TBD	Edson – Hinton	TBD
2014	Darfield – Kamloops (NPS 30)	USCD
2015	Hinton - Hargreaves	AFD
2015	Hinton - Hargreaves	USCD or EMAT
2017	Darfield - Kamloops	AFD
TBD	Kamloops – Sumas	TBD
2014	Sumas – Burnaby	USCD

4.2.2 Crack Severity Levels for Reassessment

KMC analyzes all linear anomaly data produced by ILI tools for predicted burst pressure as well as for fatigue life due to pressure cycling on the TMPL to determine inspection intervals.

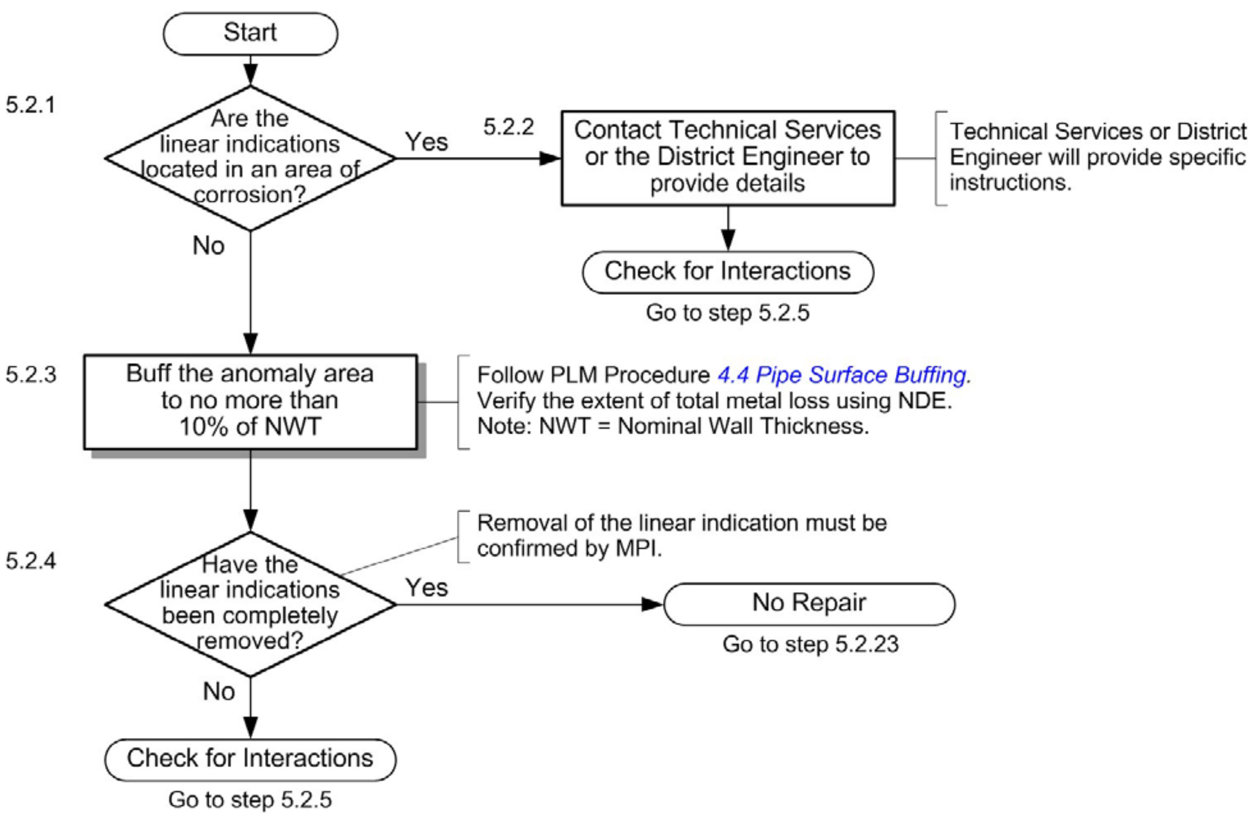
Burst pressure is typically calculated using Kiefner and Associates' KAPA software. Fatigue life is determined by interpolating pressure spectra using data between stations utilizing the pipe's elevation profile and suction and discharge pressure SCADA reports. The interpolated pressure spectra are processed through a third-party data analysis tool (BMT Fleet's FlawCheck) to calculate the normalized number of cycles per year and fatigue life.

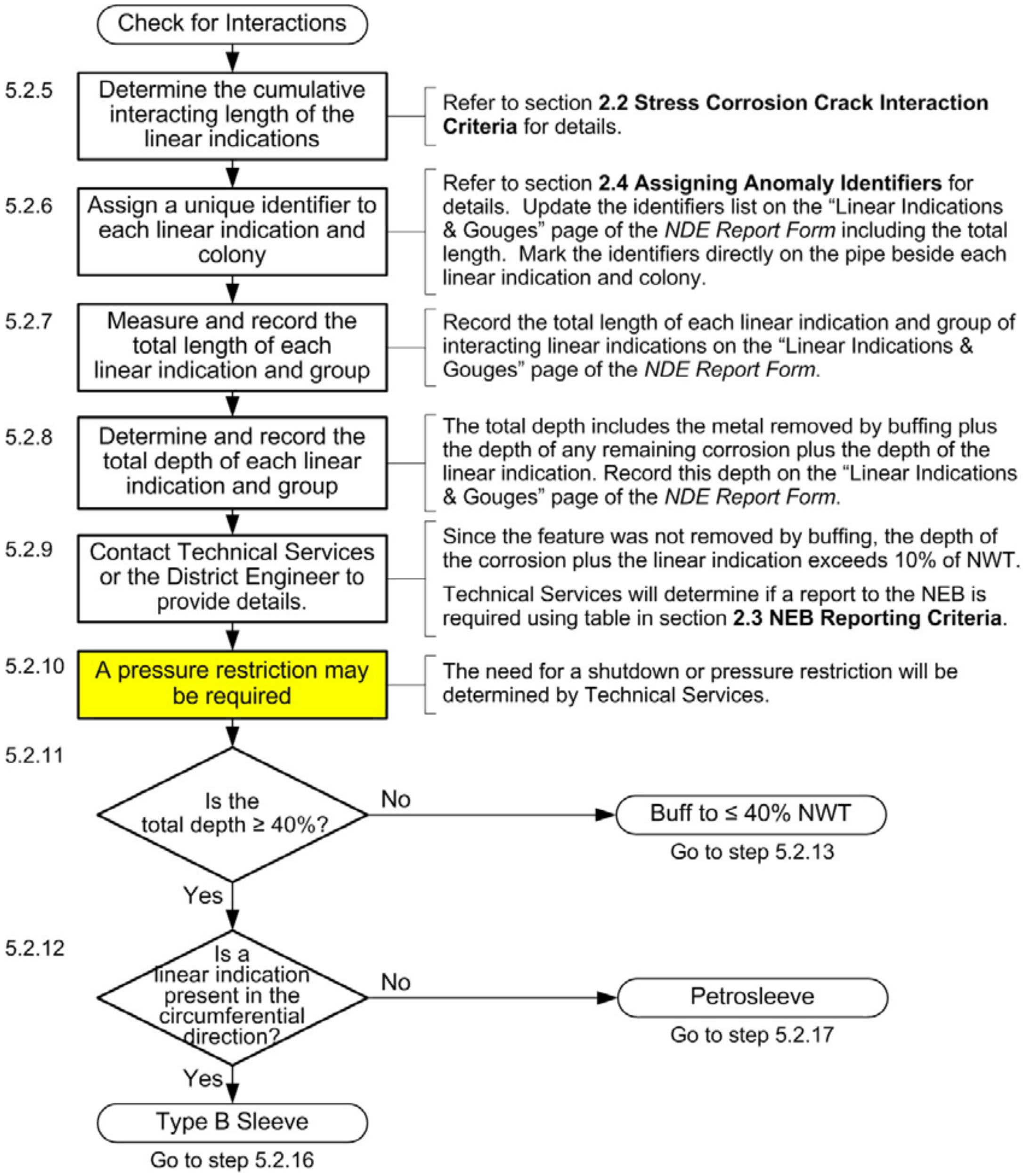
4.2.3 Excavation and Repair Criteria for Crack-Like Anomalies

An immediate dig is issued when there is probable cracking where a calculation of the remaining strength of the pipe shows a predicted burst pressure (by NG18 ln secant method) is less than the established maximum operating pressure at the location of the anomaly.

A 180 day dig is issued when there is a probable crack in the pipe body with a calculated burst pressure (by NG18 ln secant method) less than the pressure at 100% SMYS or any probable crack exists in a seam weld. All features that have been identified by prior crack detection ILI runs to meet these criteria have been excavated and repaired once they were confirmed by NDE.

KMC uses flow charts to determine the repair requirements for a defect. The flow chart below is for assessing linear indications.




Check for Interactions
5.2.5
Determine the cumulative interacting length of the linear indications
Refer to section **2.2 Stress Corrosion Crack Interaction Criteria** for details.
5.2.6
Assign a unique identifier to each linear indication and colony
Refer to section **2.4 Assigning Anomaly Identifiers** for details. Update the identifiers list on the "Linear Indications & Gouges" page of the *NDE Report Form* including the total length. Mark the identifiers directly on the pipe beside each linear indication and colony.
5.2.7
Measure and record the total length of each linear indication and group
Record the total length of each linear indication and group of interacting linear indications on the "Linear Indications & Gouges" page of the *NDE Report Form*.
5.2.8
Determine and record the total depth of each linear indication and group
The total depth includes the metal removed by buffing plus the depth of any remaining corrosion plus the depth of the linear indication. Record this depth on the "Linear Indications & Gouges" page of the *NDE Report Form*.
5.2.9
Contact Technical Services or the District Engineer to provide details.
Since the feature was not removed by buffing, the depth of the corrosion plus the linear indication exceeds 10% of NWT.
Technical Services will determine if a report to the NEB is required using table in section **2.3 NEB Reporting Criteria**.
5.2.10
A pressure restriction may be required
The need for a shutdown or pressure restriction will be determined by Technical Services.
5.2.11
Is the total depth ≥ 40%?
No
Buff to ≤ 40% NWT
Go to step 5.2.13
Yes
5.2.12
Is a linear indication present in the circumferential direction?
No
Petrosleeve
Go to step 5.2.17
Yes
Type B Sleeve
Go to step 5.2.16

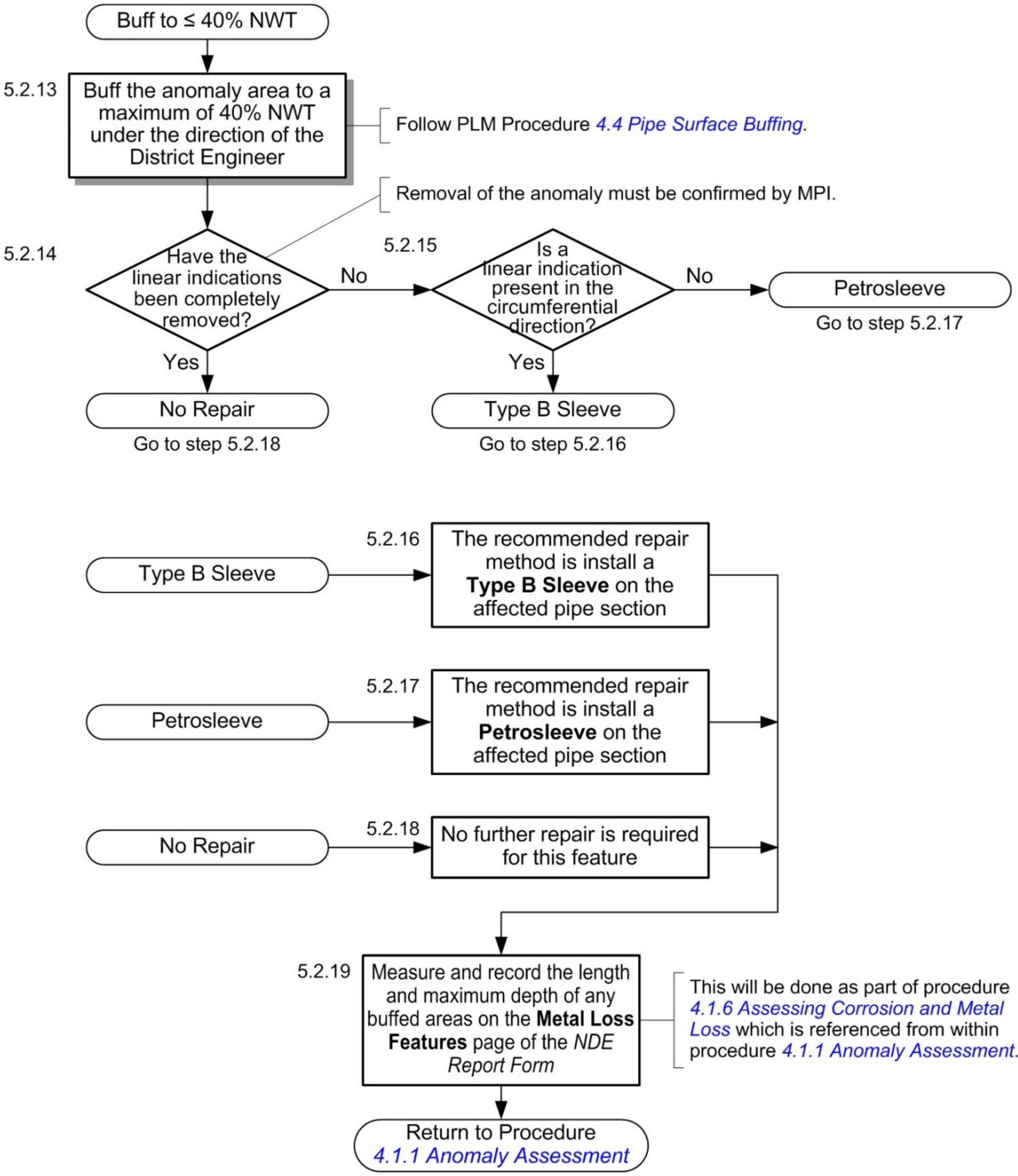


Figure 4.2 Linear Indication Repair Flow Chart

5.0 FITNESS FOR SERVICE ASSESSMENTS

5.1 Metal loss

5.1.1 External Corrosion Control

The NPS 24 / NPS 30 line from Edmonton, AB, to Burnaby, BC was coated with Coal Tar Enamel during original installation.

All pipeline systems are protected with impressed current cathodic protection (CP) systems. Rectifiers are used to impress DC current on the pipelines to minimize corrosion growth rates. The distribution of rectifiers along the six pipe segments in question is shown in Table 5.1.

TABLE 5.1 NUMBER OF RECTIFIERS PER PIPE SEGMENT

Pipe Segment	Number of Rectifiers
Edmonton - Edson NPS 24	10
Edson - Hinton NPS 30	3
Hargreaves - Darfield NPS 24	17
Darfield - Kamloops NPS 30	10
Kamloops - Sumas NPS 24	15
Sumas - Burnaby NPS 24	11

All rectifiers are monitored at least monthly to ensure that the DC current outputs are maintained within a given range. Remote monitoring units (RMU) have been installed on most rectifiers to allow constant monitoring of the rectifiers. This ensures that Kinder Morgan can react immediately if there is an issue with a rectifier or groundbed and ensures minimal downtime if a rectifier is not operating. As added security, Kinder Morgan has also installed devices on the rectifier doors that send an alarm through the RMU if the rectifier door is opened. This ensures that the company can follow up immediately if a rectifier door is opened for an unknown reason.

Voltage levels are measured annually at all available test points. Cathodic test points include test stations, valves and other above ground connections to the underground structures.

In addition, an ON/OFF Close Interval Survey (CIS) is performed on a portion of the pipeline system annually to obtain voltage readings on the pipeline system at closer intervals (generally 3m). This survey allows Kinder Morgan to address areas where there may be inadequate CP potentials that may otherwise not be apparent during the Annual Test Lead Survey. The date of the last CIS survey for each pipe segment is shown in Table 5.2:

TABLE 5.2 MOST RECENT CIS SURVEY DATES

Pipe Segment	Date of Last CIS Survey
Edmonton - Edson NPS 24	2011 (Edmonton - Stony Plain)
	2010 (Stony Plain - Edson)
Edson - Hinton NPS 30	2013
Hargreaves - Darfield NPS 24	2013 (Hargreaves - Rearguard)
	2011 (Rearguard - McMurphy)
	In Progress (McMurphy - Darfield)
Darfield - Kamloops NPS 30	2013
Kamloops - Sumas NPS 24	2013 (Kamloops - Stump)
	2012 (Stump - Hope)
	2011 (Hope - Sumas)
Sumas - Burnaby NPS 24	2011 (Sumas - Burnaby)

To maintain effective CP of the pipeline system, KMC targets a minimum value of -850 mV off-potential. This is consistent with the Canadian Gas Association Recommended Practice OCC-1 (incorporated by reference in the CSA Z662-11 Standard), and with Canadian Energy Pipeline Association published recommendations for protection of the pipeline from initiation and growth of stress corrosion cracking.

Upon completion of a cathodic protection survey, a remedial action plan is put in place to address each of the reported deficiencies. This plan allows for investigation of high and low potentials, interference testing, adjustment of rectifiers and if required, upgrading or addition of supplemental cathodic protection systems to ensure criteria is met at all locations along the pipelines.

Locations which are found to have high OFF potentials (more electro-negative than -1.200V) are the given first priority. Rectifier outputs in the area are reduced until the OFF potentials are more electro-positive than -1.200 volts.

The next priority to be addressed is those locations that did not meet the minimum polarized potential of -0.850V. Since there may be locations that fall below the -0.850V criteria after adjustments have been made to deal with the high OFF potential areas, a depolarization survey is performed which includes turning off rectifiers to allow the pipeline to depolarize. Static potentials are then collected at those locations identified in the data. Re-energization of the rectifiers then takes place to allow re-polarization of the pipe to occur and, after a short period of time, another interrupted survey is completed. The difference in the Static potential and the OFF potential, will determine if the pipeline meets the alternative 100mV shift criteria. De-polarization surveys are completed once every two years.

Test stations that require minor repairs are fixed at the time of the surveys by the CP contractor. Repairs or replacements that require ground disturbance activities are completed by KMC Pipeline Maintenance crews.

Interference testing is completed at each location identified in the survey. As each case is unique, they are handled on a case-by-case basis using applicable and acceptable techniques for identifying and controlling interference.

As a result of the various external corrosion monitoring systems described above, KMC has identified the following four areas where upgrades or changes to the existing CP system are required. Mitigation strategies are currently being implemented or planned for these areas, as described below:

- **Edmonton Terminal:** In June 2014, the Edmonton Rail Terminal (ERT) announced plans to construct a new railroad in the vicinity of Trans Mountain's Edmonton Terminal. Due to the close proximity of the two structures, the existing CP system needs to be relocated in order to reduce electrical interference with the new railroad. Work is currently in progress to remove the old groundbed and install a new one at a safe distance from the railroad crossing. KMC expects this project to be completed in October 2014.
- **Rearguard Pumping Station:** The rectifier at the Rearguard Station was originally connected to the pipeline via overhead cables. In 2012, one of the wooden poles supporting these cables collapsed, damaging the cables and interrupting the supply of impressed current in the area. This disruption was detected by a nearby RMU, and a field crew was sent out to investigate. Upon arrival, the crew found that a sizeable section of cable had in fact been removed in the vicinity of the collapsed support pole. It is suspected that this incident was a case of copper theft, where an unauthorized third party intentionally removed this section of cable following the collapse of the support pole. As a result of this incident, KMC has decided to replace the overhead cables in this area with an underground connection between the pipe and the rectifier. Work on this project is ongoing, with an anticipated completion date of November 2014.
- **KP 605-606:** Annual Test Lead Surveys have identified a shorted casing at this location, which has been prioritized in accordance with the Shorted Casing Program (initiated in 2010). Non-conductive supports have already been installed in order to physically separate the pipe from the casing to eliminate the metallic short. Work is currently underway to fill the casing with wax, in order to prevent water from entering the casing and causing an electrolytic short in the event of future casing corrosion/perforation.
- **KP 990:** Low CP levels were first identified at this location during the 2008-2009 Annual Test Lead Surveys. New anodes were installed at the site in 2010, but completion of the project was delayed due to security concerns, as the site is located in close proximity to a highway and had been tampered with in the past. These concerns were subsequently addressed, and the project is scheduled for completion in September 2014.

5.1.2 Metal Loss Incidence Charts

The charts provided in this section show the remaining metal loss features along the pipeline segments. The metal loss data for the Line 1 segments were obtained from the most recent metal loss in-line inspections completed for each section.

The metal loss charts provide a comparison between the historical normal maximum pressures, the licensed maximum operating pressure, and the predicted operating pressure in accordance with Line 1 service. The predicted burst pressure for the reported metal loss features is also included in the charts. The difference between the operating pressures and the features' burst pressure allows for a visual representation of the factor of safety in the segments' operation.

Reference metal loss indications for the charts below are as follows:

DMA – Detected Metal Loss Anomalies (BH Vectra)

CLS – Cluster Metal Loss Anomalies (BH Vectra)

Clusters – Cluster Metal Loss Anomalies (Rosen AFD)

Metal Loss Corrosion (Rosen AFD)

Metal Loss GWA – Metal Loss Girth Weld Affecting (Rosen AFD)

5.1.2.1 Charts

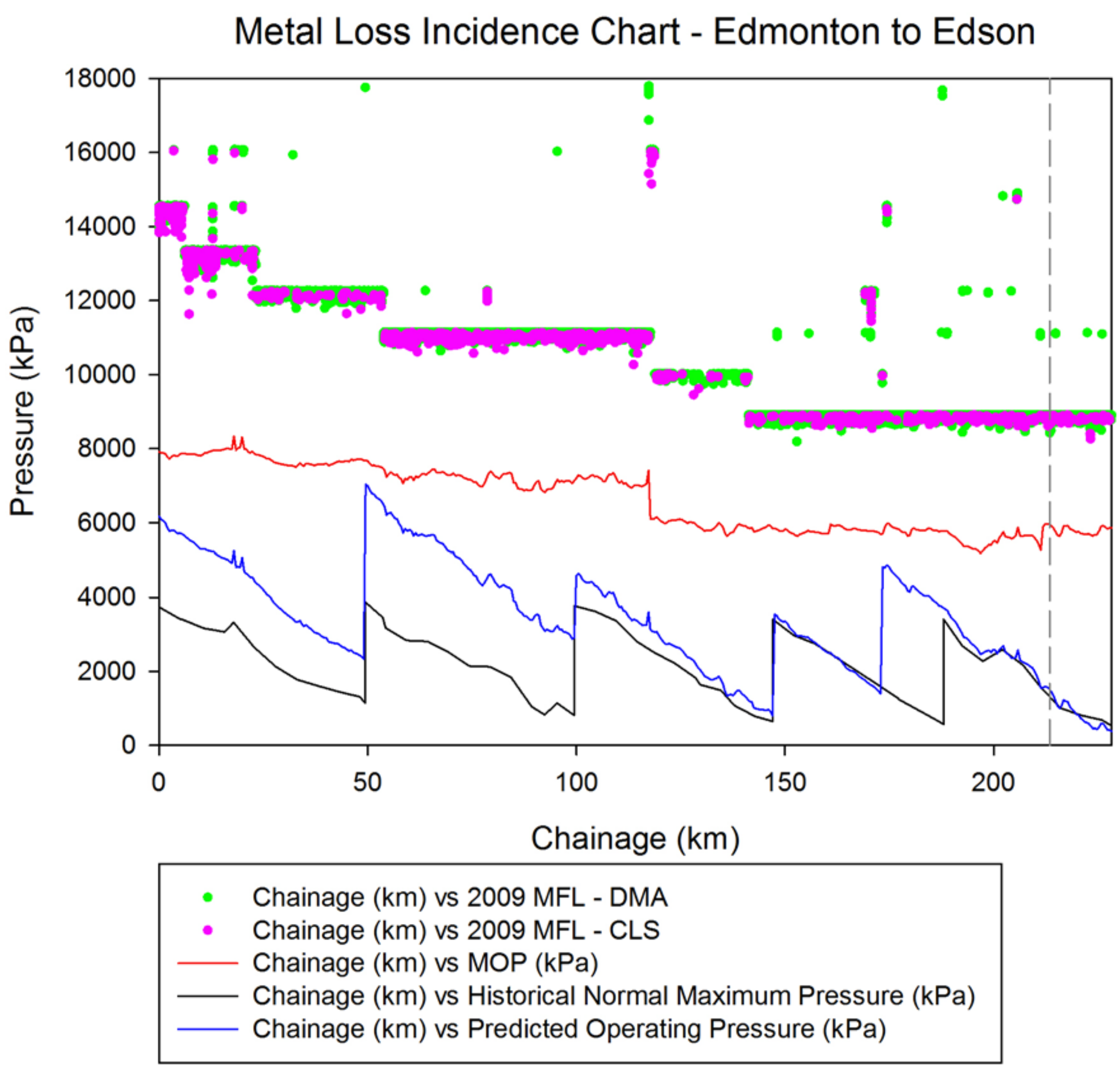


Figure 5.1 Metal Loss – Edmonton to Edson

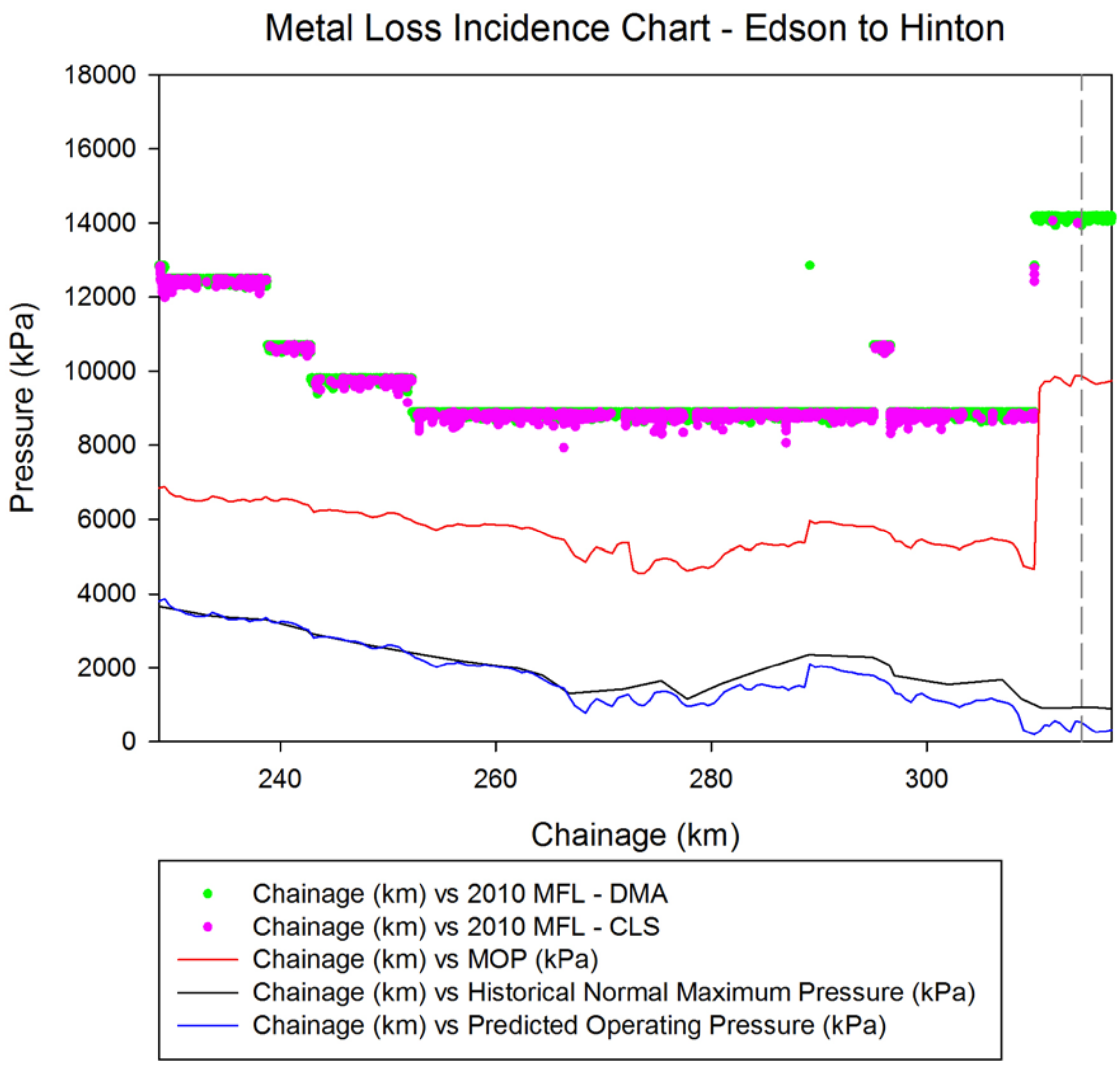


Figure 5.2 Metal Loss – Edson to Hinton

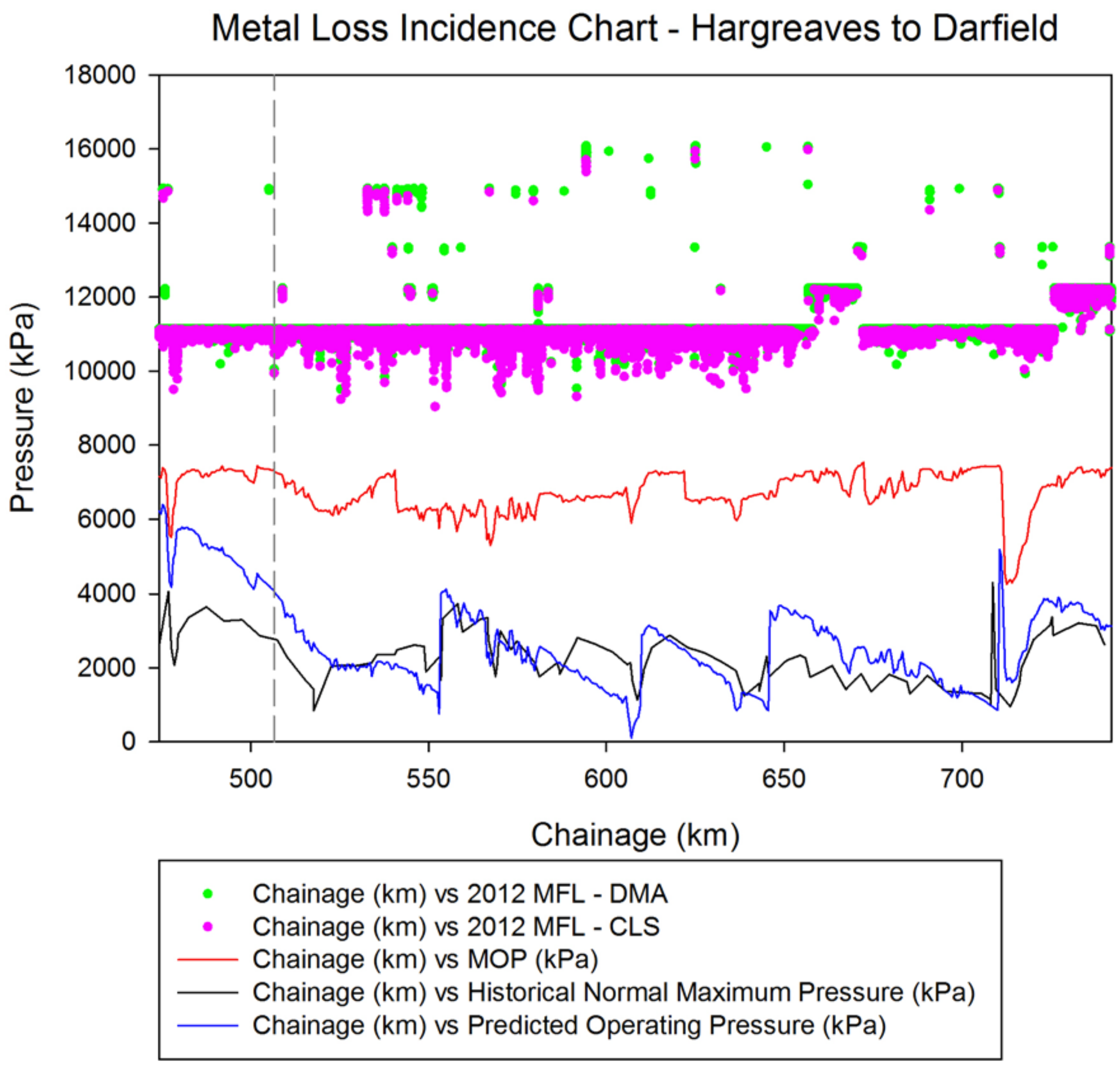


Figure 5.3 Metal Loss – Hargreaves to Darfield

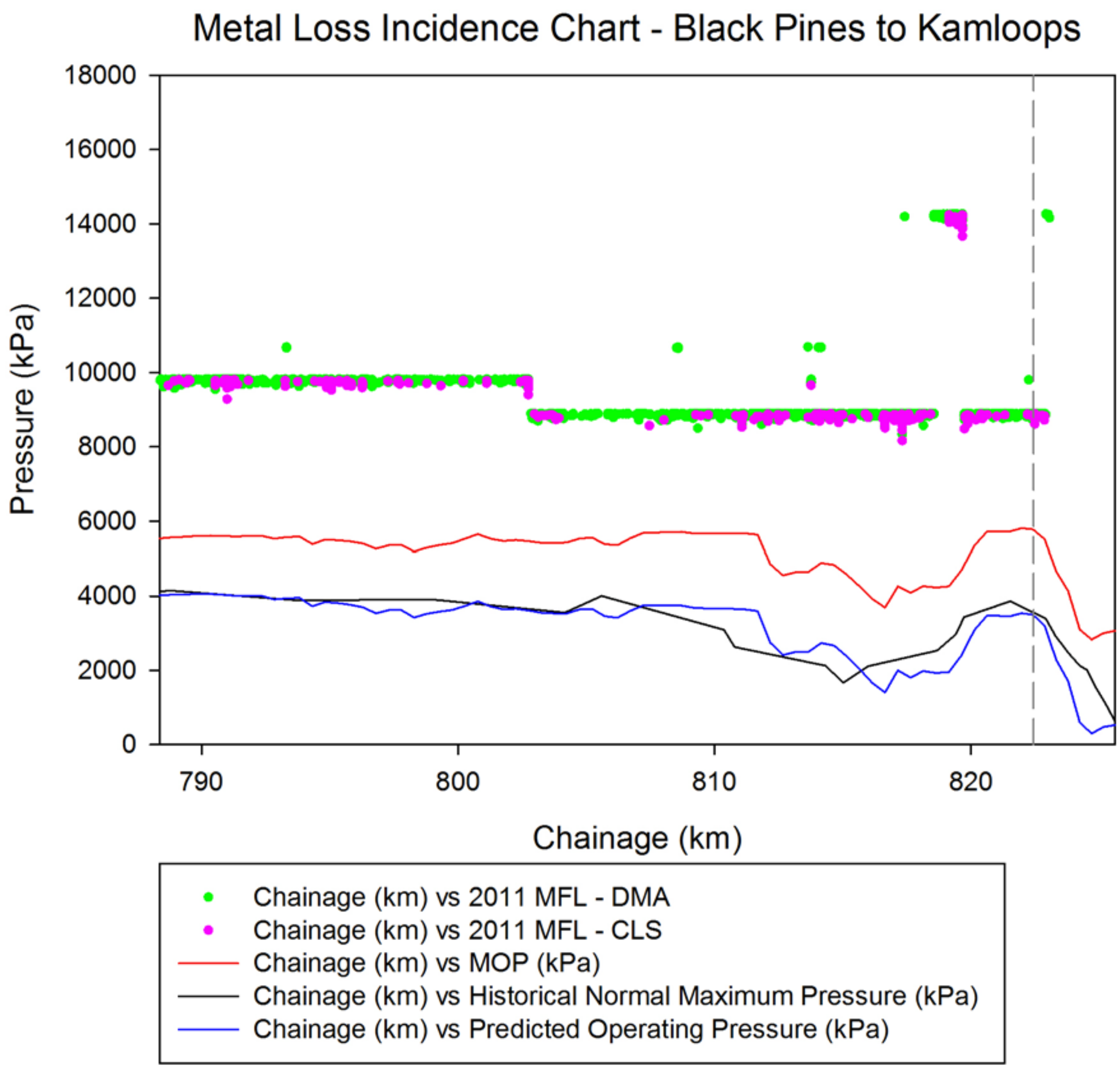


Figure 5.4 Metal Loss – Black Pines to Kamloops

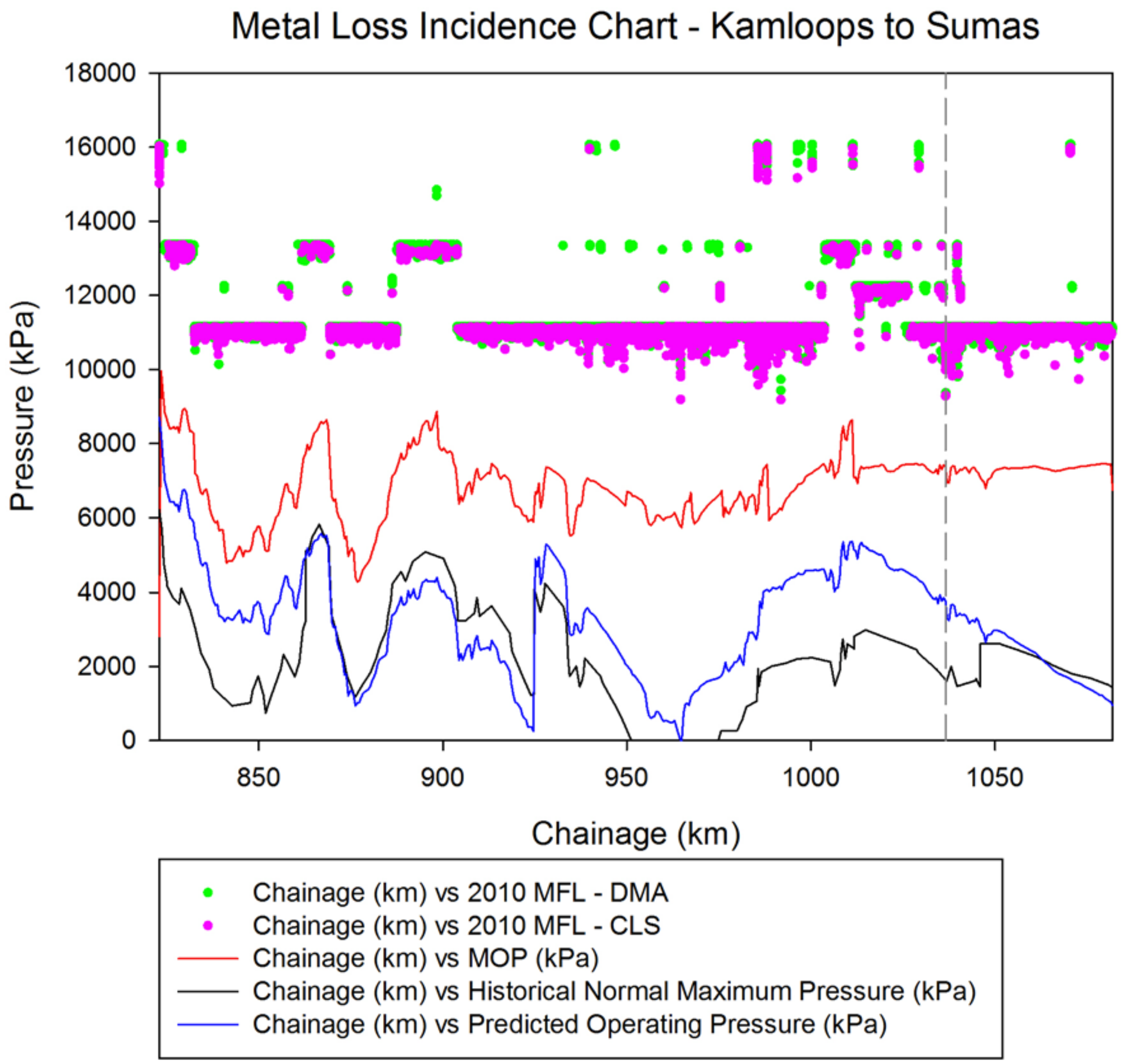


Figure 5.5 Metal Loss – Kamloops to Sumas

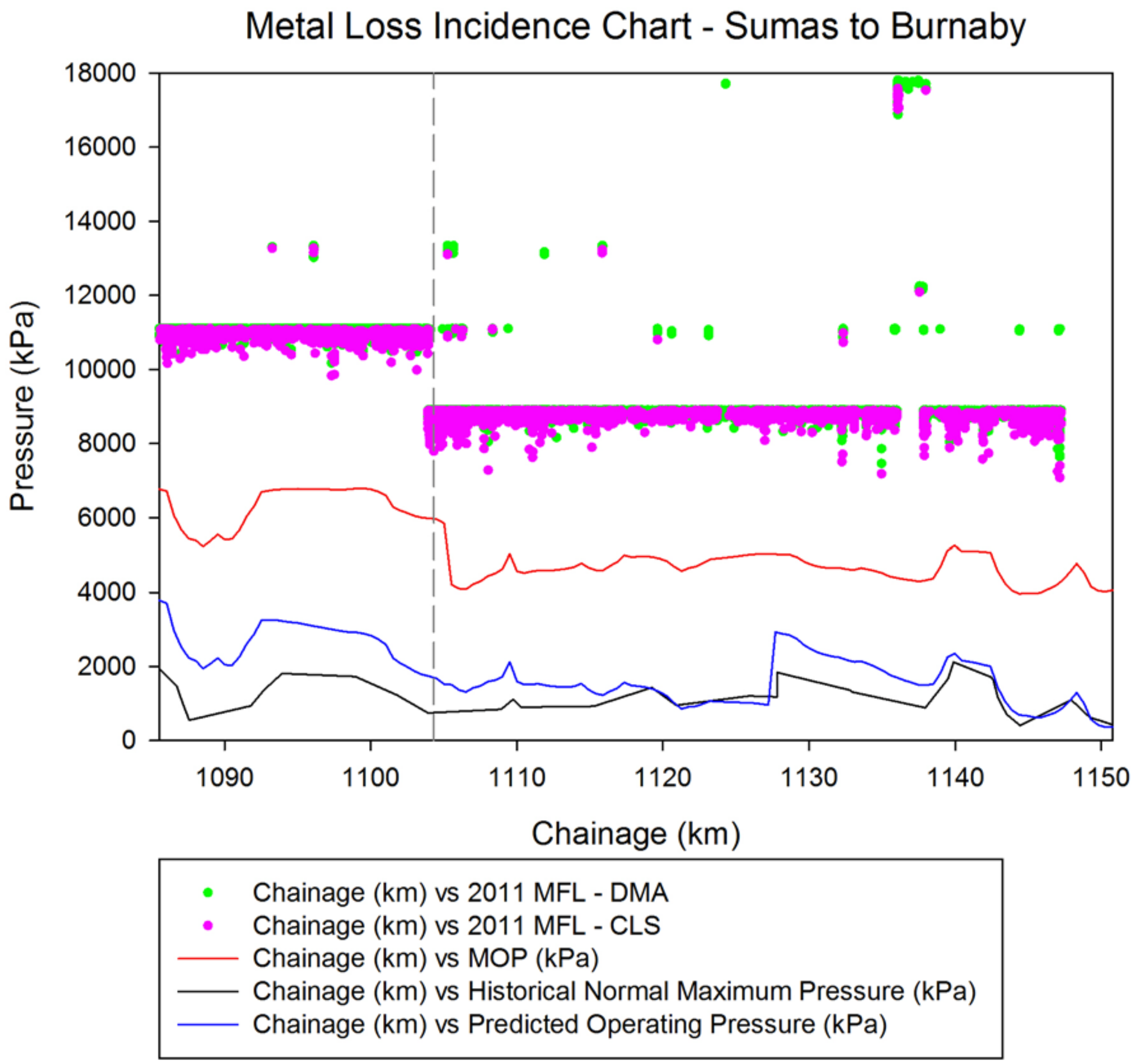


Figure 5.6 Metal Loss – Sumas to Burnaby

5.1.2.2 Factor of Safety

The dashed lines in Figure 5.1 to Figure 5.6 correspond to the chainage with the lowest difference between the MOP and the feature's rupture pressure. It can be seen that the rupture pressure for all features identified in each segment falls above the predicted operating pressure and the maximum operating pressure. These two buffers serve as factors of safety that can be quantified by applying the following equation:

$$FS = \frac{P_{\text{Rupture}}}{P}$$

Where:

FS = Factor of safety for either MOP or Predicted Pressure

P_{Rupture} = Rupture pressure of a specific feature, kPa

$P =$ Base pressure (either MOP or Predicted Pressure), kPa

The factor of safety charts are created by applying the above equation at each feature to compare its rupture pressure to both the Predicted Pressure and the MOP.

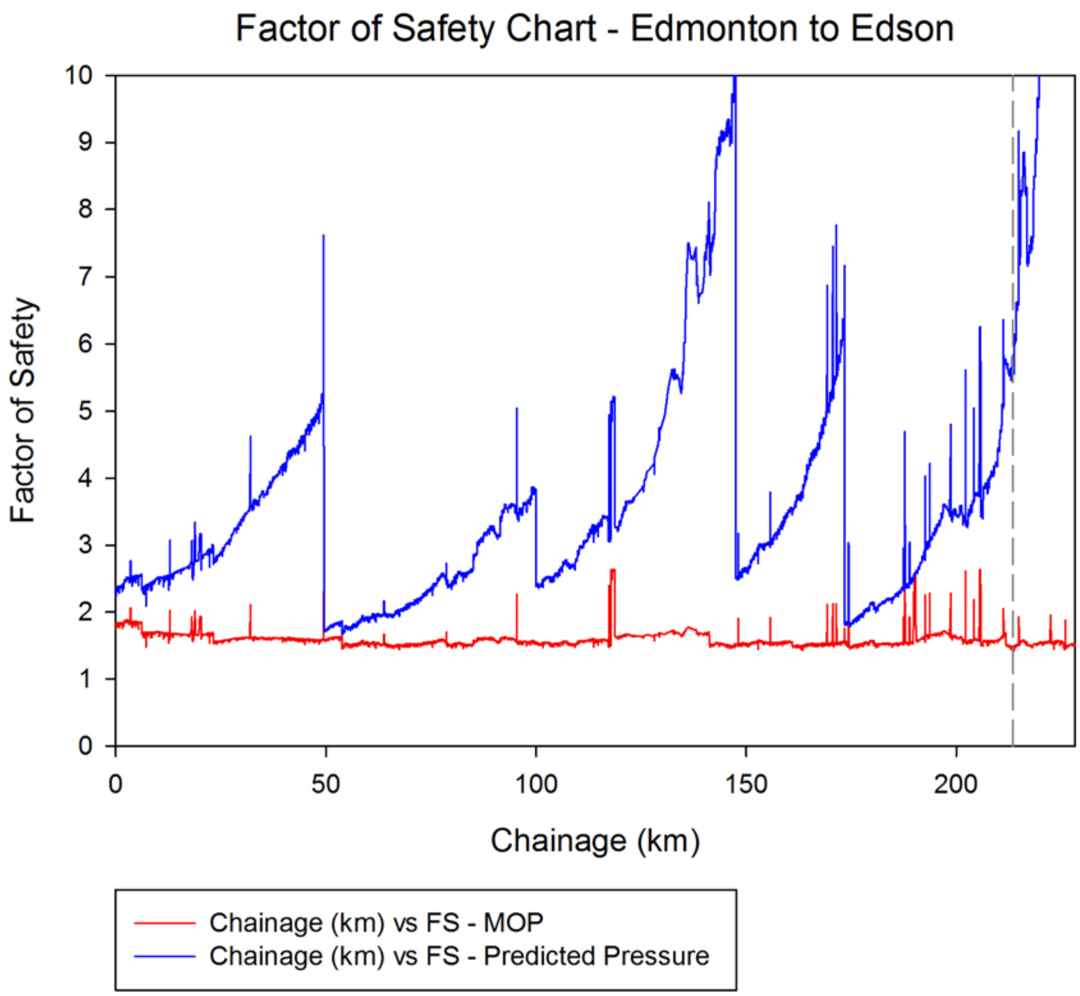


Figure 5.7 Factor of Safety – Edmonton to Edson

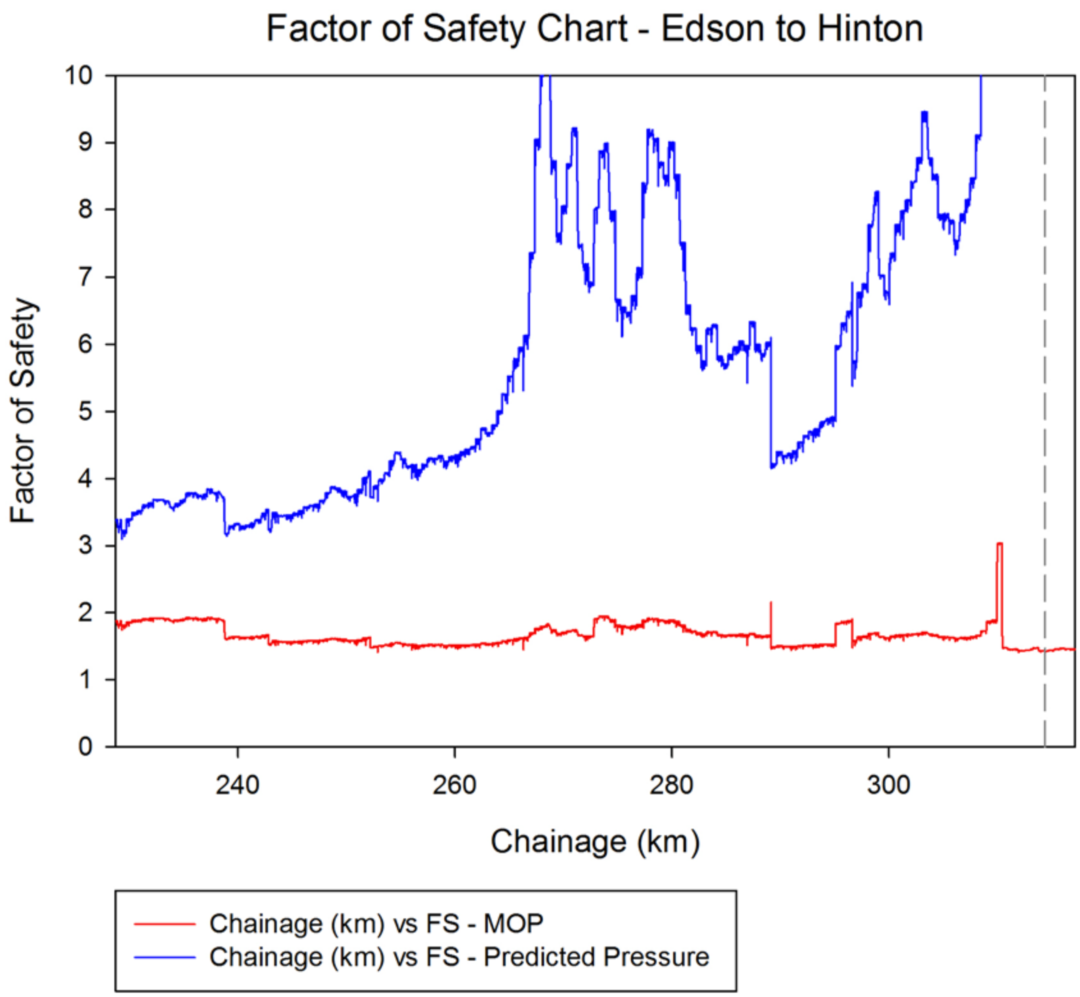


Figure 5.8 Factor of Safety – Edson to Hinton

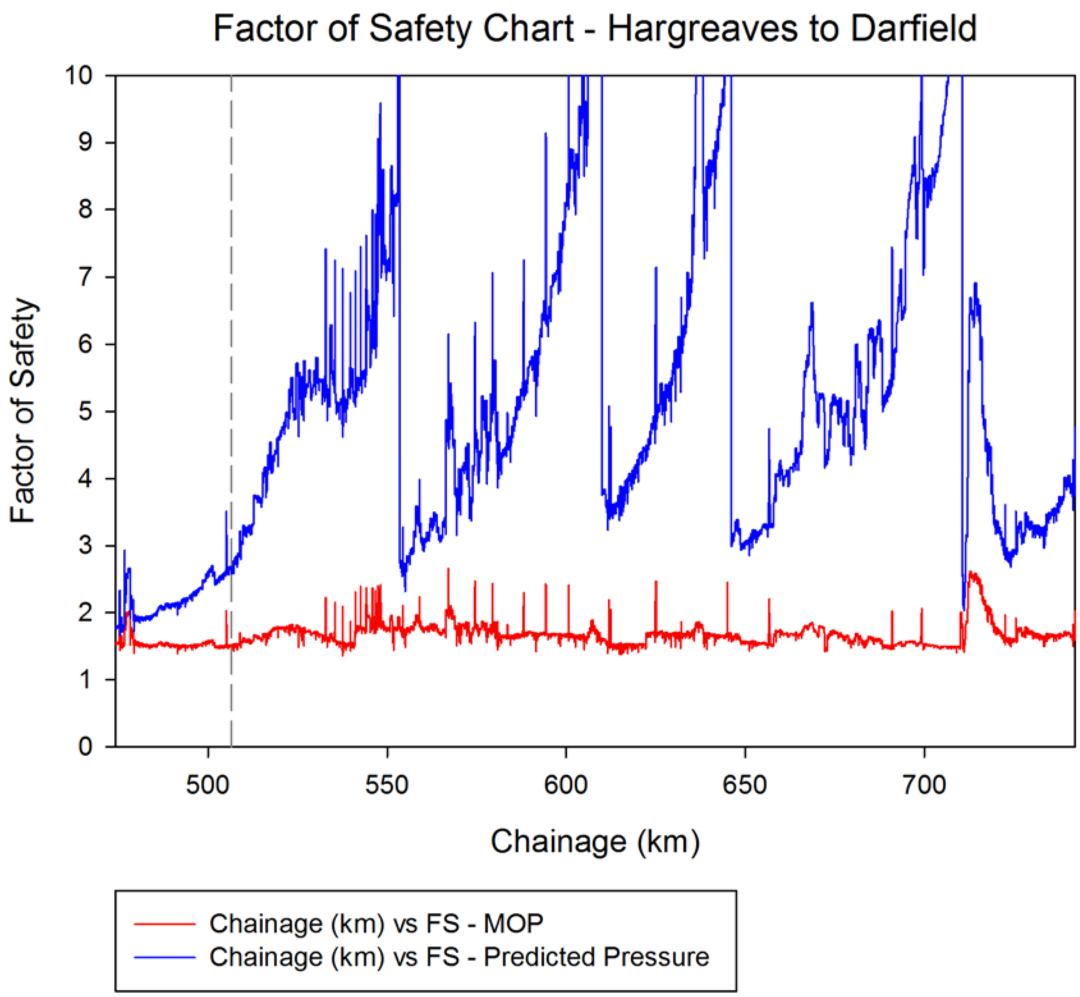


Figure 5.9 Factor of Safety – Hargreaves to Darfield

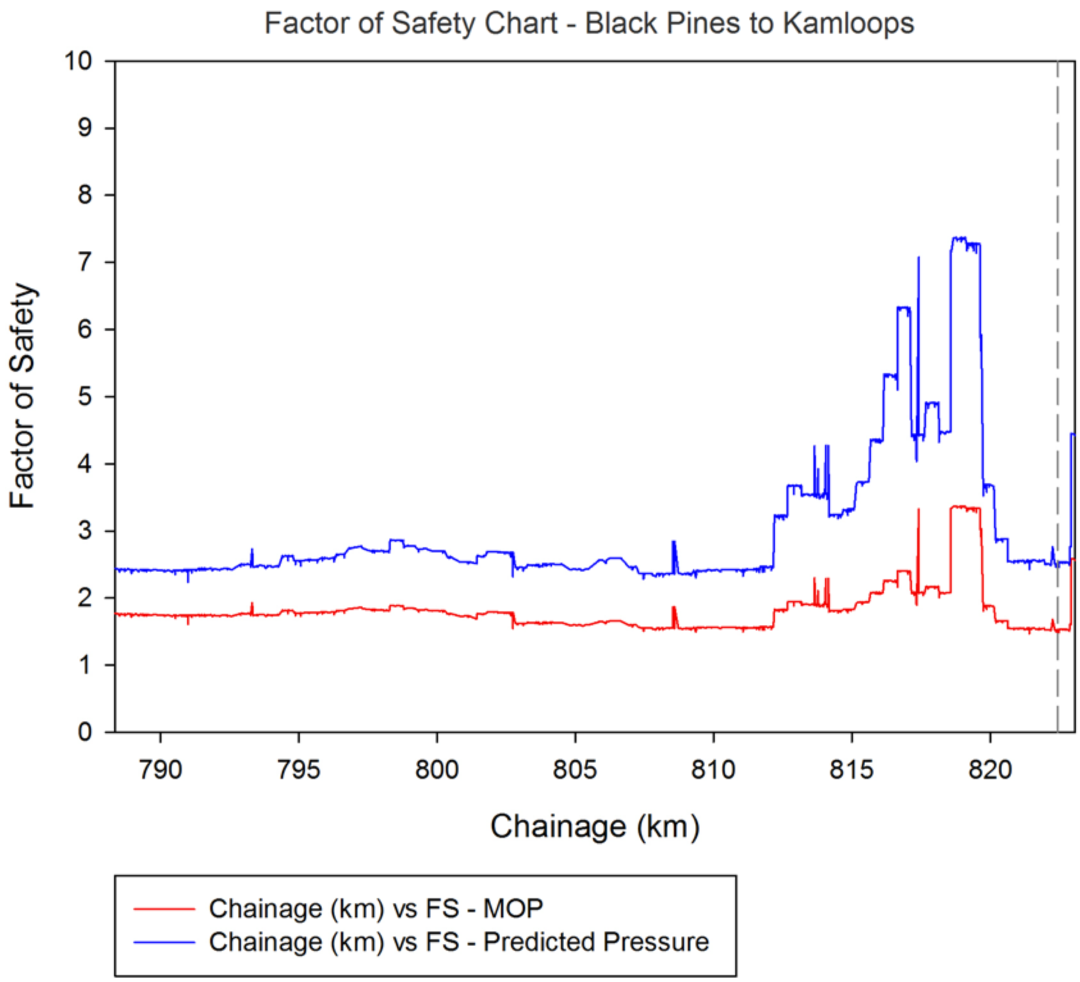


Figure 5.10 Factor of Safety – Black Pines to Kamloops

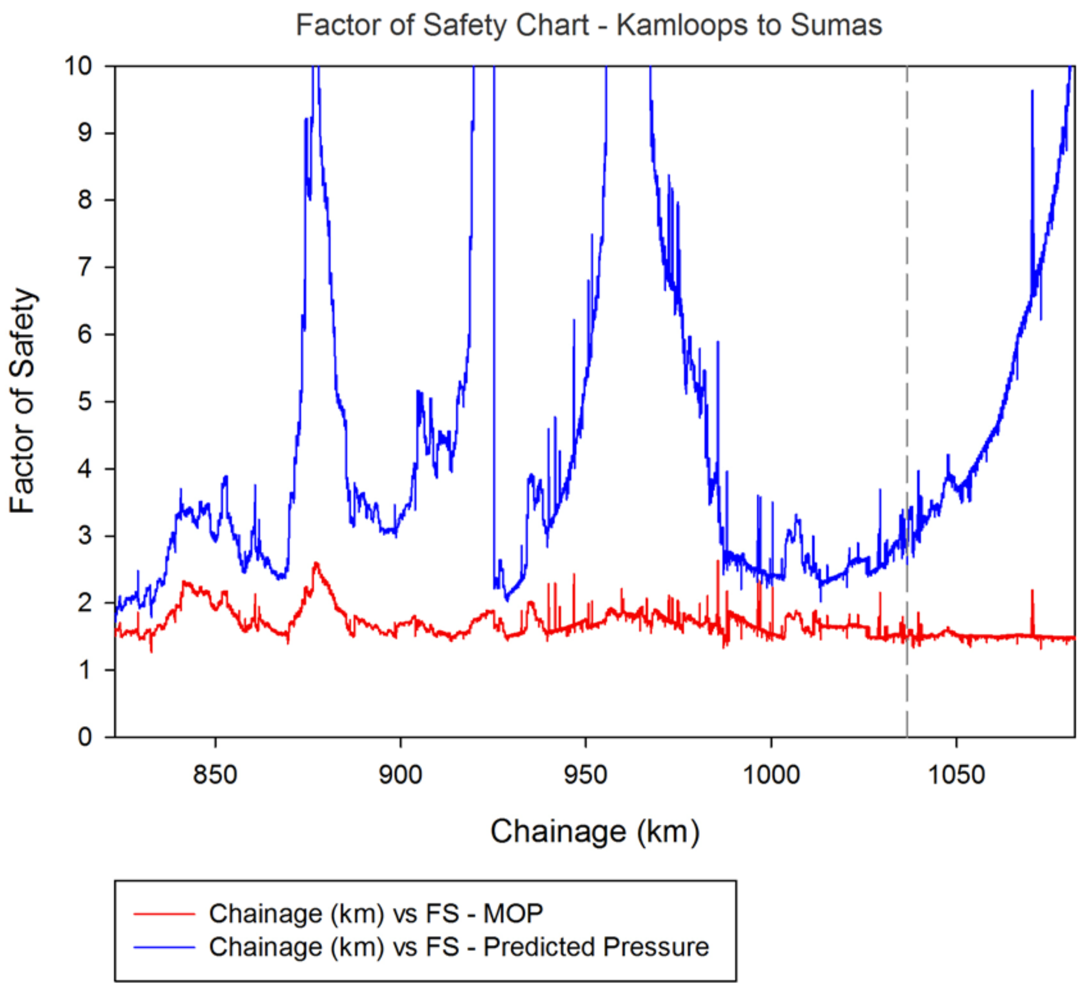


Figure 5.11 Factor of Safety – Kamloops to Sumas

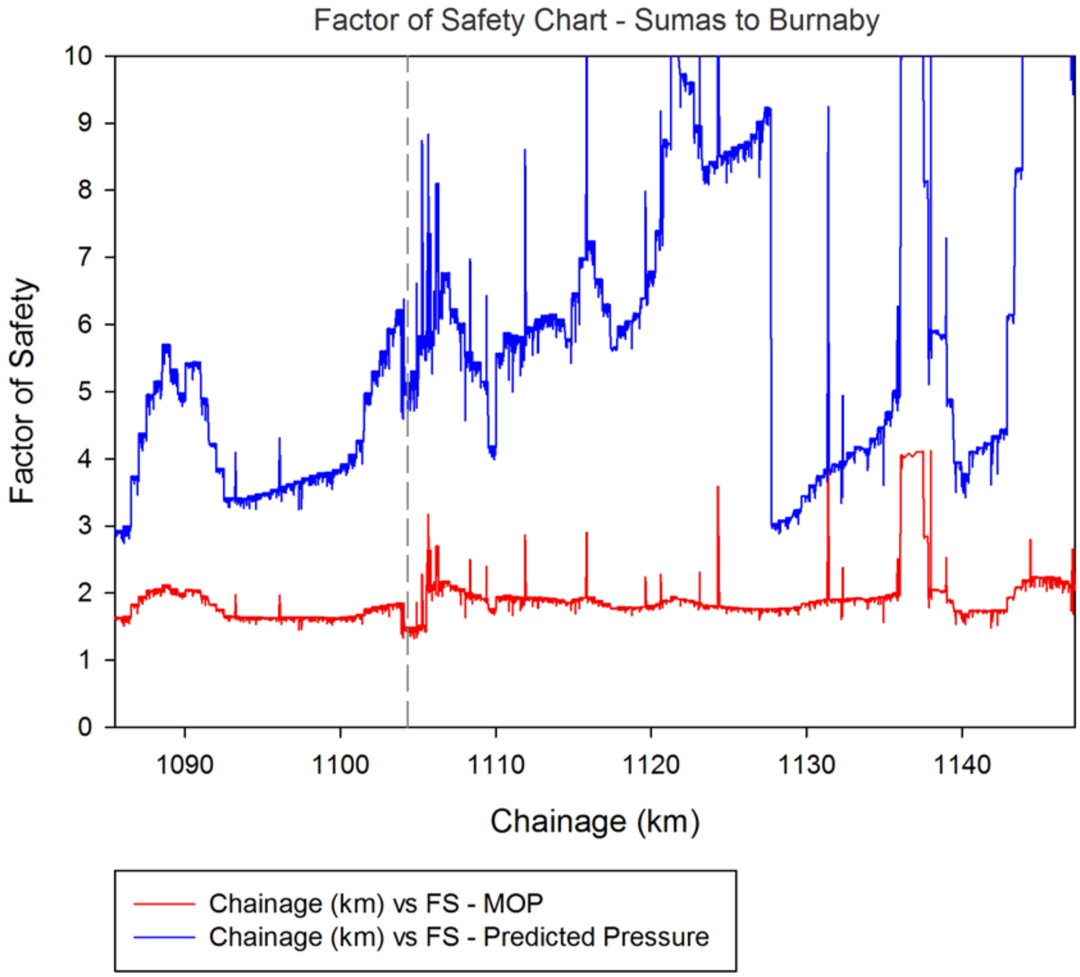


Figure 5.12 Factor of Safety – Sumas to Burnaby

From Figure 5.7 through Figure 5.12 the respective factors of safety for each segment are summarized in Table 5.3 and Table 5.4:

TABLE 5.3 FACTOR OF SAFETY SUMMARY – RELATIVE TO MOP

Segment	Edmonton to Edson	Edson to Hinton	Haregreaves to Darfield	Black Pines to Kamloops	Kamloops to Sumas	Sumas to Burnaby
Average	1.61	1.68	1.74	1.89	1.71	1.77
Mean	1.56	1.65	1.71	1.78	1.68	1.77
Minimum	1.41	1.41	1.36	1.42	1.26	1.30
Maximum	3.06	3.04	2.66	3.37	2.64	4.59

TABLE 5.4 FACTOR OF SAFETY SUMMARY – RELATIVE TO HYDRAULIC PROFILE

Segment	Edmonton to Edson	Edson to Hinton	Haregreaves to Darfield	Black Pines to Kamloops	Kamloops to Sumas	Sumas to Burnaby
Average	3.64	6.21	5.10	3.28	7.63	5.67
Mean	2.73	4.92	4.27	2.62	3.63	5.45
Minimum	1.67	3.10	1.66	2.24	1.73	2.62
Maximum	21.61	70.48	104.51	7.37	213.66	16.96

Figure 5.13 through Figure 5.24 display the calculated factor of safety data points arranged in order of decreasing value. These charts provide a comparison of the incidence of magnitudes of all calculated factor of safety.

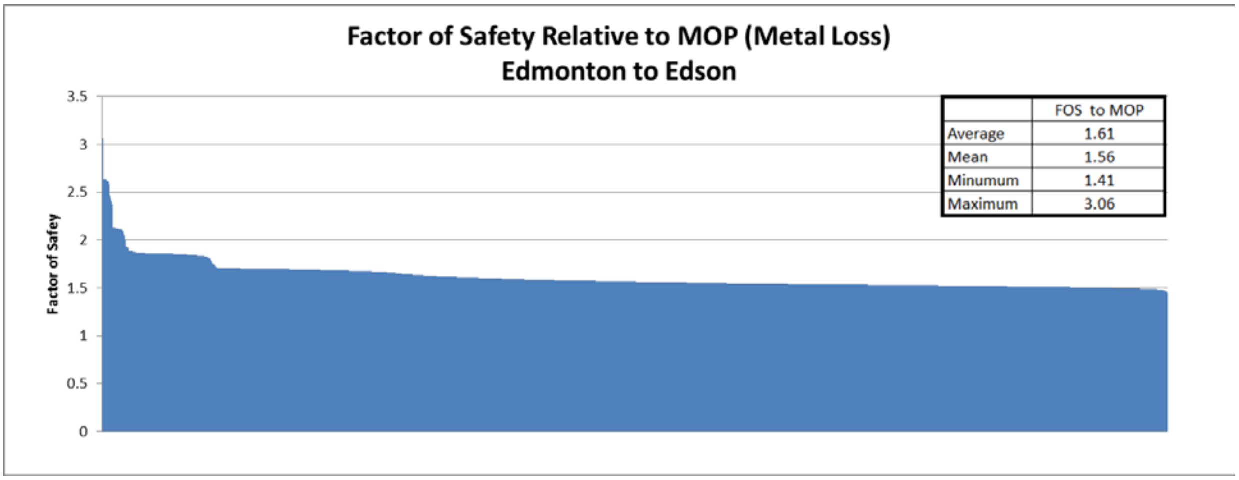


Figure 5.13 Factor of Safety Relative to MOP (Metal Loss) – Edmonton to Edson

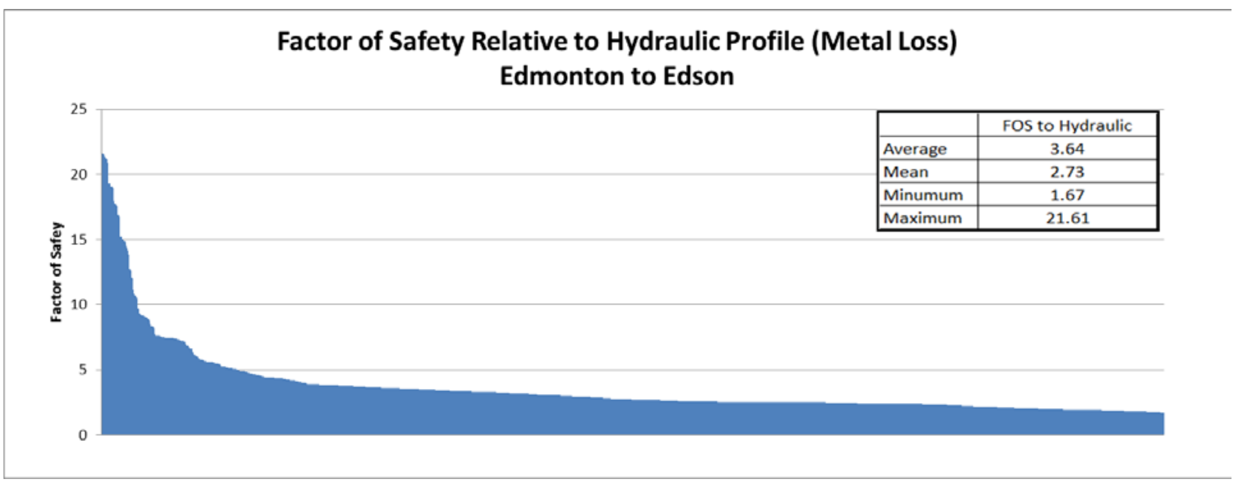


Figure 5.14 Factor of Safety Relative to Hydraulic Profile (Metal Loss) – Edmonton to Edson

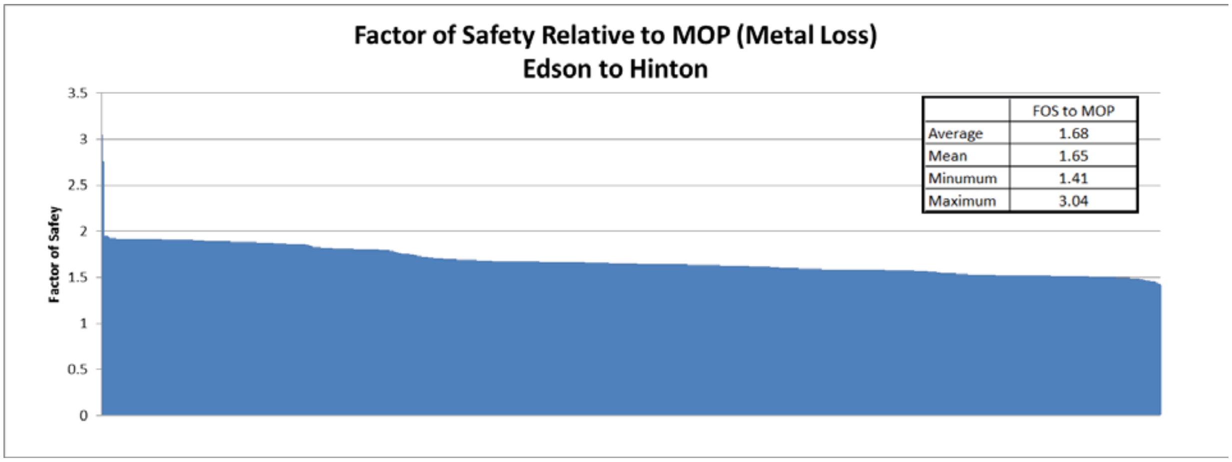


Figure 5.15 Factor of Safety Relative to MOP (Metal Loss) – Edson to Hinton

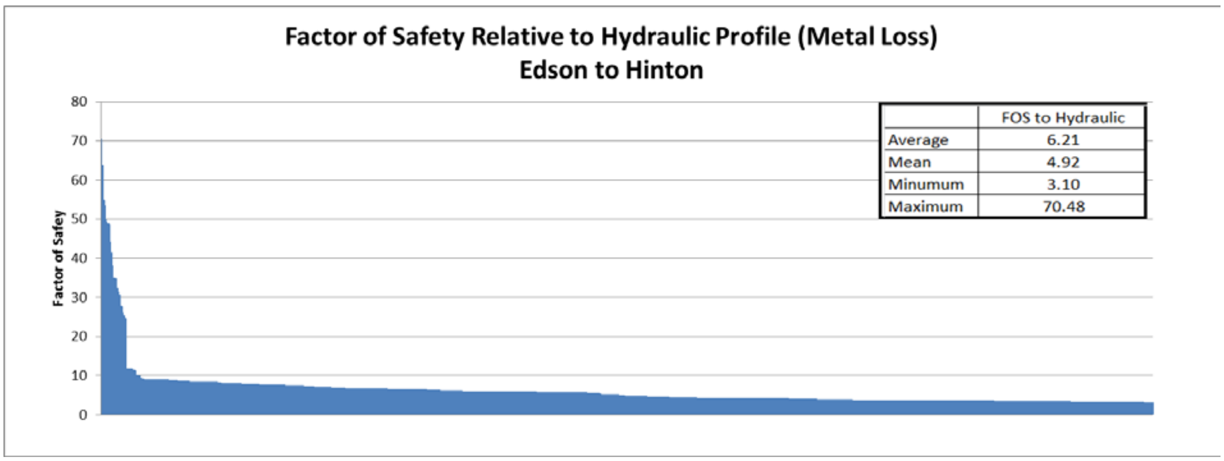


Figure 5.16 Factor of Safety Relative to Hydraulic Profile (Metal Loss) – Edson to Hinton

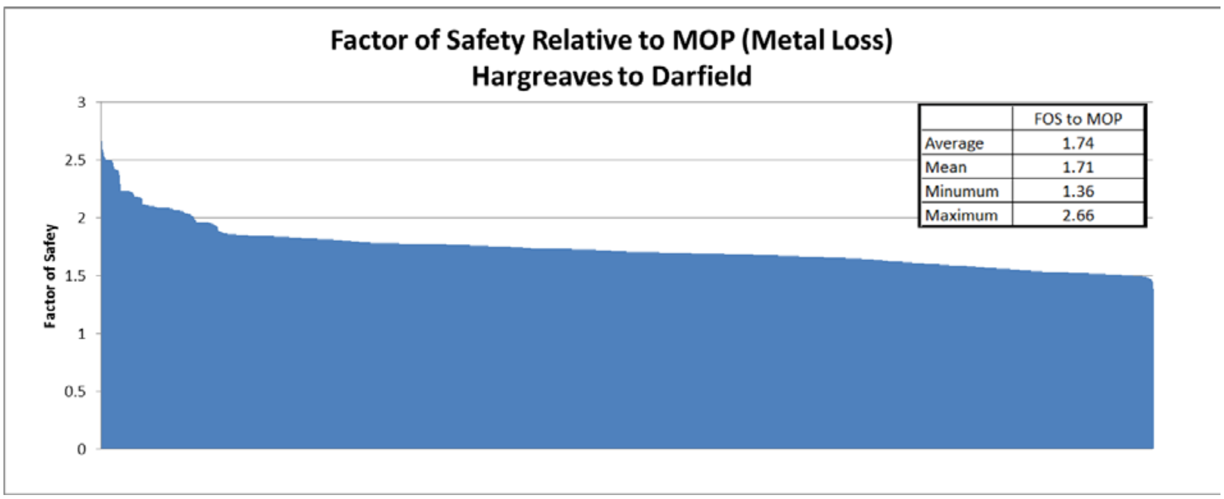


Figure 5.17 Factor of Safety Relative to MOP (Metal Loss) – Hargreaves to Darfield

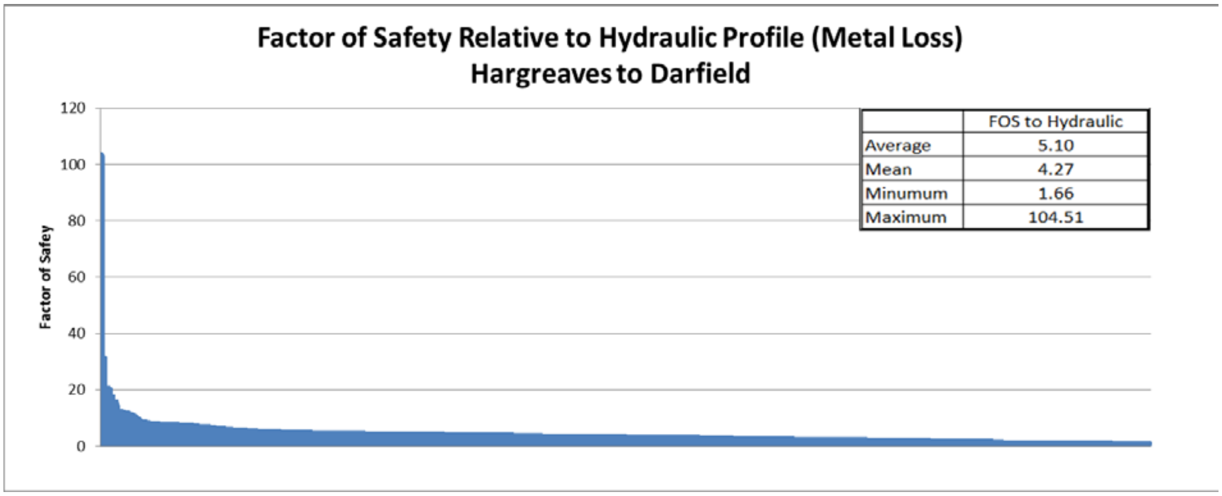


Figure 5.18 Factor of Safety Relative to Hydraulic Profile (Metal Loss) – Hargreaves to Darfield

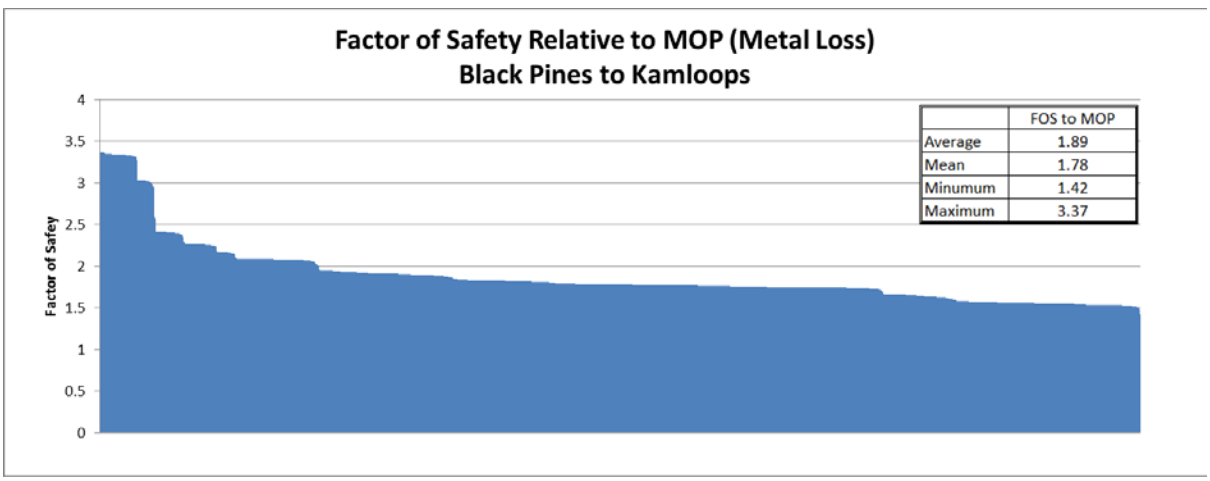


Figure 5.19 Factor of Safety Relative to MOP (Metal Loss) – Black Pines to Kamloops

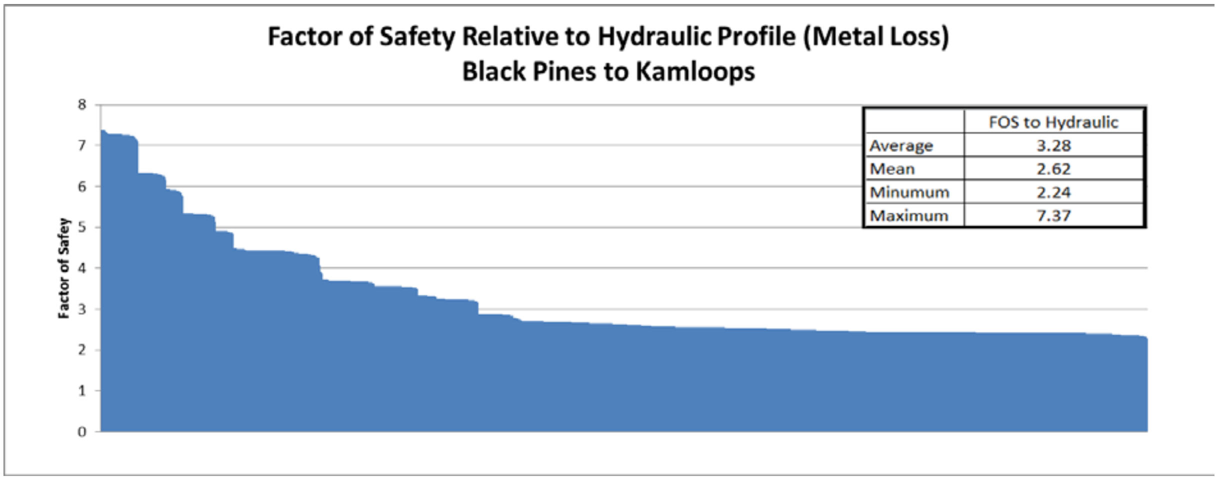


Figure 5.20 Factor of Safety Relative to Hydraulic Profile (Metal Loss) – Black Pines to Kamloops

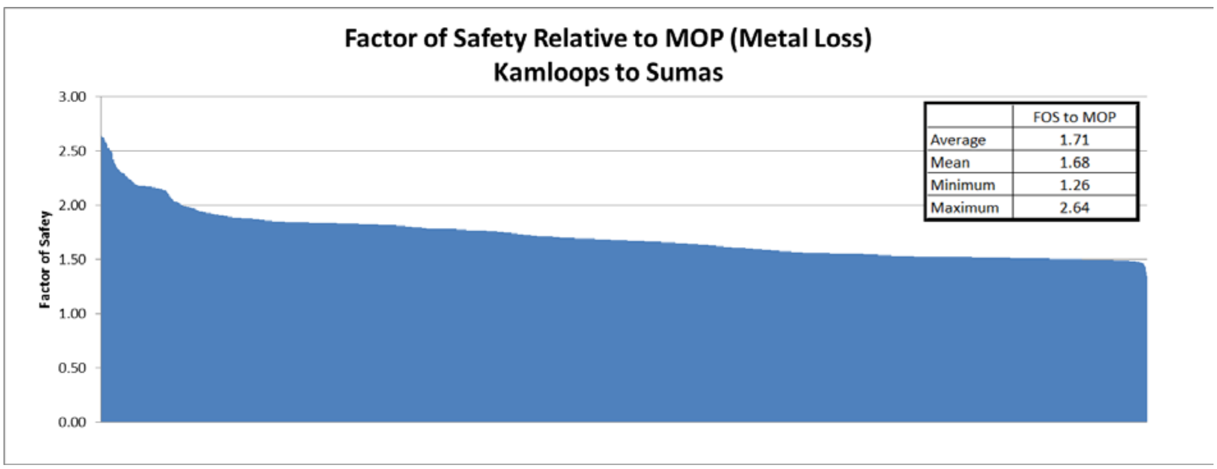


Figure 5.21 Factor of Safety Relative to MOP (Metal Loss) – Kamloops to Sumas

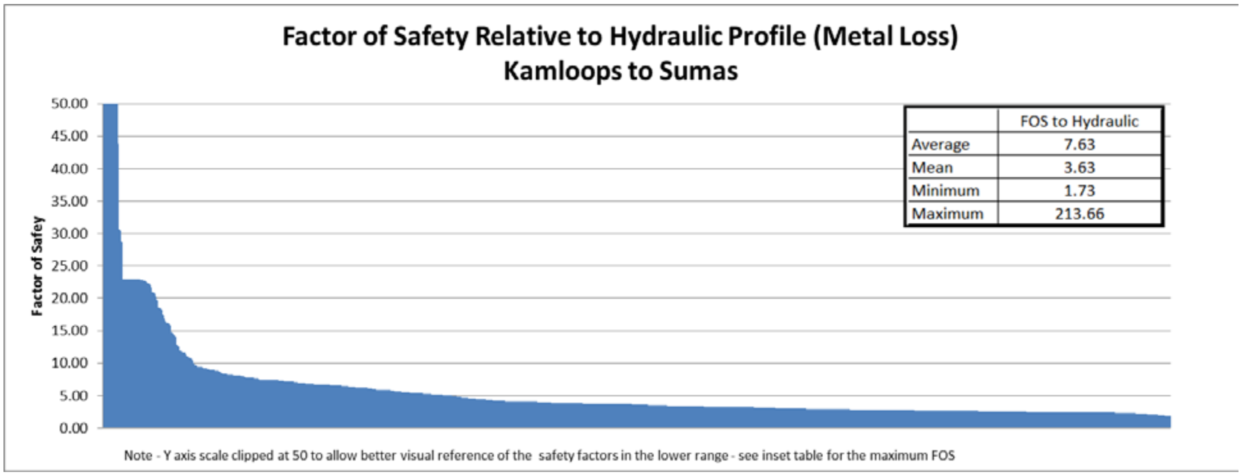


Figure 5.22 Factor of Safety Relative to Hydraulic Profile (Metal Loss) – Kamloops to Sumas

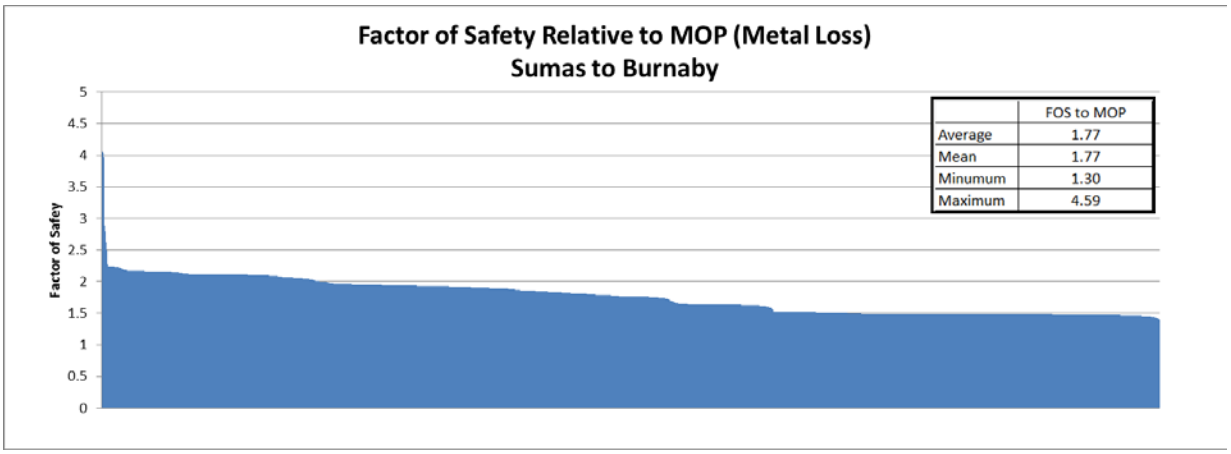


Figure 5.23 Factor of Safety Relative to MOP (Metal Loss) – Sumas to Burnaby

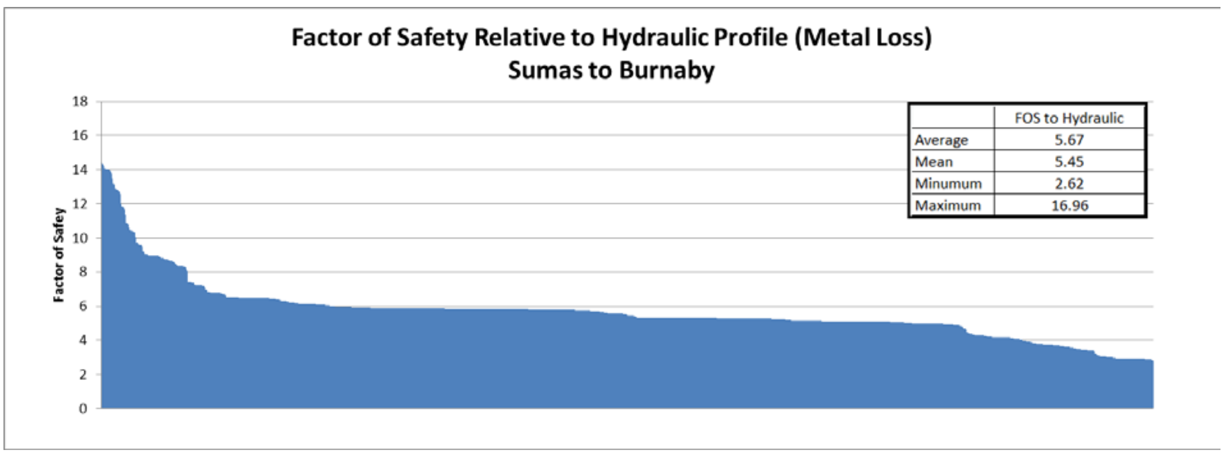


Figure 5.24 Factor of Safety Relative to Hydraulic Profile (Metal Loss) – Sumas to Burnaby

5.1.3 Corrosion Growth Rates

Corrosion growth rates (CGRs) are calculated on all KMC pipelines. They are calculated by taking the difference in corrosion depth between two metal loss ILI runs and dividing that by the amount of time between runs. This gives the average rate at which corrosion pits are growing in millimeters per year. A standard deviation of the data is also produced, which allows more conservative CGRs to be used in prediction calculations.

TABLE 5.5 CORROSION GROWTH RATES

Segment	MFL ILI		Int. CGR (mm/yr)		Ext. CGR (mm/yr)	
	Previous	Recent	Mean	Std Dev	Mean	Std Dev
Edmonton - Edson	2004	2009	0.0179	0.0441	0.0207	0.0459
Edson to Hinton*	No prior ILI	2010	TBD	TBD	TBD	TBD
Hargreaves - Blue River	2007	2012	0.0136	0.0327	0.0012	0.0496
Blue River - Darfield	2006	2012	0.0036	0.0362	0.0008	0.0363
Kamloops - Sumas	2003	2010	0.0159	0.0379	0.0132	0.0366
Sumas - Burnaby	2005	2011	0.0017	0.0456	0.0037	0.0372
Sumas - Tank Farm	2005	2012	0.0085	0.0504	0.0042	0.0187
Westridge Lateral	2008	2012	0.0208	0.0675	0.0007	0.0420

CGR has not been completed for this line segment and will be completed following the next metal loss ILI

For reference, the Industry Standard CGRs are as follows:

TABLE 5.6 INDUSTRY STANDARD CORROSION GROWTH RATES

Feature Depth Range	External Corrosion Growth Rate (mm/year)	Internal Corrosion Growth Rate (mm/year)
0 - 20% NWT	0.10	0.10
20 – 40% NWT	0.20	0.15
> 40% NWT	0.30	0.25

5.2 Cracking

This section provides background information on KMC's crack management program along with compiled crack study results for both segments.

5.2.1 Crack Management Results

The charts found in this segment represent the incidence of the seam weld anomalies and crack-like features along with their severity. KMC recently completed an crack baseline assessment program for all of the pre-1970s pipeline segments on the TMPL. The baseline assessments were complete utilizing AFD and EMAT inspection technologies. USCD programs are currently underway but are not yet complete on the line segments. As a result, the data from the AFD and EMAT inspections are provided below.

For the AFD and EMAT ILI programs, KMC chose to investigate close to 100% of the identified crack-like features on the line segments. The charts below provide a before and after view of the program. The before program shows the identified crack-like features and predicted rupture pressure of the features. The after program shows the remaining crack-like features in the line segments.

The crack-like anomaly charts provide a comparison between the historical normal maximum pressures, the maximum operating pressure, and the predicted operating pressure of the segments in Line 1 service. The difference between the operating pressures and the features' rupture pressure allows for a visual representation of the factor of safety in the segments' operation.

The maximum operating pressure, historical maximum operating pressures, and the proposed operating pressures for Line 1 service were determined in accordance with the methods outlined in section 3.2.2.

5.2.1.1 Charts

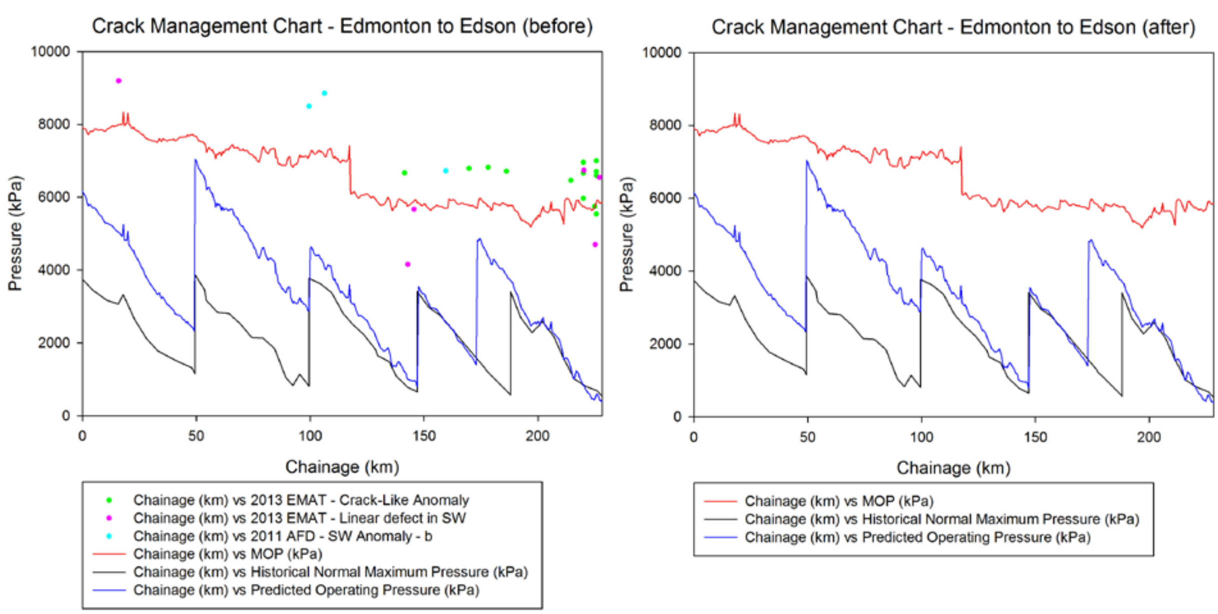


Figure 5.25 Crack-Like Anomalies – Edmonton to Edson

The Edson to Hinton section of pipeline had no crack-like anomalies detected during the 2012 and 2013 AFD and EMAT in-line inspections. The before and after chart has been included as Figure 5.26 to provide a complete picture of the pipeline that will be in Line 1 service.

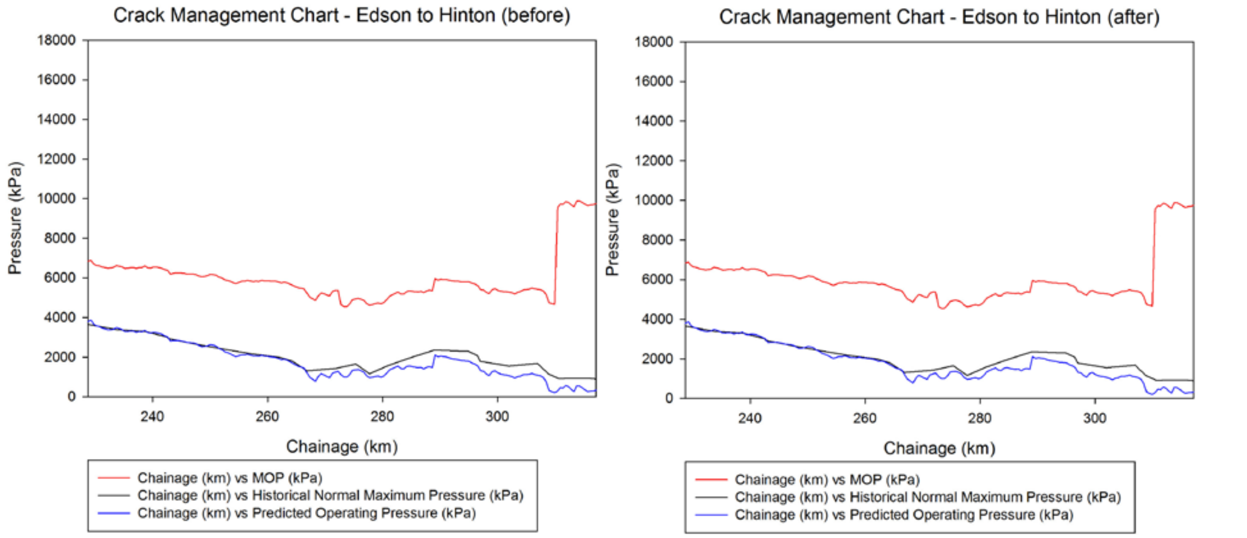


Figure 5.26 Crack-Like Anomalies – Edson to Hinton

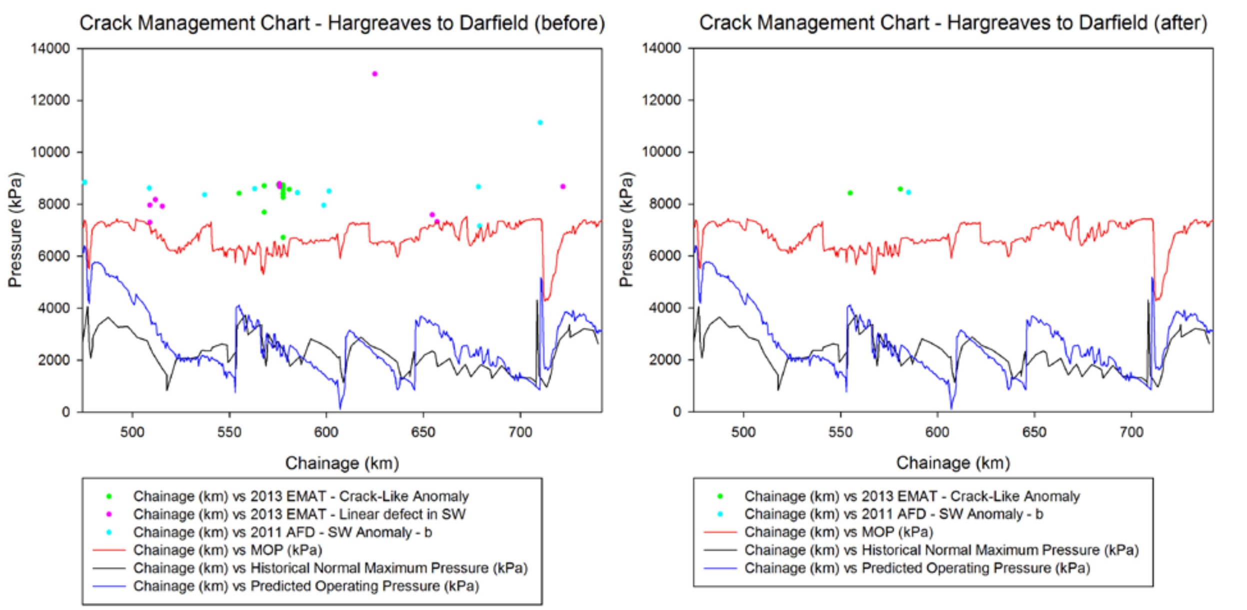


Figure 5.27 Crack-Like Anomalies – Hargreaves to Darfield

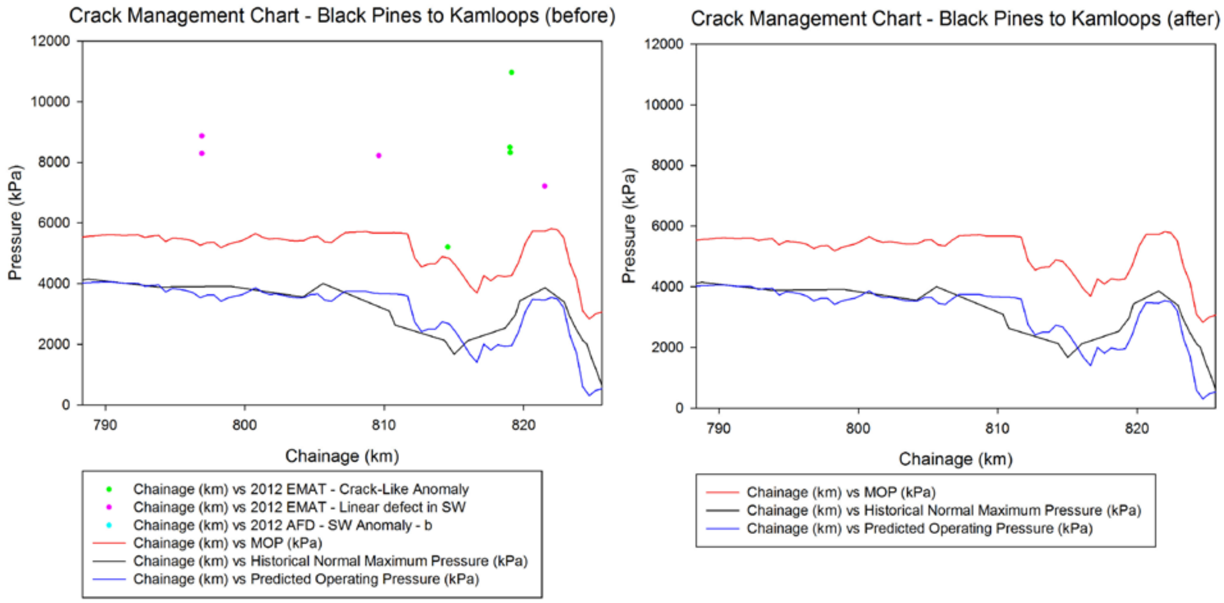


Figure 5.28 Crack-Like Anomalies – Black Pines to Kamloops

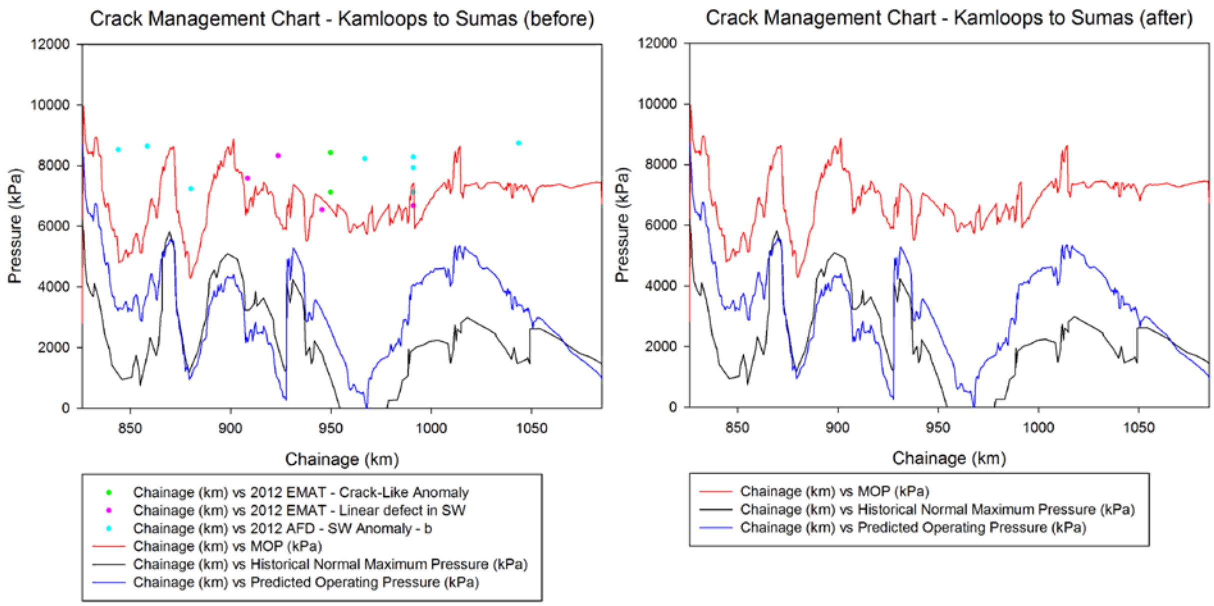


Figure 5.29 Crack-Like Anomalies – Kamloops to Sumas

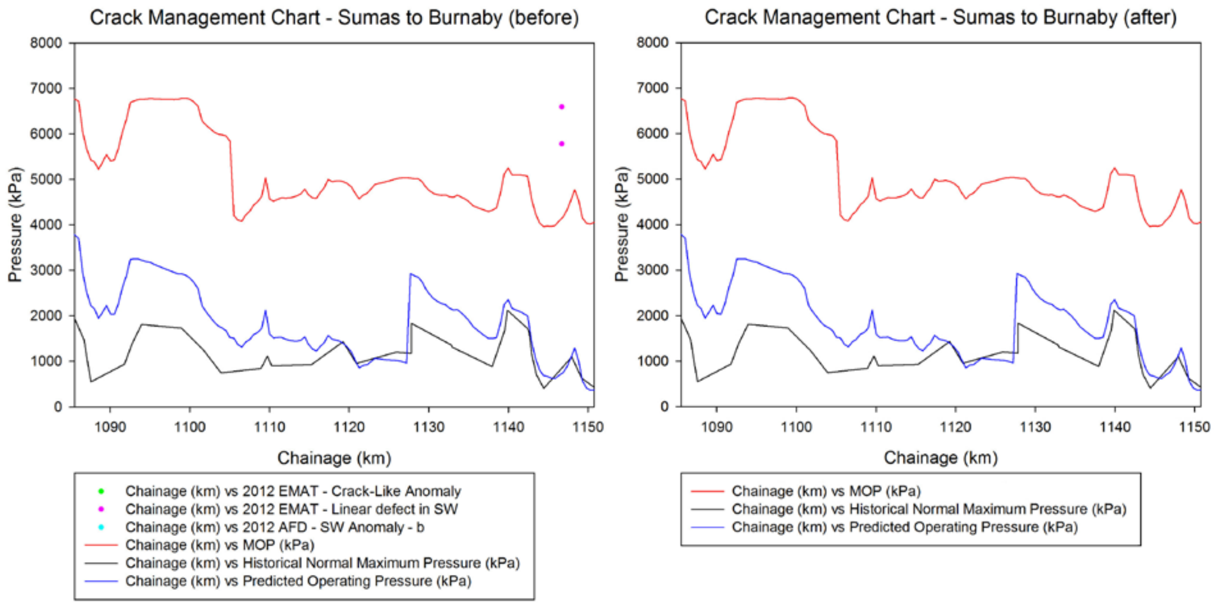


Figure 5.30 Crack-Like Anomalies – Sumas to Burnaby

5.2.1.2 Factor of Safety

As shown in Figure 5.27, Hargreaves to Darfield (after) the rupture pressure for all remaining features identified in the segment falls above the predicted operating pressure and the maximum operating pressure. These two buffers serve as factors of safety that can be quantified by applying the following equation:

$$FS = \frac{P_{\text{Rupture}}}{P}$$

Where:

$FS =$ Factor of safety for either MOP or Predicted Pressure

$P_{\text{Rupture}} =$ Rupture pressure of a specific feature, kPa

$P =$ Base pressure (either MOP or Predicted Pressure), kPa

The Factor of safety charts are created by applying the above equation at each feature to compare its rupture pressure to both the Predicted Pressure and the MOP.

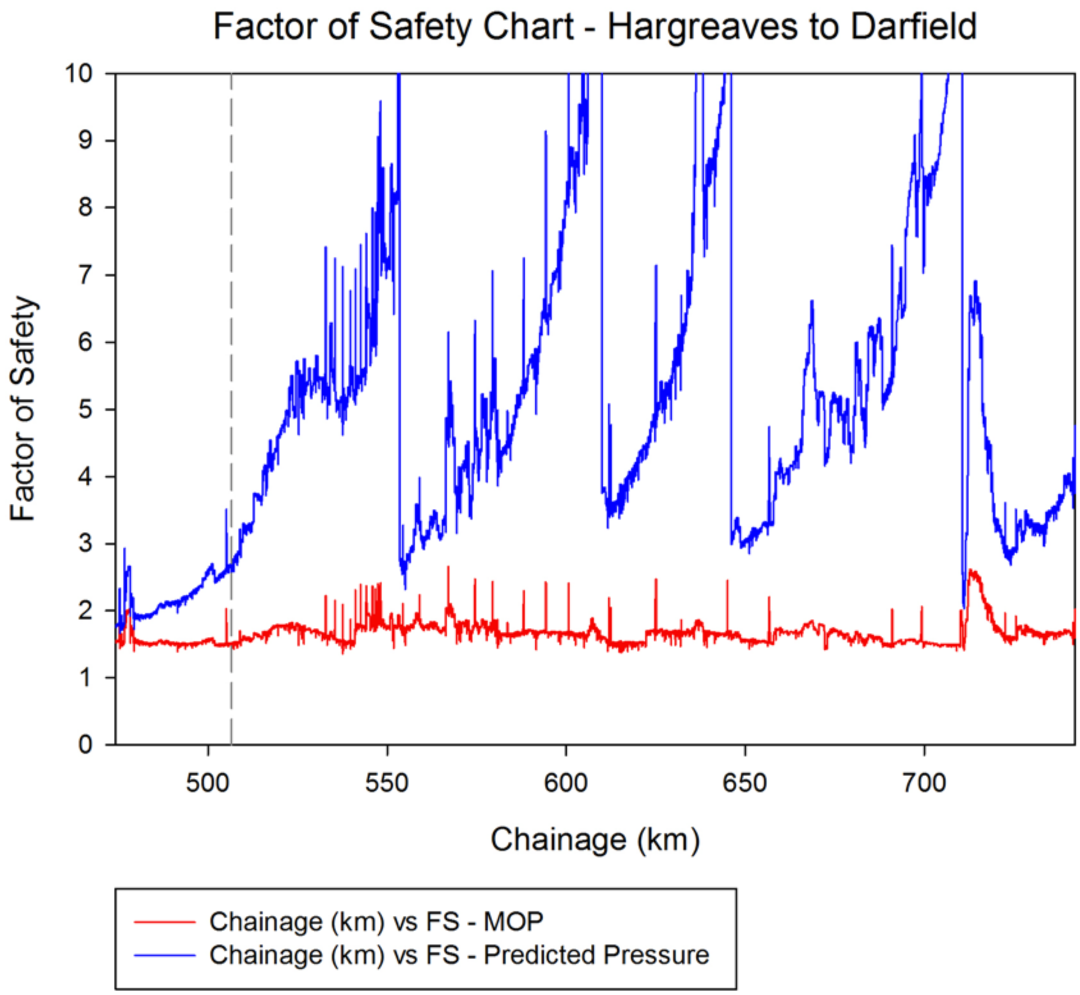


Figure 5.31 Factor of Safety for Crack-Like Anomalies – Hargreaves to Darfield

From Figure 5.31 the Factor of Safety for crack-like anomalies for the segment can be summarized in the following table:

TABLE 5.7 FACTOR OF SAFETY SUMMARY FOR CRACK-LIKE ANOMALIES

Segment	Hagreaves to Darfield	
Reference	MOP	Predicted Pressure
Average	1.30	3.06
Median	1.31	3.50
Minimum	1.26	2.04
Maximum	1.31	3.63

Figure 5.32 and Figure 5.34 display the calculated Factor of safety data points arranged in order of decreasing value. This chart provides a comparison of the incidence of magnitudes of all calculated Factor of safety.

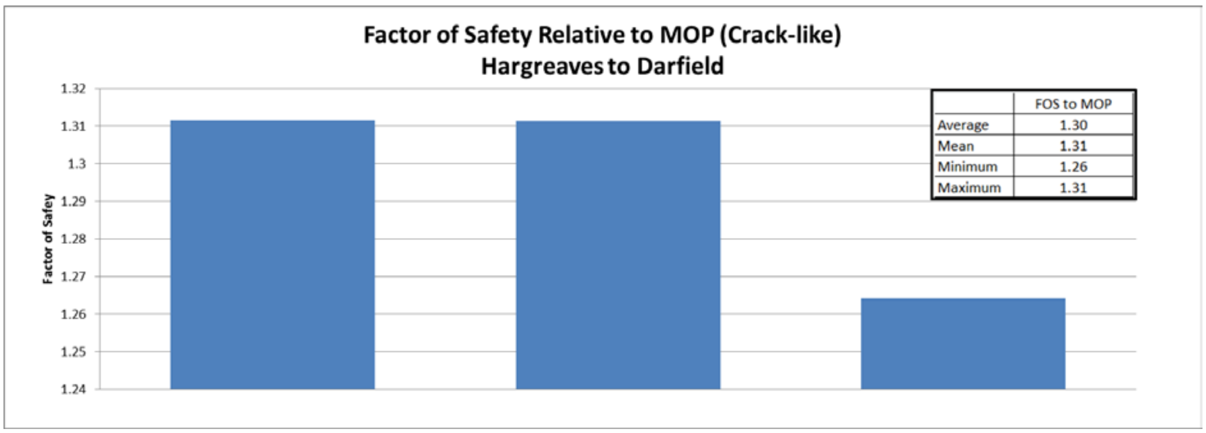


Figure 5.32 Factor of Safety Relative to MOP for Crack-Like Anomalies – Hargeaves to Darfield

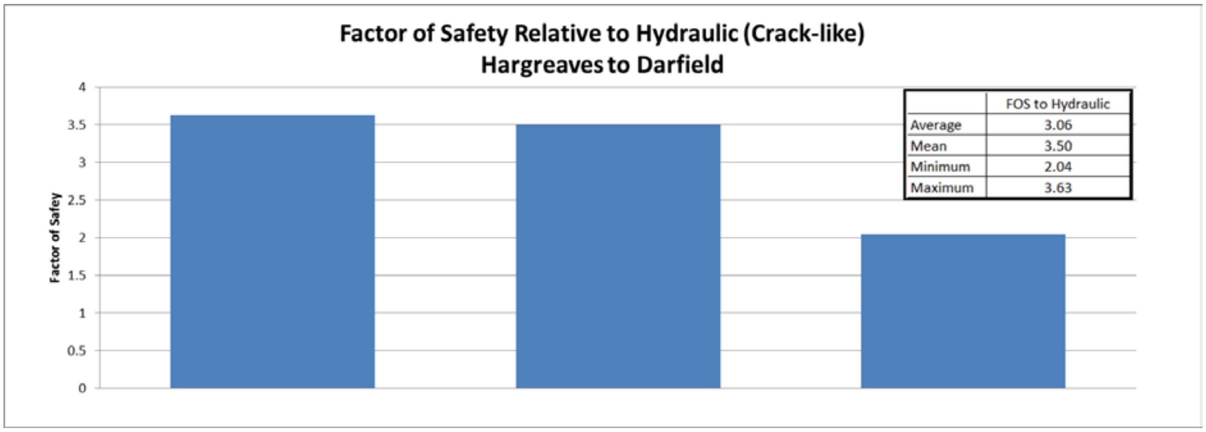


Figure 5.33 Factor of Safety Relative to the Hydraulic Profile for Crack-Like Anomalies for Hargreaves to Darfield

5.3 Mechanical Damage

5.3.1 Third Party Damage Prevention

KMC considers third-party damage a threat to pipeline integrity. A number of active and passive programs are in place to minimize the likelihood of accidental third-party damage to any part of the KMC network.

- **Public Awareness Program**: The KMC Public Awareness Program (PAP) is designed to inform and educate the public and contractors about pipeline safety, damage prevention, emergency preparedness and maintenance projects through mail-outs, personal visits, open houses, emergency response committee initiatives and the company website.
- **Signage**: KMC's ROWs are clearly marked with signs in accordance with CSA Z662 that specifically identify the hazard as a liquid petroleum pipeline and provide an emergency contact number. The signs are posted by Pipeline Protection Technicians at strategic locations, which include road, rail, water, and utility crossings; subdivision developments; construction sites; and high population areas.
- **Right of Way Surveillance**: Regularly scheduled aerial patrols of the ROW are conducted to monitor for encroachments and visible threats to pipeline integrity, which are classified as third party encroachments, natural hazards, or advisories. Aerial patrols are performed once per month for both the Hinton to Hargreaves and Darfield to Kamloops line segments. During the summer, there are two aerial patrols per month from Hinton to Hargreaves and one per week from Darfield to Kamloops. Pipeline Protection Technicians and their Supervisors are notified of all observations and are responsible for further investigation and reporting. In addition to aerial patrols, KMC staff also conducts day-to-day routine surveillance of the ROW during the performance of regular duties and report potential or existing encroachments.
- **Crossing Requests**: All crossing requests are processed by the Crossings Technologist, who will involve Technical Services if the crossing involves metallic pipelines, power lines over 50kV, major utilities, roads, parking lots or railway crossings. Any activity within areas identified as containing potentially susceptible soils is also

reviewed. All approved crossings are documented and processed by Drafting to update relevant drawings.

- **One-Call Systems**: KMC has membership in both the Alberta and B.C. one-call systems. These two agencies serve as a clearinghouse for planned ground disturbances in close proximity to or across the pipeline, and notify KMC of the location, timing, and contact information of all such activities. If required, KMC dispatches Pipeline Protection Technicians to identify the location of the pipeline and monitor activities related to ground disturbance or crossing of the line by mechanical equipment as per the NEB's Pipeline Crossing regulations.

6.0 PLANNED ACTIVITIES

Table 6.1 and Table 6.2 list the next proposed inspections in Trans Mountain's ILI Multi Year Plan for metal loss and crack inspections, respectively.

TABLE 6.1 PROPOSED METAL LOSS ILI SCHEDULE

Year	Line	Tool
2014	Edmonton – Edson	MFL/Caliper
2015	Edson – Hinton	MFL/Caliper
2016	Hargreaves – Darfield	MFL/Caliper
TBD	Black Pines – Kamloops NPS 24	TBD
2015	Kamloops – Sumas	MFL/Caliper
2016	Sumas – Burnaby	MFL/Caliper

TABLE 6.2 PROPOSED CRACK ILI SCHEDULE

Year	Line	Tool
2014	Edmonton – Edson	USCD
TBD	Edson – Hinton	TBD
2014	Darfield – Kamloops (NPS 30)	USCD
2015	Hinton - Hargreaves	AFD
2015	Hinton - Hargreaves	USCD or EMAT
2017	Darfield - Kamloops	AFD
TBD	Kamloops – Sumas	TBD
2014	Sumas – Burnaby	USCD

In addition to these inspections, the following activities will also be conducted before the pipeline is placed in Line 1 service:

- **Edmonton Terminal:** remove the old groundbed and install a new one at a safe distance from the railroad crossing.

- **Rearguard Pumping Station:** Replace the overhead cables in this area with an underground connection between the pipe and the rectifier.

- **KP 605-606:** Fill the casing with wax, in order to prevent water from entering the casing.

- **KP 990:** New anodes were installed at the site in 2010, but completion of the project was delayed due to security concerns. These concerns were subsequently addressed, and the project is scheduled for completion in September 2014.

7.0 CONCLUSION

The Engineering Assessment demonstrates that the existing TMPL can safely operate in Line 1 service. This conclusion is based on the following:

- The segments have been consistently monitored through regular ILI tool runs and will continue to be monitored for the life of the pipeline.
- The Integrity Management Program has been effective at maintaining the pipeline in a condition to operate up to the licensed MOP.
- The factor of safety for the remaining metal loss features ranges from 1.26 to 4.59 relative to the licensed MOP and 1.66 to 213.66 relative to the proposed operating profile.
- All crack-like anomalies discovered by the AFD and EMAT crack inspections have been repaired with the exception of three features in the Hargreaves to Darfield section of pipeline.
- The factor of safety for the remaining crack-like features in the Hargreaves to Darfield section of line ranges from 1.26 to 1.31 relative to the licensed MOP and 2.04 to 3.63 relative to the proposed operating profile.
- KMC has a comprehensive program for third party damage prevention and continues to monitor third party damage through the use of its damage prevention programs and in-line inspection.

PART 2:

TRANSPORT CANADA TERMPOL REVIEW #8000-22-7:
TERMPOL REVIEW COMMITTEE UPDATE (AUGUST, 2014)

Update to TERMPOL Review Committee

Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
Transport Canada Termpol Review # 8000-22-7

Submitted 16th Dec 2013

TRANS MOUNTAIN EXPANSION PROJECT,
TERMPOL REVIEW COMMITTEE UPDATE (AUGUST, 2014)

Reference: With reference to the review of studies and reports submitted by Trans Mountain to the Termpol Review Committee (TRC) on 16th December, 2013.

Preamble: At this time Trans Mountain wishes to provide the Termpol Review Committee with an update on the conceptual design development for the proposed expansion of Westridge Marine Terminal (WMT). Other information updates are also provided. This information is also being provided to the NEB.

Westridge Marine Terminal Design Optimisation

As discussed in the responses to City of Burnaby IR No. 1.18.03a, IR No. 1.18.03b, IR No. 1.18.03c, and IR No. 1.18.03d (Filing ID A3Y2E6) and various other NEB and Intervenor IRs, Trans Mountain has been working to optimize the conceptual layout of WMT to reduce the overall footprint. Revised proposed plot plans are provided in Figure-1 (the overall facility) and Figure-2 (the foreshore infrastructure). A simplified plot plan showing the major positional changes from the plot plan included in Section 3.4.4.1.4, Volume 4A of the Facilities Application (Filing ID A3S0Y9) is provided as Figure-3. A number of revised representative artistic image of WMT are also provided as Figures– 4, 5 6.

A reduction of the footprint of the expansion at WMT has been achieved through the relatively significant changes, identified below, as well as a number of minor changes.

- Shifting of the Berth 1 loading platform (and the vessel at Berth 1) approximately 50 m to the east;
- Shifting of the Berth 2 loading platform (and the vessel at Berth 2) approximately 30 m to the east;
- Shifting of the central core of the dock complex slightly to the east and canting the main access trestle to be perpendicular to the Berth 1/2 access trestle;
- Eliminating the two synthetic crude tanks and the relief tank;
- Reorganizing the remaining infrastructure on the foreshore to be more efficient.

Two primary benefits are expected to result from these changes.

- A smaller portion of the vessels moored at Berth 1 and Berth 2 will be visible from the closest residences (at Northcliffe Crescent). The loading arms at Berth 1 and Berth 2 may also be less visible.
- The new foreshore infill area, at the final grade elevation, will be approximately 6,800 m^2, compared to approximately 12,300 m^2 in the previous design, a reduction of 45%. The anticipated volume of dredging and fill cannot be confirmed at this time as the geotechnical work required to characterize the marine sediments has not been completed.

Vapour Recovery Units

As discussed in the responses to Government of Canada - Environment Canada IR No. 1.065b (Filing ID A3Y2K9) and various other NEB and Intervenor IRs, Trans Mountain, working with two of the leading international vendors of vapor recovery technology, has made some progress on further definition of the scope of the two proposed vapor recovery units (VRUs). Trans Mountain now anticipates that each VRU will include:

- a vessel containing impregnated activated carbon for H_2S and mercaptan removal;
- two vessels containing activated carbon for volatile organic compound (VOC) capture, each of which will be designed for regeneration (recovery of a rich VOC vapor stream) in cycles of between 10 and 15 minutes;
- an enhanced vacuum system for regeneration of the VOC capture activated carbon vessels;
- a compressor system to compress the regenerated VOC vapor stream;
- a condenser system to convert the rich VOC vapor stream into recovered VOC liquid; and
- a re-injection system to return the recovered VOC liquid into the vessel loading piping.

The compression and condensation approach allows for the elimination of the proposed synthetic crude tanks, which were to have been used for absorption of the regenerated VOC vapor stream. Trans Mountain is confident that the proposed vapor recovery systems will provide very high capture and recovery efficiencies. The revised design concept and emissions projections have been used in the updated air quality modelling.

Pipeline Surge

Although Trans Mountain has not yet completed the Burnaby-Westridge delivery pipelines transient hydraulic study (“surge study”), initial analysis indicates that the use of PN 50 (ANSI 300#) pressure class piping at WMT will be adequate for the maximum surge pressure that can be developed. Accordingly, the proposed surge relief tank is no longer shown on the conceptual plot plan. There remains some possibility that further analysis will indicate that PN 100 (ANSI 600#) piping is required in the absence of a relief provision, in which case a cost/benefit analysis may be required to determine if the reintroduction of the surge relief tank in combination with lower pressure piping is desirable.

Next Steps

Prior to the commencement of the detailed engineering and design phase, now anticipated to be in mid to late 2015, Trans Mountain intends to continue to carry out a number of developmental engineering activities, some of which are listed below. It is expected that all of these activities will be complete by the end of Q1 2015. Where earlier completion is anticipated, it is noted after the activity.

- Select the VR/VC technology vendor (end Q3 2014).
- Complete additional vapor sampling during vessel loadings at WMT (end Q3 2014).
- Working collaboratively with the VR/VC technology vendor and RWDI (air quality modelling specialists):
    - Refine the input parameters to the air quality modelling and carry out additional model runs.
    - Refine the VRU/VCU design;
    - Continue this process iteratively until a detailed design basis that will meet the appropriate ambient air quality objectives is finalized (end Q4 2014).
    - Determine the exact footprint of the VRUs, VCU, and associated equipment.

- Complete the offshore and onshore geotechnical field work (boreholes), laboratory work, and analysis.
- Complete the transient hydraulic study and finalize the piping pressure class and/or the need for a surge relief tank (end Q4 2014).
- Complete the preliminary hazards and operability (HAZOP) review (end Q4 2014).
- Further refine the conceptual layout of the foreshore equipment.

At this stage of development, Trans Mountain expects that further conceptual design changes at WMT will be characterized as refinements, rather than material changes to the scope or scale of the facility.

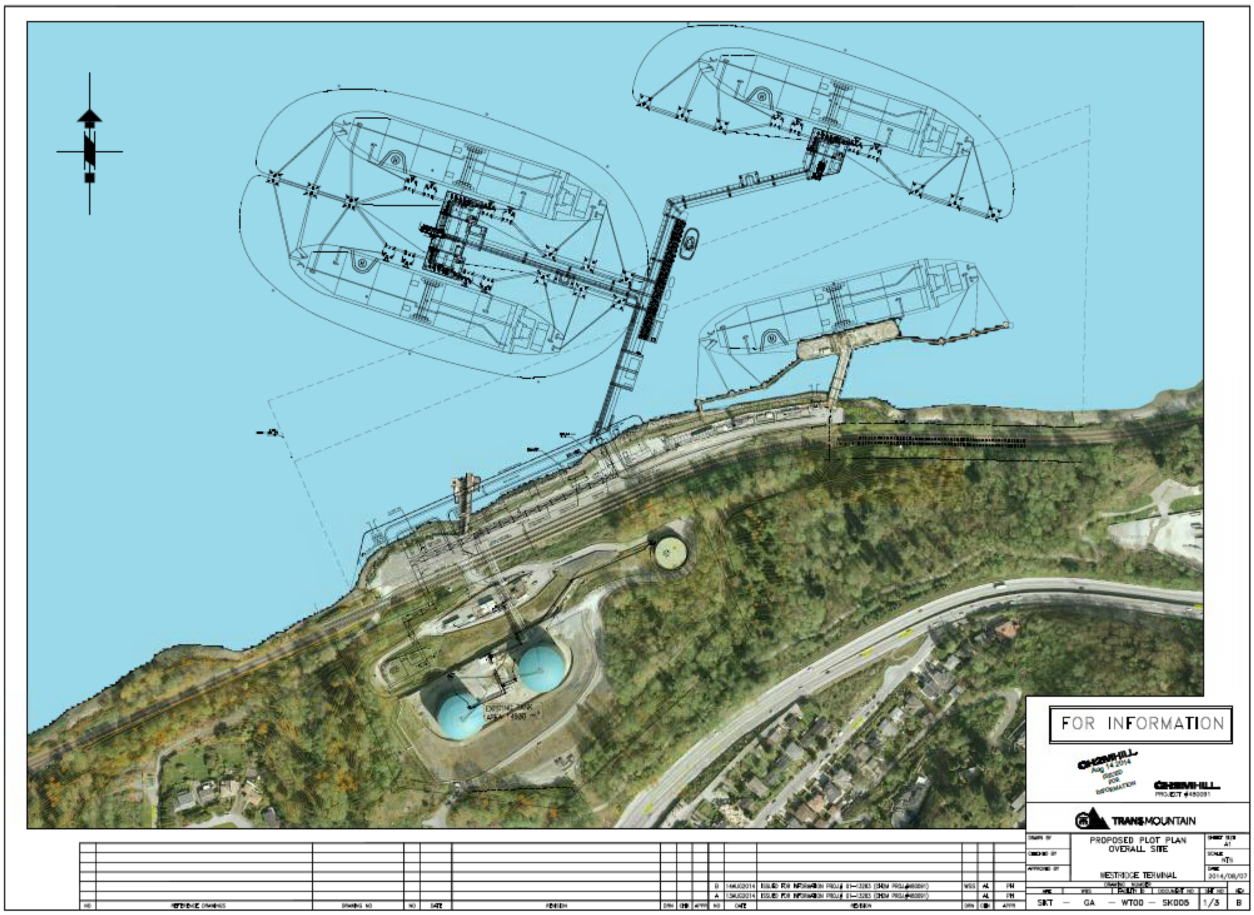


Figure 1: Westridge Terminal – Proposed Plot Plan, Overall Site

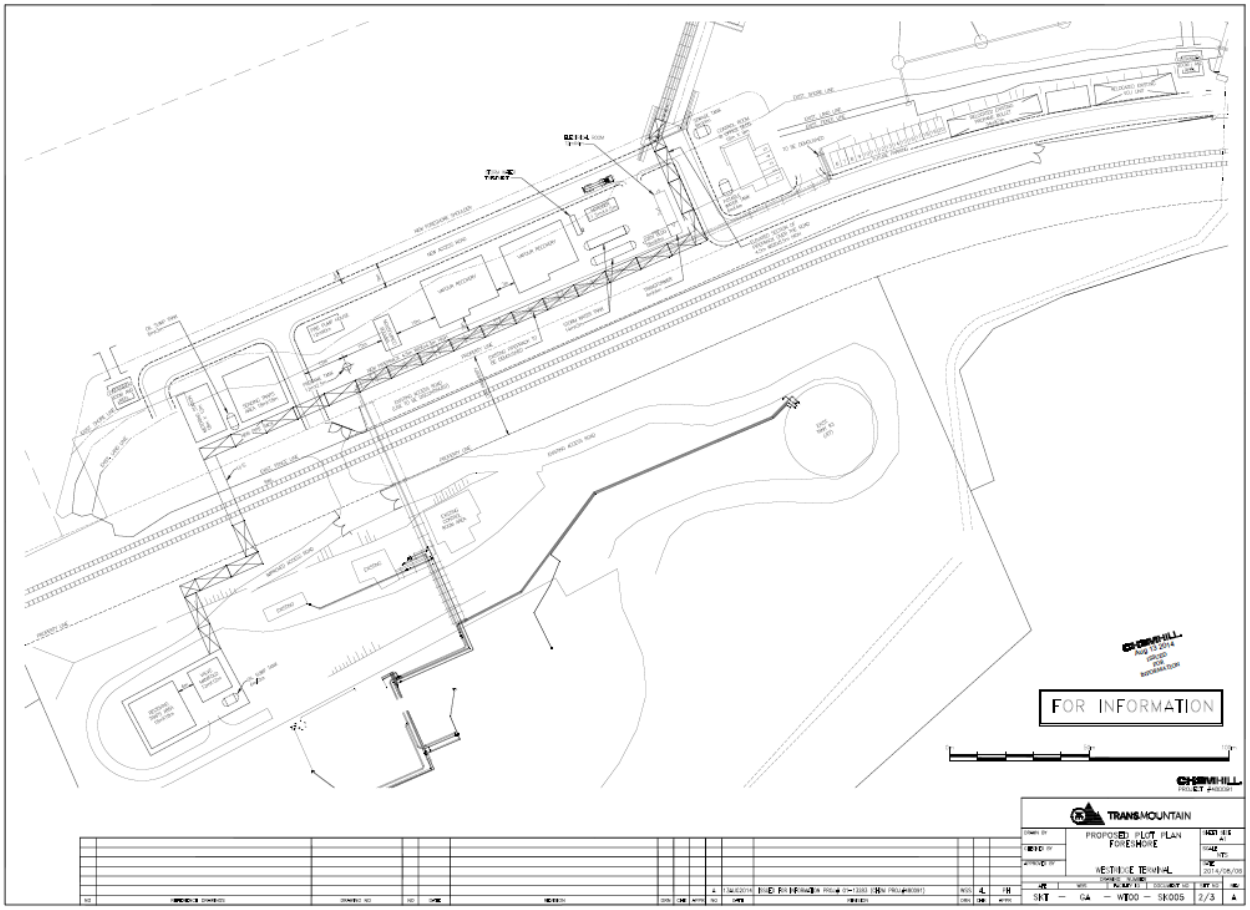


Figure 2: Westridge Terminal – Proposed Plot Plan, Foreshore

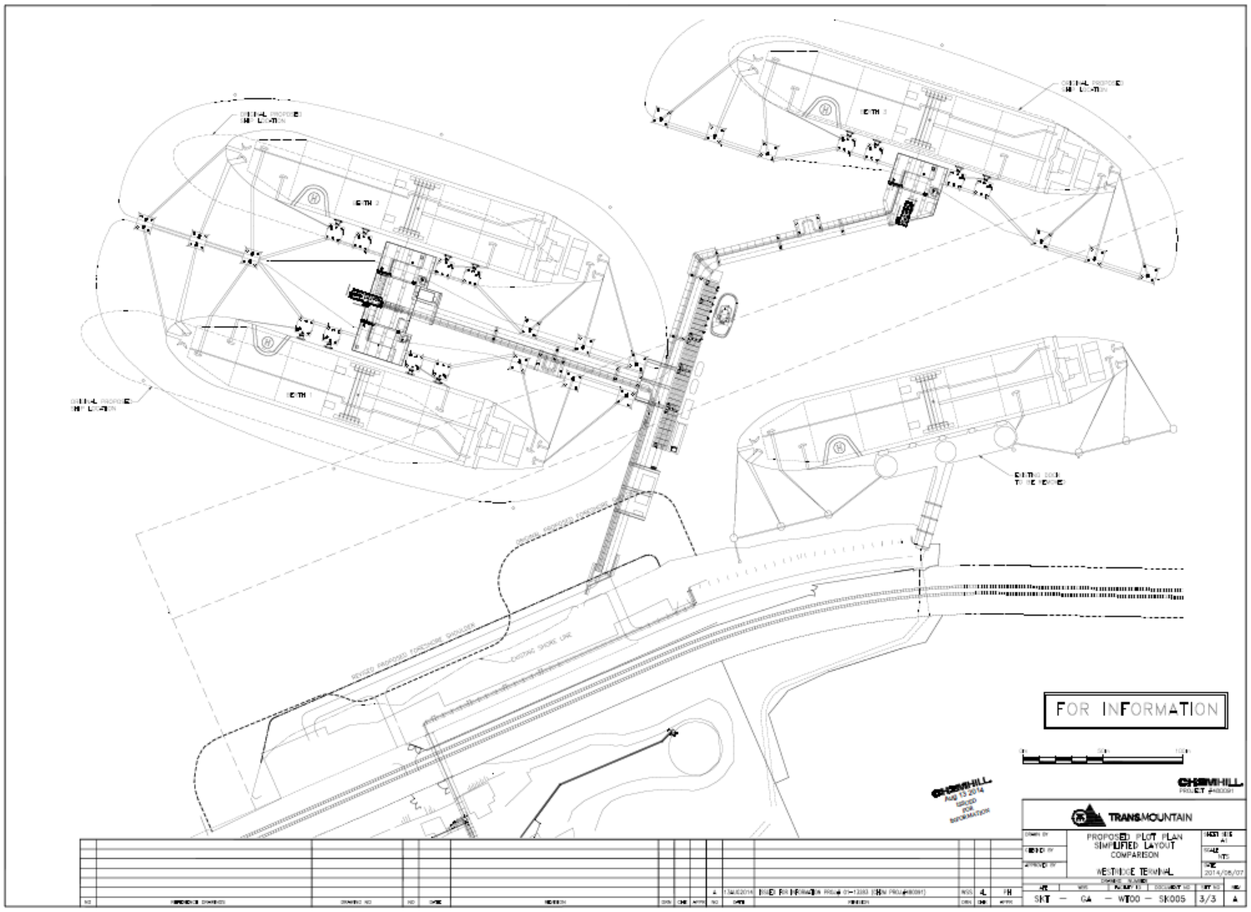


Figure 3: Westridge Terminal – Proposed Plot Plan, Simplified Layout Comparision

Figure 4: Westridge Terminal – Artistic Rendering (Aerial Overview)

Figure 5: Westridge Terminal – Artistic Rendering (View to Cates Park and Indian Arm - Northerly View)

Figure 6: Westridge Terminal – Artistic Rendering (View to Berry Point - Westerly View)

Supporting Studies and Additional Analysis

The following additional studies have been completed and are provided to the TRC:

Study	Description
Passing Ship Analysis	New information. Attachment to Volume 8C Termpol 3.15. Also supports Termpol 3.10. Requested by the TRC and based upon advice received from PMV. The objective of this study is to determine the loads imparted by passing vessels under the proposed channel alignment and traffic corridor on selected tankers berthed at the new Westridge facilities. In a meeting held on April 7 with KMC and PMV, specific scenarios were laid out for this analysis. The study shows that the minimum distance between inbound traffic within the corridor and a moored vessel at Berth 3 of the proposed Westridge facilities is about 190 meters. The proposed corridor will require adjusting some of the existing designated anchorages in the area. The proposed corridor and anchorage locations are considered draft locations for the purpose of doing this analysis, subject to finalized design to be carried out by PMV at a later date.
Manoeuvring Assessment, Westridge Terminals Vancouver Expansion Supplementary Report – July 2014 Modifications	Update to Volume 8C Termpol 3.5/3.12 Appendix C (Fast time analysis). Subsequent to the selection of a preferred design for the new Westridge Marine Terminal facility, which was filed with the National Energy Board; further engineering work to optimise the design has taken place. Although the overall modification was not substantial, there are some differences in the relative position of the shoreline and bottom slope in relation to the inner berthing face of the new dock which is referred to as Berth 1. There were no practical manoeuvring implications at all for the outer docking faces known as Berths 2 and 3. As a matter of due diligence a series of verification manoeuvres were conducted using simulation to ensure that berthing and un-berthing at Berth 1 could still be conducted in a safe and routine manner with the latest design. It was also verified that there would be no additional complications associated with berthing at the existing facility while the new terminal wharf was under construction.
Manoeuvring Assessment, Strait of Georgia Proposed Tug Escort	New information. Attachment to Volume 8C Termpol 3.15. At the request of the TRC this “Strait of Georgia proposed tug escort simulation study” was completed to assess the risk reducing effects that the proposed enhanced escort regime.
Manoeuvring Assessment, Juan de Fuca Strait Proposed Tug Escort	New information. Attachment to Volume 8C Termpol 3.15. Further to the fast time assessment conducted for Strait of Georgia, this simulation study was completed to assess the risk reducing effects that the proposed enhanced escort regime.
Casualty information	Update to Volume 8C Termpol 3.2 (provides data to 2013). This is an updated set of casualty data information including information for 2013. This was not available at the time of the initial study and is being provided for information purposes only.
Evaluation of VTS Capabilities for Termpol 3.15	New information. Update to Volume 8C Termpol 3.15. Requested by intervenors. The objective of this study is to compare the VTS capabilities of MCTS in the marine study area with those of the reference applications that DNV GL has used as the basis for estimating risk

	reduction factors, in order to establish whether this data is appropriate for the Trans Mountain risk assessment. It also helps to answer the question as to whether the region's VTS compares favourably with the rest of the world. Can be accessed on the NEB's website at: B254-4 - Trans_Mountain_Follow-Up_Response_to_Province_BC_F-IR_No._1.1.50a - A4A2Z6 B254-5 - Trans_Mountain_Follow-Up_Response_to_Province_BC_F-IR_No._1.1.50a-Attachment1 - A4A2Z7 B254-6 - Trans_Mountain_Follow-Up_Response_to_Province_BC_F-IR_No._1.1.50a-Attachment2 - A4A2Z8
A Review of Marine Recreational Vessel Activities in Burrard Inlet	New information. Update to Volume 8C Termpol 3.15. Requested by intervenors. This review includes a detailed assessment of marinas and boating facilities and observations of the flow of recreational vessel traffic in Burrard Inlet over several weeks in the summer of 2014. The review concludes that current and already proposed future additional safeguards are sufficient to comprehensively mitigate potential effects of TMEP on marine recreational vessels. Can be accessed on the NEB's website at: B256-31 - Part_7_Recreational_Boat_Traffic_Part01 - A4A4I4 B256-32 - Part_7_Recreational_Boat_Traffic_Part02 - A4A4I5 B256-33 - Part_7_Recreational_Boat_Traffic_Part03 - A4A4I6
PPA's response to question regarding current tug escort procedures	New information. Update to Volume 8C Termpol 3.15. Requested by intervenors. The PPA provides commentary on the process through which the tug escort regime has been strengthened over time and opines that it has done exemplary work in determining the requirements and will continue to use a similar approach for all new liquid bulk proposals.
PPA's response to question regarding availability of sufficient number of pilots	New information. Update to Volume 8C Termpol 3.15. Requested by intervenors. The PPA provides a level of background detail on the number of pilots necessary to sustain current trade and the steps in hand that will ensure a sufficient number of unrestricted pilots will be available to support TMEP.

Reference used:

Volume 8C Termpol Studies, Reports, 3.2, 3.8 and 3.15, 3.10, 3.15.

TERMPOL Update (August 2014)

Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
Transport Canada Termpol Review # 8000-22-7

Submitted 16th Dec 2013

UPDATE ON PROGRESS OF THE TERMPOL REVIEW PROCESS (AUGUST 2014)

Reference: With reference to the review of studies and reports submitted by Trans Mountain to the Termpol Review Committee (TRC) on 16th December, 2013.

Preamble: Trans Mountain has received several requests for additional information from the Termpol Review Committee and copies and summaries of information exchanges with the TRC are provided.

Correspondence and information exchange with Termpol Review Committee		
#	**Item**	**Details**
1	Responses to enquiries from Termpol Review Committee	12th Feb 2014
		27th Feb 2014
		13th May 2014
2	Passing Vessel Analysis – Westridge Marine Terminal	New. Attachment to Termpol 3.15. Based on request from the Termpol Review Committee, with advice and input from PMV.
3	Manoeuvring Assessment Westridge Terminals Vancouver Expansion Supplementary Report – July 2014 Modifications	Update to Termpol 3.5/3.12 Appendix C (Fast time analysis)
4	Casualty information	Update to Termpol 3.8, Casualty Data Survey. (updates data to 2013)
5	Update to the Termpol Review Committee with attachments.	August 2014
6	Letter from Transport Canada (on behalf of TRC) requesting fast time simulation of tug escort proposal.	July 24 2014

References used in the Response:

Volume 8C Termpol Studies, 3.5/3.12, 3.8 and 3.15.

Response to Transport Canada Inquiries
(February 12, February 27, May 13)

Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
Transport Canada Termpol Review # 8000-22-7

Submitted 16th Dec 2013

Responses to Information Request from
Termpol Review Committee

QUESTIONS FOR TRANS MOUNTAIN FROM TERMPOL REVIEW COMMITTEE MEETING FEBRUARY 12, 2014

Reference: With reference to the review of studies and reports submitted by Trans Mountain to the Termpol Review Committee (TRC) on 16th December, 2013.

Preamble: The TRC during its review of the information seeks clarification on certain matters included in the studies and reports.

Request: List of questions and comments received from Transport Canada on behalf of the TRC.

1. Does overfill detection also apply to barges?

2. How will Trans Mountain encourage fitting and use of AIS equipment on a voluntary basis?

3. How will Trans Mountain assist with an expedited rollout of AIS on smaller vessels by supporting fitting those small craft that enroll in WCMRC's Fishermen's Oil Spill Emergency Team (FOSET) program?

4. How will Trans Mountain encourage the fitting of radar reflectors on small vessels?

5. Clarification is required on the meaning of 'standby tugs' and their duties (3.1, p. 16, p. 95). Are the proposed standby tugs the same tugs that escort the tanker through the MRA and berth the tanker or is it an additional tug? Will the standby tug remain on stand-by for the duration of loading operations?

6. Will tugs remain tethered between the MRA and the Westridge terminal?

7. What is Trans Mountain's definition of a spill? The question arose in relation to the inclusion of oil booms as a risk reduction factor in the frequency of spills. The TRC is of the opinion that booms around the tanker during loading may reduce the impact of spills once they have occurred, but not the frequency.

8. What is a sloop tank (as referenced in Termpol 3.15 p. 62)? Is this a typo and should read "slop tank"?

9. How will Trans Mountain actively support efforts to create risk based planning standard for spill response for the Salish Sea?

10. What is the rationale for including ‘assigned exclusion zone using oil spill prevention boom around the terminal during cargo transfer operations’ and ‘use of tethered tugs and passing at reduced speed for passing large commercial vessels’ as risk controls in the calculation of spill frequency reduction?

11. Are calculations available on the impact of each risk control (as listed in Termpol 3.15, p. 62-63) on spill frequency reduction? The calculation provided in the study only looks at the impact of all risk controls on spill frequency, rather than each one individually.

12. It would be helpful for Trans Mountain to clarify what tanker traffic it is using for comparison in Case 0, 1, 1a, 1b, and 2 in Chapter 7 of the risk analysis (Termpol 3.15). Specifically, is it correct to assume only laden outbound tankers are used for comparison of accident frequency and oil spill accident frequency across all cases? The wording is unclear so clarification is appreciated.

COMMENT
1. The TRC determined a Passing Vessel Analysis is required for the TRC/PMV to support a speed restriction for large commercial vessels passing the Westridge terminal. If Trans Mountain wishes to pursue this recommendation it should discuss the details of the proposed analysis with PMV.

Response: Response from Trans Mountain prepared by:

- Michael Davies, Sr. Director, Marine Development, Kinder Morgan Canada
- Bikramjit Kanjilal, Lead Marine Development, Trans Mountain Expansion Project

Date: 25th February 2014

1. Does overfill detection also apply to barges?

Yes, barges, similar to tankers, calling Westridge Marine Terminal are fitted with overfill detection. All oil carrying vessels (tankers and barges) are required to conduct their cargo loading operations in a “closed” configuration that utilizes a Class approved vapour collection and control system onboard. It is a mandatory requirement for overfill sensors and alarms to be fitted in order for such systems to meet approval standards.

2. How will Trans Mountain encourage fitting and use of AIS equipment on a voluntary basis?

As described in Termpol 3.1 Section 2.9, Trans Mountain recommends the Termpol Review Committee to consider a number of measures, which have been listed. One of those calls upon the TRC to encourage fitting and use of AIS (Automatic Identification System) on a voluntary basis by vessels that are currently not mandated under Transport Canada regulations to do so. For its part, “Trans Mountain will assist an expedited rollout of AIS on smaller vessels by supporting fitting those small craft that enroll in WCMRC[1]'s Fishermen's Oil Spill Emergency Team (FOSET[2]) program."

Encouraging small boat owners to fit AIS could take many avenues, primarily through education and information sharing, e.g. Transport Canada has the opportunity to include information and benefits of fitting AIS to the "Boating Safety Course".The TRC may consider requesting Transport Canada and the CCG to consult with Boater and Fishermen associations on this matter.

Therefore, this recommendation is more a joint activity to promote improved marine safety in the region.

3. How will Trans Mountain assist with an expedited rollout of AIS on smaller vessels by supporting fitting those small craft that enroll in WCMRC's Fishermen's Oil Spill Emergency Team (FOSET) program?

Trans Mountain offers to fund via WCMRC the cost of fitting AIS units to small vessels enrolled in the FOSET program but not currently fitted with AIS, provided the vessel size is less than the current Transport Canada AIS size threshold and the vessel is capable of being fitted with AIS.

4. How will Trans Mountain encourage the fitting of radar reflectors on small vessels?

Trans Mountain offers to fund via WCMRC the cost of fitting radar reflectors to small vessels enrolled in the FOSET program.

5. Clarification is required on the meaning of 'standby tugs' and their duties (3.1, p. 16, p. 95). Are the proposed standby tugs the same tugs that escort the tanker through the MRA and berth the tanker or is it an additional tug? Will the standby tug remain on stand-by for the duration of loading operations?

The term "standby tugs" is used in the submitted information in the following context:

Termpol 3.1 para 2.9 : When berthing a tanker at Westridge a number of tugs are used and in addition to the tethered large harbour tugs used, a small tug stands by to assist as required, whether to pass the tanker's lines to the dock or to assist by pushing the vessel if requested to do so by the pilot.

Termpol 3.2 para 4.2.1: Standby safety vessels mentioned here are small vessels that typically stand by (or accompany) other vessels such as dredgers or long tows in order to provide warnings to other vessels in the area.

6. Will tugs remain tethered between the MRA and the Westridge terminal?

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[1] Western Canada Marine Response Corporation

[2] A "key component of WCMRC's marine coastal response capability is the Fishermen's Oil Spill Emergency Team (FOSET). Over 100 vessels and their crews from along the BC coast are registered with FOSET. In any given year close to 200 FOSET members will receive spill response training." (*WCMRC Information Handbook*)

It has been observed that currently tugs remain tethered to tankers calling Westridge terminal during their entire passage through the MRA and between the MRA and Westridge terminal. It can be expected that pilots shall continue with this practice in future as well. The actual berth maneuvering tactics will be developed by the pilots, PPA, tug operators and PMV through use of real time navigation simulation, which Trans Mountain shall provide funds and resources for in consultation with BCCP and PPA.

7. What is Trans Mountain's definition of a spill? The question arose in relation to the inclusion of oil booms as a risk reduction factor in the frequency of spills. The TRC is of the opinion that booms around the tanker during loading may reduce the impact of spills once they have occurred, but not the frequency.

Trans Mountain defines spills as any instance of lack of containment of oil. In Section 8 of Termpol 3.15 preventative booming is listed as a risk reduction measure for the terminal because preventative booming can reduce the consequence of a spill by limiting the area affected. It does not reduce the estimated return period for spills and is therefore not included in those calculations.

8. What is a sloop tank (as referenced in Termpol 3.15 p. 62)? Is this a typo and should read "slop tank"?

This is a typo and refers to a slop tank.

9. How will Trans Mountain actively support efforts to create risk based planning standard for spill response for the Salish Sea?

Trans Mountain has and will continue to actively support efforts to create risk based planning standards for spill response in the Salish Sea. Based in part on feedback received from our stakeholder engagement process Trans Mountain's efforts in relation to spill response enhancement are guided by the following principles:

- Augment capacity within the existing regime. Where the need exists for additional response capacity, it should be met through an expansion of WCMRC's resources.

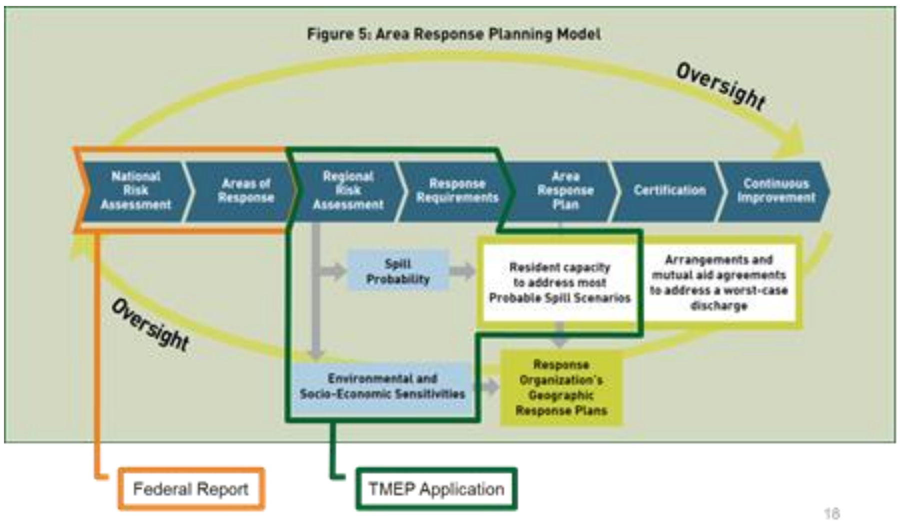
- Response capacity should reflect the risks. Response capacity should be established based on consideration of probability and consequence with particular consideration to predicted spill volumes, material fate and behavior, and geographic setting including sensitive areas.

- Investments should benefit affected communities. Where new investment in response capacity is required, Trans Mountain will seek to maximize the benefit to First Nations and other communities along the transit route. Benefits may consist of capacity building, capital investment, training and provision of ongoing services.

The second of these three principles is meant to reflect Trans Mountain's support for risk based spill response planning. In addition to guiding work submitted to the Termpol committee it also guided Trans Mountain's submissions to the Federal Tanker Safety Expert Panel which advocated for this approach. A copy of Trans Mountain's submission is available on the Panel's website.

Trans Mountain's actions also support efforts to create risk based planning standard for spill response for the Salish Sea and this is reflected in the extensive studies submitted to Termpol by Trans Mountain.

For example, the figure below shows how Trans Mountain's Termpol studies support the process for developing risk based response plans that are recommended by the Federal Tanker Safety Expert Panel. Trans Mountain expects that, subject to refinement from regulatory review and further public and Aboriginal consultation, the Termpol studies will support the establishment of the enhanced planning standards and response capacity described in Trans Mountain's submission.



In its submission to Termpol, Trans Mountain has described an overall approach (Termpol 3.1) that follows a risk based approach, including an example of proposed future risk based oil spill response planning standards (summarized in Termpol 3.1 Section 2.8). The proposed planning standards (*Review of Trans Mountain Expansion Project, Future Oil Spill Response Approach Plan, Recommendations on Bases and Equipment, November 2013)* have been developed by WCMRC based upon the work done by DNV as part of a comprehensive marine risk assessment (Termpol 3.15), which helped determine the probability of spills, possible locations of accidents resulting in an oil spill as well as the size of a credible worst case oil spill; further supported by results from meso-scale oil testing and extensive oil spill modeling in the Salish Sea set in the actual environmental conditions found in this area.

Therefore, should the TRC accept the results and recommendations from the studies and reports submitted to the Termpol, the outcome would be risk based and aimed at issues pertinent to the Salish Sea. Trans Mountain as a co-owner and shareholder of WCMRC will work with WCMRC and Transport Canada to ensure that steps are taken to ensure the agreed standards are put in place prior to commissioning of the increased capacity from the Project.

10. What is the rationale for including 'assigned exclusion zone using oil spill prevention boom around the terminal during cargo transfer operations' and 'use of tethered tugs and passing at reduced speed for passing large commercial vessels' as risk controls in the calculation of spill frequency reduction?

An exclusion zone around the terminal is expected to reduce the frequency of vessels that come so close to the terminal so as to pose a "critical situation". In the context of marine risk, a critical situation can lead to an incident and a possible accident with oil spill. By reducing the number of critical situations, the frequency for accidents will be reduced. The booms, in this manner, provide visible enforcement of an exclusion zone. Also, a defined exclusion zone will prevent passing vessels from disturbing the integrity of the deployed oil spill booms.

The use of tethered tugs and reduced speed for passing vessels has a clear impact on the oil spill frequency in DNV's risk model. It reduces the probability of collisions with the terminal/tanker at berth, and as the collision energy will be lower the combined effect will help to greatly reduce the potential impact of a collision, including the possibility of oil spill causing accidents. Also, vessels passing at reduced speed will ensure that the oil spill booms are not disturbed in any manner while they remain deployed.

11. Are calculations available on the impact of each risk control (as listed in Termpol 3.15, p. 62-63) on spill frequency reduction? The calculation provided in the study only looks at the impact of all risk controls on spill frequency, rather than each one individually.

Calculations on the impact of each risk reduction option (as listed in Termpol 3.15, p. 62-63)[3] on spill frequency reduction have not been carried out. Only the combined risk reducing effect, based on professional judgement and experience of DNV has been assessed and applied to the basic frequencies of a release during cargo transfer operations due to various causes based on DNV's internal QRA handbook and derived from European terminal accident statistics (DNV 2000) shown in Termpol 3.15 **Error! Reference source not found.**.

12. It would be helpful for Trans Mountain to clarify what tanker traffic it is using for comparison in Case 0, 1, 1a, 1b, and 2 in Chapter 7 of the risk analysis (Termpol 3.15). Specifically, is it correct to assume only laden outbound tankers are used for comparison of accident frequency and oil spill accident frequency across all cases? The wording is unclear so clarification is appreciated.

When reading this section please note that all incidents are considered and those incidents that lead to an oil spill are defined as oil spill accidents.

The total incident frequency is calculated for all traffic recorded in the AIS database, regardless of vessel type and whether empty or laden. Incident frequencies for Trans Mountain tankers are compared with the total incident frequency to give a better understanding of the Trans Mountain tanker traffic's contribution to the incident frequency in the study area.

Only tankers with oil as cargo have a risk of an oil cargo spill accident and so only laden tankers have been used to calculate the accidental oil cargo spill frequency.

- [3] Oil booms deployed around the vessel during cargo transfer activities.
- Loading platform at the berths drained to sloop tanks and treated at shore.
- Emergency Release Couplers at the loading arms
- Emergency shutdown (ESD) valves at flow pipelines by the manifold at the loading platform and at landfall, all ESD can be activated from the control room.
- Overfilling detection at the tanker vessel.
- Leak detection at the pipeline
- Operational procedures to assure that all systems works adequately prior to cargo transfer.
- Operational procedure for safe cargo transfer activities both onboard the ship and at the terminal
- A Loading Master assigned to each loading tanker.
- Assigned exclusion zone using oil spill prevention booms around the terminal during cargo transfer operations.
- Use of tethered tugs and passing at reduced speed for passing large commercial vessels.
- Fire prevention and protection both onboard the vessel and at the marine terminal.
- Marine Terminal personnel who are trained for the purpose.
- Oil spill management

COMMENT

1. The TRC determined a Passing Vessel Analysis is required for the TRC/PMV to support a speed restriction for large commercial vessels passing the Westridge terminal. If Trans Mountain wishes to pursue this recommendation it should discuss the details of the proposed analysis with PMV.

As submitted to Termpol it is Trans Mountain's view that establishment of a fairway channel through Burrard Inlet and applying speed restrictions for all commercial vessels, especially when these vessels pass oil handling facilities are effective means to avoid incidents and oil spill related accidents. Trans Mountain is willing to provide further assessment of this issue if necessary and invite's direction from the TRC committee and or its members to provide specific direction as to the necessary scope and objectives of the study required.

References used in the Response:

Termpol Studies, 3.1 and 3.15,

Review of Trans Mountain Expansion Project, Future Oil Spill Response Approach Plan, Recommendations on Bases and Equipment, November 2013

Personal communication reference:

Ole Øystein Aspholm, M.Sc
Head of Environment & Navigation Risk,
Risk Advisory Solutions
DNV GL – North America Oil & Gas

Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
Transport Canada Termpol Review # 8000-22-7

Submitted 16th Dec 2013

Responses to Information Request from Termpol Review Committee

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QUESTIONS FOR TRANS MOUNTAIN FROM TERMPOL REVIEW COMMITTEE MEETING FEBRUARY 27, 2014

Reference: With reference to the review of studies and reports submitted by Trans Mountain to the Termpol Review Committee (TRC) on 16th December, 2013.

Preamble: The TRC during its review of the information seeks clarification on certain matters included in the studies and reports.

Request: List of questions and comments received from Transport Canada on behalf of the TRC.

Received on: Via separate emails between 6th to 12th March, 2014.

1. Clarification of the following responses from Trans Mountain:

1. As part of the proposed Trans Mountain Expansion Project, will the standby tugs mentioned in the first bullet of Termpol 3.1 para 2.9 be the same as the tugs that escort the tanker through the MRA, or will they be in addition to these standby tugs? Will the standby tugs remain on stand-by for the duration of loading operations?

   Original question:

   Clarification is required on the meaning of 'standby tugs' and their duties (3.1, p. 16, p. 95). Are the proposed standby tugs the same tugs that escort the tanker through the MRA and berth the tanker or is it an additional tug? Will the standby tug remain on stand-by for the duration of loading operations?

   Original response from Trans Mountain:

   The term "standby tugs" is used in the submitted information in the following context:

   Termpol 3.1 para 2.9 : When berthing a tanker at Westridge a number of tugs are used and in addition to the tethered large harbour tugs used, a small tug stands by to assist as required, whether to pass the tanker's lines to the dock or to assist by pushing the vessel if requested to do so by the pilot.

Termpol 3.2 para 4.2.1: Standby safety vessels mentioned here are small vessels that typically stand by (or accompany) other vessels such as dredgers or long tows in order to provide warnings to other vessels in the area.

2. Trans Mountain defines spills as any instance of lack of containment of oil within which area - ship? boom? a geographic area? To clarify, if oil is spilled within the boom, is it considered a spill?
   Original question:

   What is Trans Mountain's definition of a spill? The question arose in relation to the inclusion of oil booms as a risk reduction factor in the frequency of spills. The TRC is of the opinion that booms around the tanker during loading may reduce the impact of spills once they have occurred, but not the frequency.

   Original response from Trans Mountain:

   Trans Mountain defines spills as any instance of lack of containment of oil. In Section 8 of Termpol 3.15 preventative booming is listed as a risk reduction measure for the terminal because preventative booming can reduce the consequence of a spill by limiting the area affected. It does not reduce the estimated return period for spills and is therefore not included in those calculations.

Additional questions:

3. How was the 'laden tanker exclusion zone' defined in DNV's calculations? Specifically, was it calculated at a specific size/shape?

4. We assume the exclusion zone will only be applied to TM tankers and that large commercial vessels will be the ones required to comply with the zone. Is this correct?

5. Are statistics available on the benefits of only implementing a laden tanker exclusion zone rather than both an exclusion zone and tug escort?

6. On p. 55 of Termpol 3.15, Trans Mountain states the effect of VTS mandating a moving exclusion zone around laden outbound Trans Mountain tankers is estimated to reduce the frequency of encounters with commercial shipping by 90% or more, assuming the measure is applied in a professional way. Where was the 90% statistic derived from and what is meant by 'professional way' (i.e. do you mean a federal department or agency will be resposible for broadcasting and enforcing the zone?)

7. On p. 21 of section 3.5/3.12, Trans Mountain notes the following arose as an opportunity for improvement to navigation aids through the HAZID process:
   Signals of the existing GPS/DGPS system may be affected by intentional/illegal interference, especially in urban areas. The status of the system is monitored by, amongst others, the pilots through their PPUs. In such circumstances, all vessels under guidance of a pilot would be able to either continue passage or bring the vessel to a safe anchorage. Small vessels that may be more reliant of GPS for position monitoring and navigation could be vulnerable.

   Please clarify what the opportunity or recommendation is.

8. On p. 23 of Termpol 3.5/3.12, TM recommends introduction of an Ocean Data Acquisition System (ODAS) or 'Smart' buoy for monitoring weather and environmental conditions in the southern Strait of Georgia similar to the one at Halibut Bank with the capability of transmitting the information to Pilots PPU's on a real time basis. How was the location for the 'Smart' buoy chosen?

9. Who provided the additional navigational aids suggested by the pilots on p. 23 of Termpol 3.5/3.12?

10. In regards to Trans Mountain's suggestion that an effective method of monitoring and controlling small craft in certain areas along the proposed route be implemented – this practice is done now for cruise ships in high season. However if the practice were to be extended to TM tankers, either all year round or during certain times, CCG and PMV would require resources to do so. Is Trans Mountain willing to contribute financial assistance to ensure the appropriate authorities have the resources in place to meet the request for increased monitoring and control of small craft?

Response: Response from Trans Mountain prepared by:

- Michael Davies, Sr. Director, Marine Development, Kinder Morgan Canada
- Bikramjit Kanjilal, Lead Marine Development, Trans Mountain Expansion Project

Date: 18th March 2014

1. As part of the proposed Trans Mountain Expansion Project, will the standby tugs mentioned in the first bullet of Termpol 3.1 para 2.9 be the same as the tugs that escort the tanker through the MRA, or will they be in addition to these standby tugs? Will the standby tugs remain on stand-by for the duration of loading operations?

A1. There are no plans to increase the number of tugs involved in the movement of tankers through the MRA in future unless the responsible authorities or the pilots deem it necessary. A tug is not expected to remain on standby during the loading of a tanker at Westridge.

Tug moorage will be available at the new dock and certain harbour tugs east of the 2nd Narrows may decide to take advantage of this option.

2. Trans Mountain defines spills as any instance of lack of containment of oil within which area - ship? boom? a geographic area? To clarify, if oil is spilled within the boom, is it considered a spill?

A2. Trans Mountain defines spills as any instance of lack of containment of oil, regardless of location; i.e. oil spilled within the boom would be classified as a spill.

3. How was the 'laden tanker exclusion zone' defined in DNV's calculations? Specifically, was it calculated at a specific size/shape?

A3. No assumptions regarding the shape or size of the laden tanker exclusion zone have been made other than it is large enough to reduce the frequency of encounters with other ships (an encounter is defined as when 2 ships come within 0.5NM of each other). It is appreciated that only few encounters lead to a collision and so it may be appropriate to consider its shape and size as a shipshape dimension with its boundary extending upto 500m ahead and more than 50 m around the remaining periphery of the vessel. Trans Mountain expects that it would be jointly managed between ship's personnel and the authorities ashore by means of verbal warnings transmitted over VHF. When incorporating the benefits of this risk measure to the risk calculation, it has been only applied to outbound in-transit laden Project tankers only. As a conservative assumption, the exclusion zone was modelled based on a 75% effectiveness. In practice a compliance rate of 90% or more would be expected.

4. We assume the exclusion zone will only be applied to TM tankers and that large commercial vessels will be the ones required to comply with the zone. Is this correct?

A4. The primary threat that is targeted for mitigation is all credible colliding ships (i.e. all ships that are capable of causing an oil spill from the tanker because of their energy and construction). However, the dynamic exclusion zone has secondary benefits, such as emphasising the hazardous cargo that is in transit on the waterway and providing a clearer fairway for the passage of the tanker. Trans Mountain has proposed its application to project tankers only, however the TRC may, at its discretion, wish to encourage more widespread use of this concept.

5. Are statistics available on the benefits of only implementing a laden tanker exclusion zone rather than both an exclusion zone and tug escort?

A5. Although similar concepts have been used in different parts of the world, e.g. approaches to Southampton, UK, Trans Mountain is not aware of industry statistics that are available on its specific in-practice benefits. In DNV's risk model the laden tanker exclusion zone mainly reduces collision risk, whereas the tug mainly reduces drift grounding risk and, if tethered, powered grounding risk. These two risk reduction options are complementary with no overlap.

Therefore, from the information provided in Tables 15 and 18, the effect of the laden tanker exclusion zone can be compared as in the table below. i.e. this shows that the probability of an any size oil spill as a result of a collision only would reduce to a one in 905 year event compared with a one in 226 year event without MEZ.

Return period (years)	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7	Overall
Case 1 Collision only (without exclusion zone)	20,289	666	21,556	11,671	548	24,010	1,147	226
Case 1 Collision only (with exclusion zone)	**81,157**	**2,664**	**86,225**	**46,685**	**2,192**	**96,038**	**4,586**	**905**

6. On p. 55 of Termpol 3.15, Trans Mountain states the effect of VTS mandating a moving exclusion zone around laden outbound Trans Mountain tankers is estimated to reduce the frequency of encounters with commercial shipping by 90% or more, assuming the measure is applied in a professional way. Where was the 90% statistic derived from and what is meant by 'professional way' (i.e. do you mean a federal department or agency will be responsible for broadcasting and enforcing the zone?)

A6. See response to Question 3 above.

The effectiveness of the moving exclusion zone is dependent upon several factors including the manner in which it is applied. The term "Professional way" is used to indicate that the task will be undertaken by qualified staff, whether ashore or onboard a vessel, who are motivated by their profession to ensure marine safety and the broadcasts and warnings will be carried out in a timely fashion in a conscientious and generally businesslike manner.

Although as conservative assumption compliance with the exclusion zone was modeled as only 75% in practice a rate of 90% or more is expected.

7. On p. 21 of section 3.5/3.12, Trans Mountain notes the following arose as an opportunity for improvement to navigation aids through the HAZID process:

> Signals of the existing GPS/DGPS system may be affected by intentional/illegal interference, especially in urban areas. The status of the system is monitored by, amongst others, the pilots through their PPUs. In such circumstances, all vessels under guidance of a pilot would

be able to either continue passage or bring the vessel to a safe anchorage. Small vessels that may be more reliant of GPS for position monitoring and navigation could be vulnerable.

Please clarify what the opportunity or recommendation is.

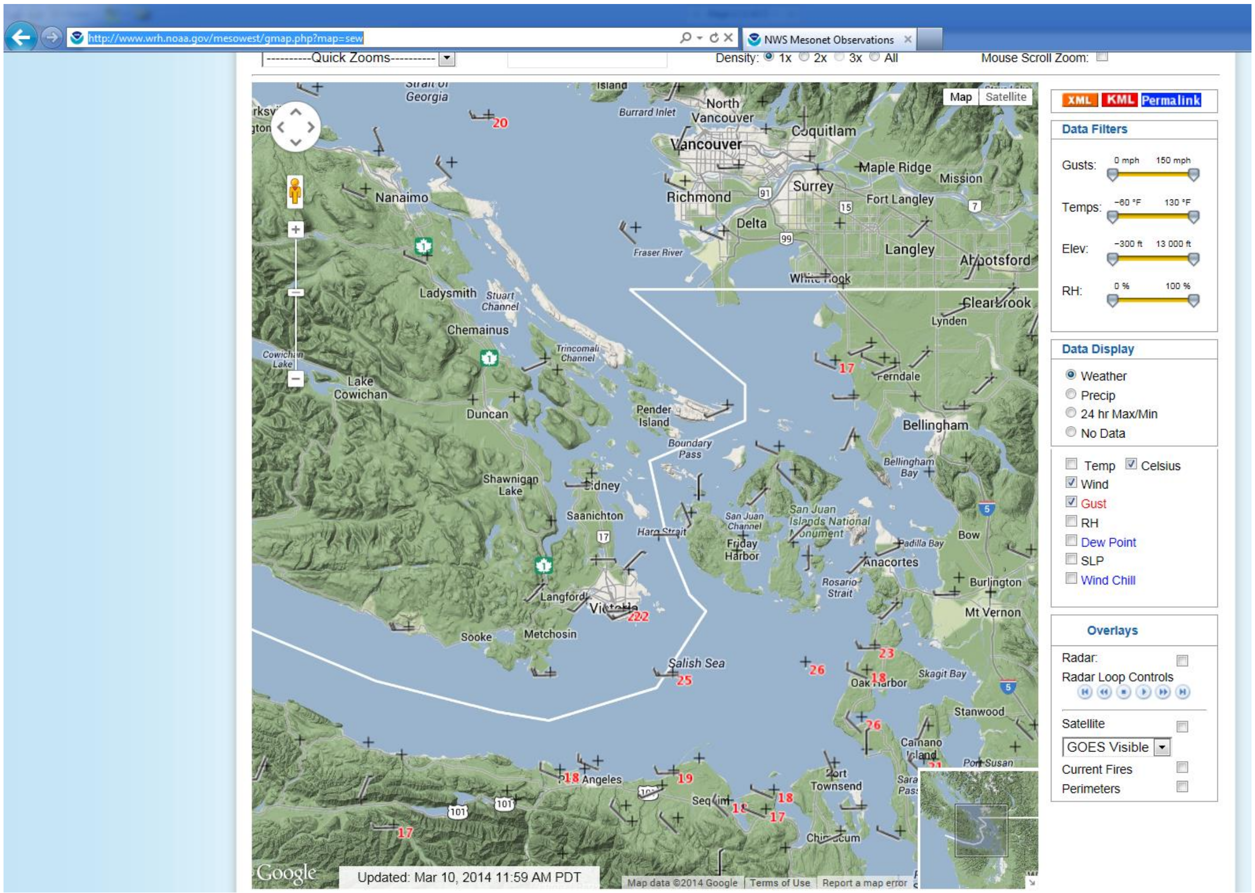
A7. This became known to the Project during interviews with the BCCP and is offered here as an observation to the TRC. No specific action is sought unless the responsible officials deem it necessary to introduce any system wide changes or oversight.

8. On p. 23 of Termpol 3.5/3.12, TM recommends introduction of an Ocean Data Acquisition System (ODAS) or 'Smart' buoy for monitoring weather and environmental conditions in the southern Strait of Georgia similar to the one at Halibut Bank with the capability of transmitting the information to Pilots PPU's on a real time basis. How was the location for the 'Smart' buoy chosen?

A8. The recommendation to install another ODAS buoy is intended primarily to supplement real-time weather and sea-state information available to pilots for navigation planning purposes. The data from such a buoy would also be of benefit to other waterway users including tugs, ferries, fishing vessels, and recreational users. It would also be a valuable source of both historic and real-time information for search and rescue, environmental monitoring and oil spill response planning. It might also be used in the area of marine mammal research.

The attached diagrams from the Environment Canada and NOAA websites show the locations of the existing weather reporting stations. Comparing the two shows that adding another buoy somewhere in the Southern Strait of Georgia (e.g. perhaps off East Point of Saturna Island) or in the Turn Point area (e.g. south of Moresby Island) may be suitable. The location should be in relatively exposed deeper water, but not located directly in a shipping lane. It is suggested that the various stakeholders who would benefit from the data be consulted to determine whether an additional buoy would be of benefit, and if so identify the optimal location as well as the jurisdiction/funding sources. Also, since the waters encompassing the international boundary are jointly managed by both Canadian and US agencies, it is suggested that stakeholders on both sides of the border be consulted.

Legend: Buoy Land Station	» Lightstations Reports » US Marine Weather



9. Who provided the additional navigational aids suggested by the pilots on p. 23 of Termpol 3.5/3.12?

A9. The list of additional navaids on page 23 of Termpol 3.5/3.12 is a compilation of feedback from various discussions with individual pilots and it is not possible to assign responses to particular persons. As explained on Page 22 of Termpol 3.5/3.12 it is not suggested that these improvements are required to ensure that adequate levels of navigational safety are maintained. As such, the experts from various agencies participating in the TRC may decide to either discard or accept any of these suggestions. It is Trans Mountain's view that they are not essential requirements, but items that could benefit all users.

10. In regards to Trans Mountain's suggestion that an effective method of monitoring and controlling small craft in certain areas along the proposed route be implemented – this practice is done now for cruise ships in high season. However if the practice were to be extended to TM tankers, either all year round or during certain times, CCG and PMV would require resources to do so. Is Trans Mountain willing to contribute financial assistance to ensure the appropriate authorities have the resources in place to meet the request for increased monitoring and control of small craft?

A10. As explained on page 24 of Termpol 3.5/3.12 this item is among several that were identified during consultation conducted as part of preparing the Risk Assessment (Termpol

Study 3.15). They are not considered essential requirements, but items that could augment existing safeguards and have been shared with the TRC for their consideration.

Trans Mountain supports improvements to marine safety and particularly measures that enhance the safety of tankers from Westridge Terminal. Should the TRC agencies implement incremental services Trans Mountain is supportive of the cost being collected directly through fees levied by the agencies that will provide the services. For example, today port dues charged to the vessels calling in the port are an important source of funding for PMV services. Should new or additional fees be required to fund incremental activities the recovery of such costs should be guided by the principle of cost causality, those vessels driving the need for the activity should be allocated the fee in an equitable manner.

References used in the Response:

Termpol Studies, 3.5/3.12 and 3.15,

Personal communication reference:

Ole Øystein Aspholm, M.Sc
Head of Environment & Navigation Risk,
Risk Advisory Solutions
DNV GL – North America Oil & Gas

Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
Transport Canada Termpol Review # 8000-22-7

Submitted 16th Dec 2013

Responses to Information Request from
Termpol Review Committee

QUESTIONS FOR TRANS MOUNTAIN FROM TERMPOL REVIEW COMMITTEE

Reference: With reference to the review of studies and reports submitted by Trans Mountain to the Termpol Review Committee (TRC) on 16th December, 2013.

Preamble: The TRC during its review of the information seeks clarification on certain matters included in the studies and reports.

Request: List of questions and comments received from Transport Canada on behalf of the TRC.

1. Why was the FOSET program chosen as the mechanism by which TM will provide (via WCMRC) funding for installation of AIS and radar reflectors?
2. What specific benefit does TM see in extending the zone of pilotage to an area west of Race Rocks to near Sooke?

Response: Response from Trans Mountain prepared by:

- Michael Davies, Sr. Director, Marine Development, Kinder Morgan Canada
- Bikramjit Kanjilal, Lead Marine Development, Trans Mountain Expansion Project

Date: 13th May 2014

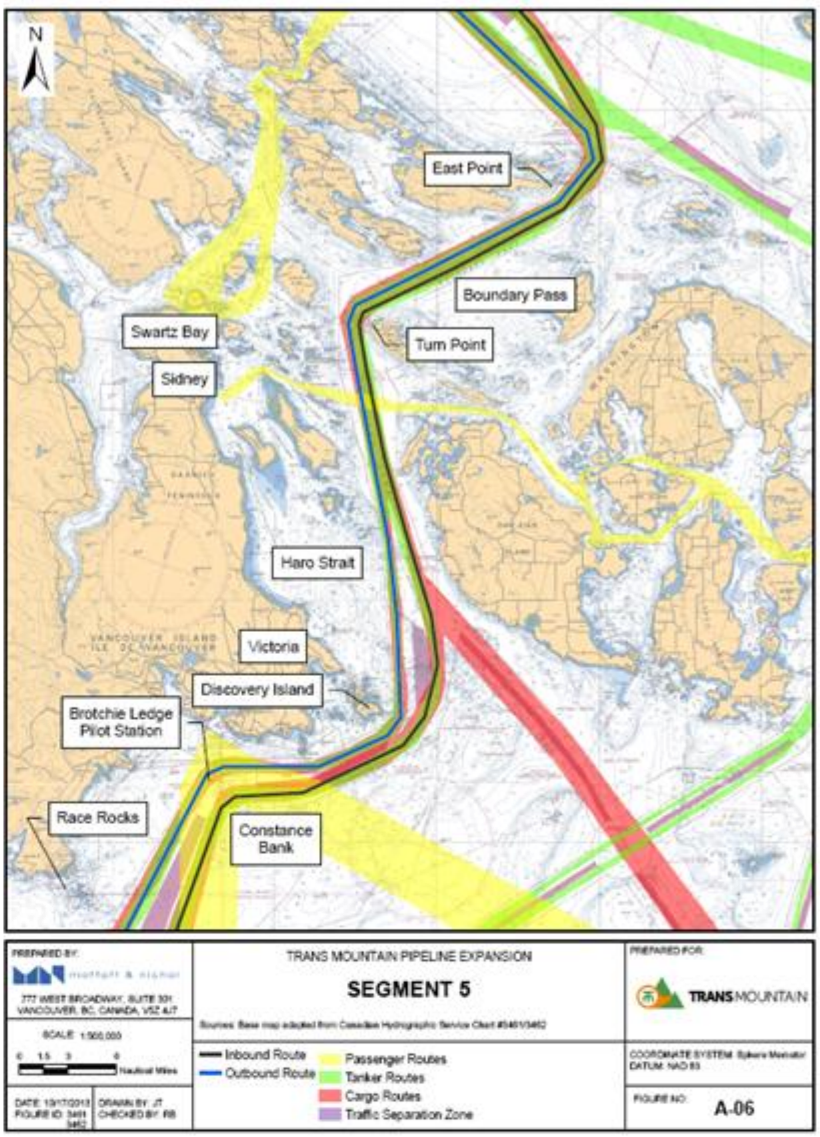
1. Why was the FOSET program chosen as the mechanism by which TM will provide (via WCMRC) funding for installation of AIS and radar reflectors?

   The FOSET program is already established and provides a venue to reach fishing vessel operators without setting up something new. Also, it will be useful to know the location of FOSET assets in normal times as well as while undertaking response activities. Tran Mountain is aware of the recent the announcement from the Minister, which mentions increasing AIS on vessels. It is assumed that this will cover boats smaller than what is in the current regulations.

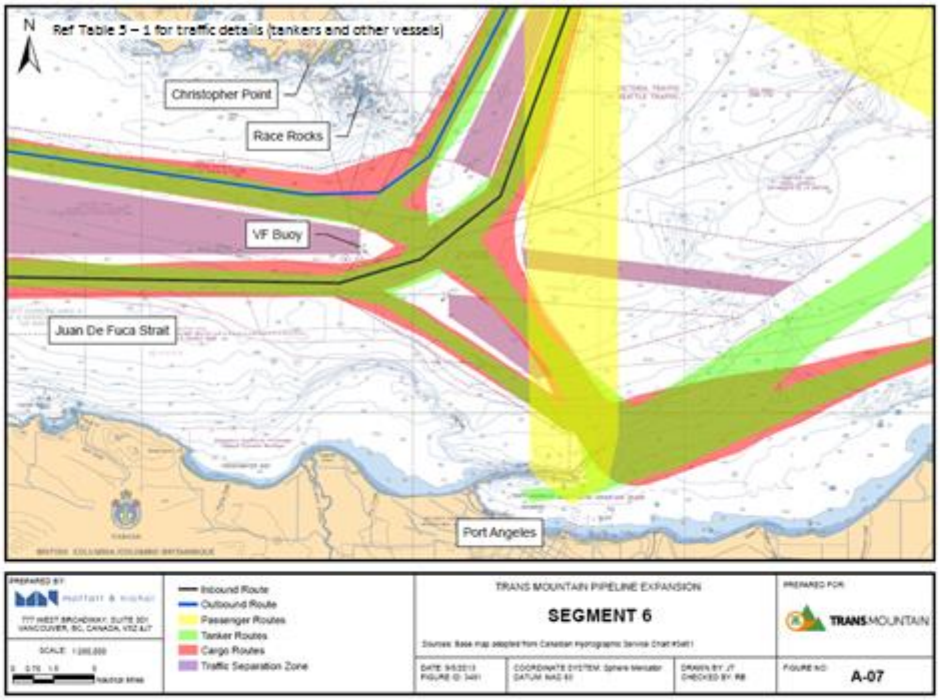
2. What specific benefit does Trans Mountain see in extending the zone of pilotage to an area west of Race Rocks to near Sooke?

   Moving the pilot disembarkation point to near Sooke obviates the need for a laden tanker to maneuver in the location near Broche along with other vessels, some with pilot and some without. Also, traffic from the US (having dropped pilot at Port Angeles) cross over and join the outbound TSS and it was felt by the Trans Mountain marine team that having a pilot onboard till the laden tanker had cleared this area would contribute to overall marine safety and help to further protect the environment and socio-economic values of the area. Two diagrams from Termpol 3.2 help illustrate the concept discussed here. However, there are a number of issues to consider including practical logistics of disembarking the pilot safely at this location. Trans Mountain assumes that the TRC shall review and balance such priorities, amongst which pilot safety can be expected to have high priority.

Trans Mountain has proposed that for added certainty the current escort tug through Haro Straits should remain tethered till the laden tanker has cleared Race Rocks. However, the practical aspects of keeping the tug tethered to that point should also be considered in conjunction with disembarking the pilots west of Race Rocks (near Sooke). On occasion that the pilot has to disembark at Broche, the tug shall untether but continue to escort in close accompaniment to the tanker and, as is the current practice, would be in a position to quickly connect using the tanker's emergency towing arrangement if required to do so.



Termpol 3.2 Figure 5-23: Segment 5



Termpol 3.2 Figure 5-25: Segment 6

References used in the Response:

Termpol Studies, 3.1, 3.2 and 3.15.

Passing Vessel Analysis

WESTRIDGE MARINE TERMINAL
VANCOUVER, BC

PASSING SHIP ANALYSIS

Prepared for:

TRANS MOUNTAIN

KINDER MORGAN CANADA

Prepared by:

moffatt & nichol

WESTRIDGE MARINE TERMINAL
VANCOUVER, BC

PASSING SHIP ANALYSIS

M&N Project No. 7773-01

Revision	Description	Issued Date	Author	Reviewed	Approved
C	Final	August 25, 2014	DRD	EDS	RDB
B	Draft	May 09, 2014	DRD	EDS	RDB
A	Interim Draft	April 30, 2014	DRD	EDS	RDB

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1. INTRODUCTION

Kinder Morgan Canada (KMC) is currently considering expansion of marine facilities at their Westridge Terminal in Burnaby which includes the construction of new moorings capable of accepting 3 tanker vessels which may range from 17,000 DWT barges to Aframax tankers. The geographic location of these facilities provides about 190 meters of clearance between tankers moored at Westridge and the proposed channel realignment scheme within Port Metro Vancouver (PMV). KMC has engaged Moffatt and Nichol to investigate passing vessel effects on moored ships at the proposed Westridge Terminal expansion.

1.1 SCOPE OF WORK

The objective of this study is to determine the loads imparted by passing vessels under the proposed channel alignment on selected tankers berthed at the new Westridge facilities. In a meeting held on April 7 with KMC and PMV, specific scenarios were laid out for this analysis:

- Panamax and Aframax tankers were to be used as the moored vessels
- The considered passing vessel would be based on the largest vessel en route to Port Moody with dimensions similar to the dry bulk carrier Shi Dai 20
- The closest passing distance between berth 3 and the proposed channel realignment is approximately 190 meters (Figure 1-1)
- A transiting speed of 10 knots would be assumed for the passing vessel.

The analysis of the passing vessel effects on the moored vessels would be carried out in two steps: first, the forces imparted on the moored vessel by the passing ship are calculated, and then these forces are input into a time-domain mooring simulation model that computes the moored vessel response with the associated mooring line loads, fender loads, and vessel motions.

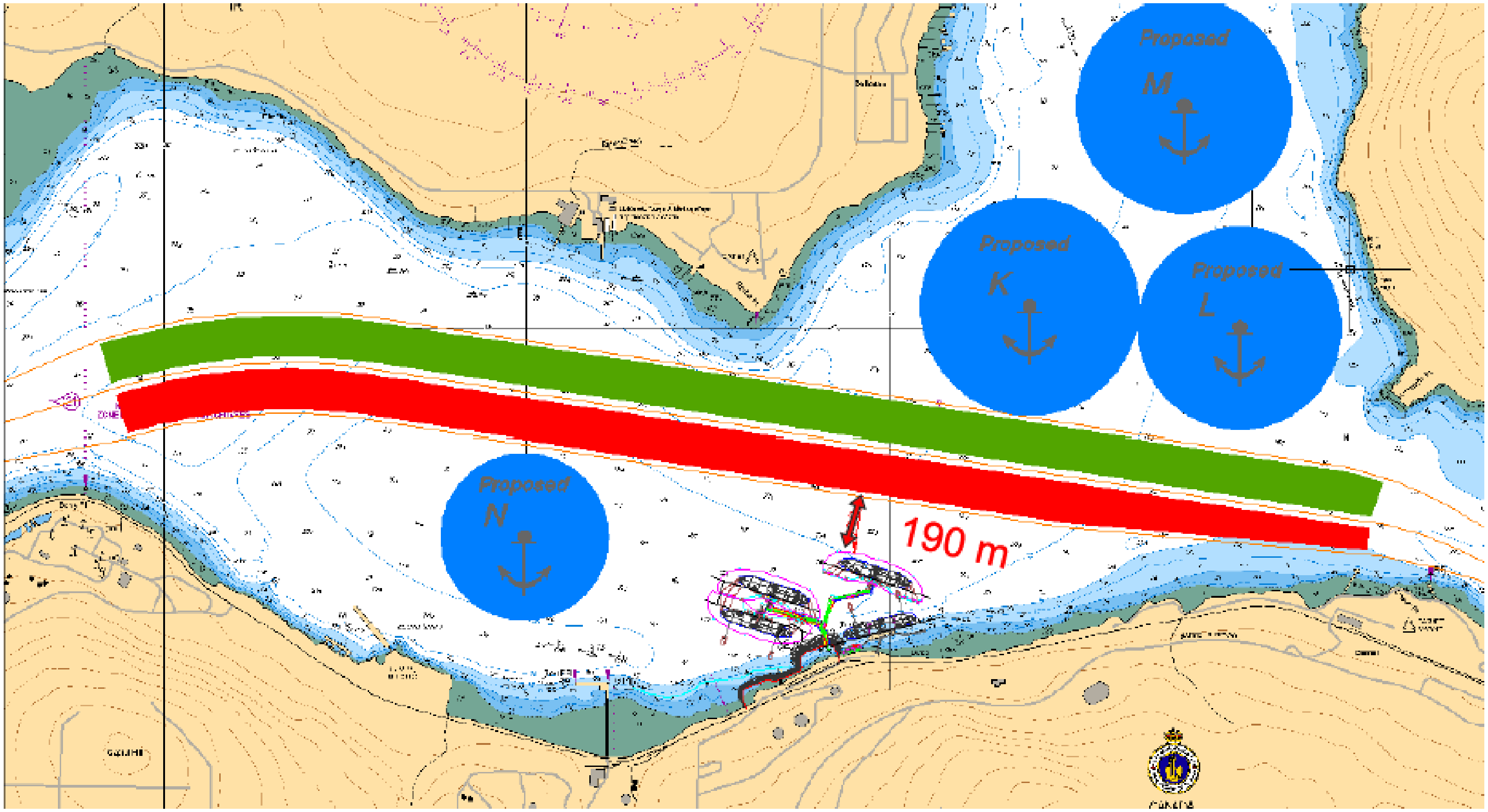


Figure 1-1: PMV Proposed Channel and Anchorage Realignment

2. PROJECT BACKGROUND

2.1 SITE LOCATION

The Westridge terminal is situated along the southern shore of Burrard Inlet within the port of Vancouver roughly 5 kilometers east of the Second Narrows Bridge and adjacent to the southern entrance to the Indian Arm (Figure 2-1).

Figure 2-1: Site Plan Overview

Vessel traffic in the immediate vicinity is typically limited to shallow draft vessels; deep draft vessel activity in the area is predominantly traffic calling at bulk terminals east of the site or at the anchorages just northwest of Westridge (Figure 2-2).

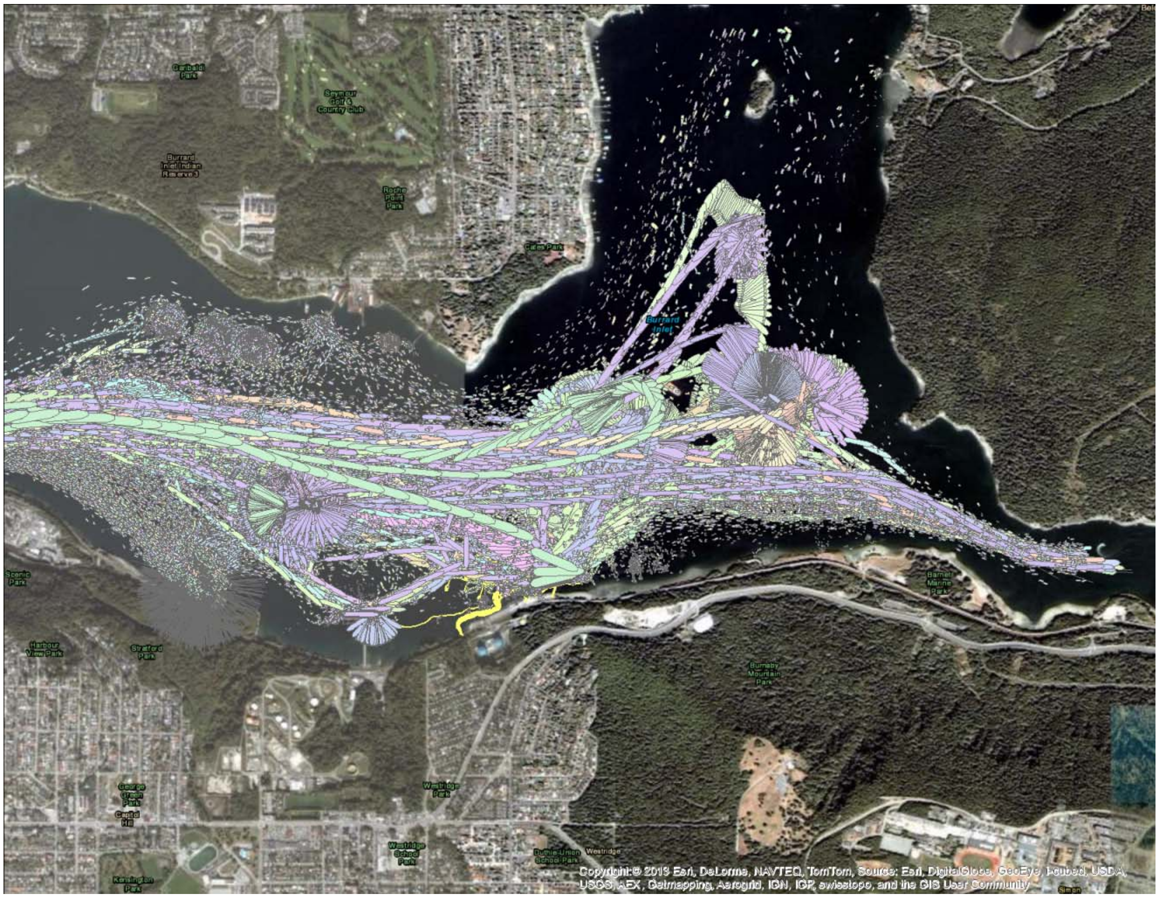


Figure 2-2: All Vessel Traffic in the Westridge Area

A general arrangement of the proposed facility is shown in Figure 2-3. The exact layout of the terminal is still evolving as the engineering process continues, so the final layout is expected to be somewhat different than is depicted here, but any potential changes in layout are not expected to have a material effect on this study.

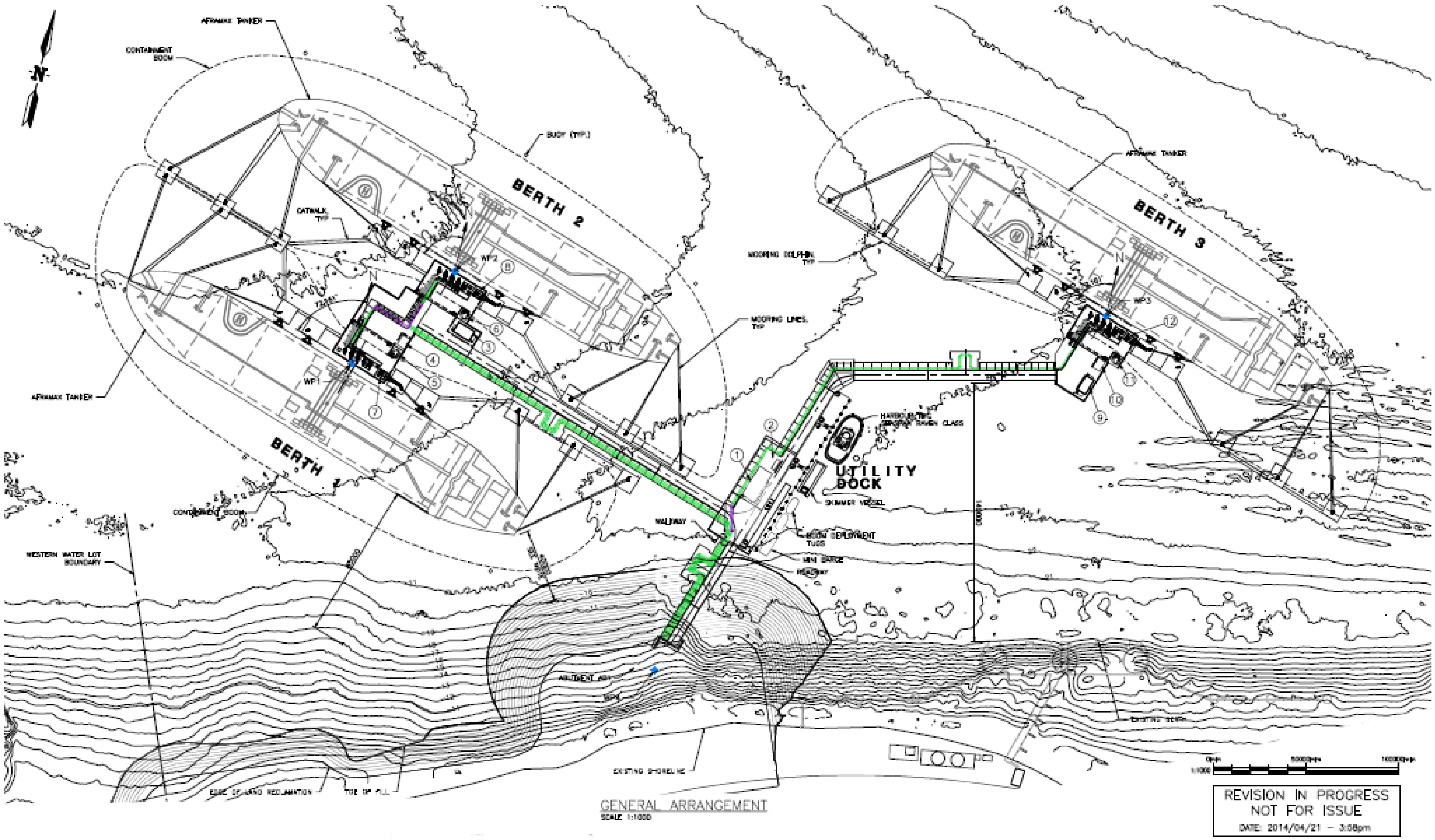


Figure 2-3: General Arrangement Plan for the Proposed Westridge Facilities

2.2 SITE BATHYMETRY

Bathymetry used in the analysis was taken from survey data delivered to M&N from Golder Associates on March 27, 2014. All three proposed berth locations are in naturally deep water with 20 meters or more of depth. Bathymetric slope from the berths to the proposed channel realignment is very mild with grades close to 30:1 (H:V). Bathymetric slopes closer to the shoreline are typically 8:1 until reaching the surface.

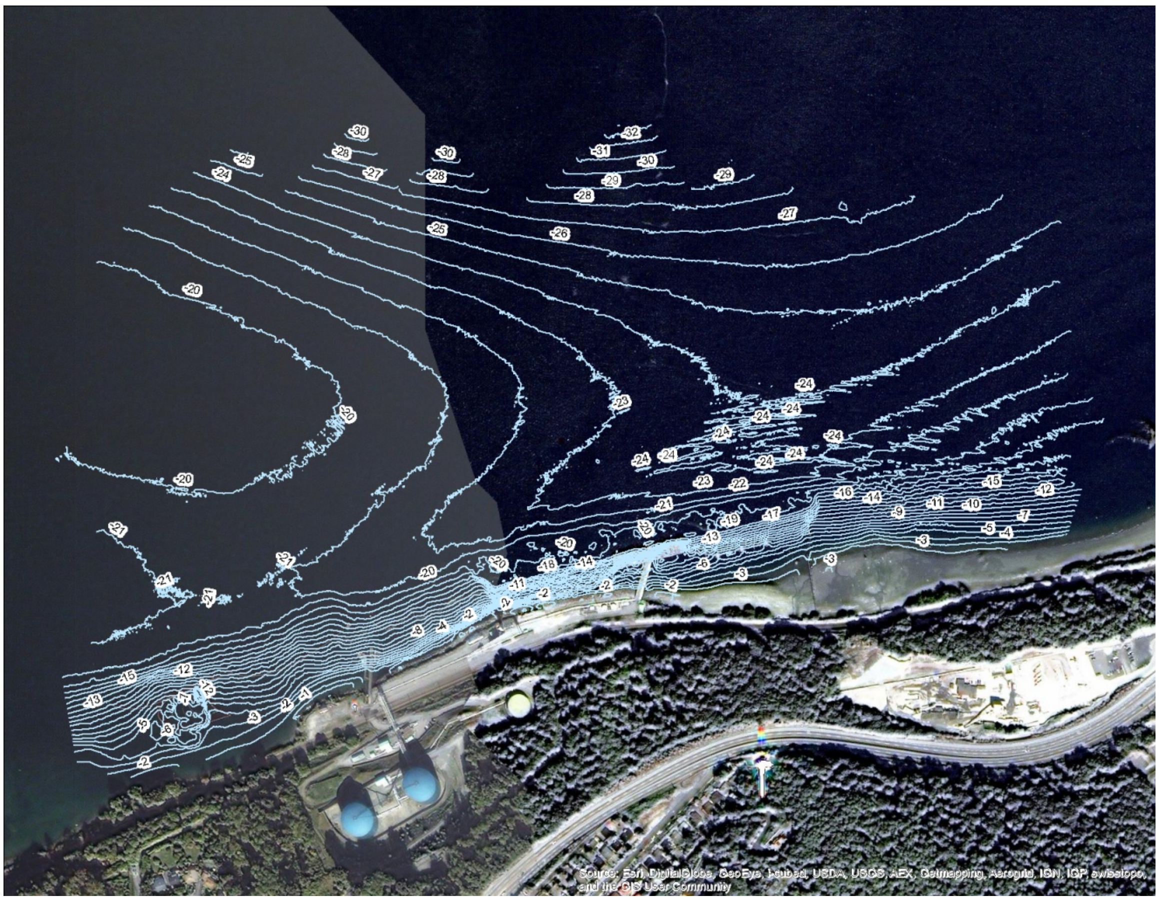


Figure 2-4: Site Bathymetry

2.3 PROPOSED FACILITY DESIGN

Proposed expansion plans at the Westridge facilities call for 3 new berths to be constructed in naturally deep water. The berths are numbered from west to east, with Berths 1 and 2 in a back-to-back configuration. Each berth has three mooring dolphins forward and three aft. The forward mooring dolphins for Berths 1 and 2 are combined structures whereas for the aft mooring dolphins they are separate structures to accommodate the roadway and piperack that passes between them.

Berth 3 represents the westernmost berth of the proposed expansion plan and has a mooring arrangement similar to that of Berth 2.

All berths moor vessels at a heading of 288 degrees true.

2.4 DESIGN VESSELS

The tanker vessels used for this analysis were based on characteristics and dimensions documented in M&N's mooring and berthing analysis submitted in November of 2012. PMV identified which vessel classifications should be used for the passing vessel. M&N selected representative vessels from those classes and obtained their principal characteristics from published ship databases such as Clarkson's Register. Table 2-1 presents a summary of the moored design vessel characteristics used. Passing vessel effects on deep draft, loaded ships is greater than on ballasted ships due to reduced underkeel clearance and greater submerged hull areas. Therefore, only loaded condition tankers were evaluated in this preliminary report.

Table 2-1: Moored Vessel Characteristics

Vessel		Panamax	Aframax
Name		Torm Ottowa	Nevisky Prospect
DWT		70,297	117,654
LOA (m)		228.0	250.00
LBP (m)		219.0	239.00
Beam (m)		32.23	44.00
Draft	Loaded (m)	13.82	15.10
Displacement	Loaded (mt)	84,204	136,337
Side Windage	Loaded (m^2)	1,378	2,177
Frontal Windage	Loaded (m^2)	448	800
Mooring Line Type		Steel-Wire	Steel-Wire
Mooring Line MBL (mt)		79	83
Mooring Tail Type		Nylon	Polyester
Mooring Tail Length (m)/ MBL (mt)		11m/ 120mt	11m/ 116mt

Vessel characteristics for the passing vessel were taken from the presentation given by PMV during the April 7 meeting with KMC and M&N. Table 2-2 provides the modeled passing vessel characteristics.

Table 2-2: Passing Vessel Characteristics

Vessel	Bulk Carrier
Name	Shi Dai 20
Gross Registered Tonnage	64,654
Deadweight (mt)	115,664
LOA (m)	254.0
Beam (m)	43
Draft (m)	13.5
Transit Speed (kts)	10

2.5 EXISTING TRAFFIC

Historical AIS ship movement data was accessed to identify the current traffic patterns and existing beam to beam clearances of navigation traffic from the proposed Westridge berths. Figure 2-5 displays recent vessel traffic around the proposed Westridge facilities for ships with a length overall greater than 150 meters and a speed over ground greater than or equal to 6 knots. With the exception of vessels passing immediately over the new facility locations, the current traffic separation scheme keeps inbound traffic more than 220 meters away from the berth 3; therefore the proposed 190 meter traffic separation scheme used in this analysis is considered conservative. Vessel speed over ground is displayed in Figure 2-6.

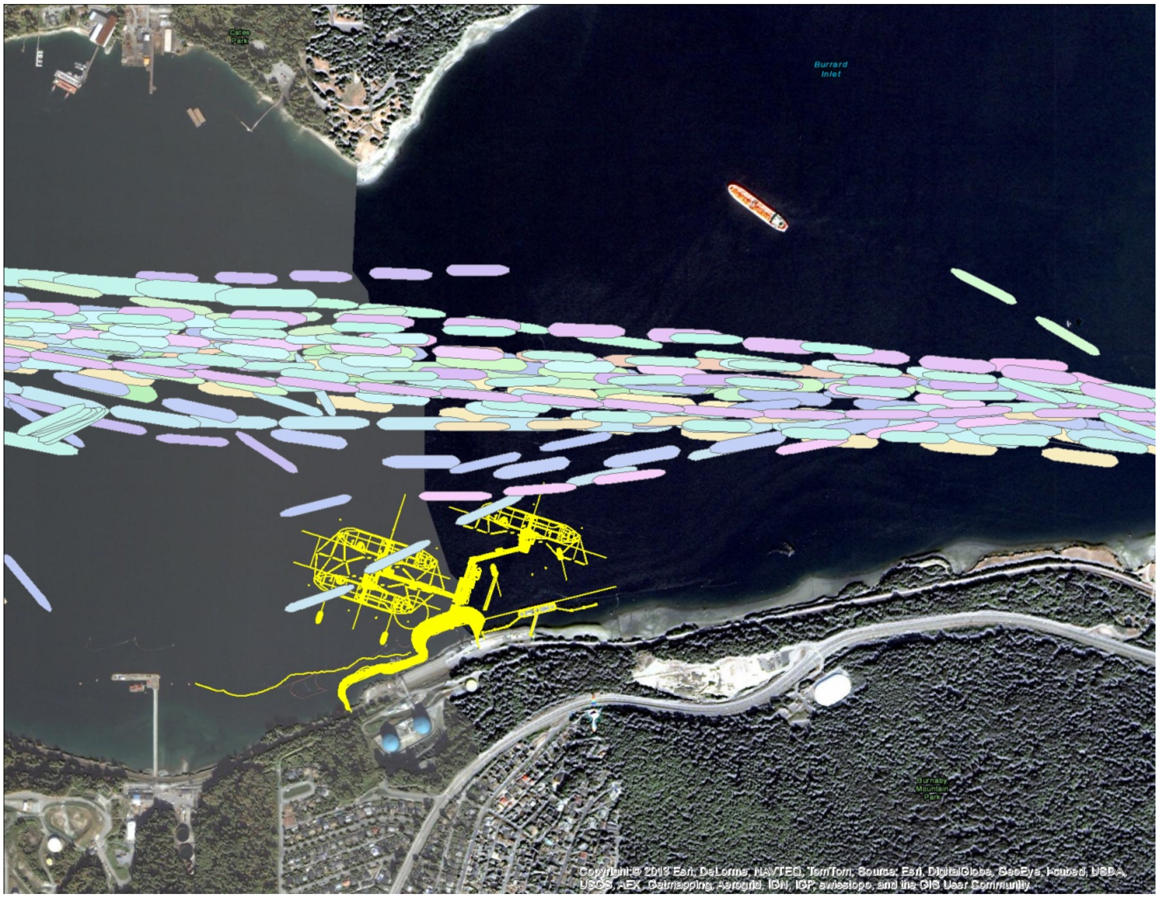


Figure 2-5: Recent Vessel Traffic (LOA > 150m SOG >= 6 kts) around the Westridge Facilities

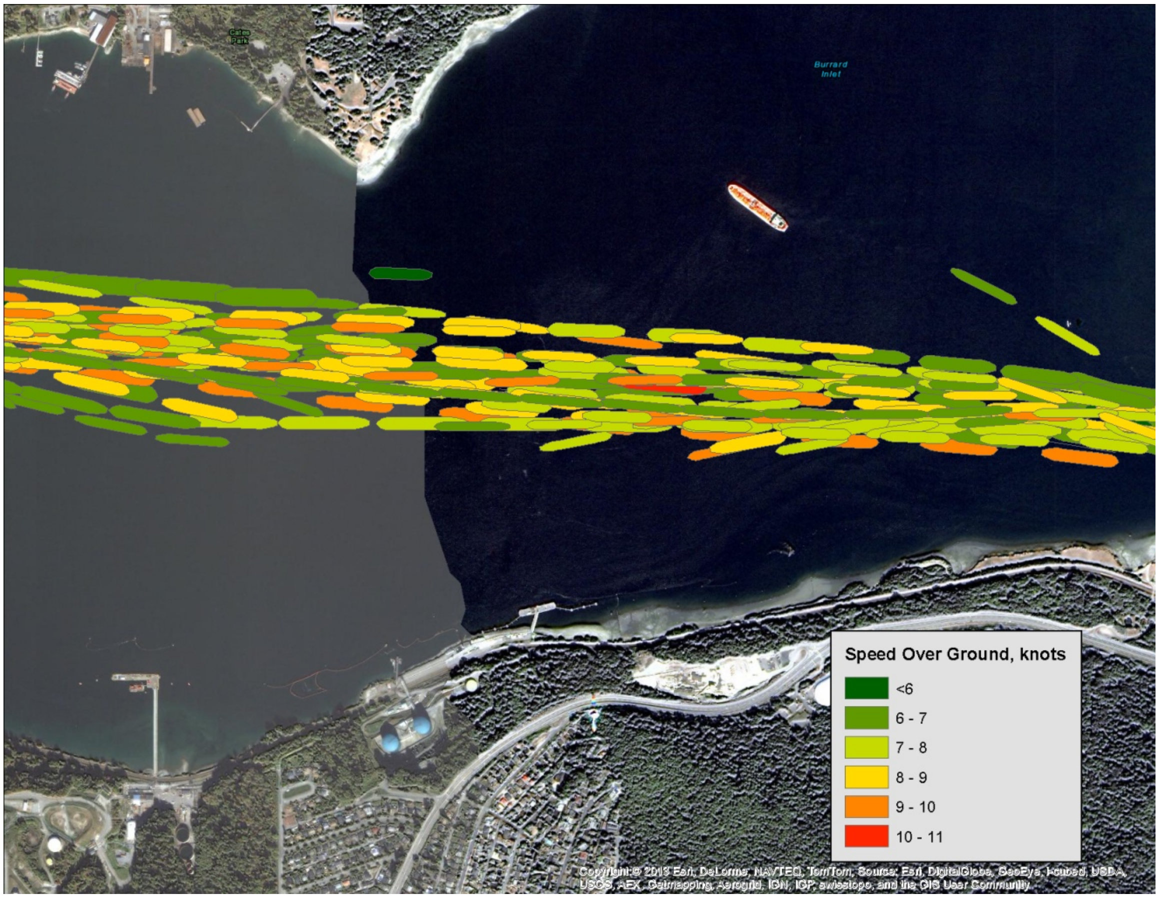


Figure 2-6: Vessel Speed Over Ground around the Westridge Facilities (Limited to Channel Traffic)

2.6 PROPOSED VESSEL TRAFFIC CORRIDOR

Port Metro Vancouver has reviewed the proposed Westridge Marine Terminal expansion and proposes defining a corridor within the Central Harbour for ship traffic to increase the separation distances and safety for large vessels passing the terminal. The proposed traffic corridor is shown in Figure 2-7. The minimum distance between inbound traffic within the corridor and a moored vessel at Berth 3 of the proposed Westridge facilities is about 190 meters (Figure 2-7). The proposed corridor will require adjusting some of the existing designated anchorages in the area. The proposed corridor and anchorage locations are considered draft locations for the purpose of doing this analysis, subject to finalized design to be carried out by PMV at a later date.

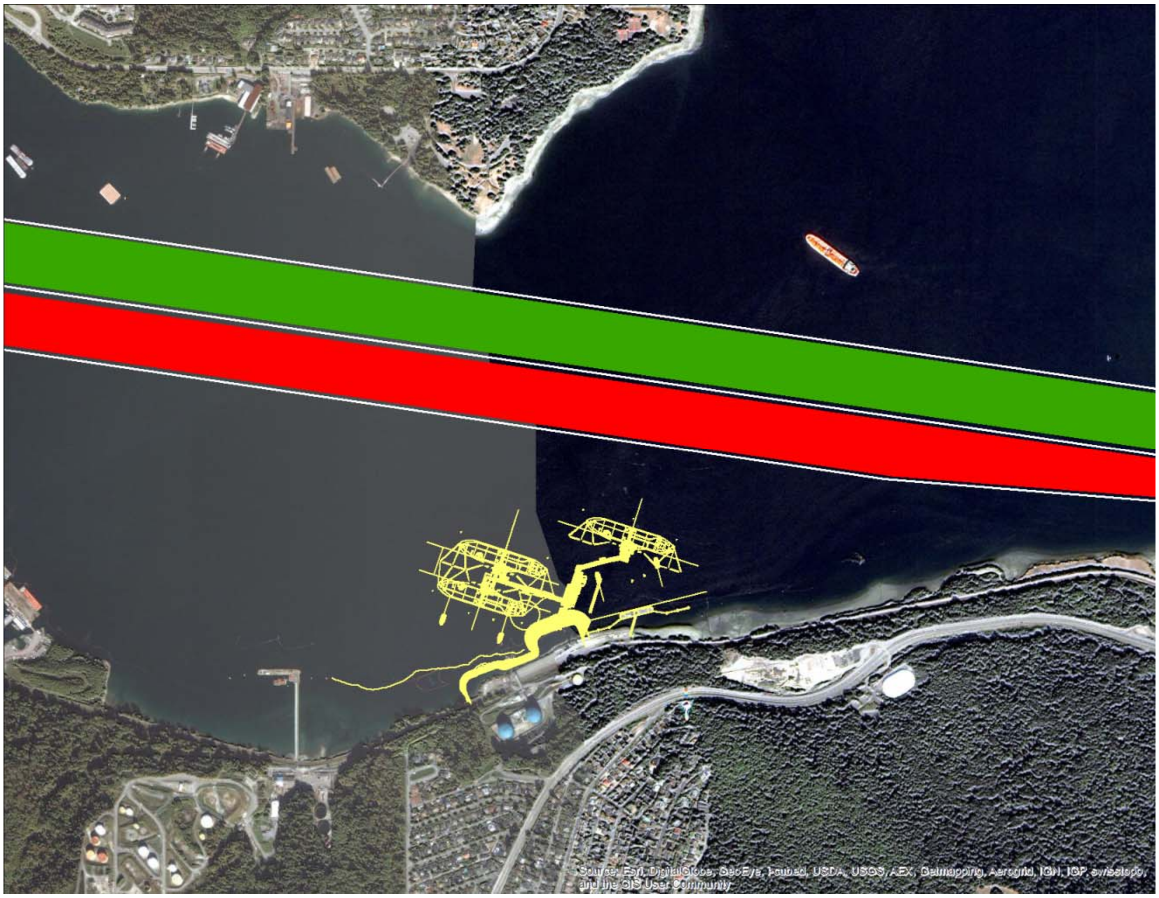


Figure 2-7: PMV's Proposed Traffic Channel Alignment near Westridge Terminal

3. PASSING VESSEL ANALYSIS

When transiting ships pass at high speed and/or in close proximity to a moored vessel, the moored vessel can experience transient dynamic mooring forces that can cause adverse ship movements and broken mooring lines. The forces imparted to the moored vessel are dependent on the distance to the passing vessel, the speed of the passing vessel, the underkeel clearance of both vessels, the displacement of the two vessels, hull geometry, channel bank geometry, and channel cross section. A representation of a passing vessel scenario is given in Figure 3-1 below.

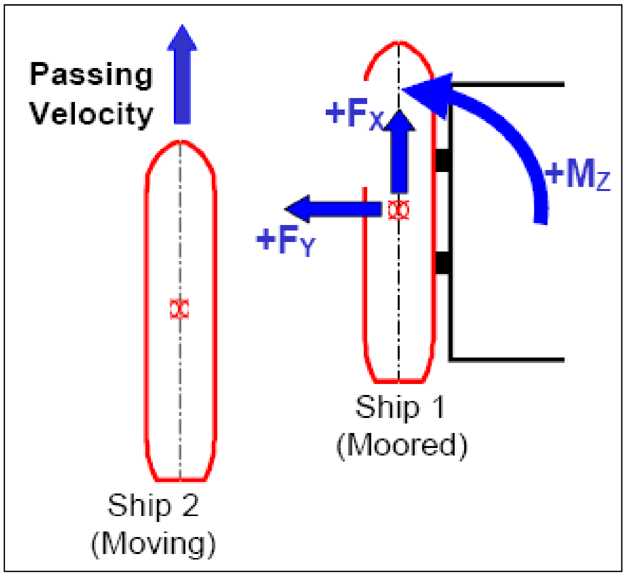


Figure 3-1: Typical representation of a passing vessel scenario

The primary loads imposed by the passing ship are longitudinal and lateral forces as well as a moment on the moored vessel, although forces are developed in all six degrees of freedom. Idealized forces based on a deep, open-water passing scenario are shown in Figure 3-2 and demonstrate that a relatively large, but transient load is experienced by the moored vessel. A surge force pulls the moored vessel aft then pushes forward as the vessel in transit passes while a suction force pulls the moored vessel away from the berth as the passing vessel is adjacent to the moored vessel. The curves in Figure 3-2 represent non-dimensional forces experienced at unconfined deepwater conditions. For shallow water and confined-channel conditions, more detailed methods are required. The method of passing vessel forces calculation used in this report is based on the ROPES numerical model which is based on computational methods developed by Pinkster Marine Hydrodynamics.

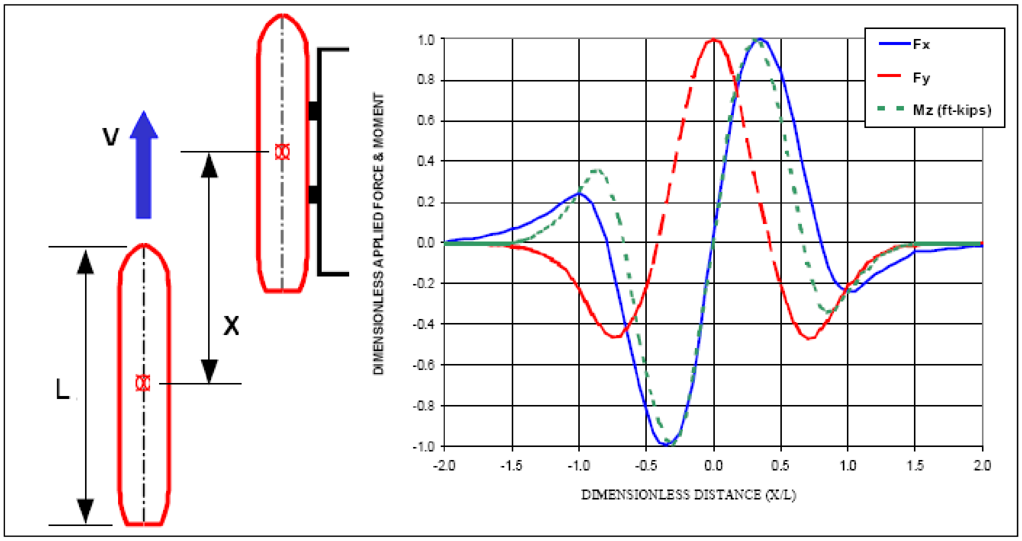


Figure 3-2: Non-dimensional results for a passing vessel scenario (Wang, 1975)

To fully examine practical problems, however, it is necessary to conduct a dynamic analysis that simulates the dynamic response of a moored vessel to the imposed hydrodynamic forces. The hydrodynamic forces are normally computed assuming the moored vessel hull is rigid. In reality, the moored ship is relatively free to move somewhat in response to the passing ship forces and will be restrained by mooring lines and fenders. The moored vessel may experience loads less than, equal to, or larger than the imposed passing ship forces depending on all the factors that dictate dynamic response (i.e. ship mass, system damping, mooring stiffness, etc.). Given the propensity for vessels to respond dynamically in most cases where passing problems have been experienced, M&N has found that dynamic analysis is imperative for practical applications, rather than static analysis.

The effects of the passing ship forces were examined using the TERMSIM computer program which is a six degree-of-freedom, time-domain model for mooring dynamics developed by the Maritime Research Institute of the Netherlands (MARIN). The six degree of freedom hydrodynamic characteristics of the ship used in the computer model are based on a series of tanker physical model tests. The model simulates the vessel response to incident waves, winds, and currents including damping and shallow water effects. The wind coefficients are based on Oil Companies International Marine Forum (OCIMF) recommendations. The forces generated by the passing vessel model may be directly applied on the moored vessel. TERMSIM computes the at-berth motions in all six degrees of freedom as well as the loads in the mooring lines and fenders. The program includes a database of the non-linear load-extension/deflection curves for typical mooring line and fender types. The user may also define the load-deflection curves manually. The output of the simulation is time trace signals of all motions and loads calculated in the mooring system.

3.1 ROPES

The ROPES 3-d diffraction model accounts for the classical suction forces which are a result of the interaction of the passing ship's draw down wave system with the port geometry. The model uses a potential flow calculation to compute the pressure fields and induced forces due to the passing ship. The model separately calculates the diffraction effects of channel and basin geometry to compute long-period disturbances in the channel. The effects of the potential flow and diffraction effects are then superposed to compute the total velocities, pressures, and fluid forces on the moored vessel. The model has been validated against scale and prototype scale measurements by the ROPES Joint Industry Project.

3.1.1 Passing Vessel Simulated Scenarios

Passing vessels forces were assessed for the moored design vessels identified above. The largest forces will be generated by large ships with low under-keel clearance; therefore, all ships were assumed at maximum draft. The analysis assumed that the passing ship travels at 10 knots along the proposed navigational channel realignment.

Bathymetric setup of the models mimicked the description provided in Section 2.2 above: a side slope of 8:1 was created from the water surface down to an elevation of -20 meters; a second slope of 30:1 was modeled from -20 meters to -30 meters. Bathymetry north of the transiting vessel was not modeled as local depths were deep enough and bathymetric slopes to the north were far enough away not to affect loads generated on either the passing ship or moored tankers.

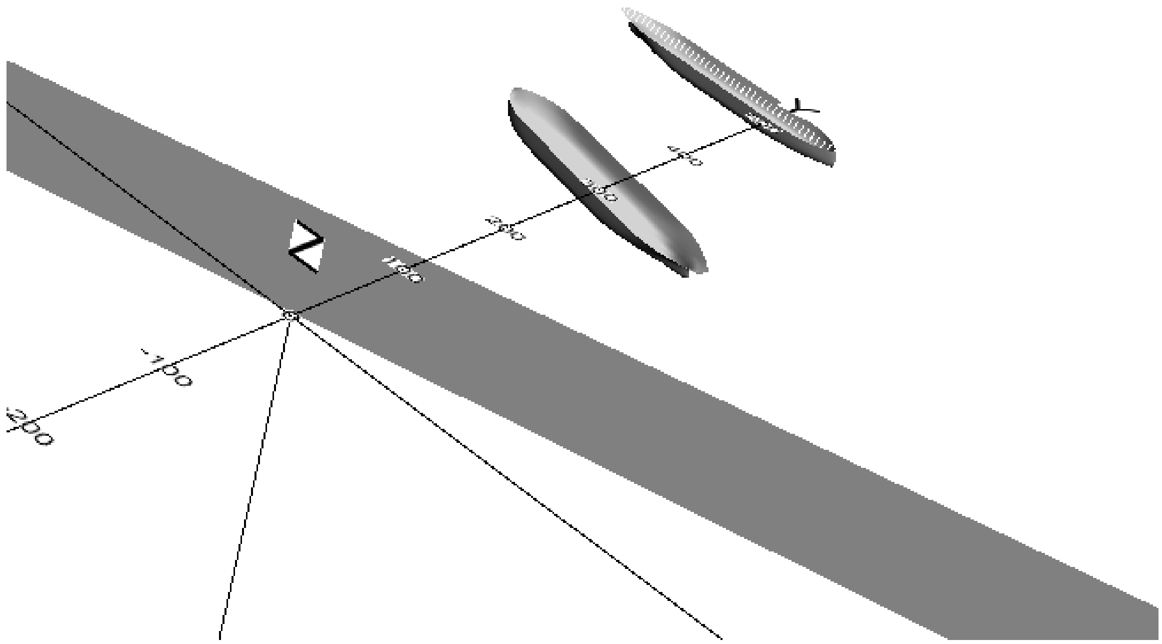


Figure 3-3: Snapshot of the ROPES model developed for moored Aframax tankers at Berth 3

In order to capture the effects of a stemming current on the passing vessel forces, the transiting vessel speed was increased to 11 knots to increase the apparent hydrodynamic speed of a passing vessel and generate forces related to such an event on the moored vessel.

Simulated scenarios are summarized in table Table 3-1 below.

Table 3-1: Simulated Passing Vessel Scenarios

Run Number	Berth Number	Moored Ship	Passing Distance	Passing Speed
1	1	Panamax	440 m	10 kts
2	1	Panamax	440 m	11 kts
3	2	Aframax	320 m	10 kts
4	2	Aframax	320 m	11 kts
5	3	Aframax	190 m	10 kts
6	3	Aframax	190 m	11 kts

3.1.2 Results

The loads generated in the passing ship simulations are presented below for each berth.

BERTH 1

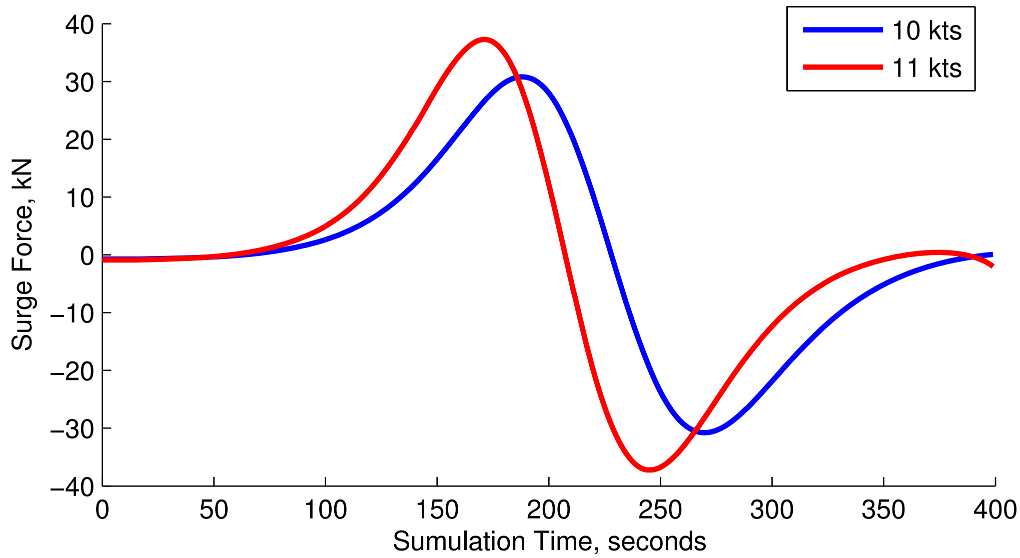


Figure 3-4: Modeled Surge Forces on the Panamax Tanker at Berth 1

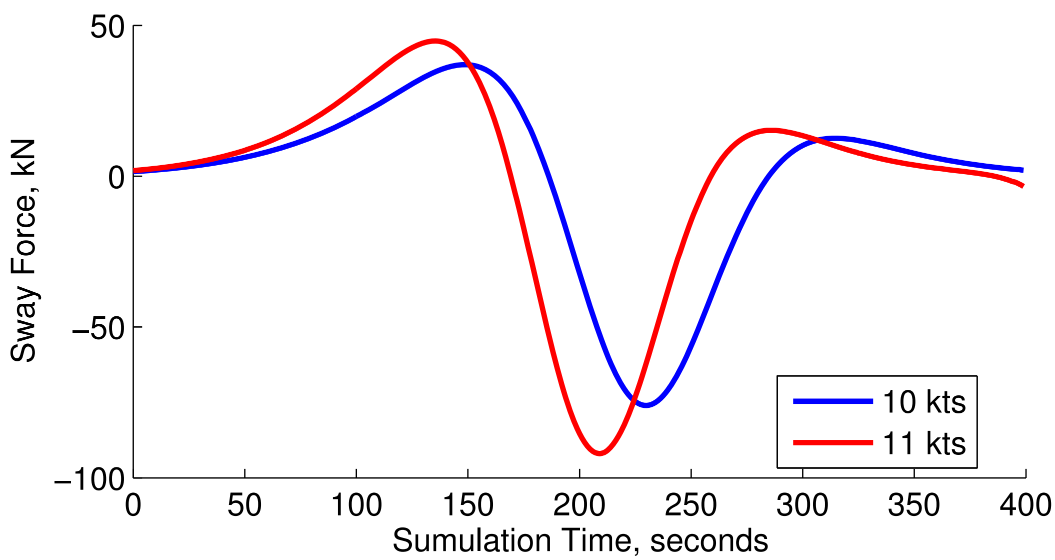


Figure 3-5: Modeled Sway Forces on the Panamax Tanker at Berth 1

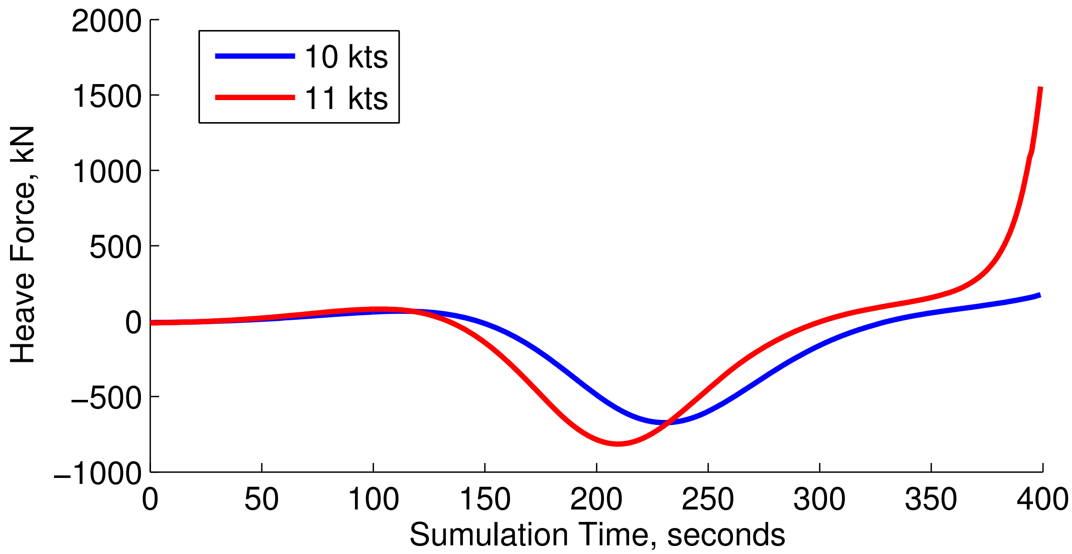


Figure 3-6: Modeled Heave Forces on the Panamax Tanker at Berth 1

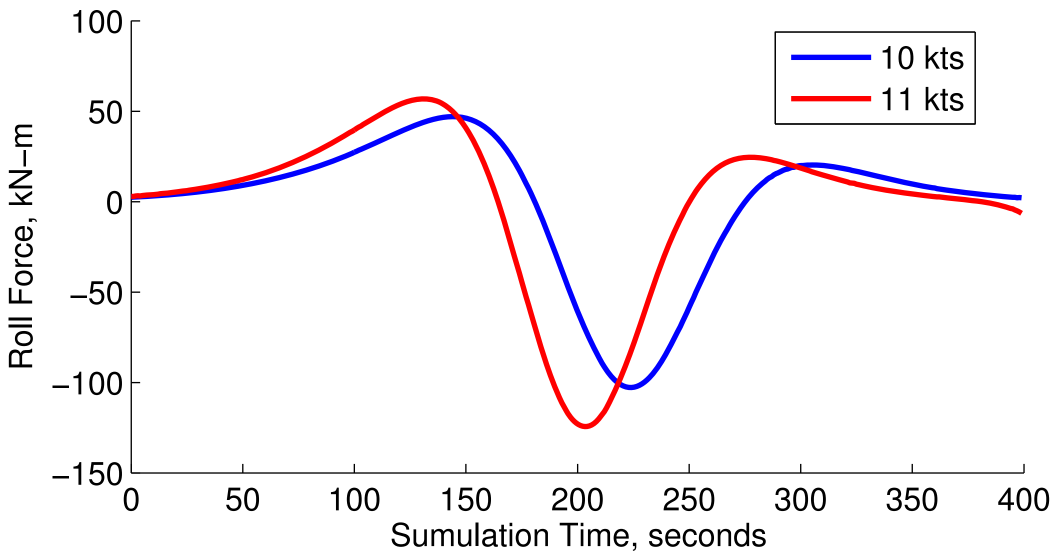


Figure 3-7: Modeled Roll Forces on the Panamax Tanker at Berth 1

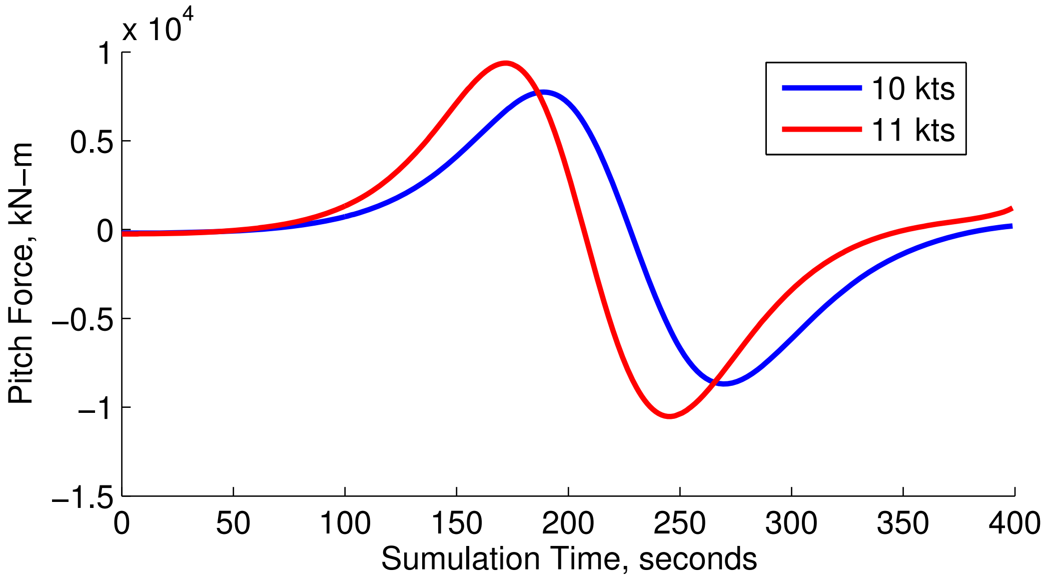


Figure 3-8: Modeled Pitch Forces on the Panamax Tanker at Berth 1

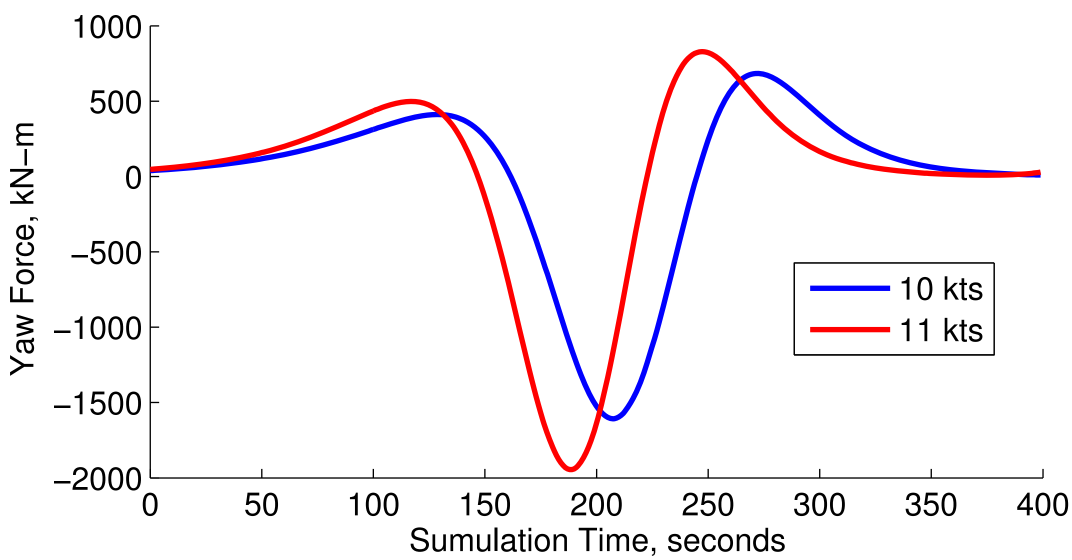


Figure 3-9: Modeled Yaw Forces on the Panamax Tanker at Berth 1

BERTH 2

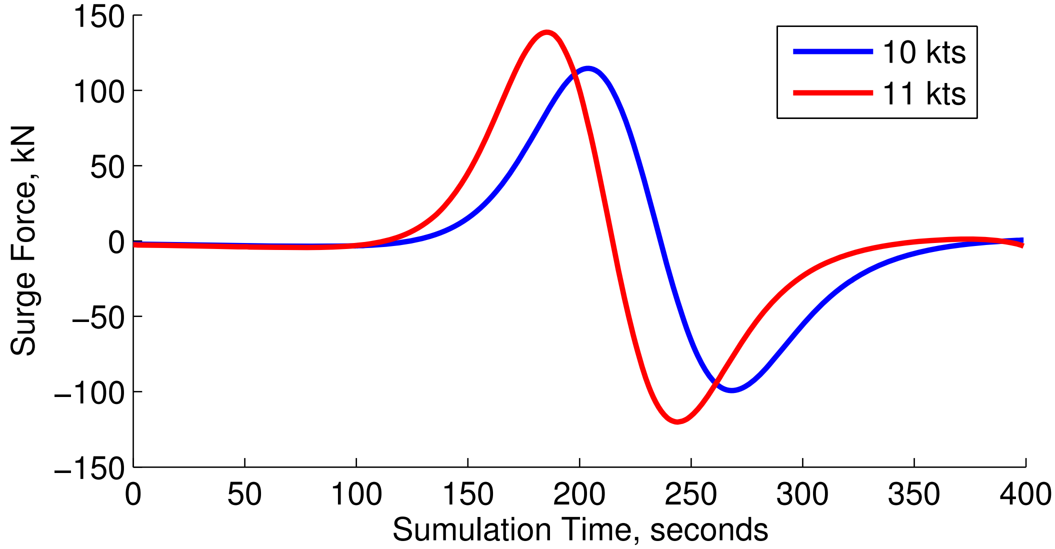


Figure 3-10: Modeled Surge Forces on the Aframax Tanker at Berth 2

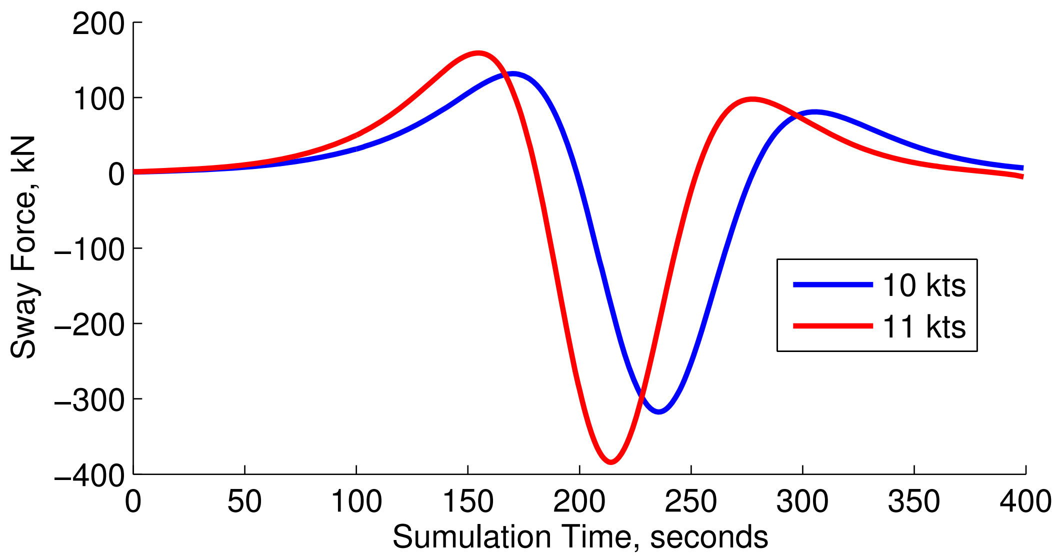


Figure 3-11: Modeled Sway Forces on the Aframax Tanker at Berth 2

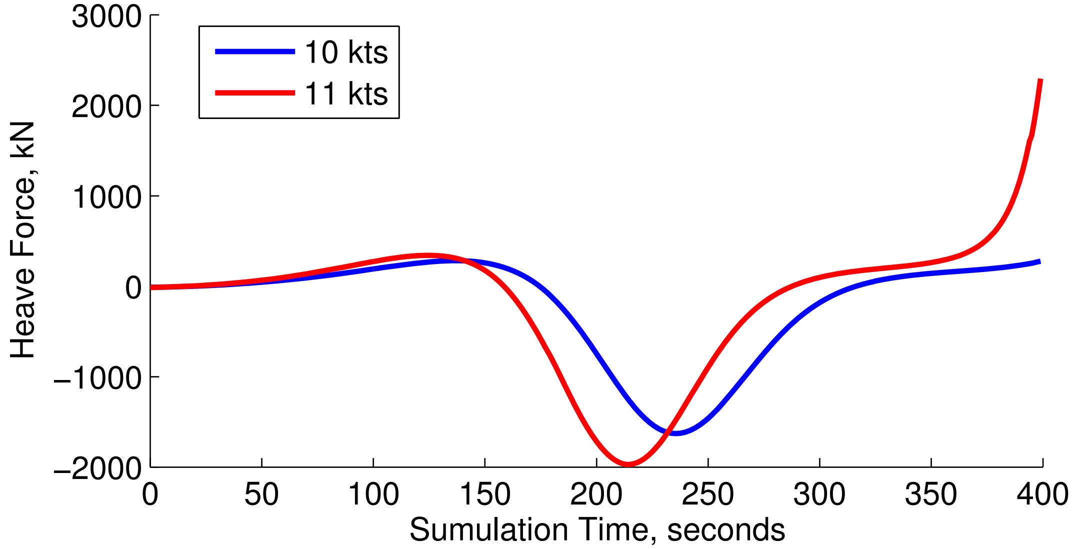


Figure 3-12: Modeled Heave Forces on the Aframax Tanker at Berth 2

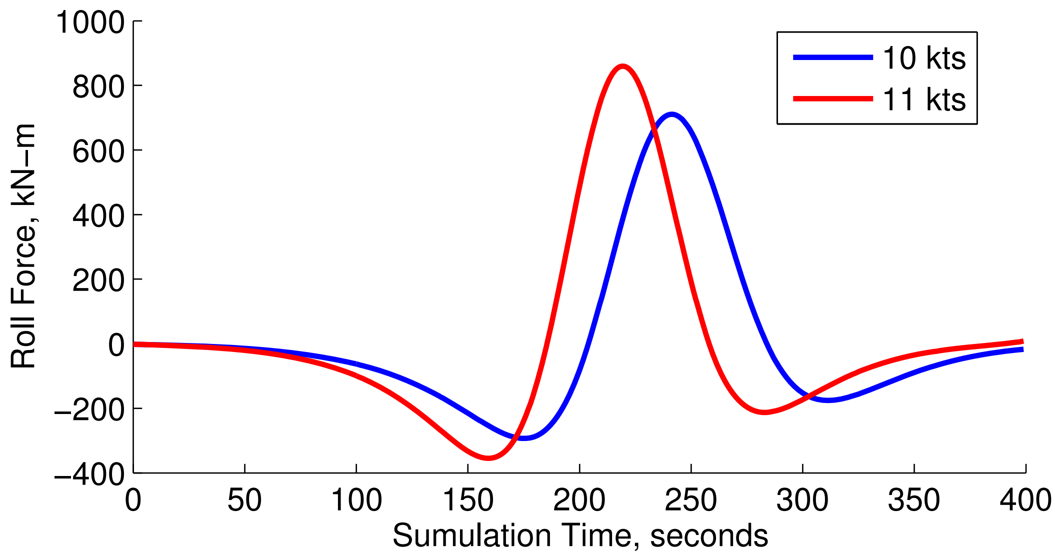


Figure 3-13: Modeled Roll Forces on the Aframax Tanker at Berth 2

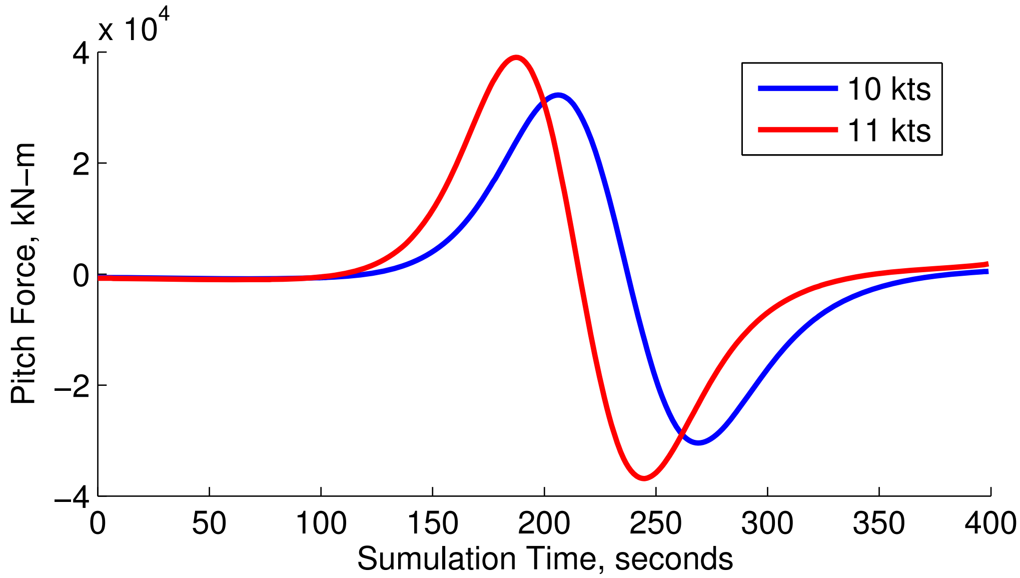


Figure 3-14: Modeled Pitch Forces on the Aframax Tanker at Berth 2

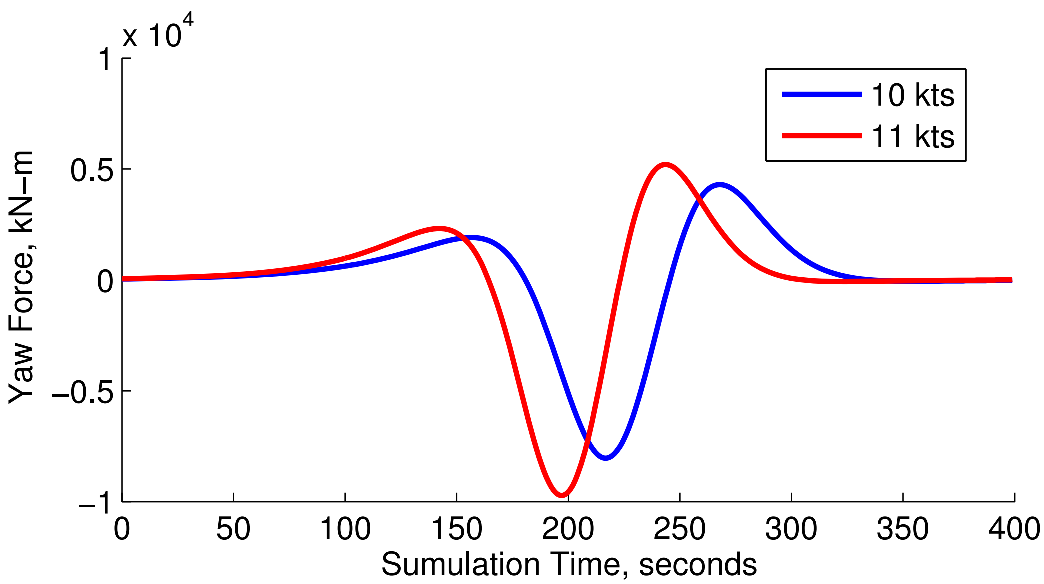


Figure 3-15: Modeled Yaw Forces on the Aframax Tanker at Berth 2

BERTH 3

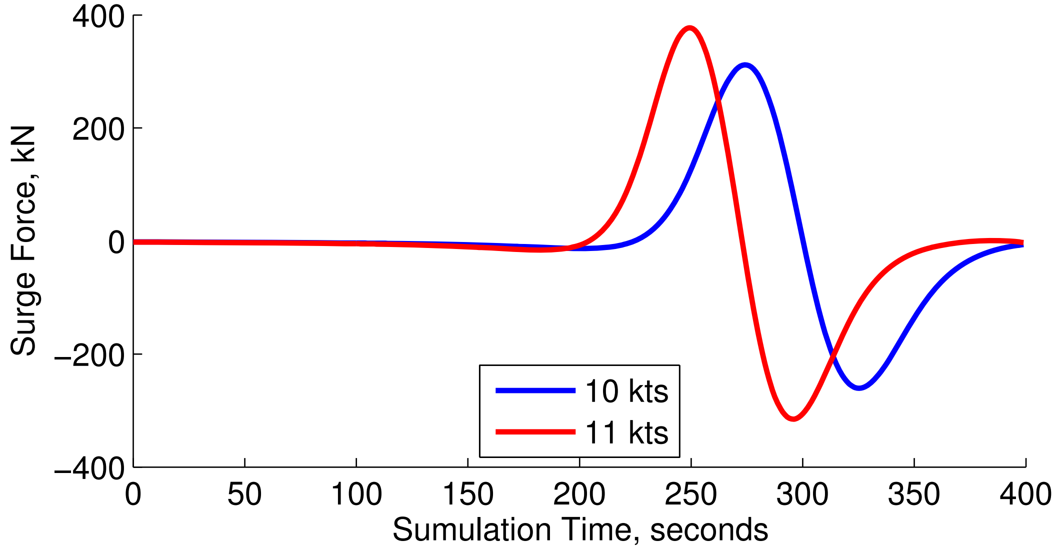


Figure 3-16: Modeled Surge Forces on the Aframax Tanker at Berth 3

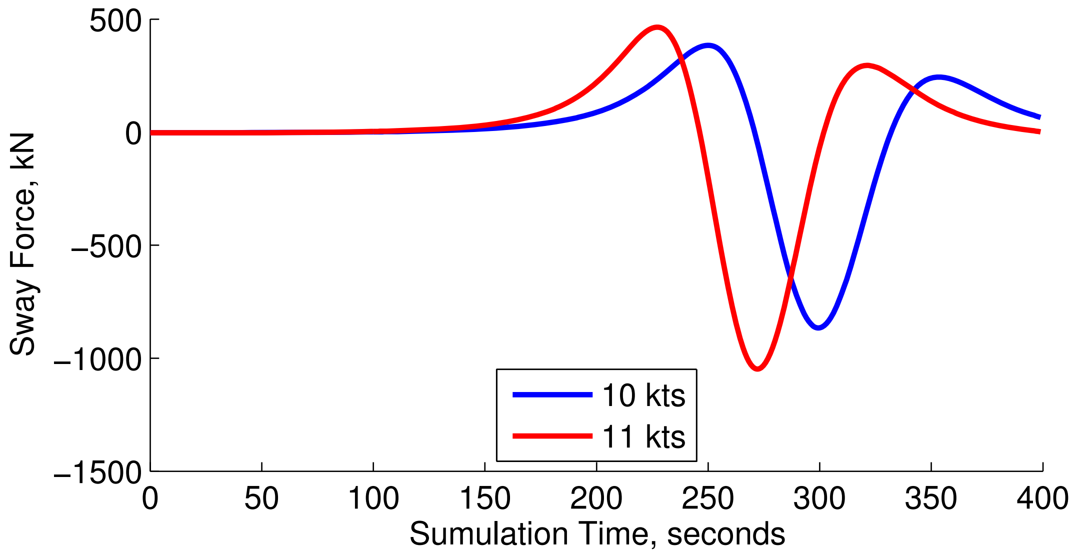


Figure 3-17: Modeled Sway Forces on the Aframax Tanker at Berth 3

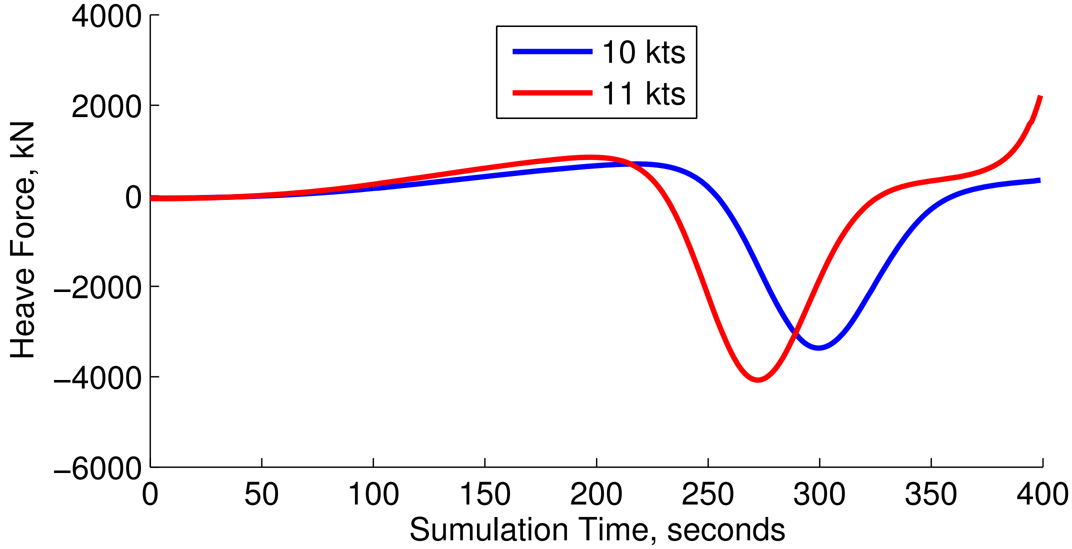


Figure 3-18: Modeled Heave Forces on the Aframax Tanker at Berth 3

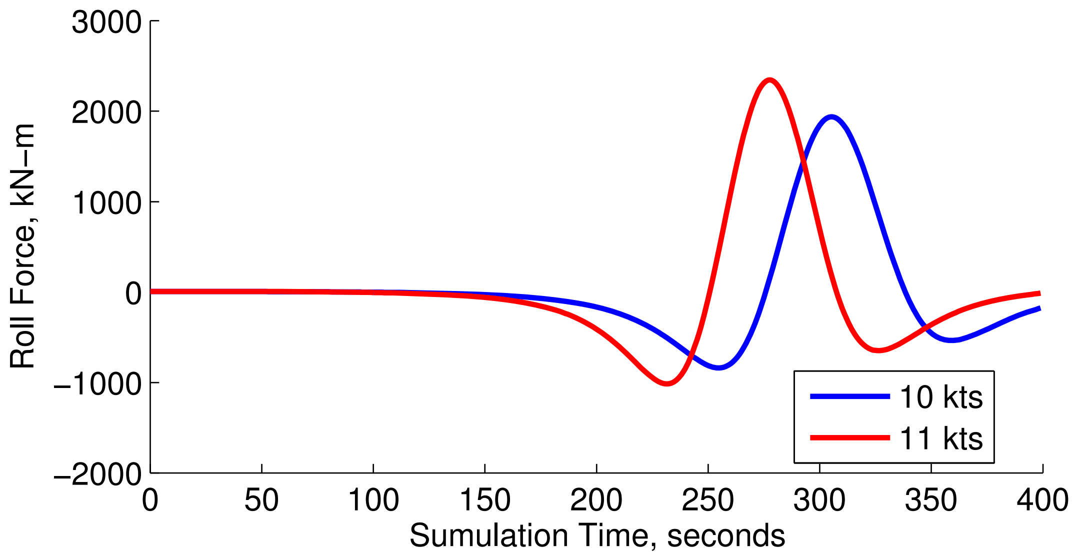


Figure 3-19: Modeled Roll Forces on the Aframax Tanker at Berth 3

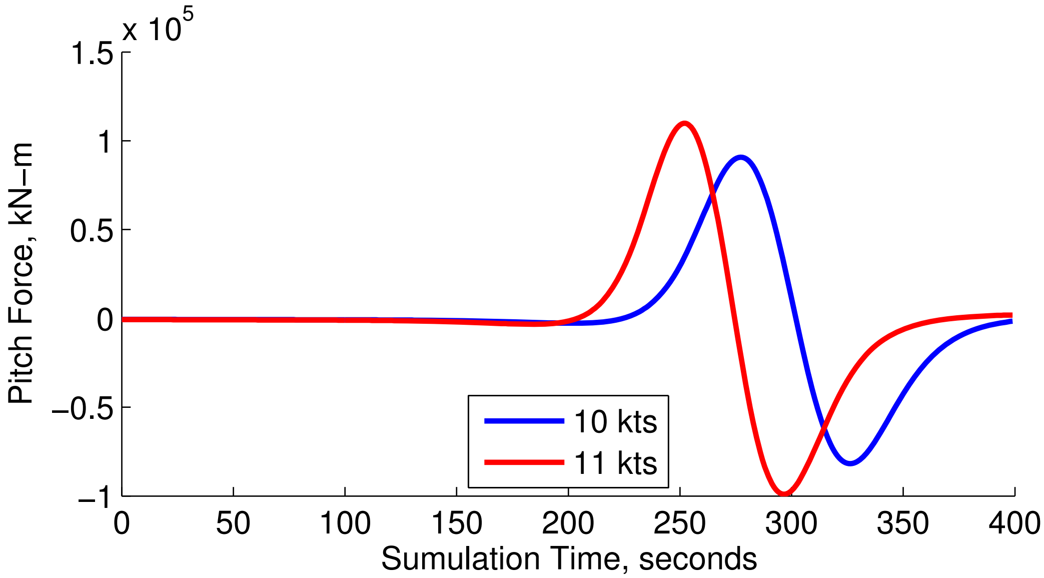


Figure 3-20: Modeled Pitch Forces on the Aframax Tanker at Berth 3

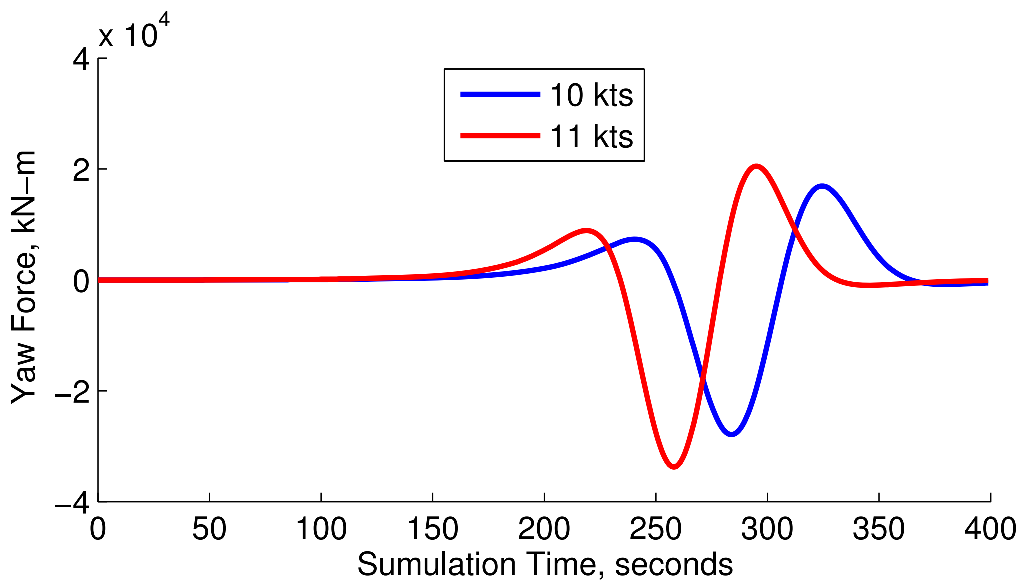


Figure 3-21: Modeled Yaw Forces on the Aframax Tanker at Berth 3

3.2 TERMSIM

The analysis of the mooring forces was computed using the mooring model TERMSIM. TERMSIM is a time domain program, developed by Maritime Research Institute Netherlands (MARIN), and is used to analyze the behavior of a moored vessel subject to wind, waves, and current. The mooring system may be a Single Point Mooring (SPM), a Multi Buoy Mooring (MBM) or a Jetty terminal, as in the case of the proposed Westridge facilities. The program simulates the mooring loads and vessel motions when the system is exposed to operational environmental conditions.

Vessel: The vessel is a generic tanker/bulker of regular dimensions. The hydrodynamic data for the vessel is based on the scale model tests of tanker-shaped hulls conducted at MARIN. Based on the main particulars of the bulker (e.g. length, breadth, draft, water depth, and displacement), a selection from the database is made and scaled to match the design vessel and site conditions. A user-defined vessel can also be input in the program.

Environment: The environmental conditions may include steady currents, steady or irregular wind fields, and/or swell and long crested irregular waves from arbitrary directions. Several spectral formulations for the wind, waves and swell are available. The program is capable of simulating vessels in both shallow and deep water. Environmental conditions were kept as static inputs to evaluate the effects of the passing vessel.

Databases: Several databases are delivered with the program.

-Mooring elements: The mooring element database contains particulars of common offshore chains, steel wires, synthetic ropes and fenders. For synthetic ropes, load-elongation characteristics are included. The load-compression curves for various fender types are included in the database. User-defined characteristics of lines and fenders may also be used.

-OCIMF wind and current coefficients: This database contains non-dimensional wind and current force/moment coefficients for calculation of wind and current loads on tanker-shaped vessels (valid for bulkers).

-OCIMF diffraction data: The new OCIMF diffraction database contains the results of diffraction analyses for several vessel configurations.

-Hydrodynamic reaction coefficients: This database contains non-dimensional coefficients for use in the formulation of hydrodynamic reaction forces.

Output: The output of each simulation consists of a binary file containing all samples of the calculated signals. The signals include vessel motions, loads in the mooring legs and other measures of mooring system behavior. In addition, an output file is produced summarizing the maximum, minimum, and mean forces and motions, as well as factors of safety. A comprehensive data processing package is delivered with the program to view, plot and print the results.

3.2.1 Environmental Parameters

The following environmental conditions were utilized in the mooring model:

- Wind: Static winds were run at every 15° at 25 knots. No wind scenarios were also conducted to evaluate if wind forces on the tankers damp out loads induced by the passing vessel.

- Current: A one knot current was applied to those simulations in which the passing vessel forces were simulated for a transit during a stemming tide. This current was applied 10° off of the starboard quarter of the vessels, in agreement with hydrodynamic model results developed for previous studies related to the new facility design.

3.2.2 Berth Geometries and Model Setup

All mooring models were set up to be identical to Optimoor mooring analyses developed in 2012. For reference, figures used to represent the mooring arrangements in the 2012 report are reproduced below.

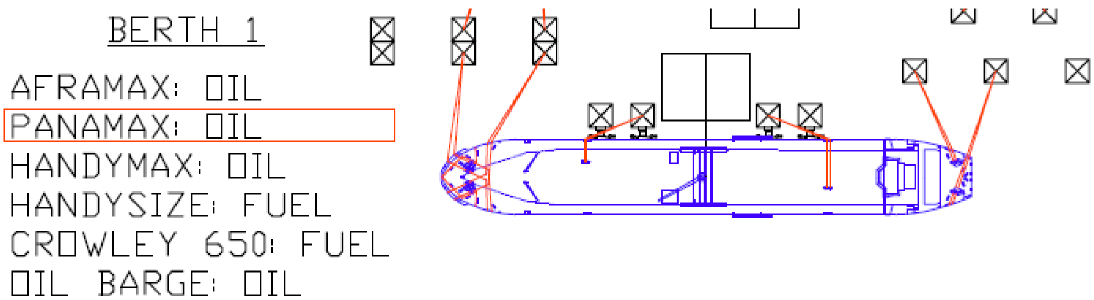


Figure 3-22: Panamax Mooring Arrangement at Berth 1

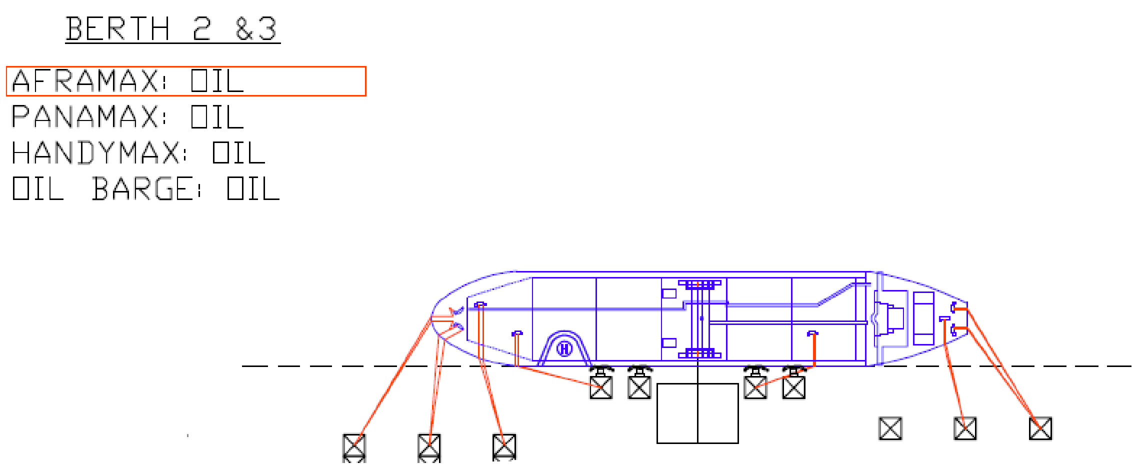


Figure 3-23: Aframax Mooring Arrangement at Berths 2 and 3

3.2.3 Mooring Evaluation Criteria

MOORING LINE TENSION LIMITS

Per recommendations provided by OCIMF, the allowable safe working load (SWL) in mooring lines is set at 55% of the minimum breaking load (MBL) for the steel wire lines found on tankers. Though each vessel deploys lines with 11 meter synthetic tails, the loading the steel lines will control the allowable safe working load limits.

FENDERS

Fenders were selected for the proposed facility based on requirements set by a berthing energy study conducted in 2012. Trelleborg Supercone Fenders SCN2000 (E1.0 rubber grade) were selected with a rated energy capacity of 305 t-m and a rated reaction of 295 mt. Acceptable fender loadings are those at or below the rate reaction of the fender at design performance (2894 kN).

MOTIONS

PIANC guidelines set envelopes for tanker motions at berth based on loading arm travel restrictions; these criteria allow for 3 meters of peak to peak motion in surge and 3 meters of zero to peak motion in sway for oil tankers.

3.2.4 Results

The following sections present the results of the dynamic mooring analyses for each modeled berth location. Tables are developed in an effort to evaluate the loading in the mooring lines (and hooks), bollards, fenders, and examine the induced vessel motions.

Directions presented below are referenced to true North. Mooring lines are numbered sequentially from the bow to the stern. Bollard load components are as follows: X-directional loading is parallel with the fender line, Y-directional loading is perpendicular to the fender line, and Z-directional loading is along the vertical axis of the bollard. Values presented for the magnitudes of vessel motions represent the envelope of motions during simulations; i.e. the amplitude between the maximum and minimum excursions of the vessel COG over the entire simulation.

BERTH 1: 10 KT PASSING SHIP

Table 3-2: Mooring Line and Hook Loads for Panamax Bulker at Berth 1 with 10 kt Passing Vessel Speed

Mooring Line	Max Load, kN	%MBL	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
1	103	14.20%	12.9/80.0	0.0/120.0
2	103	14.20%	12.9/95.0	0.0/120.0
3	103	14.20%	12.9/80.0	0.0/120.0
4	103	14.20%	12.9/80.0	0.0/120.0
5	107	14.70%	12.9/140.0	0.0/120.0
6	107	14.80%	12.9/110.0	0.0/120.0
7	247	34.10%	12.9/290.0	0.0/120.0
8	247	34.00%	12.9/290.0	0.0/120.0
9	104	14.30%	12.9/200.0	0.0/120.0
10	104	14.30%	12.9/170.0	0.0/120.0
11	101	13.90%	12.9/200.0	0.0/120.0
12	101	13.90%	12.9/215.0	0.0/120.0

Table 3-3: Bollard Loads for Panamax Bulker at Berth 1 with 10 kt Passing Vessel Speed

Bollard	Max Load, kN	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg	X-Component, kN	Y-Component, kN	Z-Component, kN
1	209	12.9/80.0	0.0/120.0	24	204	34
2	208	12.9/80.0	0.0/120.0	117	169	32
3	225	12.9/110.0	0.0/120.0	206	56	68
4	516	12.9/290.0	0.0/120.0	-479	120	148
5	211	12.9/170.0	0.0/120.0	104	179	40
6	204	12.9/200.0	0.0/120.0	160	123	26

Table 3-4: Fender Loads for Panamax Bulker at Berth 1 with 10 kt Passing Vessel Speed

Fender	Max Load, kN	%Rated Rx	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
1	389	13.40%	12.9/155.0	0.0/120.0
2	349	12.10%	12.9/ 5.0	0.0/120.0
3	325	11.20%	12.9/50.0	0.0/120.0
4	321	11.10%	12.9/50.0	0.0/120.0

Table 3-5: Panamax Bulker Motions at Berth 1 with 10 kt Passing Vessel Speed

Motion	Magnitude, m/deg	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
Surge	0.67	12.9/290.0	0.0/120.0
Sway	0.056	12.9/20.0	0.0/120.0
Heave	0.013	12.9/95.0	0.0/120.0
Roll	0.289	12.9/20.0	0.0/120.0
Pitch	0.004	12.9/245.0	0.0/120.0

BERTH 1: 11 KT PASSING SHIP

Table 3-6: Mooring Line and Hook Loads for Panamax Bulker at Berth 1 with 11 kt Passing Vessel Speed

Mooring Line	Max Load, kN	%MBL	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
1	103	14.20%	12.9/80.0	0.5/120.0
2	103	14.20%	12.9/65.0	0.5/120.0
3	103	14.20%	12.9/95.0	0.5/120.0
4	103	14.20%	12.9/95.0	0.5/120.0
5	107	14.70%	12.9/125.0	0.5/120.0
6	107	14.80%	12.9/95.0	0.5/120.0
7	257	35.40%	12.9/275.0	0.5/120.0
8	256	35.30%	12.9/275.0	0.5/120.0
9	104	14.30%	12.9/200.0	0.5/120.0
10	104	14.30%	12.9/185.0	0.5/120.0
11	101	13.90%	12.9/200.0	0.5/120.0
12	101	13.90%	12.9/170.0	0.5/120.0

Table 3-7: Bollard Loads for Panamax Bulker at Berth 1 with 11 kt Passing Vessel Speed

Bollard	Max Load, kN	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg	X-Component, kN	Y-Component, kN	Z-Component, kN
1	209	12.9/65.0	0.5/120.0	24	204	34
2	208	12.9/95.0	0.5/120.0	117	169	32
3	225	12.9/95.0	0.5/120.0	206	56	68
4	535	12.9/275.0	0.5/120.0	-497	125	153
5	211	12.9/185.0	0.5/120.0	104	179	40
6	204	12.9/170.0	0.5/120.0	160	123	26

Table 3-8: Fender Loads for Panamax Bulker at Berth 1 with 11 kt Passing Vessel Speed

Fender	Max Load, kN	%Rated Rx	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
1	426	14.70%	12.9/155.0	0.5/120.0
2	346	12.00%	12.9/ 5.0	0.5/120.0
3	217	7.50%	12.9/50.0	0.5/120.0
4	180	6.20%	12.9/50.0	0.5/120.0

Table 3-9: Panamax Bulker Motions at Berth 1 with 11 kt Passing Vessel Speed

Motion	Magnitude, m/deg	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
Surge	0.689	12.9/275.0	0.5/120.0
Sway	0.048	12.9/20.0	0.5/120.0
Heave	0.038	12.9/200.0	0.5/120.0
Roll	0.249	12.9/35.0	0.5/120.0
Pitch	0.005	12.9/200.0	0.5/120.0

BERTH 2: 10 KT PASSING SHIP

Table 3-10: Mooring Line and Hook Loads for Aframax Bulker at Berth 2 with 10 kt Passing Vessel Speed

Mooring Line	Max Load, kN	%MBL	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
1	127	13.90%	12.9/290.0	0.0/120.0
2	128	14.00%	12.9/290.0	0.0/120.0
3	102	11.10%	12.9/185.0	0.0/120.0
4	103	11.20%	12.9/170.0	0.0/120.0
5	102	11.10%	12.9/185.0	0.0/120.0
6	102	11.10%	12.9/170.0	0.0/120.0
7	103	11.20%	12.9/185.0	0.0/120.0
8	177	19.30%	12.9/290.0	0.0/120.0
9	103	11.20%	12.9/80.0	0.0/120.0
10	103	11.20%	12.9/65.0	0.0/120.0
11	102	11.10%	12.9/80.0	0.0/120.0
12	102	11.10%	12.9/50.0	0.0/120.0
13	101	11.00%	12.9/80.0	0.0/120.0
14	101	11.00%	12.9/65.0	0.0/120.0

Table 3-11: Bollard Loads for Aframax Bulker at Berth 2 with 10 kt Passing Vessel Speed

Bollard	Max Load, kN	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg	X-Component, kN	Y-Component, kN	Z-Component, kN
1	256	12.9/290.0	0.0/120.0	-128	-221	22
2	206	12.9/170.0	0.0/120.0	-16	-204	24
3	205	12.9/170.0	0.0/120.0	90	-183	24
4	207	12.9/185.0	0.0/120.0	202	-39	28
5	362	12.9/290.0	0.0/120.0	-337	-108	78
6	207	12.9/65.0	0.0/120.0	58	-197	29
7	407	12.9/50.0	0.0/120.0	236	-330	38

Table 3-12: Fender Loads for Aframax Bulker at Berth 2 with 10 kt Passing Vessel Speed

Fender	Max Load, kN	%Rated Rx	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
1	504	17.40%	12.9/80.0	0.0/120.0
2	495	17.10%	12.9/215.0	0.0/120.0
3	545	18.80%	12.9/170.0	0.0/120.0
4	566	19.50%	12.9/170.0	0.0/120.0

Table 3-13: Aframax Bulker Motions at Berth 2 with 10 kt Passing Vessel Speed

Motion	Magnitude, m/deg	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
Surge	0.418	12.9/290.0	0.0/120.0
Sway	0.084	12.9/200.0	0.0/120.0
Heave	0.021	12.9/335.0	0.0/120.0
Roll	0.127	12.9/200.0	0.0/120.0
Pitch	0.01	12.9/305.0	0.0/120.0

BERTH 2: 11 KT PASSING SHIP

Table 3-14: Mooring Line and Hook Loads for Aframax Bulker at Berth 2 with 11 kt Passing Vessel Speed

Mooring Line	Max Load, kN	%MBL	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
1	129	14.00%	12.9/290.0	0.5/120.0
2	129	14.10%	12.9/290.0	0.5/120.0
3	103	11.30%	12.9/155.0	0.5/120.0
4	106	11.50%	12.9/155.0	0.5/120.0
5	102	11.10%	12.9/170.0	0.5/120.0
6	102	11.10%	12.9/170.0	0.5/120.0
7	103	11.20%	12.9/170.0	0.5/120.0
8	168	18.30%	12.9/290.0	0.5/120.0
9	103	11.20%	12.9/65.0	0.5/120.0
10	103	11.20%	12.9/80.0	0.5/120.0
11	102	11.10%	12.9/65.0	0.5/120.0
12	102	11.10%	12.9/80.0	0.5/120.0
13	101	11.00%	12.9/65.0	0.5/120.0
14	101	11.00%	12.9/80.0	0.5/120.0

Table 3-15: Bollard Loads for Aframax Bulker at Berth 2 with 11 kt Passing Vessel Speed

Bollard	Max Load, kN	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg	X-Component, kN	Y-Component, kN	Z-Component, kN
1	259	12.9/290.0	0.5/120.0	-129	-224	22
2	211	12.9/155.0	0.5/120.0	-16	-208	24
3	205	12.9/170.0	0.5/120.0	90	-183	24
4	207	12.9/170.0	0.5/120.0	202	-39	28
5	344	12.9/290.0	0.5/120.0	-320	-103	74
6	207	12.9/65.0	0.5/120.0	58	-197	29
7	407	12.9/65.0	0.5/120.0	236	-330	38

Table 3-16: Fender Loads for Aframax Bulker at Berth 2 with 11 kt Passing Vessel Speed

Fender	Max Load, kN	%Rated Rx	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
1	478	16.50%	12.9/80.0	0.5/120.0
2	507	17.50%	12.9/215.0	0.5/120.0
3	647	22.40%	12.9/170.0	0.5/120.0
4	698	24.10%	12.9/170.0	0.5/120.0

Table 3-17: Aframax Bulker Motions at Berth 2 with 11 kt Passing Vessel Speed

Motion	Magnitude, m/deg	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
Surge	0.386	12.9/290.0	0.5/120.0
Sway	0.091	12.9/200.0	0.5/120.0
Heave	0.045	12.9/110.0	0.5/120.0
Roll	0.136	12.9/200.0	0.5/120.0
Pitch	0.012	12.9/335.0	0.5/120.0

BERTH 3: 10 KT PASSING SHIP

Table 3-18: Mooring Line and Hook Loads for Aframax Bulker at Berth 3 with 10 kt Passing Vessel Speed

Mooring Line	Max Load, kN	%MBL	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
1	151	16.40%	12.9/320.0	0.0/120.0
2	153	16.70%	12.9/320.0	0.0/120.0
3	113	12.30%	12.9/155.0	0.0/120.0
4	114	12.40%	12.9/155.0	0.0/120.0
5	108	11.80%	12.9/125.0	0.0/120.0
6	108	11.80%	12.9/125.0	0.0/120.0
7	109	11.90%	12.9/80.0	0.0/120.0
8	317	34.60%	12.9/320.0	0.0/120.0
9	104	11.30%	12.9/65.0	0.0/120.0
10	104	11.30%	12.9/65.0	0.0/120.0
11	104	11.30%	12.9/80.0	0.0/120.0
12	103	11.30%	12.9/80.0	0.0/120.0
13	103	11.20%	12.9/80.0	0.0/120.0
14	103	11.20%	12.9/80.0	0.0/120.0

Table 3-19: Bollard Loads for Aframax Bulker at Berth 3 with 10 kt Passing Vessel Speed

Bollard	Max Load, kN	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg	X-Component, kN	Y-Component, kN	Z-Component, kN
1	305	12.9/320.0	0.0/120.0	-152	-263	26
2	228	12.9/155.0	0.0/120.0	-17	-225	26
3	218	12.9/125.0	0.0/120.0	96	-194	26
4	220	12.9/80.0	0.0/120.0	215	-41	30
5	650	12.9/320.0	0.0/120.0	-604	-194	140
6	209	12.9/65.0	0.0/120.0	59	-199	30
7	414	12.9/80.0	0.0/120.0	240	-336	39

Table 3-20: Fender Loads for Aframax Bulker at Berth 3 with 10 kt Passing Vessel Speed

Fender	Max Load, kN	%Rated Rx	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
1	514	17.80%	12.9/ 5.0	0.0/120.0
2	501	17.30%	12.9/215.0	0.0/120.0
3	572	19.80%	12.9/170.0	0.0/120.0
4	601	20.80%	12.9/170.0	0.0/120.0

Table 3-21: Aframax Bulker Motions at Berth 3 with 10 kt Passing Vessel Speed

Motion	Magnitude, m/deg	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
Surge	0.827	12.9/320.0	0.0/120.0
Sway	0.086	12.9/200.0	0.0/120.0
Heave	0.045	12.9/185.0	0.0/120.0
Roll	0.13	12.9/200.0	0.0/120.0
Pitch	0.028	12.9/185.0	0.0/120.0

BERTH 3: 10 KT PASSING SHIP

Table 3-22: Mooring Line and Hook Loads for Aframax Bulker at Berth 3 with 11 kt Passing Vessel Speed

Mooring Line	Max Load, kN	%MBL	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
1	167	18.20%	12.9/350.0	0.5/120.0
2	170	18.50%	12.9/350.0	0.5/120.0
3	130	14.10%	12.9/140.0	0.5/120.0
4	129	14.10%	12.9/140.0	0.5/120.0
5	131	14.20%	12.9/20.0	0.5/120.0
6	131	14.20%	12.9/ 5.0	0.5/120.0
7	126	13.80%	12.9/95.0	0.5/120.0
8	342	37.20%	12.9/350.0	0.5/120.0
9	103	11.20%	12.9/65.0	0.5/120.0
10	103	11.20%	12.9/50.0	0.5/120.0
11	103	11.20%	12.9/65.0	0.5/120.0
12	102	11.10%	12.9/65.0	0.5/120.0
13	101	11.00%	12.9/65.0	0.5/120.0
14	101	11.00%	12.9/80.0	0.5/120.0

Table 3-23: Bollard Loads for Aframax Bulker at Berth 3 with 11 kt Passing Vessel Speed

Bollard	Max Load, kN	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg	X-Component, kN	Y-Component, kN	Z-Component, kN
1	338	12.9/350.0	0.5/120.0	-168	-292	29
2	261	12.9/140.0	0.5/120.0	-20	-258	30
3	263	12.9/ 5.0	0.5/120.0	116	-234	31
4	255	12.9/95.0	0.5/120.0	248	-47	35
5	700	12.9/350.0	0.5/120.0	-651	-209	150
6	207	12.9/50.0	0.5/120.0	58	-197	29
7	409	12.9/65.0	0.5/120.0	237	-331	38

Table 3-24: Fender Loads for Aframax Bulker at Berth 3 with 11 kt Passing Vessel Speed

Fender	Max Load, kN	%Rated Rx	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
1	643	22.20%	12.9/ 5.0	0.5/120.0
2	526	18.20%	12.9/260.0	0.5/120.0
3	674	23.30%	12.9/170.0	0.5/120.0
4	732	25.30%	12.9/170.0	0.5/120.0

Table 3-25: Aframax Bulker Motions at Berth 3 with 11 kt Passing Vessel Speed

Motion	Magnitude, m/deg	Wind Speed, m/s / Direction, deg	Current Speed, m/s, Direction, deg
Surge	0.949	12.9/ 5.0	0.5/120.0
Sway	0.123	12.9/ 5.0	0.5/120.0
Heave	0.072	12.9/185.0	0.5/120.0
Roll	0.138	12.9/200.0	0.5/120.0
Pitch	0.034	12.9/200.0	0.5/120.0

4. CONCLUSIONS AND RECOMMENDATIONS

Passing vessel analysis at the three proposed berths revealed that the proposed realigned channel provides ample clearance between transiting and moored vessels. Peak surge forces induced on the loaded Aframax tanker at berth 3 were about 400 kN (40 mt) for the transiting bulker making 10 knots against a 1 knot stemming current. Coupling these passing vessel forces with static winds and currents did not overstrain the planned mooring arrangements and their related equipment. The largest line loadings were observed in the shortest forward spring lines when they were resisting the initial surge forward induced by the passing vessel.

Peak to Peak motions of all vessels at the berth were minimal and well within PIANC recommended envelopes. All lines and fenders maintained loading safety factors well below the suggested OCIMF criteria for moored tankers at berth.

The study also serves to illustrate the sensitivity of passing vessel forces to the vessel speeds; calculated loads were about 30% higher for the 11 knot simulations than those of the 10 knot. Potential flow theory demonstrates that changes in the modeled ships' draft, displacement, passing distance, and observed speed will greatly affect the observed forces on both vessels. Bathymetric effects also greatly contribute to these effects, but the bathymetry is deep and mildly sloping around the Westridge facility so as to provide ample under keel clearance and minimal amplification to passing vessel forces.

Moffatt and Nichol does not think it is warranted to repeat this analysis for transits at a higher speed, as it seems unlikely that deep draft vessels would exceed 10 kts at engine settings comfortable for harbour transit. Should vessels larger than those considered in the report call at facilities east of Westridge, it would be prudent to verify that these ships will not strain the proposed tanker moorings beyond acceptable limits.

While the layout of the proposed new Westridge Marine Terminal is still being optimized, it should not be necessary to repeat this analysis for the final layout, provided that the final configuration is no closer to the vessel corridor than 190m. Similarly, should PMV decide to realign the channel adjacent to the Westridge facilities so as to bring inbound traffic closer to the tanker berths, reanalysis of the passing vessel effects at that time would be warranted.

5. REFERENCES

Kriebel, D., 2005 “Mooring Loads due to Parallel Passing Ships,” *Technical Report TR-6056-OCN*, Naval Facilities Engineering Service Center.

Muga, B. and Fang, S., 1975 “Passing Ship Effects – From Theory and Experiment,” *OTC 16719, Offshore Technology Conference*, ASCE.

OCIMF, 2008, “Mooring Equipment Guidelines, 3rd Edition,” London, United Kingdom.

PIANC, 1995 ‘Criteria for Movements of Moored Ships in Harbours - a Practical Guide,’ *Supplement to Bulletin nr. 88, PTC2 report of WG 24*, October.

Seelig, W., 2001, “Passing Ship Effects on Moored Ships,” *Technical Memorandum TM-6027-OCN*, Facilities Engineering Service Center.

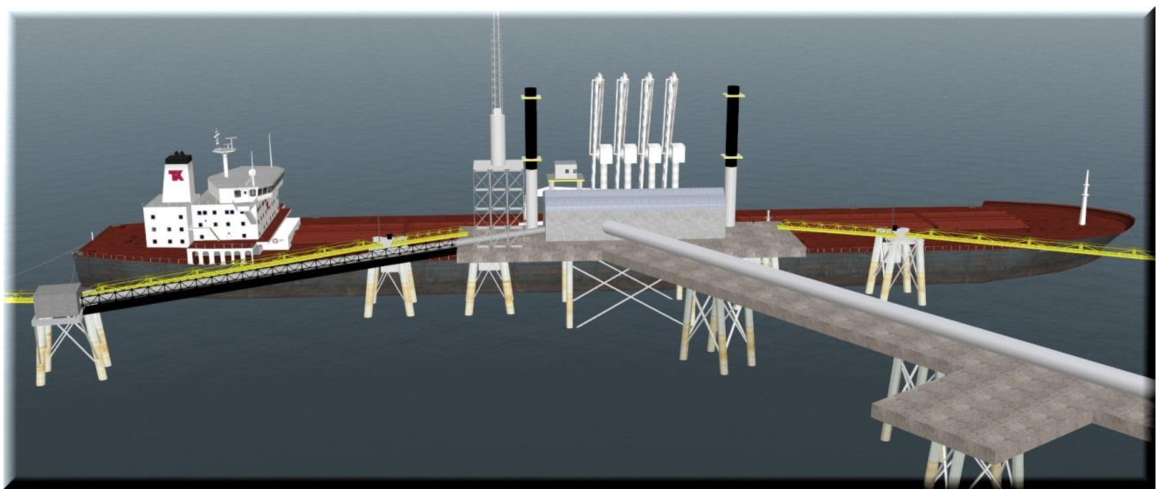
Wang, S., 1975, “Dynamic Effects of Ship Passage on Moored Vessels,” *Journal of Waterway, Port, Coastal and Ocean Engineering*, Harbour and Coastal Division, ASCE.

Summary Report of Manoeuvring Assessment, Westridge Terminals Vancouver Expansion (August 13, 2014)

Summary Report of Manoeuvring Assessment

Westridge Terminals Vancouver Expansion

Supplementary Report – July 2014 Modifications



Prepared for

TRANSMOUNTAIN

Expansion Project

By LANTEC Marine Incorporated

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1. Overview of Simulation Study

This simulation study was conducted as a supplement to an October 2013 analysis conducted by LANTEC Marine Inc. Subsequent to the selection of a preferred design for the new Westridge Terminal facility, which was filed with the National Energy Board; further engineering work to optimise the design has taken place. As a result, and in order to accommodate the results of feedback received from the public, the entire dock complex has been shifted about 50 metres to the east-southeast. Although the overall modification was not substantial, there are some differences in the relative position of the shoreline and bottom slope in relation to the inner berthing face of the new dock which is referred to as Berth 1. There were no practical manoeuvring implications at all for the outer docking faces known as Berths 2 and 3. As a matter of due diligence a series of verification manoeuvres were conducted using simulation to ensure that berthing and un-berthing at Berth 1 could still be conducted in a safe and routine manner with the latest design. It was also verified that there would be no additional complications associated with berthing at the existing facility while the new terminal wharf was under construction.

This report outlines the findings and recommendations of the verification analysis.

****It is important to note that the goal of this analysis was not to determine the ideal or best methodology for conducting approach and departure manoeuvres from the proposed terminal, but merely to identify any design issues that would unnecessarily complicate the conduct of those manoeuvres.*

▪ Simulation System

From a pure simulation and mathematical standpoint, the Kongsberg Polaris® Desktop Simulator has the same fidelity/ accuracy as their full mission simulators, the primary difference being the control systems for the simulated ships, and the degree of human environmental immersion. With the desktop system, all aspects of the simulation, and ship control mechanisms are being controlled by one computer with a single user interface for the instructor, this contrasts with the fully immersive full mission ship and tug simulator where a tug captain using real control equipment manoeuvres each tug, and a marine pilot with real controls and radio devices controls the big ship and co-ordinates all tug activity. Additionally, with desktop/ fast-time simulation, all analysis is based on assessment of numerical outputs and data plots, in contrast, full mission simulation adds the total immersion environment which incorporates human factors, man-machine interface and the assessment (sometimes subjective) of operational feasibility and risk analysis as if the operation were being conducted in real life.

Having made this distinction, it is important then to understand that the desktop system is very well suited to assessing manoeuvres that are not exceedingly complex and to determine where environmental factors and physical space constraints start to impose manoeuvring difficulties. The desktop simulator can also be used to do preliminary assessments on tug performance requirements, and to highlight advantages gained with different tug assist arrangements. The limiting factor with these simulations is the simulator operator's ability to manoeuvre the tugs in a fashion and within a timeline that is consistent with real life manoeuvres (using the limited control system of a keyboard and mouse), and hence maintaining the integrity of the simulation. For this reason, the desktop system should only be used in a limited capacity to assess emergency manoeuvres and procedures, and these items can be analysed with an elevated level of integrity in a Full Mission Interactive Simulation.

- **Area Models**

An area model which encompasses all of the area of Port Metro Vancouver already existed in the Kongsberg model library. For the purposes of this preliminary analysis/ desktop simulation, this model was augmented by adding the positional information into the instructor station chart for the new berth final design. Since the instructor chart was the only medium used to view and control the combination of the AFRAMAX and the Tug models, high detailed visuals and radar components were not required for this phase.

Detailed Tidal Stream information already existed for the entire area to cover typical conditions during the allowed MRA transit windows. Details of this are provided in the following section on Conduct of General Test Procedures.

- **Ship Models**

For the purposes of this study, an existing Kongsberg library ship model of an AFRAMAX Tanker based on the particulars of TK Shipping's "America's Spirit" and a typical skeg forward ASD Escort/Ship Assist tug were used. Details as per the table below:

Simulation Ship Models

Vessel Type	Vessel Name	Displacement tonnes	Length LOA (m)	Beam (m)	Draught Forward (m)	Draught Aft (m)
AFRAMAX Tanker	America's Spirit	61,320	249.9	43.8	6.0	8.6
AFRAMAX Tanker	America's Spirit	119,400	249.9	43.8	13.5	13.6
ASD 5000 HP Skeg Forward Escort Tug	Generic	600	30.8	11.1	5.0	5.0

The Kongsberg simulation system uses a comprehensive three-dimensional environmental model that acts upon the entire wet and dry surfaces of any simulated ownship, effecting vessel motion and dynamics (large ships and tugs). There are certain capabilities and limitations that should be noted:

- all models respond to shallow water effect, squat, sinkage and bank effect;
- all models respond to wind, and the disposition of their free surface area and superstructures effect both wind induced rotation and drift;
- ship to ship interaction is also simulated when vessels meet in a narrow or restricted waterway;
- a large ship does not block the current from a tug that is working close to the ship's side but does provide a wind and wave lee;
- the area database does not constrain or constrict the prop wash from a working tug, or cause it to circulate or backwash around a tightly enclosed basin; and
- Tug towline load figures incorporate tug engine power and azimuth settings, skeg design, tugboat’s speed and direction, the big ship’s speed and direction, and will vary with sea state and other environmental phenomena.

▪ Test Team

In the conduct of the simulation study, the test team was comprised of:

Name	Role	Organisation
Garland Hardy	Test Director	LANTEC Marine Inc.
Bikramjit Kanjilal	Lead, Marine Development	Trans Mountain Expansion Project

2. Westridge Terminal Overview

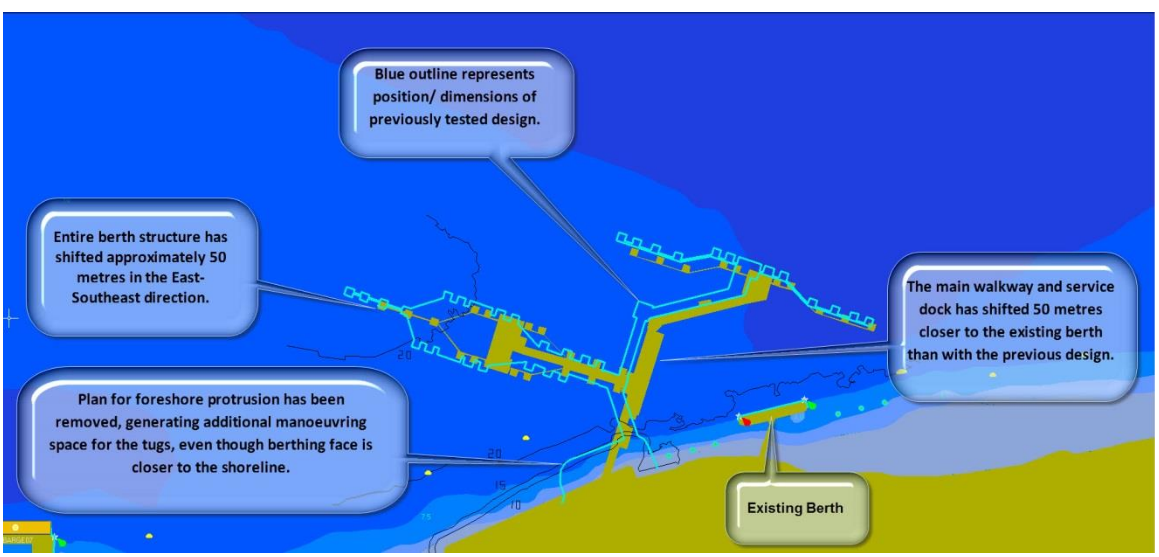
Trans Mountain Pipeline ULC has proposed an expansion of the Trans Mountain Pipeline system that carries oils from Edmonton, AB to Burnaby, BC. A significant portion of the expanded capacity will be destined for export by tankers that will load from Westridge Marine Terminal. To accommodate the increase in product being moved by ship, a larger dock facility with three Aframax capable berths is required at Westridge Terminal.

It is also critical that operations at the existing dock can continue without disruption while the new facility is under construction.

To ensure that operations are conducted in a safe and prudent fashion, and that every possible measure is taken to avoid operational or environmental mishap, Trans Mountain, Port Metro Vancouver, the British Columbia Coast Pilots, and local Towing Companies have all participated in a lengthy process of simulation studies, training and live manoeuvring trials to develop tug escort, and transit restriction rules that apply to tanker vessels proceeding to and from Westridge terminals (Port Metro Vancouver Movement Restriction Area or MRA). As a final step in this process, simulation analysis of the proposed new berth designs for Westridge terminals was required.

▪ Design Modifications

As a result of further engineering work to optimise the design, the entire dock complex has been shifted about 50 metres to the east-southeast. Highlights of this modification are illustrated below:



3. Testing Methodology

The simulation study was conducted in order to achieve the goals stated below using established testing methodologies and applying established principals for ship manoeuvring and tug escort/ assist that adhere to the regulations/ requirements of the Port of Vancouver MRA.

▪ Study Goals and Items for Analysis

As stated in the introductory overview, the primary goal of the study was to identify any design issues that would unnecessarily complicate the conduct of berthing and un-berthing manoeuvres at the new facility. Specific items or elements that were analysed included:

- Determine if modifications to the design provided adequate space for assist tugs to work effectively;

- Assess that Berth 1 and the existing dock provided adequate manoeuvring space for the ship itself;

- Identify if vessels at adjacent anchorages would encroach on the manoeuvring space, or impede the approach or departure from Berth 1; and

- Determine if the July 2014 design modifications would create complications that could restrict the use of the existing facility while the new terminal was under construction.

▪ General Test Procedures

In order to accomplish these goals the study adhered to established practices as closely as possible. All inbound runs were conducted with ballasted ships assisted by two tugs and with tidal stream conditions as experienced during the period immediately after slack water turning to ebb at Second Narrows. All outbound runs were conducted using a vessel loaded to 13.5 metres (assessed to be most common future outbound load condition) with tidal stream conditions as experienced during the period immediately after high water slack turning to flood at Second Narrows. Although outbound vessels will typically have three tugs as per the Second Narrows Escort requirements, the dock departures manoeuvres were all easily conducted with only two tugs. Details on tug employed assumptions are made in a separate section below.

Given that the goal was to identify potential design issues, rather than assess operating limits, all runs were conducted under what was considered to be typical worse case environmental conditions; as such, the wind was from the Northeast (out of Indian Arm) at 25 knots, and the tidal stream values were as per Spring Tide conditions.

▪ Conduct of Individual Manoeuvres/ Runs

Inbound runs to Berth 1 commenced at Berry Point to verify that there would be no issues with manoeuvring the ship and setting up for the approach track. The inbound run to the existing dock commenced ½ mile from the berth. All departures commenced from the designated alongside position, and terminated once the ship was in the navigation channel, at a speed of 2 knots, and no longer needed tug assistance to manoeuvre in a routine manner.

All simulation runs were conducted at “real time” and full playback files of the scenario were recorded. Additionally, the vessels’ track plots and manoeuvres were captured in chart illustrations, and numeric and graphical data of other key manoeuvring criteria were recorded. These results are all compiled in a series of Excel© Spread-sheets which are presented under separate cover.

A complete list of runs and a comprehensive summary of the conduct and findings of the study is contained later in this report in the Section 6: “Summary of Conducted Manoeuvres”

- ### Assumptions on Tug Employment and Tug Escort Procedures

In accordance with the Port Metro Vancouver MRA rules, the tug requirements for vessels transiting Second Narrows are quite specific, however there is still quite a significant range and variation of tug types used with vessels arriving and departing from the Westridge facility. To this end, the tug modelling was kept quite generic, and in adhering to a “worse case” approach, the tug power applied was limited to 50 tonnes for any one tug, and the vast majority of the manoeuvres were conducted with line forces of less than 40 tonnes. Tug positioning for arrival and departure manoeuvres is at the discretion of individual pilots, so for the assessment purposes, as far as practical, the tugs were made up on the bow and stern centre-leads or on the outboard shoulder and the centre-lead aft

4. Summary of Overall Findings

The following is a summary of the core findings of the study. Further details are provided in the Detailed Summary of the Conducted Manoeuvres.

- ### General Comments on Design Elements

Key dock design elements that were highlighted in the previous analysis have not significantly changed with the latest modifications. The proposed berth design has several features that are assessed as facilitating the ship manoeuvring process. In all cases, the main berthing faces are unobstructed, and allow an approach from an axis of at least 45° which provides flexibility and safety when manoeuvring the vessel and working the tugs. Also, the mooring pads and catwalks are recessed approximately 35 metres from the plane of the main berthing face. This provides good clearance for the tugs if needed, to work on the inboard side of the ship prior to connecting or after slipping mooring lines. When a ship is in the alongside position the clearance astern of the ship at Berth 1 is approximately 65 metres, providing good space for the tug to work as well as a margin of safety when approaching the dock. See Illustration 1 next page.

Of the 3 berths of the dock complex, Berth 1 has the least amount of manoeuvring space, but it is not overly restricted and can support both port and starboard alongside arrivals and departures without issues. If a vessel is in the anchorage to the west, there is still sufficient space to approach the dock passing to the south of the anchorage.

Illustration 1 – Favourable Design Elements

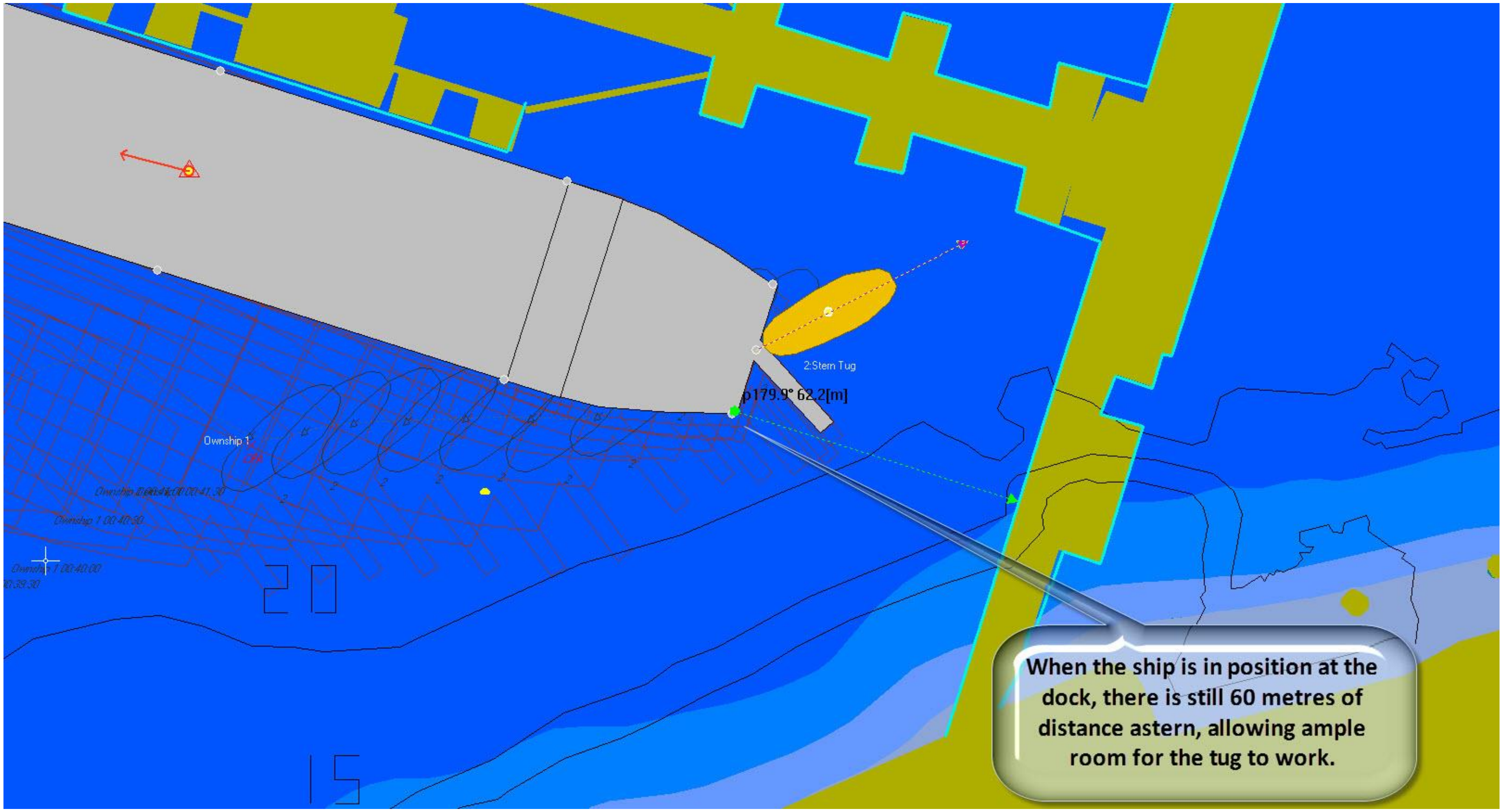
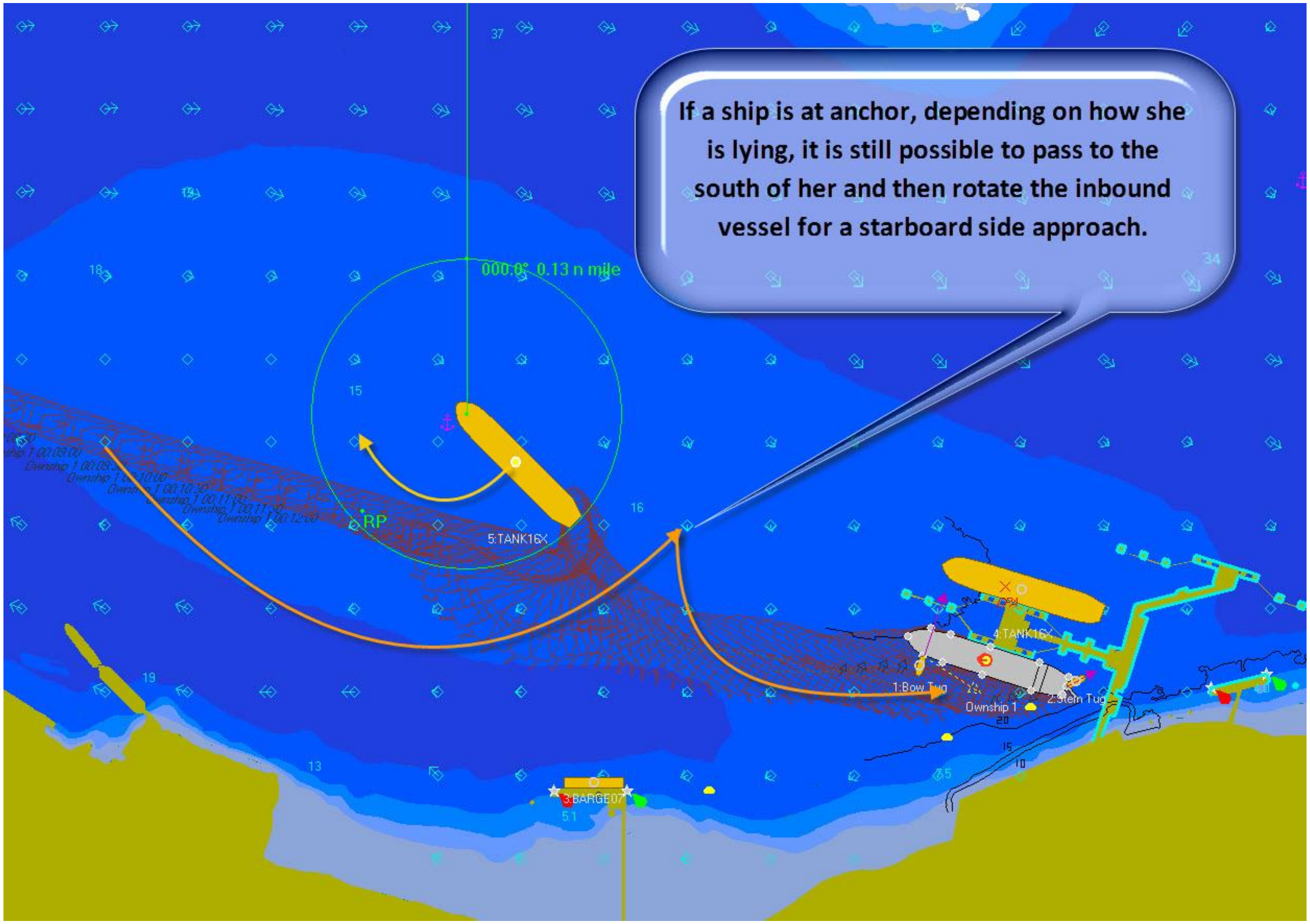


Illustration 2 – Comments on Berth 1



5. Recommendations

The recommendations provided below are a compilation of the preliminary manoeuvring analysis conducted by LANTEC Marine Inc. as a consultant to Trans Mountain Expansion Project. Any decision to implement these recommendations clearly resides with Trans Mountain, their management and any regulatory authorities.

5.1 *Final Design Modifications*

The modifications to the previously tested and preferred Design 11 from a manoeuvring standpoint are marginal and have minimal effect on the conduct of arrival and departure manoeuvres from the facility.

<u>Recommendation</u>

It is recommended that this design be implemented as planned.

5.2 *Follow-On Simulation Testing/Training Requirements*

This study should be considered a preliminary assessment based on the analysis of the test director, experience with evaluating and assessing other facilities, and experience as a professional mariner. This assessment was conducted without any input or direction from the British Columbia Coast Pilots, or Port Metro Vancouver.

<u>Recommendation</u>

For planning and feasibility assessment purposes, it is recommended that when the decision to proceed with the construction of the expanded terminal is made that a second phase simulation analysis be conducted. This phase should use a detailed Full Mission Simulation, and include participation from the British Columbia Coast Pilots, and tug masters from Seaspan/ Smit Towing to ascertain if:

- Specific rules or manoeuvring restrictions need to be placed on particular berths or movements to and from specific berths under certain conditions (i.e. A laden tanker cannot make a westerly direction departure from Berth 3 when another tanker is loading at Berth 2); and

- If different tug combinations or packages (beyond MRA minimum transit escort requirements) are needed to either arrive or depart from a specific berth in a manner that adheres to required safety margins.

The Bridge simulator should use a detailed 3-D hydrographic and visual area model that includes high definition details of the preferred dock option, and the approach channel. This would also be an opportunity to update the model with the latest information for the channel to ½ mile beyond the Second Narrows Bridges, as well as updates to the radar presentation, and the depth contour files which would be of assistance to pilot training overall. British Columbia Coast Pilots should practice complete manoeuvres commencing from the point where the escort tugs are attached/released.

6. Detailed Summary of Conducted Manoeuvres

▪ List of Individual Manoeuvres

A total of 6 individual manoeuvres were conducted as per the listing below focusing specifically on the areas that were affected by the July 2014 design modification.

July 2014 Design Manoeuvres			
Run #	**Berth**	**Run Details**	**Comments**
1	1	Arrival port side to berth	Standard analysis
2	1	Arrival starboard side to berth	Standard analysis
3	1	Departure port side to berth	Standard analysis
4	1	Departure starboard side to berth	Standard analysis
5	Existing	Arrival port side to berth	Assumes that Catwalks and Dolphins to the east of the main mooring pad on Berth 3 are not constructed until termination of operations at existing facility.
6	Existing	Arrival port side to berth	Assumes that Catwalks and Dolphins to the east of the main mooring pad on Berth 3 are not constructed until termination of operations at existing facility.

▪ **Details of Conducted Manoeuvres Berth 1 and Existing Berth July 2014 Design**

Annotated descriptions of the conduct of all common manoeuvres are provided in Illustrations 3 to 46 which follow:

Illustration 3 – Inbound Berth 1 Port Side Arrival

Illustration 4 – Inbound Berth 1 Port Side Arrival

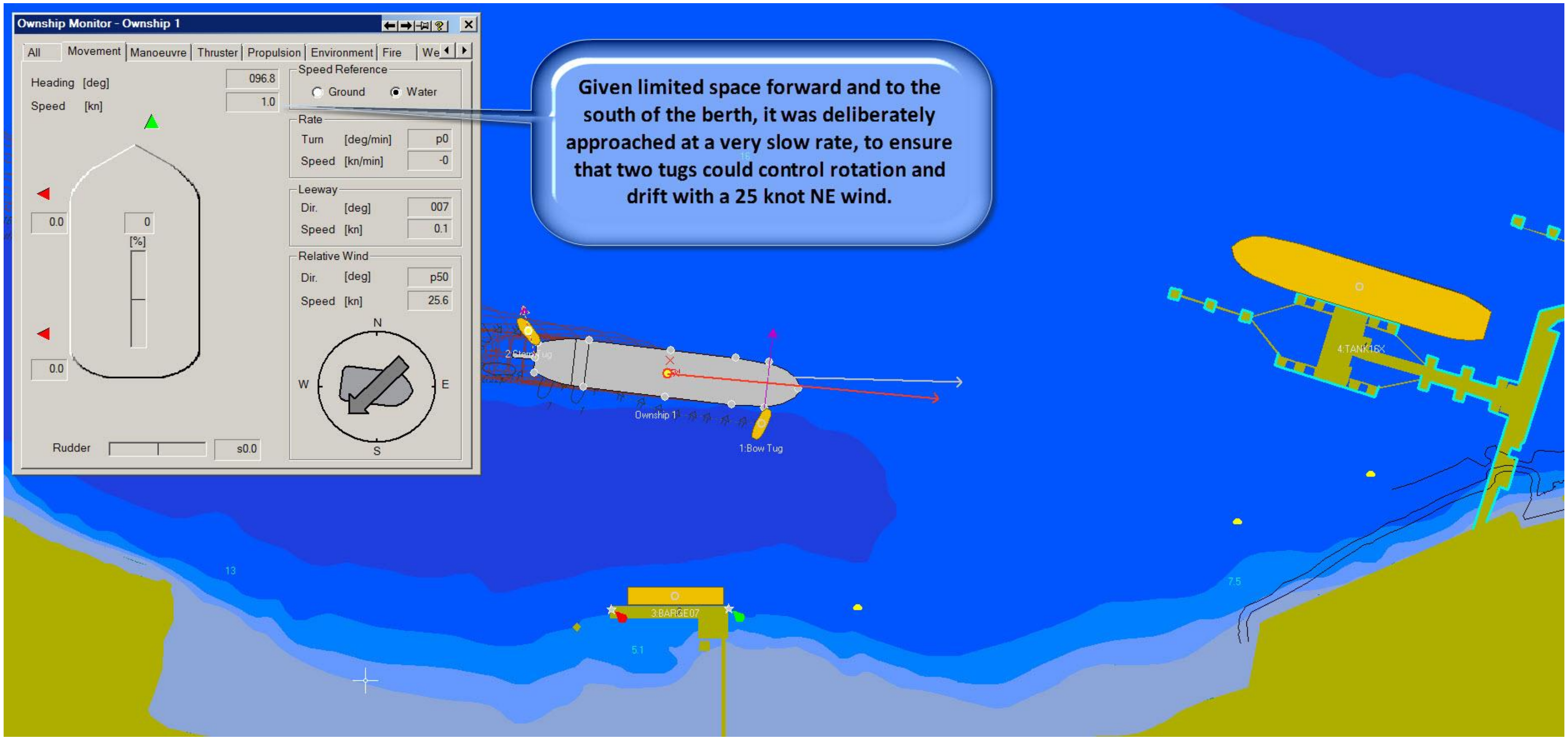


Illustration 5 – Inbound Berth 1 Port Side Arrival

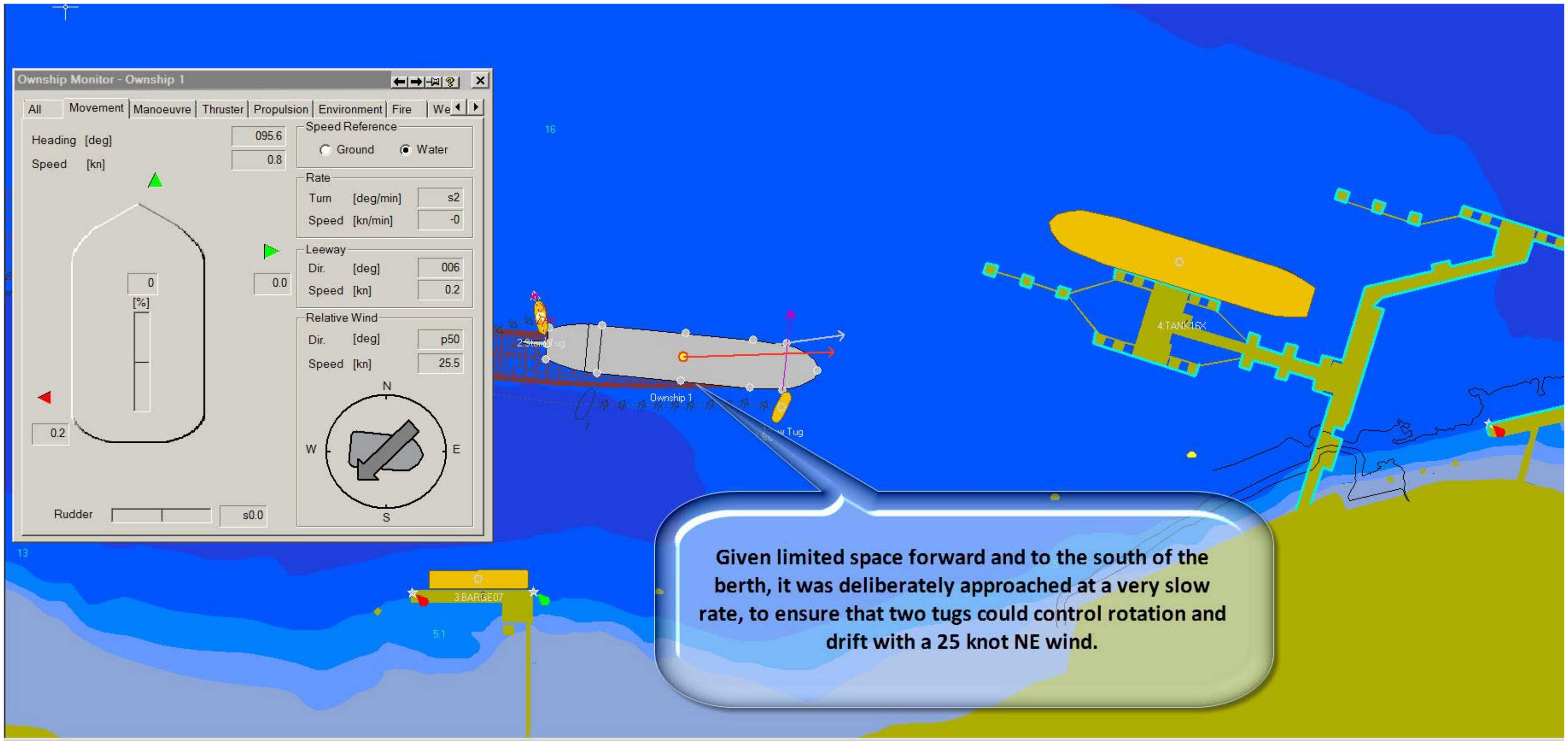


Illustration 6 – Inbound Berth 1 Port Side Arrival

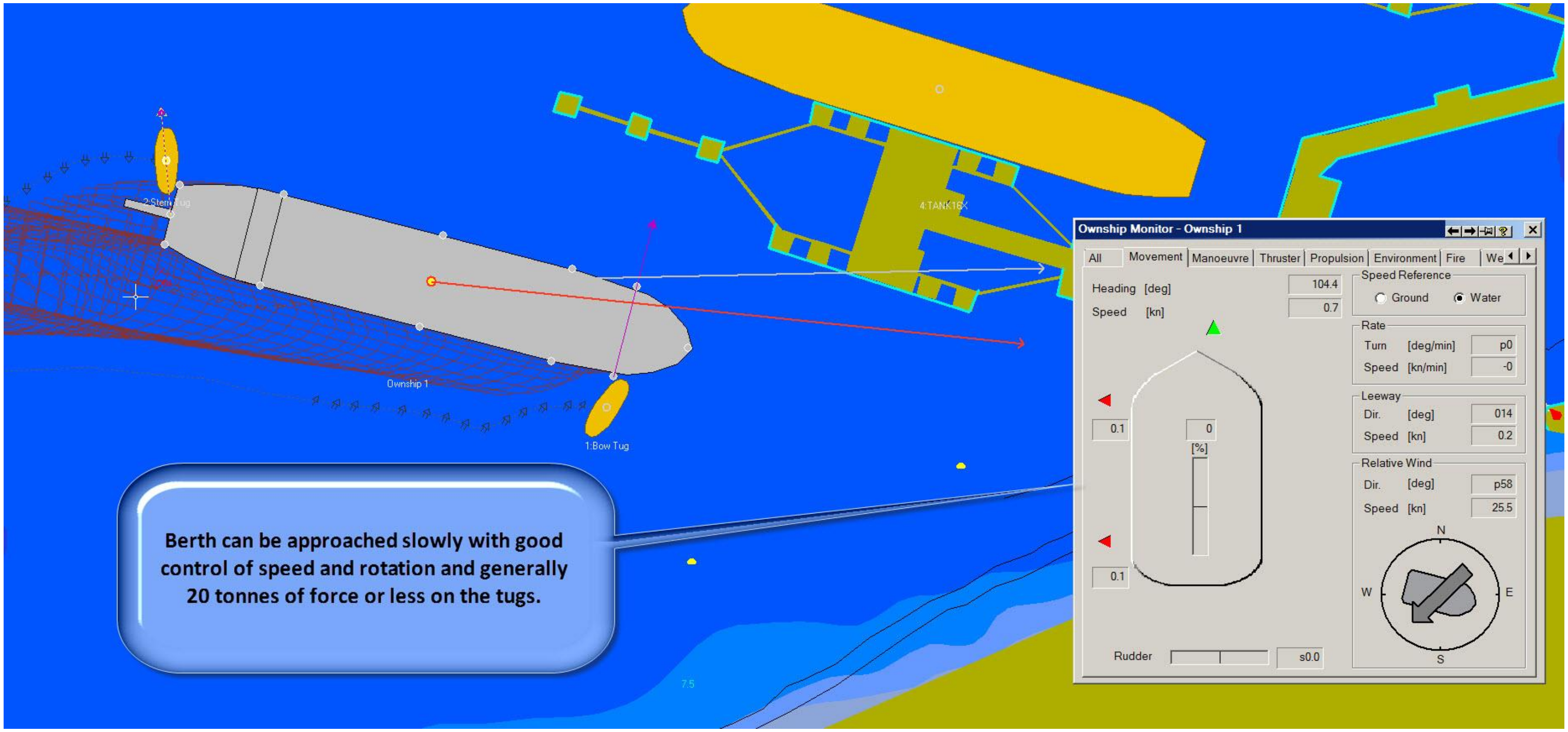


Illustration 7 – Inbound Berth 1 Port Side Arrival

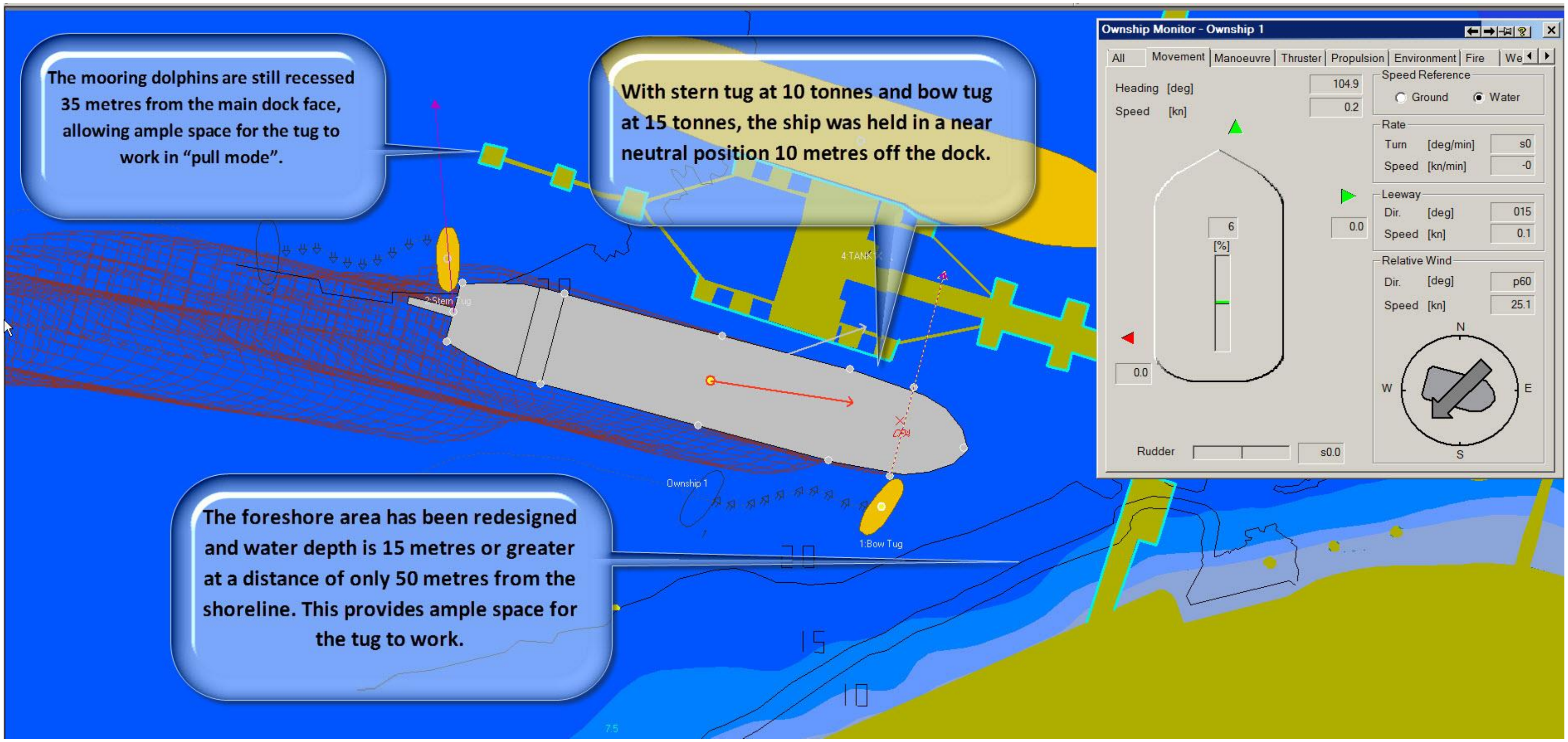


Illustration 8 – Inbound Berth 1 Port Side Arrival

Illustration 9 – Inbound Berth 1 Port Side Arrival

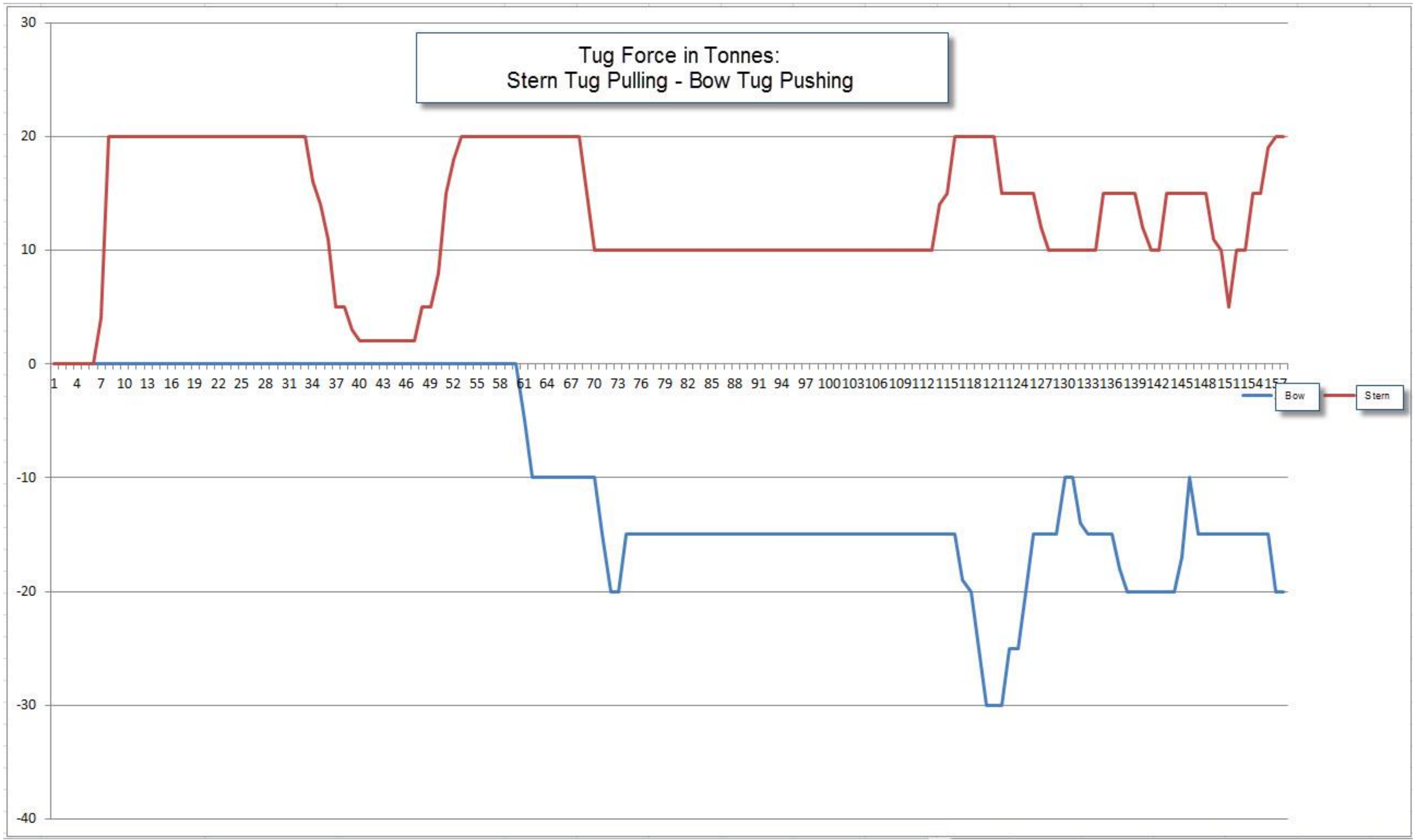


Illustration 10 – Inbound Berth 1 Starboard Side Arrival

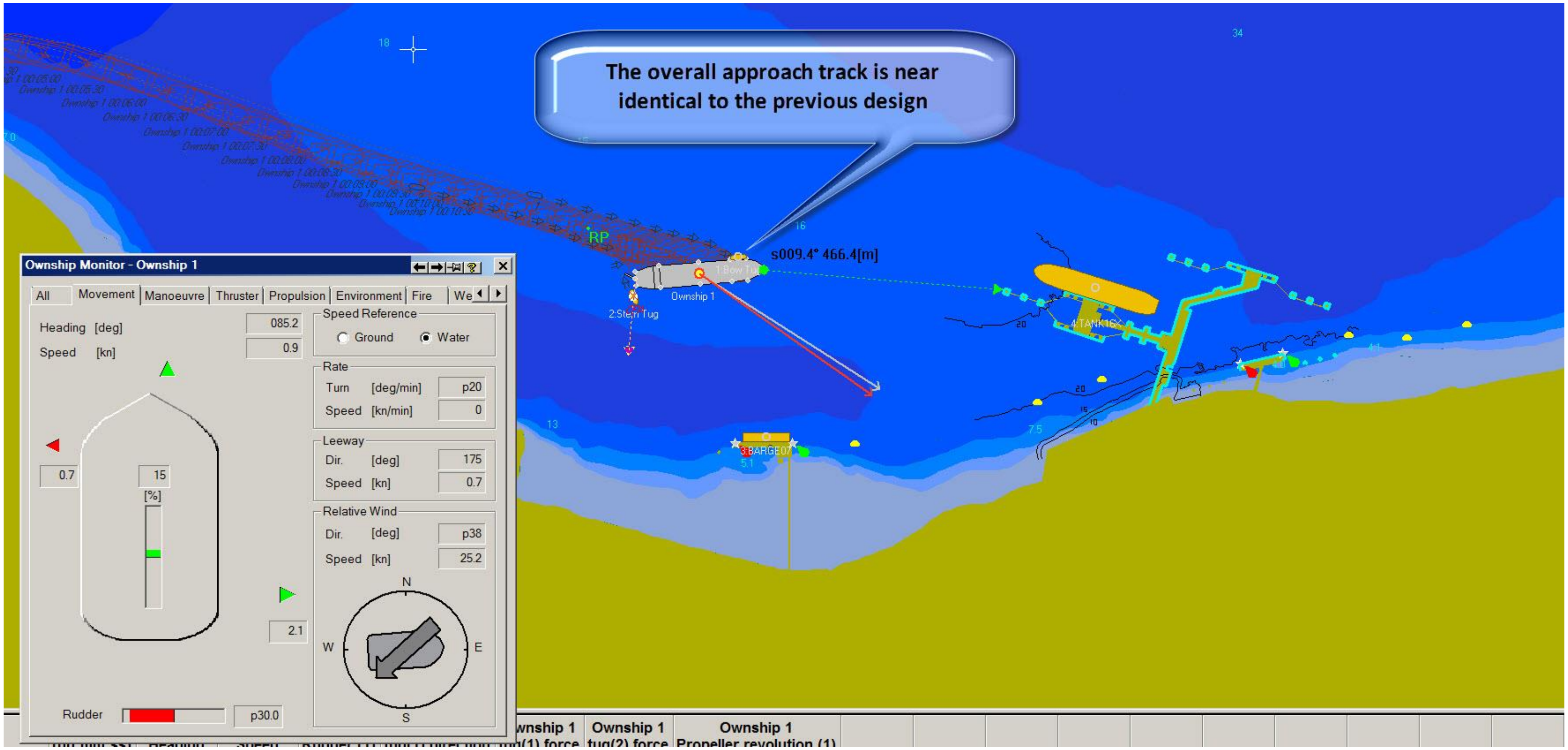


Illustration 11 – Inbound Berth 1 Starboard Side Arrival

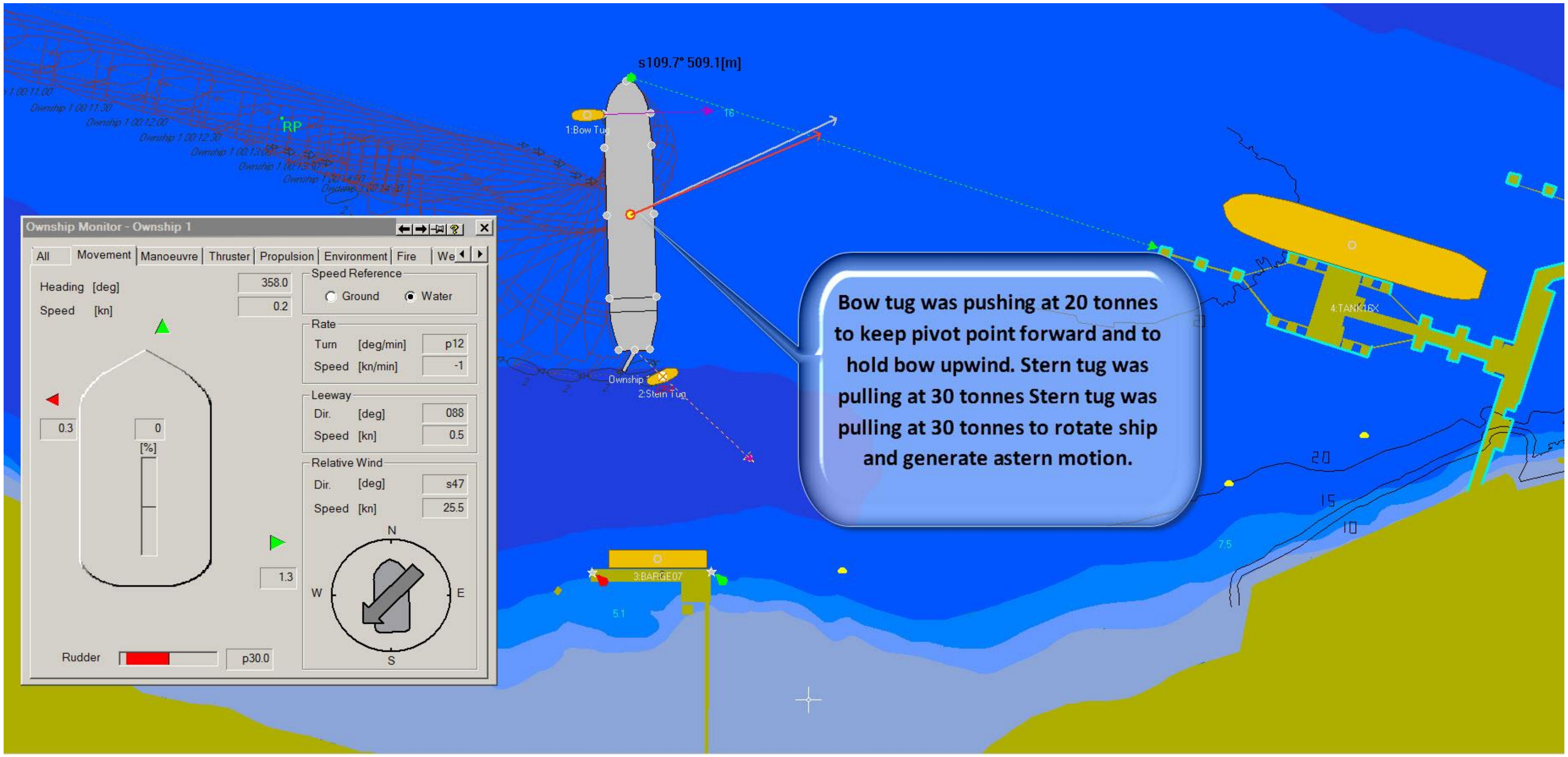


Illustration 12 – Inbound Berth 1 Starboard Side Arrival

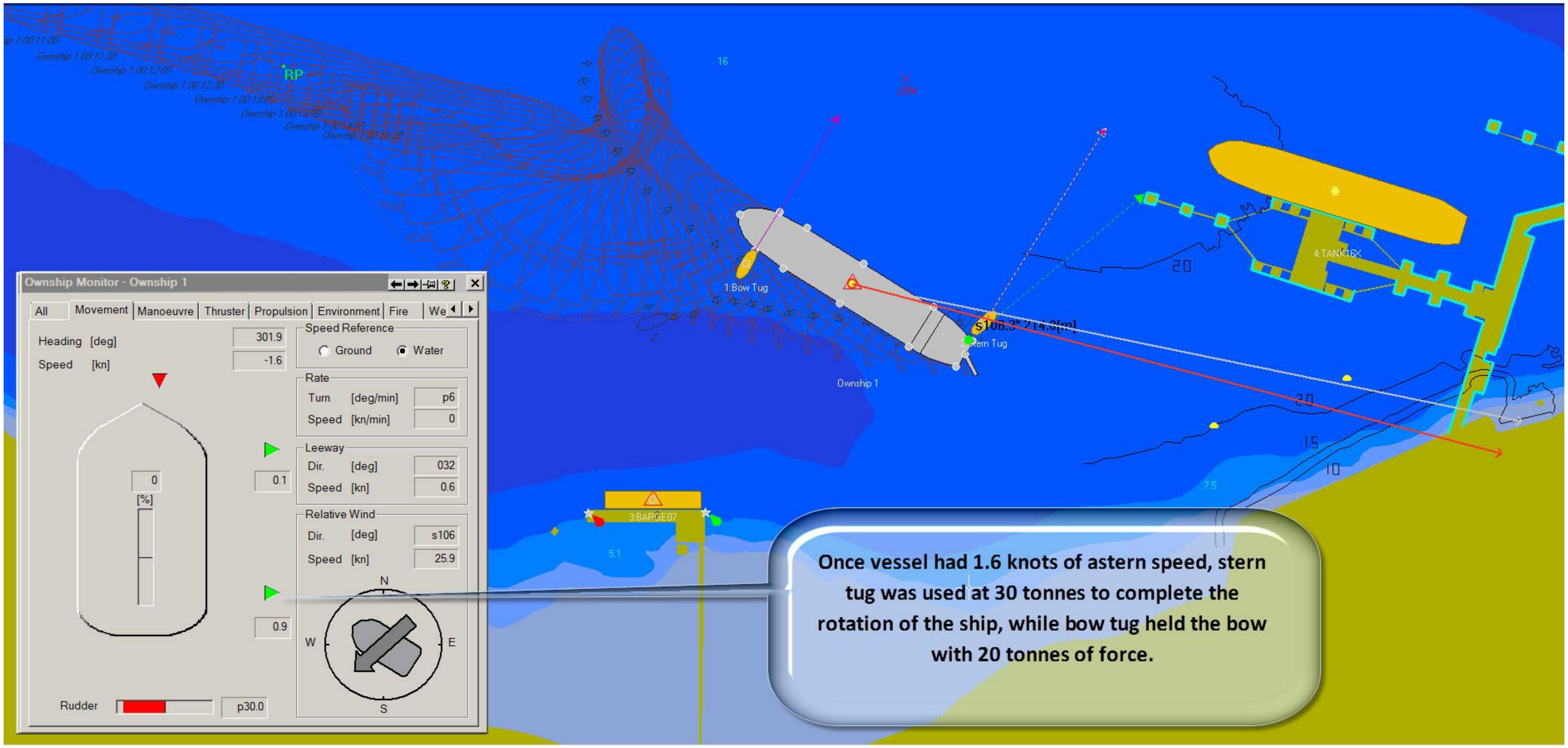


Illustration 13 – Inbound Berth 1 Starboard Side Arrival

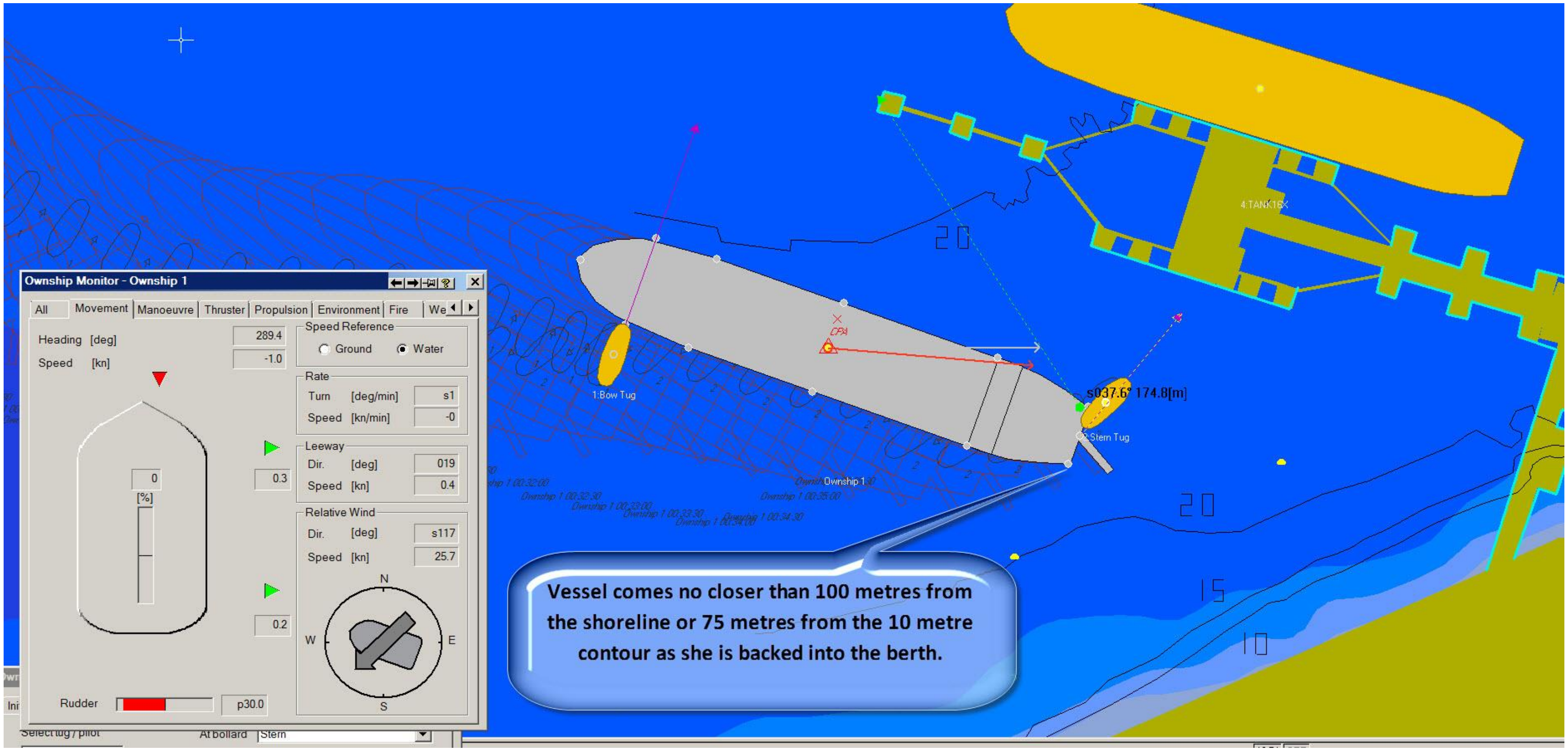


Illustration 14 – Inbound Berth 1 Starboard Side Arrival

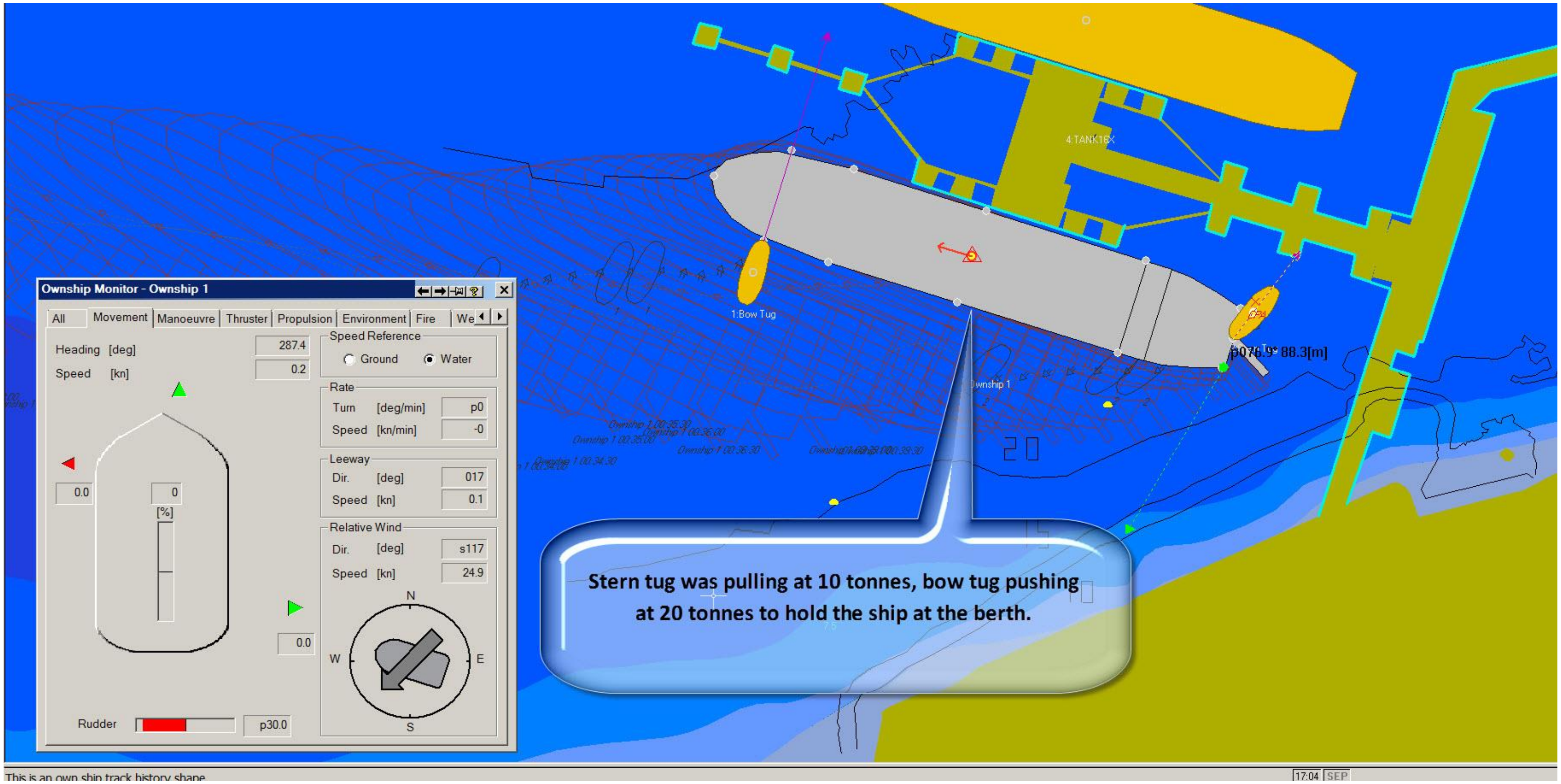


Illustration 15 – Inbound Berth 1 Starboard Side Arrival

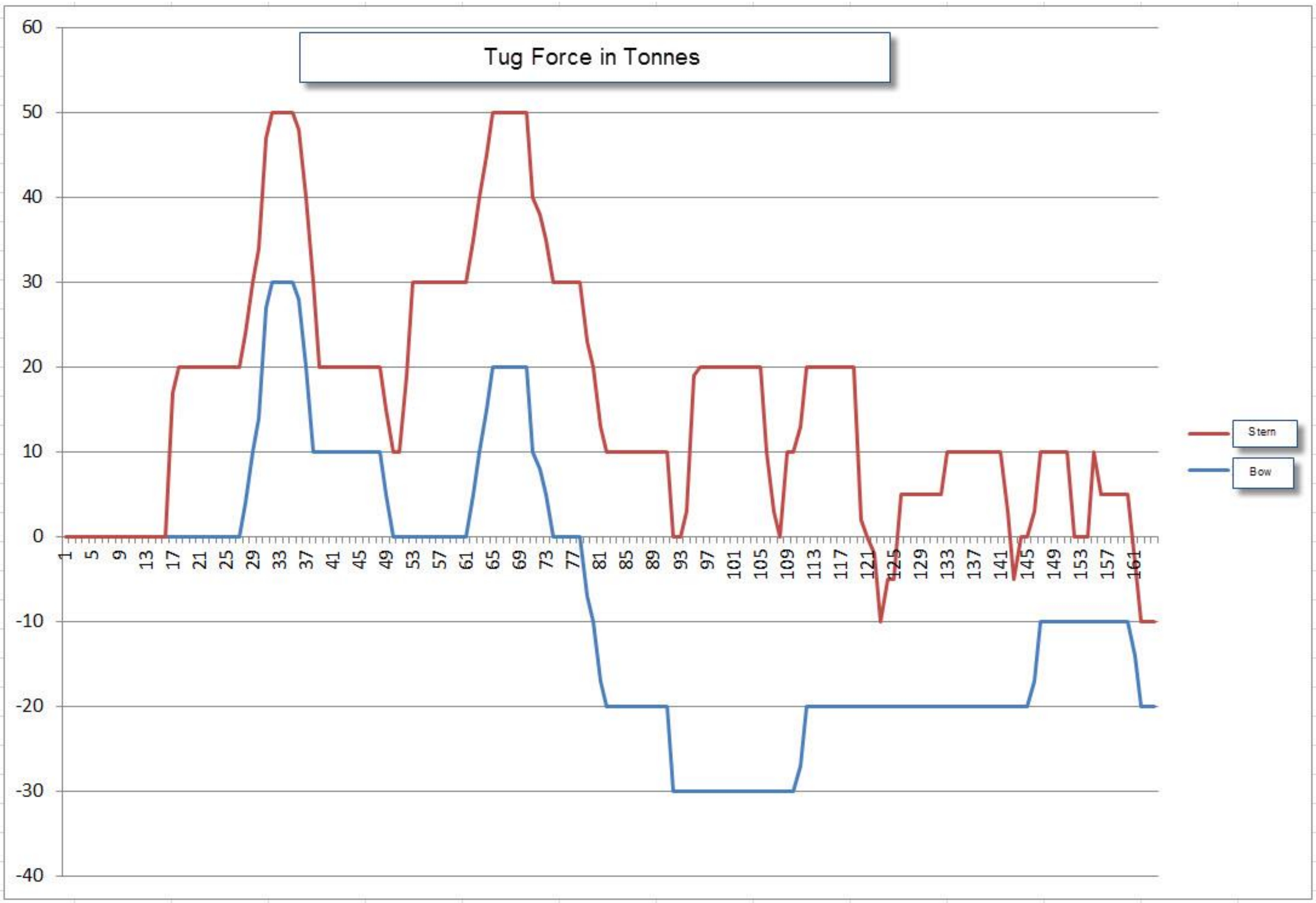


Illustration 16 – Outbound Berth 1 Port Side Departure

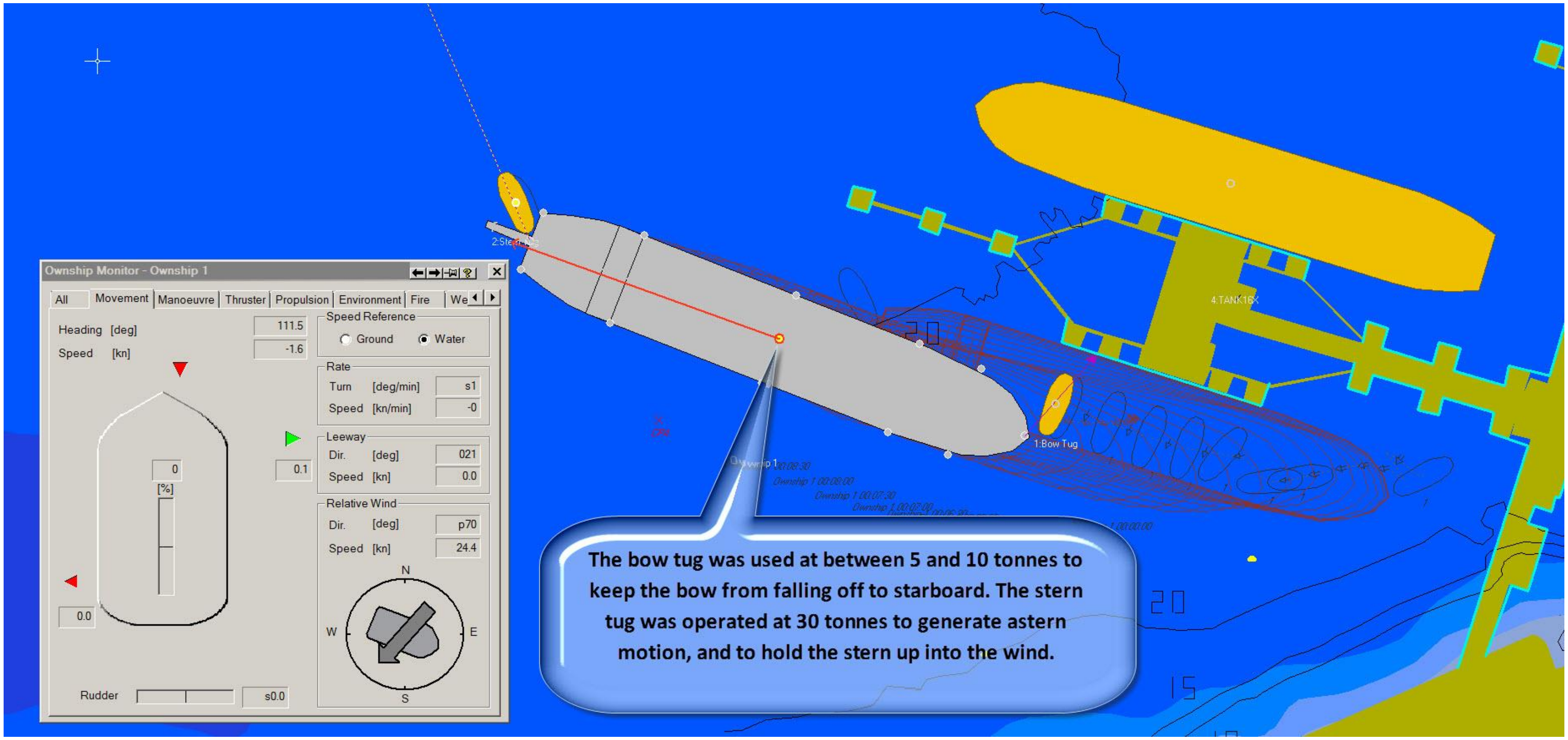


Illustration 17 – Outbound Berth 1 Port Side Departure

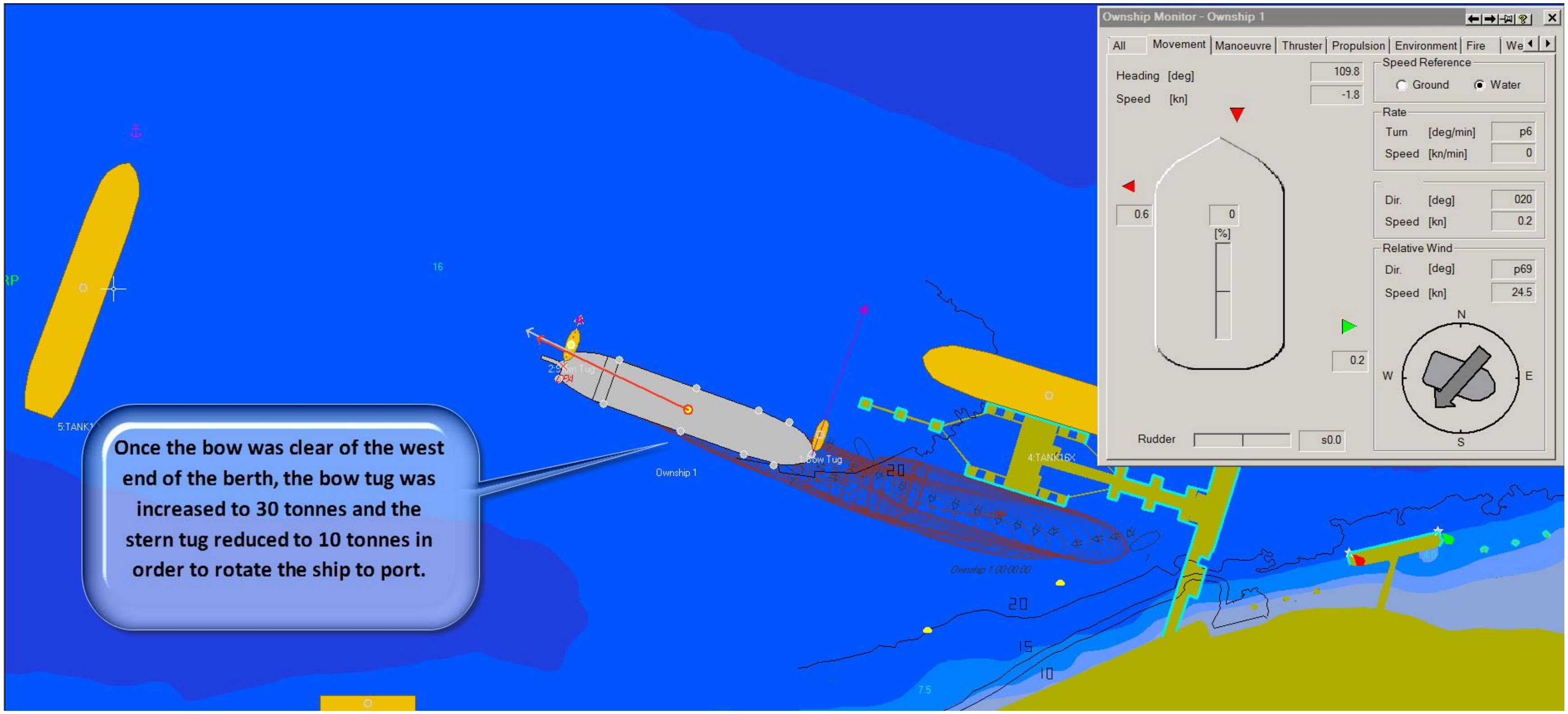


Illustration 18 – Outbound Berth 1 Port Side

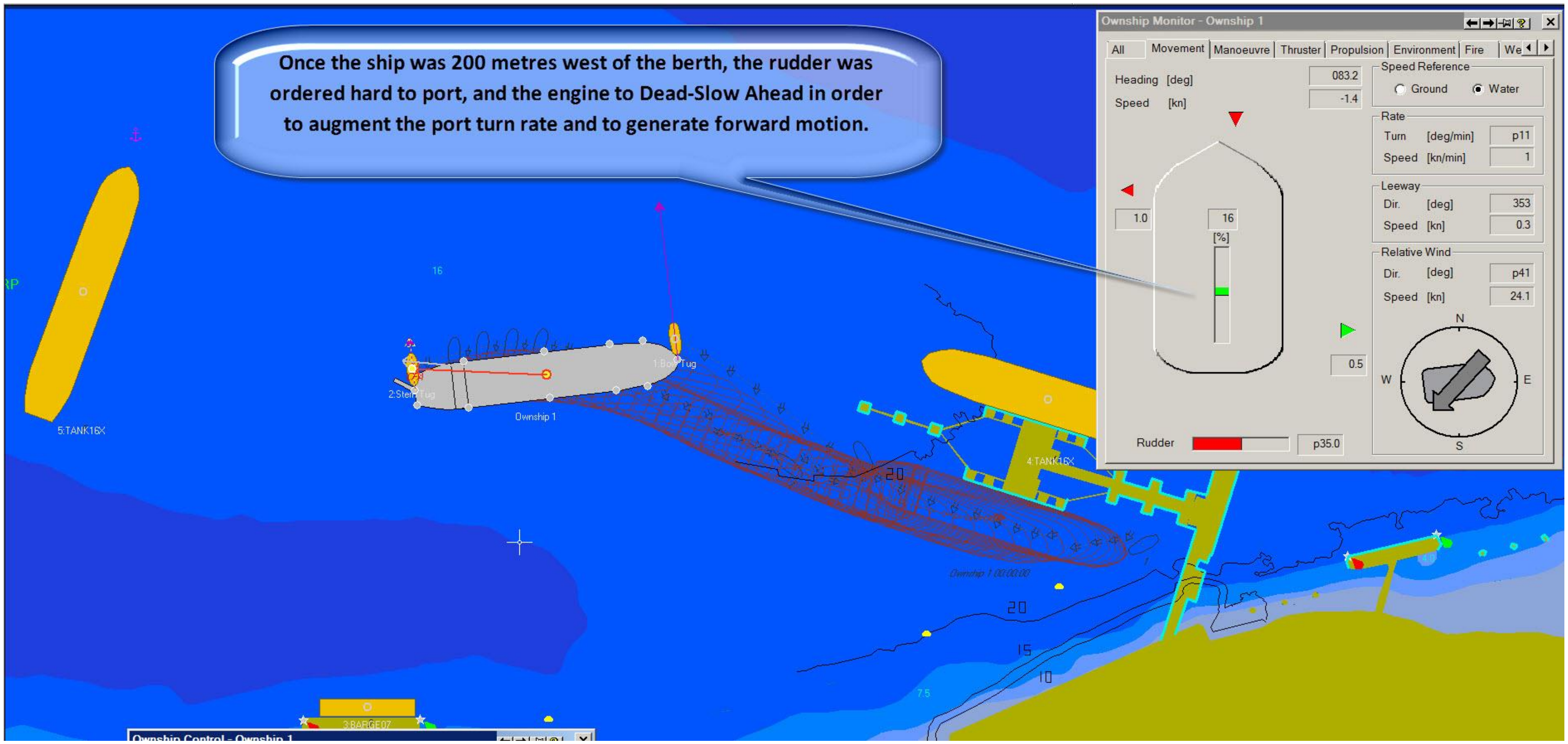


Illustration 19 – Outbound Berth 1 Port Side Departure

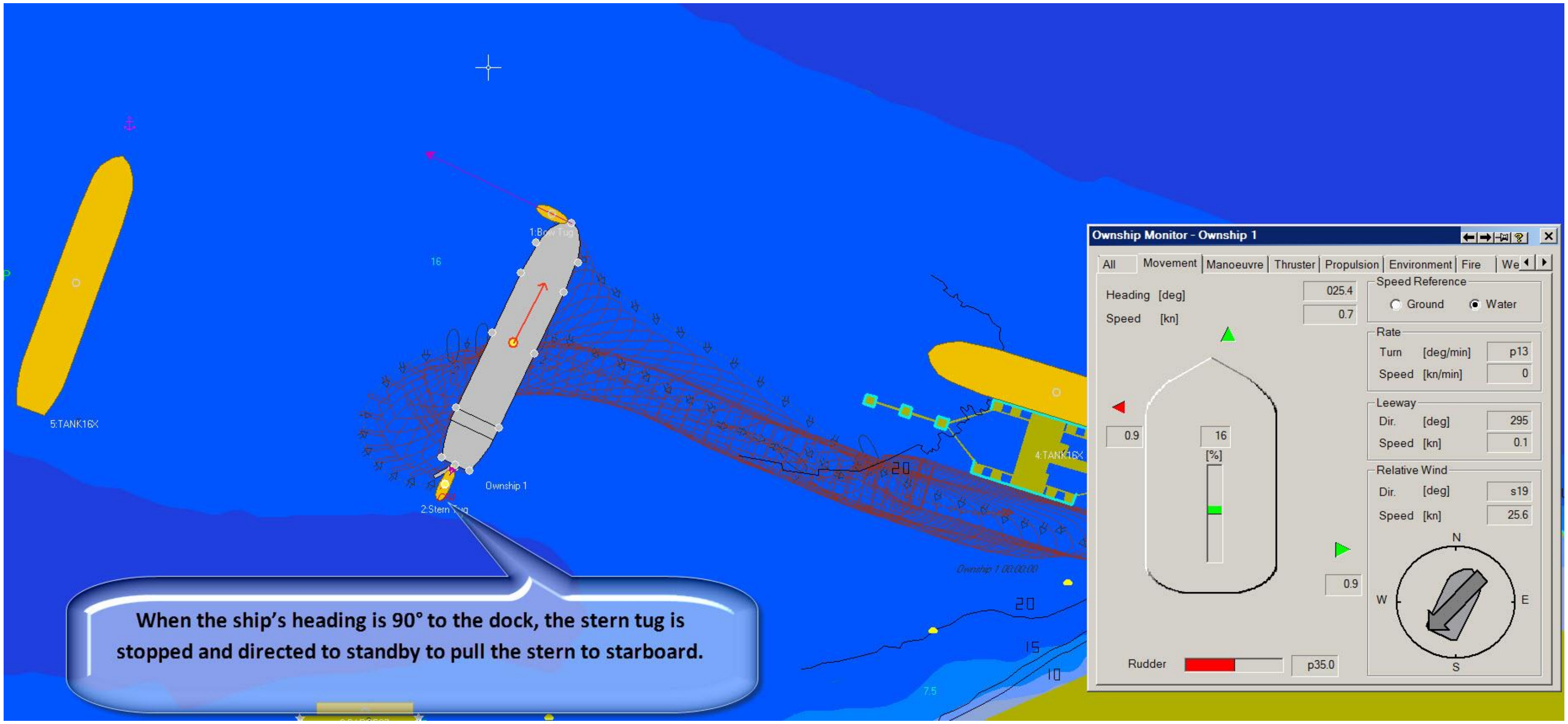


Illustration 20 – Outbound Berth 1 Port Side Departure

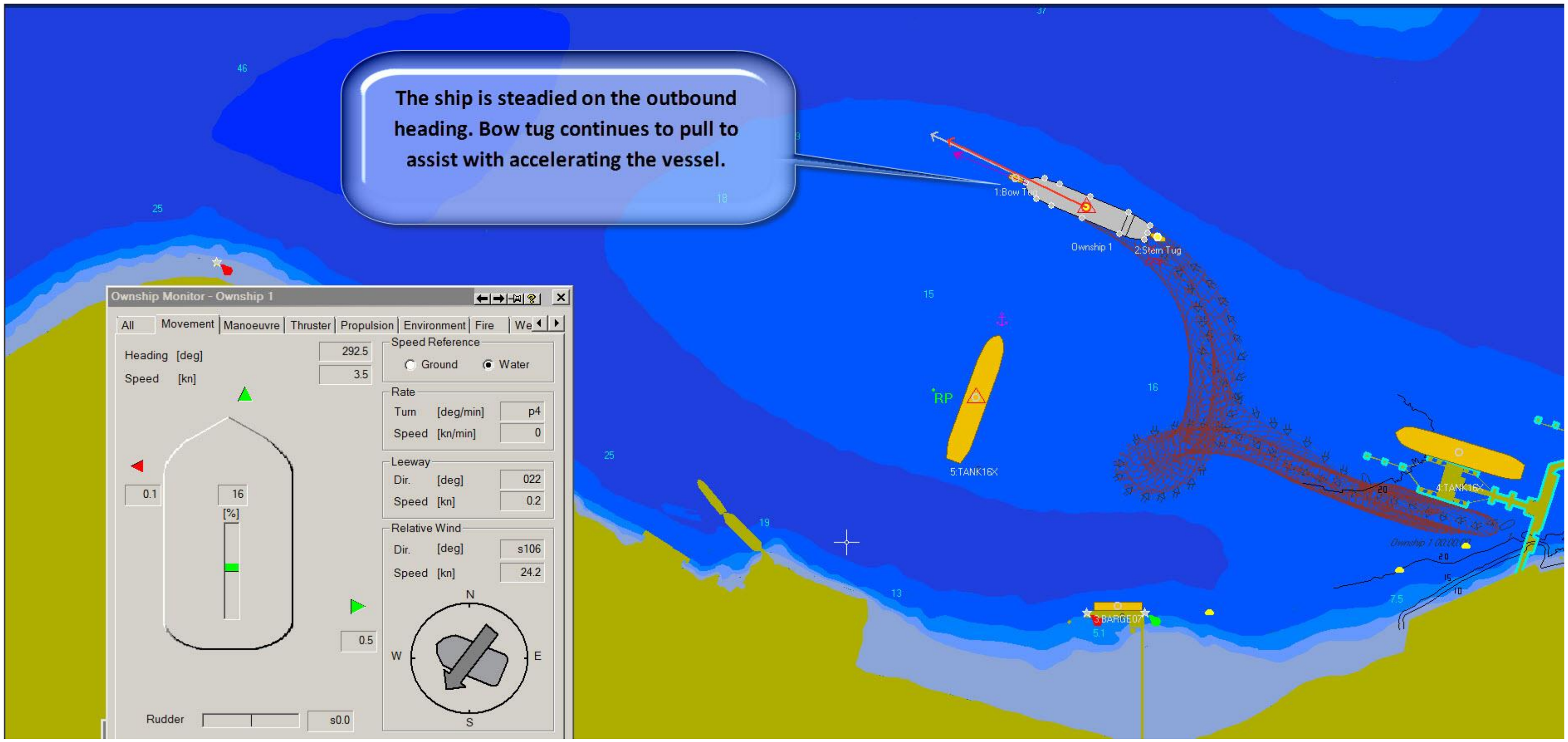


Illustration 21 – Outbound Berth 1 Port Side Departure

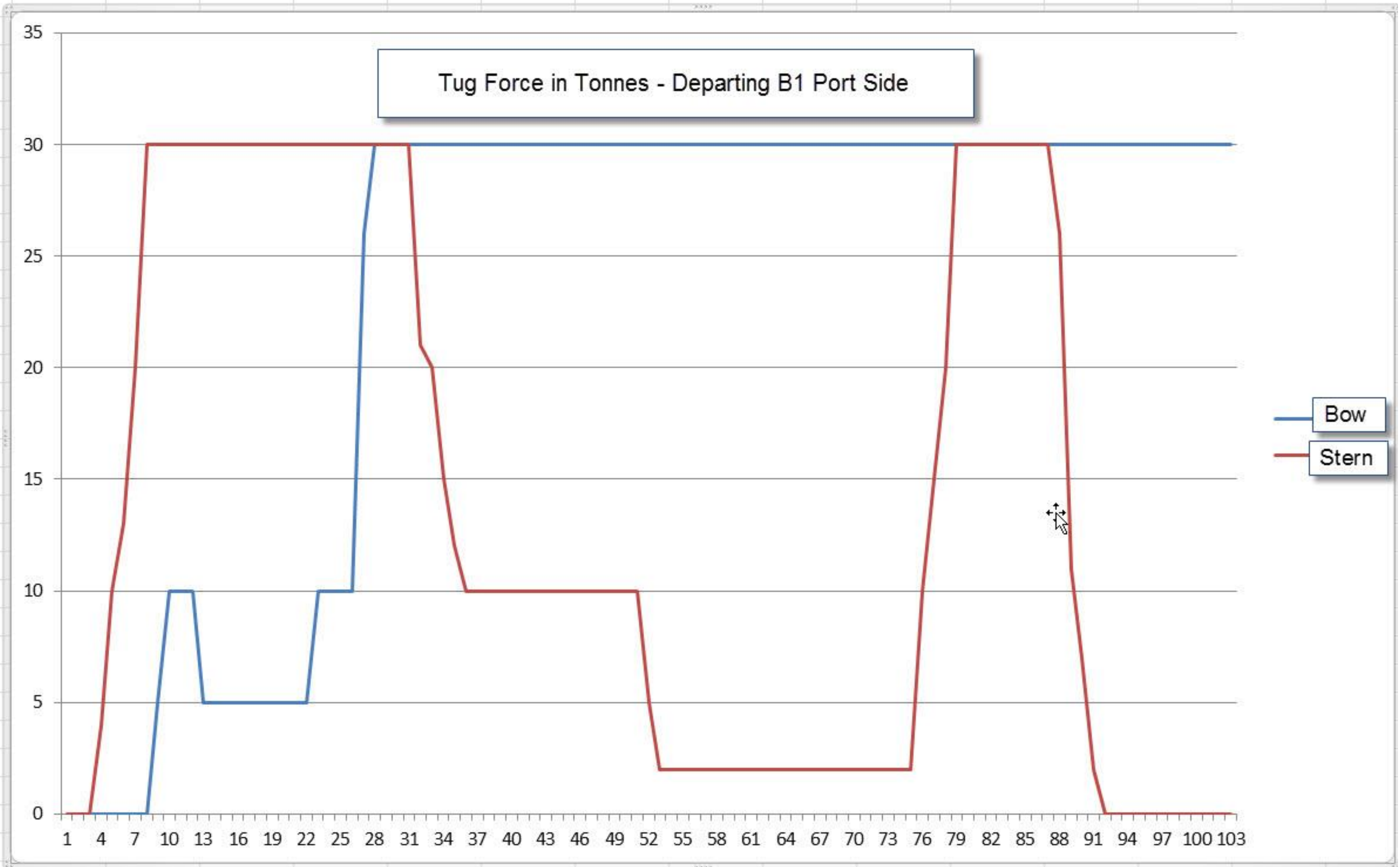


Illustration 22 – Outbound Berth 1 Starboard Side Departure

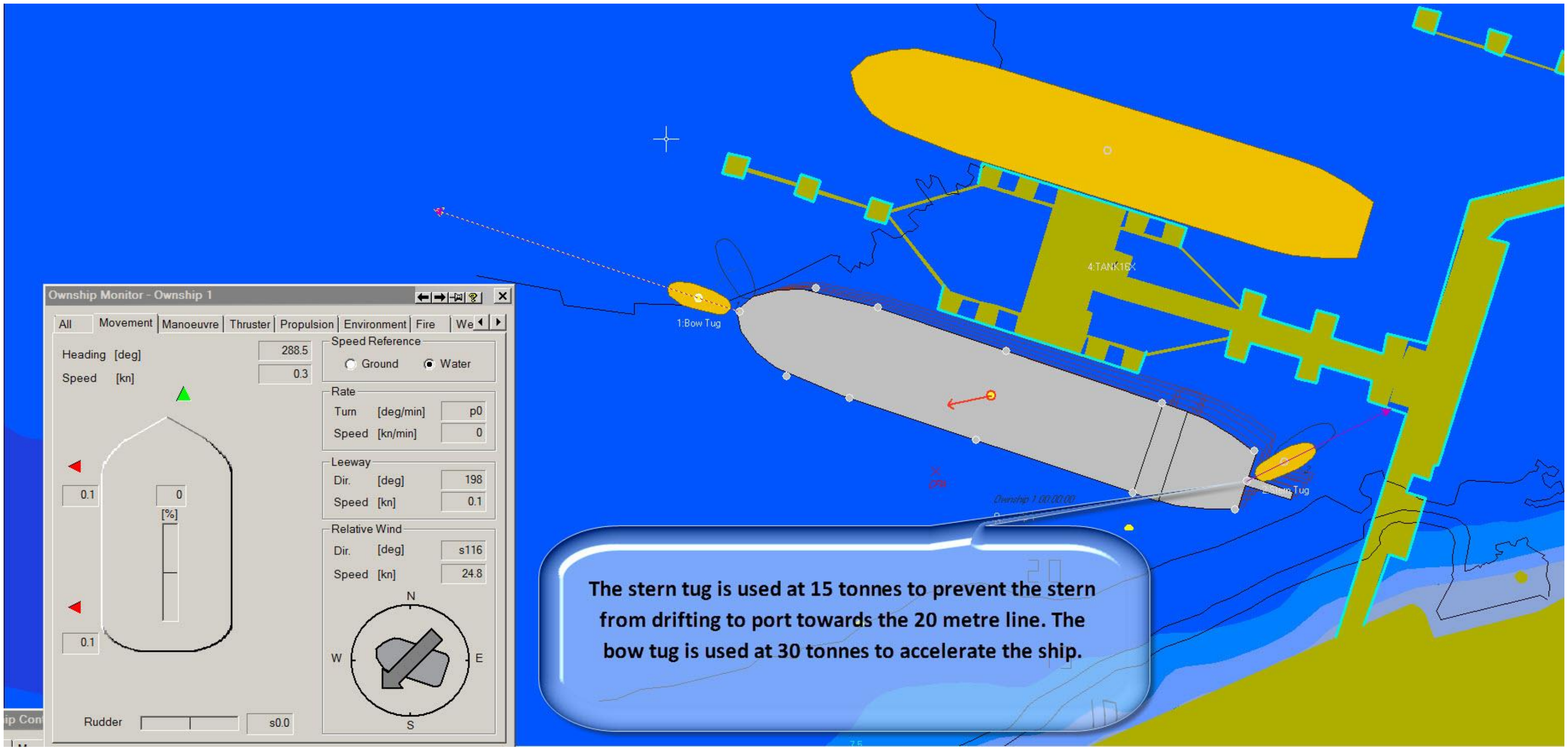


Illustration 23 – Outbound Berth 1 Starboard Side Departure

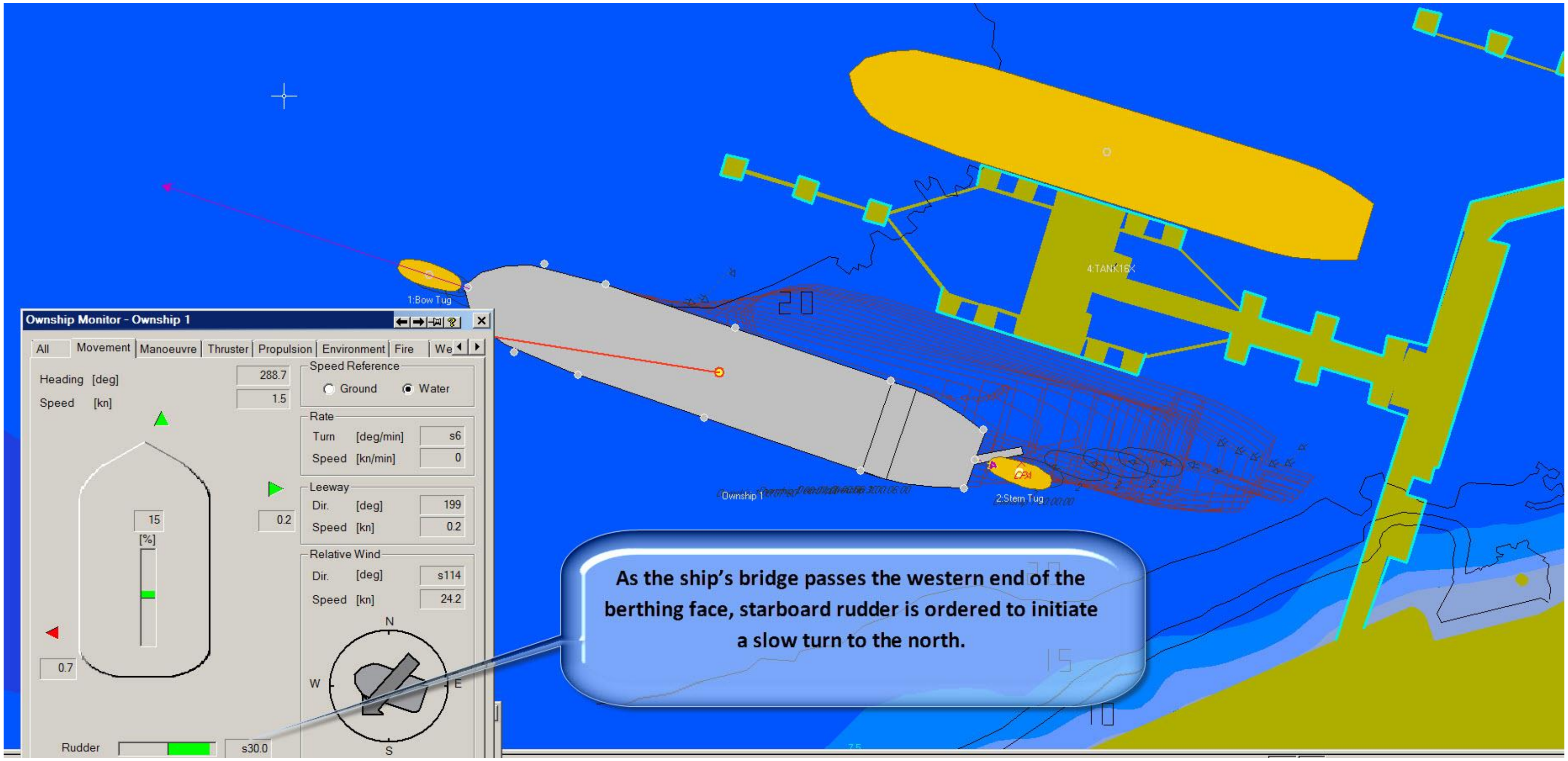


Illustration 24 – Outbound Berth 1 Starboard Side Departure

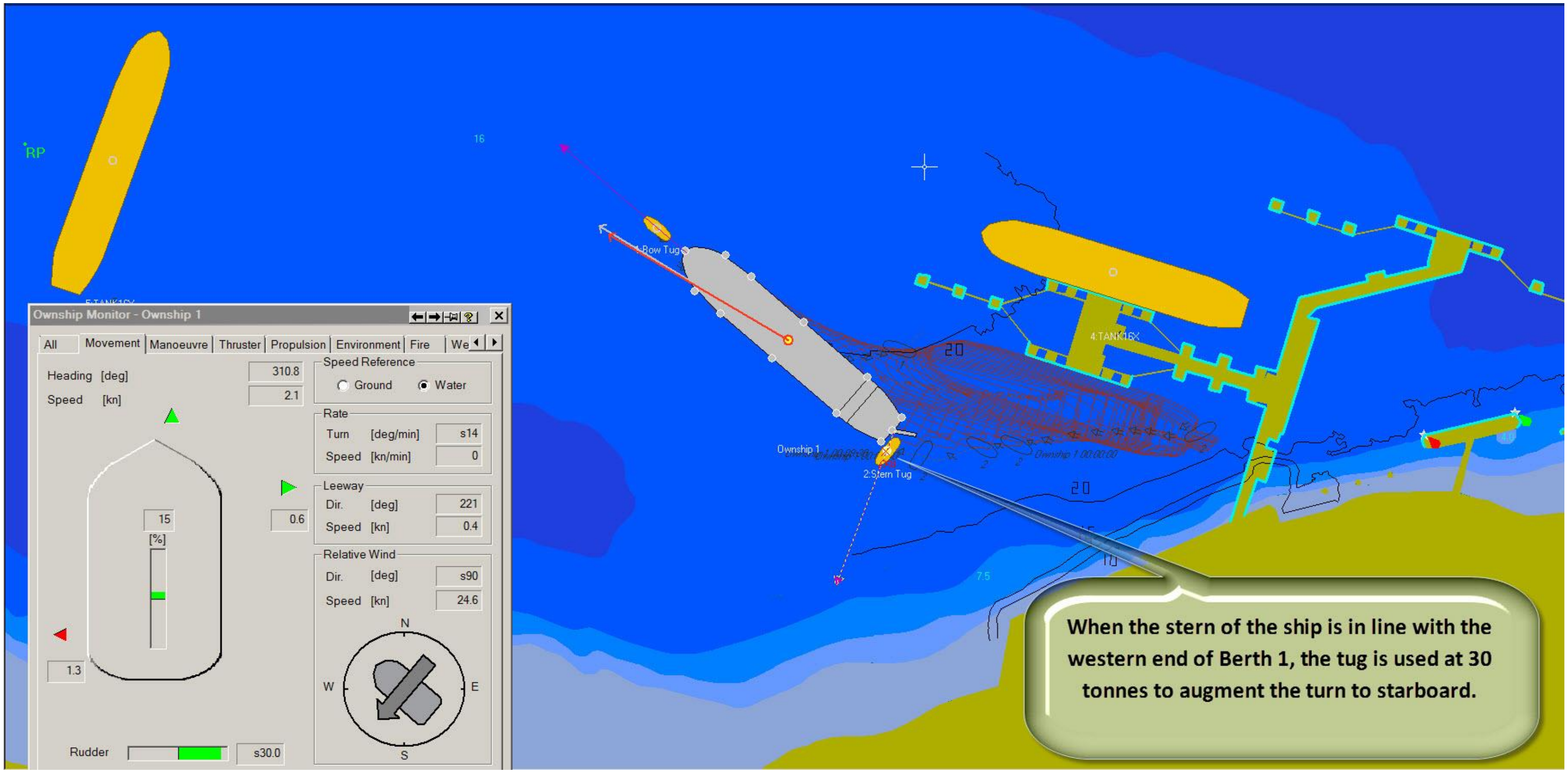


Illustration 25 – Outbound Berth 1 Starboard Side Departure

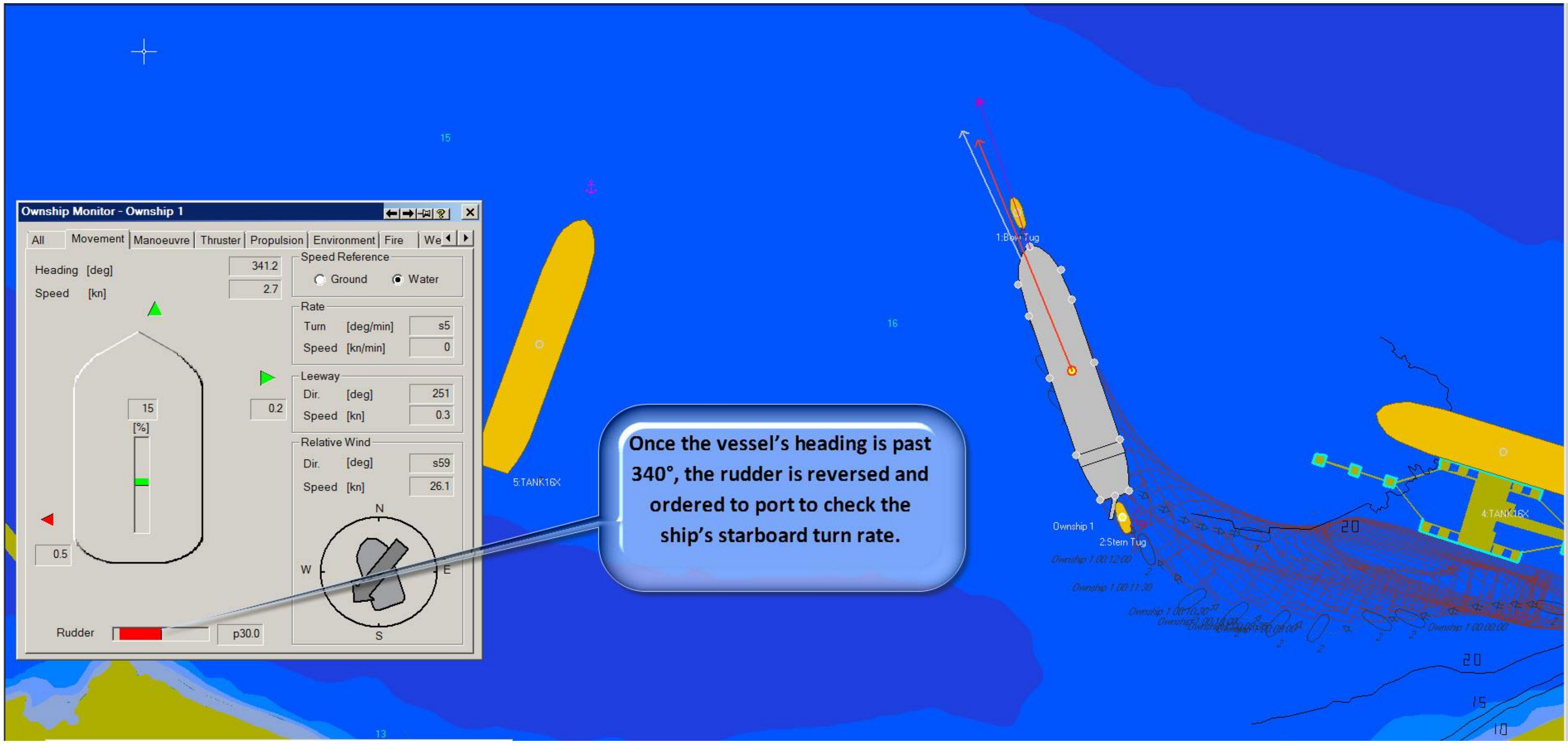


Illustration 26 – Outbound Berth 1 Starboard Side Departure

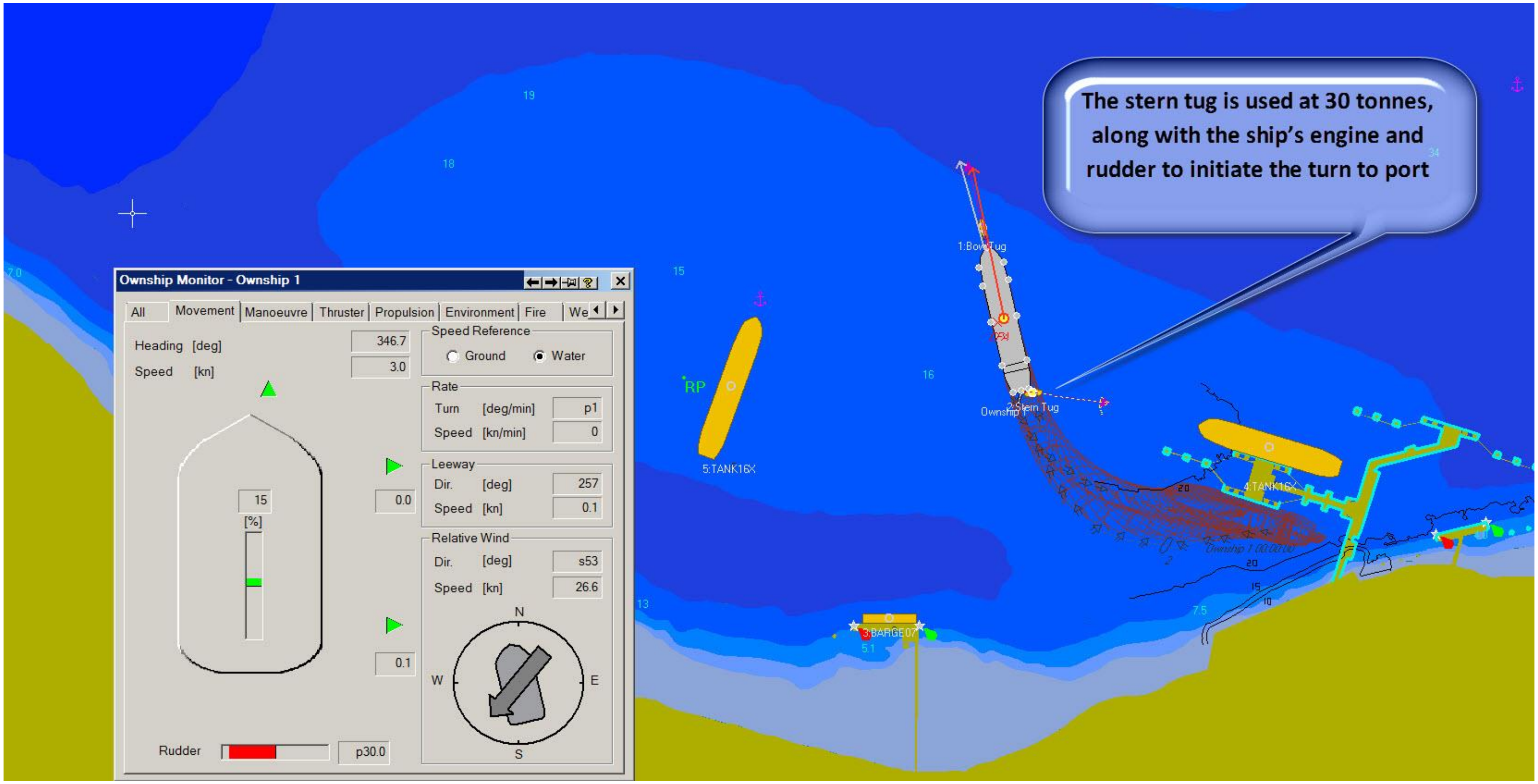


Illustration 27 – Outbound Berth 1 Starboard Side Departure

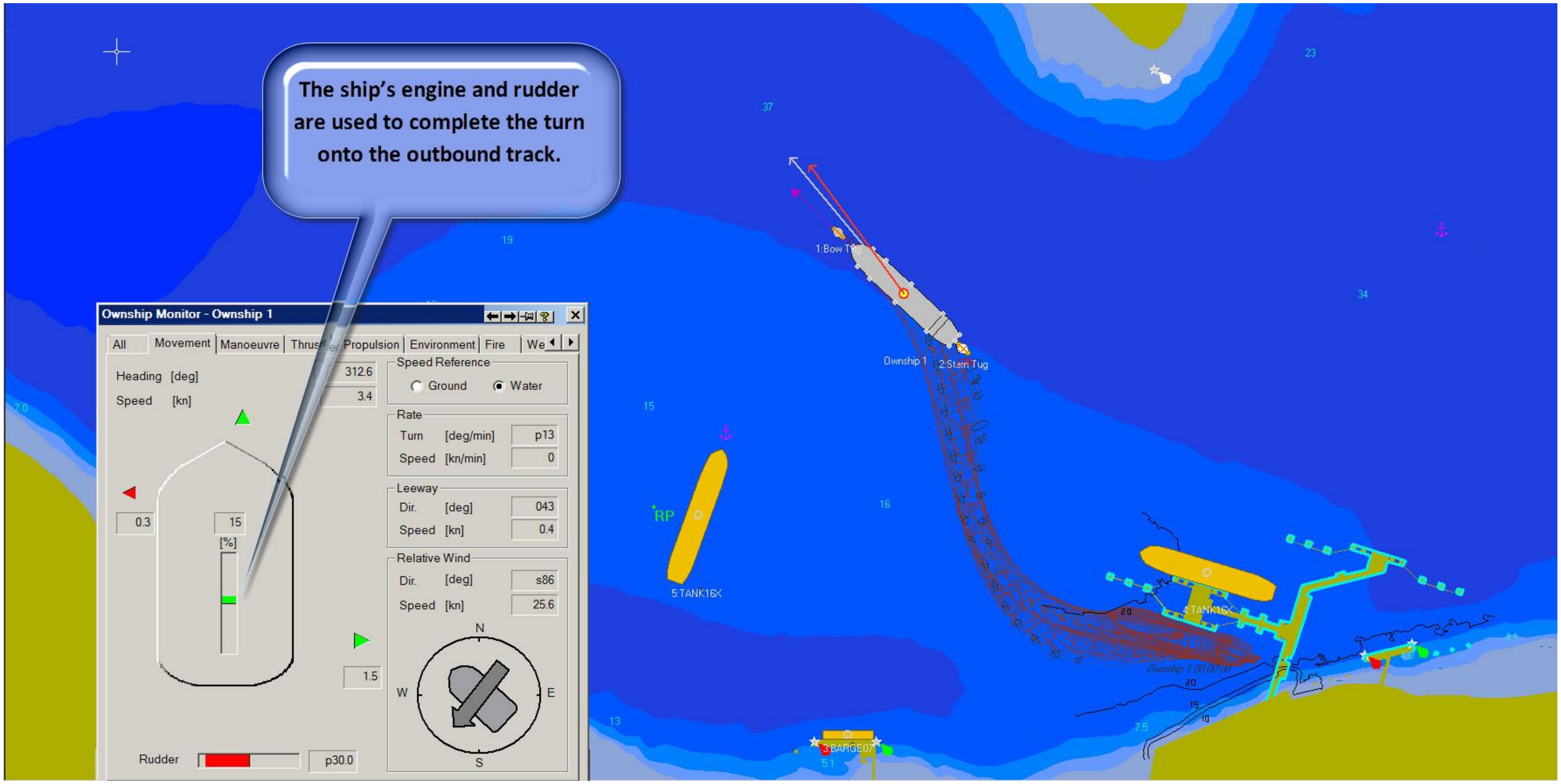


Illustration 28 – Outbound Berth 1 Starboard Side Departure

Illustration 29 – Outbound Berth 1 Starboard Side Departure

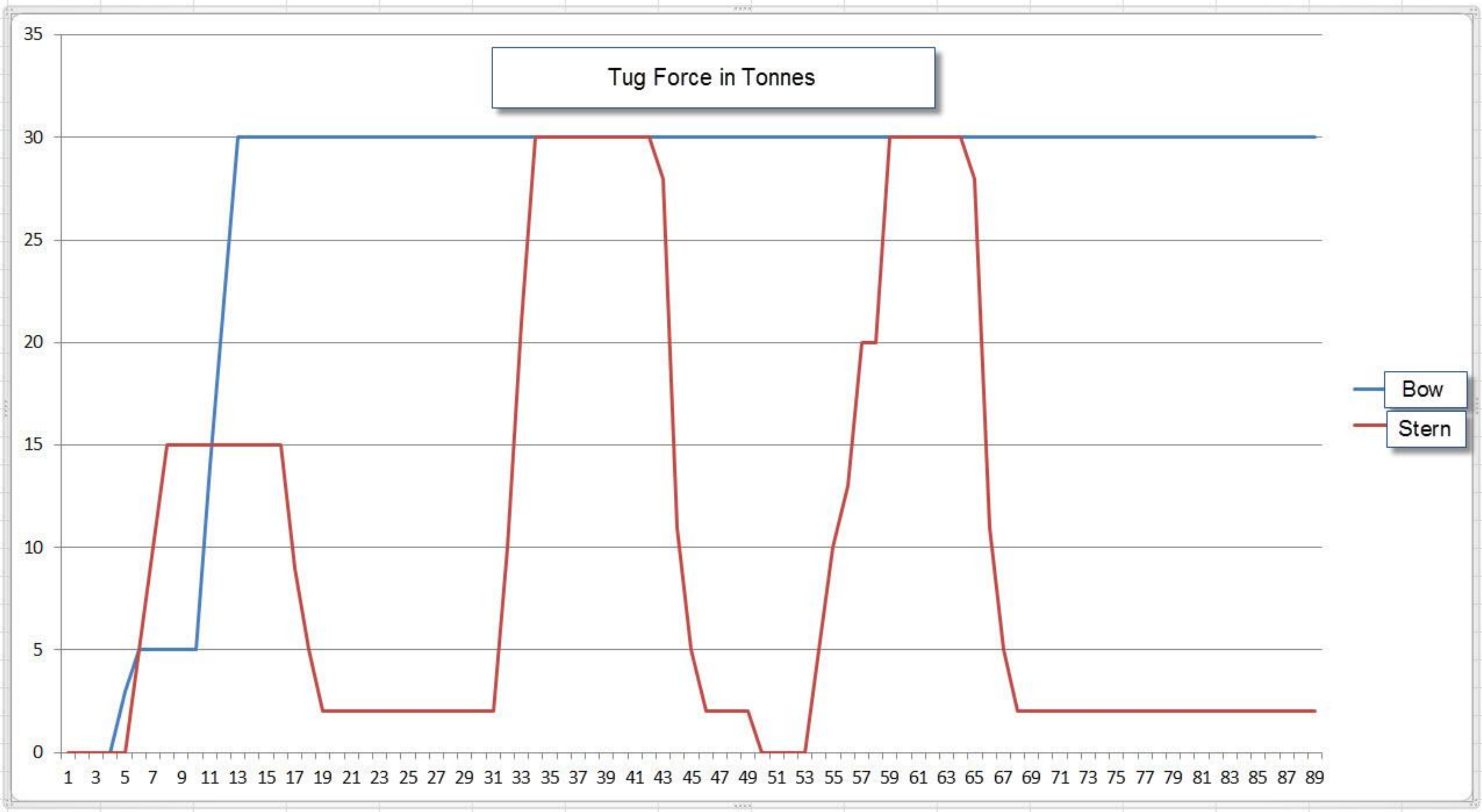


Illustration 30 – Inbound Existing Berth

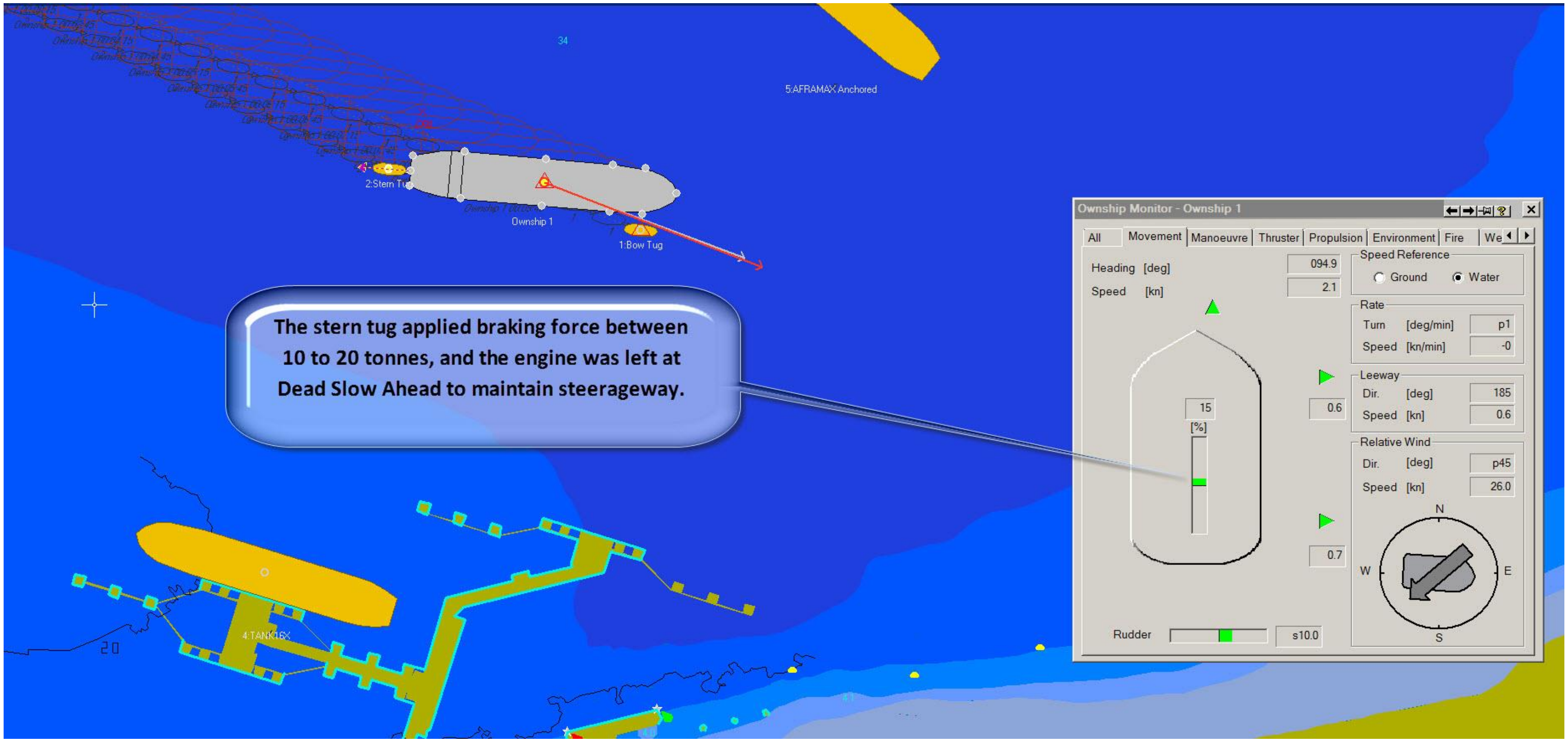


Illustration 31 – Inbound Existing Berth

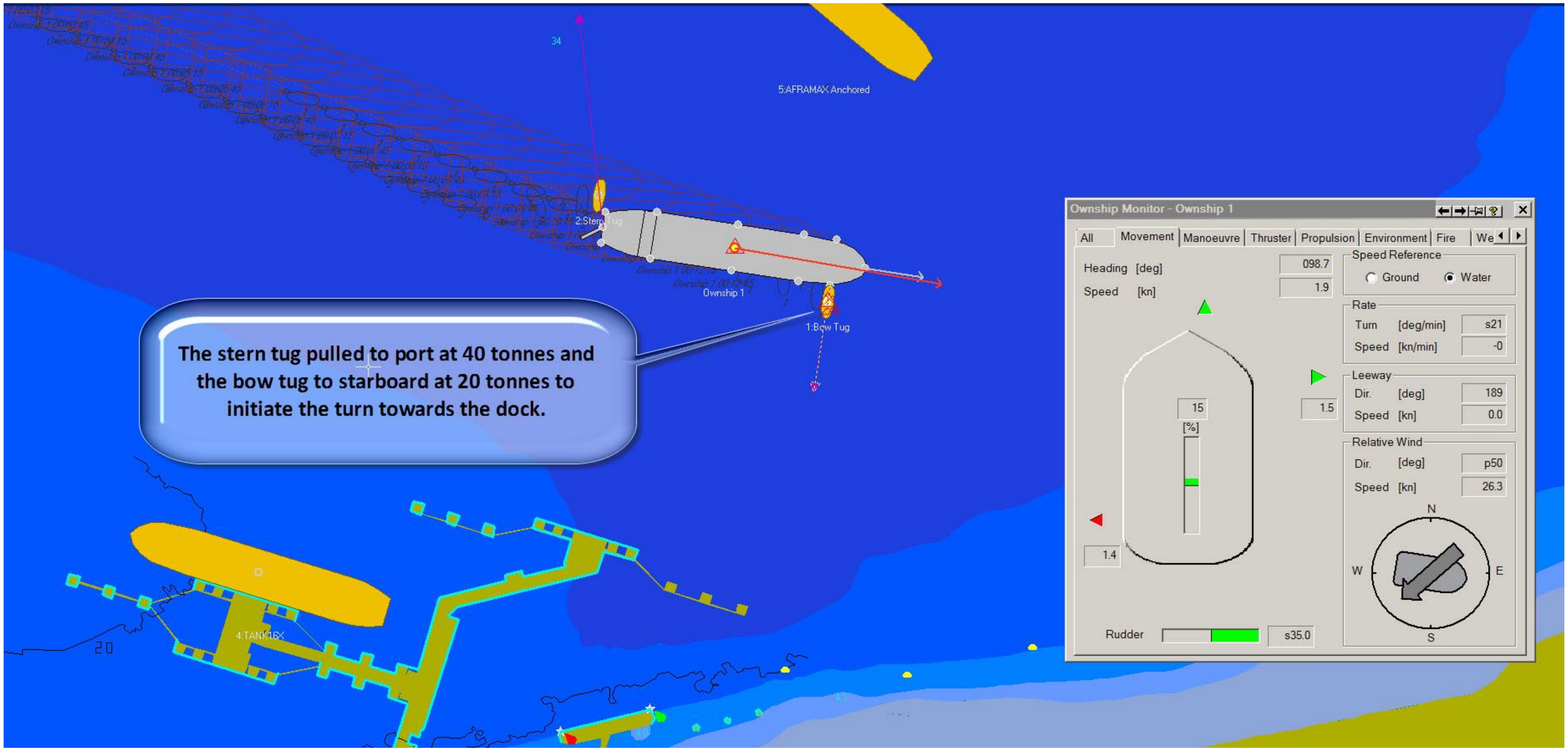


Illustration 32 – Inbound Existing Berth

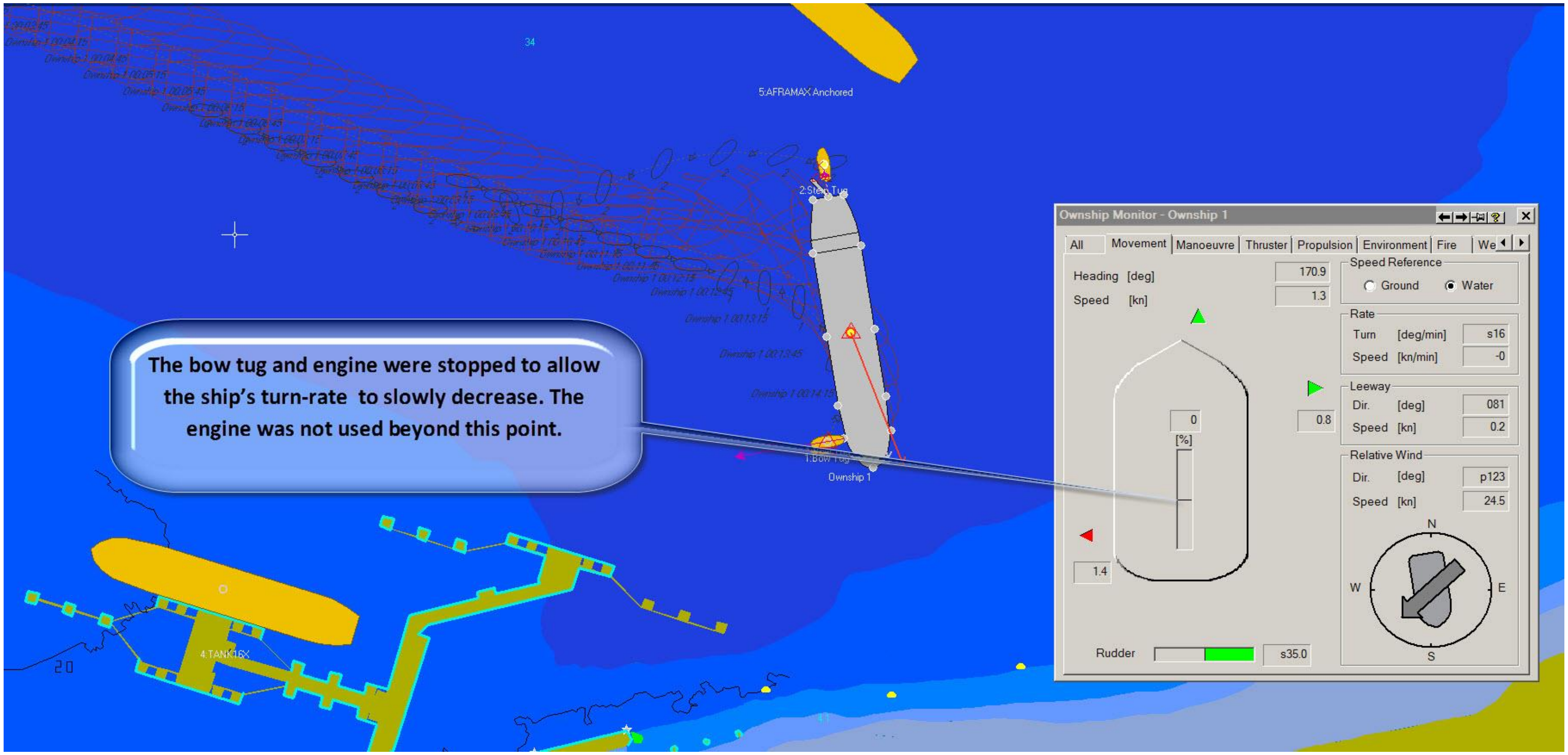


Illustration 33 – Inbound Existing Berth

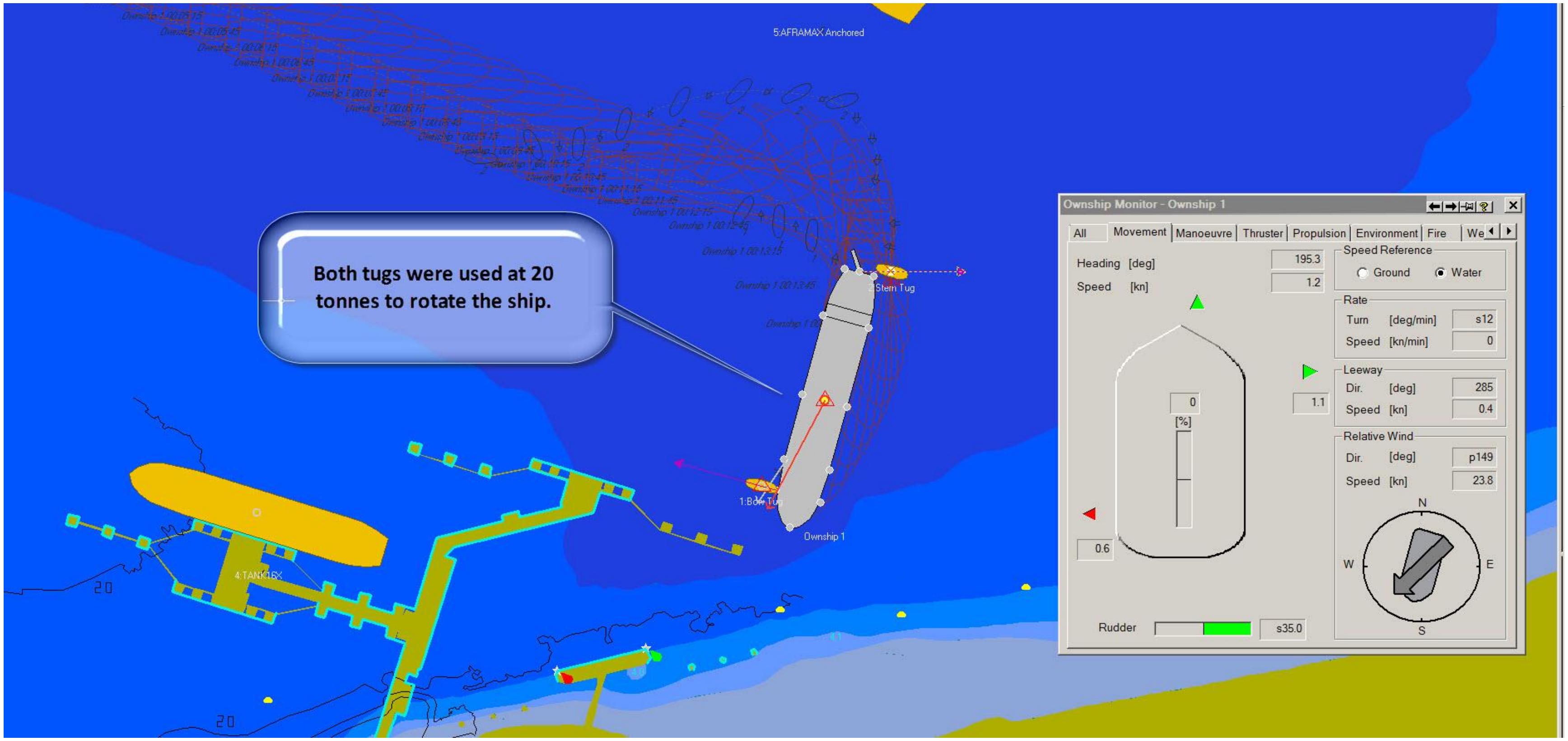


Illustration 34 – Inbound Existing Berth

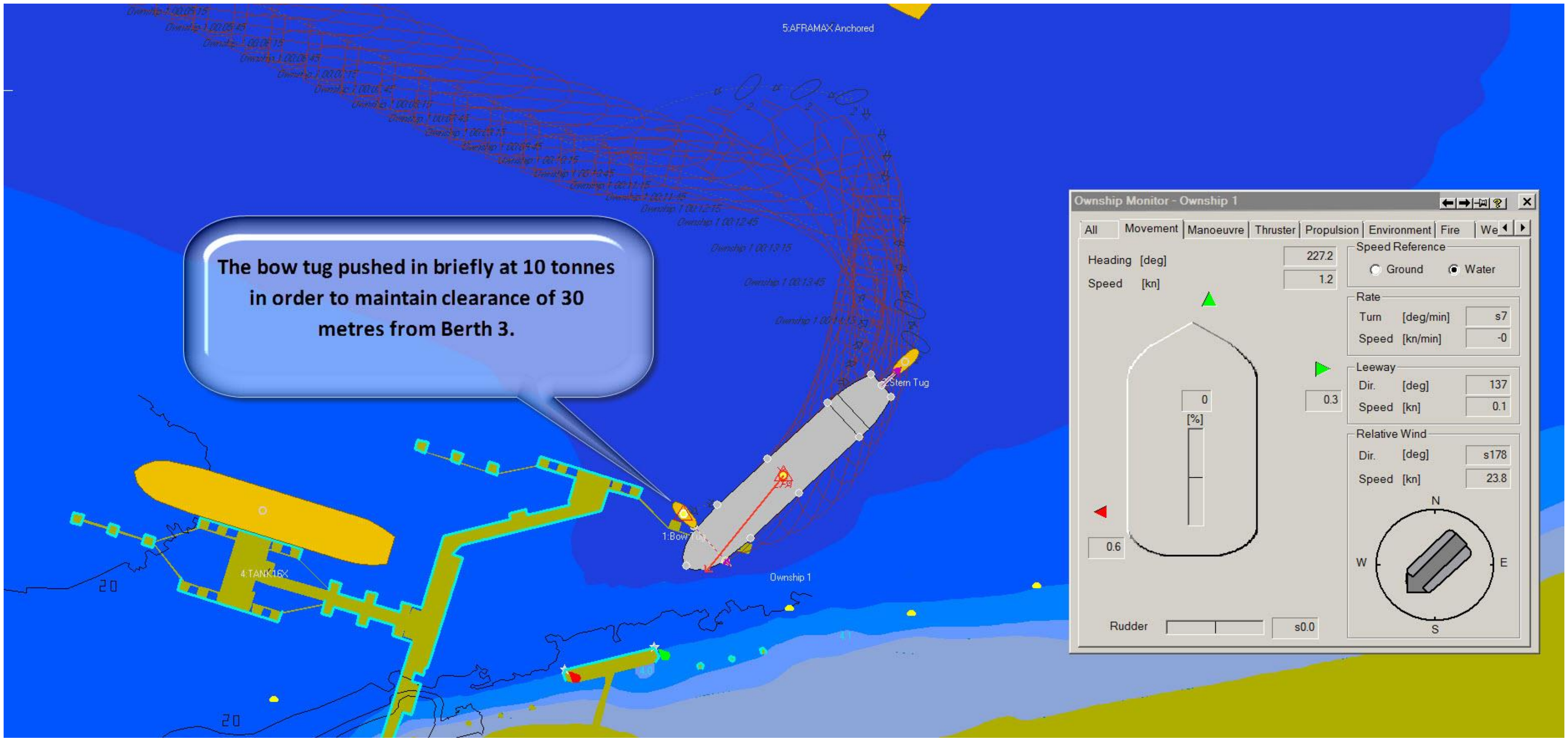


Illustration 35 – Inbound Existing Berth

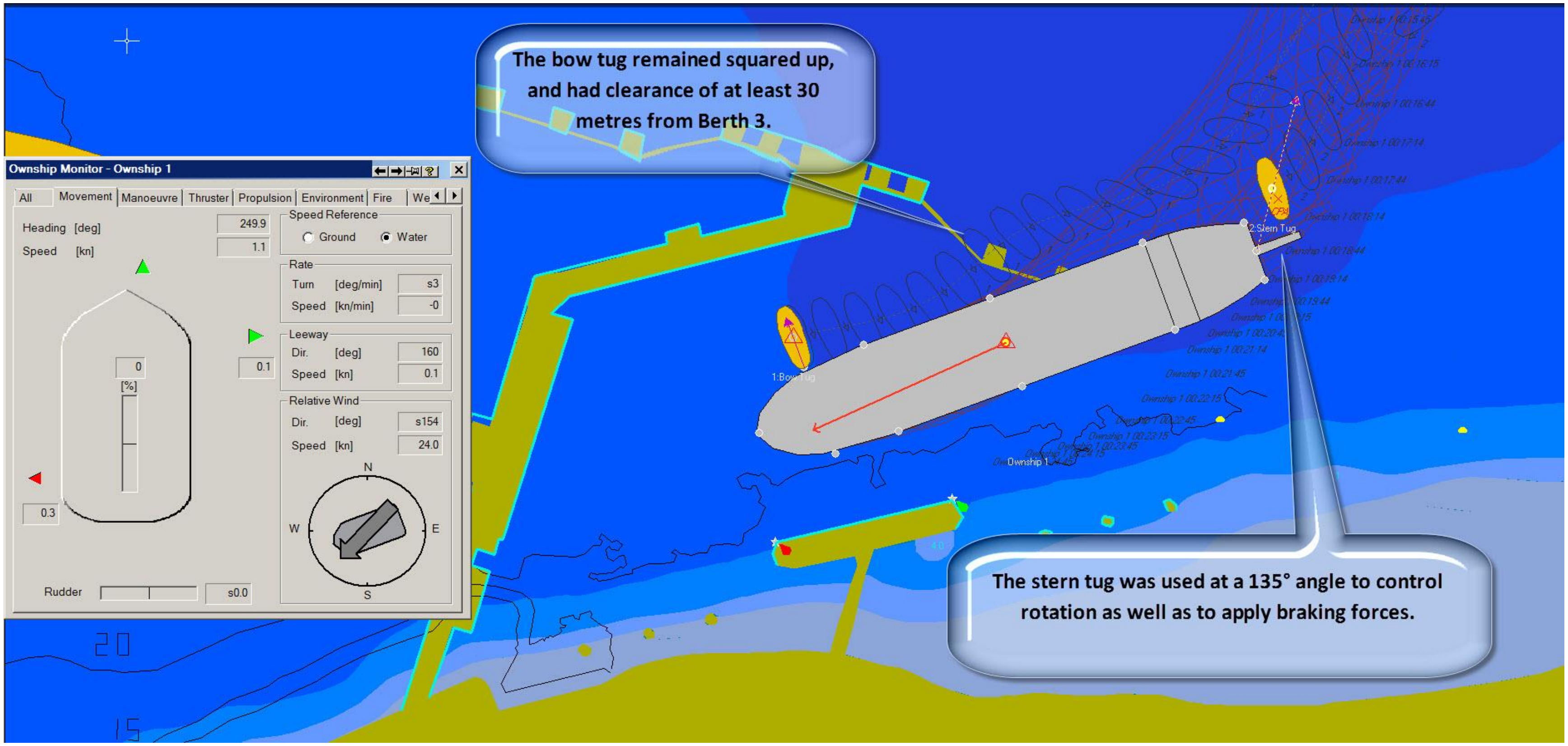


Illustration 36 – Inbound Existing Berth

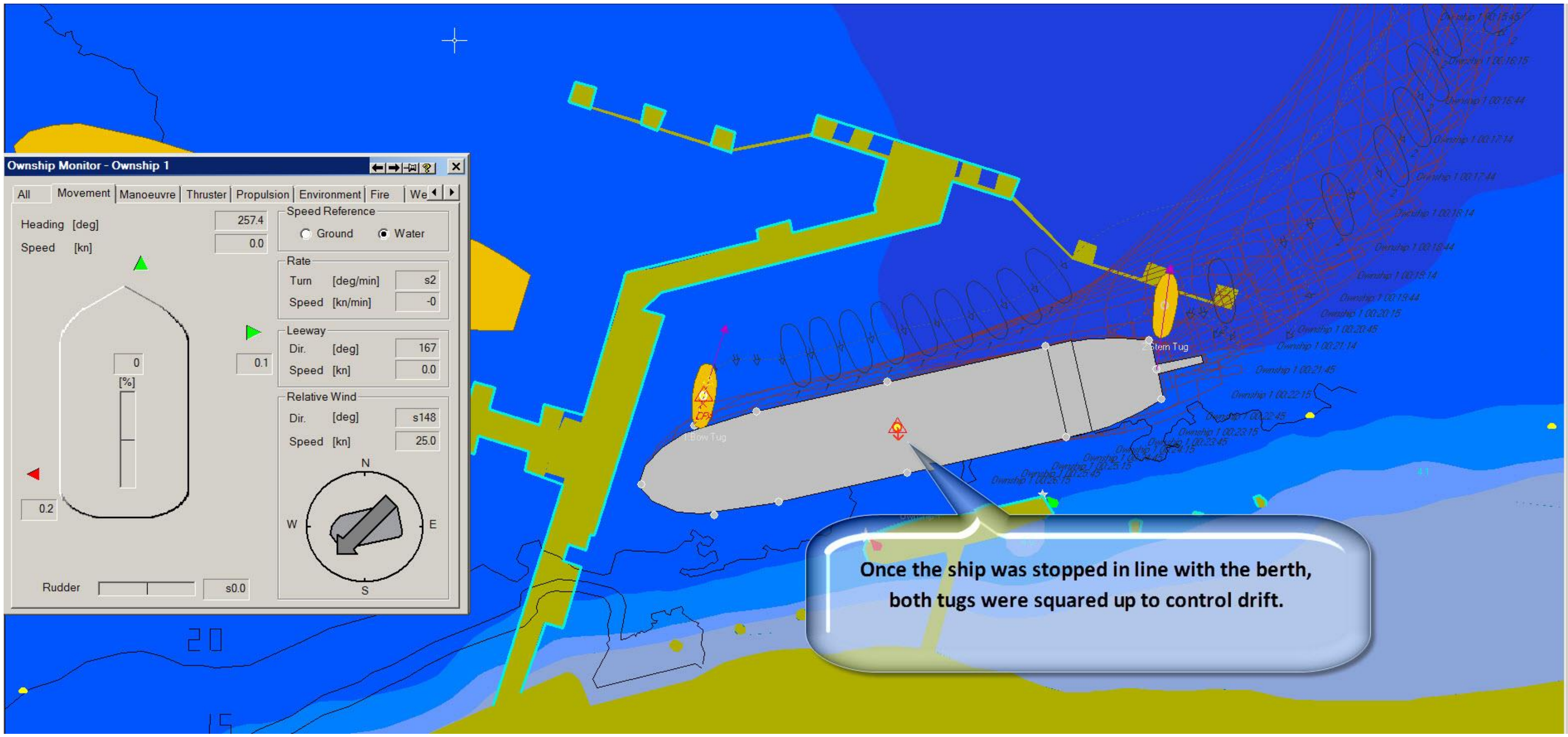


Illustration 37 – Inbound Existing Berth

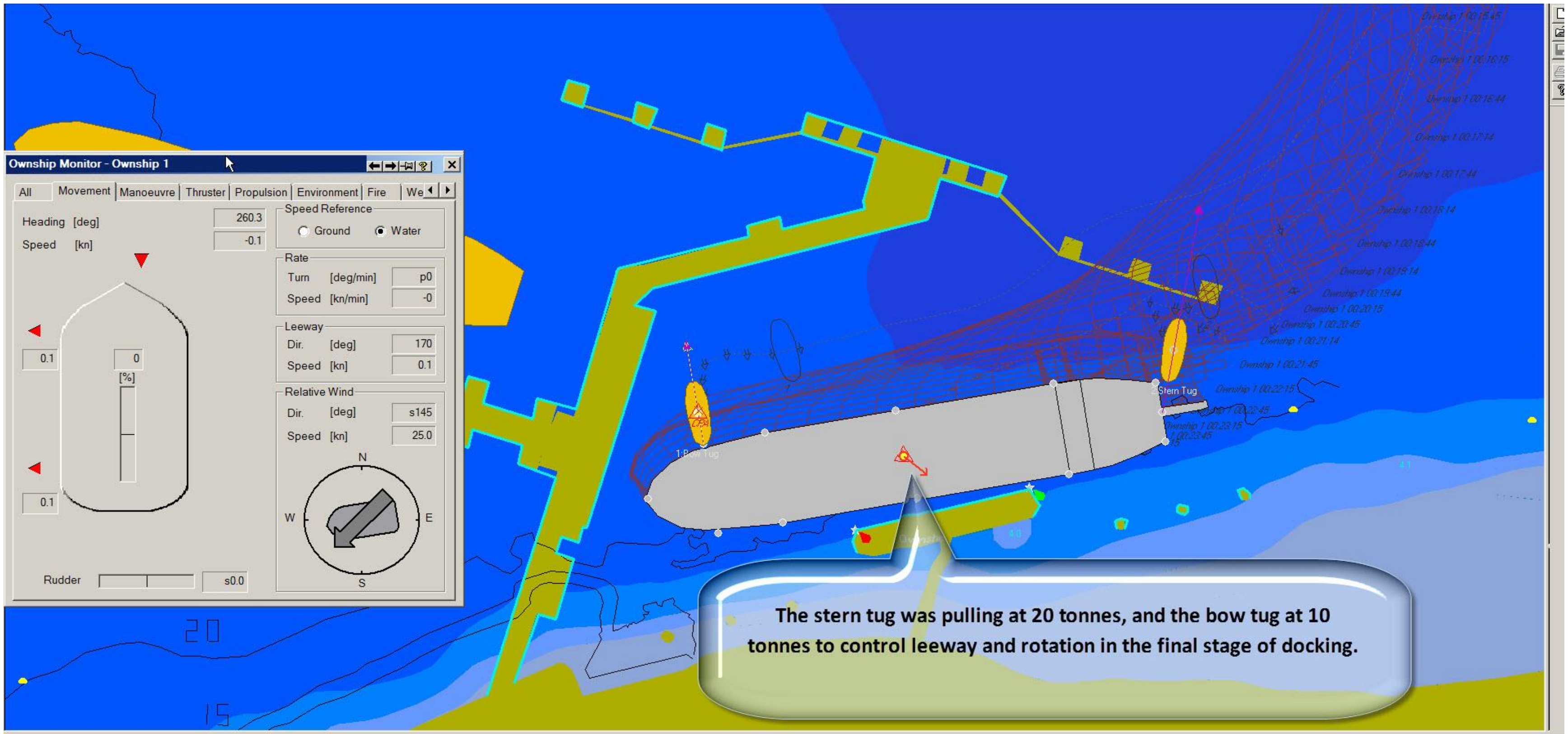


Illustration 38 – Inbound Existing Berth

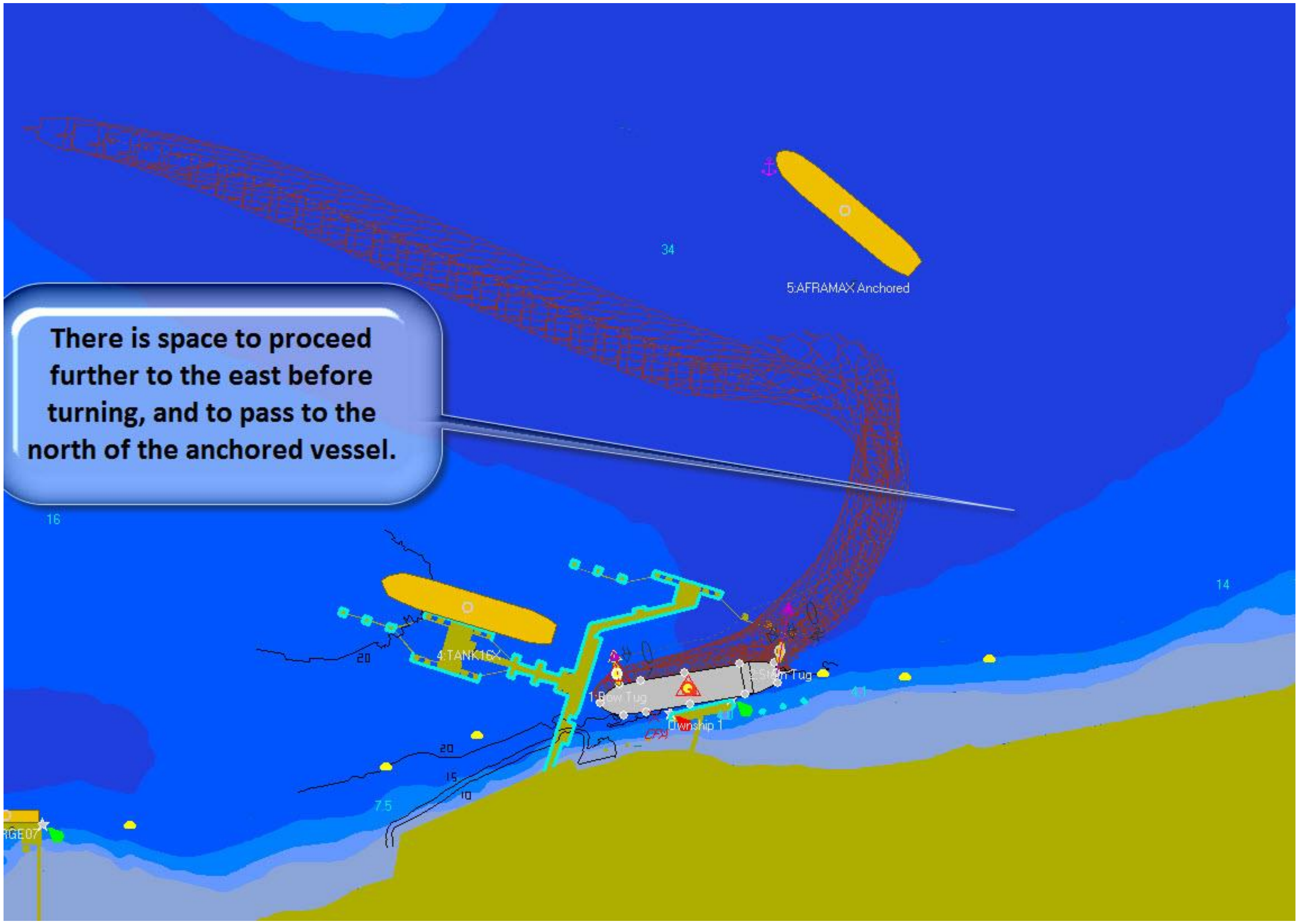


Illustration 39 – Inbound Existing Berth

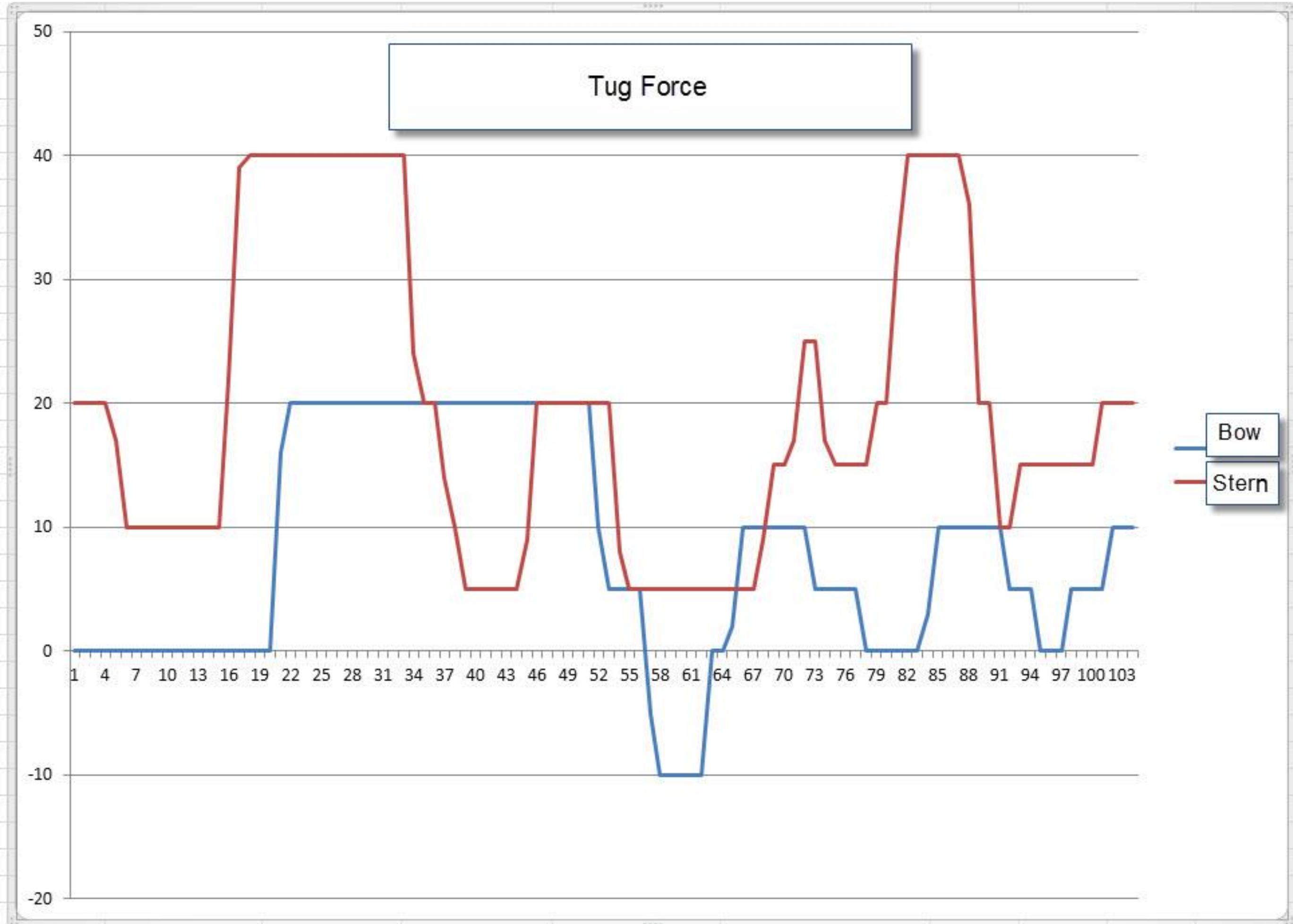


Illustration 40 – Outbound Existing Berth

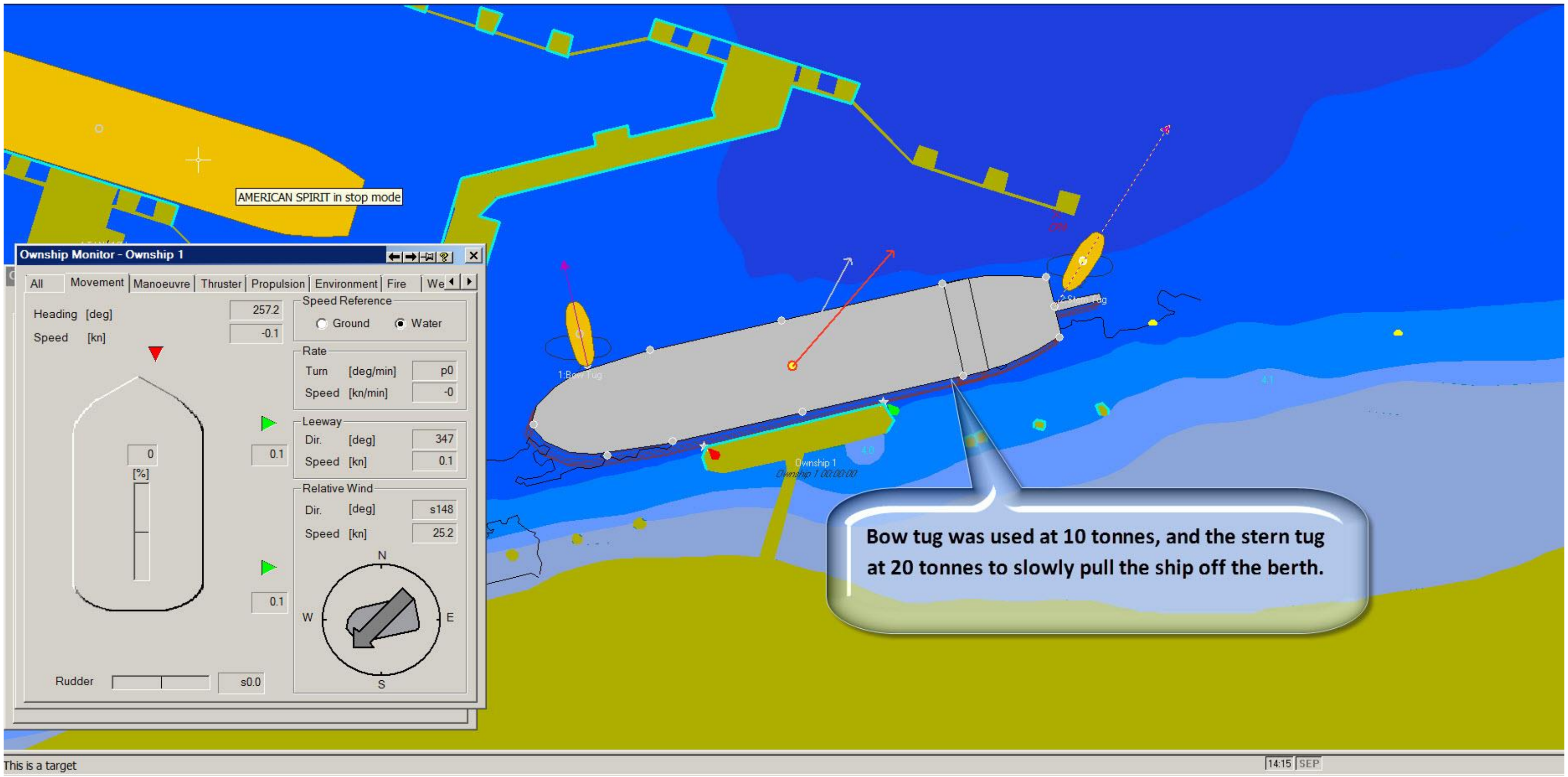


Illustration 41 – Outbound Existing Berth

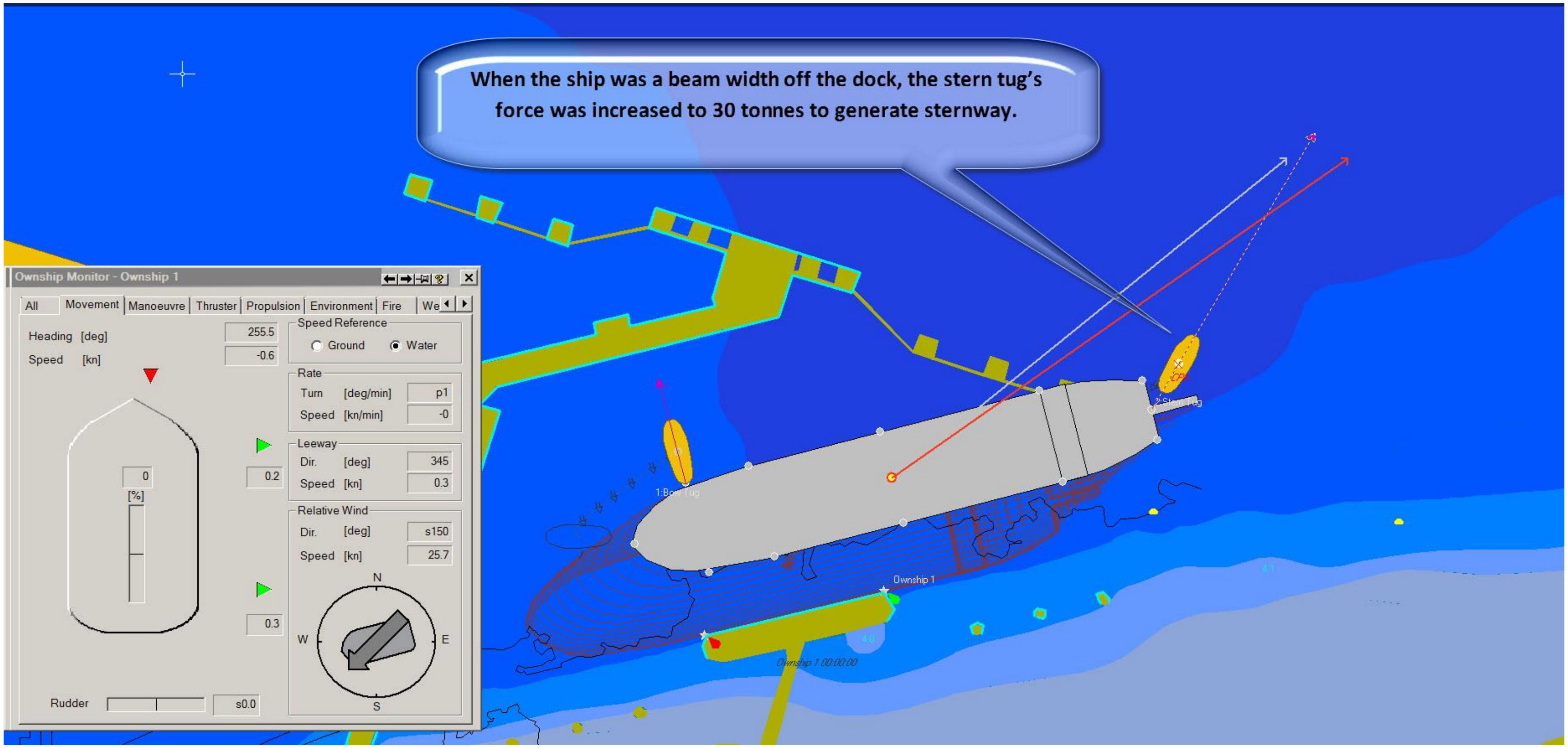


Illustration 42 – Outbound Existing Berth

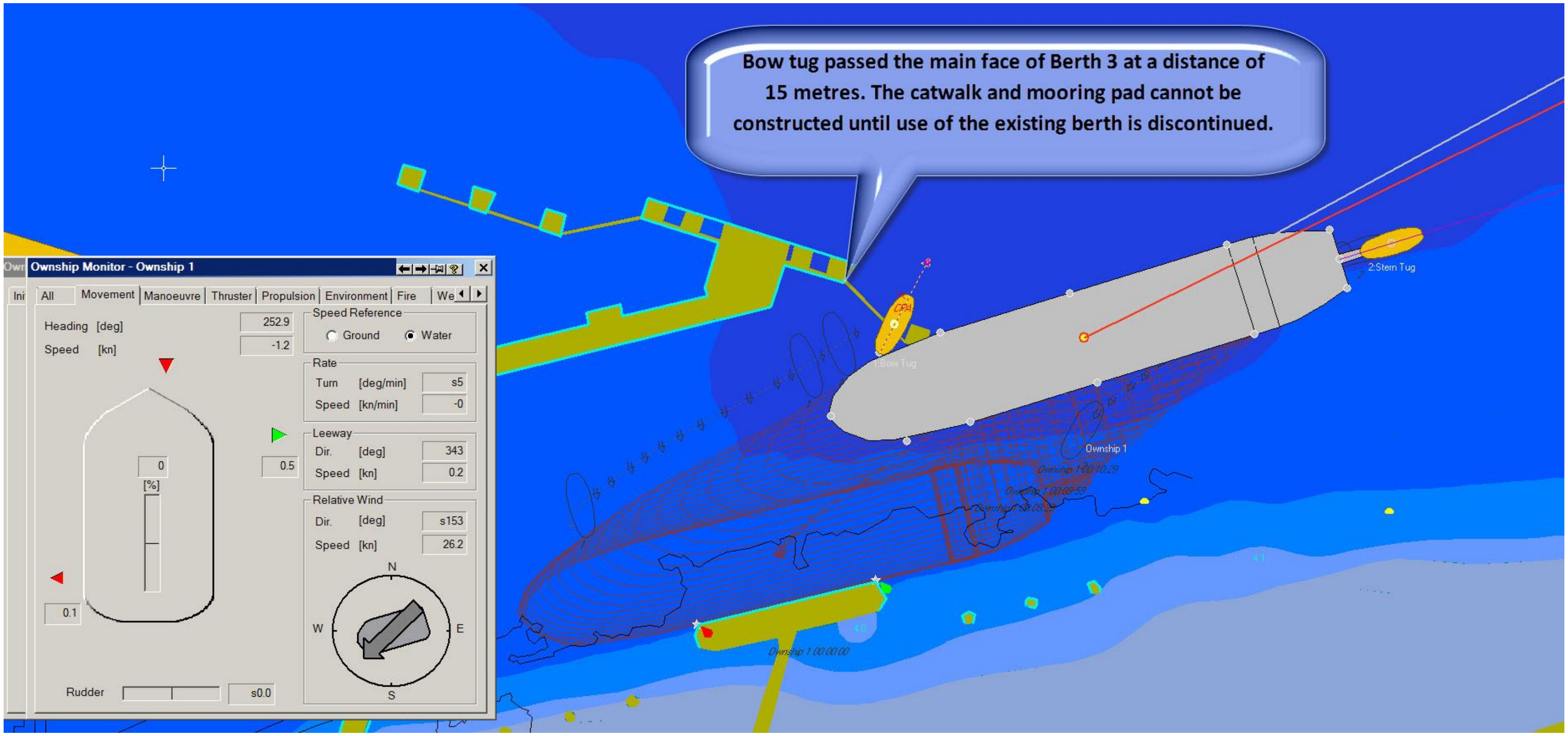


Illustration 43 – Outbound Existing Berth

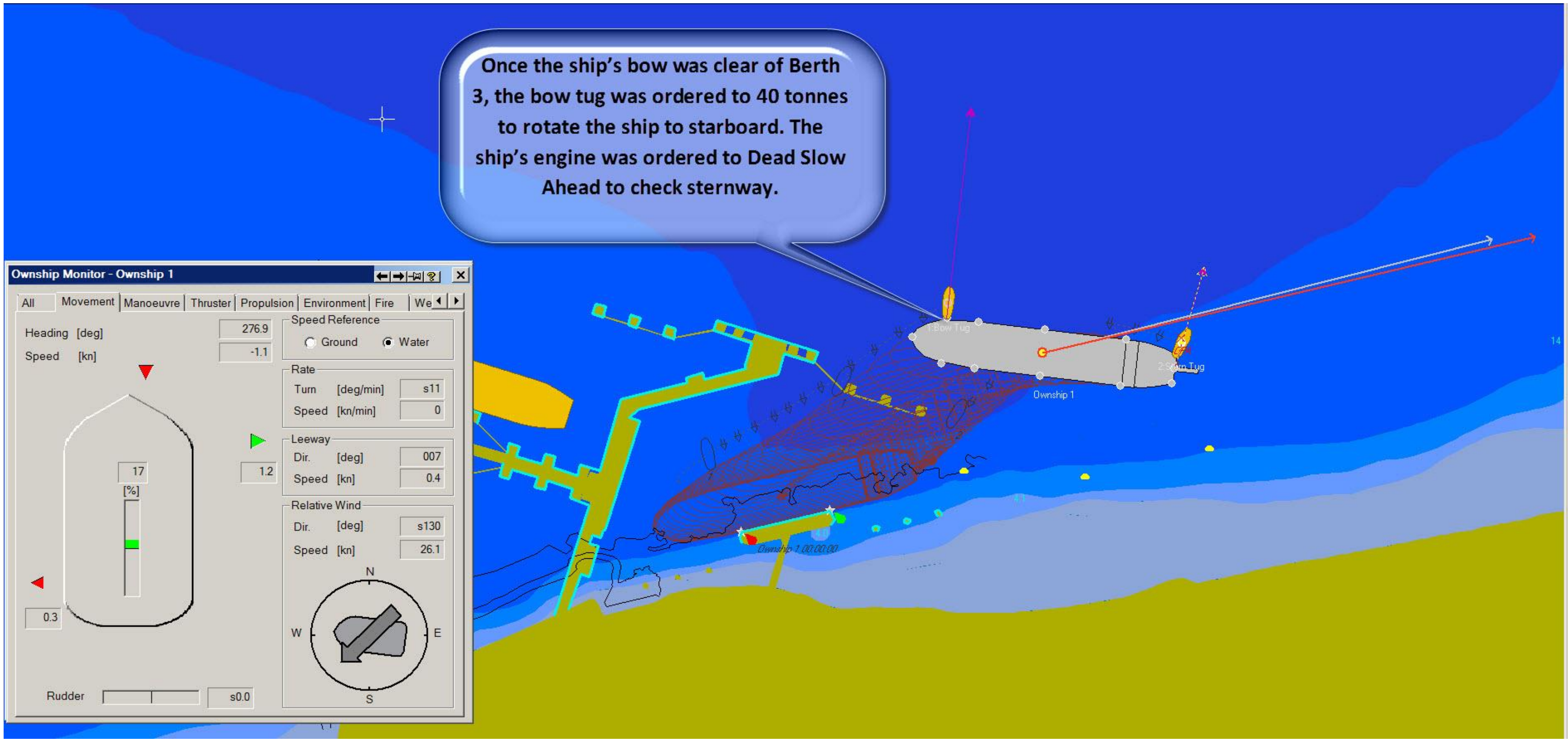


Illustration 44 – Outbound Existing Berth

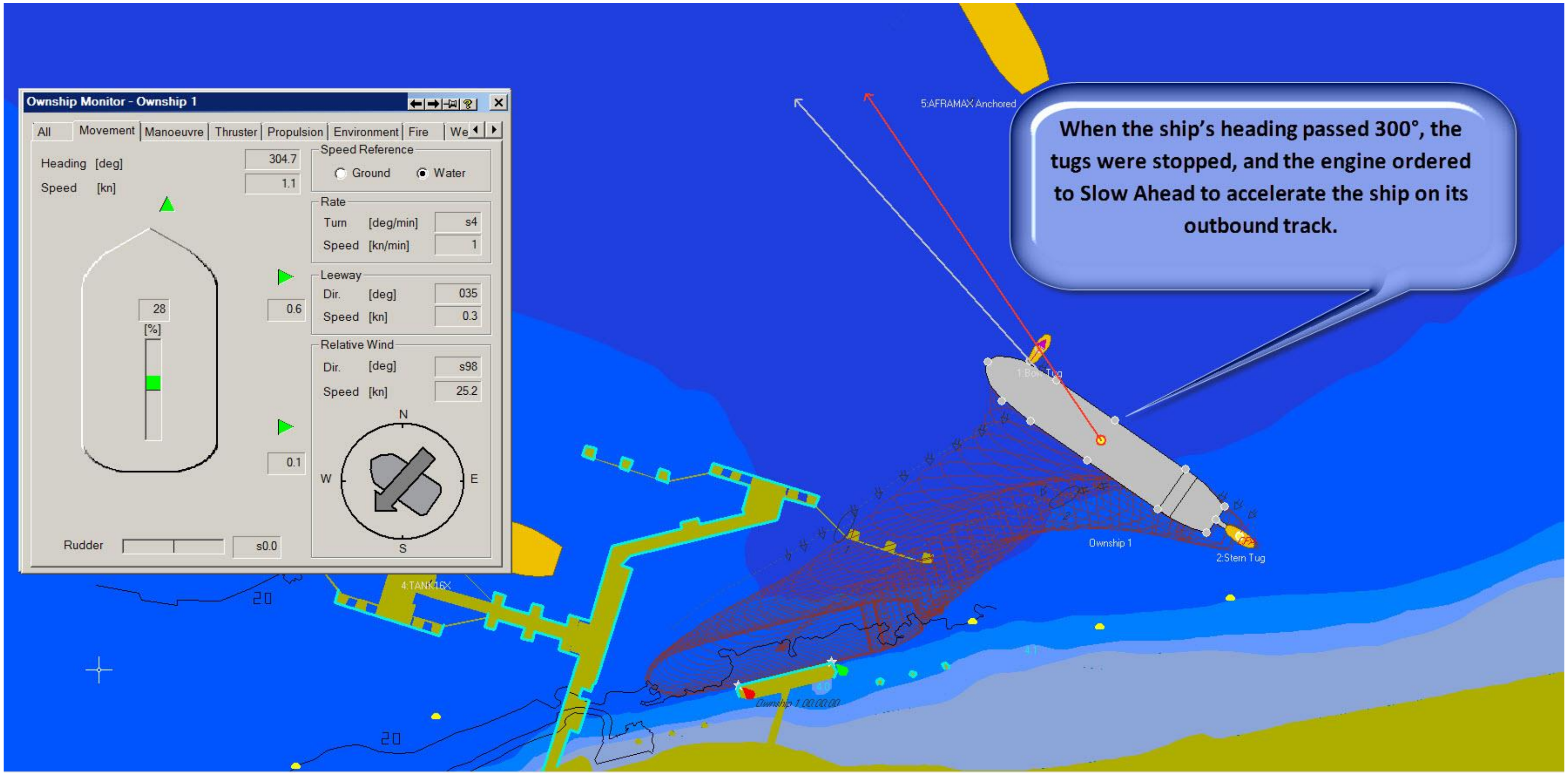


Illustration 45 – Outbound Existing Berth

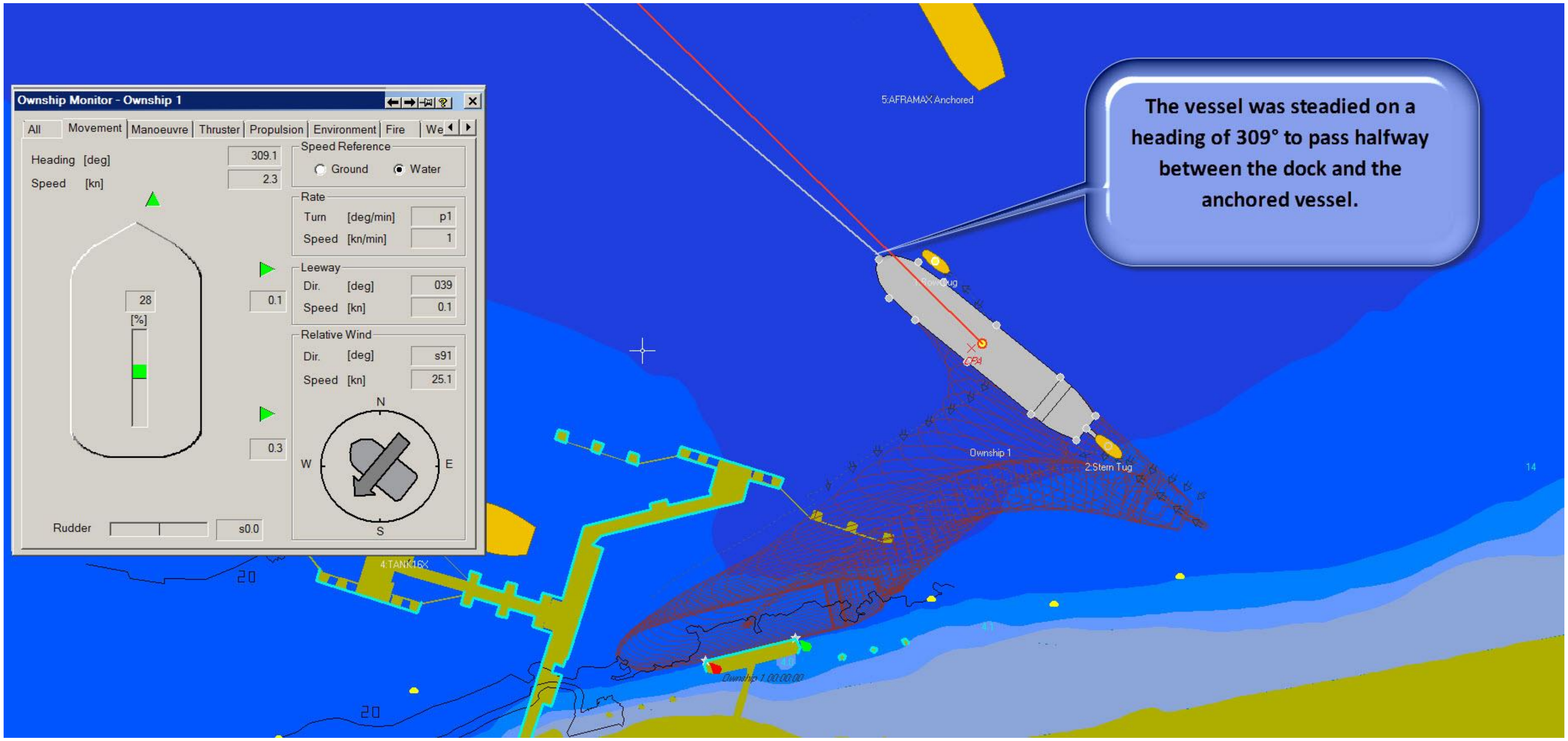
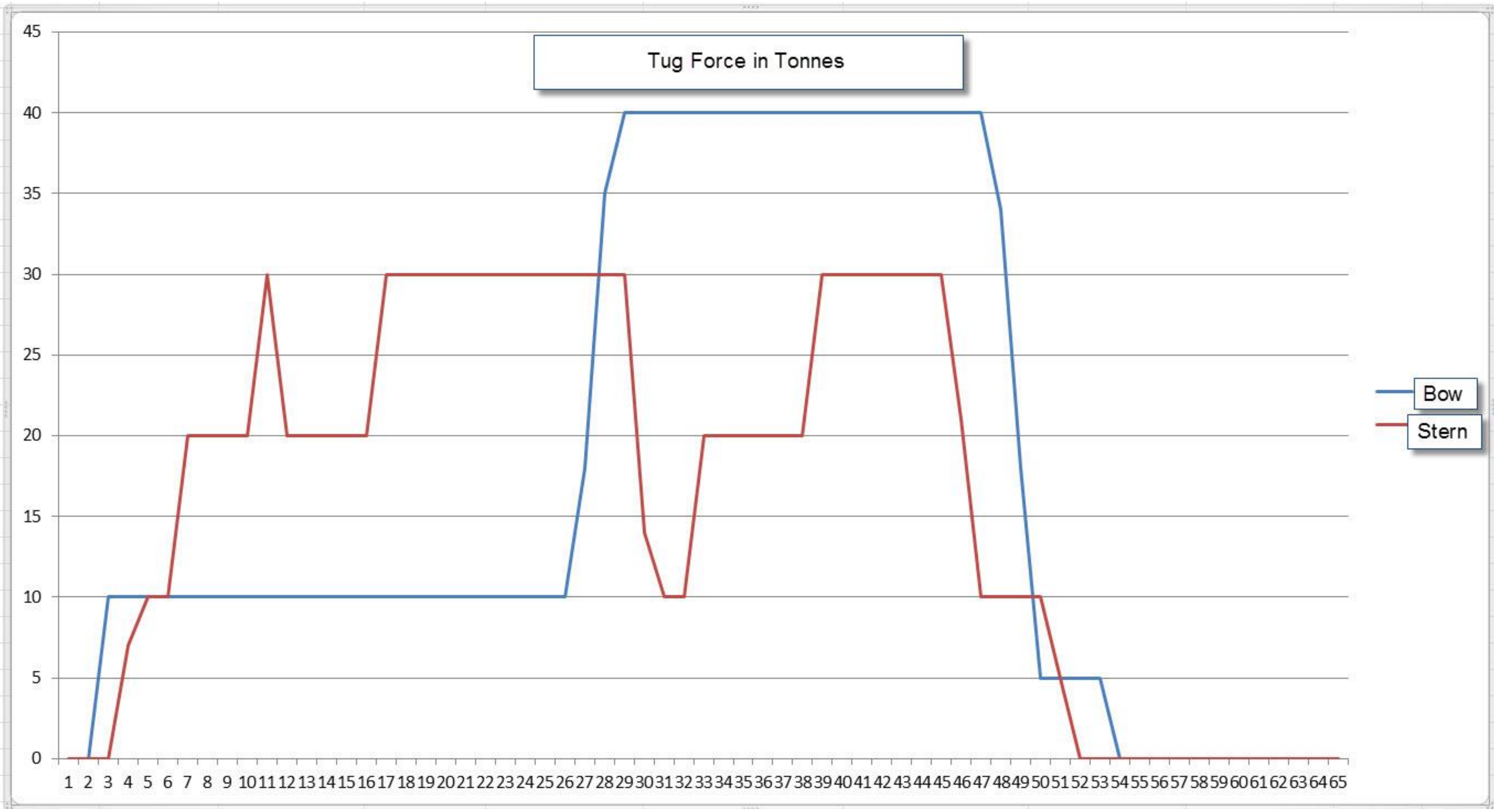


Illustration 46 – Outbound Existing Berth



TERMPOL 3.8, Casualty Data Update (August 2014)

Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
Transport Canada Termpol Review # 8000-22-7

Submitted 16th Dec 2013

UPDATE TO TRANS MOUNTAIN EXPANSION PROJECT,
TERMPOL 3.8, Casualty Data Survey

Reference: With reference to the review of studies and reports submitted by Trans Mountain to the Termpol Review Committee (TRC) on 16th December, 2013.

Preamble: At this time Trans Mountain seeks to update the NEB and Termpol Review Committee with additional global and Canadian shipping casualty data, which was not available at the time when the initial report was prepared.

Global Casualty Data

Global casualty data for 2012 and 2013 shows the positive effects of continuing improvements in safety statistics amongst the world's bulk commodity marine transportation fleet. Of these, the oil tanker fleet continues to tally the least number of serious accidents per 1000 shipyear. It is important to note that IHS Fairplay's definition of "Total Loss" has no connection with oil spill accidents. Total Loss does not differentiate between actual and constructive total loss. A vessel declared a constructive total loss by its insurers due to a high cost to repair may in fact be written off as a constructive total loss, but could subsequently repaired by its owners and thereafter return to trade. In such cases it records an economic decision on the part of the vessel's insurers and is not a reflection of actual total loss, that is, a vessel lost at sea.

Vessel Category	Year	Incidents per 1000 shipyear		
		Not Serious	Serious	Total Loss[1]
LNG-LPG Tanker	2012	3.2	10.2	0.6
	2013	3.7	7.5	0
Chemical Tanker	2012	3.4	11.9	1.5
	2013	4.1	10.8	0.6
Oil Tanker	2012	1.3	7.1	0.9
	2013	1.9	6.3	0.8
Bulk Carrier	2012	4.4	17	0.9
	2013	5.4	12.2	1.1

Source: Produced by DNV GL based on IHS Fairplay data

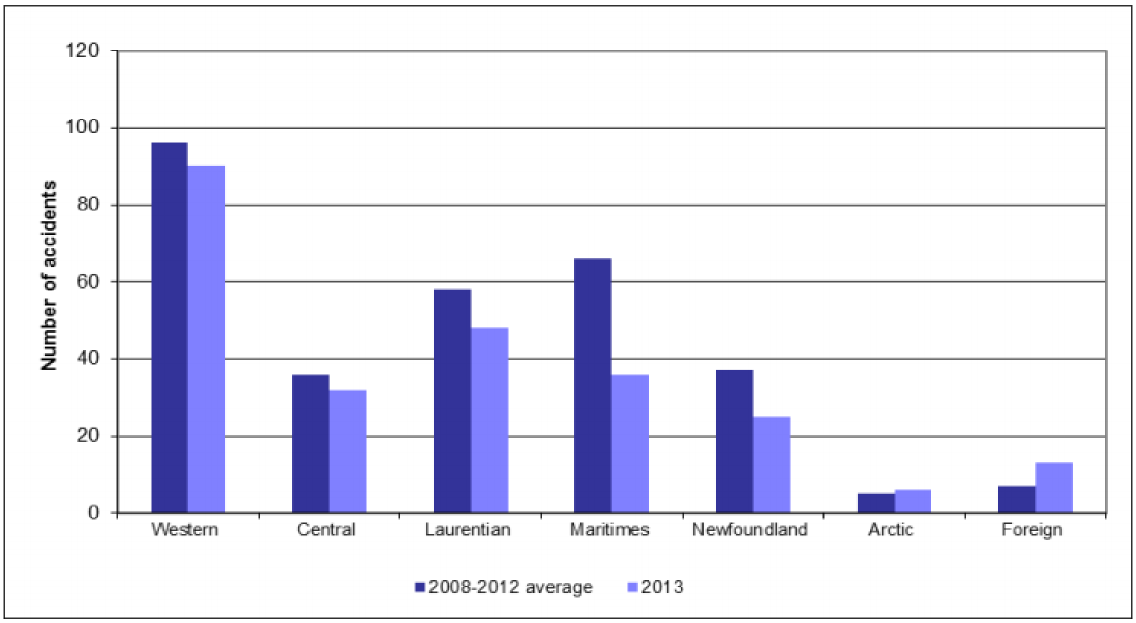
Table 1: Global casualty data for marine bulk transportation fleet

[1] IHS Fairplay data for Total Loss does not differentiate between actual and constructive total loss.

Canadian Shipping Casualties

In 2013, 305 marine accidents were reported to the Transportation Safety Board of Canada (TSB), up from the 2012 total of 288 but down from the 2008–2012 average of 357. Over the past 10 years, 87% of marine accidents were shipping accidents, while the remainder were accidents aboard ship. One-hundred and two fishing vessels (36%) were involved in shipping accidents, similar to the 99 (38%) in 2012 but down from the 2008–2012 average of 134 (39%). After fishing vessels, 54 tugs/barges (19%), 35 bulk carriers/OBO vessels (12%), and service vessels (11%) were involved most often in shipping accidents. In total 3 tanker accidents were recorded, none on the West coast of Canada.

In 2013, 86% of the 287 vessels involved in shipping accidents reported to the TSB were Canadian-flag vessels. In all, 41% of the Canadian-flag vessels involved in accidents were fishing vessels, 44% were commercial non-fishing vessels and the remaining 15% were non-commercial vessels, pleasure craft or service vessels.



Source: Transportation Safety Board of Canada (2013). Statistical Summary Marine Occurrences 2013
Figure 1: Number of shipping accidents in Canada by region

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Western region										
Shipping accidents	125	125	124	102	109	114	89	90	77	90
Accidents aboard ship	15	14	15	20	15	21	13	10	16	20
Vessels involved in shipping accidents	135	145	142	116	131	127	97	104	88	107
Cargo	3	2	9	3	3	9	5	4	10	6
Bulk carrier/Ore-bulk-oil (OBO) carrier	7	3	3	2	4	5	0	2	4	1
Tanker	0	0	0	0	0	1	0	0	0	0
Ferry/Passenger	19	26	24	12	15	15	9	13	9	10
Tug/Barge	31	34	38	42	48	24	23	28	20	29
Fishing	65	71	52	43	54	49	48	39	34	36
Other	10	9	16	14	7	24	12	18	11	24
Vessels lost	6	8	15	11	10	8	5	3	6	4
Fatalities	8	7	6	8	9	6	6	6	4	2
Incidents	98	87	84	68	146	111	117	119	127	164

Source: Transportation Safety Board of Canada (2013). Statistical Summary Marine Occurrences 2013
Table 2: Marine Accidents – West-coast of Canada

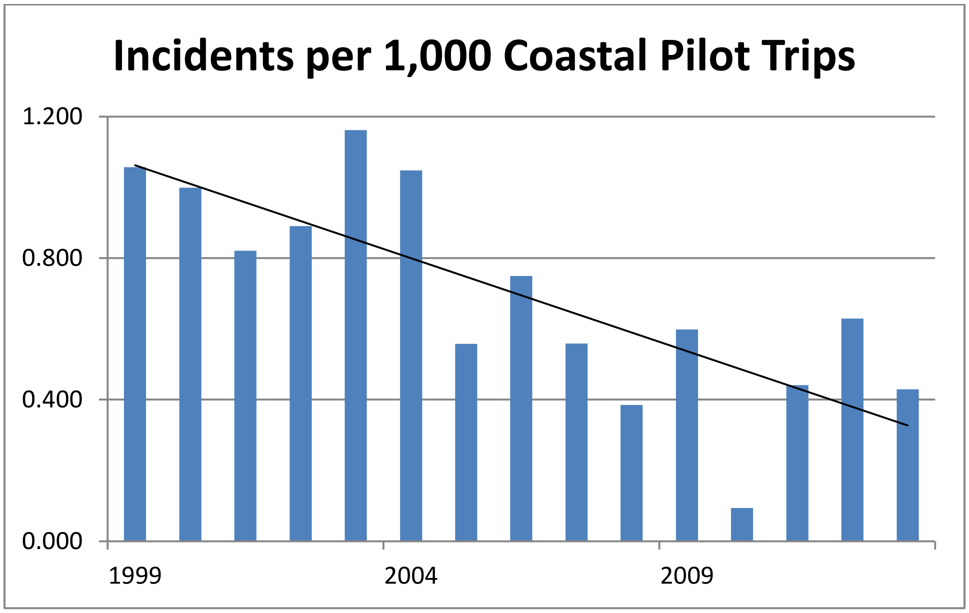
Number of incidents per 1,000 transits for vessels under service by Pacific Pilotage Authority

Information obtained from the Pacific Pilotage Authority shows that the number of trips by vessels requiring a pilot on the BC Coast (excluding Fraser River) has remained almost constant over the previous 15 year period. It highlights the continually improving trend in the number of incidents with pilot onboard and the success ratio calculated by this metric is high (99.95% in 2013). The data also confirms that no tankers have been involved in a recorded navigation incident with pilot onboard since 2008. The PPA updated previously provided pilot assignment information by replacing it with the actual number of jobs performed (trips); therefore Table 5-1 and Figure 5-6 of Termpol 3.8, Casualty Data Survey are hereby replaced by Table 3 and Figure 2 below.

Year	Coastal BC Pilot Trips	Coastal BC Incidents	Incidents per 1,000 Coastal Pilot Trips	Tanker Incidents
2013	11,635	5	0.430	
2012	11,126	7	0.629	
2011	11,336	5	0.441	
2010	10,595	1	0.094	
2009	10,029	6	0.598	
2008	10,398	4	0.385	1
2007	10,743	6	0.559	
2006	10,674	8	0.749	
2005	10,750	6	0.558	
2004	10,499	11	1.048	
2003	10,332	12	1.161	
2002	10,104	9	0.891	
2001	10,961	9	0.821	
2000	12,009	12	0.999	
1999	11,353	12	1.057	1

Source: Pacific Pilotage Authority.

Table 3: Incidents with pilot onboard – Coastal BC, Canada (excluding Fraser River)



Source: Pacific Pilotage Authority.

Figure 2: Incidents with pilot onboard – Coastal BC, Canada (1999 – 2013)

ITOPF, Oil Tanker Spill Statistics

Globally in 2013 three oil spills of 700 tonnes or more occurred, with one accident (5000 tonnes of diesel oil spill) accounting for the vast majority of the total oil spilled for the entire year. In addition four medium spills were recorded. Figure 3 is additional information from ITOPF that helps illustrate the continuing improvement trends in tanker shipping on a global basis.

Year	Quantity (tonnes)	7-700 tonnes	>700 tonnes	average spill (tonnes)
2000	14,000	21	4	560
2001	8,000	17	3	400
2002	67,000	12	3	4,467
2003	43,000	19	4	1,870
2004	16,000	17	5	727
2005	18,000	22	3	720
2006	23,000	13	5	1,278
2007	19,000	13	4	1,118
2008	3,000	8	1	333
2009	2,000	7	1	250
2010	12,000	4	4	1,500
2011	2,000	5	1	333
2012	1,000	7	0	143
2013	7,000	4	3	1000
Average global spill size (2000 – 2013)				1119

Source: ITOPF, Oil Tanker Spill Statistics 2013

Table 4: Oil spill events and volume

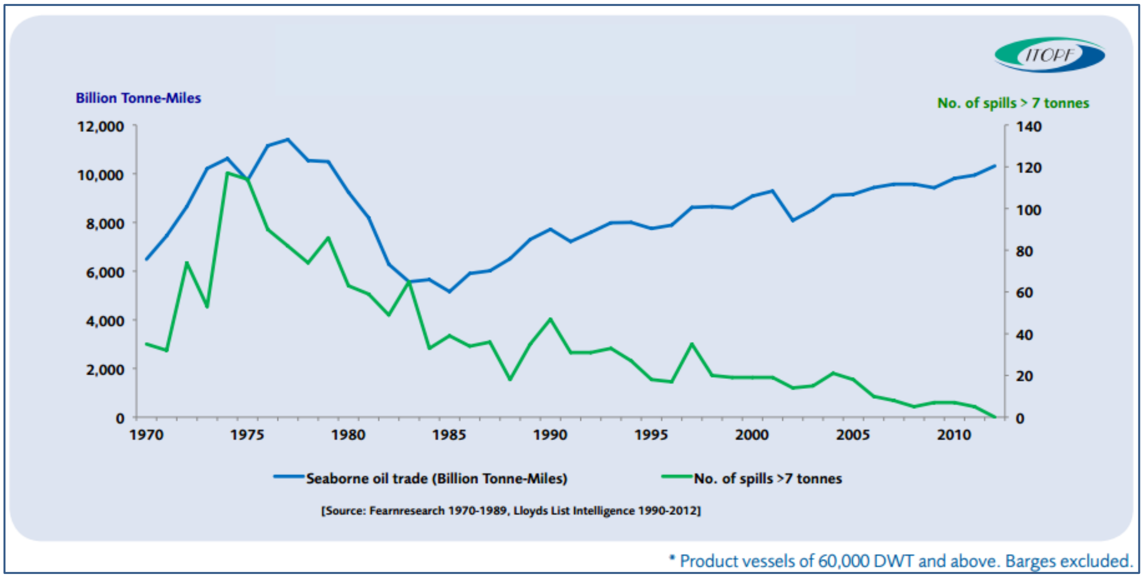


Figure 3: Seaborne oil trade and number of tanker spills > 7 tonnes.
1970 to 2012 (Crude and Oil Product)

References used:

ITOPF: Report, Oil Tanker Spill Statistics 2013
Termpol Studies, Reports, 3.8 and 3.15.
Transportation Safety Board of Canada (2013): Report, Statistical Summary Marine Occurrences 2013

Personal communication reference:

Ole Øystein Aspholm, M.Sc
Head of Environment & Navigation Risk,
Risk Advisory Solutions
DNV GL – North America Oil & Gas

Pacific Pilotage Authority

Juan de Fuca Strait Proposed Tug Escort Simulation Study (August 29, 2014)

Summary Report of Manoeuvring Assessment

Juan de Fuca Strait Proposed Tug Escort

Desktop

Simulation Manoeuvring Study

Prepared for

TRANSMOUNTAIN

Expansion Project

By LANTEC Marine Incorporated

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1. Overview of Simulation Study

▪ Background

Transmountain Pipeline is planning an expansion of their pipeline capacity from Alberta to Westridge Terminals in Vancouver which will create a significant increase in the number of crude oil carrying tankers. Currently, tethered tug escort is required from the dock until west of First Narrows, and then again when exiting The Strait of Georgia prior to entering the more confined waters of Boundary Pass and Haro Strait.

In addition to the tug escort regime already in place at different parts of the shipping route, that is, within Port Metro Vancouver (PMV) and through Boundary Pass and Haro Straits as outlined respectively in PMV's Harbour Operations Manual and in Pacific Pilotage Authority (PPA's) Notice to Industry (07/2013) Trans Mountain has proposed extending tug escort for crude oil tankers from Westridge. The proposal is to arrange escort by an untethered tug in segments of the shipping route where tug escort is not currently provided.

At the request of the Termpol Review Committee a "Strait of Georgia proposed tug escort simulation study" was completed to assess the risk reducing effects that the proposed enhanced escort regime. This "Juan de Fuca Strait proposed tug escort simulation study" is an extension from the previous study and consisted of the use of a Kongsberg desktop simulator to assess the effectiveness of a non-tethered tug escort to assist in preventing a tanker casualty such as a grounding or collision with another vessel in the Juan de Fuca Strait. Should other areas of improving navigation safety become apparent during the enactment of the various simulations, those would also be reported along with suitable observations and recommendations.

▪ Simulation System

The simulation work solicited in this proposal was conducted using Kongsberg Simulation desktop simulator. From a pure simulation and mathematical standpoint, the desktop simulator has the same fidelity/ accuracy as a full mission simulator; however the primary difference is the control systems for the simulated ships, and the degree of human environmental immersion. With the desktop system, all aspects of the simulation, and ship control mechanisms are being controlled by one computer with a single user interface for the instructor, this contrasts with the fully immersive full mission ship and tug simulator where a tug captain using real control equipment drives each tug, and a real pilot with real controls and radio devices controls the big ship and co-ordinates all tug activity.

Additionally with desktop/ fast-time simulation, all analysis is based on assessment of numerical outputs and data plots.

Having made this distinction, it is important then to understand that the desktop system can be used quite effectively to develop a very good preliminary solution for handling a ship, and to greatly reduce the time needed in a more expensive, manpower intensive full mission simulator. The desktop/fast time system can be used to assess manoeuvres that are not exceedingly complex, for example emergency braking or turning manoeuvres with one or two escort tugs, the ability of two or more ship assist tugs to hold a vessel against the wind or to overcome leeway, counter the effects of current etc. The desktop simulator can also be used to do preliminary assessments on vessel motion, adverse effects of sea state, and variations in towline load under different conditions. In conducting these tests/ analysis with the desktop system, we can determine a very good preliminary solution for handling a ship. The limiting factor with these simulations is the simulator operator's ability to manoeuvre the tugs in a fashion and within a timeline that is consistent with real life manoeuvres (using the limited control system of a keyboard and mouse), and hence maintaining the integrity of the simulation.

For the scope of this study, desktop simulation was highly suitable.

▪ Ship Models

This study was conducted using existing proven models from the Kongsberg Simulation model library. Particulars of these vessels are listed in Table 1 below:

Vessel Type	Vessel Name	Displacement tonnes	Length LOA (m)	Beam (m)	Draught Forward (m)	Draught Aft (m)
AFRAMAX Tanker	America's Spirit	119,400	249.9	43.8	13.5	13.6
ASD 5000 HP Skeg Forward Escort Tug	Generic	600	28.0	12.0	5.0	5.0

▪ Test Team

In the conduct of the simulation study, the test team was comprised of:

Name	Role	Organisation
Garland Hardy	Test Director	LANTEC Marine Inc.
Bikramjit Kanjilal	Lead, Marine Development	Trans Mountain Expansion Project
Kevin Obermeyer	Policy Implementation	Pacific Pilotage Authority

2. Juan de Fuca Strait Escort Environment

The Juan de Fuca Strait is a deep water channel (shoaling from 250m at Cape Flattery to 180m at Race Rocks) lying between Vancouver Island and the American Washington coast Olympic Mountains range. Due to the surrounding geography and fetch limitations, waves greater than 4 metres are rare and swell is only occasionally a factor in the tug escort process. Relatively strong tidal streams are experienced in the strait. The transit route for outbound tankers follows an established set of traffic lanes monitored by a Vessel Traffic Management System (Victoria/Seattle Traffic). Once clear of Victoria Pilot Station and entering into the Juan de Fuca Strait, vessels transit at distances from the shore ranging from 2 to 5 nautical miles.

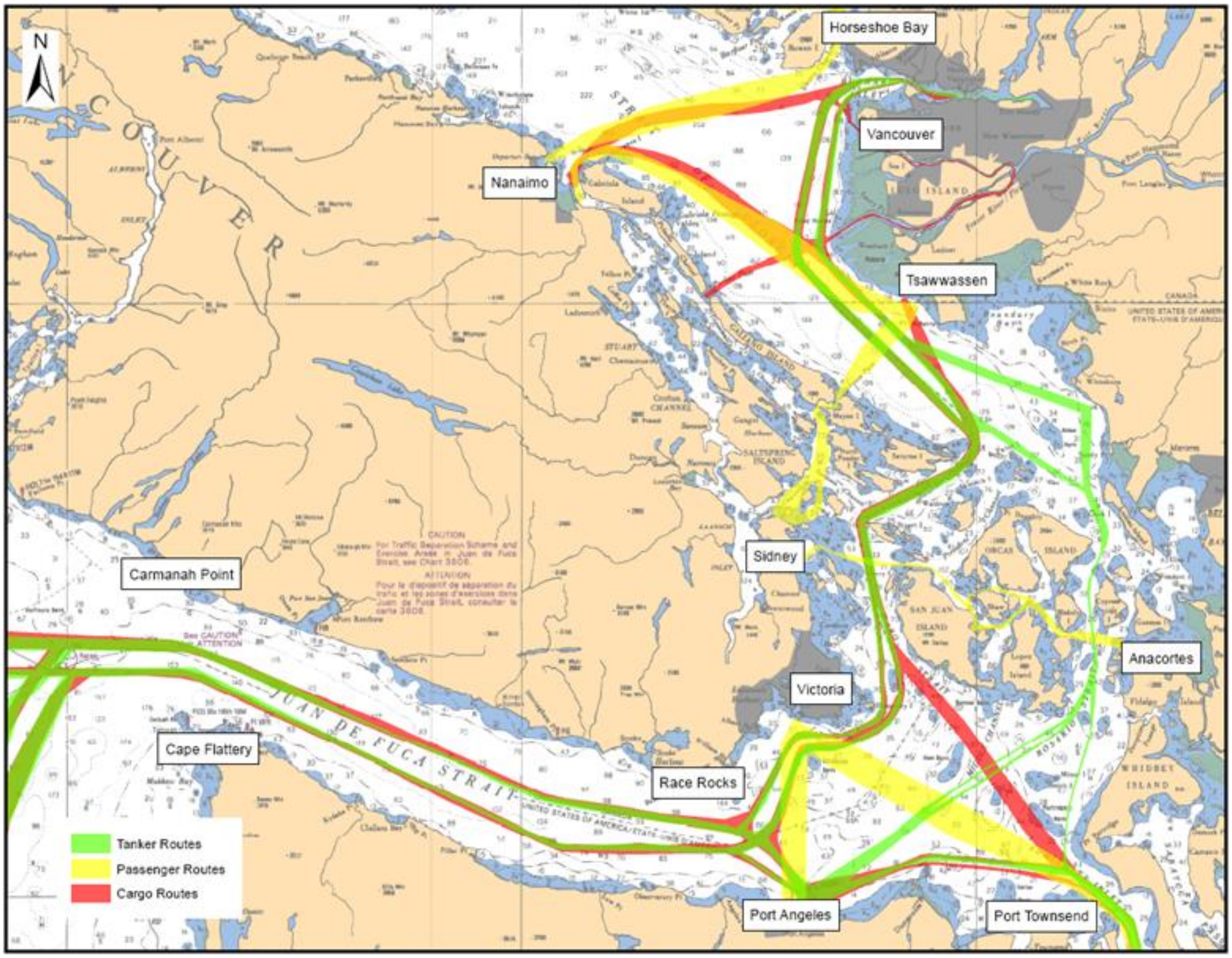
3. Testing Methodology

The simulation study was conducted in order to achieve the goals stated below using established testing methodologies and applying established principals for ship manoeuvring and tug escort/ assist that are currently in place in other ports and waterways dealing with similar vessel types. Tests were performed for a ship experiencing a rudder failure and a complete blackout (no engine or rudder control).

While in restricted waters, it is generally considered that a hard over rudder failure presents the greatest risk, as it is the situation where the ship will leave the narrow confines of the channel most rapidly. However, in a wide open strait, the hard over rudder failure is often less worrisome as the ship is several nautical miles from shore and will simply conduct a tight turn, and simultaneously lose most of its speed/ momentum more rapidly than when proceeding in a straight line. Contrary to this, if the ship experiences a total blackout, and the rudder is stuck near mid-ships, the vessel will carry her speed and momentum for a much longer time/ distance and her trajectory will be dictated primarily by the prevailing wind and tidal stream conditions.

Based upon a review of the traffic patterns in the Juan de Fuca Strait (Figure 1) and the VTMS, it is unlikely that a large vessel, such as a tanker, should it suffer a major power failure, could also stray into the path of opposing or crossing traffic. The greatest danger is northeast of Race Rocks where a major power failure could result in the grounding of a vessel owing to the strong ebb current and prevailing cyclonic winds associated with an Aleutian Low.

Given the width of the strait, each individual traffic lane, and the separation zone, it was elected to position the ship approximately ½ nautical mile to the north side of the traffic lane to illustrate that even if a ship were somewhat outside of the normal lanes (closer to shore) that there was considerable time/ distance before the ship was in danger of grounding, and similarly, that if a ship incurred a failure that were to take it initially towards the opposite traffic lane, that there is little likelihood that it would ever enter the opposite lane with any appreciable amount of water speed.



▪ Setting Objectives

Based upon input and guidance from Trans Mountain and the PPA the following objectives were set:

- Determine the trajectory of the ship (3 specific test locations) in the event of a hard over rudder failure with adverse winds and tidal streams;
- Establish the trajectory of the ship (3 specific test locations) in the event of a total blackout (engine stops and rudder is stuck near midships) with adverse winds and tidal streams;
- Assess minimum response time for a tug at a range of 1 mile from the ship;
- Determine the effectiveness of a tug to assist with controlling the ship to keep it safe from grounding and also prevent a possible close quarter situation with another vessel developing.; and
- Establish whether tethered escort should be considered in any areas.

▪ Test Procedures

In order to accomplish the goals above, five specific test locations were selected representing what was assessed to be the highest risk areas based on a) proximity to shoreline/shallow water, b) the need to conduct course alterations, and c) vessel traffic junction points. These locations are as follows:

Location	Environmental Conditions
East of Race Rocks approaching turn to the west-northwest	Wind 090@ 40 / Max Ebb Tidal Stream
4 nm south of Sheringham Point	Wind 115@ 40 / Max Ebb Tidal Stream
4 nm south of Sombrio Point	Wind 115@ 40 / Max Ebb Tidal Stream

Individual runs were conducted using the sequence outlined on the following pages with "Pilot Recognition Times" of 20 seconds and maximum tug towline force (where applicable) of 70 tonnes.

All simulation runs were conducted at “real time” and full playback files of the scenario as well as screen captures of the vessels’ track plots and manoeuvres recorded. A comprehensive summary of the conduct and findings of the study is contained later in this report in the section “Results and Findings”

▪ Test Series 1: Hard Over Rudder Failure

Simulation Time Mins/Secs	Action Taken	Comments
00:00	Start scenario, ship steering course at speed 10 knots.	Rudder applied as needed to maintain heading.
01:00	Initiate Rudder failure.	Hard to port in all cases
01:20	Pilot recognises rudder failure.	Engine is stopped to reduce generation of turn-rate.
Variable	Ship drifts out of control until momentum is lost and drifting with wind and tidal stream.	Track History recorded.

- ## Test Series 2: Total Blackout

Simulation Time Mins/Secs	Action Taken	Comments
00:00	Start scenario, ship steering course at speed 10 knots.	Rudder applied as needed to maintain heading.
01:00	Initiate total blackout.	Engine stops, and rudder is locked at current angle (as was needed to hold course).
Variable	Ship allowed drifts out of control until momentum is lost and drifting with wind and tidal stream.	Track History recorded.

- ## Test Series 3: Total Blackout with Tug Escort

Simulation Time Mins/Secs	Action Taken	Comments
00:00	Start scenario, ship steering course at speed 10 knots.	Rudder applied as needed to maintain heading.
01:00	Initiate total blackout.	Engine stops, and rudder is locked at current angle (as was needed to hold course).
01:20	Pilot realises that power is not being restored and orders the tug to close and attach to the stern centre-lead.	Tug closes with a Speed over the Ground of 11 knots owing to stemming the ebb current.
Variable (05:30 to 06:30)	Tug is positioning on the stern to connect the towline.	Tug manoeuvres on the transom to connect.
Variable (06:30 to 07:30)	Tug gets towline connected and is ordered to work by pilot.	Towline angle and force orders situational dependent on action needed to stabilise the tanker.
Variable	Tanker is manoeuvred clear of the traffic lanes or shallow water and stopped.	Tug stopped and standing by to assist depending on subsequent action required (i.e. engine restored, vessel anchored, taken under tow to anchorage etc.). Track history recorded.

4. Results and Findings

1) Trans Mountain has proposed consideration of extending the current tethered tug escort, provided pilot onboard, to a location east of Race Rocks. These simulations show that although such an arrangement would add certainty, it is not essential and an untethered tug escort would be adequate to deal with the types of scenarios, should a laden crude oil tanker be beset by such low likelihood circumstances.
2) Should a loaded crude oil tanker be beset by such low likelihood circumstances as simulated in the scenarios at locations near Sherringham Point or beyond, the tanker should remain safely afloat without grounding for a considerable period of time after the event depending on the location and environmental conditions. This should give sufficient time for other resources to be organised such as the rescue tug, which is stationed at Neah Bay. However the availability of an untethered tug escort in close proximity during an incident of this nature adds certainty to the level of support and assistance available to the laden crude oil tanker and thereby ensures control of the situation during the entire period and thus helps prevent any possible escalation of such an incident.
3) The opportunity to utilise the untethered tug in a manner that increases situational awareness and prevents close quarter situations from developing with other nearby vessels, including fishing vessels, is seen as an added benefit of the proposed enhanced tug escort regime for large crude oil tankers.

Of the three geographic areas tested, Race Rocks presents the greatest risk owing to the direction of the current in the vicinity. Of note, the simulation indicates that a vessel transiting outbound two nautical miles Northeast of Race Rocks could under certain circumstances run aground about 45 minutes after experiencing a major steering or propulsion failure. While the probability of such an event is very low, it was observed that the presence of an untethered escort within 1 nautical mile of the vessel ensures that the pilot and master has a very effective means of regaining navigational control of the vessel within 10 minutes of experiencing a major steering or propulsion failure.

Positioning the tug ahead of the ship could result in greater situational awareness. By preceding rather than following the tanker the escort tug would be better positioned to aid the pilots awareness of other traffic.

The results of these test runs are consistent with other escort trials that have been conducted by LANTEC in other jurisdictions around the world, and highlight that advantages are gained both from tugs that can apply high towline forces, and that equally important is the ability to respond quickly to the emergency before the ship displaces itself far from its original track.

5. Recommendations

Based on the findings described above, and supported by graphical illustrations which follow in Appendix 1 – Test Track Plots and Graphs, the following is recommended for large laden crude oil tankers sailing from the Westridge Marine Terminal:

1. Extension of the existing single tug, untethered escort from 2 nm west of Constance Bank to a position abreast of Sombrio Point. The vessel's transit speed should not exceed 11 knots (+/- 1 knot) as the tug (maximum speed 12 to 13 knots) needs some margin to maintain position and the tug should remain within 1 nm of the tanker. All tests showed that a tug accompanying the transiting crude oil tanker, can be connected, and assisting the ship within 8 to 10 minutes of an incident occurring; provided that it was not more than one nautical mile ahead of the vessel. Trans Mountain has proposed untethered tug escort for the entire route to Buoy J.
2. If possible the location for tanker pilot disembarkation and termination of the tethered tug escort should be extended west of Race Rocks to Sooke or another suitable location. While for all the tested scenarios within the area described the untethered escort was shown to be capable of sufficient response to avoid grounding in the event of a tanker mechanical failure, even in a scenario with markedly adverse environmental conditions, extending the tethered portion of the escort beyond the shoals at Race Rocks would effectively eliminate the response time for tug assist and the associated risk of grounding in the event of a tanker mechanical failure. Trans Mountain has proposed that the pilot disembarkation and termination of the tethered escort be extended west of Race Rocks; however it is recognized that implementation is dependent in-part on the feasibility of pilot egress at locations west of Constance Bank.
3. Any tug assigned to the duties stated in the item above must be "escort capable", and tested and proven to be able to produce a dynamic line load at a speed of 10 knots of 70 tonnes (steering force perpendicular to the tanker's longitudinal axis). It is important to note that this is not a reference to the tug's static bollard pull performance figures. Static bollard pull in isolation, is actually no guarantee that a tug is suitable for this task.
4. Consideration should be given to assigning the untethered escort tug to a position within 1 nautical mile ahead of the vessel as a means to aid situational awareness and prevent close quarter situations from developing with other nearby vessels, including smaller vessels.

6. Appendix 1: Test Track Plots and Graphs

Illustration 1: Race Rocks Port Rudder Failure

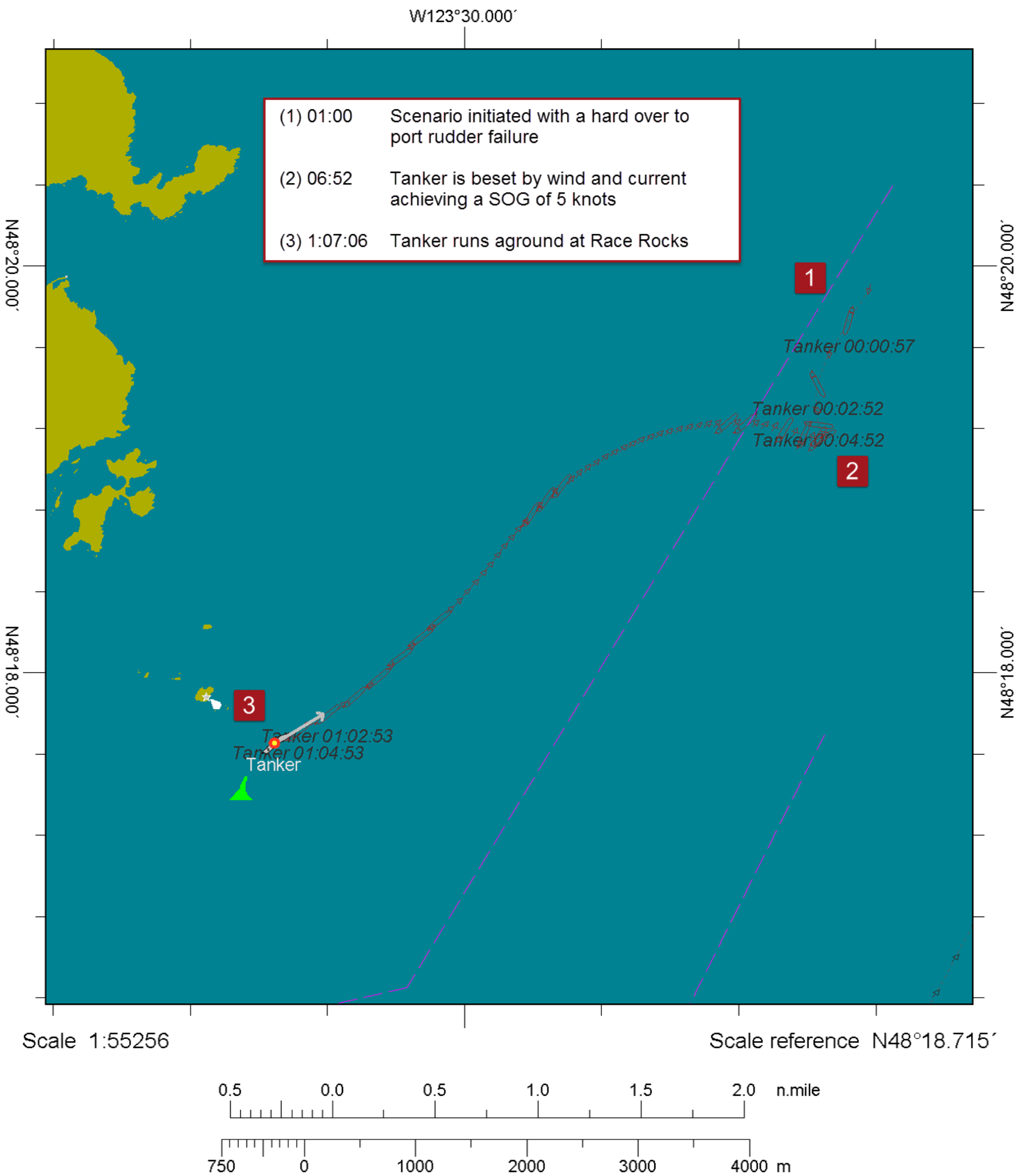


Illustration 2: Race Rocks Blackout – No Escort

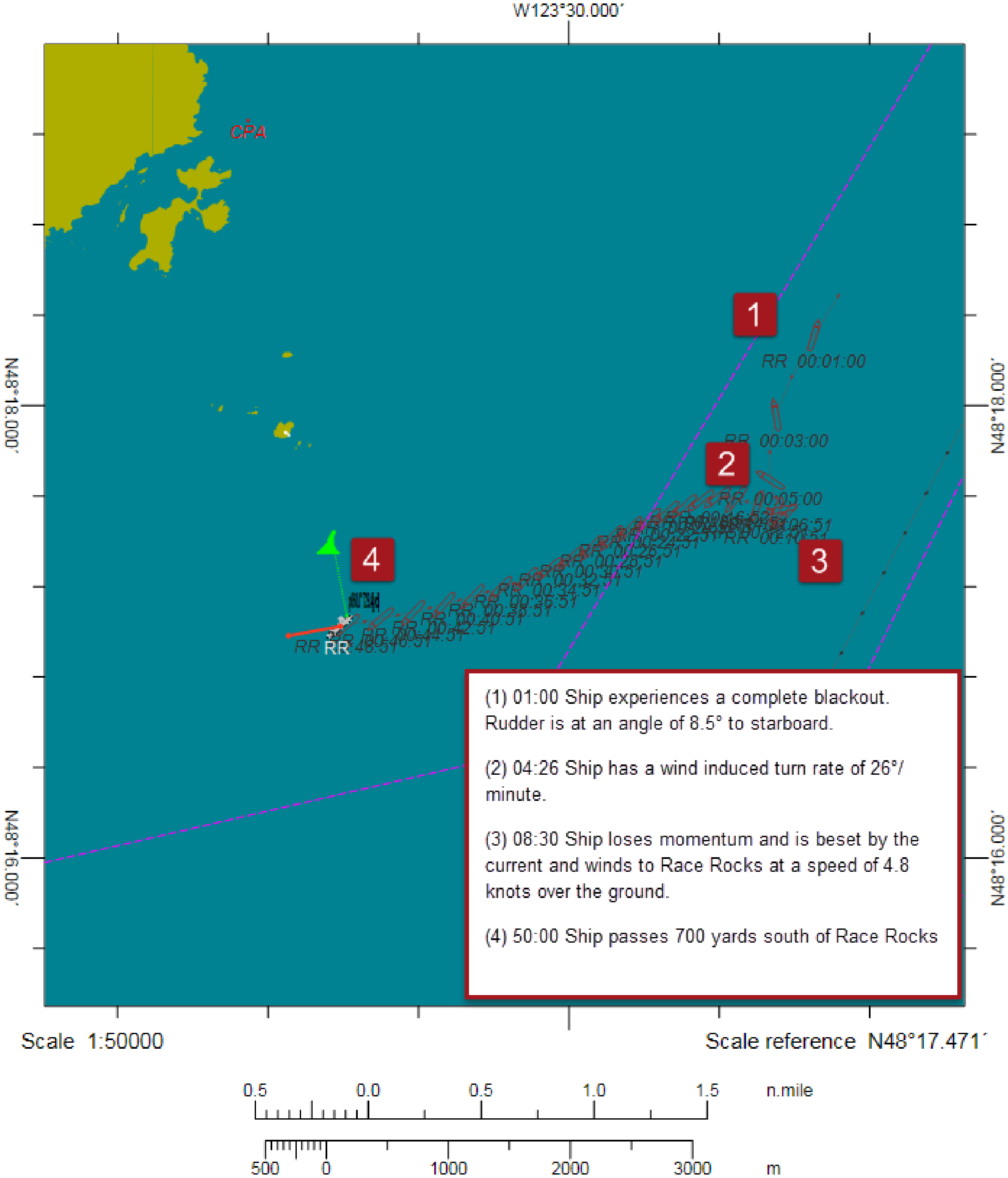


Illustration 3: Race Rocks Blackout with Escort

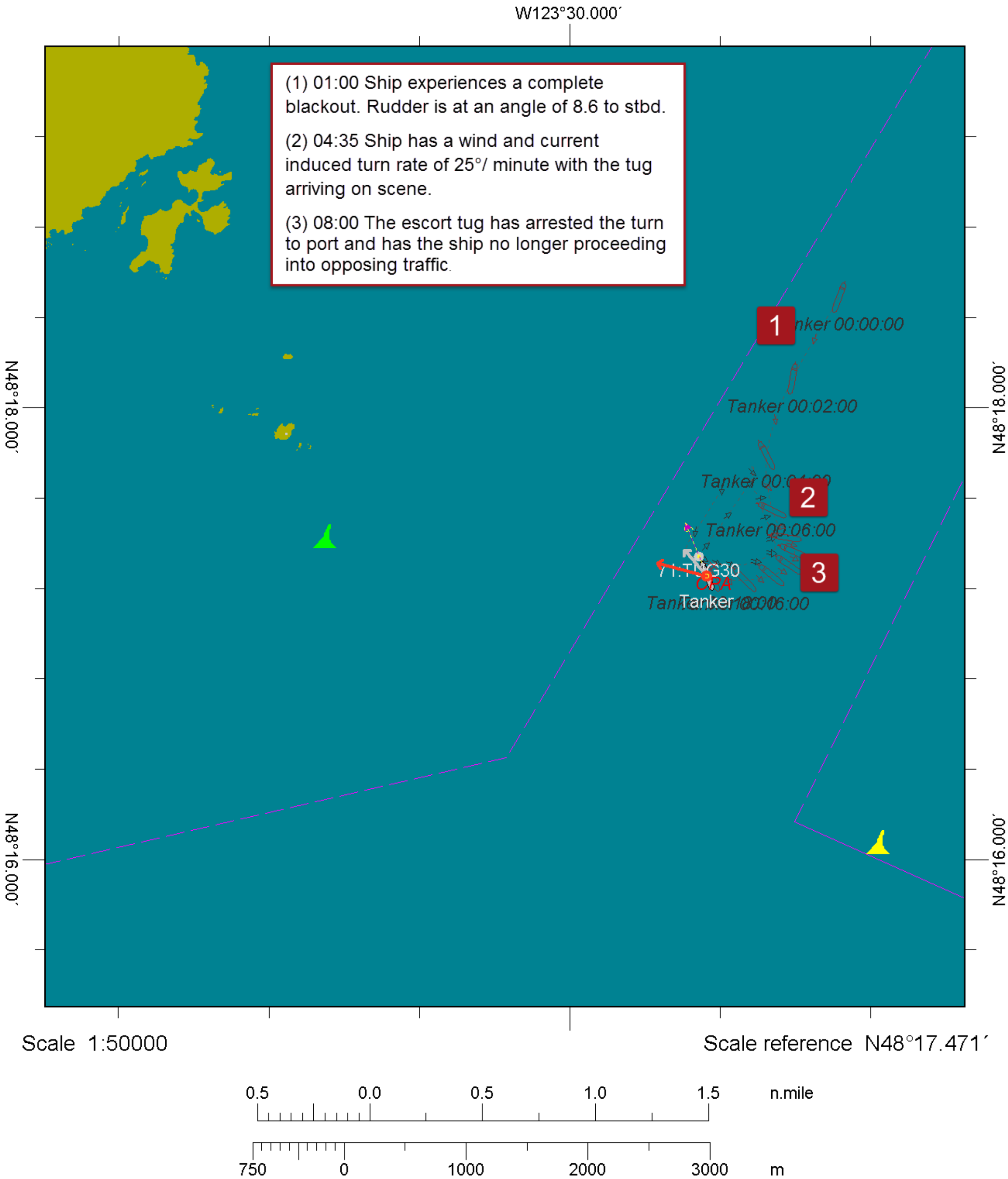


Illustration 4: Sheringham Point – Port Rudder Failure

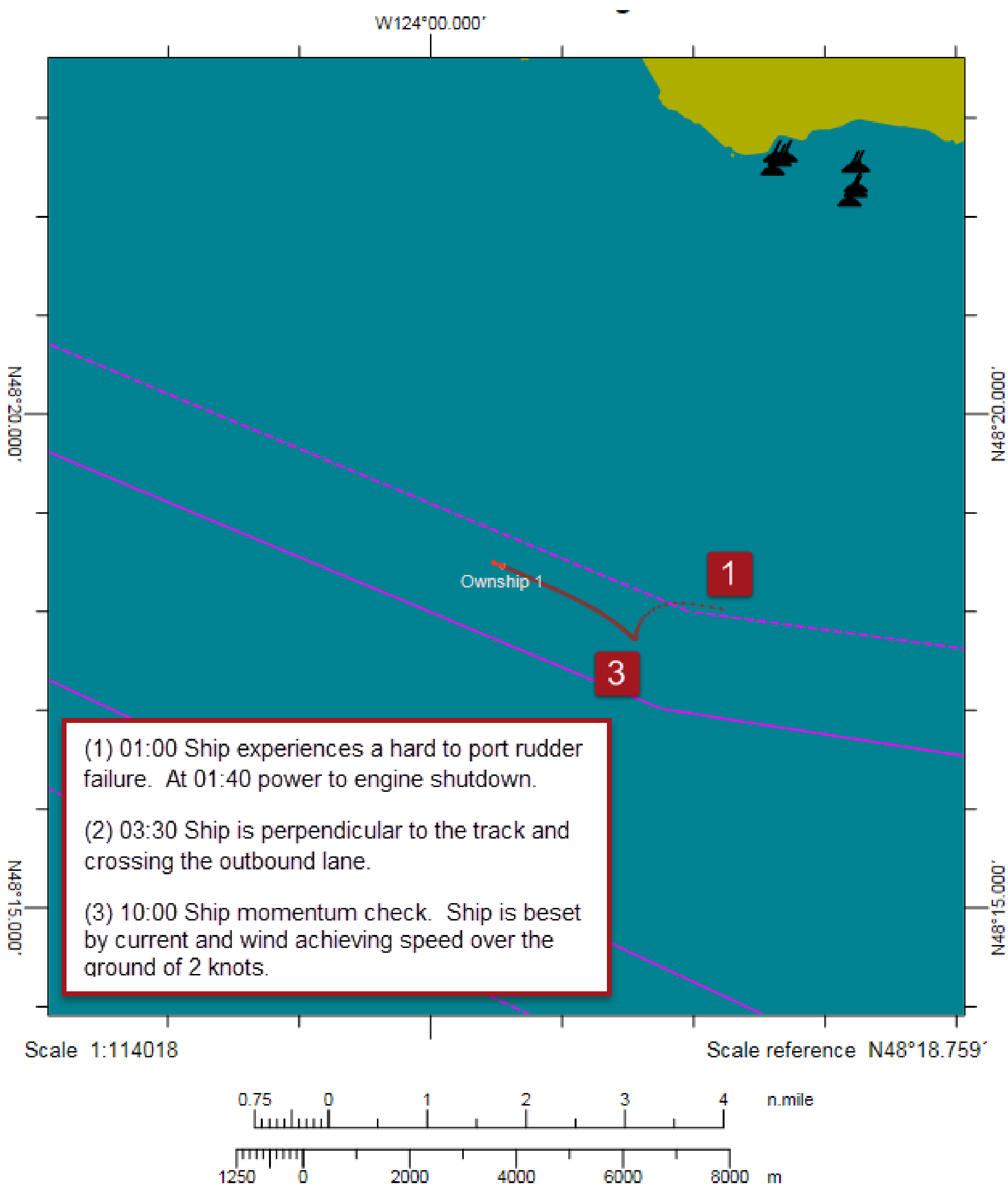


Illustration 5: Sheringham Point – Blackout no Escort

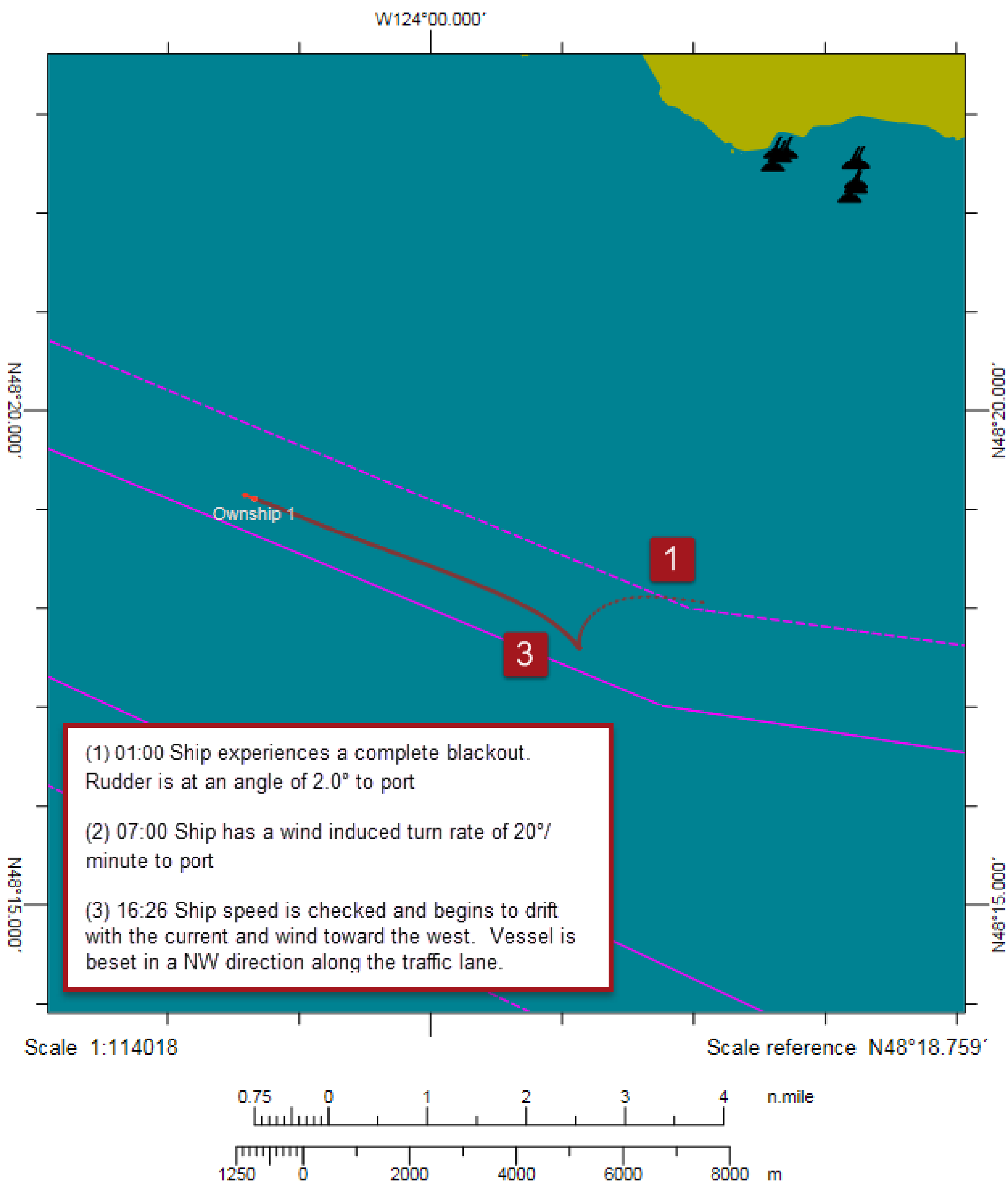


Illustration 6: Sheringham Point – Blackout with Escort

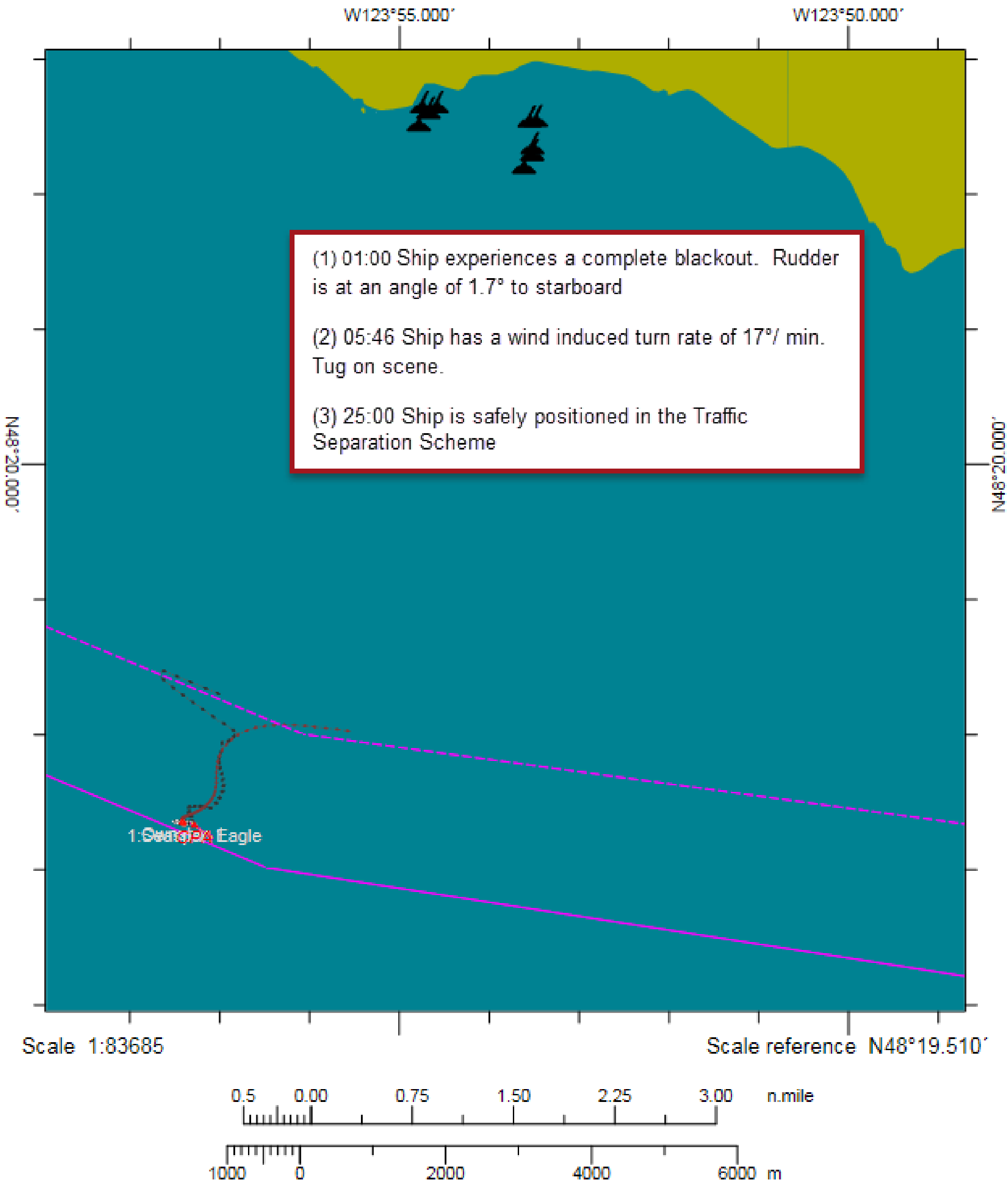


Illustration 7: Sombrio Point – Rudder Failure

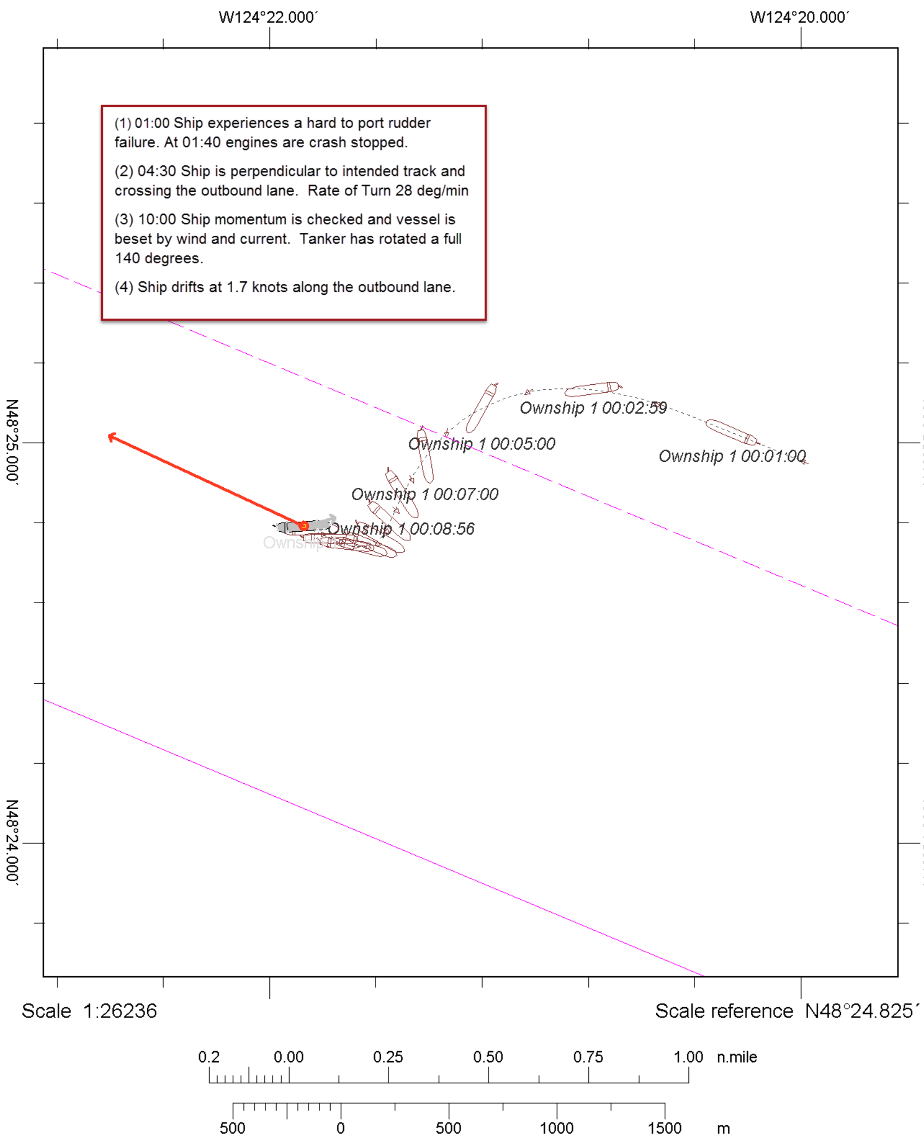


Illustration 8: Sombrio Point – Blackout no Escort

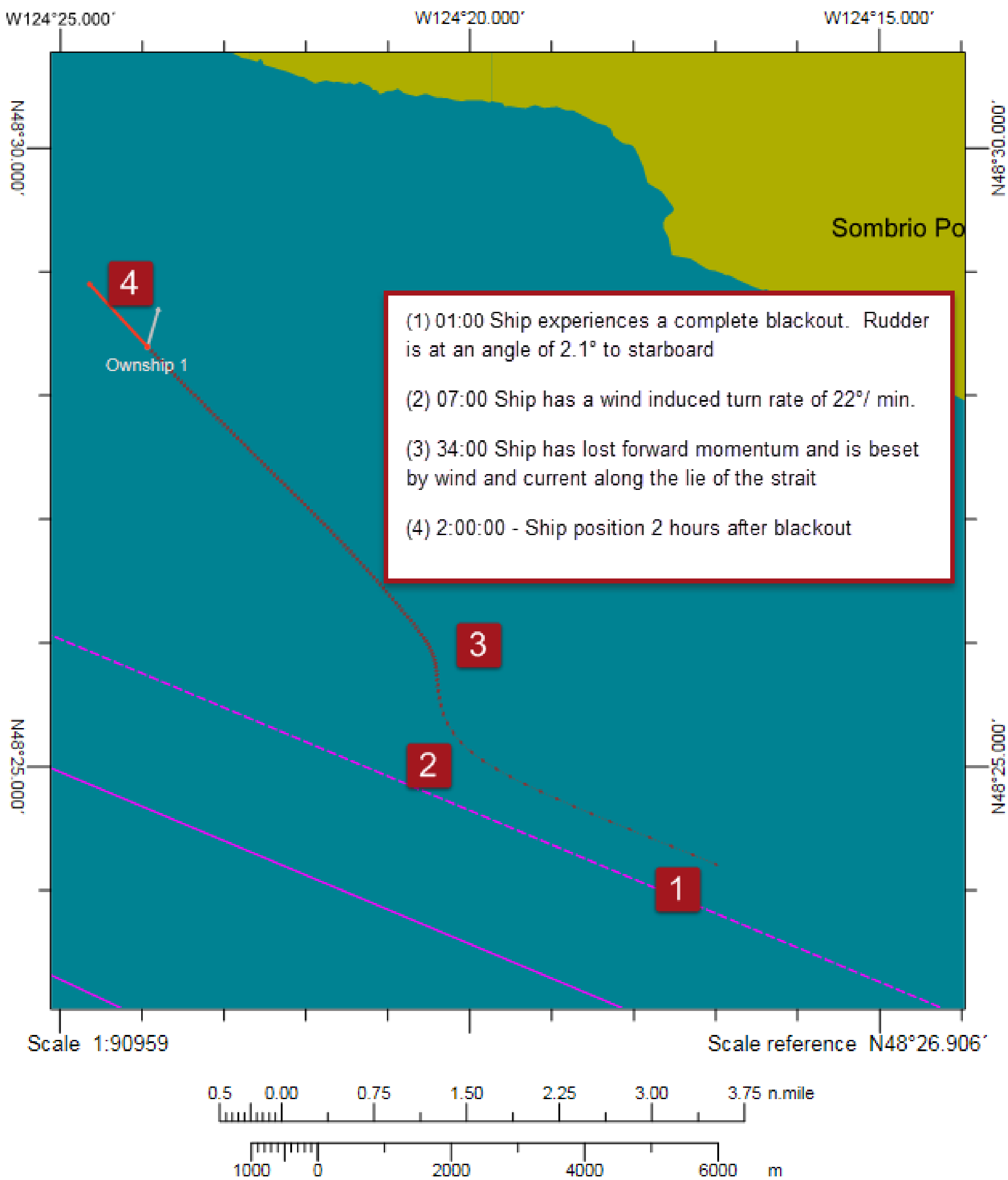


Illustration 9: Sombrio Point – Blackout no Escort – Turning to the Flood

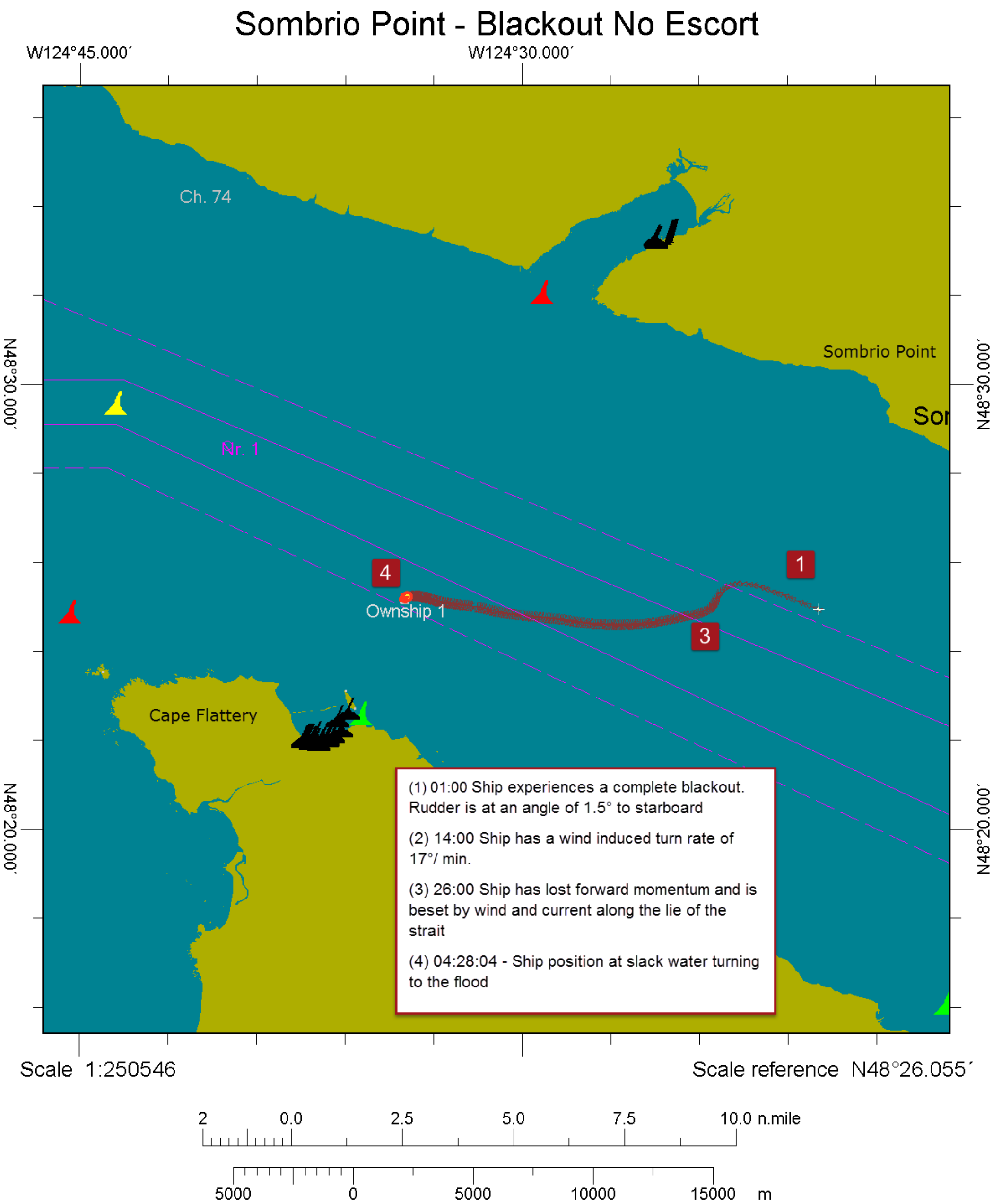

Sombrio Point - Blackout No Escort
W124°45.000´
W124°30.000´
N48°30.000´
N48°20.000´
Ch. 74
Sombrio Point
Nr. 1
Ownship 1
1
3
4
Cape Flattery
(1) 01:00 Ship experiences a complete blackout. Rudder is at an angle of 1.5° to starboard
(2) 14:00 Ship has a wind induced turn rate of 17°/ min.
(3) 26:00 Ship has lost forward momentum and is beset by wind and current along the lie of the strait
(4) 04:28:04 - Ship position at slack water turning to the flood
Scale 1:250546
Scale reference N48°26.055´
2 0.0 2.5 5.0 7.5 10.0 n.mile
5000 0 5000 10000 15000 m

Illustration 10: Sombrio Point – Blackout no Escort – Vessel Aground

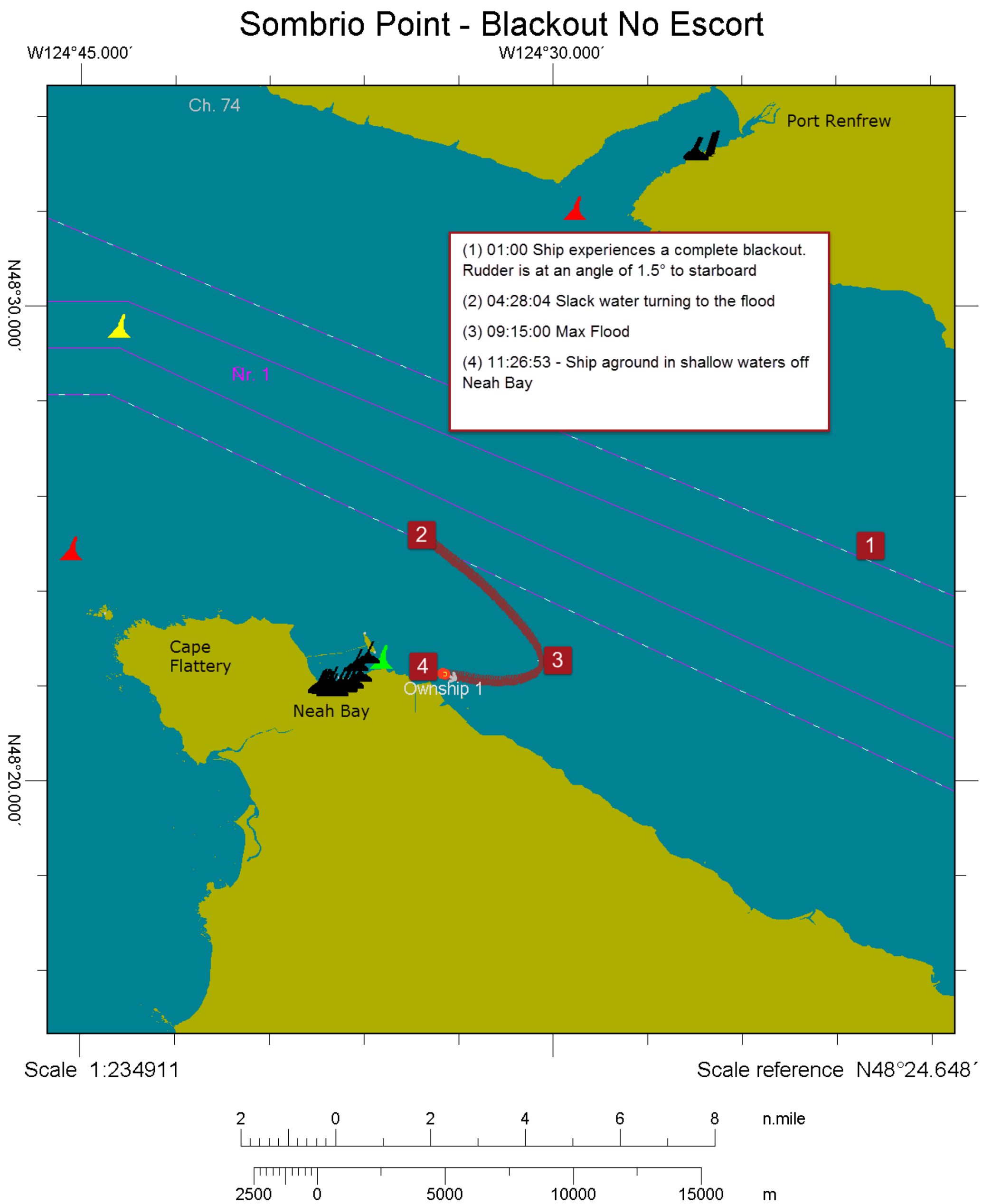


Illustration 11: Sombrio Point – Blackout with Escort

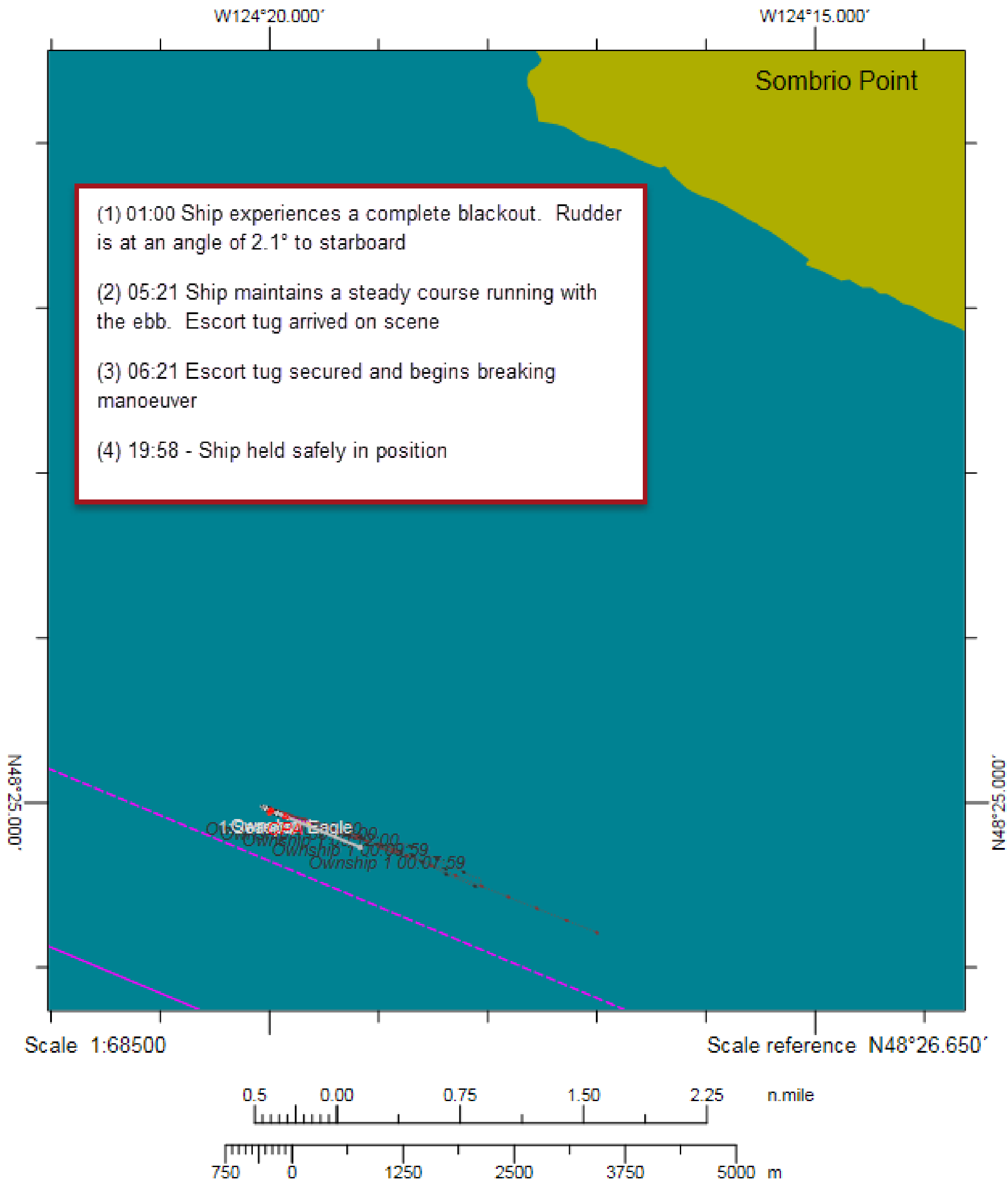
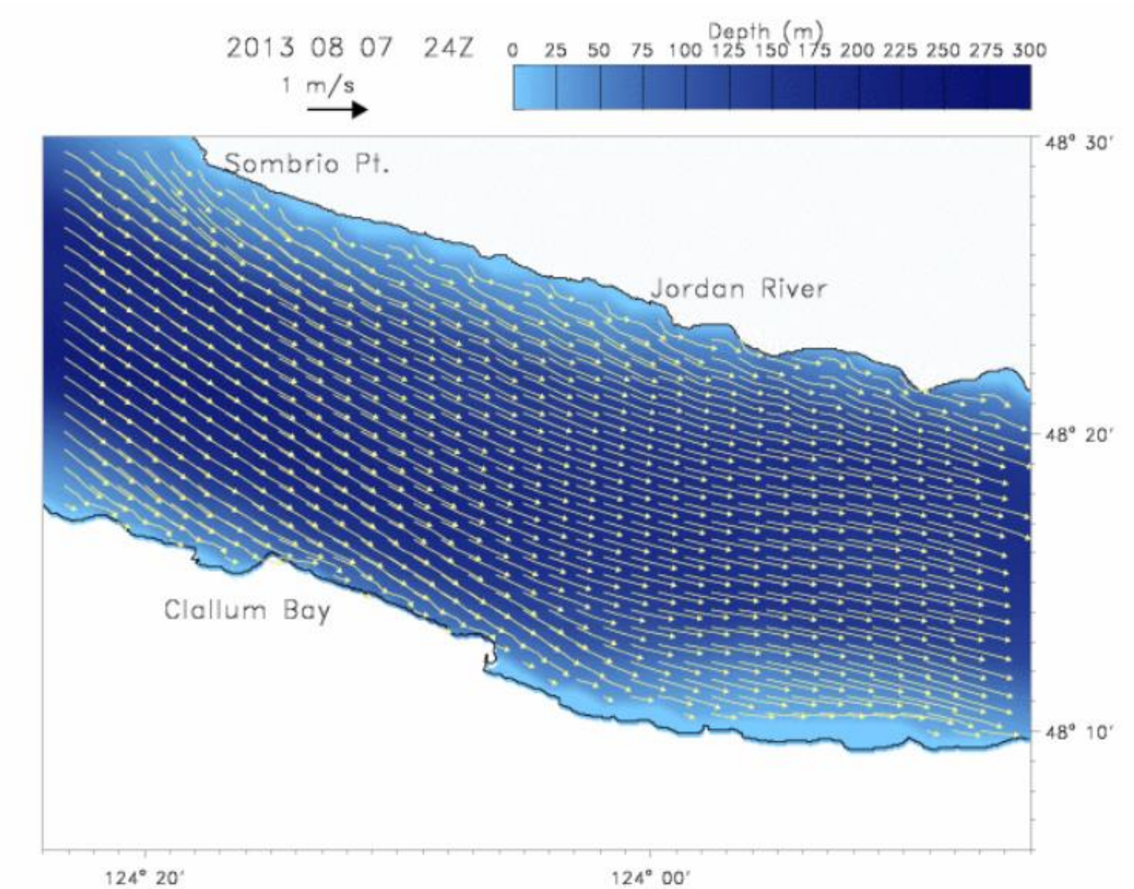
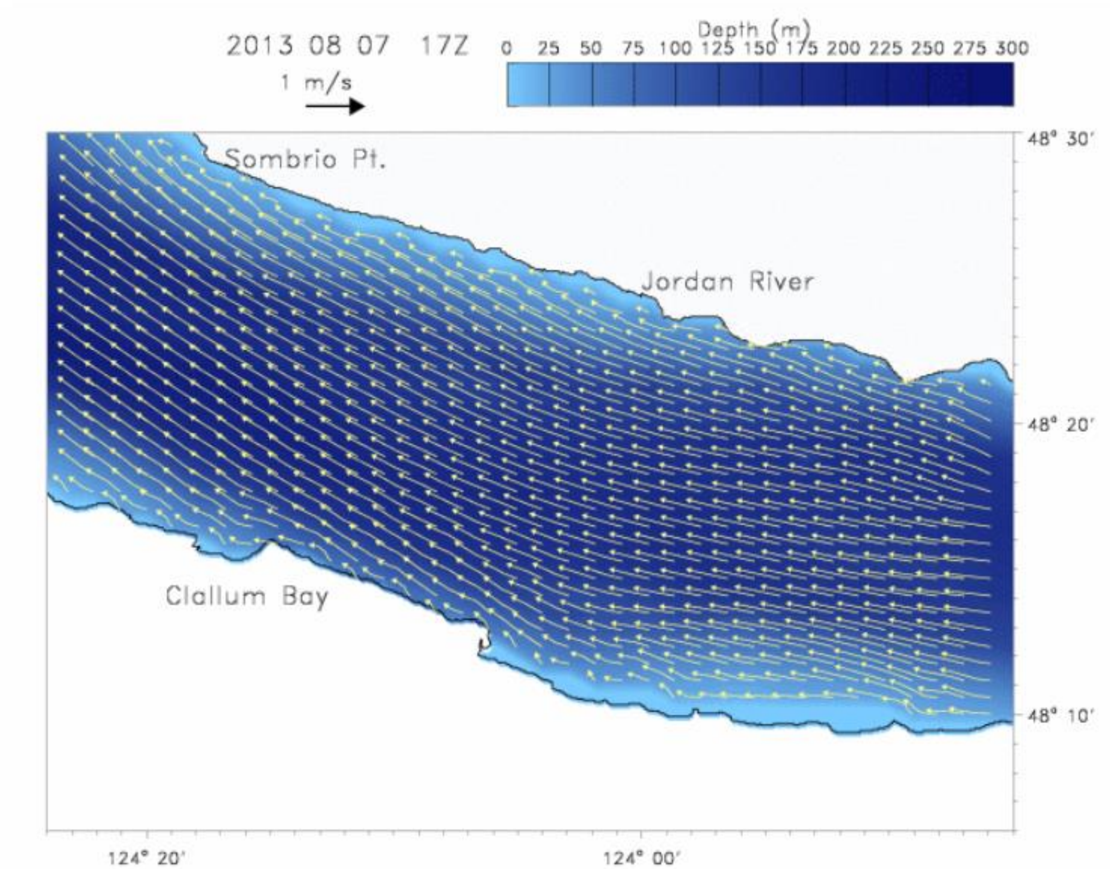


Illustration 12: Juan de Fuca Strait (West) at Max Flood



Source - http://www.pac.dfo-mpo.gc.ca/sci/juandefuca/jdf_west_animation.htm

Illustration 13: Juan de Fuca Strait (West) at Max Ebb



Source - http://www.pac.dfo-mpo.gc.ca/sci/juandefuca/jdf_west_animation.htm

Letter from Transport Canada re: Escort Simulation

Transport Canada / Transports Canada

Marine Safety and Security / Sécurité et sûreté maritimes

800 Burrard Street, Suite 620
Vancouver, BC V6Z 2J8

Phone : (604)-666-5300
Fax: (604) 666-5444

July 24, 2014

Mr. Michael Davies
Senior Director, Marine Development
Suite 2700, 300 – 5th Avenue SW
Calgary, AB
T2P 5J2

Re: **Trans Mountain Expansion Project TERMPOL Review**

Dear Mr. Davies:

As part of the TERMPOL Review Process (TRP) for the Trans Mountain Expansion Project (TMEP), the TERMPOL Review Committee (TRC) is reviewing in detail the surveys and studies submitted to it by Trans Mountain (TM). During the course of this detailed review it has become apparent that additional technical analysis is required with regard to two key areas of Trans Mountain's proposed mitigation strategy.

In the submitted risk assessment (TERMPOL study 3.15), Trans Mountain proposes tug escort and a moving exclusion zone (MEZ) for its laden tankers over the entire route in Canadian waters. In addition to being a primary means of reducing risk associated with the project, the two proposals have broader implications for marine shipping in the region.

Both proposed mitigation measures have been reviewed by the TRC based on the information provided by Trans Mountain to date. However, it has been determined that further technical analysis of the need for tug escort through the Strait of Georgia is required from Trans Mountain to inform the TRC's assessment of the proposed mitigation measures and the TRP report. Discussions with the Pacific Pilotage Authority (PPA) have revealed that there have been similar analyses conducted in the region recently and that they are willing to work with Trans Mountain to facilitate the additional analysis required by the TRC.

Therefore, the TRC respectfully requests that Trans Mountain agree to:

a) Undertake the additional analysis required for the TRC to finalize its review of the TMEP proposal; and
b) Involve the PPA in defining the scope of the additional analysis, review of submitted proposals, and assessment of the completed analysis.

Please contact the undersigned at your earliest convenience for further information. Thank you.

Sincerely,

Bob Gowe
TMEP Termpol Review Chairman
Marine Safety and Security
Transport Canada – Pacific region

cc: Kevin Obermeyer PPA
oberkev@ppa.gc.ca

PPA Response re: Pilot Availability

PPA

1000 – 1130 West Pender Street
Vancouver, BC V6E 4A4
Tel: 604-666-6771
Fax: 604-666-1647
Email: info@ppa.gc.ca

July 30, 2014

Captain Bikramjit Kanjilal
Lead, Marine Development
Trans Mountain Expansion Project
Kinder Morgan Canada
2844 Bainbridge Avenue
PO Box 84028 Bainbridge
Burnaby, BC V5A 4T9

Dear Bikram:

CoV IR # 9.6 c Regarding the increased need for Marine Pilots to support TMX Tankers

In answer to the intervenor question on the total number of additional pilots required to support the TMX tankers the answer is that it will be between 6 (low) and 15 (high).

The calculation is as follows:

(1) The number of assignments per pilot per year varies between 136 and 146

(2) Assuming 141 as an average number of assignments

(3) At present we have 91.08 FTEs

(4) Total assignments for 91 FTEs at 141 per FTE is 12,831

(5) Coastal assignments for 2013 were 11,700

(6) Slack in the system is 12,831 – 11,700 = 1,131

(7) Since 1995 assignments have been steadily decreasing largely due to the increasing vessel size (see attachment)

(8) With that in mind we will assume a flat forecast for all other vessels

(9) Additional TMX tankers coming into the system (max) 360

   a. Inbound tankers in ballast will either have one or two pilots (size and time)

   b. Inbound high of 720 low of 360 (360 x 1 or 2)

c. Outbound requires 4 pilots for a total of 1,440 (360 x 4)

d. Total additional low of 1,800 to a high of 2,160

(10) With slack in the system of just over 1,000 the actual low assignments is 800 and high is 1,160

(11) At an average of 141 assignments per FTE we will require 6 to 9 pilots

(12) If assume worst case scenario that there will be a general increase over the next 5 years then we could move the coastal assignment number to 12,600 which will mean the additional pilots required will be 12 to 15.

(13) We are presently erring on the side of caution and are already increasing our numbers. This year (2013) to date we have hired 8 apprentices and are looking at bringing on additional apprentices. We are also holding two exams this year and might well do the same next year as we move forward.

I would also like to clarify the issue of unrestricted pilots. It is well known that Aframax tankers require an unrestricted pilot (more than 6 years as a pilot) and there is a concern that we will not have a sufficient number of unrestricted pilots.

At present we are seeking a net gain of 3 to 5 pilots per annum (depending on how many projects come to fruition). In 2014 we had a net gain of 6 pilots. Between 2014 and 2020, with an expected net gain of 5 pilots per annum, we will have 90 unrestricted pilots and 30 restricted pilots. At present we have 72 unrestricted and 18 restricted. Based on these figures we feel comfortable that we will have a sufficient number of unrestricted pilots.

I trust that this answers the question as posed. Please feel free to contact me if you have further questions.

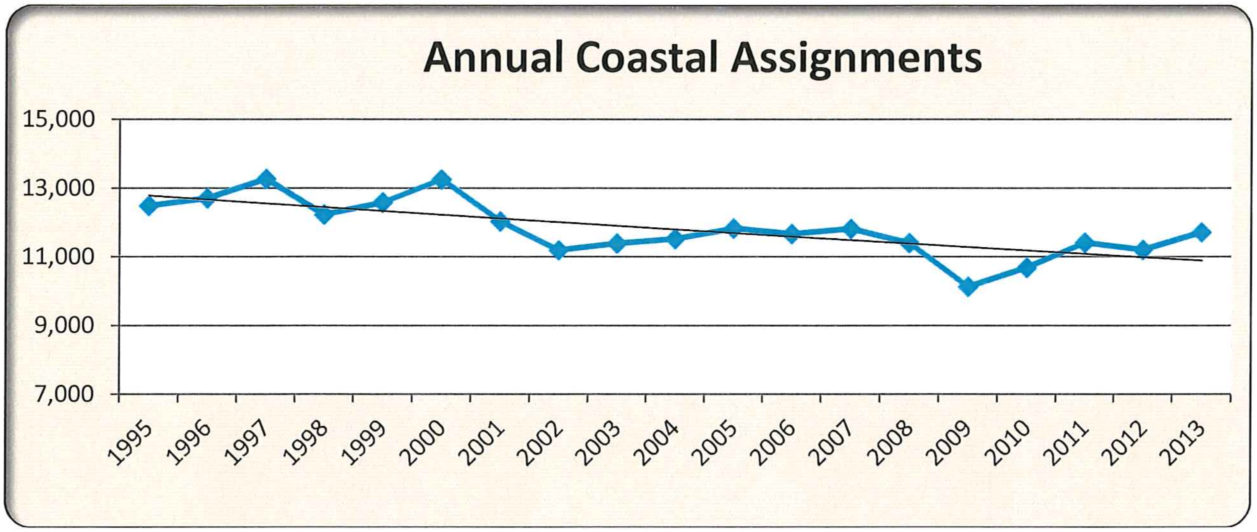
Yours sincerely,

Kevin Obermeyer
Chief Executive Officer
/if

Encl.

Annual coastal assignments

1995 - 2013



PPA Response re: Tug Escort

PPA

1000 – 1130 West Pender Street
Vancouver, BC V6E 4A4
Tel: 604-666-6771
Fax: 604-666-1647
Email: info@ppa.gc.ca

July 31, 2014

Captain Bikramjit Kanjilal
Lead, Marine Development
Trans Mountain Expansion Project
Kinder Morgan Canada
2844 Bainbridge Avenue
PO Box 84028 Bainbridge
Burnaby, BC V5A 4T9

Dear Bikram:

NEB Review – District of West Vancouver IR #1.13

The Pacific Pilotage Authority is not in a position to make a comparison between what it is presently doing with respect to escort tugs for liquid bulk carriers and what other jurisdictions choose to do. What we can do is provide a rationale, timelines and training with respect to the escort tug program we presently enjoy on the west coast of Canada.

(1) 1989 Movement restricted area (MRA) established for Second Narrows which includes a section on escort tugs through Haro Strait and Boundary Pass

(2) 1998 MRA requirements updated with specific tug requirements

(3) 2005 ↓ 2010 Review of MRA
- (a) Risk assessment of MRA conducted including setting tug bollard power
- (b) Fast time simulation of tug packages conducted
- (c) International Towing Solutions hired to review tug package for Second Narrows and make recommendations
- (d) Old methodology proved ineffective, new methodology tested in additional fast time simulation
- (e) Once fast time simulation completed, a real-time simulation in a full mission bridge simulator was conducted
- (f) Finally all lessons learned were put to the test by having Robert Allan Ltd. devising a series of live trials using an Aframax tanker on Georgia Strait

(g) An additional risk assessment was conducted. Mitigations included improvements of navaids, introduction of personal pilotage units (PPUs), training for all pilots in ECDIS, and tethered tug operations to name a few

(4) 2010

(a) All 100 pilots trained in tethered tug operations and PPUs at a cost of $1.1 million
(b) All pilots provided with a PPU at a cost of $1.2 million

(5) 2011

(a) At this time transits through Haro Strait and Boundary Pass required an escort tug for all crude oil carriers over 40,000 deadweight
(b) A fast time simulation and live trial were undertaken and as a result, all crude oil carriers over 40,000 deadweight were tethered

(6) 2013

After consultation the Haro Strait/Boundary Pass guidelines were amended to include all liquid bulk vessels over 40,000 deadweight (in force January 1, 2014)

In summary, we believe that we have done exemplary work in determining the requirements for tethered escort tugs on the West Coast and we will continue to use these principles for all new liquid bulk proposals.

I trust that this will assist you in responding. Please feel free to contact me if you have any further questions.

Yours sincerely,

Kevin Obermeyer
Chief Executive Officer
/if

15 September 2010

PPA

1000 – 1130 West Pender Street
Vancouver, BC V6E 4A4
Tel: 604-666-6771
Fax: 604-666-1647
Email: info@ppa.gc.ca

NOTICE TO PILOTS – COASTAL

Notice #192/10

SUBJECT: Interim Operating Rules for Loaded Crude Oil Tankers in excess of 40, 000 Dead Weight Tonnage

Please note: This Notice replaces Notice 90/98

This notice will remain interim in status until such time that a joint meeting is held between the representatives of Pacific Pilotage Authority (PPA), British Columbia Coast Pilots (BCCP), Chamber of Shipping BC (COSBC), Transport Canada Marine Safety (TCMS), Canadian Coast Guard (CCG) and the Petroleum Industry.

These operating rules will apply to all loaded crude oil tankers in excess of 40,000 DWT transiting Haro Strait & Boundary Pass.

1. Two (2) Pilots will be dispatched to loaded crude oil tankers in excess of 40,000 Tons Deadweight. Both Pilots are to be on the bridge when transiting between three (3) miles north of East Point and the Victoria Pilot Station.

2. On all outbound transits the vessel may proceed directly to Victoria Pilot Station providing there are no delays and the vessel will arrive at East Point prior to the commencement of the flood current.

3. If the tanker is outbound and delayed and is unable to arrive at East Point before the commencement of the flood tide where the maximum flood current predicted at Race Passage is in excess of two (2) knots, the vessel will anchor at a designated anchorage in English Bay to await a suitable departure time so as to arrive at East Point on the next high water slack.

4. If the tanker is proceeding to East Point from an anchorage the Pilots shall be dispatched to sail the vessel in sufficient time to meet the required ETA for high water slack at East Point.

5. The vessel must be ready for immediate maneuvering between English Bay and three (3) miles north of East Point.

6. Two (2) ship's officers and two (2) seamen are to be on the bridge at all times when underway.

7. Two (2) extra seamen to be called out on standby when transiting between three (3) miles north of East Point and Race Rocks.

8. Escort Tug(s) Requirements for Boundary Pass & Haro Strait:

- An "Escort Tug" is defined as a tug powered by two (2) or more omni-directional thrusters in either a "Z-drive" or "Voith Schneider" configuration, capable of safely applying steering and braking forces to a ship via a towline at speeds of six (6) knots and more. For safety, the towline length needs to be adjustable using a winch that is controlled from the safety of the tug's wheelhouse. The tug master shall be situated in the wheelhouse with clear sight lines to afford the tug operator a near 360° view (*masts, exhausts and other small items may restrict the view by a few degrees*). The tug company offering a tug for this service must prove the tug's ability to safely absorb the potential towline forces generated at the expected escort speeds, when applied at 90° to the tug centreline at the towing point without immersing the deck edge of the tug. The Owner must also demonstrate that in the event of a failure of any element of the tug's propulsion/steering system during any indirect operation, that the tug has a "fail safe" configuration of tow-point to the centre of effort (underwater), such that the tug will always yaw into the direction of applied force and not across it.
- The Escort Tug will be escort-capable and equipped with an operational tension meter.
- The Escort Tug will be capable of operating in the Indirect, Powered Indirect & Direct Escort Mode.
- The Escort Tug will be tethered from a position two (2) miles north of East Point to the vicinity of Brotchie Ledge.
- The Escort Tug must remain in attendance with the Tanker until in the vicinity of Race Rocks
- Passage planning will maintain a minimum grounding line of six (6) cables. For reasons of safety, where the grounding line is less than six (6) cables, the speed shall be reduced from 10 knots to a speed such that the escort tug(s) can be reasonably expected to bring the tanker under control within the navigational limits of the waterway.
- Tankers with a Length Overall plus beam (LOA+B) of less than 265 meters will require an escort tug with a minimum static bollard pull of 50 metric tons.
- Tankers with a Length Overall plus beam (LOA+B) of 265 meters or greater but less than 295 meters will require an escort tug with a minimum static bollard pull of 65 metric tons.
- Tankers with a Length Overall plus beam (LOA+B) greater than 295 meters will require prior approval from BC Coast Pilots and other regulatory bodies and may require an additional escort tug

9. Escort tanker speeds through the water.

- The speed of vessels being escorted shall not exceed 10 knots through the water.
- The speed shall take into consideration weather & sea conditions, manoeuvring and other characteristics of the vessel, traffic density and other factors that may affect the manoeuvring of the vessel.
- The escort speeds indicated may be adjusted to respond to prevailing conditions.

10. All vessels requiring escorts must conduct a Pilot to ship Master to tug Master pre-escort conference. Exchange of information shall include:

    - planned speed of escort transit
    - passage plan
    - SWL of hard points
    - positioning of escort tug relative to tanker vessel being escorted
    - VHF frequency used for communications
    - predicted weather and sea conditions including weather limitations
    - any other relevant information

11. Nothing in these rules relieves the Master from compliance with the Collision Regulations and the safe navigation of his ship. A departure from these rules may be required for safety purposes in response to prevailing circumstances and conditions.

Brian Young
Director, Marine Operations

PACIFIC PILOTAGE AUTHORITY
1000 – 1130 West Pender Street
Vancouver, B.C
V6E 4A4

IN FORCE JANUARY 1st 2014 KG

PPA

NOTICE TO INDUSTRY

Date Issued: 11 October 2013

Notice Number: 07/2013
(replaces Notice 03/2013)

Subject: Operating rules for vessels carrying liquids in bulk, fully or partially loaded, with a Summer Dead Weight Tonnage (SDWT) of 40,000 or greater.

Geographic Area: Boundary Pass / Haro Strait

Communication: The tug escort criteria mentioned below was developed through simulated exercises. It is the intention of the PPA/BCCP to conduct live escort trials to validate the simulated exercise data. This notice will be updated, if necessary, on completion of the live escort trials.

Details:

These operating rules are already in force for crude oil tankers, fully or partially loaded, with a SDWT of 40,000 or greater transiting Haro Strait & Boundary Pass. They will apply to all other vessels with a SDWT of 40,000 or greater carrying liquids in bulk as of 01 January 2014.

1. Two (2) pilots will be dispatched to vessels carrying liquids in bulk, fully or partially loaded, with a SDWT of 40,000 or greater. Both pilots are to be on the bridge when transiting between three (3) miles north of East Point and the Victoria Pilot Station or vice versa when inbound.

2. On all outbound transits the vessel may proceed directly to Victoria Pilot Station providing there are no delays and the vessel will arrive at East Point prior to the commencement of the flood current.

3. If the vessel is outbound and delayed and is unable to arrive at East Point before the commencement of the flood tide where the maximum flood current predicted at Race Passage is in excess of two (2) knots, the vessel will be directed to an available anchorage to await a suitable departure time so as to arrive at East Point on the next high water slack.

4. If the vessel is proceeding to East Point from an anchorage the pilots shall be dispatched to sail the vessel in sufficient time to meet the required ETA for high water slack at East Point.

5. The vessels' engines must be on maneuvering RPM between English Bay and three (3) miles north of East Point or vice versa when inbound.

6. Two (2) ship's officers and two (2) seamen are to be on the bridge at all times when underway.

7. Two (2) extra seamen to be called out on standby when transiting between three (3) miles north of East Point and Race Rocks or vice versa when inbound.

8. Escort Tug(s) Requirements for Boundary Pass & Haro Strait:

   - An "Escort Tug" is defined as a tug powered by two (2) or more omni-directional thrusters in either a "Z-drive" or "Voith Schneider" configuration, capable of safely applying steering and braking forces to a ship via a towline at speeds of six (6) knots and more. For safety, the towline length needs to be adjustable using a winch that is controlled from the safety of the tug's wheelhouse. The tug master shall be situated in the wheelhouse with clear sight lines to afford the tug operator a near 360° view (*masts, exhausts and other small items may restrict the view by a few degrees*). The tug company offering a tug for this service must prove the tug's ability to safely absorb the potential towline forces generated at the expected escort speeds, when applied at 90° to the tug centreline at the towing point. The owner must also demonstrate that in the event of a failure of any element of the tug's propulsion/steering system during any indirect operation, that the tug has a "fail safe" configuration of tow-point to the centre of effort (underwater), such that the tug will always yaw into the direction of applied force and not across it.
   - The Escort Tug will be escort-capable and equipped with an operational tension meter.
   - The Escort Tug will be capable of operating in the Indirect, Powered Indirect & Direct Escort Mode.
   - The Escort Tug will be tethered from a position two (2) miles north of East Point to the vicinity of Brotchie Ledge or vice versa inbound.
   - The Escort Tug must remain in attendance with the vessel until in the vicinity of Race Rocks when outbound and meet the vessel in the vicinity of Race Rocks when inbound.
   - Passage planning will maintain a minimum grounding line of six (6) cables. For reasons of safety, where the grounding line is less than six (6) cables, the speed shall be reduced from 10 knots to a speed such that the escort tug(s) can be reasonably expected to bring the vessel under control within the navigational limits of the waterway.
   - Vessels with a Length Overall plus beam (LOA+B) of less than 265 meters will require an escort tug with a minimum static bollard pull of 50 metric tons.
   - Vessels with a Length Overall plus beam (LOA+B) of 265 meters or greater but less than 295 meters will require an escort tug with a minimum static bollard pull of 65 metric tons.
   - Vessels with a Length Overall plus beam (LOA+B) greater than 295 meters will require prior approval from BC Coast Pilots and other regulatory bodies and may require an additional escort tug.

9. Escorted vessel speeds through the water:

   - The speed of vessels being escorted shall not exceed 10 knots through the water.
   - The speed shall take into consideration weather and sea conditions, manoeuvring and other characteristics of the vessel, traffic density and other factors that may affect the manoeuvring of the vessel.
   - The escort speeds indicated may be adjusted to respond to prevailing conditions.

10. All vessels requiring escorts must conduct a pilot to ship master to tug master pre-escort conference. Exchange of information shall include:

    - planned speed of escort transit
    - passage plan
    - SWL of hard points

- positioning of escort tug relative to vessel being escorted
- VHF frequency used for communications
- predicted weather and sea conditions including weather limitations
- any other relevant information

11. Nothing in these rules relieves the master from compliance with the Collision Regulations and the safe navigation of his ship. A departure from these rules may be required for safety purposes in response to prevailing circumstances and conditions.

If there are any queries, concerns or a wish to meet to further discuss these issues please feel free to contact me at oberkev@ppa.gc.ca or by telephone at 604-666-6771.

Kevin Obermeyer
CEO

Aboriginal Engagement Summary

TERMPOL UPDATE

Aboriginal Engagement

Introduction

Through its Aboriginal Engagement Program, the Trans Mountain Expansion Project (TMEP) manages ongoing engagement with Aboriginal groups located within the marine shipping corridor. Included in the program is the exchange of information regarding the Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL).

This section of Technical Update #3 provides information on the TMEP Aboriginal Engagement Program specific to TERMPOL-related engagement between August 1, 2013 and July 31, 2014. This update outlines engagement activity during the period and summarizes the comprehensive information provided and feedback received during the reporting period.

Detailed information on engagement activity conducted is located in the Aboriginal Engagement Logs included in Appendix A of this part.

Engagement Activity

Starting in August, 2013, engagement regarding the type of information and research being undertaken to develop TERMPOL studies took place with Aboriginal groups. Actively engaged Aboriginal groups expressed interest in the timing, content of studies and process for shaping the TERMPOL studies and participating in the review process.

On November 13, 2013, Trans Mountain sent a letter to Aboriginal groups to notify of the availability of the TERMPOL studies for review. Through this letter, Trans Mountain:

- affirmed that the TERMPOL application and studies would be submitted to Transport Canada in December, 2014;
- committed to distribute the studies to Aboriginal groups that requested copies; and,
- stated a need for advice and feedback to Trans Mountain on the TERMPOL reports within 2 to 3 months.

On December 16, 2013, a letter was sent to the Aboriginal groups who requested copies of TERMPOL studies, together with the TERMPOL studies on a USB Stick. Following the December 16, 2013 letter, a letter was also sent to Tsawout First Nation on January 27, 2014 together with hard copies of the TERMPOL studies.

The November 13 and December 16, 2013 letters are included in Appendix A of this part.

Aboriginal engagement logs for the Aboriginal groups actively engaged in the TERMPOL process are included in Appendix B of this part and include: Cowichan Nation Alliance; Hwlitsum First Nation; Pacheedaht First Nation; and Tsawwassen First Nation.

Following distribution of the December 16, 2013 letter and studies, Kinder Morgan Canada Inc. (KMC) followed up with Aboriginal groups who requested the studies, through calls and meetings to discuss:

- participating in a TERMPOL workshop;
- provision of a written response to Trans Mountain;
- initiation of a third-party review; and/or
- allocation of capacity funding for the third-party review.

TABLE 1

ENGAGEMENT ACTIVITY WITH ABORIGINAL GROUPS AND THE TERMPOL PROCESS

Aboriginal Group (Received November 13, 2013, letter from Trans Mountain)	Requested TERMPOL Studies	Response or Information Request Sent to Trans Mountain about TERMPOL Studies	Received Funding	Attended TERMPOL Workshop
Cowichan Nation Alliance (CNA)	✓	Response: April 4, 2014		January 17, 2014
Cowichan Tribes (CNA Chair)	✓			January 17, 2014
Halalt First Nation (CNA Member)	✓			January 17, 2014
Penelakut Tribe (CNA Member)	✓			January 17, 2014
Stz'uminus First Nation (CNA Member)	✓			January 17, 2014
Hwlitsum First Nation (CNA Member)	✓	Information Request: April 7, 2014	✓	January 17, 2014
Lyackson First Nation	✓			
Nuu-Chah-Nulth Tribal Council (NTC)				
Ditidaht First Nation (NTC Member)				
Huu-Ay-Aht First Nation (NTC Member)	✓			
Pacheedaht First Nation	✓	Information Request: February 18, 2014	✓	April 17, 2014
Esquimalt Nation				
Malahat First Nation				
Snaw-Naw-As (Nanoose First Nation)				
Scia'new First Nation				
Songhees Nation				
Snuneymuxw First Nation				
T'Sou-ke First Nation				
Tsartlip First Nation				
Tsawout First Nation*	✓	Response: November 17, 2013		
Tseycum First Nation				
Katie First Nation (*letter sent November 25)				
Kwikwetlem First Nation				
Tsleil-Waututh Nation				
Tsawwassen First Nation	✓	Information Request: April 11, 2014		March 25, 2014
Semiahmoo First Nation				
Sechelt Indian Band				
Musqueam First Nation	✓			

Note: * Tsawout has requested confidentiality in its engagement with Trans Mountain.

Trans Mountain received three formal responses to the TERMPOL studies and conducted three TERMPOL workshops with seven Aboriginal groups. The meeting minutes from the workshops which took place with members of the Cowichan Nation Alliance, Pacheedaht First Nation and Tsawwassen First Nation are included in Appendix C of this Part.

On April 3, 2014, the Cowichan Tribes sent a letter to Transport Canada and Trans Mountain expressing concern regarding the TERMPOL process. The letter concluded by requesting that Transport Canada discuss the timeliness of the studies and surveys and the opportunity to provide input before the final report is prepared.

In July 2014, Trans Mountain provided technical responses to Pacheedaht First Nation, Hwlitsum First Nation and Tsawwassen First Nation regarding the technical submissions submitted in respect of the TERMPOL studies. The letters received and responses provided by Trans Mountain are included in Appendix D of this Part.

Future Aboriginal Engagement Activity

Trans Mountain will continue its engagement with Aboriginal communities, groups, associations, councils and tribes following the submission of this update to ensure meaningful engagement continues to occur in regard to TERMPOL. Trans Mountain is committed to the continuation of an effective Aboriginal Engagement Program and will continue engagement through the regulatory process and into Project construction and operation.

Appendix A

APPENDIX A-1

A-01: Cowichan Nation Alliance
A-02: Hwlitsum First Nation
A-03: Pacheedaht First Nation
A-04: Tsawwassen First Nation

APPENDIX A-01

COWICHAN NATION ALLIANCE

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
8/2/2013	Email – Incoming	Melissa Charlie, Administrator	Ellen Frisch (KMC)	M. Charlie emailed team member to convey CNA's response to the ESA Document. Response provided a summary of key concerns followed by Appendix A, listing mitigation measures for consideration in bitumen-based marine spill, together with key performance indicators for consideration by Trans Mountain. Team member responded acknowledging receipt of the document.	Bitumen, Spill Response
8/6/2013	Email-Incoming	Melissa Charlie, Administrator	Ellen Frisch (KMC)	M. Charlie emailed team member and cancelled meeting on August 6, 2013 and requested a rescheduling. Team member emailed M. Charlie and provided multiple dates for the meeting throughout the week of August 12, 2013.	None
8/7/2013	Email-Incoming	Eamon Gaunt, Resource Lead	Ellen Frisch (KMC)	E. Gaunt emailed team member and accepted meeting on August 15, 2013. Team member emailed E. Gaunt and requested the time and location of the meeting.	None
8/13/2013	Email-Incoming	Eamon Gaunt, Resource Lead	Ellen Frisch (KMC)	E. Gaunt emailed team member and requested time and location for August 15, 2013 meeting.	None
8/14/2013	Email-Outgoing	Eamon Gaunt, Resource Lead	Ellen Frisch (KMC)	Team member emailed E. Gaunt and set location for meeting.	None
8/15/2013	Email-Incoming	Eamon Gaunt, Resource Lead	Ellen Frisch (KMC)	E. Gaunt emailed team member and confirmed meeting details for August 15, 2013.	None
8/15/2013	In-Person	Eamon Gaunt, Resource Lead	Ellen Frisch (KMC)	Team member met with E. Gaunt on August 15, 2013 and discussed next steps in the interest identification process and potential meetings with Chief and Council and the community.	None
9/9/2013	Email-Outgoing	Al Grove, Hwlitsum Eamon Gaunt, Resource Lead, Jack Smith, Community Consultant, Ronda Jordan, Stz'uminus, Ruth Sauder, Penelakut	Ellen Frisch (KMC)	Team member emailed CNA working Group with an invitation to attend a meeting that had been scheduled for all Chiefs with shared interests in the Salish Sea.	None
9/17/2013	Email-Outgoing	Al Grove, Denise James, Eamon Gaunt, Resource Lead, Jack Smith, Community Consultant, Ronda Jordon, Ruth Sauder	Ellen Frisch (KMC)	Team member emailed A. Grove, D. James, E. Gaunt, J. Smith, R. Jordan and R. Sauder and proposed a follow-up meeting in October to review the Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL) process. Team member provided updates for the Marine Study Terms of Reference, TERMPOL marine study review, fall meetings with chiefs and councils, capacity funding, and marine chief meeting on September 30, 2013.	TERMPOL
9/22/2013	Email-Outgoing	Eamon Gaunt, Resource Lead, Ronda Jordon, Ruth Sauder	Ellen Frisch (KMC)	Team member emailed E. Gaunt, R. Jordan and R. Sauder regarding notice of commencement of fieldwork associated with the Archeological Impact Assessment (AIA). Team member stated that the original email had gone to a more generic inbox and inquired if there was a more specific route that could be used to provide notice.	Archaeological Impact Assessment
9/23/2013	Email-Incoming	Eamon Gaunt, Resource Lead and CNA Working Group.	Ellen Frisch (KMC)	Team member emailed CNA Working Group members and provided list of TERMPOL marine studies.	TERMPOL
9/25/2013	Email-Outgoing	Eamon Gaunt, Resource Lead	Ellen Frisch (KMC)	Team member emailed E. Gaunt and provided list of TERMPOL marine studies.	TERMPOL
9/26/2013	Phone - Outgoing	Eamon Gaunt, Resource Lead	Ellen Frisch (KMC)	Team member phoned E. Gaunt and left message to arrange meeting to review marine studies and plan next steps. Team member requested return call.	None
9/26/2013	Phone - Outgoing	Eamon Gaunt, Resource Lead	Ellen Frisch (KMC)	Team member phoned E. Gaunt and left message to arrange meeting to review marine studies and plan next steps with CNA Working Group. Team member requested return call.	None
9/30/2013	In Person	Myrus James, Penelakut Representative of CNA	Ellen Frisch (KMC) Georgia Dixon (KMC)	Team members met with M. James and another representative to discuss approaches to Salish Sea marine issues and First Nations concerns and interests in future environmental, planning and other initiatives.	Sediment contamination and impacts to shellfish harvesting.
10/09/2013	Email-Outgoing	Randy Neufeldt, WCMRC	Ellen Frisch (KMC)	Team member emailed Randy Neufeldt and extended an invitation to the Aboriginal Engagement team meeting scheduled on October 10, 2013 to review the status of engagement, next steps in the consultation process and further plan Trans Mountain's marine strategy pre- and post-application filing.	Regulatory – NEB
10/09/2013	Email-Outgoing	Randy Neufeldt, WCMRC	Ellen Frisch (KMC)	Team member emailed R. Neufeldt to enquire if the draft flow chart had been updated and if the document was a subtext to review with Cowichan Nation Alliance (CNA). Team member wrote that the flowchart would help CNA members to connect with Trans Mountain's legacy funding and support members' participation in development of protection strategies. Team member noted that Traditional Marine Resource Use work could directly inform regional protection strategies as well as be integrated into the provincial database.	Traditional Marine Resource Use, West Coast Marine Response Centre
10/09/2013	Email-Outgoing	Randy Neufeldt, WCMRC	Ellen Frisch (KMC)	Team member emailed R. Neufeldt to relay that CNA would be meeting on October 22, 2013, in Duncan. Team member suggested that it would be a good opportunity for R. Neufeldt to introduce WCMRC, discuss the FOSET program and open a dialogue regarding the type of resources that were within the CNA community (i.e. vessels, captains, mates). Team member noted that such a presentation would support later Project dialogues concerning legacy opportunities and assistance in evaluating CNA human, resource and training needs.	West Coast Marine Response Centre

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
10/15/2013	Email-Outgoing	Eamon Gaunt (Resource Lead)	Ellen Frisch (KMC)	Team member emailed E. Gaunt and confirmed a CNA meeting on October 22, 2013 at the CNA office. Team member suggested that the training team lead member and R. Neufeldt from Western Canada Marine Response Corporation (WCMRC) attend the meeting, offering additional dates to accommodate the CNA members' schedules. E. Gaunt emailed team member and confirmed that the meeting should take place on an alternative date of October 31, 2013. Team member emailed E. Gaunt and suggested the meeting on October 31, 2013 should include an additional team member to discuss a pipeline routing location and R. Neufeldt from WCMRC. E. Gaunt emailed team member and enquired if Trans Mountain would require a private meeting with CNA.	None
10/23/2013	Email-Outgoing	Eamon Gaunt (Resource Lead)	Ellen Frisch (KMC)	Team member emailed E. Gaunt to confirm the meeting on October 31, 2013 during which Lower Mainland pipeline routing, training and spill response infrastructure planning would be discussed.	Routing, Spill Response, Employment and Training, Infrastructure planning
10/24/2013	Email-Incoming	Eamon Gaunt (Resource Lead)	Ellen Frisch (KMC)	E. Gaunt emailed team member and confirmed meeting details for the October 31, 2013 meeting.	None
10/26/2013	Email-Outgoing	Eamon Gaunt (Resource Lead)	Ellen Frisch (KMC)	Team member confirmed with E. Gaunt the meeting attendees and agenda topics for the October 31, 2013 meeting at the CNA offices.	None
10/30/2013	Email-Outgoing	Randy Neufeldt, WCMRC	Ellen Frisch (KMC), John MacLeod (KMC)	Team member wrote to thank R. Neufeldt to thank R. Neufeldt for attending the CNA meeting and discussed meeting logistics such as routing maps and a projector.	West Coast Marine Response Centre
10/30/2013	Email-Outgoing	Eamon Gaunt (Resource Lead)	Ellen Frisch (KMC)	Team member emailed E. Gaunt and confirmed that a meeting with the CNA at the CNA offices would take place on October 31, 2013.	None
10/31/2013	In-Person	Eamon Gaunt (Resource Lead)	Ellen Frisch (KMC)	Team member met with CNA representatives A. Grove, D. James, H. Reid, R. Jordon, R. Sauder, J. Smith and E. Gaunt on October 31, 2013 to discuss Lower Mainland Routing in the CNA Territory, Project archaeological studies within the proposed corridors, WCMRC Pilot Spill Response Program and TERMPOL studies. Action items from the meeting included: - Trans Mountain to provide the length of each TERMPOL study to assist CNA in determining which reports to be selected for review - TERA/Trans Mountain to provide CNA notice of future AIAs occurring in the Lower Mainland, particularly the Coquitlam River Watershed - Hwlitsum First Nation to be consulted on all work in the Coquitlam River Watershed - Trans Mountain to provide names of archaeologists being used in this region - Trans Mountain to report on number of spills on the TMPL in 2012 - Trans Mountain to clarify CBC news report citing 270 oil spills in BC. KMC noted all TMEP spills are reported to the NEB and identified on the TMEP website. As of 10/31/2013, it was 81 spills since 1961. - CNA to pass team member's contact information to P. Sam at Coast Salish Employment and Training System (CSETS) - CNA to notify TERA if there is any interest in sending participants for archaeological fieldwork. The next meeting was tentatively scheduled for November 20, 2013.	West Coast Marine Response Centre, Archaeological Impact Assessment, TERMPOL, Spill Response, Regulatory – NEB
11/07/2013	Phone - Outgoing	Helen Reid (Referrals Coordinator)	Ellen Frisch (KMC)	Team member phoned H. Reid to identify Cowichan Tribe (CT) and CNA participant representatives for Archaeology field work commencing during the week of November 18, 2014 in the Hope and Coquihalla region. H. Reid directed team member to contact D. Hinkely for all Archaeology work in the future. H. Reid would contact E. Gaunt to determine the best way to engage CNA in the upcoming study.	Archaeological Impact Assessment
11/07/2013	Email-Outgoing	Eamon Gaunt (Resource Lead)	Wanda Lewis (TERA), Clare Peacock (TERA), Ellen Frisch (KMC)	Team member emailed E. Gaunt, J. Smith, R. Sauder, D. James, H. Reid, R. Jordan, and A. Grove to state that TERA Archaeology crews potentially could begin field work during the week of November 18, 2013. Team member was responsible for contacting CNA to determine participant information. A. Grove emailed team member and volunteered a participant from HWFN to partake in the Archaeology Study during the week of November 18, 2013 in Hope. A. Grove requested a phone call to discuss financial and logistics information.	Archaeological Impact Assessment
11/17/2013	Email-Outgoing	Eamon Gaunt (Resource Lead)	Ellen Frisch (KMC)	Team member emailed E. Gaunt and confirmed a follow-up conference call to discuss legacy agreements with CNA members on November 20, 2013.	Agreements
11/19/2013	Email-Outgoing	Eamon Gaunt (Resource Lead)	Ellen Frisch (KMC)	Team member emailed E. Gaunt to confirm the details of the meeting with CNA members on November 20, 2013.	None
11/26/2013	Phone - Attempt	Eamon Gaunt (Resource Lead)	Ellen Frisch (KMC)	E. Gaunt left a voicemail to confirm if the meeting November 27, 2013 was to occur.	None
11/27/2013	Email-Incoming	Eamon Gaunt (Resource Lead)	Ellen Frisch (KMC)	Due to scheduling confusion, CNA met without Trans Mountain and advised on next available dates.	None
11/27/2013	Email-Outgoing	Eamon Gaunt (Resource Lead)	Ellen Frisch (KMC)	Team member reminded CNA members of upcoming opportunity to comment on TERMPOL studies after they affirmed October 31, 2013 interest in doing so. Funding is available and timing will be tight. The list of TERMPOL studies was attached. Team member will be away in December and wanted to initiate as much as possible pre-holidays.	TERMPOL
11/30/2013	Phone - Incoming	Helen Reid (Referrals Coordinator)	Ellen Frisch (KMC)	H. Reid phoned team member to confirm that topics scheduled for a conference call on November 20, 2013 would be discussed at a meeting tentatively scheduled December 5, 2013. Meeting dates in January 2014 would be confirmed at a later date.	None
12/03/2013	Email-Incoming	Ruth Sauder (Penelakut)	Ellen Frisch (KMC)	R. Sauder emailed team member on December 3, 2013 to discuss meeting time options. Team member confirmed meeting at 1:30 pm on December 11, 2013 at Cowichan and discussed attendees.	None

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
12/05/2013	In-Person		Brandy Mayes (TERA), Tess Espey (TERA)	One CNA Archaeological assistant participated in an Archaeological Impact Assessment from December 5-13, 2013.	Socio-Econ. Terrestrial - Heritage Resources - Archaeology
12/05/2013	Email-Incoming	Melissa Bellamy (Cowichan Tribes Treaty Manager)	Ellen Frisch (KMC)	M. Bellamy emailed team member and confirmed a CNA working group meeting on December 11, 2013 at CT.	None
12/11/2013	Email-Incoming	Melissa Bellamy (Cowichan Tribes Treaty Manager)	Ellen Frisch (KMC)	M. Bellamy emailed team member the details for the meeting scheduled December 11, 2013.	None
12/11/2013	In-Person	David Robbins (Woodward & Company) Alan Grove (Hwlitsum) Jack Smith (Community Consultant Halalt), Ronda Jordan (Stz'uminus), Ruth Sauder (Penelakut)	Ellen Frisch (KMC)	Meeting with CNA members to discuss status of Traditional Marine Resource Use(TMRU) Studies and considerations for mutual benefit approach Topics Discussed -Contaminated Sediments: Want remediation plan in the event of a spill to address contamination -Spills - Environmental Impact -Role of Transport Canada -Emergency Spill Response – CNA wants improved spill response regime immediately not waiting until project approval. Spill response concerns: -CNA noted concerns about no spill response plans available now for CNA communities. BC Nuka report identifies shortcomings in spill response now; equipment, human resources, locations and size of tankers with poor weather and sea conditions. -Impacts of spill are catastrophic in the marine environment. CNA had nominated an Hwlitsum FN member to participate in field studies, however, Burnaby work had subsequently been put on hold to undertake other work outside of the CNA territory. There have been no other permits applied for within the CNA territory. Discussion of TERMPOL Reports: Trans Mountain highlighted that they would be mailed on a disk to CNA members in mid-December upon their release. CNA noted concern that Transport Canada had not been engaged to date and requested a workshop. January 10, 2014 was set as the date.	Spill response, Environmental Impact, Cumulative Effects, TERMPOL, West Coast Marine Response Centre, Transport Canada, Traditional Marine Resource Use
12/12/2013	Email-Incoming	Eamon Gaunt (Resource Lead) Ruth Sauder (Penelakut) Melissa Charlie (Administrator) Alan Grove (Hwlitsum) Melissa Bellamy (Cowichan Tribes Treaty Manager) Ronda Jordan (Stz'uminus)	Ellen Frisch (KMC)	Team Member wrote to report on CNA's confirmation of request for a TERMPOL workshop and the proposed date of January 10, 2014. Due to availability an alternative date in January was identified.	TERMPOL
12/13/2013	Email-Outgoing	Eamon Gaunt (Resource Lead) Ruth Sauder (Penelakut) Melissa Charlie (Administrator) Alan Grove (Hwlitsum) Melissa Bellamy (Cowichan Tribes Treaty Manager) Ronda Jordan (Stz'uminus)	Ellen Frisch (KMC)	Team member emailed M. Bellamy, E. Gaunt, R. Jordan, R. Sauder, M. Charlie, A. Grove to confirm a follow-up meeting with M. Bellamy on January 17, 2014 at which Trans Mountain and Transport Canada would lead a workshop on TERMPOL studies.	TERMPOL, Transport Canada
1/6/2014	Email – Outgoing	Alan Grove, Hwlitsum Denise James (Natural Resources/Community Planner, Penelakut Tribes), Eamon Gaunt (Negotiator), Jack Smith, Halalt Ronda Jordan (Administrator, Stz'uminus First Nation), Ruth Sauder (Band Manager, Penelakut), Penelakut Larry George, Cowichan David Robbins, Legal Counsel Celina Albany, Cowichan Tribes	Ellen Frisch (KMC)	Team member wrote to confirm the date of the TERMPOL workshop on January 17, 2014 in Duncan. E. Gaunt responded that this date works. Team member booked venue and notified members.	TERMPOL, Transport Canada

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
1/13/2014	Email – Outgoing	Alan Grove, Hwlitsum Denise James (Natural Resources/Community Planner, Penelakut Tribes), Eamon Gaunt (Negotiator), Jack Smith, Halalt Ronda Jordan (Administrator, Stz'uminus First Nation), Ruth Sauder (Band Manager, Penelakut), Larry George, Cowichan David Robbins, Legal Counsel Celina Albany, Cowichan Tribes Helen Reid, Cowichan Tribes	Ellen Frisch (KMC) Max Nock (KMC)	Team member distributed draft agenda for TERMPOL workshop January 17, 2014 and outlined participation by Transport Canada and KMC technical representatives.	TERMPOL, Transport Canada
1/14/2014	Email – Outgoing	Eamon Gaunt	Ellen Frisch (KMC)	Team member wrote to clarify KMC's proposal to Cowichan Nation Alliance (CNA) regarding TERMPOL study funding.	TERMPOL
1/17/2014	In Person	Alan Grove, Hwlitsum Denise James (Natural Resources/Community Planner, Penelakut Tribes), Eamon Gaunt (Negotiator), Jack Smith, Halalt Ronda Jordan (Administrator, Stz'uminus First Nation), Ruth Sauder (Band Manager, Penelakut), Larry George, Cowichan David Robbins, Legal Counsel Celina Albany, Cowichan Tribes	Bob Gowe, TC Katherine Beavis, TC Madhvi Russell, TC Nar Hijjari: TC Michael Davies (KMC) Chris Badger (KMC) Bikram Kanjilal (KMC) Georgia Dixon (KMC) Gary Youngman (KMC) Max Nock (KMC) Jamie Andrews (KMC)	Discussion regarding expectations for TERMPOL reports including fishing rights and First Nations issues. Discussion Topics: Who sits on the TERMPOL committee and who gives direction for the reports? Transport Canada explained that the TERMPOL Review Committee is constituted by Transport Canada and includes various branches of Federal agencies: Canadian Coast Guard, BC Coast Pilots, Environment Canada, Port Metro Vancouver, and the Department of Fisheries and Oceans. The proponents are responsible for the studies and the surveys. The TERMPOL Review Committee does not have involvement in producing the studies and surveys, but reviews them once they are submitted. Regarding concerns relevant to the TERMPOL review process, Trans Mountain encouraged CNA to submit them in writing to TMEP and the TERMPOL Review Committee. If concerns are related to environmental impacts, they should be submitted to the NEB. CNA takes issue with the characterization of risks. KMC discussed its assessment of spill consequences and probability. Spill Response: In terms of the scope of the TERMPOL process and the recommendations. Fishing Interface with vessels: What is the protocol for traditional fishing within shipping lanes? Compensation: The Ship-Source Oil Pollution Fund (SOPF) provides compensation to communities in the event of an oil spill and loss to the fishery. A separate explanation will be provided. Tankers: Vessels calling at Westridge terminal will be required to be double-hulled. Hazard Assessment Workshops: Workshops were held with experts and First Nations were invited to attend. There were not aboriginal specific workshops. Risk: Concern that increase in traffic will increase the risk probability. Trans Mountain has included traffic forecasts in the report and mitigation measures were discussed. Probability Methodology: the model is based on averages (weather). What about abnormalities and worst-case scenario. KMC explained averages are used because they mathematically account for a range of potential probabilities. Halalt has an interest where the pipeline crosses the Fraser River. Timing: CNA believes TERMPOL will have conclusions at the Federal level. It will be a piece of evidence and these timelines need to be more flexible if we are to have input. Transport Canada noted that they indicated to Trans Mountain that TC is willing to incorporate input provided that is relevant to the TERMPOL review. We have also indicated that we expect our review will take approximately 4 months. As such, input would need to be received by late March or early April.	Aboriginal Consultation and Engagament, Spill response, Risk – Marine Traffic, TERMPOL, BC Coast Pilots, Canadian Coast Guard, Environment Canada, Port Metro Vancouver, Department of Fisheries and Oceans, Transport Canada, Ship-Source Oil Pollution, Spill Response
1/20/2014	Email-Incoming	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	E. Gaunt emailed team member to request a discussion of funding opportunities on January 21, 2014. Team member emailed E. Gaunt to provide suggested times for a phone conversation on January 21, 2014. Team member also informed E. Gaunt that TERA had received funding opportunities from CNA.	None
1/21/2014	Email-Incoming	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	E. Gaunt emailed team member to cancel today's scheduled phone conversation and to confirm that CNA had contacted TERA about funding options. Team emailed E. Gaunt and inquired about the nature of CNA's funding requests. E. Gaunt emailed team member to state that CNA was seeking funding from TERA for TMRU studies because that opportunity was available. CNA would be discussing TERMPOL funding internally on January 22, 2014.	TERMPOL
1/27/2014	Email-Outgoing	Al Grove	Ellen Frisch (KMC)	Team member emailed A. Grove to provide Hwlitsum First Nation and CNA with a description of the relationship between the Marine Liability Act and the Ship Source Oil Pollution Fund as per a question raised at the January 17, 2014 TERMPOL workshop.	TERMPOL

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
1/27/2014	Email-Outgoing	Alan Grove, Denise James (Natural Resources/Community Planner, Penelakut Tribe), Eamon Gaunt (Negotiator), Jack Smith, Ronda Jordan (Administrator, Stz'uminus First Nation), Ruth Sauder (Band Manager, Penelakut)	Ellen Frisch (KMC)	Team member emailed E. Gaunt, R. Jordan, A. Grove, R. Sauder, D. James and J. Smith a copy of the TERMPOL presentation given at the January 17, 2014 workshop. Team member provided requested answers to questions posed at the TERMPOL workshop by explaining how weather information was incorporated into the risk evaluation model and by confirming that all oil-carrying tankers would be double-hulled.	TERMPOL
1/27/2014	Email-Incoming	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	E. Gaunt emailed team member to state that the CNA working group meeting scheduled for January 27, 2013 had been cancelled. Team member provided availability to meet. Team member expressed interest in discussing each CNA member nation's views on a legacy approach.	None
1/27/2014	Email-Outgoing	Alan Grove, Denise James (Natural Resources/Community Planner, Penelakut Tribe), Eamon Gaunt (Negotiator), Helen Reid, Jack Smith, Ronda Jordan (Administrator, Stz'uminus First Nation), Ruth Sauder (Band Manager, Penelakut)	Ellen Frisch (KMC)	Team member wrote to CNA members, and sent additional information following the TERMPOL workshop. Team member had committed to providing: 1. Confirm that all tankers would be double hull tankers. A. Grove mentioned a sentence on page 96 of TERMPOL 3.15 that appeared to indicate otherwise. 2. Explain how weather data was input and used in the risk model 3. Provide a copy of the presentation	TERMPOL, Tanker design
1/27/2014	Email-Outgoing	Al Grove (CNA)	Ellen Frisch (KMC)	Team member wrote to A. Grove to send follow-up information from a team member, in response to A. Grove's query at the TERMPOL workshop, Friday, January 17, 2014 regarding the relationship between the Marine Liability Act and the Ship Source Oil Pollution Fund (SOPF). The information provided: At the meeting with the CNA, A. Grove asked for references to the Marine Liability Act (MLA) that relate to the SOPF. Administration of the SOPF falls under the Marine Liability Act. Part 7 (sections 91-125) of the Act deals with the SOPF. Eligible claimants are defined in section 107 and include: (a) an individual who derives income from fishing, from the production, breeding, holding or rearing of fish, or from the culture or harvesting of marine plants (d) an individual who fishes or hunts for food or animal skins for their own consumption or use The MLA can be found here: http://laws-lois.justice.gc.ca/eng/acts/M-0.7/	TERMPOL, Ship Source Oil Pollution
1/27/2014	Email-Incoming	Alan Grove	Ellen Frisch (KMC)	A. Grove emailed team member to acknowledge that the supplied information had been received.	None
1/28/2014	Email-Outgoing	Alan Grove, Denise James (Natural Resources/Community Planner, Penelakut Tribe), Eamon Gaunt (Negotiator), Helen Reid, Jack Smith, Ronda Jordan (Administrator, Stz'uminus First Nation), Ruth Sauder (Band Manager, Penelakut)	Ellen Frisch (KMC)	Team member emailed E. Gaunt, A. Grove, R. Sauder, H. Reid, D. James, R. Jordan, and J. Smith a table provided by Transport Canada that indicated how KMC's Project submission compared to the studies listed in the TERMPOL guide. The table outlined studies that could be included in a TERMPOL submission, the objectives of the studies and abstracts of the studies included in Trans Mountain's submission.	TERMPOL
1/30/2014	Email-Outgoing	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	Team member wrote to E. Gaunt regarding legacy discussions, and suggested dates for the following weeks. Team member offered to forward draft language and so to discuss in detail about the more specific interest and build the terms together. E. Gaunt replied that the February 4, 2014 and February 13, 2014 would work for a meeting.	None
2/4/2014	Email-Outgoing	Pam Sam	Ellen Frisch (KMC)	Team Member emailed P. Sam to follow-up on the meeting scheduled for February 5, 2014. Team member provided an outline on the team member's role with KMC and advised which communities are being consulted along the proposed tanker route.	Routing
2/16/2014	Email-Outgoing	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	Team member wrote to E. Gaunt, noting the time sensitivity of the TERMPOL report study process. Team Member sought to confirm that CNA will be securing a consultant to review certain TERMPOL studies with the intention of submitting a report back to KMC by March 30, 2014. Team member proposed to get that funding to CNA on behalf of Cowichan Tribes through an amendment to the existing LOU to providing for the funding. Team member asked E. Gaunt to provide a brief summary of the TERMPOL reports targeted and Team member would create a draft amendment.	TERMPOL

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
2/27/2014	Email-Incoming	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	E. Gaunt sent team member a draft of the CNA third-party TLU funding proposal.	Traditional Land Use
3/4/2014	Email-Outgoing	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	Team Member wrote to E. Gaunt to inform that the funding proposal had been approved. Trans Mountain proposed that the TERMPOL provision would look like an amendment to the Cowichan Tribes (CT) Memorandum of Understanding (MOU). Team Member requested further clarifying details on the expectation of CT and CNA with regards to the MOU. Team member requested that E. Gaunt reply as soon as possible.	Agreements, TERMPOL
3/5/2014	Email-Outgoing	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	Team member wrote to E. Gaunt to request a list of TERMOL studies that the CNA proposes to review, so that team member can include the studies in the funding agreement draft. Team member hoped to complete the correspondence by end of day because as of 3/7 she was away for 10 days. This way payment processing could begin immediately. E. Gaunt replied that CNA would try to provide the information by end of day. Team member replied to E. Gaunt and sent the draft funding agreement. Team member wrote that KMC had tried to describe the process, as previously discussed, but is open to edits. Team member wrote that KMC sees the TERMPOL studies inserted in the first line.	TERMPOL,
3/6/2014	Text Message – Incoming	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	Team member notes she is checking in on the TERMPOL funding agreement status and enquires if the report number are identified or if there are any other edits. E. Gaunt responded to talk that afternoon.	TERMPOL
3/7/2014	Phone Call – Incoming	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	E. Gaunt called team member to verbally relay the list of TERMPOL studies for review and noted that CNA had been thus far unable to secure a third party consultant for the work to be concluded within the timeframe required.	Timing of TERMPOL response.
3/10/2014	Email-Incoming	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	E. Gaunt emailed Team member to inquire when KMC President would be on Vancouver Island.	None
3/20/2014	Email-Outgoing	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	Team member emailed E. Gaunt to follow-up on an email sent March 10, 2014 regarding when KMC President will be on Vancouver Island. Team member suggested arranging a meeting in mid-April. Team member stated that Trans Mountain would like to have a conversation with all CNA groups together about potential regional interests crafting the Mutual Benefits Agreements. Team member offered to attend a meeting in-person, or advised that a conference call could be arranged.	Agreements
3/24/2014	Email-Outgoing	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	Team member emailed E. Gaunt to inquire whether there were any edits or comments to the draft TERMPOL funding letter and attachment which were sent on March 6, 2014. Team member also requested that the report numbers be inserted on the first line of the Workplan.	TERMPOL
3/27/2014	Email-Incoming		Ellen Frisch (KMC)	E. Gaunt wrote to team member inquiring availability for April 4, 2014 to meet with the CNA technical working group to discuss the project and legacy approaches. Team member replied that KMC was available on April 4, 2014. E. Gaunt confirmed meeting April 4, 2014.	None
3/27/2014	Email-Outgoing	Alan Grove, Eamon Gaunt (Negotiator), Jack Smith, Ronda Jordan (Administrator, Stz'uminus First Nation), Ruth Sauder (Band Manager, Penelakut) Melissa Bellamy	Ellen Frisch (KMC)	Team member wrote to CNA Team to inform that the Project is hosting a focused workshop in Burnaby to receive feedback on anticipated impacts of the proposed study corridor through the Lower Mainland region. The possible impacts had been identified through consultation activities and environmental assessments.	Impact Assessment
3/27/2014	Email-Outgoing	Alan Grove, Eamon Gaunt (Negotiator), Jack Smith, Ronda Jordan (Administrator, Stz'uminus First Nation), Ruth Sauder (Band Manager, Penelakut)	Ellen Frisch (KMC)	Team member emailed E. Gaunt, A. Grove, J. Smith, R. Sauder and R. Jordan to invite CNA members to attend a Lower Mainland TMEP Routing workshop on March 27, 2014.	None
3/27/2014	Phone - Incoming	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	Team member received phone message from E. Gaunt requesting next steps on TERMPOL funding, and setting up meeting on April 4, 2014 with CNA to discuss mutual benefits agreement. Team member returned phone message and confirmed April 4, 2014 date.	TERMPOL
4/3/2014	Email-Outgoing	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	Team member emailed E. Gaunt to enquire whether the draft TERMPOL funding LOU had been reviewed and was ready for execution by KMC. E. Gaunt emailed Team Member to note that Team Member would be contacted on April 4, 2014 about the matter.	Agreements; TERMPOL

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
4/3/2014	Letter - Incoming	Eamon Gaunt (Negotiator) Katherine Beavis (Transport Canada)	Ellen Frisch (KMC)	E. Gaunt sent a letter to team member and K. Beavis (Transport Canada) regarding CT's participation in the TERMPOL process. E. Gaunt expressed concerns regarding procedural issues related to the TERMPOL studies, which E. Gaunt said had excluded CT until one and a half years after the studies were initiated. E. Gaunt said that the marine environments potentially impacted by the Project were of paramount importance to CT's member nations. Important topics included casualty risks and potential impacts to Aboriginal rights. E. Gaunt noted that CT should have had an opportunity to be part of the initial scoping of studies and surveys and to sit on the TERMPOL Review Committee. In order for CT to fully understand and informed about the studies to date, E. Gaunt requested the following: 1. All TERMPOL Review Committee meeting minutes, agendas and correspondences; 2. All information related to the TERMPOL mandate and marine vessel oversight for the Project; 3. Qualifications of the TERMPOL Review Committee members; 4. The 1993 Guidelines for Escort Tugs and Transport Canada's monitoring results pursuant to those guidelines (including frequency of services, number of exercises, annual reports, etc.); 5. Data from Transport Canada's National Places of Refuge Contingency Plan (for 1995 to present); and 6. Transportation Canada's certification findings for the WCMRC pertaining to shoreline clean-up response exercises (for 1995 to present). E. Gaunt requested that the scope of the boundaries for the TERMPOL studies be provided, including (but not limited to) port boundaries, the 12-mile territorial sea limit and the 200 mile ecological exclusion zone. E. Gaunt noted that KMC and Transport Canada should provide the above-listed information and allow CT to provide input before the TERMPOL report was finalized. CNA members stated completing this comprehensive review would take longer than the March 2014 deadline due to the time at which participant funding was approved by the NEB (March 14, 2014) and would become available (mid-April 2014). E. Gaunt requested that Transport Canada consult with CT to provide timelines for review and completion of the TERMPOL studies before a final report was submitted. E. Gaunt expressed interest in continuing further dialogue to and participating in the TERMPOL study process.	Study areas, increased traffic in marine areas, regulatory, Procedural process of TERMPOL
4/4/2014	In-Person		Ellen Frisch (KMC)	Team Member met with Cowichan Nation Alliance (CNA) representatives. Topics included: -Status of TERMPOL funding -NEB Process and Timelines -Legacy Issues – Common approach -Schedule meetings with KMC President Action: CNA to forward new LOU language. CNA to forward revenue sharing proposal. Team Member will continue to contact individual FNs to continue MBA discussions.	TERMPOL response timing was too tight, ; NEB dates for Aboriginal Oral Hearings, Project equity
4/4/2014	Email-Incoming	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	E. Gaunt emailed team member and K. Beavis (Transport Canada) a copy of the April 3, 2014 CNA letter.	Transport Canada
4/10/2014	Email - Outgoing	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	Team Member sent updated LOU with amendments discussed on April 4, 2014.	Agreements
4/14/2014	Email-Outgoing	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	Team member wrote to E. Gaunt to follow up on the final TERMPOL funding LOU that was sent to E. Gaunt and D. Robbins on April 10, 2013 for Chief Clem Seymour's signature.	Agreements
4/16/2014	Phone - Attempt	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	Team Member left voicemail for E. Gaunt, coordinator for CT seeking to know the status of the LOU agreement for signature by Chief Seymour. Team member asked for phone call or email if there was a problem and noted that with the holiday it could not be actioned until April 22, 2014.	Agreements
4/17/2014	Phone – Attempt (incoming)	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	E. Gaunt called Team Member and left a voicemail message requesting a call back. E. Gaunt informed Team Member that they had not been able to retain a third party consultant to review the TERMPOL studies.	TERMPOL
4/22/2014	Email-Outgoing	Eamon Gaunt (Negotiator)	Ellen Frisch (KMC)	Team member emailed E. Gaunt to follow-up on a phone message exchanged and affirm if CT can execute the funding LOU sent on April 10, 2014. Team member asked for confirmation if the funding and analysis of TERMPOL reports is something that is still realistic given certain time constraints. Team member wrote they would be open to discussing if the scope needs to be adjusted to expedite receipt of information before the end of April.	TERMPOL
4/24/2014	Phone Attempt - Outgoing	Eamon Gaunt (Negotiator) (CNA)	Ellen Frisch (KMC)	Team member attempted to telephone E. Gaunt cell phone but was unable to leave message. Team member left message at CT land line.	None
4/25/2014	Text-Outgoing	Eamon Gaunt (Negotiator) (CNA)	Ellen Frisch (KMC)	Team Member texted E. Gaunt to follow up on a phone message left April 24, 2014 and affirmed that due to timing and lack of availability of a third party reviewer, CNA will not be able to enter into the LOU with Trans Mountain to conduct the TERMPOL review	TERMPOL
6/30/2014	Letter – Outgoing	Chief Chip Seymour	Gary Youngman (KMC)	Team Member sent a letter to Chief C. Seymour and invited CNA to attend Westridge Marine Terminal offset Workshop on either July 28, 2014 or August 1, 2014.	Western Canada Marine Response Centre
7/4/2014	Email – Outgoing	Chief Chip Seymour	Theresa Lane (KMC)	Team Member emailed Chief C. Seymour and attached an invitation to CNA to attend Westridge Marine Terminal offset Workshop on either July 28, 2014 or August 1, 2014.	Western Canada Marine Response Centre

APPENDIX A-02

HWLITSUM FIRST NATION

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
8/1/2013	Email-Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team member e-mailed A. Grove to confirm availability for a meeting to discuss legacy and Mutual Benefits Agreement (MBA). Team member wanted to discuss also Hwlitsum ideas around the type of community benefits and opportunities of interest.	Agreements
8/6/2013	Email-Incoming	Alan Grove (Consultant)	Ellen Frisch (KMC)	A. Grove e-mailed team member, asking for a convenient time to discuss section G of the Letter of Understanding (LOU).	Agreements
8/7/2013	Email-Outgoing	Alan Grove (Consultant)	Maria Hoiss (TERA)	Team member sent a confidentiality agreement to Chief R. Wilson for him to sign, and they discussed where to send the fax of the signed Agreement.	None
8/08/2013	Letter-Outgoing	Chief Raymond (Rocky) Wilson	Regan Schlecker (KMC)	Team member sent a letter to Chief R. Wilson which notified Hwlitsum First Nation (HWFN) that capacity funding has been made available from the National Energy Board (NEB), effective July 22, 2013, under the Participant Funding Program to assist landowners. Noted further were the List of Issues released by the NEB on July 29, 2013 which was also available on the NEB website. The letter also stated that the NEB did not intend to consider the environmental and socio-economic effects associated with upstream activities, the development of oil sands, or the downstream use of oil transported by pipeline. Requests for further information on the Participant Funding Program were directed to the NEB and its contact information was provided.	Regulatory – NEB
8/12/2013	Email-Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team member e-mailed A. Grove with varying times and dates that team member was available to discuss section G of the LOU as per A. Grove's request.	Agreements
8/12/2013	Phone - Incoming	Alan Grove (Consultant)	Angelina Silver (TERA)	A. Grove left a message for team member providing contact information, and asking team member to call back.	None
8/12/2013	Email-Incoming	Alan Grove (Consultant)	Ellen Frisch (KMC)	A. Grove emailed team member and relayed details of the August 26, 2013 meeting with team member.	None
8/26/2013	In-Person	Chief Raymond (Rocky) Wilson	Ellen Frisch (KMC)	Team member met with Chief and Council to discuss the LOU Extension terms.	Agreements
9/18/2013	Email-Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team member emailed A. Grove and provided the draft LOU amendment.	Agreements
9/22/2013	Email-Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team member emailed A. Grove of the Cowichan Nation Alliance (CNA) regarding Notice of Commencement of Fieldwork associated with the Archeological Impact Assessment. Team member stated that the email originally had gone to a more generic inbox, and inquired if there was a more specific route that could be used to provide notice.	Archaeological Impact Assessment
10/01/2013	Email-Outgoing	Alan Grove (CNA Working Group Member)	Ellen Frisch (KMC)	Team member emailed A. Grove and attached the draft Hwlitsum Letter of Understanding (LOU) Amendment Letter and would await feedback on this document following A. Grove's discussions with Hwlitsum First Nation (HWFN) Chief and Council. Team member also committed to follow up with WCMRC regarding the land lease/barge/net storage option discussed as part of the Vancouver Airport Fuel Delivery (VAFD) Project. Team member enquired as to what additional training HWFN members would be interested in receiving. Team member noted an upcoming meeting regarding the next phase of the legacy agreement was targeted for the week of October 14, 2013.	Vancouver Airport Fuel Delivery, Port Metro Vancouver
10/02/2013	Email-Outgoing	Alan Grove (CNA Working Group Member)	Ellen Frisch (KMC)	Team member emailed A. Grove regarding the LOU and also noted KMC willingness to move toward scoping the framework of a legacy agreement Team member requested to be notified as to how HWFN would like to proceed.	Agreements
10/09/2013	Email-Outgoing	Alan Grove (CNA Working Group Member)	Ellen Frisch (KMC)	Team member emailed A. Grove to acknowledge receipt of the draft LOU Amendment Letter. Team member requested feedback regarding the LOU.	Agreements
10/18/2013	In-Person	Alan Grove (CNA Working Group Member), Chief Raymond (Rocky) Wilson	Ellen Frisch (KMC)	Team member met with Chief R. Wilson and A. Grove to review the amended draft LOU and discussed HFN's concerns and interests regarding spill response in the Salish Sea.	Agreements
10/25/2013	Email-Outgoing	Alan Grove (CNA Working Group Member)	Ellen Frisch (KMC)	Team member emailed A. Grove and attached an amended LOU.	Agreements
10/28/2013	Letter - Outgoing	Chief Raymond (Rocky) Wilson	Gary Youngman (KMC)	Team member sent Chief R. Wilson a letter to acknowledge receipt of HWFN's preliminary interests related to the Project. Team member noted that KMC was reviewing these interests and would provide a thorough response to the issues raised by HWFN. Pursuant to a confidential LOU, interests would be compiled in the Project's Facilities Application, which was to be filed with the NEB in December 2013.	Agreements, Regulatory – NEB
10/30/2013	Email-Outgoing	Alan Grove (CNA Working Group Member), John Gailus (Devlin Gailus Barristers and Solicitors), Chief Raymond (Rocky) Wilson	Ellen Frisch (KMC)	Team member emailed Chief R. Wilson, A. Grove and J. Gailus to provide a copy of the draft Legacy Agreement.	Agreements
10/31/2013	In-Person	Alan Grove (CNA Working Group Member)	Ellen Frisch (KMC), John MacDonald (KMC), Randy Neufeldt (West Coast Marine Response Corp)	Team member met with CNA representatives A. Grove, D. James, H. Reid, R. Jordon, R. Sauder, J. Smith and E. Gaunt on October 31, 2013 to discuss Lower Mainland Routing in the CNA Territory, Project archaeological studies within the proposed corridors, WCMRC Pilot Spill Response Program and TERMPOL studies. Action items from the meeting included: - KMC to provide the length of each TERMPOL study to assist CNA in determining which reports to be selected for review - TERA/KMC to provide CNA notice of future AIAs occurring in the Lower Mainland, particularly the Coquitlam River Watershed - Hwlitsum First Nation to be consulted on all work in the Coquitlam River Watershed - KMC to provide names of archaeologists being used in this region - KMC to report on number of spills on the TMPL in 2012 - KMC to clarify CBC news report citing 270 oil spills in BC. KMC noted all TMEP spills are reported to the NEB and identified on the TMEP website. As of 10/31/2013, it was 81 spills since 1961. - CNA to pass team member's contact information to P. Sam at Coast Salish Employment and Training Services (CSETS) - CNA to notify TERA if there is any interest in sending participants for archaeological fieldwork. The next meeting was tentatively scheduled for November 20, 2013.	Agreements, Western Canada Marine Response Centre, TERMPOL, Spill Response, Coast Salish Employment and Training

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
11/07/2013	Email-Incoming	Alan Grove (CNA Working Group Member)	Ellen Frisch (KMC)	Team Member and A. Grove exchanged emails regarding a proposed field visit on Canoe Pass to be attended by KMC and WCMRC.	Western Canada Marine Response Centre
11/07/2013	Phone - Outgoing	Alan Grove (CNA Working Group Member)	Ellen Frisch (KMC)	Team member phoned A. Grove to plan how to progress discussion regarding potential Project mitigation measures, including the form of enhanced spill response. A. Grove reported that HWFN had developed a spill response plan for another project on the Fraser River, a critical pathway for salmon fingerlings. Agreement was made for the team member to consult KMC and WCMRC team members to agree on a date for the tour. A. Grove stated that HWFN was planning a meeting with the NEB and that KMC's application for the Project must include HWFN's interests.	Spill Response, Western Canada Marine Response Centre, Regulatory - NEB
11/07/2013	Phone - Incoming	Alan Grove (CNA Working Group Member)	Ellen Frisch (KMC)	A. Grove phoned team member regarding a letter from TERA that notified CNA of Archaeological fieldwork on CNA Traditional Territory. A. Grove noted that an HWFN community member from the study area would be able to participate. Team member explained TERA's participation method and noted that team member would liaise with CNA to introduce a TERA's coordinator and schedule field participation.	Archaeological Impact Assessment
11/11/2013	Email-Outgoing	Alan Grove (CNA Working Group Member)	Karen Baylis (TERA)	Team member emailed A. Grove to discuss participation on Archaeological studies for the Project on behalf of the CNA.	Archaeological Impact Assessment
11/12/2013	Email-Incoming	Alan Grove (CNA Working Group Member)	Ellen Frisch (KMC)	A. Grove emailed team member to confirm the meeting on November 13, 2013 between KMC and HWFN. Team member confirmed the meeting and provided the names of WCMRC participants	Western Canada Marine Response Centre
11/12/2013	Email-Outgoing	Alan Grove (CNA Working Group Member)	Karen Baylis (TERA)	Team member emailed A. Grove to discuss participation on Archaeological studies for the Project.	Archaeological Impact Assessment
11/12/2013	Email-Outgoing	Alan Grove (CNA Working Group Member)	Clare Peacock (TERA)	Team member emailed A. Grove to notify HWFN of an upcoming Archaeology Study Crew 6 (shift 2) scheduled November 20, 2013 - November 29, 2013. Team member provided logistical details for HWFN participant.	Archaeological Impact Assessment
11/13/2013	In-Person	Alan Grove (CNA Working Group Member), John Gailus (Devlin Gailus Barristers and Solicitors), Chief Raymond (Rocky) Wilson	Michael Davies (KMC), Bikramjit Kanjilal (KMC), Ellen Frisch (KMC)	Team members met with HWFN for a site visit and marine tour of Canoe Pass region on an Hwlitsum vessel. Participants observed the habitat of the South Fraser, currents, navigation, shoreline attributes and discussed marine spill response in the Fraser River region. HWFN discussed the critical nature of the ecosystem of the area, and the critical nature of stopping any spill should it occur outside the river from entering that ecosystem. HWFN will be developing a vision document for the area in the future. The “Moody Report” was referenced as a research document regarding monitoring marsh vegetation response to a jet fuel spill. A. Grove to forward Moody Report to KMC.	Spill Response, Risk – Marine
11/13/2013	Email-Incoming	Alan Grove (CNA Working Group Member)	Ellen Frisch (KMC)	A. Grove emailed Team Member and attached the Moody Report.	None
11/13/2013	Letter - Outgoing	Chief Raymond (Rocky) Wilson	Gary Youngman (KMC)	Team member sent Chief R. Wilson a letter to inform HWFN about KMC’s engagement with Transport Canada in as part of the TERMPOL study process for the Project. Team member noted that these studies addressed oil tanker navigation and safety in the Salish Sea, expanding the scope of Project-related marine studies being conducted by KMC, TERA and individual First Nations (which were outlined in a March 22, 2013 letter detailing ESA field studies). Team member provided an overview of the study methodology and evaluation process through the TERMPOL Review Committee (TRC). Team member provided an invitation to receive and comment on these studies in December 2013, stating that feedback from First Nations would be shared with Transport Canada and the TRC to assist in reviewing study results. Team member requested that HWFN’s intent whether or not to participate in the TERMPOL process be sent to team member by November 30, 2013.	TERMPOL, Transport Canada, Western Canada Marine Response Centre
11/18/2013	Email-Outgoing	Alan Grove (CNA Working Group Member)	Clare Peacock (TERA)	Team member emailed A. Grove to provide additional logistical information for HWFN participant on Archaeology Study Crew 6 (shift 2) scheduled November 20, 2013 - November 29, 2013. A. Grove emailed team member to confirm logistics for HWFN participant on Archaeology Study Crew 6 (shift 2) scheduled November 20, 2013 - November 29, 2013.	Archaeological Impact Assessment
11/20/2013	Email-Outgoing	Alan Grove (CNA Working Group Member)	Theresa Lane (KMC)	Team member emailed A. Grove a copy of the TERMPOL study letter originally mailed to HWFN on November 13, 2013.	TERMPOL
11/29/2013	Email-Outgoing	Alan Grove (CNA Working Group Member)	Clare Peacock (TERA)	Team member emailed A. Grove to notify HWFN of upcoming Archaeology Crew 6 (Shift 3) scheduled December 5, 2013 - December 12, 2013. Team member requested one HWFN participant. A. Grove emailed team member to provide a HWFN participant for upcoming Archaeology Crew 6 (Shift 3) scheduled December 5, 2013 - December 12, 2013. Team member emailed A. Grove to provide study logistics for the HWFN participant on upcoming Archaeology Crew 6 (Shift 3) scheduled December 5, 2013 - December 12, 2013.	Archaeological Impact Assessment
11/30/2013	Email-Incoming	Alan Grove (CNA Working Group Member)	Wanda Lewis (TERA)	A. Grove emailed team member a set of HWFN Traditional Territory maps illustrating traditional use areas.	Routing, Traditional Marine Resource Use
11/30/2013	Email-Incoming	Alan Grove (CNA Working Group Member)	Wanda Lewis (TERA)	A. Grove emailed team member an electronic copy of the 2013 Hwlitsum Marine Traditional Use Study, noting that a hard copy of the document was being mailed.	Traditional Marine Resource Use
12/02/2013	Email-Outgoing	Alan Grove (CNA Working Group Member)	Karen Baylis (TERA)	Team member emailed A. Grove and confirmed receipt of the 2013 Hwlitsum Marine Traditional Use Study.	Traditional Marine Resource Use
12/03/2013	Email-Outgoing	Alan Grove (CNA Working Group Member)	Clare Peacock (TERA)	Team member emailed A. Grove and provided additional logistical details for the HWFN participant on Archaeology Crew 6 (Shift 3) scheduled December 5, 2013 - December 12, 2013.	Archaeological Impact Assessment

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
12/11/2013	In-Person	Alan Grove (CNA Working Group Member)	Ellen Frisch (KMC)	Meeting with CNA members to discuss status of MTRU Studies and considerations for mutual benefit approach Topics Discussed -Contaminated Sediments: Want remediation plan in the event of a spill to address contamination -Spills - Environmental Impact - Role of Transport Canada -Emergency Spill Response – CNA wants improved spill response regime immediately not waiting until project approval. Spill response concerns: -CNA noted concerns about no spill response plans available now for CNA communities. --BC Nuka report identifies shortcomings in spill response now; equipment, human resources, locations and size of tankers with poor weather and sea conditions. -Impacts of spill are catastrophic in the marine environment. CNA had nominated an Hwlitsum FN member to participate in field studies, however, Burnaby work had subsequently been put on hold to undertake other work outside of the CNA territory. There have been no other permits applied for within the CNA territory. Discussion of TERMPOL Reports: KMC highlighted that they would be mailed on a disk to CNA members in mid-December upon their release. CNA noted concern that Transport Canada had not been engaged to date and requested a workshop. January 10 was set as the date.	Spill response, Environmental Impact, Cumulative Effects, TERMPOL, West Coast Marine Response Centre, Transport Canada, Traditional Marine Resource Use
12/13/2013	Email-Outgoing	Alan Grove (CNA Working Group Member)	Ellen Frisch (KMC)	Team member emailed M. Bellamy, E. Gaunt, R. Jordon, R. Sauder, M. Charlie, A. Grove, J. Smith to confirm a follow-up meeting with M. Bellamy on January 17, 2014 at which KMC and Transport Canada would lead a workshop on TERMPOL studies.	TERMPOL
12/16/2013	Letter - Outgoing	Chief Raymond (Rocky) Wilson	Gary Youngman (KMC)	Team member mailed Chief R. Wilson a copy of the Transport Canada TERMPOL studies (on a USB stick) related to the Project for HWFN's review. Team member requested that HWFN provide feedback on the studies within two to three months.	TERMPOL
12/16/2013	Letter - Outgoing	Chief Raymond (Rocky) Wilson	Ian Anderson (KMC)	Team member sent a letter sent a letter to Chief R. Wilson and notified HWFN of the Facilities Application Filing with the National Energy Board (NEB) on December 16, 2013. Team member provided a URL to the Application's location on the Trans Mountain website. Team member noted the NEB would hold a public engagement process, which would include a hearing on the Application prior to a formal decision on the Project. Team member included the NEB's website URL for further information on this process. Team member noted the results of the Environmental and Socio-Economic Assessment as related to the preliminary interest shared by the community are currently being reviewed and a finalized response would be provided by January 14, 2014.	Regulatory – NEB, Environmental Assessment, Socio-Economic Assessment
1/10/2014	Email-Incoming	Alan Grove (Consultant)	Ellen Frisch (KMC)	A. Grove emailed Team Member and requested a phone conversation. Team Member committed to calling back on January 10, 2014.	None
1/10/2014	Phone - Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team Member phoned A. Grove to discuss the future legacy approach and timeline. It was agreed that certain terms would continue to be reviewed and KMC would provide a more detailed response.	None
1/13/2014	Email-Incoming	Alan Grove (Consultant)	Ellen Frisch (KMC)	A. Grove emailed Team Member to request a phone call on January 13, 2014. Team Member committed to phone A. Grove on January 13. 2014.	None
1/13/2014	Phone - Incoming	Alan Grove (Consultant)	Ellen Frisch (KMC)	A. Grove phoned Team Member to discuss progress on terms related to a future agreement between KMC and Hwlitsum First Nation (HWFN). Team Member and A. Grove also discussed the scope and content of a potential Legacy Agreement and HWFN's interest in spill protection of Canoe Pass.	Effective oil spill response and protection of Canoe Pass.
1/14/2014	Email-Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team Member emailed A. Grove to state that Team Member had developed a framework for funding and timing for the Legacy Agreement but required more input from HWFN to finalize these parameters. Team Member proposed identifying key areas that HWFN has expressed interest in developing. KMC was working with WCMRC to design a spill response program in which HWFN may be interested in participating.	Spill response program
1/14/2014	Phone – Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team Member phoned A. Grove to discuss potential Legacy Agreement content.	Agreements
1/15/2014	Email-Incoming		Ellen Frisch (KMC)	A. Grove emailed Team Member to state availability for a phone call to discuss the Legacy Agreement. Team Member resolved to phone to discuss the Legacy Agreement. Next steps included establishing a working model for HWFN and the Western Canadian Marine Response Corporation (WCMRC).	Regulatory – NEB, Western Canada Marine Response Centre
1/15/2014	Phone – Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team Member phoned A. Grove to continue discussion of a future benefits opportunities and concerns regarding spill response.	Spill Response
1/27/2014	Email-Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team Member emailed A. Grove to provide HWFN and Cowichan Nation Alliance (CNA) with a description of the relationship between the Marine Liability Act and the Ship Source Oil Pollution Fund as per a question raised at the January 17, 2014 TERMPOL (Technical Review Process of Marine Terminal Systems and Transshipment Sites) workshop.	TERMPOL
1/28/2014	Email-Outgoing	Alan Grove (Consultant) Chief Raymond Wilson	Ellen Frisch (KMC)	Team Member emailed Chief R. Wilson and A. Grove information regarding a relationship agreement and proposed timing.	Regulatory - NEB
1/29/2014	Email-Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	A. Grove emailed Team Member to confirm a meeting on January 31, 2014.	None
1/31/2014	In-Person	Alan Grove (Consultant), Chief Raymond Wilson John Gailus (Legal Counsel)	Ellen Frisch (KMC)	Team Member met with Chief R. Wilson, A. Grove and G. Gailus to review details and draft language of the Mutual Benefits Agreement (MBA) on January 31, 2014. HWFNs primary concerns were: • effective marine spill response to protect the Fraser River fishery • marine fishing that accommodated limited fishing openings for First Nations.	Emergency spill response, marine fishing, Agreements
2/6/2014	Email-Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team Member sent A. Grove email to inform that KMC is encouraging First Nation community groups to file as intervenors with the NEB.	Regulatory - NEB
2/10/2014	Email – Outgoing	Alan Grove (Consultant) John Gailus (Legal Counsel)	Ellen Frisch (KMC)	Emails were exchanged to affirm administrative information and document drafting.	Agreements

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
2/12/2014	Letter – Outgoing	Alan Grove (Consultant) John Gailus (Legal Counsel)	Peter Forrester	Team Member conveyed funding and executed MBA.	Agreements
2/19/2014	Email – Incoming	Alan Grove (Consultant)	Ellen Frisch (KMC)	A. Grove and Team Member exchanged emails regarding setting up a time to talk. A phone call was held later that day to discuss timing and content of TERMPOL analysis report.	TERMPOL
3/5/2014	Letter Incoming	Alan Grove (Consultant) Chief Raymond Wilson	Ellen Frisch (KMC)	A. Grove sent email conveying draft Hwlitsum TERMPOL Analysis report HWFN appreciates KMC reaching out to both HWFN and CNA on the matter with a view to integrating their views into the TERMPOL process. Comments were provided on the 3.5 and 3.13 Route Analysis and Anchorage Elements report and 3.18 Contingency Planning Additional details are reflected below on the April 5 – final TERMPOL submission	Increased marine activity impacts Aboriginal rights. Crown duty to consult has not occurred. Risk mitigation is not sufficient. (Rescue tug) Ability for FN to receive compensation if s.35 fisheries loss. Appropriate levels of KMC spill liability insurance to cover losses. Comprehensive study of all vessel traffic required to address interface with fishing vessels.
3/5/2014	Telephone Conversation	Alan Grove (Consultant)	Ellen Frisch (KMC)	A. Grove requested that the TERMPOL report provided March 5, 2014 in accordance with Hwlitsum's LOU is to be held pending review and finalization by Cowichan Nation Alliance members.	Agreements
3/7/2014	Email-Outgoing	Alan Grove (Consultant)	Derek Sorkilmo (TERA)	Team Member emailed A. Grove to provide notification of Archaeology Crew 6 (Cycle 5) scheduled March 18, 2014 - March 27, 2014 and to indicate logistics details for the study. Team Member requested one HWFN archaeology assistant.	Archaeological Impact Assessment
3/8/2014	Email-Incoming	Alan Grove (Consultant)	Derek Sorkilmo (TERA)	A. Grove emailed Team Member to confirm an HWFN archaeology assistant for Archaeology Crew 6 (Shift 5) scheduled March 18, 2014 - March 27, 2014. A. Grove enquired about logistics for the study.	Archaeological Impact Assessment
3/14/2014	Email-Incoming	Alan Grove (Consultant)	Sondra Baker (TERA), Derek Sorkilmo (TERA)	A. Grove emailed Team Member to request an answer to the March 8, 2014 logistics query about Archaeology Crew 6 (Shift 5) scheduled March 18, 2014 - March 27, 2014. Team Member emailed A. Grove to provide the requested logistics details and a Work Participation Form for the HWFN archaeology assistant.	Archaeological Impact Assessment
4/4/2014	In-Person	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team Member met with Cowichan Nation Alliance (CNA) representatives Topics included: -Status of TERMPOL funding -NEB Process and Timelines -Legacy Issues – Common approach -Schedule meetings with KMC President Action: CNA to forward new LOU language. CNA to forward revenue sharing proposal. Team Member will continue to contact individual FNs to continue MBA discussions.	Lack of involvement in the TERMPOL Process. Timing of TERMPOL process too soon to provide a response. NEB hearing dates of August interrupts fishing season and creates financial hardship.
4/7/2014	Letter – Incoming	Alan Grove (Consultant)	Ellen Frisch (KMC)	A. Grove emailed Team Member and attached the final TERMPOL Analysis report which provided comments and questions related to TERMPOL report 3.5 and 3.12 Route Analysis and Anchorage Elements and 3.18 Contingency Planning.	TERMPOL
5/28/2014	Call – Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team member left a voicemail to confirm if the HWFN letter to TMEP could be forwarded to Transport Canada.	Transport Canada
5/28/2014	Email – Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team member emailed A. Grove to confirm if the HWFN letter sent to TMEP could be forwarded to Transport Canada.	Transport Canada
5/29/2014	Email – Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team member emailed A. Grove a draft project support letter, requesting HWFN to meet the NEB filing window before August hearings.	Regulatory – NEB
6/2/2014	Call – Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team member and A. Grove discussed the creation of the project support letter.	Regulatory – NEB
6/3/2015	Call-Incoming	Alan Grove (Consultant)	Ellen Frisch (KMC)	A. Grove advised that Cowichan Nation Alliance had met he called to discuss KMC's approach to benefit agreements.	Agreements
6/16/2014	Email – Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team Member emailed A. Grove and requested confirmation that HWFN would be forwarding the draft support letter to Trans Mountain.	Agreements
6/30/2014	Letter – Outgoing	Chief Rocky Wilson	Gary Youngman (KMC)	Team Member sent a letter to Chief R. Wilson and invited HWFN to attend Westridge Marine Terminal offset Workshop on either July 28, 2014 or August 1, 2014.	Western Canada Marine Response Centre
7/4/2014	Email – Outgoing	Alan Grove (Consultant) Chief Rocky Wilson	Theresa Lane (KMC)	Team Member emailed Chief R. Wilson and A. Grove and attached an invitation to HWFN to attend Westridge Marine Terminal offset Workshop on either July 28, 2014 or August 1, 2014.	Western Canada Marine Response Centre

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
7/11/2014	Email – Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team Member emailed A. Grove and provided the link to the NEB's draft project conditions with regards to Trans Mountain. A. Grove responded with a request to have a telephone conversation. Team Member and A.Grove subsequently exchanged emails regarding a regulatory letter from HWFN	Regulatory - NEB
7/22/2014	Email – Letter Outgoing	Alan Grove (Consultant), Chief Rocky Wilson	Ellen Frisch (KMC) Michael Davies (KMC)	Team Member emailed A. Grove and Chief R. Wilson and attached a copy of the July 20, 2014 letter which detailed the formal response from KMC regarding HWFN's TERMPOL-related information requests. Topics addressed: • Route Analysis and Anchorage Elements • Navigational Hazards • Real Time Simulations • Cargo Transfer and Transshipment Systems • Tanker Barge Specifications • Contingency Planning	TERMPOL, Routing, Hazards, Spill Response and Reclamation
7/23/2014	Email – Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team Member emailed A. Grove and notified of availability for meeting to discuss HWFN support. Team Member also stated that the draft Support letter to be submitted to the NEB from HWFN could be delayed and recommended reviewing that of another FN which could be used as an example of a First Nation intending to support but still having discussions and concerns addressed with Trans Mountain	Regulatory - NEB
7/23/2014	Email – Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team member emailed A .Grove to ask if HWFN could attend August 1, 2014 Westridge Workshop since there had only been one RSVP for the July 28, 2014 meeting. Chief Wilson confirmed this was possible.	Westridge Marine Terminal Workshop
7/28/2014	Email-Outgoing	Alan Grove (Consultant)	Ellen Frisch (KMC)	Team Member advised on content for regulatory letter from HWFN.	
8/1/2014	Meeting	Alan Grove (Consultant) Chief Rocky Wilson	Ellen Frisch (KMC)	HWFN attended meeting with First Nations to discuss Westridge Marine Terminal marine offset proposal. HWFN expressed an interest in ensuring construction did not impede the migration of salmon to fish bearing streams in Burrard Inlet. The primary interest is in the health of salmon stocks. The WRMT is in the Tsleil-Waututh territory and they should advise on the proposed marine habitat. A. Grove advised that discussions with WCMRC were positive and training was a possibility. Liability insurance was required for participation and the cost of this was considered a barrier to training. A. Grove requested consideration for support.	Protection of salmon migration.

APPENDIX A-03

PACHEEDAHT FIRST NATION

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
8/6/2013	Email-Incoming	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	D. Hunt of Pacheedaht First Nation (PTFN) emailed Team Member and requested the marine studies, permits and the Terms of Reference for Environmental Assessment completed for the Project thus far.	Permits, Traditional Marine Resource Use, Marine Biophysical Studies, Regulatory - ESA
8/6/2013	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	D. Hunt e-mailed Team Member and provided a list of community members who would be attending the presentation August 9, 2013. Team Member informed D. Hunt that an additional Team Member would join the meeting as well.	Agreements
8/6/2013	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member e-mailed D. Hunt and provided answers on completion of environmental/marine studies, public documents availability, KMC's permits application to the Federal and Provincial Government et al.	Permits, Traditional Marine Resource Use, Marine Biophysical Studies, Regulatory – ESA
8/8/2013	Letter-Outgoing	Chief Marvin McClurg	Regan Schlecker	Team Member sent a letter to Chief M. McClurg which notified PTFN that capacity funding has been made available from the National Energy Board (NEB), effective July 22, 2013, under the Participant Funding Program to assist landowners. Noted further were the List of Issues released by the NEB on July 29, 2013 which was also available on the NEB website. The letter also stated that the NEB did not intend to consider the environmental and socio-economic effects associated with upstream activities, the development of oil sands, or the downstream use of oil transported by pipeline. Requests for further information on the Participant Funding Program were directed to the NEB and its contact information was provided.	Agreements, Regulatory – NEB
8/9/2013	In-Person	Chief Marvin McClurg Tracy Charlie (Councillor) Lenore Jones (Councillor) Dale Peeler (Treaty Team) Dorothy Hunt (Band Manager) Robert Freedman (Legal Counsel) Kevin Neary (Treaty Department) Maddie Jones (Treaty Team) Pam Jones (Treaty Team) Helen Jones (Fisheries Manager) Jeff Jones (Fisheries) Tom Jones (Forestry/Treaty Team) Joan McKinnon (Finance Manager)	Ellen Frisch (KMC)	Team Member met with the negotiating team from Pacheedaht First Nation on September 9, 2013 and provided a project presentation and answered questions.	Agreements
8/13/2013	In-Person	Dorothy Hunt (Band Manager) Robert Freedman (Legal Counsel) Kevin Neary (Treaty Department)	Ellen Frisch (KMC)	Team Member met with the Chief, resource staff and key advisors of Pacheedaht First Nation on August 13, 2013.	None
8/15/2013	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member e-mailed D. Hunt and notified of the date of the Chiefs' leadership meeting on potential directions in marine spill response.	Marine Spill Response
8/15/2013	Email-Incoming	Robert Freedman (Legal Counsel)	Ellen Frisch (KMC)	R. Freedman emailed Team Member and inquired into other consult parties and whether the shipping routes go through Pacheedaht territory.	Shipping and Logistics, Routing
8/16/2013	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt and provided a list of action items stemming from a meeting on August 13, 2013. These items included: a list of First Nations that Kinder Morgan is engaging with, the location of the Regional Marine Study area, data being analyzed for other marine Projects in the region, spill response inventory and equipment in the surrounding areas, resending the March list of federal/provincial permits and authorizations and setting dates for the next meeting.	Marine Biophysical Studies, Spill Response, Permitting
8/16/2013	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt and requested meeting in Victoria September 4, 2013 or September 5, 2013 to discuss budget and work plan.	Agreements
8/16/2013	Email-Outgoing	Robert Freedman (Legal Counsel)	Ellen Frisch (KMC)	Team Member emailed R. Freedman and acknowledged R. Freedman's request for further information.	None
8/20/2013	Email-Incoming	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	D. Hunt emailed Team Member in response to August 16, 2013 email and indicated availability for a meeting in September 9, 2013 onwards.	None
8/22/2013	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member e-mailed D. Hunt to confirm availability for a meeting on September 10, 2013 – September 12, 2013.	None
8/22/2013	Email-Outgoing	Robert Freedman (Legal Counsel)	Ellen Frisch (KMC)	Team Member emailed R. Freedman and requesting potential meeting dates in early September.	None
8/23/2013	Email-Incoming	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member e-mailed D. Hunt to check availability for a meeting in the middle of September. D. Hunt replied back with different options. D. Hunt also confirmed that Chief M. McClurg declined attending the Salish Sea Chiefs meeting at end of August 2013,	None

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
8/23/2013	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member confirmed the meeting regarding a potential marine spill response with leadership will go ahead on August 27, 2013 but that additional dates would be scheduled. Team Member inquired into whether Chief M. McClurg will be attending.	None
8/24/2013	Email – Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt and acknowledged confirmation of a meeting on September 9, 2013 with D. Hunt.	None
9/9/2013	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt an invitation to the Salish Sea Chiefs & Designates on September 30, 2013	None
9/9/2013	In-Person	Dorothy Hunt (Band Manager), Kevin Neary (Treaty Department), Robert Freedman (Legal Counsel)	Ellen Frisch (KMC)	Team Member met with D. Hunt, R. Freedman and K. Neary to discuss the impacts of an oil spill on the marine fishery. Pacheedaht First Nation expressed a desire to participate in all marine field study work, a socio-economic impact assessment and a traditional land use study to understand more about these impacts. Proposal for Marine Use study given to Team Member	KMC's Facility Application would be missing key information from Pacheedaht. Pacheedaht must undertake a thorough socio-economic baseline study to understand how a spill could impact the community.
9/10/2013	Email-Incoming	Robert Freedman (Legal Counsel)	Ellen Frisch (KMC)	R. Freedman emailed Team Member regarding Letter of Understanding (LOU).	Agreements
9/11/2013	Phone - Outgoing	Robert Freedman (Legal Counsel)	Ellen Frisch (KMC)	Team Member contacted R. Freedman regarding approach to capacity funding and potential deliverables and funding	Agreements
9/13/2013	Email-Outgoing	Robert Freedman (Legal Counsel)	Ellen Frisch (KMC)	Team Member emailed R. Freedman as follow up to phone conversation September 11, 2013.	None
9/14/2013	Email-Incoming	Robert Freedman (Legal Counsel)	Ellen Frisch (KMC)	Robert Freedman (Legal Counsel) followed up with Team Member regarding email sent September 11, 2013. R. Freedman indicated that discussion on potentially funded deliverables had to be discussed.	Agreements
9/14/2013	Email-Incoming	Kevin Neary (Treaty Department)	Ellen Frisch (KMC)	K. Neary emailed Team Member to facilitate the commencement of the Traditional Marine Use Study. K. Neary inquired what Team Member thought was the appropriate next step, and stated his availability over the next week.	Traditional Marine Resource Use
9/17/2013	Email-Outgoing	Kevin Neary (Treaty Department)	Ellen Frisch (KMC)	Team Member emailed K. Neary and stated that budget had to be approved prior to work. Team Member stated that a call September 18, 2013 would be warranted to discuss. R. Freedman indicated a discussion with D. Hunt was required regarding budgets. Emails were exchanged and time set for September 18, 2013	Traditional Marine Resource Use
9/18/2013	Call – Outgoing	Kevin Neary (Treaty Department)	Ellen Frisch (KMC)	Team Member discussed need to receive deliverables from TMRU by dates that allowed PTFN's interests and the study and conclusions to be included in the first and second supplemental Facility Application filings.	Traditional Marine Resource Use
9/18/2013	Email-Outgoing	Robert Freedman (Legal Counsel)	Ellen Frisch (KMC)	Team Member emailed R. Freedman and provided a study area map including an overlay of the Pacheedaht Territory and shipping lanes, and list of First Nation communities engaged in the Project.	Shipping and Logistics, Routing, Regulatory – ESA
9/18/2013	Call – Incoming	Robert Freedman (Legal Counsel) Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member called R. Freedman and D. Hunt and discussed the timing and potential funding levels of a capacity agreement and marine traditional use study.	Agreements
9/29/2013	Email – Incoming	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	D. Hunt emailed Team Member and enquired about whether the Chief's meeting was still occurring and requested a response to the Pacheedaht proposal.	Agreements
9/29/2013	Email – Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt and confirmed the Chiefs' meeting for September 30, 2013 and indicated a formal response would be forthcoming.	Agreements
10/01/2013	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt and attached response to PTFN Budget/Studies proposal. Team Member outlined key project review components in the coming weeks as follows: - Working with PTFN to support community needs to have enough information about the project to decide to engage with KMC at upcoming member meetings; - supporting research to PTFN towards understanding the Environmental and Socio-Economic Approach and ability to review the TERMPOL marine studies as they become available in the coming weeks; - Initiating a TMRU study Team Member noted the possibility to meet to review a more detailed collective approach.	Aboriginal Consultation and Engagement, Regulatory – ESA, TERMPOL, Traditional Marine Use

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10/15/2013	Letter - Incoming	Dorothy Hunt (Band Manager)	Ian Anderson (KMC), Peter Forrester (KMC)	D. Hunt sent a letter to Team Members which demonstrated PTFN's interest and concerns in the following areas: • PTFN is engaged in capacity discussions with KMC. • Traditional Marine Resource Use (TMRU) Data - PTFN's TMRU Data must be collected and incorporated into KMC's Application before it is filed with the National Energy Board (NEB). It is not a stand-alone document. Pacheedaht has serious concerns that the Application will be filed without the MTRU and that KMC will not revise conclusions related to the project impacts and effects, irrespective of the TMU data. KMC is asked to revisit the intention to file in December. • Marine Biophysical Studies: - PTFN is concerned with the understanding that no marine biophysical studies outside Burrard Inlet are intended to be undertaken. Desktop studies are not adequate to permit the effects from the Proposed project to be considered and analyzed. This approach is considered a half-measure, and is unacceptable considering the impacts of a tanker spill of diluted bitumen. PTFN proposes studies to be conducted. • Fate and Behaviour of Bitumen - This is of particular concern as PTFN understand spilled diluted bitumen would sink. The matter should be fully explored and PTFN would like to receive all information related to the matter. • Selection of VCs - PTFN is unaware of what VCs have been identified and the criteria and thresholds KMC is considering. PTFN welcomes engagement to devise an appropriate methodology. An approach must result in meaningful assessment of impacts to aboriginal rights – which would include effects on harvesting activities, culture and cultural transference of traditional ecological knowledge and preferred means and locations for exercising rights. • TERMPOL Process - PTFN would like to learn more about this process and whether KMC has agreed to engage in such a process. Pacheedaht wishes to participate on the committee if it has been struck. PTFN seeks to understand KMC's intentions with respect to the committee's recommendations. PTFN believes that TERMPOL studies and recommendations must be incorporated into the analysis set out in the KMC application to the NEB. • Crown Consultation - PTFN is concerned about the lack of crown consultation to date. • TMRU study information will be too late to influence KMC filing. KMC should not file until receipt of information. • Biophysical studies of the marine environment should be undertaken to understand potential effects. • Environmental impacts of bitumen was unknown.	Traditional Marine Resource Use, Marine Biophysical Studies, Bitumen, Agreements, Aboriginal Engagement and Consultation, TERMPOL, Regulatory – NEB, Environmental Impacts,
10/17/2013	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt and notified that KMC would move forward with capacity agreement approach to enable PTFN to be engaging with KMC. KMC would propose to send PTFN a draft LOU with schedule attached that outlines deliverables. Team Member noted that the expiry date would be August 31, 2014. Team Member requested additional information on the Traditional Marine Resource Use (TMRU) study regarding proposed deliverables, timing, involvement of the community, use of existing digitized information and details associated with line items as part of the budget proposal.	Agreements, Traditional Marine Resource Use
10/21/2013	Email-Incoming		Ellen Frisch (KMC)	Email exchanges to establish a time for a telephone call that afternoon to discuss the email to move forward with capacity and marine traditional use study work.	None
10/21/2013	Email-Incoming	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle provided the Workplan for PTFN's TMRU study.	Agreements, Traditional Marine Resource Use
10/21/2013	Phone - Outgoing		Ellen Frisch (KMC)	Team Member confirmed requirements for timing and deliverables for TMRU study and proposed funding amount. Requested a Workplan and detailed budget associated with work. Discussed timing, amounts and mechanisms for agreement on funding a single or separate Letter of Understanding (LOU). PTFN seeks significant funding to undertake research, baseline studies, engagement, application review etc. over the next 24 months. It's expected that KMC will provide appropriate funding in the next fiscal year. NEB funding is inadequate for PTFN to conduct the research necessary to participate in the NEB process.	Traditional Marine Resource Use, Agreements,
10/21/2013	Email-Incoming	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle emailed Team Member and attached the Workplan for PTFN's TMRU study. R. Kyle requested feedback for the Workplan in order to move forward with the engagement.	Agreements, Traditional Marine Resource Use
10/23/2013	Email-Outgoing	Dorothy Hunt (Band Manager), Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	Team Member responded to R. Kyle email from October 21, 2013. Team Member provided information regarding LOU and TMRU study funding to R. Kyle. Team Member included attachments of the TMRU study Workplan Budget.	Agreements, Traditional Marine Resource Use
10/23/2013	Email-Outgoing	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	Team Member emailed R. Kyle and attached a draft LOU. Team Member noted being available by phone to discuss if needed.	Agreements
10/24/2013	Email-Incoming	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle forwards the updated TMRU study work plan.	Traditional Marine Resource Use
10/24/2013	Email-Incoming	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle emailed Team Member and informed that PTFN does not agree with KMC's impact assessment and methodological approach in relation to studying Aboriginal Groups. R. Kyle indicated the importance of PTFN's traditional marine use data being used in the application. R. Kyle noted the length of the funding negotiation process hand that PTFN would seek separate funding from KMC to conduct the historical research. R. Kyle attached a revised Workplan for review. R. Kyle noted concern regarding missed deadline for input on the ESA approach document and informed that this was due to a lack of funding. R. Kyle requested a list of marine studies currently available for review and copies of these studies. R. Kyle stated that the draft agreement would be reviewed and comments provided.	Impacts Assessment, Aboriginal Consultation and Engagement, Agreements, Regulatory – ESA, Traditional Marine Resource Use
10/25/2013	Email-Incoming	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle sends edited LOU and offers Monday, October 28 to discuss it.	Agreements
10/29/2013	Email-Outgoing	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	Team Member responded to R. Kyle and provided availability for a phone call on October 31, 2013.	None

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10/29/2013	Email-Outgoing	Dorothy Hunt (Band Manager), Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	Team Member emailed D. Hunt and R. Kyle and acknowledged receipt of the draft LOU and asks to contact PTFN for high level feedback that afternoon on PTFN edits and questions. Team Member emailed R. Kyle and D. Hunt on October 29, 2013, and provided R. Kyle and D. Hunt with a link to the NEB's public notice posted in July for participant funding from the NEB. Team Member informed R. Kyle and D. Hunt that additional funding to review and comment on the project application beyond what was provided by the NEB was not being considered at that time. On October 29, 2013 R. Kyle responded by email to Team Member's email regarding funding for PTFN to participate in the process. Team Member replied to R. Kyle email providing the details of future and currently proposed funding. R. Kyle requested to set up a time to talk to R. Kyle the afternoon of October 29, 2013.	Agreements, Regulatory – NEB
10/29/2013	Email-Outgoing	Dorothy Hunt (Band Manager), Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	Team Member contacted R. Kyle and D. Hunt by email on October 29, 2013, to summarize the TMRU study deliverables and budget, and Capacity Budget. Team Member provided R. Kyle and D. Hunt with a list of TERMPOL studies to be released in mid-December which may interest PTFN. R. Kyle responded by email to Team Member on October 29, 2013, to discuss a meeting time. Team Member provided times of availability and contact information to R. Kyle.	Traditional Marine Resource Use, TERMPOL
11/04/2013	Email-Outgoing	Dorothy Hunt (Band Manager), Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	Team Member was contacted by R. Kyle on November 4, 2013 to determine a time to discuss an agreement regarding the TMRU study. Team Member responded to R. Kyle's email on November 4, 2013, identifying a time of availability and commenting on the budget. Emails were further exchanged outlining an editing approach and document sharing.	Traditional Marine Resource Use, Agreements
11/05/2013	Email-Outgoing		Ellen Frisch (KMC)	Team Member transmits next draft LOU with accepted changes, edits and items flagged for discussion. Team Member offers a call that afternoon or Nov 6.	Agreements
11/06/2013	Email-Outgoing	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle summarized key issues related to the proposed outputs of the TMRU study and budgeting process in advance of the call. TMRU study is not being conducted to identify project impacts. Impacts should be part of the overall environmental assessment process. PTFN will not agree to a deliverable that assesses how their interests may be impacted by the project. PTFN wants to understand why KMC seeks a detailed TMRU study budget as funding proposed does not align with actual PTFN budget. PTFN's views on where to allocate additional funding between the TMRU study or other capacity were provided. Work will need to be prioritized.	Traditional Marine Resource Use, Agreements
11/06/2013	Phone - Outgoing		Ellen Frisch (KMC)	Discuss key matters raised in previous email, resulting in understandings on funding allocations, deliverables and engagement elements going forward.	None
11/06/2013	Email-Outgoing	Dorothy Hunt (Band Manager), Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle provided Team Member with a revised LOU. Team Member responded on November 6, 2013, to R. Kyle indicating the LOU would be looked at and a clause inserted as discussed previously. KMC requests more detailed budget for marine use study. PTFN expresses concern regarding the level of funding offered and purpose for detailed budget.	Agreements
11/07/2013	Email-Outgoing	Dorothy Hunt (Band Manager), Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	Team Member emailed R. Kyle and D. Hunt regarding TMEP/Pacheedaht draft LOU.	Agreements
11/08/2013	Email-Outgoing	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle emailed Team Member with a budget for the TMRU study Workplan and committed to contacting Team Member the week of November 11-15, 2013.	Traditional Marine Resource Use
11/12/2013	Email-Outgoing	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle emailed Team Member on November 12, 2013 regarding PTFN LOU. R Kyle indicated PTFN is confirming PTFN TMRU study Workplan and budget. Team Member responded on November 12, 2013, with attachments of the draft PTFN LOU, TMRU study Budget and revised Workplan.	Agreements
11/13/2013	Letter - Outgoing	Chief Marvin McClurg	Gary Youngman (KMC)	Team Member sent a letter to Chief M. McClurg regarding the TERMPOL process and notified of KMC's intent to file the Facilities Application to the NEB in mid-December. Team Member advised that in addition to completing environmental studies, KMC has been working with Transport Canada to complete studies which focus on the safety of tankers entering Canadian waters, navigating through channels, approaching and berthing at a marine terminal and loading and unloading processes. Team Member stated that KMC is providing the opportunity for PTFN to review and comment on the technical studies over the next 2-3 months, and aggregate comments will be considered in the TERMPOL process. Team Member requested that PTFN respond by November 30, 2013 if interested in receiving the studies.	TERMPOL, Regulatory – NEB
11/14/2013	Email-Outgoing	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle emailed Team Member on November 14, 2013 to discuss changes to the TMRU study Workplan, and PTFN TMRU study budget. Emails were exchanged to affirm funding actions.	Traditional Marine Resource Use
11/18/2013	Email-Incoming	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	D. Hunt transmitted to Team Member the signed LOU.	Agreements
11/18/2013	Email-Outgoing	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle emailed Team Member with a revised final TMRU study Workplan and budget.	Agreements
11/20/2013	Email-Outgoing	Dorothy Hunt (Band Manager)	Theresa Lane (KMC)	Team Member emailed D. Hunt a copy of the TERMPOL study letter originally mailed to PTFN on November 13, 2013.	TERMPOL
11/25/2013	Email-Outgoing	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle emailed Team Member on November 25, 2013, for a map indicating the proposed tanker routes, and a copy of the signed LOU.	Agreements
11/26/2013	Email-Outgoing	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	Team Member emailed R. Kyle on November 26, 2013 with a copy of the signed PTFN LOU, and a map of the tanker traffic lanes as requested by R. Kyle on November 25, 2013. Team Member noted the map of tanker routes had also been sent in August, 2013.	Agreements
11/27/2013	Fax - Incoming	Virginia Mathers (JFK Law)	Gary Youngman (KMC)	V. Mathers, staff member of JFK Law, faxed Team Member a response to KMC's November 13, 2013 TERMPOL study letter, indicating that PTFN intended to receive copies of and comment on the studies for the Project.	TERMPOL
12/13/2013	Email-Incoming	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle inquired if KMC still planned to file its application to the NEB on December 18/2013. R. Kyle also inquired if there are any NEB mandated timelines for the sufficiency review of the draft application. R. Kyle acknowledged that there is a commitment between KMC and PTFN to provide comments on the TERMPOL studies and Facilities Application by Feb 15, 2014.	TERMPOL, Regulatory – NEB

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
12/16/2013	Letter - Outgoing	Chief Marvin McClurg	Gary Youngman (KMC)	Team Member mailed Chief M. McClurg a copy of the Transport Canada TERMPOL studies (on a USB stick) related to the Project for PTFN's review. Team Member requested that PTFN provide feedback on the studies within two to three months.	TERMPOL
12/16/2013	Letter - Outgoing	Chief Marvin McClurg	Ian Anderson (KMC)	Team Member sent a letter to Chief M. McClurg and notified PTFN of the Facilities Application Filing with the NEB on December 16, 2013. Team Member provided a URL to the Application's location on the TransMountain website. Team Member noted the National Energy Board (NEB) would hold a public engagement process, which would include a hearing on the Application prior to a formal decision on the Project. Team Member included the NEB's website URL for further information on this process.	Regulatory – NEB
12/17/2013	Email-Incoming	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	D. Hunt asked Team Member to provide dates in January to give a presentation to PTFN members and offered January 14, 1:30 at the PTFN community in Port Renfrew.	None
12/17/2013	Email-Outgoing	Rosanne Kyle (JFK Law)	Ellen Frisch (KMC)	R. Kyle emailed Team Member on December 17, 2013, requesting a hard copy and CD of the TMEP NEB Application.	Regulatory - NEB
1/8/2014	Email-Incoming	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	D. Hunt emailed Team Member on January 8, 2014, inquiring about dates to schedule two meetings in PTFN. Team Member provided D. Hunt with potential dates and possible presentation types.	None
1/8/2014	Email-Incoming	Rosanne Kyle (Principle, JFK Law Corporation)	Ellen Frisch (KMC)	R. Kyle emailed Team Member on January 8, 2014, requesting a response to the December 17 request for a hard copy and CD of the Project's National Energy Board (NEB) Application. Team Member responded on January 8, 2014, indicating a copy requested materials were sent to R. Kyle and D. Hunt. Team Member provided R. Kyle with a hyperlink to the Application materials online. Team Member requested to know if Pacheedaht First Nation (PTFN) had received copies of the Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL) studies. R. Kyle to check if TERMPOL reports were received.	TERMPOL
1/8/2014	Email-Incoming	Virginia Mathers (Associate, JFK Law Corporation) Dorothy Hunt (Band Manager), Eva Roberts (JFK Law Corporation) (JFK Law Corporation) Marvin McClurg (Participant) Rosanne Kyle (Principle, JFK Law Corporation)	Ellen Frisch (KMC)	V. Mathers responded to Team Member's email to R. Kyle on January 8, 2014 inquiring about PTFN receiving copies of the TERMPOL studies. V. Mathers provided names of individuals to include when sending copies of the TERMPOL studies. Team Member provided V. Mathers with a link to the NEB Application and who in PTFN copies of the TERMPOL studies were sent to.	TERMPOL
1/8/2014	Letter - Outgoing	Dorothy Hunt (Band Manager), Rosanne Kyle (Principle, JFK Law Corporation)	Gary Youngman (KMC), Ellen Frisch (KMC)	Team Member mailed D. Hunt and R. Kyle of Pacheedaht First Nation (PTFN) a letter and USB stick containing the Project's Facilities Application for the Project that was submitted to the NEB on December 16, 2013.	Regulatory – ESA; Regulatory - NEB
1/8/2014	Email-Incoming	Dorothy Hunt (Band Manager) Rosanne Kyle (Principle, JFK Law Corporation) Jaela Shockey Monique Cotton	Ellen Frisch (KMC)	D. Hunt emailed Team Member with dates and times for possible meetings and presentations to Community members by KMC. Team Member agreed to January 29 and February 12. Team Member stated it would be helpful to have the Western Canada Marine Response Corporation (WCMRC) participate and would confirm any additional participation with D. Hunt. J. Shockey confirmed her availability.	TERMPOL
1/8/2014	Email – Outgoing	Virginia Mathers Eva Roberts (JFK Law Corporation)	Ellen Frisch (KMC)	Team Member emailed V. Mathers to confirm that the TERMPOL letter and USB stick with the information was sent directly to PTFN, attention Chief McClurg on December 17, 2013. The USB stick with the Application information is being sent today to both the Chief, D. Hunt and a cc: to R. Kyle. An additional TERMPOL USB stick will be placed in the R. Kyle package. In the interim, the Application in a searchable format is available online at the Trans Mountain website. V. Mathers acknowledged receipt of the email.	TERMPOL
1/9/2014	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	D. Hunt emailed Team Member to follow-up on the meeting scheduled for January 29, 2014 and to advise that D. George will not be in attendance. D. Hunt provided logistics details for the meeting.	None
1/15/20154	Phone Message - Incoming	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	D. Hunt left a voicemail asking for a one page project information summary for distribution to the PTFN community in advance of the community meeting January 29, 2014.	None
1/17/2014	Email - Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt to acknowledge the request and indicate work will commence when she returns from being out of town.	None
1/19/2014	Email-Incoming	Rosanne Kyle (Principle, JFK Law Corporation) Virginia Mathers	Ellen Frisch (KMC)	R. Kyle emailed Team Member to request a hard copy of the application.	None
1/22/2014	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt and referred D. Hunt to two KMC websites with information concerning the Project overview and the Project proposed marine plans.	TERMPOL
1/23/2014	Phone Message – Incoming	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	D. Hunt left a voicemail for the Team Member seeking an update on the status of the one page project fact sheet.	None
1/23/2014	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt to inform that KMC is preparing a new Project Fact Sheet, which will be available the following day. Team Member stated that KMC would bring hardcopies of the Project Fact Sheet and a digital copy to the meeting the following week. D. Hunt hoped the fact sheet would be attached to the meeting notice and available so that people could read it prior to attending the meeting. Team Member noted it could be possible to send the digital version January 24, 2014.	Information Request

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1/27/2014	Email-Incoming	Dorothy Hunt (Band Manager) Denise Chewka Pacheedaht Treaty member Responses: R. Kyle D. Mathers	Ellen Frisch (KMC)	D. Hunt wrote to Team Member and expressed concerns regarding KMC's response to information request of January 23, 2014. Team Member responded by email, stated that KMC had provided multiple links for Project information and sent two PDF's, regarding the Project overview and the media background information package. Team Member wrote that KMC was unable to create a separate Fact Sheet that met PTFN's time requirements. Team Member also noted that the Project website was transparent and had the environmental assessments, reports and detailed information as well as high level overviews. D. Hunt responded that the issue is members wanted project information before the community meeting.	Response to information request.
1/28/2014	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt to advise that the Team Member would be attending the meeting on January 29, 2014 with another Team Member. Team Member advised that no representatives from WCMRC were available to attend. Team Member proposed an agenda for the meeting.	None
1/28/2014	Email-Outgoing	Rosanne Kyle (Principle, JFK Law Corporation) Virginia Mathers, JFK Law Corporation	Ellen Frisch (KMC)	Team Member emailed R. Kyle to follow-up on the email of January 19, 2014 in which R. Kyle requested a hard copy of the facilities application. Team Member advised that the application is more than 15,000 pages long (in binders) and a vast amount is focused on the land based elements. Team Member enquired as to whether there were particular sections to target such as Volume 8 and Marine work. It is available on the TransMountain website and on the NEB website and JFK Law had received a copy of the Application on USB stick. It was proposed that Volume One be reviewed and the JFK Law may advise the specific elements of the Application which may be required such as the	None

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
1/29/2014	Community Meeting	Community Members (about 40 members), Chief and Council and Staff	Ellen Frisch (KMC) Georgia Dixon (KMC)	Team Members made a presentation to the PTFN community from 10:00am to 3:30pm. Discussion topics included: a. Shipping increase in the territory and interaction with fishery, b. How speed and vessel traffic was regulated. c. Does KMC have statistics on wildlife that might be impacted by the Project and how was this information collected. Concern that general information was utilized rather than biophysical studies d. Concern was expressed about the residual effects of an oil spill. e. The type of studies which were conducted on the marine environment in PFN's territory or in the marine area. KMC explained that studies were primarily desk top and Marine Traditional Use Studies which were received in the fall, but will be submitted in the next Supplemental filing. f. Questions about the WCMRC. Discussion regarding how WCMRC protects shorelines and responds to spills. Team Member responded that WCMRC is a professional emergency response organization with professionally trained responders to address a range of marine spill scenarios. WCMRC has been invited to attend a meeting with PFN to explain the type of equipment and response process. Transport Canada wants to engage with First Nations. PFN has the TERMPOL studies and an agreement is in place for PTFN to review the studies and provide advice to KMC/TC. Discussion regarding the number of tanker movements in the Strait of Juan de Fuca was 1197 in 2011 compared to the number which terminate in Westridge. Review of shipping lane location and discussion about higher volume of loaded tankers transiting Juan de Fuca to Anacortes/Cherry Point. PTFN asked questions regarding shippers. KMC noted that international shipping companies own the ships. There are other projects which move petroleum products and are not connected to a pipeline. Also, tankers serve the needs of refineries such as those at Chevron in Burnaby and Cherry Point and Anacortes. PTFN asked about the process for a spill response in US Waters. WCMRC would lead protection in BC waters. PTFN members questioned KMC's role in spill response. The role of WCMRC and Transport Canada was explained. KMC wishes to work with communities in the long-term to provide training and discuss community protection and other initiatives if the community wants to work with us. There was a discussion regarding KMC vetting tankers prior to docking at Westridge. Q What types of conditions does KMC place on the shippers? Discussion that Captains are employed by shipping company and their own employment standards apply. More information can be shared at a follow-up meeting. PTFN wants to understand the content of the Application and ESA Findings. What is the Environmental impact? What will be the impact to PTFN resources? Want an overview of environmental effects of species important to PTFN. PTFN asked what are other First Nation Communities comments regarding the Project. Team Member responded that logs have recorded all feedback and KMC believes they are honest and correct. Other FN communities are interested in spill response and effects of a spill on their traditional fisheries. First Nations are concerned that the Salish Sea is polluted and are interested in working with KMC to address this at a higher level. The Federal Government is also conducting the tanker safety review panel. KMC has been supporting work with First Nations' to come together across the Salish Sea. Members pointed out that PFN is not Salish and the Juan de Fuca waters are not the Salish Sea. PFN Chief is interested in meeting with Ian Anderson when he is on Vancouver Island in late February, early-March PTFN asked if KMC required up to 35 tankers per month. Team Member responded that the proposal is for up to 35 additional tankers. It may be flexible given demand. ACTION: • KMC to contact Transport Canada regarding the Shipping Lane designation and initiate identifying the persons responsible to liaise with PFN. • PFN would like to have a technical session to review the ESA studies and report content. • PFN would like to meet with Ian Anderson in late-February to early March. Team Member to coordinate. • KMC to ensure the next meeting includes WCMRC and Marine technical representatives.	Increase in risk of an oil spill. Fate and behaviour of bitumen (sinking). Spill responses processes, techniques and equipment for retrieving bitumen. Effectiveness of spill response equipment on bitumen spills. Interaction of PTFN fishing vessels with tankers in foggy conditions at Swiftsure Bank. Use of 'average' weather conditions for various TERMPOL studies. Long-term impact to the environment and the PTFN culture in the event of a spill. Coordination of spill response in international waters.
1/30/2014	Email-Incoming	Kevin Neary (Project Director, Traditions Consulting Services Inc.)	Ellen Frisch (KMC)	K. Neary emailed Team Member requesting a digital copy of a PowerPoint presentation, stating several community members had requested a copy.	None
1/30/2014	Phone - Attempt	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	D. Hunt, PTFN Negotiator, telephoned Team Member and requested a call back to discuss the next meeting.	None
1/30/2014	Phone - Incoming	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	D. Hunt phoned Team Member to follow up on the community meeting held January 29. 2014.	None

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
1/31/2014	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt to confirm meeting dates with the TERMPOL committee on February 18, 2014 and February 19, 2014. Team Member also inquired about meeting between the KMC president and the PTFN Chief. Team Member also requested to know if a community member had access to a vessel, as to give the KMC President a perspective from the water.	None
1/31/2014	Email-Outgoing	Rosanne Kyle (Principle, JFK Law Corporation)	Ellen Frisch (KMC)	Team Member emailed R. Kyle regarding R. Kyle's request for a hard copy of the Facilities Application and pointed out that the hard copy Application was more than 15,000 pages. Team Member stated a digital copy was available on the Project website as well as on the NEB website. PTFN legal counsel had received a copy of the Application on a USB drive to help in more immediate access and searching. Alternatively, KMC proposed that a review of Volume 1 be undertaken as it had a summary of the entire Application. Given PTFN's marine location, much of the marine information was found in Volume 8. A significant component of the Application pertains to the land and the pipeline route. Team Member requested to know what sections PTFN wished to receive from the Application.	Response to information request.
1/31/2014	Phone - Attempt	Randy Neufeldt WCMRC	Ellen Frisch (KMC)	Team Member called R. Neufeldt (VI Manager, WCMRC) to discuss the outcome of the PTFN Community meeting that occurred on January 29, 2014, and to plan participation in a meeting with Pacheedaht in Port Renfrew on February 12, 2014. Team Member left a voicemail. R. Neufeldt returned Team Member's call. Team Member reported the key interests of PTFN were related to marine spill response speed, type of equipment and efficacy of equipment in the Strait of Juan de Fuca. Also, interests were expressed about how cooperation with US authorities and Canadian authorities and the Makah occurs if there were a spill in US waters. R. Neufeldt committed to attending meetings with PFTN and sharing information and providing a future tour of the Duncan facility.	Emergency spill response
1/31/2014	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt to advise that a note had been sent to Transport Canada to follow up on PTFN's concerns about the location of the Juliet Buoy, the designated shipping lanes and the interface between commercial vessels and PTFN fishers at Swiftsure Bank. Team Member informed D. Hunt that Transport Canada contacts B. Gowe and K. Beavis had initiated an internal enquiry. Team Member requested former key contacts and timing of previous discussions to pass on to Transport Canada.	None
1/31/2014	Phone - Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member called D. Hunt and discussed the needs for the next meeting on February 12, 2014. KMC will bring marine technical and WCMRC to the next meeting and Team Member will affirm their availability. There is the possibility of touring the Duncan WCMRC office. There is the possibility for a pre-community meeting with technical Team Members and staff/Chief and Council to go into more detail before the Community session.	None
1/31/2014	Phone - Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member called D. Hunt to discuss the community meeting held January 29, 2014 and the need for a technical briefing/discussion opportunity for PTFN staff and Chief and Council separate from the community meetings. The new Chief A. Daniels started work on January 27, 2014 and would be learning more about the Project. Team Member stated that the next community meeting was scheduled for February 12, 2014 and it would be important to have WCRMC and marine technical staff present from KMC. Team Member would explore holding the technical meeting prior to the Community meeting. WCMRC's offices were in Duncan and Team Member would pursue a site tour with WCMRC, and possibly a brief meeting with the regional manager the week of February 3, 2014. It was noted that PTFN was working with the government and being consulted on matters related to the proposed new Pacific Gateway Marina in the region.	None
2/3/2014	Email-Outgoing	Kevin Neary (Project Director, Traditions Consulting Services Inc.)	Ellen Frisch (KMC)	Team Member emailed Kevin Neary (Project Director, Traditions Consulting Services Inc.), MTRU technical lead for PTFN and attached PowerPoint presentation, utilized by KMC on January 29, 2014.	None
2/3/2014	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt and provided the TERMPOL 3.5 & 3.12 – Route Analysis & Anchorage Elements report to elucidate the questions regarding tanker route and traffic separation that arose during a meeting on January 29, 2014. Team Member sent D. Hunt a letter from the Pacific Pilotage Authority to address questions about pilotage processes and speed limits. Team Member was investigating getting access to a digital file of the report and the shipping lanes selected for the TMRU Study.	Routing; TERMPOL
2/4/2014	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt to follow up on a meeting on January 29 meeting and to say that the KMC marine technical members were unavailable on February 12, 2014, but were available during the week of February 19, 2014. This would include one of two KMC Team Members and R. Neufeldt from WCMRC. Team Member also recommended a pre-technical meeting with the Chief and Council, staff and technical advisors so that everyone at the technical meeting will be prepared for the discussion.	None
2/9/2014	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt to reschedule the meeting on February 12, 2014 as WCMRC and KMC's marine team presence were unable to attend. Team Member suggested February 19, 2014 in Pacheedaht. Team Member provided Team Member's contact details.	None
2/11/2014	Email-Incoming	Dorothy Hunt (Band Manager) Denise Chekwa Pacheedaht Treaty Kevin Neary (Project Director, Traditions Consulting Services Inc.)	Ellen Frisch (KMC)	D. Hunt emailed Team Member and PTFN members to advise that the individual from West Coast Marine Emergency Response Team is unable to attend the TERMPOL meeting scheduled for February 12, 2014 and has suggested February 19, 2014 as a possible alternate date. D. Hunt suggested delaying the meeting until March 6, 2014; March 7, 2014 or March 12, 2014.	TERMPOL
2/12/2014	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member wrote to D. Hunt and stated that the KMC team was unavailable for the suggested meeting dates, but suggested March 26, 2014. Team Member stated that WCMRC was also available March 26, 2014. Team Member would follow-up and confirm with the marine leadership team and PTFN.	None
2/12/2014	Email-Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt to follow-up on the email sent February 11, 2014 regarding possible dates for the TERMPOL meeting. Team Member advised that the KMC team is not available on any of the dates proposed by D. Hunt. Team Member suggested March 26, 2014.	TERMPOL
2/14/2014	Email-Incoming	Eva Roberts (JFK Law Corporation)	Ellen Frisch (KMC)	E. Roberts sent Team Member a message on behalf of R. Kyle, enclosed was a preliminary Traditional Marine Use and Occupancy Study (TMUOS) Report, delivered pursuant to the terms of the Letter of Understanding with PTFN. Team Member confirmed receipt of the TMUOS preliminary report.	Traditional Marine Use and Occupancy

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
2/18/2014	Email-Incoming	Eva Roberts (JFK Law Corporation)	Ellen Frisch (KMC)	E. Roberts emailed Team Member and attached a letter from R. Kyle. Team Member confirmed receipt of the letter.	None
2/18/2014	Letter-Incoming	Rosanne Kyle (Principle, JFK Law Corporation)	Ellen Frisch (KMC)	R. Kyle sent a letter to Team Member which constituted the deliverables required under the Workplan attached to the LOU. This letter detailed compliance with NEB regulation and identified PTFN's concerns and questions with regards to the TERMPOL studies.	Agreements
2/19/2014	Email-Outgoing	Dorothy Hunt (Band Manager) Denise Chekwa Kevin Neary (Project Director, Traditions Consulting Services Inc.) Pacheedaht Treaty	Ellen Frisch (KMC)	Team Member emailed D. Hunt to inquire on potential meeting dates for a TERMPOL marine technical workshop with WCMRC, PTFN and KMC. Team Member had connected with Transport Canada, who were available on March 24, 2014; March 25, 2014 and March 28, 2014. Pacheedaht Treaty responded that the treaty team is not available the March 24, 2014 and March 25, 2014.	TERMPOL
2/19/2014	Email-Incoming	Eva Roberts (JFK Law Corporation)	Ellen Frisch (KMC)	E. Roberts emailed Team Member and attached a letter from R. Kyle to the National Research Council of Canada requesting further information on the Crown's consultation process regarding the Project.	None
3/4/2014	Email-Incoming	Eva Roberts (JFK Law Corporation)	Ellen Frisch (KMC)	E. Roberts emailed Team Member to advise that PTFN is available on April 14, 2014 or April 17, 2014 for the TERMPOL meeting. E. Roberts advised that the meeting would consist of the TERMPOL marine technical workshop (which includes PTFN, KMC technicians and the Western Canada Marine Response Corporation, followed by the community meetings.	TERMPOL
3/6/2014	Email-Outgoing	Eva Roberts (JFK Law Corporation)	Ellen Frisch (KMC)	Team Member emailed E. Roberts to confirm that the KMC technical team is available to attend the TERMPOL meeting on April 17, 2014. Team Member discussed meeting logistics and advised of an upcoming absence from March 7 to 17, 2014.	TERMPOL
3/10/2014	Email-Incoming	Eva Roberts (JFK Law Corporation)	Ellen Frisch (KMC)	E. Roberts emailed Team Member to confirm PTFN's attendance at the TERMPOL meeting scheduled for April 17, 2014. E. Roberts inquired whether the Team Member would be coordinating with Transport Canada regarding the meeting.	TERMPOL
3/19/2014	Email-Incoming	Dorothy Hunt Rosanne Kyle J. McKinnon Virginia Mathers	Ellen Frisch (KMC)	D. Hunt emailed Team Member requesting and update on Capacity funding deliverables.	Agreements
3/20/2014	Email-Incoming	Eva Roberts (JFK Law Corporation)	Ellen Frisch (KMC)	E. Roberts emailed Team Member to follow-up on an email sent March 10, 2014 in which E. Roberts inquired whether the Team Member would be coordinating with Transport Canada to attend the TERMPOL meeting scheduled for April 17, 2014. Team Member replied to confirm that Transport Canada would be in attendance for the technical meeting. E. Roberts replied to inquire whether Western Canada Marine Response Corporation would also be in attendance. Team Member replied to advise that Western Canada Marine Response Corporation has committed to have a representative present at the meeting.	TERMPOL
3/27/2014	Letter – Outgoing	Rosanne Kyle (Principle, JFK Law Corporation)	Shawn Denstedt (Osler)	Team Member sent a letter to R. Kyle in response to PTFN's October 15, 2013 and February 18, 2014 letters, as well as the correspondence from PTFN to the NEB on February 19, 2014. Team Member detailed the process undertaken to file the Facilities Application thus far as well as consultative efforts made with regards to PTFN. Topics also addressed: • Selection of Valued Components, Criteria and Thresholds • Significance Determination • Marine Biophysical Studies • Traditional Marine Use Data and Pacheedaht-Specific Resource Use Information • "Pan-Aboriginal" Approach • Assessment Methodology for Effects from Marine Transportation • Fate and Behaviour of Diluted Bitumen • Effects Analysis/Risk Assessment of Spill Events • TERMPOL Process	TERMPOL, Bitumen, Aboriginal Consultation and Engagement, Traditional Marine Resource Use, Spill Risk Assessment and Analysis
4/7/2014	Phone – Incoming	Kevin Neary (Project Director, Traditions Consulting Services Inc.)	Ellen Frisch (KMC)	PTFN's interim TMUOS was due March 31, 2014. Due to a death in the community and project team an extension was requested and provided by KMC to April 30, 2014	Traditional Marine Use and Occupancy
4/11/2014	Email-outgoing	Dorothy Hunt (Band Manager) Rosanne Kyle (Principle, JFK Law Corporation) Virginia Mathers	Ellen Frisch (KMC)	Team Member emailed D. Hunt and R. Kyle. Team Member: • affirmed a meeting was still scheduled for April 17, 2014 • understood there was a desire to have a broader community meeting and a technical session • proposed session times • the approach for the community session, including the Project overview and a separate presentation by WCMRC. • KMC, Transport Canada and WCMRC attendees were confirmed. D. Hunt confirmed the meeting was scheduled and PTFN council would be consulted for any additional requirements. Team Member acknowledged confirmation and committed to contacting D. Hunt on April 15, 2014.	Traditional Marine Use and Occupancy
4/15/2014	Phone Call – Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member called D. Hunt and discussed travel arrangements for attending the April 17 TERMPOL workshop. Emails were exchanged regarding unique travel requirements.	TERMPOL

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
4/17/2014	Meeting – In Person	Chief Arlyss Daniels, Jeff Jones (Councillor), Marvin McClurg, Dorothy Hunt (Band Manager), Jason Howes, Kevin Neary (Project Director, Traditions Consulting Services Inc.) Rosanne Kyle (Principle, JFK Law Corporation), Virginia Mathers (Associate, JFK Law Corporation)	Ellen Frisch (KMC) Michael Davies Bikram Kanjilal Dave Fowles Randy Neufeldt (WCRMC) Kathryn Beavis (Transport Canada) Bob Gowe (Transport Canada)	A technical meeting to focus on the Project marine component, TERMPOL research and TERMPOL. A project overview and overview of TERMPOL study results was provided by KMC marine experts and questions were asked and answered. Topics identified were: a. change in volume of bitumen being shipped b. Change in the number of vessels and tankers in the Strait of Juan de Fuca as a result of the Project. c. Vessel separation scheme in the Strait of Juan de Fuca. d. Process to respond to and assist a laden tanker in distress. e. Different size response tug vessels are required for the TMEP Project (vs. Northern Gateway) because the size tankers calling on Westridge are smaller (carrying approximately 580,000 barrels) versus tankers proposed for Northern Gateway which can carry 2.0m barrels f. KMC terminal requirements for vessels g. Behaviour of the product in the environment (sink or float), effects of the density of salinity and sediment present in the marine environment. h. Behaviour of oil spill with high wave action and the ability to contain a spill or respond under heavy weather conditions. i. Oil spill trajectory modeling under heavy weather conditions rather than the 'average day'. j. How KMC gained information on fisheries activity in the Strait of Juan de Fuca – through Automatic Identification System (AIS) information. Transport Canada presented on the TERMPOL process and discussion followed. Transport Canada discussion topics: a. Timing of TERMPOL and whether the current Phase 1 review will be completed and incorporated before the TMEP project review. No. b. How the Tanker Safety Panel report will factor into TERMPOL report on the Project. c. Worst case spill modeling d. TC reviewed the 2001 and 2006 traffic separation scheme approaches in the Juan de Fuca Strait Concern was expressed that the changes in 2006 resulted in conflict with large vessels being directed over Swiftsure Bank. Additional consultation with First Nations was required due to safety and food impacts. WCMRC initiated a presentation on WCMRC role and spill response planning, but due to time, was limited. Discussion topics: a. How would equipment be deployed to new base locations (through Government, Kinder Morgan)? A: by the organization designated by Transport Canada, WCMRC b. Regarding KMC's proposal for more spill response bases and equipment, who must agree and make it happen? A: KMC has recommended that it be adopted through the Federal Tanker Safety Review Panel (FTSRP) as part of the regulation. Otherwise WCMRC would implement it. c. Upon reviewing the WCMRC proposal for new bases and response coverage, concerns were expressed regarding response times to the PTFN. d. Timing of final consultation on marine base locations on Vancouver Island. This will occur after the NEB hearings. WCMRC has ongoing work and is hiring staff and building capacity to engage with First Nation communities. e. Deployment of booms based on wave size. The skirt depth of the boom depends on wave height. PTFN would like additional evaluation of its rights. KMC noted its desire to work with PFN to develop processes and opportunities together to mitigate the impact of effects. PFN felt that it needed to know the impact to its aboriginal rights before discussion on mitigation. PTFN noted the specific environmental concern about the Port San Juan and Pacheena Beach and campground. Safety issues with Swiftsure Bank were identified. KMC suggested that PTFN work with KMC to develop a protocol for ships calling at Westridge to raise awareness about the interaction at Swiftsure Bank. KMC also identified the opportunity to equip vessels with AIS systems to 'see' the ships coming. PTFN queried KMC about the ability to move tankers the designation of the international shipping lane to address the matter related to the interface of fishers and tankers.	PFN believes fate and behaviour testing should occur with the sediment and salinity levels of the Pacheedaht territory. Studies should look at weather extremes. Full stochastic model of extreme wind and wave conditions should be run. There is concern about the risk associated with the inability to mitigate a spill and the environmental impact and ensuing impact on aboriginal rights. TC changes to vessel traffic scheme within FN consultation has impact FN fishers at Swiftsure Bank. Concern that new marine response base locations will not provide adequate coverage to Pacheedaht and Port San Juan. PFN is concerned about the lack of evaluation of PFN's rights in the Facilities Application. Supporting studies do not include information received from Pacheedaht. Impact of an oil spill given the saline and sediment conditions of Port San Juan and the impact to the Pacheena Beach, a campground and important economic driver for PTFN.
4/17/2014	Meeting – In Person	Pacheedaht Community Members (Chief and Council, Staff members and about 10 community members)	Ellen Frisch (KMC) Michael Davies Bikram Kanjilal Dave Fowles Randy Neufeldt (WCRMC)	KMC provided a PPT presentation and project overview for community members. Participants queried the spill response process; the ability to deploy spill response equipment in heavy waves and weather; concern about the interface between fishers and vessels at Swiftsure Bank, vessel navigation in fog and heavy weather and the impact of oil spill on the fisheries resources.	Spill response process Interface between fishers and vessels Vessel navigation in fog and heavy weather. Impact of an oil spill on the fish and marine environment and long term impacts.
4/25/2014	Email-Incoming	Kevin Neary (Project Director, Traditions Consulting Services Inc.), Rosanne Kyle (Principle, JFK Law Corporation)	Ellen Frisch (KMC)	K. Neary emailed Team Member with a copy of the Pacheedaht Traditional Marine Use and Occupancy Study (TMUOS) Interim Report as required by the Project's LOU. Report provides a digital location of key recorded information for 465 sites that are in, or partially in, the Project Study Area. The locations of these sites are portrayed on the map titled Map of Pacheedaht Traditional Marine Use and Occupancy Sites Interim Report April 2014 provided in Appendix A to this report. This map illustrates the 465 TMUOS sites intersected by the Project's Study Area.	None

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
5/15/2014	Email – Outgoing	Dorothy Hunt (Band Manager)	Ellen Frisch (KMC)	Team Member emailed D. Hunt about logistical arrangements for travel of TMEP members to the TERMPOL and Pacheedaht community meetings.	
5/29/2014	Email – Incoming	Virginia Mathers (Associate, JFK Law Corporation)	Shawn Destendt (KMC Legal Counsel)	V. Mathers emailed Team Member and provided the meeting minutes for the April 17, 2014 meeting between PTFN, Transport Canada, WCRMC and KMC.	None
6/8/2014	Email – Incoming	Kevin Neary (Project Director, Traditions Consulting Services Inc.)	Ellen Frisch (KMC)	K. Neary emailed Team Member and attached a copy of the TMUOS Final report.	Traditional Marine and Occupancy Use
6/9/2014	Email – Outgoing	Kevin Neary (Project Director, Traditions Consulting Services Inc.)	Ellen Frisch (KMC)	Team Member emailed K. Neary and confirmed receipt of the TMUOS Final report.	Traditional Marine and Occupany Use
7/21/2014	Letter – Outgoing	JFK Law Corporation	Michael Davies (KMC)	Team Member sent a letter to PTFN, care-of JFK Law Corporation, detailing a formal response to PTFN's TERMPOL-related information requests (sent, February 18, 2014). Topics addressed: • Fishery Resource Services • Origin, Destination and Marine Traffic Volume Survey • Fast Time Simulation	TERMPOL, Fish and Fish habitats, Marine Traffic
7/23/2014	Email – Outgoing	Rosanne Kyle (Principle, JFK Law Corporation)	Ellen Frisch (KMC)	Team Member emailed R. Kyle and attached a copy of the July 21, 2014 which detailed a formal response to PTFN's information request (February 18, 2014) regarding KMC's TERMPOL studies.	TERMPOL

APPENDIX A-04

TSAWWASSEN FIRST NATION

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
8/08/2013	Letter-Outgoing	Chief Kim Baird	Regan Schlecker (KMC)	Team member sent a letter to Chief K. Baird which notified Tsawwassen First Nation (TAFN) that capacity funding has been made available from the National Energy Board (NEB), effective July 22, 2013, under the Participant Funding Program to assist landowners. Noted further were the List of Issues released by the NEB on July 29, 2013 which was also available on the NEB website. The letter also stated that the NEB did not intend to consider the environmental and socio-economic effects associated with upstream activities, the development of oil sands, or the downstream use of oil transported by pipeline. Requests for further information on the Participant Funding Program were directed to the NEB and its contact information was provided.	Regulatory – NEB
9/11/2013	Email-Outgoing	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team member emailed T. McCarthy to discuss deliverables. Team member stated that the updated maps were being couriered to Tsawwassen First Nation. Team member also discussed further study opportunities and possible meeting times.	Routing
9/11/2013	Letter - Outgoing	Tom McCarthy (Chief Administrative Officer)	Theresa Lane (KMC)	Team member sent a letter to T. McCarthy and provided him with copies of routing maps.	Routing
9/11/2013	Phone - Attempt	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team member left a voice message for T. McCarthy inviting Chief B. Williams to the September 30, 2013 Salish Sea event.	None
9/11/2013	Phone - Attempt	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team member attempted to contact T. McCarthy and left a voice message in regards to inviting Chief B. Williams to the September 30 Salish Sea event. Team member also wanted to follow up on an email exchange what the next steps would be in seeking a proposal from Tsawwassen in support, and understanding Tsawwassen's interests in the Application.	Regulatory - NEB
9/12/2013	Email-Incoming	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	T. McCarthy e-mailed team member to inform that a follow up was needed with LGL prior to discussing KMC's offer to fund a study to understand potential project impacts.	None
10/04/2013	Email-Outgoing	Saira Bradley (Manager of Human Resources)	Sondra Baker (TERA)	Team member sent TAFN notification related to TMEP Archaeological Impact Assessment (AIA) fieldwork.	Archaeological Impact Assessment
10/07/2013	Email-Outgoing	Andrew Bak (Government Services Technician), Saira Bradley (Manager of Human Resources)	Clare Peacock (TERA)	Team member contacted A. Bak and S. Bradley attached notification of AIA.	Archaeological Impact Assessment
10/08/2013	Email-Incoming	Saira Bradley (Manager of Human Resources)	Clare Peacock (TERA)	S. Bradley emailed Team member enquiring if monitors from TAFN were need, if so how many and requested timeframes. Team member responded to S. Bradley and requested a contract or work agreement with TAFN be filed before starting work. Two weeks are needed to perform work in TAFN boundary and involve 10 work days. S. Bradley responded to Team member. One TAFN member is interested (F. Bak) and provided contacted information and requested work agreement/contract be forwarded. Team member provided S. Bradley two options of work agreements. Team member provided a revision of the two options of work agreements to S. Bradley. S. Bradley requested forms for the first work agreement with TERA.	None
10/09/2013	Email-Outgoing	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team member e-mailed T. McCarthy checking for availability to discuss TAFN's interests regarding the TMEP project and potential mitigations	None
10/10/2013	Email-Outgoing	Andrew Bak (Government Services Technician), Saira Bradley (Manager of Human Resources)	Sondra Baker (TERA)	Team member emailed S. Braley and A. Bak to inform them that the upcoming archaeology crew shifts would be postponed until further notice due to ongoing contract negotiations with other First Nations in the lower mainland.	None

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
10/17/2013	Phone - Outgoing	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team member called T. McCarthy (CAO of TAFN) and discussed next steps and the status of the Project. Team member noted that KMC is awaiting a project proposal from TAFN for funds to articulate and map treaty/marine interests in the region as well as an outstanding interests statement. Team member made T. McCarthy aware of the following progress: - TERMPOL studies would be available for review in mid-December - WCMRC pilot project in Burrard Inlet is working well, potential for replication on the Coast - Dialogue with Salish Sea Chiefs in progress to address environmental interests - Opportunities to bid on the TMEP project - Opportunity to explore TAFN's environmental protection needs and meet long term objectives (training, habitat restoration and other initiatives) Team member notified of request to receive TAFN's interest statement in time for the Application Filing in mid-December TAFN advised of the following: - Concerns to community of potential spill - Participation in spill response program not economically viable - Interest in regional initiatives - Concerns about lack of response capacity cited by BC government T. McCarthy noted that further engagement with KMC must go to Council and got the sense that Council is not supportive of project and would likely not be interested in discussing long-term project opportunities. Team member offered a project presentation to Chief and Council or an update with KMC's president directly. T. McCarthy felt it necessary to brief Council on project status directly and let them decide to meet with KMC. Team member and T. McCarthy discussed next steps: - T. McCarthy to meet with technical team on October 18, 2013 to discuss outstanding Interests Lists from the LOU and potential project proposal. - T. McCarthy to add KMC's proposal for project update to Chief and Council on Council Agenda - Team member would follow up on October 28, 2013.	TERMPOL
10/17/2013	Email-Outgoing	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team member emailed T. McCarthy to confirm an upcoming phone call later that day. Team member emailed T. McCarthy to follow up on an earlier phone call: - Follow up on October 28, 2013 - T. McCarthy to brief Chief and Council on status of project and determine if they want to receive a project update directly from KMC - T. McCarthy to meet with Technical Team and provide feedback on "2 pager" interests statement flowing from the LOU and potential for marine-related research project.	None
10/22/2013	Email-Outgoing	Saira Bradley (Manager of Human Resources)	Clare Peacock (TERA)	Team Member emailed S. Bradley to advise that current contract negotiations with other First Nation groups had temporarily paused Archaeology Impact Assessment progress in the lower mainland and that Team Member would contact S. Bradley as soon as a revised schedule was available. S. Bradley emailed Team Member and thanked them for letting them know.	Archaeological Impact Assessment
11/04/2013	Phone - Outgoing	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team member phoned T. McCarthy to enquire if a discussion of the Project had been put on the Legislature Agenda for the week of October 23, 2013 or October 30, 2013 to determine what future engagement activities may take place. T. McCarthy noted that the Project wasn't on the agenda yet, so team member offered to make a presentation during the week of November 11, 2013. T. McCarthy would provide an email update on a potential marine use study later in the week.	None
11/10/2013	Email-Outgoing	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team member emailed T. McCarthy to request an update as to whether the Project discussion had been placed on the Legislature Agenda this week and/or the technical committee had discussed a potential marine use study.	None
11/13/2013	Letter - Outgoing	Chief Bryce Williams	Gary Youngman (KMC)	Team member sent Chief B. Williams a letter to inform TAFN about KMC’s engagement with Transport Canada in as part of the Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL) for the Project. Team member noted that these studies addressed oil tanker navigation and safety in the Salish Sea, expanding the scope of Project-related marine studies being conducted by KMC, TERA and individual First Nations (which were outlined in a March 22, 2013 letter detailing ESA field studies). Team member provided an overview of the study methodology and evaluation process through the TERMPOL Review Committee (TRC). Team member provided an invitation to receive and comment on these studies in December 2013, stating that feedback from First Nations would be shared with Transport Canada and the TRC to assist in reviewing study results. Team member requested that TAFN’s intent whether or not to participate in the TERMPOL process be sent to team member by November 30, 2013.	TERMPOL
11/20/2013	Letter - Outgoing	Chief Bryce Williams, Tom McCarthy (Chief Administrative Officer)	Gary Youngman (KMC)	Team member emailed letter regarding the TERMPOL process and notifying TFN of the intent to file the Facilities Application to the NEB in mid-December. In addition to completing environmental studies, KMC has been working with Transport Canada to complete studies which focus on the safety of tankers entering Canadian waters; navigating thorough channels, approaching and berthing at a marine terminal and loading and unloading processes. The TERMPOL process was described. KMC is providing the opportunity for LFN to review and comment on the technical studies and aggregate comments will be considered into the TERMPOL process. Feedback and advice from TFN is sought in the initial 2-3 months to ensure adequate time. If TAFN was interested in receiving the studies a response was required by November 30.	TERMPOL
11/20/2013	Email-Outgoing	Tom McCarthy (Chief Administrative Officer)	Theresa Lane (KMC)	Team member emailed T. McCarthy a copy of the TERMPOL study letter originally mailed to TAFN on November 13, 2013.	TERMPOL

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
11/22/2013	Email-Incoming	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	T. McCarthy requested a summary of key topics decision that were before TAFN in order that a briefing note may be prepared for TAFN executive council for end of day. Team member responded with the following decision points: 1. Whether TAFN wished to undertake marine research which would support learning more about TAFN's activities in treaty harvest areas and other marine areas on the TFN territory; or to undertake alternative research and study related to the marine corridor to be agreed. 2. KMC would like to meet with the Executive Committee or other leadership group it recommend to discuss the project and opportunities to collaborate on Regional processes. 3. Regional processes are being developed to explore geographic spill response planning, a FN role on spill response, cooperative Salish Sea environmental monitoring initiatives. We want to discuss Tsawwassen's interests in being part of or even providing leadership in these initiatives. T. McCarthy confirmed receipt and that a regional meeting had been attended earlier that day attended by the TAFN Chief.	Marine Biophysical, Spill Response, Field Studies
12/03/2013	Email-Incoming	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	T. McCarthy confirmed desire to receive TERMPOL studies and asked that they be sent to the attention of B. Bocking who was to provide his address.	TERMPOL
12/03/2013	Email-Incoming	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	T. McCarthy confirmed discussion had occurred with the Executive Committee. December 6, 2013 was suggested for a call.	None
12/03/2013	Email-Incoming	Tom McCarthy (Chief Administrative Officer)	Theresa Lane (KMC)	T. McCarthy emailed team member and requested that TAFN receive TERMPOL studies related to the Project. T. McCarthy noted that these studies should be sent to TAFN representative B. Bocking.	TERMPOL
12/04/2013	Email-Outgoing	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team member emailed T. McCarthy to confirm call for December 6, 2013.	None
12/06/2013	Email-Outgoing	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team member emailed T. McCarthy acknowledging that TAFN's Executive Committee decision on how to engage on the Project, but that KMC looked forward to speaking to TAFN Executive Council to better convey information about TMEP. Team member clarified that funding available for a marine use would be targeted at identifying potential impacts of the Project on TAFN's treaty rights under normal operations. Information gathered in such a study would need to be submitted to KMC by June 2014 to be included in supplemental filings with the National Energy Board (NEB). Team member requested confirmation of January 22, 2014 for the proposed TMEP presentation to the Executive Council.	Aboriginal Consultation and Engagement, Regulatory – NEB
12/06/2013	Phone - Incoming	Tom McCarthy (Chief Administrative Officer)	Regan Schlecker (KMC)	Team member phoned T. McCarthy and left a voicemail message requesting a call back. Team member phoned T. McCarthy and acknowledged TAFN's request for TERMPOL studies. T. McCarthy indicated that the TAFN Executive Committee was not in favour of the Project at that time, but TAFN would like to continue to receive information updates on mitigations and benefits while conducting its own analysis of the Project. T. McCarthy noted that KMC was welcome to make a presentation about the Project; January 22, 2014 was suggested as a date. Team member reminded T. McCarthy of KMC's offer to fund marine studies for TAFN, and T. McCarthy noted that a proposal for a cumulative impact assessment would be forthcoming. Next steps included KMC confirming team participation with TAFN and T. McCarthy placing a Project update on the Executive Council agenda.	TERMPOL
12/16/2013	Letter - Outgoing	Bob Bocking (Vice President of LGL Limited)	Gary Youngman (KMC)	Team member mailed B. Bocking, of LGL Environmental Associates, a copy of the Transport Canada TERMPOL studies (on a USB stick) related to the Project for TAFN's review. Team member requested that TAFN provide feedback on the studies within two to three months.	TERMPOL
12/16/2013	Letter - Outgoing	Chief Bryce Williams	Ian Anderson (KMC)	Team member sent a letter to Chief B. Williams and notified TAFN of the Facilities Application Filing with the NEB on December 16, 2013. Team member provided a URL to the Application's location on the Trans Mountain website. Team member noted the NEB would hold a public engagement process, which would include a hearing on the Application prior to a formal decision on the Project. Team member included the NEB's website URL for further information on this process.	Regulatory - NEB
1/6/2014	Email-Outgoing	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team Member emailed T. McCarthy requesting confirmation of the date, length, topics for discussion and number of attendees for the proposed meeting between KMC and TAFN on January 22, 2014.	None
1/6/2014	Email-Outgoing	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team Member emailed T. McCarthy to speak about their last conversation and reassuring that January 22, 2014 would still be the best date for a KMC meeting and project level presentation to the Executive Council. Team Member confirmed agenda.	None
1/9/2014	Email-Outgoing	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team Member emailed T. McCarthy and asked T. McCarthy if TAFN had confirmed January 22, 2014 for a KMC meeting and project level presentation to the Executive Council.	None
1/10/2014	Email-Outgoing	Tom McCarthy (Chief Administrative Officer)	Ellen Frisch (KMC)	Team Member emailed T. McCarthy in regards to their email exchanges from the past days, stating that the KMC staff are no longer available for the meeting on January 22, 2014 due to another meeting. They stated that if the Executive Council continues to wish to talk with KMC to please suggest a confirmed available date in the coming weeks/months. Team Member also stated that TAFN should have received the Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL) studies electronically over the holidays and that they were available to answer any questions or provide any further information. T. McCarthy replied to Team Members email, T. McCarthy stated that this email would stand as an official hand-over to C. Ward, TAFN's Director of Public Services. C. Ward will be handling referral files. T. McCarthy requested the Team Member touch base with C. Ward on the KM file from this point forward and should work with them to find a new time to come speak with the Executive Council. T. McCarthy included C. Ward's contact information	TERMPOL

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
1/28/2014	Email-Outgoing	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member emailed C. Ward to follow up on "the hand off" between C. Ward and T. McCarthy. Team Member wanted to set up a project overview meeting, reaffirm Executive Council interest in Project presentation, identify dates for a meeting with KMC and determine if there was interest in a technical meeting to discuss TERMPOL studies. Team Member stated availability after February 13, 2014. C. Ward replied and stated that the earliest meeting would be after February 18, 2014 and suggested February 19, 2014 and February 26, 2014. C. Ward said the Council might be available to meet before the proposed dates to discuss the TERMPOL studies and other related studies and requested Team Member's availability. C. Ward proposed discussing potential cumulative impact studies and that KMC is waiting for a formal proposal from TAFN and could discuss this at a staff level meeting.	Regulatory
2/14/2014	Phone Conversation	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member phoned C. Ward to follow up on setting meeting dates and a presentation to the Executive Council. The February 19, 2014 and February 24, 2014 dates were available for a direct meeting with Team Member and a TERMPOL or broader presentation to Executive would need to consider dates in March, 2014.	TERMPOL
2/14/2014	Email-Outgoing	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member emailed C. Ward to inform a meeting with full KMC team was not possible for February 19, 2014, but Team Member would be available for a smaller meeting and Project over view February 25, 2014. Team Member wrote that if there is interest in a detailed, TERMPOL discussion with Transport Canada, a meeting could be arranged March 3, 2014, March 6, 2014, or March 18, 2014. Team Member provided C. Ward background of previous discussions with TAFN and mentioned that TAFN had declined KMC's Spring 2013 funding proposal to work with the TAFN membership to conduct research and a report to identify marine uses and site together with key culture and heritage sites within the TAFN Territory (defined in the Treaty). Alternatively, KMC proposed that funding could remain available for related marine interest purposes. TAFN preferred to undertake a broader "cumulative impacts" analysis. KMC indicated the NEB process required cumulative effects analysis and TAFN's input related to the KMC project would support the larger analysis. KMC would continue to welcome a proposal from TAFN that examines the current Application and proposed mitigation measures together with TAFN's treaty rights. It is important for KMC to receive tangible feedback from TAFN on the proposed project (Pipeline, terminal and marine corridor) to identify where specific mitigations can occur. It is important the reports are available for the NEB process, and there are a few windows for supplemental filings in 2014 and indicated that these deadlines are important. Team Member asked C. Ward for available dates in March for an Executive Committee meeting.	Regulatory-NEB; Cumulative Impact; TERMPOL
2/18/2014	Email-Incoming	Robert Bocking (Vice-President, Western Region, Fisheries at LGL Limited)	Ellen Frisch (KMC)	Team Member wrote to R. Bocking to inquire if R. Bocking had any questions regarding the TERMPOL studies. Team Member also inquired if there were any gaps or items of interest R. Bocking wished to pass on to KMC. Team Member proposed a meeting in March 2014. R. Bocking confirmed unavailability, due to being out of the office on holidays.	TERMPOL

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
2/26/2014	Meeting – In Person	Tsawwassen Executive Council Tom McCarthy (Chief Administrative Officer) Tony Wilson Laura Cassidy Ken Baird	Ellen Frisch (KMC) Bikram Kanjilal (KMC)	Team members provided a project overview presentation, focusing on marine risk analysis and spill response planning. Discussion of interest focused upon elements of the project including: ▪ Pipeline is being maintained (not replaced) and the age and lifespan of a pipeline. ▪ Location of pipeline around water crossings and sensitive habitats, proximity to Indian Reserves, Private land and Crown land and KMC's legal detection process and how pipeline flows can be shut down. ▪ History of KMC Spills and their location and size in BC, particularly in 2013 (Merritt). ▪ Westridge terminal modifications and environmental enhancements (such as vapour recovery and return rather than incineration). ▪ Tanker routes and access to BC through US waters due to the traffic international separation scheme. How spills are managed in the Straight (through cooperative agreement between US/Canada Coast Guard) ▪ TAFN observed that KMC's tanker traffic will go from 32 per year of 600 tankers in the Strait of Juan de Fuca to about 408 per year in Juan de Fuca – almost 50%. This is a significant amount. KMC noted it is 2% of PMV traffic and will be 7% of PMV traffic in the future. ▪ The type of risk analysis which were undertaken and whether it includes large scale tanker accidents and full environmental damage. ▪ How KMC can assert that the risk of a tanker accident will be lower after the project is in place rather than currently. It was explained this is a combination of risk and probability impacted by KMC's mitigations as well as WCMRC's enhanced response initiatives. ▪ TERMPOL process: TAFN was one of five first nations that expressed interest to receive the TERMPOL studies, and did receive them in December, 2013. TAFN acknowledged receipt and said its experts were analyzing the results. TAFN affirmed when questioned that KMC would fund the review process. Team Member confirmed discussions had been taking place and would continue. T. McCarthy indicated an intention to conclude discussions soon as TAFN wished to be able to file information to NEB. ▪ Western Canada Marine Response Corporation (WCMRC): Team Member enquired as to whether TAFN has met with or has a relationship with WCMRC as they are responsible for spill response for all areas of BC, not just the KMC project. It was clarified to TAFN that WCMRC's decision to local spill bases was separate from any legacy or benefit agreements with KMC. TAFN said they had never engaged with WCMRC. They were interested in contacting Huu-Ay-Aht FN, which Team Member had indicated as an example FN considering including marine spill response in their emergency management planning. Team Member encouraged TAFN to contact WCRC directly to meet and initiate a relationship, much as Tsleil-Waututh has done. ▪ TAFN expressed concern that WCMRC had not responded to major oil spill. KMC affirmed that a major oil spill has never occurred in Canadian waters. The three largest spills recently were on the West Coast of Vancouver Island from US vessels and at Squamish terminals. Risk is collisions and loss of fuel. WCMRC was the responding agency in Burrard Inlet during the Westridge spill. ▪ TAFN sought to understand what agreements KMC has with FN's which have pipeline on the reserve and how those discussions are proceeded. KMC explained some history and the approach to discussions with those communities.	Spill response in the Salish Sea and in cooperation with the US. Cumulative impacts of shipping in the Salish Sea. Risk analysis methodology related to tankers. Pipeline maintenance and integrity management. Pipeline leaks. Ability of WCMRC to respond to a major oil spill Synergies for oil spill response facilities in the nearby port facility.
2/26/2014	Email-Outgoing	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member emailed C. Ward in follow-up to the meeting about the Project overview and proposed project mitigations identified in the Environmental Assessment submission to the NEB as well as an overview of the proposed enhanced spill response regime identified by the WCMRC. At the meeting, two BC spills which were reported by KMC in 2013 were discussed. Team Member provided a link to the KMC webpage which provides detailed spill history. Additionally, Team Member attached an excerpt from the two spills discussed. T. McCarthy asked specifically about the Merritt region spill, which is identified as Kilometre Post (KP) 966; 4 cubic metres or 25 barrels.	Spill response strategy.
2/27/2014	Email-Outgoing	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member emailed C. Ward to confirm a TERMPOL meeting with TAFN on March 6, 2014 and asked for confirmation by February 28, 2014. Team Member suggested March 24, 2014 – March 26, 2014 or March 28, 2014 as alternate meeting dates. C. Ward replied that a meeting confirmation would be provided by end of day, February 28, 2014.	None
2/27/2014	Email-Outgoing	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member emailed C. Ward attached the PowerPoint slides discussed on February 26, 2014.	None
3/5/2014	Email-Outgoing	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member emailed C. Ward to discuss logistics for the meeting scheduled for March 24, 2014.	None
3/6/2014	Email-Incoming	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	C. Ward emailed Team Member to reply to the email sent March 5, 2014 by the Team Member regarding logistics for the meeting scheduled for March 24, 2014. C. Ward asked Team Member to confirm whether the meeting date is March 24 or March 25, 2014. Team Member replied to advise that the meeting is scheduled for March 25, 2014.	None
3/24/2014	Email-Outgoing	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member emailed C. Ward regarding logistics for the TERMPOL meeting scheduled for March 25, 2014. Team Member attached draft agenda. C. Ward replied to confirm logistics. Team Member replied to confirm the number of attendees from KMC and Transport Canada.	TERMPOL

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
3/25/2014	Meeting – In Person	Colin Ward (Director of Public Services), Andrew Bak (Resource Specialist) Robert Bocking (Vice-President, Western Region, Fisheries at LGL Limited) Mike DiMarch, (LGL, Wildlife Biologist)	Bikram Kanjilal, KMC, Marine Lead Michael Davies, KMC, Terminal/Marine Lead Ellen Frisch, KMC, Aboriginal Engagement Team Bob Gowe, Transport Canada, TERMPOL Committee Hart McKinnon, Transport Canada, TERMPOL Katherine Beavis, Transport Canada	TERMPOL workshop was held to discuss the purpose and process related to TERMPOL and review the marine technical TERMPOL studies submitted by Kinder Morgan. Transport Canada provided an overview of the TERMPOL process. Geographical limit of the TMEP project has been set from Westridge Terminal to 12 mile limit. TERMPOL guide changes are underway and there could be some mandatory inclusion. TERMPOL is voluntary as the findings are not binding and are project-specific. Kinder Morgan's TERMPOL reports make recommendations and those are to Transport Canada (TC). The TERMPOL Committee will evaluate the reports and recommendations and may endorse them or make separate recommendations. TC will forward them to the responsible organization for action. The TERMPOL process is a benefit to KMC (and companies) as the NEB Guide does not outline marine risk elements in depth and TERMPOL allows the collection and use of data in a variety of ways to address project risks and design effective preventative measures and mitigations. The timing is not 'in step' as they are different processes, but are linked through NEB filings. Discussion occurred regarding the influence of proponents and First Nations over the processes, including developing terms of reference and joint definition of studies. TC noted that this is a consideration for future TERMPOL processes, but currently the TERMPOL Guide is a prescriptive list of studies and does not allow that flexibility. When discussing the "Scope" of TERMPOL, this term is very limited, and refers only to which studies may be conducted and the geographic boundaries for the studies. Timeline: • TC has committed to a first draft TERMPOL study back to KMC within four months of receiving reports – about mid-April. This timeline may be slightly adjusted. TC seeks to understand First Nation interests and to ensure they are considered in the TERMPOL Committee report. FN Input into TERMPOL Studies: Given the current timing of the TERMPOL and NEB processes, KMC and TC would like to receive written comments on the TERMPOL Reports as soon as possible. Any additional studies or reviews by TAFN would need to be achieved in the next 8 weeks to meet anticipated NEB supplementary filing deadlines before the hearing process is likely to commence KMC provided an overview of the TERMPOL process and the Risk Analysis Study (3.15). Discussion followed including Statistical modelling approach/Future Marine Growth: ▪ TAFN advised that the DNV report should include Confidence Intervals and the changes to those confidence intervals with differing input values. The current numbers appear "too tidy". KMC agreed this is a sound approach to statistical modeling and will enquire with DNV ▪ With regard to Roberts Bank T2 Expansion consideration, all marine traffic has a predictable steady growth pattern over time. This factor was applied to 2012 numbers to arrive at a 2018 number, and calculated through 2028. ▪ In response to a question about considering future limitations on marine growth, Transport Canada noted that compared to the Straits of Malacca or the English Channel, at a 'world level', BC's coastal waterways are considered very light. Limitations are not under consideration. Vessel traffic can be viewed online at www.marinetraffic.com. Environmental Impacts: ▪ TAFN noted that there are environmental effects accompany heavy shipping and there are concerns in the region on cumulative effects. TAFN is contributing to a number of project reviews, but there is not one process looking at vessel safety or other issues, for example. Risk Mitigations: ▪ Tug Services: Are changes to the current tug fleet considered? The Robert Allan report noted that the current fleet of tugs can perform the work 99% of the time. Other challenges can be mitigated by not heading out into weather conditions. There is time to build any necessary tugs. This must be a market driven approach whereby tug manufacturers see the demand. ▪ Moving Exclusion zone: TAFN's interest is in how recommendations by the TERMPOL Committee and NEB will be enforced? Specifically for this initiative, implementation would include formalized processes to prioritize tanker traffic through vessel traffic control management. There are a number of levels; Vancouver Traffic Safety would monitor routes and provide security announcements; Coastal pilots onboard ships have communication protocols between them and Coast Guard would be aware. Ideally a policy will be implemented which includes procedures and training within the marine industry Next Steps: TAFN wants to ensure there is information available to share with the community. Andrew Bak is the linkages. ▪ KMC (Team Member) noted that staff are available to make a project presentation at a TAFN community meeting if this of interest. Evening meetings around a meal are a good option. ▪ TC would make a presentation of the TERMPOL report once it is released, likely fall is the best timing. Action Items: 1. KMC to provide PPT presentation of TERMPOL Studies to TAFN. 2. TAFN to provide written TERMPOL report and questions to KMC and TC TERMPOL Committee. 3. KMC to enquire with DNV about inclusion of confidence intervals in their risk figures in Report 3.15 and KMC to provide results of that discussion to TAFN. TAFN to confirm if a broader community meeting or open house is of interest in the weeks ahead	FN involvement in TERMPOL process (study definition) etc. Ability of FN information to influence KMC reports. Statistical risk model methodology. Environmental effects of increased marine traffic. Enforcement of proposed marine traffic mitigation measures.
3/27/2014	Email-Outgoing	Andrew Bak (Resource Specialist) Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member emailed C. Ward and A. Bak with an invitation to attend a workshop on April 3, 2014 to receive feedback on anticipated impacts of the proposed study corridor though the Lower Mainland region. Team Member advised that information gathered in this workshop will also be used in continued engineering, construction and restoration planning along the corridor. Team Member requested that C. Ward and A. Bak RSVP to KMC as soon as possible if able to attend. Team Member advised that a routing meeting had been held with TAFN in the summer of 2013, and that there was no routing through provincial parks within the territory which could impact TAFN's treaty gathering rights.	None

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3/28/2014	Email-Incoming	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	C. Ward emailed Team Member with an update about the list of comments and questions related to the TERMPOL meeting, they should be ready in the next week. C. Ward also asked for clarification about the exact time of the regional workshop on routing. Team Member replied that the workshop was scheduled April 3, 2014 followed by a public open house.	None
4/8/2014	Email – Outgoing	Tom McCarthy (Chief Administrative Officer) Colin Ward (Director of Public Services) Andrew Bak Bob Bocking Mike Demarchi	Ellen Frisch (KMC)	Team Member emailed T. McCarthy, C. Ward, A. Bak, B. Bocking and M. Demarchi to inform TAFN of the recruitment underway by the WCMRC for the position of Aboriginal Relations Advisor for strategic work between WCMRC and First Nations, full-time based out of the Burnaby office. A link to the posting was attached. A. Bak responded noting that it would be made available to be posted in the TAFN newsletter.	None
4/10/2014	Letter – Incoming			TAFN sent a letter to KMC requesting further information regarding the TERMPOL studies, particularly with regards to: • Risk modelling • Fisheries • Wildlife • Liabilities • Cumulative effects • Integration	Risk modelling, liability, integration, fish and fish habitats, wildlife, cumulative effects
4/11/2014	Email-Outgoing	Saira Bradley (Human Resources Manager)	Regan Schlecker (KMC)	Team Member emailed S. Bradley to provide an April 11, 2014 letter regarding summer employment opportunities for TAFN youth with KMC at the Burnaby Westridge Terminal.	None
4/11/2014	Email-Outgoing	Saira Bradley (Human Resources Manager)	Regan Schlecker (KMC)	Team Member sent a letter to S. Bradley to notify TAFN of summer youth employment opportunities with KMC at the Burnaby Westridge Terminal. Team Member explained the positions and requirements, noting that candidates should be submitted for consideration no later than April 18, 2014. Team Member provided contact information for KMC's Procurement Coordinator.	Employment and Procurement
4/14/2014	Email – Incoming (Letter)	Colin Ward (Director of Public Services) Andrew Bak Mike Demarchi Bob Bocking	Ellen Frisch (KMC)	C. Ward provided a TERMPOL letter and memo outlining TAFN's technical questions related to TERMPOL asking that it be forwarded to Transport Canada team. C. Ward requested next steps as to how the input will be considered in the context of TERMPOL and whether KM will be responding to the technical matters in the memo.	TERMPOL
4/14/2014	Letter – Incoming	Colin Ward (Director of Public Services)	Bob Gowe (Manager, Transport Canada) Katherine Beavis, TransCanada Hartinder MacKinnon, TransCanada Michael Davies (KMC) Bikram Kanjilal (KMC) Ellen Frisch (KMC)	TERMPOL Technical Review Memo: The review included the following categories: Oil spill Risk Management: ▪ TERMPOL Scope ▪ Adequacy of Present Regime: Ability of BC based rescue tugs to respond under certain circumstances, current spill response resources. With improvements in the previous and addition of the moving exclusion zone, together with KMC's vessel acceptance criteria – it is critical that all the commitments occur in a timely and effective manner. Risk Modelling: ▪ Model Inputs and Assumptions: A number of inputs to the model need to be better described to assist TAFN in understanding the key drivers for the model. ▪ TERMPOL submission must provide a better accounting of role military vessels in the risk management framework in order that collision risks are more fully understood. ▪ Model Outputs: o Meaningfulness of the difference can only be gained through completion of an impact assessment that examines the environmental, social, and economic implications of the outcomes of the risk analysis and the extent to which mitigation might serve to mitigate the risks and consequences of an oil spill. o Modeling would be more meaningful for identifying appropriate mitigation measures if the accident risks and consequences (i.e. spill probabilities) were calculated and presented for each study segment as well as for each season. Chronic (Operational) Oiling: ▪ TAFN requests that the matter of operational spill prevention, management, monitoring and enforcement in the Salish Sea be addressed by TC.	Enhanced spill response Enhanced risk mitigation (rescue tugs) Improved liability regime Integration of other national studies and recommendations. Incorporate TAFN fishing and wildlife interests in reports. Soundscape modelling to address impacts to Orcas. Cumulative impacts of marine traffic Deeper FN engagement on TERMPOL planning and report review opportunity. Risk Modelling, Chronic Operational Oiling, Liability, Risk Assessment, Spill Response Capacity, Wildlife, Fish, Cumulative Effects

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
Cont'd from above	Cont'd from above	Cont'd from above	Cont'd from above	Liability: ▪ TAFN seeks confirmation that all tankers that presently call to Westridge Terminal, and those that would do so if the project proceeded, are operated by companies that are capable of and prepared to cover the necessary costs of spill prevention, cleanup, rescue, rehabilitation, remediation, and monitoring. To the extent that a given company or companies are unable to do this, TAFN seeks assurances from TM that adequate financial resources exist to address a full range of potential spill scenarios in a timely and effective manner. Integration with Other Regional Initiatives: ▪ Perhaps due to matters of timing in the delivery of the various reports, the TM TERMPOL submission does not, in our opinion, make adequate use of two notable reports in particular: ▪ Tanker Safety Panel Secretariat. 2013. A review of Canada's ship-source oil spill preparedness and response regime: Setting the course for the future. ▪ Puget Sound Partnership. 2014. Preventing oil spills from large ships and barges in northern Puget Sound and Strait of Juan de Fuca: VTRA 2010 Final Report TAFN seeks assurances that Transport Canada (TRC) will take the findings of these studies into consideration in preparing their report. Fisheries: ▪ Shipping on fishing ground activities as they pertain to the TAFN. Wildlife: ▪ The TERMPOL submission lacks any meaningful discussion on the topic of the adequacy of present or future wildlife (i.e., marine birds, marine mammals, shoreline mammals) rescue and rehabilitation resources that could be deployed in the event of a spill. ▪ TAFN expects that the matter of underwater noise and its associated implications for marine biota such as Orca are fully addressed in the NEB Application. Spill Response Capacity: ▪ The relatively small (1250 tonnes) spill response capacity proposed for the Delta Port seems disproportionately small to the environmental values of the Fraser River delta and foreshore. Cumulative Effects: It is not clear that the full extent of the cumulative effects of marine transportation in the future have been considered in the TERMPOL submission. Expansion of Deltaport and Westridge, and the concomitant cumulative increases in marine vessel traffic, present notable concerns for potential risks to marine biota and other Treaty interests of TAFN that warrant a comprehensive assessment. Input from TAFN will undoubtedly improve this effort. TERMPOL Review Committee Report: ▪ Future changes to the TC process to require FN involvement are not in effect presently. TAFN wants to ensure the present project may benefit from the revised TERMPOL project, if even retroactively. ▪ TAFN wishes to review the draft TERMPOL report. ▪ TAFN seeks confirmation that the final TRC report will be submitted to the NEB for its use in considering whether to issue a Certificate of Public Convenience and Necessity (**CPCN**) and in determining what conditions may be required of the Proponent should a CPCN be granted ▪ Even in the event that the Project does not proceed, TAFN expects that the information arising from the TERMPOL, NEB Review, and recent independent initiatives in the region will form the basis of a comprehensive assessment of the status quo by the TRC. Concerns regarding vessel risk management in the Salish Sea must be addressed as a means of safeguarding the Treaty rights and interests of TAFN.	Cont'd from above
4/14/2014	Email - Outgoing	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member emailed C. Ward and acknowledged receipt of the TAFN TERMPOL letter and confirm it was forwarded to the internal team. C. Ward responded with a suggestion of a call on April 16, 2014.	TERMPOL
4/22/2014	Phone – Outgoing	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team member provided and overview of how the comments would be shared and evaluated and a response would be provided to TAFN. Team member reiterated the opportunity to meet to discuss potential marine study funding for TAFN and that the window to achieve NEB timelines was closing. C. Ward was to discuss with T. McCarthy for further direction.	Regulatory - NEB
6/20/2014	Phone – Attempt	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member called C. Ward and left a message requesting a call back.	None
6/20/2014	Email- Incoming	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	C. Ward emailed indicating he was not available and suggesting a telephone call the following week.	None
6/20/2014	Email-Outgoing	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member emailed C. Ward and followed-up on: • Meeting with KMC President and Chief Williams to be scheduled • Offer to meet and provide additional information about routing in the Lower Mainland, construction, and permits/activities at Westridge Terminal. • Explore interest in discussing mutual benefit opportunities with Kinder Morgan. • Training/Employment opportunities • Spill response planning and marine habitation restoration Team Member committed to following-up later with KMC President's availability to meet.	Spill Response, Training and Employment, Agreements, Permits, Construction, Westridge Terminal

Event Date	Event Type	Community Contacts	Team Members	Details	Concerns
6/26/2014	Phone – Outgoing	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member called C. Ward and discussed the previous voicemail and email exchange regarding: • a meeting between Chief Williams and KMC's President • benefit opportunities with Trans Mountain C. Ward noted that TAFN Council continued to wish to remain 'neutral' and would not be entering into MBA discussions with KMC. Team member noted that at the Executive Council meeting a few members had queried economic benefits, related to the marina and potential spill response, and KMC had shared information about employment opportunities. C. Ward affirmed that TAFN Council remained of the same view that they would not consider MBA or other benefit discussions. Regarding a meeting with KMC's President and Chief Williams, C. Ward would discuss with T. McCarthy, Chief Administrative Officer, as it was T. McCarthy who met with KMC's President previously. It was agreed that Team Member would seek dates available for the meeting in the coming weeks.	Spill Response, Socio-Economic, Agreements
7/4/2014	Letter – Outgoing	Chief Bryce Williams	Gary Youngman (KMC)	Team Member sent an invitation to Chief Bryce Williams to attend a Project procurement workshop in Coquitlam on July 31, 2014.	Employment and Procurement
7/22/2014	Letter – Outgoing	Colin Ward (Director of Public Services)	Michael Davies (KMC)	Team Member sent a letter to TAFN detailing the formal responses to several TERMPOL-related information requests made by TAFN in an April 10, 2014 letter. Topics included: • Risk modelling • Liability • Integration and Other Regional Initiatives • Fisheries • Wildlife • Cumulative Effects	Risk modelling, liability, integration, fish and fish habitats, wildlife, cumulative effects
7/23/2014	Email – Outgoing	Colin Ward (Director of Public Services)	Ellen Frisch (KMC)	Team Member emailed C. Ward and attached a copy of the July 22, 2014 letter which detailed the information requested by TAFN regarding TERMPOL studies in TAFN's April 10, 2014 letter.	TERMPOL
7/31/2014	Meeting		Jennifer Hooper (KMC) Ellen Frisch (KMC) Bob Cross (KMC)	Team Members held a Procurement Workshop which was attended by TAFN representative in Coquitlam, BC.	

Appendix B

November 13, 2013

Chief

Dear Chief :

Re: Trans Mountain Expansion Project and First Nation input in Transport Canada's TERMPOL Process re: marine issues

I am writing to let you know about the engagement process that Trans Mountain Pipeline ULC has been undertaking with Transport Canada regarding the Trans Mountain Expansion Project (TMEP). This process will be of interest to your First Nation as it addresses studies associated with vessel safety and navigation in the Salish Sea.

We also want to provide you with early information so that you can acquire and review copies of several studies that will come out of this process. As background, Trans Mountain has been engaging with your community over the past months on environmental matters related to the development of our application to the National Energy Board (NEB) pertaining to TMEP.

Trans Mountain intends to submit its application requesting a Certificate of Public Convenience and Necessity to the NEB in mid-December 2013. In support of the application, a number of studies are being undertaken by Trans Mountain's contractors, TERA, and First Nations to inform the NEB in relation to the marine aspects of TMEP. These studies were listed in detail in the Environmental and Socio-Economic Approach (the ESA) document, first circulated in March 2013 and form part of the process of understanding potential environmental and social impacts of the TMEP.

In addition to the environmental assessment process, Trans Mountain has been working with Transport Canada on a "Technical Review Process of Marine Terminal Systems and Transshipment Sites" or TERMPOL. TERMPOL is a voluntary, extensive review process, led by Transport Canada, which focuses on the marine transportation components of a project. TERMPOL examines:

- the safety of tankers entering Canadian waters,
- navigating through channels,
- approaching and berthing at a marine terminal; and
- loading or unloading oil.

TERMPOL recommends the completion of a number of studies by the proponent, Trans Mountain, including a risk assessment. The TERMPOL Review Committee (TRC) is chaired by Transport Canada and includes a number of experts and administrators from different Federal agencies besides Transport Canada. TERMPOL does not have a regulatory role and the outcome of the report is not binding on the proponent or the regulators who have jurisdiction over the project. It does, however, help inform the regulators (National Energy Board and involved federal departments) and the public on the marine safety aspects of the project.

The TRC reviews the various studies prepared and submitted by the proponent and evaluates the potential risks and mitigations associated with the project as well as the adequacy of the marine network system to accommodate the project safely. At the end of the review the TRC prepares a report that is made public. The nature and scope of these studies, prepared for the TERMPOL process, are summarized in the attached summary.

Trans Mountain wishes to provide you with the opportunity to review and comment on the technical studies, and to aggregate these comments to be considered into the TERMPOL process. Trans Mountain expects the various TERMPOL studies to be ready in December 2013 at which time they will be shared with interested First Nations for comment and advice. These studies will form a submission to the TRC and the NEB as part of the Application. The TRC review will inform the NEB hearing process, therefore Trans Mountain is seeking to receive feedback and advice from interested First Nations in the initial 2-3 months of the TERMPOL process to ensure adequate time to consider those comments in the TERMPOL process.

Communities wishing to receive the studies in December 2013 will be requested to provide advice and feedback to Trans Mountain within 2 to 3 months of receiving the studies. Trans Mountain will collect this feedback and provide it to Transport Canada and the TRC for their knowledge and information to take into account when they evaluate the various studies. Depending on the nature of the comments received, Trans Mountain may decide to carry out further work on the studies. Transport Canada has offered to participate in the proponent-lead meetings with First Nations to explain the TERMPOL process, upon request from either Kinder Morgan or participating First Nations.

If your community is interested in receiving the studies and providing comments or advice, please contact me to arrange for distribution and a potential meeting to agree on the process and timing. We appreciate the technical nature of this material and will be available to assist your community in understanding aspects that are of specific interest to the community.

Please respond at your earliest convenience, by November 30, 2013 if you seek to receive the TERMPOL studies.

Sincerely,

Gary Youngman

Gary Youngman

Lead, Aboriginal Engagement

Attachment

cc.

Summary of TERMPOL Studies

1. Introduction (Termpol Study 3.1) - This introductory section provides a brief overview of the TMEP project and a summary of the Termpol scope as agreed upon with the TRC.

2. Origin, Destination and Marine Traffic Volume Survey (Termpol Study 3.2) -The objectives of this survey are to quantify and describe all marine traffic movement that collectively forms the regional marine traffic network. The purpose is to assess the impact of the proposed shipping traffic on existing and potential future shipping traffic in the region. The traffic data is used as input into the risk analysis elements (Termpol 3.8 and 3.15).

3. Fishery Resources Survey (Termpol Study 3.3 - The objectives of this survey are to identify locations of fish, fish habitat, fishing operations and the customary routes to major fishing grounds. It serves to update the existing database on regional fisheries resources.

4. Offshore Exercise, Exploration and Exploitation Activities Survey (Termpol Study 3.4) - This identifies the geographical locations and frequency of use of military exercise areas involving ships and aircrafts; and the routes used by offshore supply vessels engaged in the offshore exploration and exploitation of oil and gas fields. This study was not required because the movement of military vessels is covered in Termpol 3.2 and there are no offshore oil and gas fields within the project's study area.

5. Route Analysis, Approach Characteristics and Navigability Survey (Termpol Study 3.5) - This study is to assess ship and route safety, the adverse effects of ship accidents and, when applicable, public safely matters associated with tanker traffic. This study is at the heart of the navigation assessment and involves a detailed assessment and description of the route.

6. Special Underkeel Clearance Survey (Termpol Study 3.6) - All relevant factors which may affect underkeel clearance in order to ensure navigation safety is covered as part of this study.

7. Transit Time and Delay Survey (Termpol Study 3.7) - The objective of the "transit time" component of this survey is to determine the safest coastal zone and/or inland waterway speed profile for ships proceeding to and from the proposed marine terminal. The objective of the "delay" component of this survey is to determine the probable causes, locations, durations and the frequencies of delays in the movements of marine traffic

through a ship channel or ship channels connecting the coastal approaches and the proposed marine terminal.

8. Casualty Data Survey (Termpol Study 3.8) - This study researches historical casualty information and is an important component of the risk analysis.

9. Ship Specifications (Termpol Study 3.9) - The objective of this is to document the range of tankers expected to demonstrate that the navigability assessment and terminal design are appropriate for the intended vessels, and that all vessels will be compliance with statutory requirements under the IMO and Canada Shipping Act.

10. Site Plans and Technical Data (Termpol Study 3.10) - This is a technical discussion of the engineering design information relating to the proposed marine terminal together with relevant background data, design criteria, environmental and other site studies.

11. Cargo Transfer and Transshipment Systems (Termpol Study 3.11) - The survey outlines the plans and descriptions of the design ship's cargo containment and transfer systems. It briefly outlines the key features of the marine terminal's cargo handling and transfer system, which will incorporate equipment and instrumentation and procedures that will be to industry best practices. Transshipment of cargo is not considered part of this project and is not covered in this study.

12. Channel, Manoeuvring and Anchorage Elements (Termpol Study 3.12) - Here the suitability of existing channels for the design ship(s) is assessed and it identifies any areas of concern where navigation requires particular attention.

13. Berth Procedures and Provisions (Termpol Study 3.13) - Although specific detailed procedures will only developed later after the terminal design has advanced, the study documents normal or expected berthing and unberthing procedures based on fast time simulation of the design vessel in relation with the design terminal and accepted best practices in the industry.

14. Single Point Mooring Provisions and Procedures (Termpol Study 3.14) - This section is not applicable for the TMEP project.

15. General Risk Analysis and Intended Methods of Reducing Risks (Termpol Study 3.15) - The risk of uncontrolled releases of cargo either en route or at the terminal are assessed together with the fate and behaviour of any oil spilled to the marine environment. Risk mitigation is discussed and detailed in this study.

16. Port Information Book (Termpol Study 3.16) - The Port Information Book is to provide ship's personnel with a comprehensive set of details relevant to the needs of the port of Vancouver. It is based on the Port Metro Vancouver Harbour Operations Manual and would be prepared prior to the facility commencing operations in order to ensure it is up to date.

17. Terminal Operations Manual (Termpol Study 3.17) - A Terminal Site Operations Manual is meant to inform and to guide the crews of ships calling at the marine terminal on specific terminal related items that the vessel would require to know in order to conduct itself safely and responsibly. As with the Port Information Book, this document will be prepared prior to commencement of operations.

18. Contingency Planning (Termpol Study 3.18) - A preliminary outline of the future expanded marine facilities intended contingency plan is prepared. The actual plans will be based upon detailed design work of the marine terminal, which will be available later and shall be developed in consultation with the Western Canada Marine Response Corporation (WCMRC) and other experts in the field of marine emergencies. It will be submitted at a later date.

19. Oil Handling Facilities Requirements (Termpol Study 3.19) - This section documents that the terminal design and operation will be implemented in a manner consistent with the requirements of an Oil Handling Facility as defined in the Canada Shipping Act. While the proposed TMEP facilities have not yet been fully designed, Trans Mountain can confirm that the future facilities and operations will meet or exceed all applicable regulations.

20. Hazardous and Noxious Liquid Substances (Termpol Study 3.20) - This study is not applicable to TMEP.

TRANSMOUNTAIN

Trans Mountain Expansion Project
Email: info@transmountain.com | Phone: 1.866.514.6700 | Website: www.transmountain.com | @TransMtn

December 16, 2013

Chief

Dear Chief :

Re: Request for Copies of TERMPOL Studies

Enclosed please find a USB stick containing copies of the Transport Canada TERMPOL studies as they relate to the Trans Mountain Expansion Project for your review. We would appreciate receiving your advice and feedback within two to three months of receipt of the studies.

Should you have any questions or comments, please do not hesitate to contact me at 604-312-9897 or gary_youngman@transmountain.com.

Sincerely,

Gary Youngman
Lead, Aboriginal Engagement

cc.
Enclosure

Appendix C

TRANS MOUNTAIN EXPANSION PROJECT
Minutes of Meeting

Meeting Location: Travelodge, Duncan, BC; TERMPOL Meeting		Team & Discipline: AET
DOCUMENT NUMBER:	**DATE: January 17, 2014**	**TIME** (24 hour)**: 1100 to 1400**

MEETING TYPE: **Internal** ☐ (send record to documentcontrol@teraenv.com) **Aboriginal** ☒ (send record to elog@teraenv.com)

PARTICIPANTS

Full Name, Title, Organization	Email	Phone	Additional
Al Grove; Hwlitsum First Nations			
Jack Smith; Halalt First Nations			
Ruth Sauder; Penelakut Tribe			
Myrus James; Penelakut Tribe			
Ronda Jordan; Stz'uminus First Nations			
Eamon Gaunt; Cowichan Tribes			
Helen Reid: Cowichan Tribes			
Larry George; Cowichan Tribes			
David Robbins; Legal Counsel			
Celina Albany; Cowichan Tribes			
Denise James; Penelakut Tribe			
Bob Gowe; Transport Canada	Bob.gowe@tc.gc.ca		
Katherine Beavis; Transport Canada	Katherine.beavis@tc.gc.ca		
Michael Davies; Kinder Morgan, Canada	Michael_davies@kindermorgan.com		
Madhvi Russell; Transport Canada	Madhvi.russell@tc.gc.ca		
Hart MacKinnon: Transport Canada	Hart.macKinnon@tc.gc.ca		
Stafford Reid; Guest			
Chris Badger; TMEP	falabamarine@shaw.ca>,		
Bikram Kanjilal; TMEP	Bikramjit_kanjilal@transmountain.com		
Georgia Dixon; TMEP	Georgia_dixon@transmountain.com		
Gary Youngman; TMEP	Gary_youngman@transmountain.com		
Max Nock; AET; TMEP	mnilc@shaw.ca		
Jamie Andrews; TMEP	Jamie_andrews@kindermorgan.com		

MEETING MINUTES

Introductions

A distinction was made that there are five different tribes within the Cowichan Nation Alliance and not solely the Cowichan Nation. These Tribes are Halalt, Stz'uminus, Hwiltsum, Cowichan and Penelakut.

Al Grove explained that the TERMPOL reports were found to be lacking as there was no reference to Section 35 and various other categories including fishing rights. It was also found that there was silence on First Nations issues.

Overview of TERMPOL Process

Katherine (Transport Canada) explained that:

- the TERMPOL process is voluntary and the process is driven by the proponent;
- Transport Canada recommends that proponents seek local and traditional knowledge to inform the studies and enhance the marine safety assessment;
- there is an opportunity for input at this time on the TERMPOL surveys and studies; and
- these surveys and studies have also been provided to the National Energy Board (NEB) in support of the marine volume of the facilities application. Ideally, comments should be provided to the NEB, Transport Canada and Kinder Morgan Canada Inc. (KMC).

Transport Canada Explained the Timeline for Upcoming Events

- Input opportunities in regards to environmental impacts and impacts to Aboriginal rights, these would be best captured through the NEB's Environmental Assessment and Aboriginal consultation process.
- If information is provided to Transport Canada regarding traditional knowledge relevant to the technical review of marine safety (*e.g.*, navigational hazards), it can be considered by the TERMPOL Review Committee during the review of the studies.
- Comments on surveys and studies will also be reviewed by Trans Mountain Expansion Project (TMEP).
- There is no formal information request system for TERMPOL, however, Transport Canada intends to submit the TERMPOL Report to the NEB and it would be subject to the same rules there as other evidence filed.
- It is anticipated that the TERMPOL report will be finalized in the spring 2014.
- Information requests should best be directed to the NEB.
- The TERMPOL recommendations are not legally binding.

Q: Who sits on the TERMPOL review committee? Who gives direction for the reports?

A (Transport Canada): The TERMPOL Review Committee is constituted by Transport Canada and includes various branches of federal agencies: the Canadian Coast Guard; BC Coast Pilots; Environment Canada; Port Metro Vancouver; and Fisheries and Oceans Canada (DFO). The proponents are responsible for the studies and the surveys. The TERMPOL Review Committee does not have involvement in producing the studies and surveys, but reviews them once they are submitted.

C: With respect to Aboriginal engagement, as this group has been excluded from the report, there is concern that it is too late to be involved in the scoping of these studies. This is a problem at this point.

R (Transport Canada): The TERMPOL manual is outdated (2001) and there is duplication with other processes and programs that have started since that time, like environmental assessments. Transport Canada acknowledges that early engagement is better, but beyond discussing with TMEP which surveys and studies would be conducted from the list in the TERMPOL manual, Transport Canada has not been involved in the development of the surveys and studies. Transport Canada can provide more information about how the scoping was done (*i.e.*, which surveys and studies were identified for the TERMPOL). Most of the surveys and studies were included and those that were not were deemed not relevant to the project.

C: The communities have a difficult time dealing with [review of TERMPOL studies] as there is a lack of technicians to review these studies. There are only 6 references in 200 pages with no citations (referring to the Quantitative Risk Assessment report from DNV). This report is not a valid academic study and we need to gather and put forward new information.

R (Transport Canada): If there are specific concerns relevant to the TERMPOL review process, we encourage CNA to submit them in writing to TMEP and the TERMPOL Review Committee. If concerns are related to environmental impacts, they should be submitted to the NEB.

C: It does a dis-service to state that there will be no risk. I think that there will be a spill in the next 100 years.

A (Trans Mountain): The consequences of a spill are often considered so dire that the probability side is lost. The report does identify various probabilities that are outlined within the report. The small ones are more probable than a larger one.

Q: In terms of the scope of the TERMPOL process and the recommendations, I believe that spill response is not adequately developed. Which process is this likely to come out of? TERMPOL or NEB?

A (Transport Canada): It is not crystal clear at this point as to how spill response will be addressed in the TERMPOL report as the regime is currently changing. The Federal Tanker Expert Safety panel recently released a report discussing this.

Q: What is the protocol for traditional fishing within shipping lanes? It's an issue in the communities as the fishing is important in the communities.

A: Every opening is broadcast to shippers. A part of this process is to review the opportunities to improve the current practices.

Trans Mountain Expansion Project TERMPOL Process Overview

C: It should be noted for this group that once the oil is on the tanker, the oil is no longer owned by KMC.

R (Trans Mountain): As a part of the vessel acceptance program, there are requirements and criteria that must be met if shippers want to use the Westridge Terminal.

Q: Would communities be compensated if there were a loss to fisheries?

A (Trans Mountain): The SOPF provides compensation. Please see additional explanation provided separately.

Q: On Page 96 it says that all the vessels will be double-hulled. This says that the majority will be double-hulled.

A (Trans Mountain): The tankers will all be double-hulled. Please see additional explanation provided separately.

Q: You spoke of workshops (Hazard Identification), who were they done with?

A (Trans Mountain): Many experts, however, I think you are referring to the lack of Aboriginal-specific workshops. We did have First Nations attendees at our second hazard meeting in Vancouver.

Q: When KMC is asking their experts to develop their report regarding workshops, what is the direction as to who is involved in these workshops?

A (Transport Canada): Transport Canada was there as an observer.

Q: If increased traffic continues to grow, there will be an increase in accident probability.

A (Trans Mountain): There is a traffic forecast in the report. The vessels and tonnage have gone up so, therefore, it's not necessarily shipping numbers going up. TERMPOL 3.2 has this information. Accident probability in the risk assessment is specific to Trans Mountain's traffic.

Q: Escort tugs were used when transporting coal in the same scenario that Trans Mountain is proposing. This coal was spilled and it was devastating for the community (reference is to an incident that occurred at Westshore Terminals).

A (Trans Mountain): The tug practices are different for TMEP. Multiple tugs will be secured to the vessel far before it reaches the berth, and in this example, the coal was spilled as a result of the vessel striking the loading conveyor; the coal was not spilled from the vessel.

Q: This probability model is based on averages (referring to weather). What about the abnormalities? The worst-case scenario?

A: Computer models have inherent limitations. Averages are used because they mathematically account for a range of potential probabilities. Please see the additional explanation provided separately.

C: The pipeline crosses the Fraser River and the Halalt First Nations has an interest in that area.

David Robbins showed two maps. One of the Fraser River and the other of the shipping lanes.

C: TERMPOL will have conclusions at the federal level. It will be a piece of evidence and these timelines need to be more flexible if we are to have input.

R (Transport Canada): We have indicated to Trans Mountain that we are willing to incorporate input provided that is relevant to the TERMPOL review. We have also indicated that we expect our review will take approximately 4 months. As such, input would need to be received by late March or early April.

Action #	Action	Assigned To	Target Date (mmddyyyy)	Completion (mmddyyyy)	Task Creation (Y/N)
1	To provide response regarding First Nation participation in Hazard Identification.	Trans Mountain			
2	Confirm that all tankers would be double-hulled (Page 96).	Trans Mountain		January 21, 2014	
3	To circulate the list of how the First Nations were selected to be involved in the workshops.	Trans Mountain			
4	Links to be sent to Cowichan Nation Alliance regarding SOPF funding.	Trans Mountain		January 20, 2014	
5	Explain how weather data was inputted and used in the risk model.	Trans Mountain		January 21, 2014	
6	Provide a copy of the presentation.	Trans Mountain		January 21, 2014	
7	Clarify scope of studies included in the Trans Mountain TERMPOL submission.	Transport Canada		January 24, 2014	

MEETING RECORD COMPLETED BY: Jamie Andrews

APPENDIX A

2. Page 96 mentions: "Oil tankers that call Trans Mountain's Westridge Marine Terminal are and will be modern double-hull vessels of Aframax size (80,000-120,000 DWT), and in the majority of these vessels, the bunker oil tanks will be protected by a double-hull, so only the most severe impacts from an incident like a high-energy collision or grounding is expected to cause an oil spill."

   As explained during the meeting, until recently, the construction rules for tankers to be designated as DH required the cargo tanks to be of DH construction. The bunker tanks could be single hull. As of 2010, construction rules for all vessels have been changed and bunker tanks of more recently built tankers would be of double-hull. This information can be found on Page 20 of the study: "IMO requires that all tankers built after August 2010 are designed with protected bunker tanks and with individual bunker tank size not exceeding 2,500 metric tons. The average age of the global Aframax and Panamax size tanker fleet is 9 years. Based on this, it is expected that 40% of the tankers will have protected bunker tanks in 2018 and 100% in 2028."

4. References to the *Marine Liability Act* that relate to the SOPF. Administration of the SOPF falls under the *Marine Liability Act* (MLA). Part 7 (Sections 91 to 125) of the act deals with the SOPF. Eligible claimants are defined in Section 107 and include:

   (a) an individual who derives income from fishing, from the production, breeding, holding or rearing of fish, or from the culture or harvesting of marine plants; and

   (d) an individual who fishes or hunts for food or animal skins for their own consumption or use.

   The MLA can be found here: http://laws-lois.justice.gc.ca/eng/acts/M-0.7/

   The SOPF publishes an annual report which contains an excellent summary of the overall regime. It appears that the SOPF website has changed recently, it is located here: http://ssopfund.gc.ca/en/home. The latest annual report appears to be here: http://ssopfund.gc.ca/CMFiles/reports-en/AnnualReport2012-2013-en.pdf.

   Note that the Federal Tanker Safety Panel has recommended eliminating the liability limit the SOPF and that this is described in their report to the Federal Government http://www.tc.gc.ca/media/documents/mosprr/transport_canada_tanker_report_accessible_eng.pdf.

5. The weather information used in DNV's marine risk evaluation model was prepared by EBA based upon historical Environment Canada data; the entire report is contained in "Meteorological and Oceanographic Data Relevant to the Proposed Westridge Terminal Shipping Expansion", which forms part of the TERMPOL submission. Weather patterns for the different sections of the route have been input to the DNV model according to Table 3 of TERMPOL

3.15 (see Page 28) and thus, the model incorporates a percentage of poor weather in the calculation.

6. Presentation copy is attached.

Tsawwassen First Nation

Trans Mountain Expansion Project Meeting

TERMPOL Process Workshop

March 25, 2014: 12 PM to 3 PM

Attendees:

- Colin Ward, Tsawwassen First Nation, Director of Public Services;
- Andrew Bak, Tsawwassen First Nation, Resource Specialist;
- Bob Bocking, LGL, Fisheries Biologist;
- Mike DiMarchi, LGL, Wildlife Biologist;
- Bikram Kanjilal, Kinder Morgan Canada (KMC), Marine Lead;
- Michael Davies, KMC, Terminal/Marine Lead;
- Ellen Frisch, KMC, Aboriginal Engagement Team;
- Bob Gowe, Transport Canada, TERMPOL Committee;
- Hart MacKinnon, Transport Canada, TERMPOL; and
- Katherine Beavis, Transport Canada.

Meeting opened with introductions and a working lunch at 12:15 PM.

1. Transport Canada: Overview of TERMPOL Process: (Bob Gowe)

TERMPOL was started in the 1970s and has undergone a series of revisions. Currently, a Phase 1 policy review of the TERMPOL Guide is underway. Some revisions have been made, which are not yet reflected in the guide.

Q: Has the geographical limit for the Trans Mountain Expansion Project (TMEP) been established?

A: Yes. Westridge Terminal to the 12 mile limit.

Q: How revisionary will the TERMPOL Guide changes be (*e.g.*, as sweeping as the *Canadian Environmental Assessment Act, 2012*?)

A (Transport Canada [TC]): Not as sweeping, since the process is not mandatory. However, it will include a recommendation to engage Aboriginal groups in the TERMPOL Review Process when surveys and studies are being conducted.

Q: What is the rationale for TERMPOL to be voluntary?

A (TC): The findings are not binding. Current standards are compliance-based and regulations apply across Canada. TERMPOL is a project-specific opportunity for companies to get feedback on their proposals. It supports potential gap identification for future National Energy Board (NEB) submissions.

Q: Recommendations are made within KMC's reports. Who do the recommendations target and who undertakes the recommended enhancements? The federal government? Kinder Morgan? Other organizations?

A (TC): Kinder Morgan's studies make recommendations "in" to Transport Canada and the TERMPOL Review Committee. The TERMPOL Review Committee evaluates them and issues a report with final recommendations "out". Recommendations may endorse those proposed by KMC or they make separate recommendations. They will be forwarded to the responsible organizations for consideration.

Q: What is the benefit to KMC of TERMPOL?

A (KMC): There is a public expectation that the process will be completed. It provides a structured review of key marine issues, which may be considered by the NEB. The NEB Guide is not outlined in depth and TERMPOL allows for the collection and use of data in a variety of ways to address project risks and to design effective preventative measures and mitigations.

Q: TERMPOL seems out of step with NEB. What is the linkage between the processes?

A (TC): Yes, the TERMPOL process is ahead of the NEB process. The TERMPOL studies were submitted to the NEB and the TERMPOL Review Committee at the same time in December. The TERMPOL process will allow for a focused review of marine matters which can then potentially be addressed by the NEB. Using other projects as examples, the NEB may include project approval conditions which flow from TERMPOL recommendations. Also, KMC collected data and conducted studies which inform separate reports for the NEB which are more focused on environmental influences.

Discussion regarding influence proponents have to be completed over the process and selection of studies. The proponent reviews the list of TERMPOL studies, the requirements of which are detailed in the TERMPOL Guide. The proponent then identifies which studies are applicable to the project and seeks the TERMPOL Review Committee's concurrence on the proposed list of studies to be conducted. Although the proponent may not complete all surveys and studies listed in the TERMPOL Guide, the content of the studies that it does complete must adhere to the requirements prescribed in the TERMPOL Guide.

Discussion regarding First Nation and stakeholder influence in other processes that allow for the development of terms of reference or joint definition of studies. TC noted that this is a consideration for future TERMPOL processes, but currently the TERMPOL Guide is a prescriptive list of studies and does not allow that flexibility. When discussing the "scope" of TERMPOL, this term is very limited and refers only to the studies that may be conducted and the geographic boundaries for the studies.

Q: What are the studies measured against – a terms of reference?

A (TC and KMC): Terms of Reference are not determined, only agreement on the studies to be conducted and geographic scope. The proposed studies and the geographic scope were included in a proposal letter from KMC to Transport Canada, [which] was affirmed by Transport Canada. The letters are part of KMC's Facility Application.

Q: What is the timeline for the TERMPOL review and how does the Tsawwassen First Nation meeting and feedback factor into the review?

A (TC): The TERMPOL Review Committee will aim to complete its review within 4 months of receiving reports – about mid-April. This timeline may be adjusted. TC encourages proponents to include First Nations input into the studies for consideration by the TERMPOL Review Committee.

Q: Will TERMPOL studies reflect engagement with First Nation communities?

A (KMC): KMC has been engaging with many First Nation communities. More than six marine use studies with First Nations have been completed which have fed into the TERMPOL and environmental studies.

KMC noted that since first engaging with Tsawwassen First Nation (TFN) in 2013, the project has advanced without the benefit of TFN's specific advice and interests. It was KMC's preference to have information received from TFN in 2013 to include in the TERMPOL and NEB reports and wish to receive anything from TFN as early as possible to continue to feed into the TERMPOL and NEB processes.

Given the current timing of the TERMPOL and NEB processes, KMC and TC would like to receive written comments on the TERMPOL studies as soon as possible. Any additional studies or reviews by TFN would need to be achieved in the next 8 weeks to meet anticipated NEB supplementary filing deadlines before the hearing process is likely to commence.

KMC seeks to understand what information TFN would be prepared to provide to the process after the meeting. TFN noted that they will submit a written report and questions to both TC and KMC.

2. KMC TERMPOL Process

Mike Davies, TMEP Marine Lead, provided an overview of the project using a PowerPoint presentation. The group was guided by questions that TFN had prepared and answers were discussed in the context of the reports which reflected that work.

Q: KMC currently has barges off-loading jet fuel at the Westridge Terminal. Will this be impacted by the Vancouver Airport Fuel Delivery project?

A (KMC): No. The net number of barges will likely remain the same. Current barging going to Westridge Terminal could be redirected to Vancouver Airport.

Q: How is "vessel" defined in the studies?

A (KMC): Anything with an Automated Information System as a result, not a small pleasure craft, for example. The studies breakdown figures by type of vessel.

1:20 PM - Break

KMC provided an overview of the Risk Analysis Study (3.15). It was explained that the traffic study was developed, including the use of the MARCS model, to look at the probability side of risk. A key element of all of the studies is to look at the cumulative probability which then leads to an analysis of the consequences.

1. Reducing Risk – Studies analyzed the risks of a probability of a certain size of spills. KMC explained how preventative measures have been identified (*e.g.*, enhanced tug escort through Straight of Juan de Fuca) and a moving exclusion zone.
2. Mitigation Measures – Increasing confidence in coastal marine spill response capacity is a key need. KMC is a board member of West Coast Marine Response Corporation (WCMRC) and requested that WCMRC develop a new policy to address enhanced response standards. WCMRC has led studies to identify additional marine base locations and resources in the coming years. These include a 2 hour response window in Burrard Inlet and 6 hours elsewhere in the Salish Sea, as well as addition of five bases, the Nanaimo, Sooke, Roberts Bank, Sidney and Bamfield regions.

Another report is the Fate and Behaviour Study which evaluates how product behaves in the environment under certain circumstances. Information received from this study was fed into the environmental assessment process as well as the spill response planning process led by WCMRC.

Discussion Regarding Risk Analysis 3.15

TFN has reviewed the Vessel Traffic Risk Analysis (VTRA) Study led by George Washington University with Makah Tribe. TC noted that the TERMPOL Review Committee had received a presentation on the (VTRA) study in the past week.

Q: What is the difference between the VTRA and DNV (author of the KMC-commissioned risk analysis report)?

A (KMC): KMC noted that a detailed analysis is being prepared now. Both reports are different ways of looking at the same information. VTRA is about the change in risk throughout the region. DNV is risk related to the KMC project.

TFN advised that the DNV report should include confidence intervals and the changes to those confidence intervals with differing input values. The current numbers appear “too tidy”. KMC agreed this is a sound approach to statistical modelling and will enquire with DNV.

Q. Does KMC consider risks associated with security?

A (KMC): The application refers to the requirements of the *Marine Transportation Security Act*; please see Volume 8A, Section 1.4.1.7.

Q. How did Roberts Bank Port (RBT2) factor into KMC’s studies?

A (KMC): All marine traffic has a predictable steady growth pattern over time. This factor was applied to 2012 numbers to arrive at a 2018 number, and calculated through 2028.

Q: Would the TERMPOL Review Committee ever analyze the potential for future growth and consider certain limitations?

A: No, the TRC reviews the marine safety elements of a specific project. Compared to the Straights of Malacca or the English Channel, at a “world level”, British Columbia’s coastal waterways are considered very light in terms of traffic. Vessel traffic can be viewed online at www.marinetraffic.com.

TFN noted that there are environmental effects that accompany heavy shipping and there are concerns in the region on cumulative effects. TFN is contributing to a number of project reviews, but there is not one process looking at vessel safety or other issues, for example.

Q: Regarding potential need for marine rescue tugs, does KMC anticipate changes of the tug fleet as a result of the Robert Allan Report (which indicates there are only two tugs capable of rescue under certain weather conditions)?

A (KMC): The report indicates the current fleet of tugs can perform the work 99% of the time. Other challenges can be mitigated by not heading out into weather conditions. There is time to build any necessary tugs. This must be a market-driven approach whereby tug manufacturers see the demand.

Q: Will KMC provide capacity to provide the tug?

A (KMC): KMC prefers to see a regulatory requirement for the tug. This will drive market demand. As a terminal operator, another option is to modify vessel acceptance process to include arrangements with tug operators.

Q: How can a “moving exclusion zone” be enforced?

A (KMC): Implementation would include formalized processes to prioritize tanker traffic through vessel traffic control management. There are a number of levels; Vancouver Traffic Safety would monitor routes and provide security announcements, coastal pilots onboard ships have communication protocols between them and the Coast Guard would be aware. Ideally, a policy will be implemented which includes procedures and training within the marine industry.

TFN queried TC’s role in the process. TC could evaluate where there could be consequences for vessel operators which do not comply. This depends on if it is enshrined in a regulation. Compliance is otherwise based on the professionalism of the pilots and vessel operators.

TFN’s interest is in how requirements recommended by TERMPOL/NEB are enforced.

Next Steps

TFN wants to ensure that there is information available to share with the community. Andrew Bak is the linkage.

- KMC (EF) noted that staff are available to make a project presentation at a TFN community meeting if this is of interest. Evening meetings around a meal are a good option.

- TC (KB) noted that TC can offer to make a presentation of the TERMPOL report once it is released.

Action Items

1. KMC to provide PowerPoint presentation of TERMPOL studies to TFN.
2. TFN to provide written comments on TERMPOL submission and questions to KMC and TC.
3. KMC to enquire with DNV about the inclusion of confidence intervals in their risk figures in Report 3.15 and KMC to provide results of that discussion to TFN.
4. TFN to confirm if a broader community meeting or open house is of interest in the weeks ahead.

Pacheedaht TERMPOL Workshop

April 17, 2014

Port Renfrew

10:30 AM to 1:15 PM

Attendees:

- Pacheedaht: Treaty Negotiation Team and Chief and Council;
- Marvin McClurg, Dorothy Hunt, Chief Arlyss Daniels, Councillor Jeff Jones, Jason Howes, Kevin Neary, +2, Rosanne Kyle, Virginia Mathers and JFK Law;
- Kinder Morgan Canada: Mike Davies, Bikram Kanjilal, Ellen Frisch and Dave Fowles;
- Transport Canada: Katherine Beavis and Bob Gowe; and
- Western Canada Marine Response Corp: Randy Neufeld (arrived 12 PM).

1. Project Overview by KMC - Mike Davies 10:30 AM to 12 PM

Q: What is the change of the percentage of dilbit being shipped if the project is approved?

A: Now about 25-30%. Producers were asked for the type of materials for transport, but are not required to remain with that product.

Action: To provide percentage of diluted bitumen anticipated post-project implementation.

Q: How many ships transit the Juan de Fuca Straight and what will the change in that number be due to the project?

A: Now about 6,000 large vessels/year. 600 are tankers, and of those, 60 are bound for Westridge. The project could increase the number of tankers annually bound for Westridge to more than 400.

Westridge tankers are about 4% of projected 2018 traffic in JdFs.

Q: How does the regulation work for traffic separation and compliance with sovereign maritime rules when ships are entering Canada in US water and US ships are departing in Canadian waters?

A: Vessels have the “right of innocent passage” through international agreement. Vessels compliant in the country whose destination they are bound for are deemed to be compliant in the waters of the country they are transiting.

Q: What happens if a laden Canadian tanker has a problem?

A: It will have two pilots onboard until the Brotchie Ledge.

Q: Northern Gateway is building “super tugs” – will KMC undertake the same?

A: The difference in projects is vessel size. Westridge tankers are limited to Aframax size (approximately 580,000 barrels). Northern Gateway proposal is for VLCC size carriers which hold up to 2 million barrels. KMC has studied the Vancouver tug fleet and the ability of it to monitor an Aframax tanker is appropriate.

Q: NG had terminal requirements, including other restrictions such as speed – will KMC?

A: Yes. KMC has terminal requirements. Speed in JdFs is expected to be 13 knots.

Action: KMC to provide vessel terminal requirements.

Q: What is the difference between "crude" and "heavy" oil?

A: Viscosity; heavier density. The tariff sets limits on the density and viscosity of materials transportable in the Trans Mountain pipeline.

Q: Does the product float or sink?

A: Many tests were made through the Gainford Study which demonstrated floating over 10 days. With the right environmental conditions and sediment, it can sink.

Discussion occurred about the relative density of salt and freshwater and the unique features of Port San Juan. There is a high concentration of fresh water because of the rivers and the bay is very shallow with significant sediment. With the lower density of fresh water and high sediment, there are fears that the product will sink and foul the shoreline and shallow areas.

Recommendation: PFN believes fate and behaviour testing should occur with the sediment and salinity levels of the Pacheedaht territory.

Q: Is KMC aware of the sediment levels in the JdFs?

A: Not specifically. Sediment testing approximated that at the mouth of the Fraser River.

PFN noted that there was interest in understanding the sediment levels in the JdFs and the salinity levels in the PFN Territory to understand the effects in an area such as Port San Juan.

Q: Is there a wave action study?

A: Yes – oil spill trajectory modelling and wave action. Weather data for the year 2012 was used as it was deemed to have "normal" overall conditions.

PFN Recommendation: Studies should look at weather extremes. Full stochastic model of extreme wind and wave conditions should be run. There is concern about the risk associated with the inability to mitigate a spill and the environmental impact and ensuing impact on Aboriginal rights.

2. Transport Canada TERMPOL Process - 12 PM to 12:45 PM

Q: When will the review of Transport Canada's Phase 1 TERMPOL Guide be completed?

A: In the next 12 months, and not in time for the Trans Mountain Expansion Project.

Q: How will the Tanker Safety Panel Report (TSPR) factor into the review?

A: The TERMPOL Review Committee is reviewing the report and recommendations, but it is a separate process from TERMPOL. TC will consider KMC's submission in respect of the TSPR. Government will respond formally to the report in the coming weeks.

Q: How did KMC get Fisheries Report information?

A: Through aggregation of Automated Information System (AIS) information. TC has received PFNs recent Marine Traditional Use Study and is reviewing it.

Q: What is the worst-case spill that TC has required?

A: The TERMPOL Guide states [that] the proponent should identify a “worst-case”, but credible accident scenario. KMC chose its worst-case scenario as the loss of two full cargo tanks at sea, which is 16,500 tonnes and the 90th percentile worst-case outflow scenario. At present, the spill risk planning standard recommended by KMC is for 20,000 tonnes.

TC reviewed the 2001 and 2006 traffic separation scheme approaches in the JdFs. Concern was expressed by PFN that the changes in 2006 resulted in conflict with large vessels being directed over Swiftsure Bank. There was no consultation with PFN on the change and it has had a significant impact to their safety and ability to conduct a safe food fishery.

Foggy fishing conditions present additional challenges when ships “surprise” fishers.

Discussions occurred about the possibility of equipping PFN vessels with AIS receivers to see the vessels nearby and potentially AIS transceivers to send a similar signal and be “seen” in addition to radar.

PFN Recommendation: Modify shipping transit through the Swiftsure Bank region, either through agreement with KMC or by modifying the shipping lanes.

3. Spill Response Planning - 12:45 PM to 1:15 PM

Q: How would equipment be deployed to new base locations (through government, Kinder Morgan)?

A (KMC): By the organization designated by Transport Canada, West Coast Marine Response Corporation (WCMRC).

Q: Regarding KMC’s proposal for more spill response bases and equipment, who must agree and make it happen?

A (KMC): KMC has recommended that it be adopted through the FTSPR as part of the regulation. Otherwise WCMRC should implement it. WCMRC must ensure that it has a budget to cover those costs and would levy the bulk oil cargo fee from shippers to ensure it occurs.

Q: The confluence of the “6 hour response time” circles have Pacheedaht at the outer edges of both. There is a lack of confidence in the ability to respond quickly. PFN asked who would protect the Pacheedaht community.

A: These are dedicated bases for WCMRC, but KMC and WCMRC want to work with communities to develop geographic response plans, provide training, and where invited in, potentially equipment for rapid deployment by trained community members. WCMRC will be consulting on base locations.

Q: When is the consultation to occur on final base locations?

A: After NEB hearings. WCMRC has ongoing work and is hiring staff and building capacity to engage with First Nation communities. Decisions will be made by early 2016 and [will be] implemented in early 2017.

Discussion occurred around deploying booms based on the size of waves. Boom size and skirt depth depends on the size of waves. Double booms is another strategy. It was acknowledged the booms cannot be deployed in heavy weather or fog conditions.

PFN noted “approving” the project first, then planning second is too late.

PFN is concerned about the lack of evaluation of PFN’s rights. KMC noted its desire to work with PFN to develop processes and opportunities together to mitigate the impact of effects, however, PFN felt it **needs to know the impact to its Aboriginal rights before discussion on mitigation.**

PFN noted the specific environmental concern about the Port San Juan and Pacheena Beach and campground. Much of the PFN economic development is about tourism and destruction of the beach would impact the economy. PFN wants equipment or a vessel in the Bay to enable them to “attack” a spill immediately, given it is so shallow. The former government dock used to have a larger tug. Are there vessels or other equipment available to be kept here?

PFN legal counsel reiterated the need to explore the impact to PFN’s rights before discussing any mitigation measures. Safety issues with Swiftsure Bank were identified. KMC suggested that PFN (Kevin Neary/Jeff Jones) work with KMC to develop a protocol for ships calling at Westridge to raise awareness about the interaction at Swiftsure Bank. KMC also identified the opportunity to equip vessels with AIS systems to “see” the ships coming.

PFN queried KMC about the ability to move tankers transiting over Swiftsure Bank. KMC noted that this is an international shipping lane and the federal government (TC) is better placed to address the matter. KMC queried if the matter related to fishing rights in this area was raised in treaty; PFN confirmed that Fisheries and Oceans Canada has not been at the table.

Action: TC to send copies of the 2001 and 2006 traffic separation scheme maps and PowerPoint presentation.

Appendix D

Technical Review Comments

Prepared for:	**Tsawwassen First Nation**	Date:	**10 April 2014**
Prepared by:	**Mike Demarchi** **Bob Bocking** **LGL Limited**		
Document(s) reviewed:	**TERMPOL Submission** **29 November 2013**	Projects:	**Trans Mountain Pipeline ULC** **Trans Mountain Expansion Project**

Background

Kinder Morgan, via its subsidiary, Trans Mountain (**TM**), is proposing to triple the capacity of its existing pipeline, expand berthing at Westridge Terminal, and increase shipping in the Salish Sea from the current 5 Aframax tankers per month to 34 Aframax tankers per month. The current barge traffic of 2–3 barges of jet fuel per month is not expected to change. Because vessel size, cargo type and volume, anchorages, and shipping lanes are not proposed to change as a result of the project, the project entails an increase (6.8x) in existing transshipment operations as opposed to a material change in ways in which those operations are conducted.

In May 2012, TM requested that Transport Canada (**TC**) conduct a Termpol review to assess the safety and risks associated with tanker movements to, from, and around the Westridge Marine Terminal that will result from the Trans Mountain Expansion Project (**TEMP**). TC agreed to the request, a Termpol Review Committee (**TRC**) was struck, a scope of work was finalized in July 2013, and TM undertook the studies required under the TC document, Termpol Process (2001; TP743E). Although the Termpol process is voluntary, the proponent does benefit from the insights provided and to a degree by satisfying public expectations that a Termpol be completed for a high-profile project such as this.

In November 2013, TC submitted the Termpol studies, supporting work, and a summary of the recommendations to the TRC. The complete submission totals 2659 pages. At the same time, the Termpol submission was submitted to the NEB as part of TM's National Energy Board (**NEB**) Application. Following input from parties such as Tsawwassen First Nation (**TFN**), the TRC will prepare a report with non-binding recommendations. Those recommendations will be taken into consideration by government and the NEB Joint Review Panel (**JRP**). Ideally, TFN will be given the opportunity to comment on a draft of the TRP report.

This review is based solely on the TEMP Termpol submission. We recognize that the NEB Application contains information that is redundant, supplemental, and additional to that presented in the Termpol submission. TFN has applied for Intervener status and funding to participate in the NEB Panel process. Assuming the necessary resources are granted, TFN will then be in a position to comment on the complete submission and not only the Termpol documents. However, until such time, our review is accordingly limited in its scope.

OIL SPILL RISK MANAGEMENT

Termpol Scope

The following statement is made (emphasis added) in Termpol 3.1 (Introduction):

> *While the Project will result in increased tanker traffic it will be the same vessels carrying the same type of petroleum and transiting the same well established routes that are used today. TMEP is an expansion of existing operations. Therefore, during the initial meetings with Transport Canada it was agreed that the Termpol Review Committee should focus on the new elements that will result from the Project rather than document the existing tanker safety regime,* ***which is well understood and known to be adequate****. With respect to the Termpol scope, Project-related changes include the reconfigured marine terminal and the increased frequency of tanker traffic.*

We contend that although tankers have been operating safely in the Salish Sea, the absence of a catastrophic event cannot be fully attributed to the *adequacy* of the existing tanker safety regime. In part, the fortuitous absence of any catastrophic event has meant that the full extent of the safety regime has not been tested. For example, until such time as a tanker lost power in severe marine conditions and was successfully rescued by a tug to avoid a grounding or other event that could lead to an oil spill; or until such time as an oil spill occurred and the prevention and clean-up response proved to be adequate, it would seem presumptuous to deem the safety regime “adequate”.

Adequacy of the Present Regime

Termpol submission studies such as *An Evaluation of Local Escort and Rescue Tug Capabilities in Juan de Fuca Strait* (Robert Allen Ltd. Naval Architects; Project 213-063) pose serious questions regarding the ability of B.C.-based rescue tugs to respond successfully to a tanker that has lost power during an extreme weather event. These limitations stem primarily from shortcomings in the Vessel Automatic Identification System (**AIS**) and in the tug fleet itself.

Moreover, the Tanker Safety Panel Secretariat report (2013) made 45 recommendations to improve the preparedness and response to oil spills in Canadian marine waters. We note the (somewhat conflicting[1]) statement in the cover letter to that report:

[1] It is striking that a regime can be deemed fundamentally sound; yet require improvement by way of 45 recommendations – some of which entail potentially significant and costly changes to the way in which TC conducts its operations with regard to oil spill preparedness and response. Perhaps the wording is deliberately intended to prevent the report from being interpreted as alarmist while pointing out deficiencies in the regime.

> *In this first phase of our review, we have concluded that the overall preparedness and response regime is fundamentally sound, but that the Government can and should make important improvements.*

Indications that the current system of spill preparedness and response in the Salish Sea may be inadequate are implicit in TM's recommendations for improvements to tanker safety, including:

- a moving exclusion zone around laden tankers
- expanded use of escort tugs
- expanded deployment of spill response resources

A complete list of TM's recommendations[2] to TC is presented in section 2.9 (Summary of Recommendations) in the Introduction (3.1). It is important to note that TM does not have control over the fate of all of these recommendations – most of them rest with TC or other federal departments. Although TM will not own or operate the tankers and tugs that call the Westridge Terminal, TM can exert a measure of control over those vessels, by specifying strict 'vessel acceptance' criteria that must be fulfilled by the vessels and their operators.

TFN Perspective

From the foregoing, it is apparent that not only would development of the TM project justify demands for improvements to the oil spill management regime in the Salish Sea, but that the current state of the regime is likely inadequate to safeguard the region's natural resources from the consequences of a spill. Correcting this situation will involve the efforts and collaborations of governments and industry. It is not the concern of TFN who undertakes these measures, but rather that the commitments and resources exist to ensure that they do happen in a timely and effective manner.

RISK MODELLING

The DNV report (T*ERMPOL 3.15 – General Risk Analysis and Intended Methods of Reducing Risks*) concluded:

> *Without the Project in 2018 the risk of a credible worst case oil spill is estimated to be 1 in every 3093 years. Once the Project is implemented, if no additional risk reducing measures are implemented, the frequency will be 1 in every 456 years. If all the risk reducing measures discussed in this report are implemented the frequency will be 1 in every 2366 years.*

The risk results presented by DNV are based on output from their Marine Accident Risk Calculation System (MARCS) model. MARCS is a proprietary model developed and owned by DNV. We understand that the National Academy of Science has

[2] The basis for these recommendations may be grounded in the results of the Det Norske Veritas (DNV) risk assessment report or as a matter of appeasing the perceptions and concerns of a general public that is not well versed in the matter of risk assessment when it comes to marine oil spills.

reviewed, and apparently approved of, the model (or at least its output) on two occasions[3]. TFN would appreciate receiving digital copies of those reviews.

Model Inputs and Assumptions

There is insufficient discussion of the key model assumptions and potential implications for the TERMPOL study findings. For example, the report needs to describe the effect that an underestimation of vessel traffic has on the model output and conclusions (i.e., quantify the model's sensitivity to vessel traffic).

A number of inputs to the model need to be better described to assist TFN in understanding the key drivers for the model. For example, the limitations of the AIS data in capturing all vessel traffic is not described. The proportion of each vessel class represented by AIS needs to be indicated and interannual variation needs to be addressed. The choice of 2012 for the AIS data is not substantiated and, as pointed out below, would underestimate commercial salmon fishing traffic by a wide margin.

A component of the model that is mentioned in the DNV report, but that needs to be more fully explained and that has important implications for vessel safety in the Salish Sea, pertains to military operations by the Canadian and U.S. navies. In addition to the movement of military ships and submarines throughout much of the Salish Sea, including tanker shipping lanes, a number of spatially defined ranges are delineated for training purposes, including live-fire exercises. Bookings and scheduling of Canadian naval ranges for training purposes are handled by DND (J32). Regional Joint Operations Centre (RJOC) tracks range users that enter Canadian marine ranges at the onset of training and clears them once training is completed. RJOC also tracks any reportable incidents (e.g., accidents and malfunctions). It is our understanding that military ships and submarines do not transmit their positions as per other vessels in the AIS. This then begs the question as to how collision risks between tankers and naval vessels – particularly submarines[4] – are assessed in MARCS and what recommendations might be made to mitigate increased risks that result from the project. In our opinion, the Termpol submission must provide a better accounting of role military vessels in the risk management framework in order that collision risks are more fully understood.

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[3] From: http://www.portmetrovancouver.com/docs/default-source/port-users-marine-operations/Fraser_River_Tanker_Traffic_Study_Full_Report.pdf?sfvrsn=0

> 5.3 Academic Peer Review
>
> In addition to the client review of the MARCS methods and results during the many project applications, MARCS has been subjected to third party peer review by US academics on two occasions.
>
> At the end of the Prince William Sound risk assessment (1995-1997), the project results, including results produced by MARCS, were submitted to peer review in Washington DC by the Marine Board of the US National Academy of Sciences.
>
> During the Aleutian Islands Risk Assessment (Phase A, 2009-2011) MARCS was subjected to further review from a panel appointed by the US National Academy of Science.
>
> These peer reviews were thorough and independent. In both cases the results from the projects went forward to full publication without change.

[4] http://www.cnn.com/2007/WORLD/asiapcf/01/08/japan.us.ship/index.html

Model Output

From the foregoing risk probabilities, it is evident that the point value portrayed as the projected frequency of a credible worst case oil spill diminishes with mitigation. However, a more complete interpretation of the meaningfulness of the mitigation is lacking. This is rooted in at least two causes. First, the probabilities are derived from a model that combines local conditions with empirical data on marine accidents. Neither marine weather nor marine accidents follow tight, predictable patterns. This is clear in the current routine deficiencies in predicting weather systems (not to mention the additional complications that climate change appear to be bringing) and the absence of any ability to predict marine accidents in a timely manner (not to mention how improvements to marine safety might be acting to reduce future risks implicit in the historical database).

Predictive models rely on numerous parameter estimates whose values span a probability distribution that may be very predictable (e.g., tidal current in a given area), or amount to little more than educated guesses based on expert opinion (e.g., geographic locations in a given area where the probability of a collision is ranked). Regardless of the degree to which an individual parameter's distribution is understood, models, such as MARCS, which seek to predict the probability of a given outcome (e.g., an oil spill of a given size) run numerous (Monte Carlo) simulations in which the parameter values are varied (sampled) across their known range and in accordance with their known or hypothesized distributions.

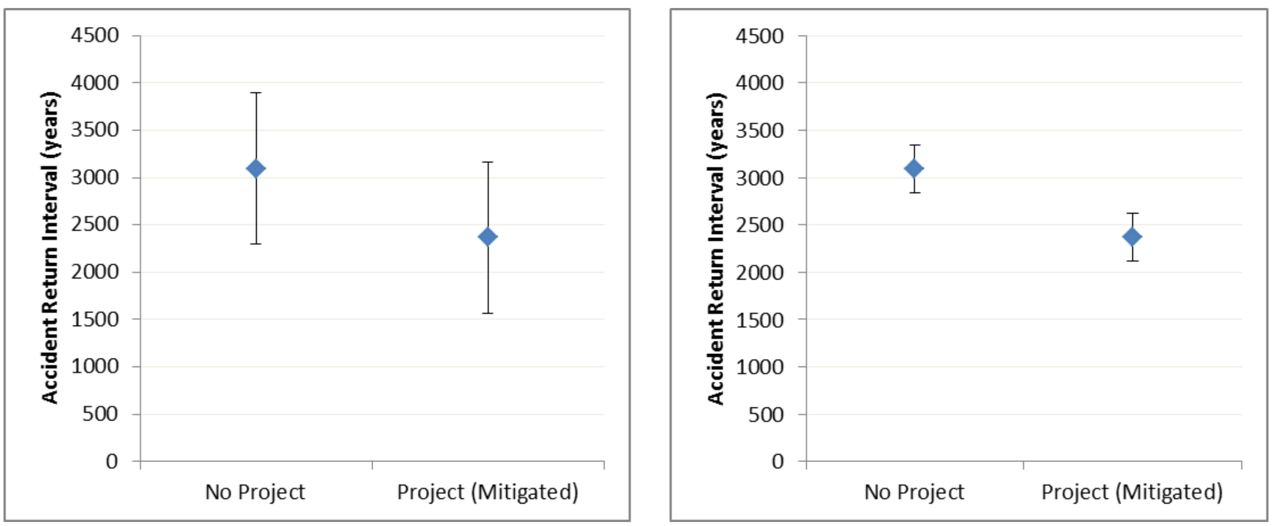
A key piece of MARCS model output appears to be lacking from the DNV report. Considering that the parameters are not static values, the output values (i.e., probability of a spill) resulting from numerous simulations will span a range of values in accordance with some distribution. From those output values, confidence intervals (e.g., 90%, 95%, 99%) around the estimate can then be derived. As presented, the single output values (e.g., a spill probability of 1 in 3093 or 2366 years) do not provide any indication of the variance associated with each estimate. Absent this information, it is not possible to gauge either the precision (confidence) of the estimate or the degree to which a change in the estimate is actually meaningful. The meaningfulness of the difference is recognized in the DNV report:

> *…it is DNV's view that the majority of the benefit of a risk model is derived from building the model and examining how its relative results vary with the inputs used. This promotes understanding of the key risk drivers and hence allows the identification of the more appropriate risk reduction options.*

We agree with this point, as we can appreciate that assigning a probability to a rare, but catastrophic event such as an oil spill is an inherently difficult task and the actual meaning and veracity of a statement such as "1 in 2366 years" does not connote that there will necessarily be one spill within that timeframe.

In addition, there are no commonly accepted reference points for the threshold or risk acceptability. For example, we are not aware of any process by which mitigating a risk down from 1 in 456 years to 1 in 2366 years constitutes a socially and ecologically acceptable risk reduction. In other words, besides the obvious direction of the change (declining risk indicator) and some general sense of the magnitude of this change, by what process might we *objectively* determine that a 1 in 456 year event is any less acceptable than a 1 in 2366 year event? This further bolsters the need to present the precision of the model output.

The following charts illustrate the value in presenting information on estimate precision. Both charts show the DNV model point predictions for the probability (in 2018) of a credible worst case oil spill: 1 in every 3093 years assuming the project does not proceed [i.e., status quo operations and growth] and no additional safety enhancements are made 'No Project') and 1 in every 2366 years assuming the project proceeds and additional safety enhancements (mitigation) are implemented. Two sets of hypothetical confidence intervals are presented for illustrative purposes only. The sizes of the confidence intervals were arbitrarily set as equal for the two scenarios within each chart, but we expect that actual model output would show them to be different. On the left, the confidence intervals overlap to the point that the two scenarios might not be statistically different, whereas on the right, it is clear that statistical testing would reveal a difference. Beyond statistical hypothesis testing, the practical meaningfulness (e.g., for management purposes) of the difference between these values is another matter altogether.



See text above for an explanation of these charts

Further interpretation of the meaningfulness of the difference can only be gained through completion of an impact assessment that examines the environmental, social, and economic implications of the outcomes of the risk analysis and the extent to which mitigation might serve to mitigate the risks and consequences of an oil spill. We expect that information is presented in the NEB Application, yet absent an indication of precision as described above, it too will be incomplete.

Finally, the modeling would be more meaningful for identifying appropriate mitigation measures if the accident risks and consequences (i.e. spill probabilities) were calculated and presented for each study segment as well as for each season. Partitioning the risk assessment by location and time of year would presumably increase the precision of a given estimate of risk and is something that TFN is very interested in reviewing.

CHRONIC (OPERATIONAL) OILING

The TC Termpol guide does not reference the need to address the hazards and risks of operational spills[5] (e.g., oily bilge discharge) and how the project might affect this. Similarly, we did not see any mention in the Termpol submission of this type of pollution and its potential harm to marine flora and fauna. Despite regulations and guidelines[6] that prohibit or discourage the exchange of ballast water in waters such as those of the Salish Sea, accidental discharges of fuel, oil or bilge will likely occur during the life of the project. Should there be an accidental spill of oil or fuel at an anchorage or on route, there may be adverse local effects to marine biota depending on the location and timing. To the extent that these effects might be significant will depend on many factors including the time of year, the marine receptors present, and the response measures enacted.

TFN requests that the matter of operational spill prevention, management, monitoring and enforcement in the Salish Sea be addressed by TC.

LIABILITY

As per the Termpol guidance document:

> *3.15.7 The Canada Shipping Act requires all oil spills originating from ships to be reported immediately to a Pollution Prevention Officer. The polluter has statutory obligations to repair, remedy, minimize or prevent pollution damage and for costs incurred to prevent actual or anticipated pollution damages resulting from a spill. The CCG will monitor the conduct of countermeasures and assume command and control if, in view of the Canadian Coast Guard, the polluter is unable to protect the public interest*

TFN seeks confirmation that all tankers that presently call to Westridge Terminal, and those that would do so if the project proceeded, are operated by companies that are capable of and prepared to cover the necessary costs of spill prevention, cleanup, rescue, rehabilitation, remediation, and monitoring. To the extent that a given company or companies are unable to do this, TFN seeks assurances from TM that adequate financial resources exist to address a full range of potential spill scenarios in a timely and effective manner.

INTEGRATION WITH OTHER REGIONAL INITIATIVES

With the rapid development of domestic supplies of petroleum hydrocarbons in North America in the past decade, the transportation of synthetic crude oil and natural gas

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[5] Operational spills (also referred to as chronic spills) are defined as those that occur during routine operations and are not associated with a major accident (e.g., tanker grounding) or malfunction (e.g., hull failure). Ship-related operational discharges of oil include the discharge of bilge water from machinery spaces, fuel oil sludge, and oily ballast water from fuel tanks. Also other commercial vessels than tankers contribute operational discharges of oil from machinery spaces to the sea. Cargo-related operational discharges from tankers include the discharge of tank-washing residues and oily ballast water. Source: http://oils.gpa.unep.org/facts/operational.htm

[6] e.g., *Canadian Shipping Act*, *Canadian Ballast Water Control and Management Regulations* (BWCMR), International Maritime Organization (IMO)

is a very active topic at present. The numerous proposals to build oil and gas pipelines to the west coast of British Columbia destined for Asian markets have brought a heightened level of public awareness to this matter. In response, governments, industry, and non-governmental organizations have engaged a number of studies and assessments of the social and ecological risks as well as accident-response readiness. Perhaps due to matters of timing in the delivery of the various reports, the TM Termpol submission does not, in our opinion, make adequate use of two notable reports in particular:

- Tanker Safety Panel Secretariat. 2013. A review of Canada's ship-source oil spill preparedness and response regime: Setting the course for the future.
- Puget Sound Partnership. 2014. Preventing oil spills from large ships and barges in northern Puget Sound and Strait of Juan de Fuca: VTRA 2010 Final Report

TFN seeks assurances that TRC will take the findings of these studies into consideration in preparing their report.

FISHERIES

The Termpol Review Process (TRP) requires consideration of:

> *…the potential effects of increased shipping activity on existing regional shipping networks and fishing ground activities.*

We found the TM Termpol submission to be deficient in its consideration of potential effects of increased shipping on fishing ground activities as they pertain to the TFN. Aside from some cursory level baseline (and dated) information, there is inadequate treatment of aboriginal fisheries let alone TFN treaty rights to fish.

We understand that TC is currently discussing a revised Termpol process and that consultation with aboriginal groups will likely be more substantial in future Termpol submissions. However, despite any increases in consultation between a proponent and an aboriginal group that might occur in future, the duty to consult remains a federal responsibility and one that TFN expects will be carried out to its fullest and in accordance with the Tsawwassen Treaty for the purpose of this project.

More specifically we found the fishery resource assessment (Termpol 3.3) deficient in that it did not address Fraser River Eulachon or Fraser River Sturgeon, two species of concern and importance to TFN. It is also surprising that there was no reference to the oil spill atlas[7] for the area or mapping of sensitive habitats through the FREMP process.

The selection of the year 2012 to portray the seasonal variation of commercial fishing activities in the project area is odd given that there were no commercial fisheries for Fraser sockeye in that year. This highlights the extreme deficiency in the Fishery Resource Study for Termpol. Indeed, given that fishing vessel traffic is an input into the model, the selection of years of data is vital. A more appropriate choice would have been 2010 which was a year of salmon abundance and likely a high (conservative) level of fishing vessel traffic as a result.

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[7] http://archive.ilmb.gov.bc.ca/cis/coastal/mris/coast.htm

WILDLIFE

The Termpol submission lacks any meaningful discussion on the topic of the adequacy of present or future wildlife (i.e., marine birds, marine mammals, shoreline mammals) rescue and rehabilitation resources that could be deployed in the event of a spill. The TC Termpol guidelines do not specifically state that wildlife rescue and rehabilitation must be addressed, however. TFN expects this information is presented in detail in the NEB Application.

There is one passage in the submission, though its utility is not evident to us:

> *Wildlife may be exposed to spilled oil through several pathways: inhalation, ingestion, and direct contact. The latter may entail smothering and/or thermal impairment due to oil coating on fur or feathers. Due to the relatively rapid loss, or lower concentration, of light-end volatile hydrocarbons, most wildlife treatment is for stabilization, cleaning, and rehabilitating oiled animals. Wildlife treatment following the 2010 Marshall spill response entailed cleaning and rehabilitation of birds and many turtles using protocols and procedures common to spills of medium to heavy oils. Focus Wildlife, contracted by Enbridge for the response, reported successful use of mineral oil as a cleaning agent for turtles and Dawn™ soap for feathers (birds).*

There is no mention of how the project may contribute directly, indirectly, or cumulatively to the underwater soundscape. This is an apparent shortcoming of the Termpol process in that it is not required of the proponent. TFN expects that the matter of underwater noise and its associated implications for marine biota such as Orca are fully addressed in the NEB Application.

PROPOSED SPILL RESPONSE CAPACITY

The relatively small (1250 tonnes) spill response capacity proposed for the Delta Port seems disproportionately small to the environmental values of the Fraser River delta and foreshore.

CUMULATIVE EFFECTS

It is not clear that the full extent of the cumulative effects of marine transportation in the future have been considered in the Termpol submission. Expansion of Deltaport and Westridge, and the concomitant cumulative increases in marine vessel traffic, present notable concerns for potential risks to marine biota and other Treaty interests of TFN that warrant a comprehensive assessment. Input from TFN will undoubtedly improve this effort.

TERMPOL REVIEW COMMITTEE REPORT & OUTCOMES

The Termpol submission is a proponent-led document that follows the prescriptions of a Termpol process that is recognized by TC to be deficient in some regards – notably those involving Consultation with First Nations. This presents a concern to TFN in that the NEB Panel may be poised to adopt the TRC Report and implement definitive actions with potentially far-reaching implications for users of the marine environment. It will be important to document any potential limitations that might result from a Termpol process under the present regime as compared with one that might be produced under the revised Termpol process which is anticipated to be released soon. Ideally, efforts will be taken to ensure that the present project will be capable of benefitting, retroactively, from improvements made to the revised Termpol process. The timeline of the NEB review and timing of the release of the new Termpol process should allow for this.

The TRC report is yet to be prepared. We anticipate that the TRC report will take this review into serious consideration. In addition, TFN requests the opportunity to review a draft of the TRC report with a view to ensuring that the rights and interests of TFN have been adequately captured and addressed and that project and cumulative risks to those interests have been thoroughly researched and that comprehensive and effective means of mitigating those risks are put forward with a view toward implementation should the project proceed.

TFN seeks confirmation that the final TRC report will be submitted to the NEB for its use in considering whether to issue a Certificate of Public Convenience and Necessity (**CPCN**) and in determining what conditions may be required of the Proponent should a CPCN be granted.

Finally, even in the event that the Project does not proceed, TFN expects that the information arising from the Termpol, NEB Review, and recent independent initiatives in the region will form the basis of a comprehensive assessment of the status quo by the TRC. The present deficiencies of the existing regime of vessel risk management in the Salish Sea must be addressed as a means of safeguarding the Treaty rights and interests of TFN.

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February 18, 2014

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Delivered by E-mail

File No. 1062-010

Kinder Morgan Canada Inc.
Trans Mountain Expansion Project
2844 Bainbridge Avenue
Burnaby, BC V5A 4T9

Attention: Ellen Frisch **(Ellen_Frisch@transmountain.com)**

Dear Sirs/Mesdames:

Re: TransMountain Pipeline ULC's Proposed TransMountain Project (the "Project")

I am writing to provide TransMountain Pipeline ULC ("TransMountain") with Pacheedaht's comments in relation to the following matters:

- How the draft application to the National Energy Board ("NEB") complies with TransMountain's Environmental Socio-Economic Approach document ("Proposed Approach Document");
- TransMountain's marine TERMPOL studies; and
- Marine components of TransMountain's draft application to the NEB.

As you will see from the attached table, Pacheedaht has a number of concerns about the accuracy and completeness of TransMountain's application to the NEB and the marine TERMPOL studies. TransMountain has not complied with the various filing requirements set out in its Proposed Approach Document, the NEB's List of Issues and its September 10, 2013 guidance letter, the NEB Filing Manual and the *Canadian Environmental Assessment Act, 2012* ("*CEAA, 2012*").

<u>Filing Requirements</u>

The Proposed Approach Document states that:

> The environmental and socio-economic elements to be considered within the marine transportation portion of the effects assessment include marine sediment and water quality, marine air and GHG emissions, marine acoustic environment, marine fish and fish habitat, marine mammals, marine birds, marine species at risk, Aboriginal marine resource use, and marine commercial, recreational and tourism use.
>
> The effects assessment will also evaluate potential direct and indirect effects of a tanker spill, including the risk of a spill, anticipated spill response and potential effects for several hypothetical spill scenarios. In addition to the potential effects of a tanker spill on the applicable elements noted above, the evaluation of the hypothetical spill scenarios will also include a human health risk assessment and an ecological risk assessment.

The List of Issues released by the NEB on July 29, 2013 includes: "Potential impacts of the project on Aboriginal interests". The NEB's September 10, 2013 letter to TransMountain set out the following filing requirements:

> The assessment of accidents and malfunctions related to the increase in marine shipping activities must include an assessment of potential accidents and malfunctions at the Terminal and at representative locations along the marine shipping routes. Selection of locations should be risk informed considering both probability and consequence. The assessment must include a description of:
>
> - measures to reduce the potential for accidents and malfunctions to occur, including an overview of relevant regulatory regimes;
> - credible worst case spill scenarios and smaller spill scenarios;
> - the fate and behavior of any hydrocarbons that may be spilled;
> - potential environmental and socio-economic effects of credible worst case spill scenarios and of smaller spill scenarios, taking into account the season-specific behaviour, trajectory, and fate of hydrocarbons spilled, as well as the range of weather and marine conditions that could prevail during the spill event;
> - ecological and human health risk assessments for credible worst case spill scenarios and smaller spill scenarios, including justification of the methodologies used; and
> - preparedness and response planning and measures, including an overview of the relevant regulatory regimes.

The NEB Filing Manual provides guidance in relation to what Kinder Morgan was required to file as part of its application, including:

- a summary of the comments and concerns expressed by potentially affected persons or groups;
- a summary of the response made regarding each of the concerns or comments, including:
    - the measures taken, or that will be taken to address those concerns or an explanation of why no further action is required to address the concerns or comments; and
    - the methods and dates that the response was made to the person(s) who raised the concern(s);
- how outstanding concerns will be addressed;
- how input from persons or groups has influenced the design, construction or operation of the project;
- details regarding discussions with Aboriginal groups[1].

The Filing Manual also provides:

> Where the project may impact Aboriginal communities and affect the use of traditional territory or potential or established treaty or Aboriginal rights, applicants must identify the potentially affected Aboriginal groups and carry out effective consultations with them to determine their views and concerns. If there are potential impacts, applicants must file information about the Aboriginal groups affected, the concerns they have raised, how the applicant will address the concerns and identify any outstanding concerns. The level of detail provided should reflect the nature and extent of the impacts, the nature of the rights or interests affected and the degree of concern expressed by Aboriginal groups.[2]

Table A-1 in the NEB Filing Manual provides that the circumstances and interactions requiring detailed information, considering all project phases including potential accidents and malfunctions during each phase, include the following:

- The project may affect a water body of specific concern to an Aboriginal group;
- The project may affect fish or fish habitat of specific concern to an Aboriginal group;
- The project may affect wildlife of specific concern to an Aboriginal group;

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[1] NEB Filing Manual, s 3.3.4
[2] NEB Filing Manual, s A.2.4

- There are outstanding concerns about species at risk or species of special status, and related habitat;
- There are outstanding concerns about human occupancy and resource use;
- The project would be located on, or traverse, Crown land or the traditional territory, reserve land or settlement area of an Aboriginal group;
- The project may adversely affect the current use of lands and resources by Aboriginal peoples;
- There are outstanding concerns about heritage resources;
- There are outstanding concerns about navigation and navigational safety;
- The project may affect the social and cultural well-being of Aboriginal groups, local residents or communities;
- There are outstanding concerns about human health and aesthetics.[3]

The NEB Filing Guide also requires that the current biophysical and socio-economic setting of each element be provided and described (*i.e.,* baseline information) in the area where the project is to be carried out, including:

- the ecological land classification and key terrain features, such as mountains, rivers, lakes and other important features;
- the locations of any nearby communities and residences (permanent and temporary);
- current land and resource uses, including traditional land and resource uses;
- the potential to encounter heritage resources;
- the areas of physical and environmental constraints (*e.g.,* biophysical, land use or natural resource use);
- navigable waters that may be affected by project components;
- any environmentally-sensitive areas, sensitive habitats or areas of special concern (*e.g.*, existing and candidate protected areas), including those identified through public or Aboriginal consultation, which influence facility routing or site locations.[4]

The NEB Filing Manual requires that the application describe which biophysical or socio-economic elements in the study area are of ecological, economic or human importance and

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[3] NEB Filing Manual, s A.2.4, Table A-1
[4] NEB Filing Manual, s A.2.5

require more detailed analysis taking into account the results of consultation. The Guide also sets out a number of other requirements in relation to what type of detail must be included, including references to scientific literature, field studies, local and traditional knowledge.[5] Similarly, baseline information must also include both scientific information and local and traditional knowledge.[6]

The NEB Filing Manual prescribes the use of a valued component based approach to effects assessment that focuses on those biophysical or socio-economic elements, or a subset of those elements, that may be affected by a project and are of concern or value to the public and Aboriginal groups.[7]

CEAA, 2012 requires consideration of potential project effects on Aboriginal peoples in respect of any change that may be caused to the environment on:

> (i) health and socio-economic conditions,
>
> (ii) physical and cultural heritage,
>
> (iii) the current use of lands and resources for traditional purposes, or
>
> (iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.[8]

CEAA, 2012 also requires that an environmental assessment take into account the effects of accidents, including the significance of those effects.[9]

These various requirements have not been met in the draft application. Pacheedaht's concerns about the incompleteness of TransMountain's application include the following:

- an inaccurate/incomplete record of communication vis-à-vis Pacheedaht;
- a "pan-Aboriginal" approach that does not take into account distinctions among different First Nations, their current uses or their traditional territories;
- lack of Pacheedaht-specific use data or considerations in the effects assessments;
- inappropriate selection of Valued Components (VCs) due to lack of consideration of Pacheedaht-specific data;
- lack of analysis of potential impacts on Aboriginal rights, including title;
- deficient assessment methodologies for effects from marine transportation;

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[5] See NEB Filing Manual, s A.2.5
[6] NEB Filing Manual, s. A.2.5
[7] NEB Filing Manual, s. A.2.6.1
[8] *CEAA, 2012*, s. 5(1)(c)
[9] *CEAA, 2012*, s. 19(1)

- flawed determinations of significance; and
- a flawed risk assessment of spill events.

Inaccurate/Incomplete Record of Communication with Pacheedaht

The summary provided in Volume 3 of the application does not accord with the Record of Communication submitted by TransMountain. In addition, the Record of Communication does not reference the concerns raised by Pacheedaht through various communications, including Pacheedaht's October 15, 2013 letter to Ian Anderson, which remains unanswered to date (see enclosed copy of the letter). The suggestion in the application that Pacheedaht has raised no concerns about the Project is completely inaccurate and misleading.

"Pan-Aboriginal" Approach

The application references marine use information from only one First Nation located in the marine corridor, out of a total of 21 First Nations, including Pacheedaht. The marine use information from this one First Nation was used to reach conclusions for all First Nations within the marine corridor, including Pacheedaht. TransMountain "approximated" the locations of subsistence activities.

The severity of an impact on various habitats from an oil spill depends on the type of oil involved, the physical and biological characteristics of the shoreline, and the way in which species respond to oil. In the case of oil spills, the type of shoreline is an important factor in oil residency (how long oil remains on shore), and therefore the potential significance of an effect of a spill. In order to provide a valid assessment of the risk of significant effects to Pacheedaht resources, the application must therefore accurately reflect the shoreline characteristics within Pacheedaht territory. The application does not do this. Readily available information about the shorelines in Pacheedaht's traditional territory indicates the following:

- The Pacheedaht territory contains approximately 129 km of shoreline mapped by the BC ShoreZone, which can be divided into two discrete kinds of coast. Approximately 100 km, or 78%, of this shoreline lies along the outer marine coast of southwestern Vancouver Island, and has mostly high wave energy. The remaining 22% is sheltered estuarine shoreline associated with the San Juan and Gordon Rivers.

- An analysis of the BC ShoreZone data set shows that the outer marine coast intertidal shores in Pacheedaht territory is dominated (59% of the territory) by rock platforms or rock with gravel/sand beaches. The sheltered estuarine shoreline is dominated (17%) by marsh or lagoon habitat.

- The Oil Residency Index (ORI) data layer within the BC ShoreZone data set rates oil persistence on a five point scale from short term ("days to weeks") to long term ("months to years"). The shore type, coupled with wave energy reaching the shore, is a strong determinant of the length of time oil, once ashore, will remain present. Both the high energy boulder/cobble beaches on the outer coastline of Pacheedaht territory and the sheltered salt marsh and lagoon habitat are ranked as having medium to long term oil residency.

- The BC ShoreZone data set also provides detailed spatial information about intertidal and shallow subtidal plant assemblages or "biobands" that represent discrete habitat types. Each bioband supports characteristic assemblages of intertidal biota (e.g., blue mussels, canopy kelps, rockweed). Of note is the fact that benthic and canopy kelps, surfgrass and the red algae biobands are almost continuously present in the shallow subtidal along the length of the marine shoreline in Pacheedaht territory. This is typical of high energy rocky coasts in southern BC, and is considered to have both high biodiversity and high biological productivity.

Taken together, sections 3.2.1 and 3.2.2 of the application suggest an underestimation of both habitat sensitivity and environmental risk in Pacheedaht territory, as follows:

- the Pacheedaht territory shorezone is composed of a disproportionately large percentage of shore types likely to retain oil for months to years as compared with the project RSA as a whole; and

- by assigning a low biological sensitivity factor to "high exposure rock and high exposure sand and gravel" shoreline types that are, in fact, known to have high productivity and retain oil for months to years (considered "long"), the application under-estimates the risk of an accidental spill on Pacheedaht's territory and interests.

In addition, the calculation of percentage risk of oiling is based on a number of "most likely" accident locations, the nearest of which to Pacheedaht territory is Location G off Race Rocks, BC. Since a key element of a risk assessment is to examine low probability, high impact events, Pacheedaht is justifiably concerned about the effects of an accidental spill much closer to its territory that would result in much higher probability of significant oiling along significant portions of the shorezone in its territory.

Given all of this, there is insufficient information in the application for the either the Pacheedaht or the NEB to evaluate what risks are presented by the Project, and whether those risks are acceptable.

These serious deficiencies need to be addressed in the application before it can be considered "complete".

Lack of Pacheedaht-Specific Resource Use Information

As Pacheedaht has repeatedly advised, it is critical that Pacheedaht-specific information, including a Traditional Marine Use Study ("TMUS"), be used to inform the effects assessment in the application to the NEB. Despite not committing to funding for Pacheedaht's TMUS until November, 2013, TransMountain decided to file its application with the NEB in December 2013, in the absence of any TMUS data that would inform its assessment of environmental effects and effects to Pacheedaht's rights and interests. As a result, the application is completely devoid of any traditional use data to inform TransMountain's effects assessments in Pacheedaht's traditional territory. Indeed, the application contains no identification of effects, mitigation measures or significance determinations specific to Pacheedaht.

The following sections in the application need to consider and incorporate Pacheedaht-specific information, together with information on the specific shoreline types in Pacheedaht's territory, in order to inform the effects assessments: the Environmental and Socio-Economic Effects assessment of the increase in marine traffic associated with the Project; the Socio-Economic Effects and Environmental Risk Assessment of marine oil spills; and the Human Health Risk Assessment of marine oil spills.

These omissions need to be addressed through amendments to the application which incorporate Pacheedaht's TMUS data into the effects assessment methodology. Pacheedaht's TMUS cannot be used as a "stand alone" document. The TMUS, when completed by the end of April 2014, will not be an assessment of Project effects to Pacheedaht; rather, it will identify Pacheedaht's historical and current uses, species of importance, harvesting areas and cultural areas of importance. This information should then be used to determine appropriate VCs for the effects assessments, indicator species, criteria to be considered in assessing effects, and thresholds for determining "significance". Pacheedaht is willing to work with TransMountain to discuss these matters so that potential effects can be properly assessed in a revised application to the NEB.

Inappropriate Selection of Valued Components

Pacheedaht had no input into the selection of VCs used in the application, nor did Pacheedaht's traditional uses or Aboriginal rights inform that selection. Effects to harvesting and cultural sites VCs were assessed without specific Pacheedaht site locations. The application also fails to properly distinguish between fin fish and shellfish, or to properly assess impacts from an oil spill on these different species. Disruption of Pacheedaht's harvesting activities and cultural sites as a result of safety, access, sensory disturbance or damage/loss are not properly or adequately assessed in the application.

Lack of Analysis of Aboriginal Rights

The VCs chosen for the application are not appropriate for assessing impacts to Aboriginal rights, such as governance, culture and title. Qualified effects were specifically linked to one biophysical species only (southern resident killer whale). In addition, no VCs were chosen in relation to harvesting activities. None of the considerations taken into account in the application related to safety issues. Effects are extrapolated from the Marine Commercial, Recreational and Tourism Use analysis. For all of these reasons, the application does not contain an assessment of impacts to Pacheedaht's Aboriginal rights.

Deficient Assessment Methodology for Effects from Marine Transportation

As Pacheedaht has advised TransMountain on numerous occasions, Pacheedaht is very concerned about the lack of any marine field studies outside Vancouver Harbour. Desktop studies are insufficient to study potential Project effects to the marine environment, Pacheedaht's current uses and Pacheedaht's aboriginal rights, including aboriginal title, as required as part of the NEB process.

TransMountain needs to undertake appropriate marine field studies, including wake studies, archaeological assessments, marine mammal studies (including studies looking at cumulative effects from the proposed additional tankers in relation to noise and strikes), coastal sensitivity mapping and stochastic oil spill modelling. As offered previously, Pacheedaht would be pleased to work with TransMountain to identify the necessary field work.

Flawed Determination of Significance

The application reached conclusions of "not significant" for effects relating to marine transportation in the absence of any specific marine use information for Pacheedaht, and without a meaningful consultation process. In addition, the application includes no significance determinations for any VCs in the event of an oil spill, despite a requirement in *CEAA, 2012* to make such a determination. These deficiencies in the application need to be remedied.

Flawed Effects Analysis/Risk Assessment of Spill Events

The socio-economic effects analysis of spill events in the application was cursory. The Screening Level Human Health Risk Assessment did not identify the presence of any Aboriginal community in the Strait of Juan de Fuca.

The application does not accord with standard methodologies for environmental and soci-economic assessments. More specifically, it does not provide a defensible assessment of risks consistent with standard methods or an evidence-based rationale for concluding that TransMountain's proposed contingency plans are sufficient to render risks to VCs acceptable. The assessment of risk in the application doe not integrate an understanding of both likelihood and consequence, reach clear conclusions regarding the acceptability of unmitigated risks, or clearly demonstrate whether the contingency plans (mitigation) are sufficient to result in an acceptable risk.

As a result of these application gaps, reviewers and decision makers are left with unanswered questions such as:

- Does the potential for a marine spill from the proposed route, frequency and method of marine transportation of bitumen pose acceptable or unacceptable risks to the VCs?

- Is the proposed contingency plan sufficient to appropriately manage the risks to an acceptable level?

- What would be the significance of the effects from an accidental spill considering mitigation?

In addition, Pacheedaht is very concerned about the lack of sufficient analysis in relation to the fate and behavior of spilled diluted bitumen in a marine environment. The application does not acknowledge that evaporative losses from accidentally discharged diluted bitumen products could, in certain circumstances, lead to sufficient buoyancy loss that the oil could descend beneath the sea surface before responders could do much to prevent it. Another problematic aspect of the application is a reliance on generic data in the form of averages, general trends and overall characteristics, when specific data are required to meaningfully inform quantitative assessments of risk.

The application is also deficient with respect to its oil spill trajectory modelling. The application and supporting modelling results do not present and analyze realistic thin-slick, high-wind and wave conditions. The application and supporting studies need to consider quantitative data on wind speeds, surface salinity and currents as a function of direction, time and season, rather than generic accounts of weather and currents in the region. The data used in the application are limited to a single year. Inter-annual variations in storm frequencies and intensities, river discharges and other model input factors need to be considered in the application and supporting studies.

These issues need to be addressed in a revised application, if the application is to inform a proper assessment of potential effects and public interest considerations.

Concluding Comments

For all of these reasons, the current version of the application does not comply with the requirements of the Proposed Approach Document, the NEB's List of Issues or September 10, 2013 guidance letter, the NEB Filing Manual or *CEAA, 2012*. Pacheedaht has attempted to identify in the attached table how these identified application deficiencies could be remedied.

Pacheedaht looks forward to working with TransMountain in relation to the additional work that is required to complete TransMountain's application to the NEB.

Yours truly,

Janes Freedman Kyle Law Corporation

Per:

Rosanne M. Kyle
RMK/ejr
Enclosures
cc: Pacheedaht First Nation

PACHEEDAHT FIRST NATION COMMENTS ON DRAFT NEB APPLICATION DATED FEBRUARY 18, 2014

ID	EIS Section	Application Wording	Pacheedaht Comment	Required Revision	NEB Filing Manual	CEAA 2012	LoI	Board Letter
1	Vol 3B 1.1 (Introduction) p3B-1	*In addition to the land-based communities along the pipeline in Alberta and BC, and in recognition of potential environmental and socio-economic effects of increased marine shipping that is required to transport product delivered to Westridge Terminal as part of the Project, including the potential effects of an oil spill, Trans Mountain extended its consultation to include Aboriginal communities along the marine corridor on the south coast of BC.*	Although the proposed Project would result in an increase from 10 tankers a month to 68 tankers a month (half of which would be laden) through the traditional territory of Pacheedaht First Nation ("PFN"), the application does not include an assessment of potential Project effects on PFN's interests resulting from marine shipping activities from either increased tanker traffic or accidents and malfunctions).	Application must include assessment of effects on PFN interests - needs to reference relevant baseline information, field investigations, VCs and criteria to assess effects to PFN's interests.	3.4.2 Design of Consultation Program	na	5, 9	p 1
2	Vol 3B 1.2.2 (Principles and Goals of the Aboriginal Engagement Program) p3B-5	*Address legal requirements – Carry out Trans Mountain's legal requirements as a regulated company under the NEB jurisdiction to engage with and mitigate, where necessary, there are any Project impacts on the assertion of Aboriginal rights and title governing traditional and cultural use of the land and marine environment.*	This stated goal is not addressed anywhere in the application. For example changes or effects to "Aboriginal rights and title" were not described nor examined by the Proponent. The application as filed contains no information specific to PFN.	Application must include assessment of impacts on PFN's Aboriginal rights and title, including from operations and accidents and malfunctions.	3.4.1 Principles and Goals of Consultation	na	5, 9	p 1
3	Vol 3B 1.3.4.1 (Comprehensive Aboriginal Engagement Process) p3B-12	*As outlined in Section 1.3.4 each community and group has the opportunity to engage with Trans Mountain in the manner they choose, depending on Project interests and potential effects.*	As stated, it appears there were different levels of engagement contemplated for aboriginal groups based on potential effects to a specific Aboriginal group.	The application needs to set out Project interests and potential effects for each First Nation, and level of consultation undertaken by the Proponent., and the criteria used by the Proponent to determine level of consultation.	3.4.2 Design of Consultation Program	na	na	na
4	Vol 3B 1.3.5.2 (Traditional Marine Resource Use Studies) p3B-13	*Information gathered is used to determine the potential impacts the Project may have on the use of identified traditional marine areas and the ability of the users to maintain the current traditional use of the marine environment.*	The Proponent's stated approach only considers current uses, which is too restrictive an approach to understand effects to Frist Nations' rights and interests. No traditional marine use (TMU) data for PFN was referenced in the application - that data is required to assess potential impacts to PFN's interests.	Application needs to include assessments of other types of effects, beyond current uses, such as effects on aboriginal title, governance, culture, and anticipated future uses. Application needs to incorporate TMU data to inform the assessment of impacts to PFN's interests.	3.4.2 Design of Consultation Program	s 5(1)(c)(iii)	5, 9	p 1, 2
5	Vol 3B 1.4.2.2 (Employment) p3B-21	*In addition to engagement with Aboriginal communities, extensive consultation with training providers, industry associations, and communities to inform and gather labour market information, interests, and the current capacity of the community is ongoing. Further information about employment interests are included in the Aboriginal community overviews in Volume 5D of this application.*	It appears that the studies referenced by the Proponent did not extend to the marine corridor communities identified, including PFN. No information specific to PFN is found in the Volume cited.	As project benefits such as employment may be used in accommodation discussions for aboriginal interests, the applicant should specify what employment interests have been identified for Aboriginal communities within the marine transportation corridor.	3.4.3 Implementing a Consultation Program	na	5, 9	p 1
6	Vol 3B 1.4.2.3 (Workforce Development - Education and Training) p3B-22	*The goals of the policy focus on priority areas such as construction readiness, environmental monitoring and emergency response.*	These studies did not extend to the marine corridor communities identified.	The application needs to include information on the proposed environmental monitoring and emergency response plans for the marine corridor. Without this information, it is not possible to assess potential Project effects in the marine corridor.	3.4.3 Implementing a Consultation Program	na	5, 9	p 1
7	Vol 3B 1.5.2 (Aboriginal Engagement by Community and Group p3B-25	*For purposes of this volume, September 30, 2013 has been used and further engagement activities will be reported in supplemental filings.*	As noted above, no TMU data for PFN was used to inform the assessments in the application. As a result, the application cannot be used to assess potential effects to PFN's interests.	The application needs to incorporate TMU data for First Nations so as to inform the effects assessments; it is not sufficient to file supplementary "stand alone" filings later - the TMU data must inform the selection of VCs and indicator species and the determiantin of Project effects and their significance.	3.4.3 Implementing a Consultation Program	na	na	na

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8	Vol 3B 1.5.2.5.8 (PFN First Nation) p3B-64	*As a result of the engagement process, through a series of subsequent meetings in person, over the phone and via email dialogue, multiple Project-based interests arose, which are detailed in Appendix A of this volume.*	Appendix A does not list any of the Project-based interests which arose as a result of PFN engagement, including concerns about lack of field studies outside Vancouver harbour, the need to incorporate TMU data, the risk of diluted bitumen sinking if spilled in a marine environment, the selection of VCs and indicators, and impacts to PFN's aboriginal rights and title.	Appendix A needs to be revised to reflect the concerns raised by PFN.	3.4.3 Implementing a Consultation Program	na	5, 9	p 1
9	Vol 3B 1.5.2.5.8 (PFN First Nation) p3B-64	*PFN First Nation conducted an independent, third-party TMRU study during the summer of 2013. The results of these engagement activities as well as Trans Mountain's response to any issues raised through these activities are detailed in Volume 8A of this application.*	This is an incorrect statement. As Appendix A indicates, as late as Sept. 2013, discussions were still ongoing about TMRU funding for PFN. Capacity funding to conduct a TMRU study was not provided to PFN until Nov. 2013.	The application needs to be revised to address this inaccuracy. The final application should incorporate the data from PFN's TMU study that is currently underway, so that the data can inform the selection of VCs and indicator species and the determination of Project effects and their significance.	3.4.3 Implementing a Consultation Program	s 5(1)(c)	5, 9	p 1,2
10	Vol 3B App A-5-05	*Record of Consultation - PFN First Nation*	This record of consultation is not complete. PFN's concerns are not recorded in this record of consultation	Appendix A needs to be revised to include PFN's concerns.	3.4.3 Implementing a Consultation Program	na	5, 9	p 1
11	Vol 8A 1.2 (Scope of Volume 8A) p8A-34	*To understand the potential effects of the Project-related increase on marine traffic, Trans Mountain undertook an Environmental and Socio-Economic Assessment (ESA), as well as a quantitative marine risk assessment of the potential for oil spills in the marine environment.*	Both the ESA and the RA were undertaken without information specific to PFN interests. This statement contradicts other statements in this volume that state an RA was conducted instead of an ESA on marine shipping activities.	The application needs to clarify whether both an ESA and a RA were conducted in relation to the marine component of the Project. The ESA and/or RA need to incorporate TMU data from PFN to properly inform the effects assessment.	A.2.6.1 Identification and Analysis of Effects	s 5(1)(c)(iii)	5, 9	p2
12	Vol 8A 3.1.1.2 (Focus Participants) p8A-74	*"Through building relationships with the focus participants, Trans Mountain gathered informed input, identified issues or concerns and where appropriate, developed early mitigation measures"*	It is unclear who "focus participants" are meant to refer to.	Application should specfiy who the "focus participants" were. Application needs to specify what effects were identified in relation to PFN's interests, and what mitigation was identified for those effects.	3.4.3 Implementing a Consultation Program	na	5, 9	p 1
13	Vol 8A 3.2 (Aboriginal Engagement) p8A-81	*"Volume 3B provides detailed information on the Trans Mountain approach to the Aboriginal Engagement Program as well as detailed information on the Trans Mountain vision and the principles and goals of the program."*	Vol 3B does not provide detailed information on engagement with respect to marine shipping.	The application needs to set out detailed information on the Proponent's approach to the Aboriginal Engagement Program in the context of the marine shipping component of the proposed Project.	3.4.3 Implementing a Consultation Program	na	5, 9	p 1
14	Vol 8A 3.2.1.5 (Incorporating Aboriginal Traditional Marine Resource Use Studies) 8A-85	*The aim of the TMRU studies is to identify and mitigate effects of the increase in Project-related marine vessel traffic on current use of traditional marine resources. This is achieved by meeting the following objectives: determine the extent and general nature of each community's current use of marine resources for traditional activities relative to shipping lanes; • identify existing concerns and potential effects of the Project on traditional marine resource use for baseline scoping and selection of social or environmental indicators for the effects assessment; • provide traditional knowledge, where appropriate, for the assessment of potential effects of Project-related marine vessel traffic on traditional marine resource use; and • recommend appropriate mitigation measures to address concerns raised relative to the Project-related marine vessel traffic regarding traditional marine resource use.*	Application does not include any TMU data for PFN. As a result, the application does not set out the extent and general nature of PFN's current use of marine resources, identify PFN's concerns and potential effects on its traditional marine resource use for the purposes of baseline scoping and selection of indicators, provide PFN's traditional knowledge for the assessment of potential effects, or identify mitigation measures to address concerns about effects to PFN's marine resource uses.	Application needs to incorporate TMU data from PFN to inform the assessment of impacts as set out in Vol. 8A, 3.2.1.5.	3.4.3 Implementing a Consultation Program A.2.5 Description of the Environmental and Socio-Economic Setting A.2.6 Effects Assessment	5(1)(c), 19(1)	5, 9	p2

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15	Vol 8A 3.2.1.5 (Incorporating Aboriginal Traditional Marine Resource Use Studies) 8A-86	*The issues that were raised and where they are considered in the traditional marine resource use assessment are also summarized in Table 3.2.1.*	Table 3.2.1 is a list of Aboriginal Communities Located In The Burrard Inlet Region only. Table 3.2.2 is a list of communities located in the marine corridor; however there does not appear to be a corresponding list of issues raised for marine corridor groups, including PFN.	The application needs to summarize and consider the issues raised by PFN.	3.4.3 Implementing a Consultation Program	5(1)(c), 19(1)	9	p 1
16	Vol 8A 3.2.2.1 (engagement activity) p8A-86	*The results of these engagement efforts, in conjunction with the collection of traditional marine resource use (Section 3.2.1.4) have contributed to the development of the marine transportation assessment, including mitigation and enhancement measures.*	This is an overstatement, as the engagement efforts with PFN have yet to result in a TMU study to develop a baseline from which effects could be established.	TMU data collected by PFN need to be used in the marine transportation effects assessment sections of the application.	3.4.3 Implementing a Consultation Program A.2.5 Description of the Environmental and Socio-Economic Setting A.2.6 Effects Assessment A.2.6.2 Mitigation Measures	s 5(1), 19(1)	5, 9	p 2
17	8A 4.2.5.2 (Existing Noise Levels) 8A -125	*In the Haro Strait to Boundary Pass (Segment 5) and Victoria to Race Rocks (Segment 6), various islands are located within the Marine LSA. These locations are either not inhabited or sparsely developed. Ambient measurements have not been conducted for these locations.*	Ambient measurements were not conducted through segment 7 because of distance to receptors ie permanent dwellings; as a result, the assessment does not take into account activities related to traditional harvesting practices and the exercise of Aboriginal rights, as well as reserve communities and Aboriginal title lands.	Additional noise receptor locations in areas important to Aboriginal title and harvesting need to be identified and considered in the effects assessment in the application.	A.2.5 Description of the Environmental and Socio-Economic Setting	s 5(1), 19(1)	5, 9	p 1, 2
18	8A 4.2.6.2 (Field Data Collection) p8A-130	*Information on marine resources within the Marine RSA is readily available in published literature and is deemed to be sufficient to assess potential effects of the increased Project-related marine vessel traffic on marine fish and fish habitat. Therefore, Project-specific field studies for this aspect of data gathering were not considered warranted.*	No field studies to collect project-specific baseline information were carried out with respect to fish and fish habitat along the tanker routes. Project specific field studies are a fundamental step in a credible environmental assessment.Establishing baseline conditions through desktop analysis is insufficient, unless the proponent can establish current baseline conditions for all areas required for this project assessment are available and complete. The information gathered was not related to PFN.	Marine field studies must be undertaken to gather project specific baseline information for each valued component, and this information must be used to inform the effects assessments in the application.	A.2.5 Description of the Environmental and Socio-Economic Setting	s 5(1), 19(1)	5, 9	p 1, 2
19	8A 4.2.6.6 (Aboriginal Traditional Knowledge) marine fish and fish habitat 8A-145	*Available literature indicates that Aboriginal people traditionally harvested at least 71 animal species... Numerous species of seaweed have also been traditionally harvested by Aboriginal people...*	This is an example of the pan-Aboriginal approach to this application taken by the proponent, that fails to recognize that differences between different groups of Aboriginal peoples exist. It is scientifically inappropriate to use limited available literature to support broad conclusions with respect to PFN. Many varieties of marine resouces, including fish, shellfish, marine mammals and seaweed are culturally significant to PFN.	The application needs to provide an evaluation of the possible effects of marine vessel traffic and possible accidents and malfunctions on marine resources, including various species of value to PFN. Information from PFN's TMU should inform this assessment.	A.2.5 Description of the Environmental and Socio-Economic Setting	s 5(1)(c), 19(3)	5, 9	p 1, 2
20	8A 4.2.7.2 (Field Data Collection) p8A-148	*Information on marine mammal resources within the region is readily available in published literature and on government and research group websites and is deemed to be sufficient for the assessment of potential effects of the increased Project-related marine vessel traffic on marine mammals. Therefore, Project-specific field studies for this aspect of data gathering were not considered necessary.*	There is insufficient marine mammal information included in the application. For example, the proponent identifies a lack on information on marine mammal strikes. There are a large number of uncertainties including unknown reporting compliance, unknown frequency of struck animals sinking, limited capacity to re-sight and investigate carcasses of reported dead floating animals etc, and inconclusive cause of death determinations. See p.8A-430	Project specific existing baseline conditions need to be included in the application to inform the impacts of marine vessel traffic on marine mammals, including Traditional Ecological Knowledge. The applicaton is deficient in only relying on desktop literature reviews.	A.2.5 Description of the Environmental	s 5(1)(c), 19(3)	5, 9	p 1, 2
21	8A 4.2.7.6.1 (Southern Resident Killer Whale) 8A-156	*Key threats to the southern resident population include: reductions in the availability or quality of prey (primarily Chinook salmon); physical and acoustic disturbance; and chemical and biological contaminants (COSEWIC 2008, DFO 2011a).*	As stated, key threats to killer whales include physical and acoustic disturbance. The proponent also states that marine vessel traffic increase related to the project will contribute to detrimental effects on killer whales. The proponent has already identified significant effects on killer whales. The health and abundance of whales are a particular cultural concern to PFN, but PFN's use and knowledge of whales are not considered in the application.	Project specific existing baseline conditions for killer whales need to be identified and considered in the application, including Traditional Ecological Knowledge about killer whales.	A.2.5 Description of the Environmental and Socio-Economic Setting	s 5(1)(c), 19(3)	5, 9	p 1, 2

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22	8A 4.2.7.6.1 (Southern Resident Killer Whale) 8A-156	*Killer whales are frequently observed in or within close proximity to the marine shipping lanes.*	The health and abundance of whales are a particular cultural concern to PFN, but PFN's use and knowledge of whales are not considered in the application. The northeast pacific southern resident Killer Whale population is listed as Endangered under the Species at Risk Act (SARA). On the 4 point sensitivity scale used in the application, however, all whales are assigned a BSF of 3 (where 3 = "medium" risk). The rationale for this is not defensible. According legal protection to a species suggests the highest concern for its survival. Furthermore, the application notes that "for populations such as southern resident killer whale, the loss of a single animal would constitute an effect at the population level, and recovery could take a decade or longer…" (Vol. 8B, p. iv).	A listed species where the loss of a single individual could result in population level effects should be accorded the highest biological sensitivity factor in the application. Failure to do so underestimates the consequences and hence overall risk to a species of social and ceremonial importance to the Pacheedaht.The application needs to provide an analysis of project effects specific to whales and PFN Aboriginal rights and title.	A.2.5 Description of the Environmental and Socio-Economic Setting	5(1)(c), 19(3)	5, 9	p 1, 2
23	8A 4.2.7.6.2 (Humpback Whale) p8A-158	*Humpback whales are regularly observed in or within close proximity to the marine shipping lanes.*	The health and abundance of whales are a particular cultural concern to PFN, but PFN's use and knowledge of whales are not considered in the application.	The application needs to consider project specific existing (current) baseline conditions for humpback whales, including Traditional Ecological Knowledge.	A.2.5 Description of the Environmental and Socio-Economic Setting	5(1)(c). 19(3)	5, 9	p 1, 2
24	8A 4.2.7.6.2 (Humpback Whale) p8A-159	*Key threats to the eastern North Pacific humpback whale include: noise disturbance; habitat degradation; entanglement in fishing gear and debris, and ship strikes (COSEWIC 2011). Activities identified by DFO as "likely to destroy or degrade critical habitat" include vessel traffic, toxic spills, overfishing, seismic exploration, sonar, and pile driving (DFO 2013h)*	The health and abundance of whales are a particular cultural concern to PFN, but PFN's use and knowledge of whales are not considered in the application; further habitat degradation is not investigated in the application, despite the fact that humpback whales are listed in the *Species at Risk Act* .	Project specific existing (current) baseline conditions need to be considered in the application, including Traditional Ecological Knowledge.	A.2.5 Description of the Environmental and Socio-Economic Setting	5(1)(c), 19(3)	5, 9	p 1, 2
25	8A 4.2.7.7 (Aboriginal Traditional Knowledge) p8A-164	*The literature review indicates that marine resource extraction was, and continues to be, an important activity for coastal Aboriginal communities in the Marine RSA. Marine mammals have traditionally been harvested at the intersection of the Fraser River and the Pacific Ocean, throughout the Gulf Islands, in the Strait of Georgia and along the southern coast. Traditionally hunted marine mammal species included grey whales, Steller sea lions, Pacific white-sided dolphins, killer whales, harbour seals and porpoises (BC Transmission Corporation 2006, Canadian Environmental Assessment Agency 2006, Simonsen et al. 1995).*	This is a complete generalization of marine resource use by PFN for rights and title purposes. The reliance of the proponent solely on a literature review results in a generalized and inaccurate description of marine resource use by PFN. It also appears as though the proponent relied on information 10 and 20 years out of date for an assessment of current conditions. These few paragraphs are the entirety of the ATK section on marine mammals.	Baseline conditions of species of cultural importance to PFN need to be identified and utilized in the effects assessments. TEK and TMU data need to inform the selection of VCs and indicator species, and the determination of effects and their significance.	A.2.5 Description of the Environmental and Socio-Economic Setting	s 5(1)(c), 19(3)	5, 9	p 1, 2
26	8A 4.2.8.3 (Field Data Collection) Marine Birds p 8A-172	*The abundant literature and data resources currently available for marine ecological information within the Marine RSA is deemed sufficient for the assessment of potential effects of the increased Project-related marine traffic on indicator species. Studies to pursue the collection of additional marine bird biological field data were considered unnecessary.*	The decision of the proponent to forego collection of project specific biological field data is inconsistent with basic environmental assessment methodology. This generalization on the availability and adequacy of marine ecological information within the entire marine RSA is unsubstantiated. Further this decision was made without taking into account species of importance to PFN.	The proponent needs to conduct field studies to collect baseline information on species of importance to PFN and other First Nations, and incorporate that data into the selection of VCs and indicator species and the effects assessments. The application needs to include a complete list of information sources used to arrive at the conclusions.	A.2.5 Description of the Environmental and Socio-Economic Setting	5(1)(c)	5, 9	p 1, 2

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27	8A 4.2.8.7 (Aboriginal Traditional Knowledge) Marine Birds p8A-183	*Traditional harvesting of marine resources, including marine birds for food and other purposes, has historically been and remains important for coastal Aboriginal communities in the Marine RSA. Ducks hold cultural importance to coastal communities, and their feathers are used to insulate clothing (Canadian Environmental Assessment Agency 2006, Suttles 2006). Birds maybe shot or snared, or hunted by net and spear. Common kinds of birds and eggs harvested in the Marine RSA include goldeneye, canvasback, ruddy duck, wood duck, American wigeon, northern pintail, mallard, northern shoveler, green-winged teal, grebe and murre (First Nations Health Council 2011a, Jacques Whitford Ltd. 2006, Simonsen et al. 1995). Extensive studies completed by Fediuk and Thom (2003) with the Elders from various Salish communities have identified 31 bird species as culturally relevant that have been traditionally harvested (e.g., black scoter, white scoter, murre, bald eagle, golden eagle, ruffed grouse, blue grouse, mallard, trumpeter swan, western grebe).*	This is a complete generalization of marine resource use by First Nations for rights and title purposes. This is the entirety of the ATK section on marine birds. No information pertaining to the PFN was collected or used in the application. Traditional harvesting is more than important, it is fundamental to the culture of First Nations. This is a pan-Aboriginal description of marine bird use and importance that does not specifically consider PFN. It appears as though the proponent relied on information 10 and 20 years out of date for an assessment of current conditions. Further the proponent relies on Fediuk and Thom (2003) citation which is a Salish study.	The proponent needs to set out the baseline conditions specific to PFN. TMU studies need to inform the selection of VCs and indicator species and the effects assessments.	A.2.5 Description of the Environmental and Socio-Economic Setting	5(1)(c)	5, 9	p 1, 2
28	8A 4.2.9 (Marine Species at Risk) p8A-184	*This subsection identifies the federally and provincially listed marine species at risk (fish, mammals and birds) that may occur within the Marine RSA (Table 4.2.9.1), including those whose potential occurrence would be considered rare or unlikely*	It is unclear if the application includes any information on the habitat of the species at risk; the reliability of sources used for this description is also unclear.	The application needs to identify the habitats of the species at risk.	Table A-1 "Species at Risk or Species of Special Status" Filing Req 1 "identify their habitat(s), including any critical habitat(s) identified in a recovery strategy or an action plan listed on the sara public registry..."	na	na	na
29	8A 4.2.9.1 (Aboriginal Traditional Knowledge) Species at risk p8A-188	*A desktop review of Aboriginal traditional knowledge as it relates to species at risk is discussed under the marine fish and fish habitat, marine mammals, and marine birds sections (Sections 4.2.6, 4.2.7 and 4.2.8).*	None of the sections mentioned in this citation contain ATK specifically about species at risk. At minimum, this is a misleading statement. No information from PFN is reflected in this Volume.	The application needs to include and consider ATK about species at risk.	A.2.5 Description of the Environmental and Socio-Economic Setting	19(3)	na	na
30	8A 4.2.10.1 (Traditional Marine Resource Use Indicators) p8A-189	*Two indicators were selected to represent potential effects from increased Project-related marine vessel traffic on traditional marine resource use: subsistence activities and sites, and cultural sites.*	No effects assessment on subsistence activities specific to PFN or cultural sites specific to PFN are included in the application. Also, the indicators are too broad to measure changes.	Information specific to effects to PFN subsistence activities and PFN cultural sites need to be referenced and considered in the application.	A.2.5 Description of the Environmental and Socio-Economic Setting	5(1)(c)	5, 9	p 1, 2
31	8A 4.2.10.3.1 (Literature/Desktop Review) p8A-191	*The results of this literature/desktop review will be verified and augmented through field data collection by potentially affected communities.*	This statement directly contradicts the Proponent's conclusion that sufficient information was available to forego the conduct of field investigations specific to this project. In its current form, the application fails to assess impacts on specific PFN interests.	The application needs to reference and consider TMU data for PFN so as to inform the selection of VCs and indicator species and the determination of effects and their significance.	A.2.5 Description of the Environmental and Socio-Economic Setting	na	na	na
32	8A 4.2.10.3.2 (Traditional Marine Resource Use Studies) p8A-199	*Engagement with potentially affected Aboriginal communities is ongoing. Trans Mountain continues to engage potentially affected Aboriginal communities and will continue to facilitate TMRU studies with interested communities. The results from ongoing TMRU studies will be provided to the NEB.*	The EA in its current form fails to assess impacts on specific PFN interests. PFN's TMU study cannot be used as a "stand alone" assessment that is filed separately from the application, as use studies are not effects assessments.	The application must consider and incorporate PFN TMU data to inform the selection of VCs and indicator species, and the determination of effects and their significance.	A.2.5 Description of the Environmental and Socio-Economic Setting	na	na	na

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33	8A 4.3.8 (Marine Birds) p8A-332	*This subsection of the ESA considers the potential effects of the increased project-related marine vessel traffic on marine birds. Key issues for marine birds were identified through discussions with provincial and federal government agencies, including EC, and the professional judgment of the assessment team based on extensive experience working on marine terminal and transportation projects in BC.*	This statement illustrates an approach taken by the proponent to make key decisions on the structure and execution of the EA without information from Aboriginal consultation generally and PFN specifically.	The selection of key bird species for assessment in the application must be updated following the receipt of PFN TMU data, and the TMU data must be used to inform the effects assessments in the application.	3.4.3 Implementing a Consultation Program, A.2.5 Description of the Environmental and Socio-Economic Setting, A.2.6 Effects Assessment	s 5(1)(c), 19(1)	5, 9	p 1, 2
34	8A 4.3.8 (Marine Birds) p8A-333	*...special attention to species of importance to the culture and traditional harvest of Aboriginal communities whose traditional territories overlap with the shipping lanes.*	PFN information was not used to inform the selection of species. This statement also contradicts the approach taken by the proponent - see comment re p-8A-332 indicating that aboriginal consultation did not play a role in the selection of species.	PFN TMRU information must be used to inform the selection of VCs and indicator species and the assessment of project effects on marine birds.	3.4.3 Implementing a Consultation Program, A.2.5 Description of the Environmental and Socio-Economic Setting, A.2.6 Effects Assessment	s 5(1)(c), 19(3)	5, 9	p 1, 2
35	8A 4.3.10 (Traditional Marine Resource Use) p8A-356-57	*This subsection considers the potential effects of increased Project-related marine vessel traffic associated with the expansion of the Westridge Marine Terminal in Burnaby, BC on TMRU of the coastal waters of southwest BC and US waters that are covered by the spatial boundaries of the Marine RSA...Issues associated with the current volume of tanker traffic, total marine vessel traffic in the study areas, and future increases in vessel traffic associated with general population growth are not assessed.*	The description of baseline conditions associated with existing marine traffic in the RSA is a requirement. This is necessary to estimate changes resulting from activities related to the project. Further, describing future increases on vessel traffic associated with general population growth limits the consideration of cumulative effects, particularly those components with an identified project effect.	The application needs to provide a description of issues associated with existing marine traffic in the marine RSA specific to PFN and other First Nations. The application needs to provide a description of issues related to future increases in marine traffic from all causes including future population growth.	A.2.5 Description of the Environmental and Socio-Economic Setting, A.2.6 Effects Assessment	s 5(1)(c), 19(1)	5, 9	p 1, 2
36	8A 4.3.10.1 (Assessment indicators and measurement endpoints) Traditional Marine Resource Use p8A-358	*The selection of indicators and measurement endpoints reflect the NEB Filing Manual (2013c) requirements for traditional land and resource use in Table A-3 and considered key issues and interests identified during Aboriginal and stakeholder engagement. They also considered feedback from participants in the North Vancouver and Victoria ESA Workshops.*	The selection of indicators and endpoints for Marine Use specific to PFN are too broad for measurement. "Measurement Endpoints" as described could only be measured by a presence/absence measurement; PFN specific information would have to have been collected for this approach to be valid. This statement also infers that input from non-Aboriginal participants ("stakeholders") were used to inform Aboriginal indicators, which is inappropriate.	The application needs to select indicator and measurement endpoints based on PFN information, in order to inform the assessment of Project effects on PFN's Aboriginal interests, including Aboriginal title.	3.4.3 Implementing a Consultation Program, A.2.5 Description of the Environmental and Socio-Economic Setting, A.2.6 Effects Assessment	s 5(1)(c), 19(1)	5, 9	p 1, 2
37	8A 4.3.10.4.1 (Effects Considerations) p8A-364	Nonetheless, the Traditional Marine Resource Use – Marine Transportation Technical Report (Volume 8B, TR 8B-5) provides information of the existing conditions related to habitation sites and inland fisheries that may occur within or in proximity to the Marine RSA for consideration of the potential effects of a marine spill on marine users assessed in Section 5.0.	Vol 8B TR 8B-5 provides information of the existing conditions related to habitation sites and inland fisheries that may occur within or in proximity to the Marine RSA for Esquimalt Nation only. The assessment of potential effects of a marine spill on marine users in section 5.6.1 is deficient; in fact, the proponent indicates on p8A-614 that it hasn't conducted one.	The application must include an assessment of potential effects of a marine spill on marine users, including PFN specifically.	na	na	na	na
38	8A 4.3.10.6.1 (Traditional Marine Resource Use Indicator - Subsistence Activities and Sites) p8A-372	*Based on the results of the TMRU studies and the desktop analysis, subsistence marine resources harvested are found throughout the Marine RSA, and include marine mammals, fish, shellfish and marine vegetation.*	This statement does not inform the analysis and must be considered in light of the lack of specific harvesting information from any Aboriginal group (other than Esquimalt Nation). This is the totality of the Proponent's information on marine resource use by Aboriginal groups.	At a minimum, the application needs to include an analysis of effects utilizing PFN baseline information for each VC.	A.2.6 Effects Assessment	5(1)(c), 19(1)	na	na

ID	EIS Section	Application Wording	Pacheedaht Comment	Required Revision	NEB Filing Manual	CEAA 2012	LoI	Board Letter
39	8A 4.3.10.6.1 (Traditional Marine Resource Use Indicator - subsistence Activities and Sites) Alternation of Traditional Marine Resource Users' Vessel Movement Patterns p 8A-374	*The increase in Project-related marine vessel wake traffic may result in alteration of traditional marine resource users' vessel movement patterns...Project-related marine vessel wake traffic may result in increased disruption of marine user activities...This residual effect is assessed under the commercial fisheries and aquaculture indicator in Section 4.3.11.*	It appears the prediction of effects to subsistence activities and sites was restricted primarily to vessel wake. The reader is directed to a section describing recreational and non-Aboriginal fisheries (See comment on page 8A-398 below).	The application needs to include an analysis on the effects of both project-related marine vessel wake and marine vessel traffic on Traditional Marine Resource Use with respect to sites used by PFN members in the Juan de Fuca Strait.	A.2.6 Effects Assessment	s 5(1)(c), 19(1)	5, 9	p 1, 2
40	8A 4.3.10.6.1 (Traditional Marine Resource Use Indicator - Subsistence Activities and Sites) p8A-375	*There is a good understanding of general cause-effect relationships between increased Project-related marine vessels and interactions with subsistence hunting, fishing and plant gathering activities; however, further Aboriginal community engagement will increase confidence and the robustness of the significance evaluation.*	Without TMU and TEK information from PFN, the confidence level and robustness of the conclusions set out in the application are questionable in relation to potential effects to PFN. Therefore the significance evaluation of matters of importance to PFN is deficient.	The application must consider and incorporate PFN's TMU data including in relation to the selection of VCs and indicator species, the effects assessments, and the significance determinations.	A.2.5 Description of the Environmental and Socio-Economic Setting, A.2.6 Effects Assessment	s 5(1)(c)	5, 9	p 1, 2
41	8A 4.3.10.6.2 (Traditional Marine Resource Use Indicator - Cultural Sites) 8A-375	*The increase in Project-related marine vessel wake traffic may result in increased sensory disturbance for marine users. This potential residual effect is assessed under the marine recreational use indicator in Section 4.3.11....The disruption of marine user activities from Project-related marine vessel wake is unlikely to occur and consequently was not considered....*	It appears the prediction of effects to cultural sites was restricted primarily to vessel wake. The reader is directed to a section describing recreational and non-Aboriginal fisheries.	The application needs to include an analysis of the effects of both project-related marine vessel wake and marine vessel traffic on Traditional Marine Resource Use with respect to sites used by PFN members in the Juan de Fuca Strait.	A.2.6 Effects Assessment	s 5(1)(c), 19(1)	5, 9	p 1, 2
42	8A Combined Effects of Project Related Marine Vessel Traffic on Cultural Sites 8A-376	*The disruption of marine user activities from Project-related marine vessel wake is unlikely to occur and consequently was not considered in the evaluation of combined effects on the marine use indicator in Section 4.3.11 MCRTU*	It appears the definition of 'cultural sites' was restricted to land-based locations only; this seems to contradict the proponent's exclusion of land-based activities from project interaction at the beginning of this section at 4.3.10.1 p8A-364. This presupposes PFN does not have cultural sites in the marine environment itself, which is an incorrect assumption	The application needs to clarify whether cultural sites included cultural sites located on the water. The application needs to include an analysis on the effects of both project-related marine vessel wake and marine vessel traffic on Traditional Marine Resource Use with respect to sites used by PFN members in the Juan de Fuca Strait.	A.2.6 Effects Assessment	s 5(1)(c), 19(1)	5, 9	p 1, 2
43	8A 4.3.10.8 (Summary) 8A-377	The results of the TMRU assessment do not contradict any management objectives of established regional marine conservation plans or planning documents for marine environments under federal and provincial jurisdiction. As identified in Table 4.3.10.4, the residual effects associated with increased Project-related marine vessel traffic on TMRU are considered not significant, with the exception of the expected residual effects on the southern resident killer whale population, which are considered to be significant (see Section 4.3.7).	The TMRU assessment in the application was not informed by information from Aboriginal groups in the marine corridor including PFN.	The application needs to include an analysis of the effects of both project-related marine vessel wake and marine vessel traffic on Traditional Marine Resource Use with respect to sites used by PFN members in the Juan de Fuca Strait, informed by TMU data.	A.2.6 Effects Assessment	s 5(1)(c), 19(1)	5, 9	p 1, 2
44	8A 4.3.10.8 (Summary) p8A-377	*The results of the TMRU assessment do not contradict any management objectives of established regional marine conservation plans or planning documents for marine environments under federal and provincial jurisdiction. As identified in Table 4.3.10.4, the residual effects associated with increased Project-related marine vessel traffic on TMRU are considered to be not-significant, with the exception of the expected residual effects on the southern resident killer whale population...*	The conclusions in the application in relation to acceptable levels of change to valued components representing Aboriginal interests were made without acknowledgement or apparent consideration of the existence of PFN's Aboriginal rights and title.	The application needs to include an assessment that considers Aboriginal rights and title.	A.2.6 Effects Assessment	s 5(1)(c), 19(1)	5, 9	p 1, 2

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45	8A 4.3.11.6.1 (Marine Commercial, Recreation and Tourism Use Indicator - Commercial Fisheries and Aquaculture) p 8A-398	Marine vessels may be temporarily inconvenienced by the presence of Project-related marine vessels (low), but for some commercial fishing and other commercial vessels delays could have business implications (medium)... This is a conservative evaluation of magnitude, however, as discussions with marine users including commercial fishing industry representatives, recreational organizations, and marine tourism operators (identified in Table 2.1.1 in the Marine Commercial, Recreational and Tourism Use – Marine Transportation Technical Report in Volume 8B, TR 8B-6) indicated that the additional marine traffic that will be generated by the Project is unlikely to materially affect the activities of most marine users in the Marine RSA.	Despite being referenced by the analysis on page 8A-374, this section does not include any assessment of the effects caused by the increase in marine vessel traffic to traditional harvesting. Further, the groups consulted on the potential for vessel interaction do not include Aboriginal people generally, or PFN members specifically. The conclusions reached with respect to marine vessel traffic interacting with traditional harvesting and title harvesting vessels are unsubstantiated.	The application needs to include an analysis of the effects of both project-related marine vessel wake and marine vessel traffic on Traditional Marine Resource Use with respect to sites used by PFN members in the Juan de Fuca Strait, informed by TMU data.	A.2.6 Effects Assessment	s 5(1)(c), 19(1)	5, 9	p 1, 2
46	8A 4.3.13.1 (Incident Types) p8A-427	*Operation of tanker traffic is highly regulated in Canadian waters, and the marine shipping industry has a long history of safe operations. However, incidents such as accidental release of untreated bilge water, grounding of a vessel, the strike of a marine mammal, or the inadvertent venting of a tanker's cargo tank could occur.*	This list of potential incident types does not capture all activities/impacts related to the exercise of Aboriginal rights and title to specific to PFN related to harvesting of resources (for example marine shipping interference\disruption\strikes).	The application needs to set out and consider a complete list of incident types, with input from PFN.	A.2.6 Effects Assessment	s 5(1)(c), 19(1)(a)	5, 9	p 1, 2
47	8A 5.4.3 (Weathering of Diluted Bitumen) p8A-542	*In May 2013, Trans Mountain conducted applied research on the fate and behaviour of diluted bitumen in a marine environment (i.e., the Gainford Study, Volume 8C, TR 8C-12, S7). The Gainford Study included a weathering test of diluted bitumen spilled in a marine environment over a 10-day period.*	The marine environment investigated was for Burrard inlet only. Conditions (including wave height and direction, temperature, shipping activity levels, marine resources) through the Juan de Fuca Strait are different. Elsewhere in the application it is mentioned that approximately 2% of spilled crude can be expected to remain on water up to 2 weeks after a spill, but the Gainford Study only considered a 10-day period.	The application needs to consider and analyze how winds and wave action in the Juan de Fuca Strait would influence the results of the Gainford Study. The study needs to consider more than 10 days, given the potental for oil to remain on the water for more than 2 weeks.	A.2.6.1 Identification and Analysis of Effects	s 19(1)(a)(b)(j)	5, 9	p 1, 2
48	8A 5.5.2 (Proposed Improvements) p8A-606	*The results of the fate and behaviour studies indicate that a prompt response can significantly reduce the consequences of a spill. As well, the diluted bitumen tested remained floating over the 10-day test period; therefore, to be effective, planning standards for on-water operations should be based on removing free oil with in 10 days.*	This test was conducted under very different conditions than exist in the marine shipping lanes (i.e. at a facility in Alberta). The buoyancy of dilbit following discharge to receiving waters is crucially important. Once dilbit becomes submerged in receiving waters, its environmental trajectory is no longer amenable to monitoring, and this dramatically increases uncertainty regarding subsequent environmental effects. This uncertainty has a high economic cost, arising from human behavioural changes in response to imagined adverse threats or effects. For example, instead of perceptions of oil contamination being limited to known beaches, all beaches in the region become suspect once oil can no longer be credibly tracked. Because the density of bitumen from the oil sands of Alberta and Saskatchewan are inherently very close to the density of water, this issue warrants much more careful attention than it gets in the application. Some bitumen produced from the oil sands have densities that exceed that of water, and float on water only when diluted with less dense hydrocarbon diluents	The application needs to considers conditions more closely related to those found in the shipping lanes of the Juan de Fuca Strait to determine the potential for oil to sink, to inform the effects assessment and identification of mitigation measures.	A.2.6.1 Identification and Analysis of Effects	s 19(1)(a)(b)(j)	5, 9	p 1, 2

ID	EIS Section	Application Wording	Pacheedaht Comment	Required Revision	NEB Filing Manual	CEAA 2012	LoI	Board Letter
49	8A 5.4.3 (Weathering of Diluted Bitumen) p8A-542	*In May 2013, Trans Mountain conducted applied research on the fate and behaviour of diluted bitumen in a marine environment (i.e., the Gainford Study, Volume 8C, TR 8C-12, S7). The Gainford Study included a weathering test of diluted bitumen spilled in a marine environment over a 10-day period. Worst case test conditions would include wind speeds of 15 m/s (54 kph), a 1 mm slick thickness in water of 5 ppt salinity or less. Because such conditions were not used in the Gainford study, or in most other weathering studies of oil sands bitumen products, the applicability of these studies to realistic environmental conditions must be interpreted with considerable caution, and the possibility of evaporative losses leading to submerged dilbit taken seriously.*	The Gainford Study evaluated changes of physical properties and chemical composition for two dilbits, Access Western Blend (AWB) and Cold Lake Bitumen (CLB). Both used the winter formulations, meaning they were diluted with the highest proportion of diluent seasonally to achieve viscosity specifications for pipeline transport at the colder ambient temperatures of winter, but the test conditions were typical of summer. Use of the summer formulation would have decreased the time necessary for evaporative loss of the condensate and hence the rate of increase of density of the remaining dilbit. Use of the summer blend under summer conditions would have been more realistic and have made the dilbit density reach neutral buoyancy more rapidly. Other test conditions employed during the Gainford study include water salinity of 20 parts per thousand (ppt), three levels of wind and wave conditions (static, mild and moderate) at temperatures near 15 °C , and a ~1 cm oil thickness. While the authors of the Gainford Study acknowledge that such a thick slick would only correspond to oil confined by a containment boom or something similar, this caveat is elsewhere ignored, both in the Gainford study and in the references to it in the Application. During an actual dilbit spill, a slick would rapidly spread to a thickness of less than 1 mm, with a limiting thickness of about 0.4 mm according to Vol. 8C 12 TR S9 Appendix B (see also p. 8A-643 and the recognition that oil would spread rapidly to a thin slick). Because evaporative weathering varies inversely with slick thickness, density changes requiring 10 days for a 1 cm slick would occur within a day for a 0.4 mm slick. Worst case test conditions would include wind speeds of 15 m/s (54 kph), a 1 mm slick thickness in water of 5 ppt salinity or less. Because such conditions were not used in the Gainford study, the applicability of these studies to realistic environmental conditions must be interpreted with considerable caution, and the possibility of evaporative losses leading to submerged dilbit taken seriously.The results of the Gainford study indicate that the density of both AWB and CLB increase from less than 940 kg/m3 to 980 – 990 kg/m3 within 48 h under the test conditions used. Water incorporated by oil contributed to variability of the results, especially in the moderate wind and wave test conditions, and the densities reported were not corrected for water content. The maximum density observed during these tests was 1010 kg/m3 after 10 days, equivalent to the density of 13 ppt seawater at 15 °C. Hence, while the authors of the Gainford study (and the Kinder-Morgan Application) repeatedly point out that dilbit never sank during the tests, it is important to remember that this only means that it didn't sink in 20 ppt seawater at 15 °C. Notwithstanding, the test results still imply the dilbit would have sunk at 13 ppt and 15 °C, but this is nowhere pointed out in the parts of the Application. It is also important to remember that the nearly 10 days required to reach these densities, repeatedly mentioned in the study and the other parts of the Application, are largely an artifact of the test conditions employed for the Gainford study. In a real oil spill these densities could likely be achieved in less than a day under true worst-case conditions.The Gainford tests also ignores the value of test replication, making it impossible to quantitatively evaluate whether results of different test conditions are real or just an artifact of uncontrolled test variables.	The Application needs to be revised to properly consider the risk of diluted bitumen sinking in marine environments, including in the Strait of Juan de Fuca. Proper consideration includes recognizing that diluted bitumen is not the same as other heavy oils - diluted bitumen and syntehtic bitumen have distinctly different distillation curves than other oils, meaning that the diluent used to make diluted bitumen or synthetic bitumen is rapidly lost through evaporation. As a result, environmental weathering models developed for other crude or heavy refined oils should not be used. Weather and oceanography data should not be presented as summary averages; the ranges need to be provided and considered in the analysis. The Application also needs to consider the fate and behaviour of spilled diluted bitumen in the summer, as this is the time period in which the diluted bitumen would be at a higher temperature and therefore closer to a density to permit sinking. The density measurements need to be corrected for water incorporation and compared with water density at 15 C. The studies need to include replication for density resuls and PAH analyses. Diluted bitumen products need to be tested at realistic slick thicknesses, higher wind speeds and lower salinity waters to reflect actual environmental conditions. The Proponent needs to provide its oil weathering model so that it can be properly analyzed and tested. Application references to the Gainford Study showing that Cold Lake Bitumen "won't sink" need to be removed, as this is not accurate - all the study showed is that the diluted bitumen did not sink in the conditions present in that study.	A.2.6	5(1)(c);. 19(1)(a)(b)(j)	5, 9	page 2

ID	EIS Section	Application Wording	Pacheedaht Comment	Required Revision	NEB Filing Manual	CEAA 2012	LoI	Board Letter
50	8A 5.6.1 (Socio-Economic effects) p8A-614	*Where applicable, the information provided here reflects issues identified by Aboriginal peoples, residents, land users, service providers and regulatory authorities. The complexity of predicting socio-economic effects, particularly for hypothetical scenarios, is a function of numerous factors including: • the constant change that is occurring in socio-economic conditions of any community or region, influenced by an array of economic, political and cultural factors; • a lack of precise information about goods, services, and employment demands for hypothetical spill scenarios; • the role of human interpretation and its influence on individuals' physical and perceptual experiences of social effects; and • inherent uncertainty regarding individuals' abilities, willingness and confidence to respond to change (Loxton et al. 2013). Given the complexity of predicting socio-economic outcomes, this discussion of the potential socio-economic effects of marine oil spills references past spills and other relevant incidents as examples of actual documented effects rather than evaluating one or more specific scenarios. The Exxon Valdez Oil Spill (EVOS) is the largest and best studied example of the effects of a large oil spill on many aspects of the coldwater marine environment, and of communities and residents who live near, or depend on marine resources.*	This section highlights deficiencies in the application: 1) Information provided here does not reflect information provided by PFN; 2) Predicting socio-economic effects may be complex, but the complexity and lack of information should not prevent an identification of the socio-economic effects potentially resulting from this project - rather, it should prompt the Proponent to gather sufficient information to enable an analysis; and 3) precise socio-economic information including information on the exercise of Aboriginal rights and title could have been collected by the proponent through field studies and other means, but the proponent chose not to do so. .	As per the direction provided by the NEB, the application needs to include a description of "potential environmental and socio-economic effects of credible worst case spill scenarios and of smaller spill scenarios".	A.2.6 Effects Assessment	19(1)(a)(b)(j)	5, 9	page 2

ID	EIS Section	Application Wording	Pacheedaht Comment	Required Revision	NEB Filing Manual	CEAA 2012	LoI	Board Letter
51	8A 5.6.2 (Environmental Effects) p8A-619 to 711	*As with socio-economic effects, numerous factors contribute to the complexity of predicting environmental outcomes of hypothetical worst case and smaller spills. However, the ecological risk assessment process provides an established, accepted and transparent method to evaluate potential acute and chronic effects of hypothetical spill scenarios for a suite of ecological receptors. For this reason, an ecological risk assessment process was applied to assess environmental effects, rather than the qualitative approach adopted to evaluate potential socioeconomic effects of marine oil spills.*	The application does not include a structured risk assessment that is focused on determining the level of risk to VCs. The risk assessment was not conducted according to recognized risk assessment approaches using a thorough and rigorous examination of the likelihood and consequences (ecological, socioeconomic and cultural) of the proposed marine transportation. The Ecological Risk Assessment of Marine Transportation Spills (ERA) provided in the application in Volume 8B (Marine Transportation Technical Reports) does not assign risk ratings (or risk rankings or levels). The application provides information about some effects and consequences of a variety of spills (in different locations and seasons) for different VCs, but does not interpret the results in terms of a scale of risk (considering the likelihood of those effects occurring). As a result, there is no method applied to standardize the results to allow a comparison of the risk of a spill between locations and timing for different VCs. Overall, the application is deficient because it lacks an overarching risk assessment framework to lead the reviewer through the steps that are critical to key decisions. The application presents the results of modelling and analyses to the extent that it indicates a possibility that a spill could include some ecological and socioeconomic effects of large magnitude to various VCs, but it lacks a methodological conclusion on the risk of effects that the proposed marine transportation activity may cause to the VCs. As noted above, the application also fails to include a determination of the significance of the effects from an accidental spill (as required by CEAA 2012). In the absence of a risk assessment framework and risk ratings assigned to the possible spill scenarios, there is no coherent method for judging the adequacy of the contingency plans in the application.	The method to assign risk ratings in the application should be based on the (i) likelihood of an effect occurring, and (ii) the consequence of the effect on the VC, and applied uniformly across the VCs. The application needs to be revised to include a presentation of how risks vary geographically and temporally. This is required in order to prepare a contingency plan that may manage the varying risks, especially when there is a potential for significant effects. The risk assessment must also consider the varying levels of uncertainty involved in each component of the decision. The application also needs to contain a rationale for the adequacy of the contingency plan (i.e., a risk management plan) to achieve its objectives in sufficient detail to explain the appropriate management of risks to tolerable levels in order to rule on the sufficiency of emergency planning. The application must include determinations of the significance, after mitigation, of the accidental effects on VCs from a marine spill in order to allow decision-makers to decide whether risks can be reduced to a level that can be confidently defined as 'tolerable'. The first two items are required for regulatory decision making on the acceptability of the risk of the proposed marine transportation including the adequacy of the contingency plan. The last item above is required to meet the requirements of CEAA 2012.	A.2.6	19(1)	5, 9	p. 1, 2

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52	8A 5.6.2 (Environmental Effects) p8A-619 to 711	*As with socio-economic effects, numerous factors contribute to the complexity of predicting environmental outcomes of hypothetical worst case and smaller spills. However, the ecological risk assessment process provides an established, accepted and transparent method to evaluate potential acute and chronic effects of hypothetical spill scenarios for a suite of ecological receptors. For this reason, an ecological risk assessment process was applied to assess environmental effects, rather than the qualitative approach adopted to evaluate potential socioeconomic effects of marine oil spills.*	Its appears that the potential environmental and socio-economic effects of a credible worst case spill scenario and smaller spill scenarios were not analyzed, contrary to direction from NEB List of Issues and Board Letter. For example, the fact that oil spills routinely cause mass seabird mortalities is well established in the scientific literature, yet little of this literature is mentioned in the application. The assessment doesn't evaluate magnitudes of likely bird mortalities or consequences for rare or endangered species. Similarly, mortality estimates are available for marine mammals killed by the Exxon Valdez spill, but there is no reference to this body of work. With an Orca population already headed toward extinction in the region, a more careful assessment of the additional threat a spill would pose would seem to be in order, along with a more inclusive survey of the literature from the Exxon Valdez as well. More recent papers show patterns of decline for two pods, which does not bode well for their indefinite survival. In addition, there is no mention of the effects on armoured beaches, or data from measurements of hydraulic conductivity of the sediments, which affects oil residency times and therefore effects. For example, the application speculates that mud and sand beaches will remain water saturated at low tide, but this depends of their hydraulic conductivity. Many regions in the Project area contain armoured beaches, which trap oil for several years, but this is not considered in the application. It is also unclear where shoreline lengths of each sensitivity class come from. The sensitivity ranks for birds, and bird recovery time scales, are arbitrary. The marine mammal recovery time scale is also arbitary, and does not recognize the threatened state of whales in the region. The conclusions in relation to marine fish populations does not take into account published research indicating impacts on wild pink salmon lasted for at least 4 years after the Exxon Valdez oil spill.	As required by the Attachment to the Board Letter of 2013 at page 2, the application needs to include a description of "potential environmental and socio-economic effects of credible worst case spill scenarios and of smaller spill scenarios." Relevant studies and data on oil spill effects need to be referenced and incorporated into the application. In addition, the application needs to summarize population estimates for keystone or high-valued species in relevant regions, including the Straits of Juan de Fuca as the absence of reliable pre-spill estimates will guarantee that evaluations of any spill-related effects on these species will be inconclusive. The application also needs to properly account for the particular shoreline types and the oil residency times on the various types.	A.2.6 Effects Assessment	19(1)(a)(b)(j)	5, 9	page 2

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53	8A 5.6.2 (Environmental Effects) p8A-619 to 711	*As with socio-economic effects, numerous factors contribute to the complexity of predicting environmental outcomes of hypothetical worst case and smaller spills. However, the ecological risk assessment process provides an established, accepted and transparent method to evaluate potential acute and chronic effects of hypothetical spill scenarios for a suite of ecological receptors. For this reason, an ecological risk assessment process was applied to assess environmental effects, rather than the qualitative approach adopted to evaluate potential socioeconomic effects of marine oil spills.*	The application fails to take into account the information specific to Pacheedaht's traditional territory in considering and analysing potential Project effects to Pacheedaht's interests and resources in Pacheedaht's territory. The approach taken in the application is completely inappropriate and inadequate to assess impacts to Pacheedaht's interests and Aboriginal rights, including title. Indeed, the application under-represents the risk to Pacheedaht because it assumes that shoreline sensitivity for the RSA as a whole is representative of the shoreline types within Pacheedaht's territory, which is not in fact the case. It is important to note that BC ShoreZone data indicates that the shorelines within Pacheedaht's traditional territory contain a greater percentage of shorelines that are susceptible to long-term retention of oil and attendant effects following a spill than the average within the overall Regional Study Area ("RSA"), meaning that conclusions about risk to the RSA as a whole may underrepresent risk to the Pacheedaht shoreline. The application does not consider this issue. The application also contains a number of assumptions regarding biological values which has resulted in an underestimation of sensitivity along Pacheedaht's shorelines and to species of value to Pacheedaht. Assumptions made to assign sensitivity in the application are also questionable. Kinder Morgan assumes that sites with lower wave exposure and greater physical complexity can support higher levels of biological diversity and productivity and therefore are more biologically sensitive. While this is generally true, the converse statement – the statement in the application that high exposure, rock, or high exposure, sand and gravel sites, along the outer coast in particular, are characterized by relatively low biodiversity (number of species) and productivity – is false. Higher energy rocky shorelines associated with shallow subtidal canopy kelp forests of the type prevalent more or less continuously along the length of the Pacheedaht territory coastline are considered to have high intertidal biodiversity (number of species) and can also be said to be highly biologically productive habitats. Despite this high level of productivity, however, these shoreline types are classified in the application (Vol. 8B, Table 5.5, p. 5-5) as having the lowest BSF (BSF = 1). This is of great concern to the Pacheedaht because although these high energy boulder/cobble beaches, noted as "high [oil] penetration potential…include coarse beaches associated with rock platforms; although high energy, may result in lengthy [oil] persistence" (Vol. 8B, p.5-4, Table 5.2, shore type #11) make up only 2% of the total RSA shore length (ibid), almost all of this area appears to be located along the shoreline within Pacheedaht territory	The application needs to be revised to take into account the specific shoreline zones and sensitivity within Pacheedaht's territory, so as to properly inform the effects and significance determinations, including in relation to Pacheedahts interests and rights.	A.2.6 Effects Assessment	19(1)(a)(b)(j)	5, 9	page 2
54	8A 5.6.1.3.2 (Aboriginal Culture and Subsistence Use) p8A-617-18	*Aboriginal peoples have historically used or presently use the shipping route to maintain a traditional lifestyle and continue to use marine resources throughout the Salish Sea region for a variety of purposes including fish, shell-fish, mammal and bird harvesting, aquatic plant gathering, and spiritual/cultural pursuits as well as through the use of waters within the region to access subsistence resources, neighbouring communities and coastal settlements. The EVOS affected subsistence harvest of Aboriginal communities and individuals. Adverse effects resulted from reduced availability of fish and wildlife, concern about possible health effects of eating fish and wildlife, and disruption of traditional lifestyle due to participation in, or disturbance by, clean-up activities. Fears about food safety have diminished over time and harvest levels have increased since the spill, but the increase has been variable, and composition of harvested species has changed. Other factors have influenced this change and discerning what is spill-related is difficult (Palinkas et al 1993, EVOSTC 2010; see also Section 5.6.2.1).*	This is the entirety of the socio-economic effects assessment of the worst case and smaller spill scenarios related to Aboriginal culture and subsistence use. The Proponent does not acknowledge the existence of rights and title, and how those could be affected by a spill. No Project specific information is presented in the application. No PFN information is reflected in this section, and the Proponent has not identified possible effects on the PFN because the Proponent has neither established relevant current baseline information nor performed an assessment of the potential effects to PFN arising from a worst case spill scenario or a smaller spill scenario. The entirety of the socio economic effects assessment section is less than 6 full pages and is deficient to inform an effects assessment of oil spills.	The application needs to include an effects assessment, specific to PFN, of the potential environmental and socio-economic effects of credible worst case spill scenarios and of smaller spill scenarios.	A.2.6 Effects Assessment	19(1)(a)(b)(j)	5, 9	p 2

ID	EIS Section	Application Wording	Pacheedaht Comment	Required Revision	NEB Filing Manual	CEAA 2012	LoI	Board Letter
55	8A 5.6 (Environmental and Socio-Economic Effects of an Oil Spill from a Tanker) 5.6.1 (Socio-Economic Effects p8A-612	*Entire section to pages 613 - 619*	The entirety of the application's analysis on the potential socio-economic effects of an credible worst case spill and of smaller spills is less than 6 full pages long. This section of the application is entirely deficient as it has failed to seriously consider the socio-economic effects of either credible worst case spill scenarios or smaller spill scenarios either generally or specifically with regard to PFN interests. The full text of the potential effects commentary with respect to consumptive uses by first nations is as follows: "The EVOS affected subsistence harvest of Aboriginal communities and individuals. Adverse effects resulted from reduced availability of fish and wildlife, concern about possible health effects of eating fish and wildlife, and disruption of traditional lifestyle due to participation in, or disturbance by, clean-up activities. Fears about food safety have diminished over time and harvest levels have increased since the spill, but the increase has been variable, and composition of harvested species has changed. Other factors have influenced this change and discerning what is spill-related is difficult (Palinkas et al 1993, EVOSTC 2010; see also Section 5.6.2.1)." (Vol 8A, p.8A-618)	The application needs to include an effects assessment, specific to PFN, of the potential socio-economic effects of credible worst case spill scenarios and of smaller spill scenarios.Crucial elements that must be included in the application are: • Potential health effects based on specific consumption patterns (e.g.; shellfish vs. finfish; e.g. spring diet composition vs autumn diet composition) specific to south coast communities; • Potential health effects associated with abandonment of traditional diet; • The length of time for a return to baseline conditions regarding food safety (both real and perceived); • Effects, and duration of effects, on non-consumptive uses (e.g. social and ceremonial use of the land and seascapes) important to mental health and wellbeing; • A determination of significance of these potential effects.	A.2.6 Effects Assessment	19(1)(a)(b)(j)	5, 9	p 2
56	8A 5.6.2.1.1 (Problem Formulation) p8A-634	*Stochastic oil spill fate modeling completed for three of the four hypothetical spill locations described in Section 5.4 (Figure 5.5.2) was used to evaluate potential ecological effects with a preliminary quantitative ERA (Buoy J) Location H) was excluded because results of the Strait of Georgia (Location D), Arachne Reef (Location E) and Race Rocks (Juan de Fuca Strait, Location G) reflect the range and extent of ecological effects that could result from a spill along the shipping route a Project-related tanker would travel.*	The range and extent of ecological effects with respect to species and habitat types might be reflected by the models within the channel, but the geographic range and extent of those effects is not. It appears as if they were excluded from the application because the results would far exceed the boundaries of the RSA and call into question its limited extent.	The Marine RSA in the application should not exclude areas which spill modeling suggests could be affected by project-related tankers. The application need to provide information on the range and extent of effects of spills that might arise outside the RSA, particularly with respect to: 1) any sensitive shorelines or habitats which might be found outside the RSA, but which stochastic modeling suggests could be affected by a spill event, and 2) WCMRC ability to respond to a spill, the effects of which would extend outside of the RSA including transit time to the furthest areas which modeling suggests might be affected, and capacity.	A.2.6 Effects Assessment	5(1)(c) 19(1)(a)(b)(j)	5, 9	p 2

ID	EIS Section	Application Wording	Pacheedaht Comment	Required Revision	NEB Filing Manual	CEAA 2012	LoI	Board Letter
57	8A 5.6.2.1.1 (Problem Formulation) p8A-634	*Stochastic oil spill fate modeling completed for three of the four hypothetical spill locations described in Section 5.4 (Figure 5.5.2) was used to evaluate potential ecological effects with a preliminary quantitative ERA (Buoy J) Location H) was excluded because results of the Strait of Georgia (Location D), Arachne Reef (Location E) and Race Rocks (Juan de Fuca Strait, Location G) reflect the range and extent of ecological effects that could result from a spill along the shipping route a Project-related tanker would travel.*	The proprietary nature of the EBA oil weathering model precludes critical assessment of how the effects of spreading to thinner slick thicknesses than were used for the Gainford study affect evaporative losses, and the consequences of thinner slicks in combination with differing wind speeds. The accuracy of the model under realistic thin-slick, high-wind and wave conditions is not presented. The model also does not consider the possibility of oil sinking. Similarly, the environmental data used to drive the EBA hydrodynamic model to predict the trajectory and ambient conditions of spilled dilbit appears to be informed by generic accounts of weather and currents in the region (i.e. Thomson 1991, Lange 1998 and Lange 2003). Thomson 1991 does not present quantitative data on wind speeds, surface salinity or currents as a function of direction, time and season, but presents annual or seasonal averages and typical ranges instead. Generic data sources for winds and other meteorological factors are mentioned in the technical report (8C 12 TR S9, sec. 3.1), but citations for the specific data used are not given. For reasons that are not entirely clear, the specific input data for modeling spill trajectories and oil weathering are limited to data from a single year, from 1 Oct 2011 to 30 Sep 2012. This immediately excludes consideration of inter-annual variation in storm frequencies and intensities, river discharges and other model input factors. Because such variation may be considerable, the results of the modeling presented in the application should be considered as merely illustrative and cannot found a proper risk assessment.	The Proponent needs to provide its weathering model so that it can be properly asesssed. Realistic thin-slick, high-wind and wave conditions need to be presented and analyzed in the application or supporting studies. Generic accounts of weather and currents in the region should not be used - the application and supporting studies need to consider quantitative datea on wind speeds, surface salinity and currents as a function of direction, time and season. Data should not be limited to a single year - interannual variations in storm frequencies and intensities, river discharges and other model input factors need to be considered in the application and supporting studies.	A.2.6 Effects Assessment	5(1)(c) 19(1)(a)(b)(j)	5, 9	p.2
58	8B 3 of 6 Ecological Risk Assessment of Marine Transportation Spills TR 4.3 (Spatial Boundaries of PQERA (Preliminary Quantitative Environmental Risk Assessment) p 4-3	*Spatial boundaries for evaluating the environmental effects of spills originating from marine transportation accidents include the geographic domain where potential environmental effects of spilled crude oil are expected to be measurable i.e., the modelling domain for the stochastic oil spill model. The areas considered in the PQERA are identified as follows: · Oil spill footprint - the area predicted to be directly affected by floating oil resulting from a release at various locations along the shipping lanes · Regional Study Area (RSA) - The area of ecological relevance where environmental effects could potentially result from accidents and malfunctions. This area is effectively established by the limits of the domain for the stochastic oil spill modelling.*	The modeling domain and the predicted oil spill footprint (the area predicted to be directly affected by floating oil resulting from a release at various locations along the shipping lanes) are both much larger than the RSA.	The spatial boundaries for the RSA for evaluating the effects of spills need to be extended to include the anticipated oil spill footprint.	A.2.6 Effects Assessment	5(1)(c) 19(1)(a)(b)(j)	5, 9	p 2
59	8B 3 of 6 Ecological Risk Assessment of Marine Transportation Spills TR 4.8 (Aboriginal Traditional Use) 4-25	*The following description of Aboriginal Traditional Use within the Regional Study Area has been extracted from the Marine Resources Marine Transportation Technical Report Volume 8B.*	This information is not specific to PFN interests, including PFN harvesting, PFN cultural sites, and use by PFN of the marine area.	A "pan-Aboriginal approach" should not be taken in the application; the application needs to include First Nation-specific analysis and conclusions.	A.2.6 Effects Assessment	5(1)(c) 19(1)(a)(b)(j)	5, 9	p 2

ID	EIS Section	Application Wording	Pacheedaht Comment	Required Revision	NEB Filing Manual	CEAA 2012	LoI	Board Letter
60	8B 3 of 6 8.2 Potential Environmental Effects to Shoreline and Near Shoreline 8-4	*Stochastic results for both spill scenarios indicate areas with a high to very high probability of oiling (≥50%) from a spill at this location range from west of the Gulf Islands, south into US waters and throughout the Juan de Fuca Strait to the 12 nautical mile limit (refer to Figures F.1 to F.8). Protected areas and Indian Reserves in these areas which could be affected are shown on Figure C.2.*	The proponent identifies that "Indian Reserves... could be affected". The map referred to, Figure C.2, describes "Biological Sensitivity factors for shoreline habitats". Figure C1 Identifies "Protected areas and Indian Reserves". The PFN traditional territory extends well beyond the reserve identified in figure C.1. This application does not acknowledge or consider Aboriginal rights and title to areas outside the reserve. Restricting areas of interest to reserves minimizes effects to Aboriginal rights title.	The application needs to be revised to take into account Aboriginal interests beyond reserve lands.	A.2.6 Effects Assessment	5(1)(c) 19(1)(a)(b)(j)	5, 9	p 2
61	8B 3 of 6 8.3 Potential Environmental Effects of Marine Fish and Supporting Habitat 8-5	*In circumstances where crude oil is driven into this shallow water habitat by strong winds, there would be a greater potential for negative effects, including potential mortality of fish, crustaceans and shellfish.*	The Proponent did not conduct field studies to investigate and analyze Project effects. As a result, possible effects of an oil spill on seaweed, crustacean and shellfish species were not sufficiently investigated.	The application needs to provide project specific information to document how shallow water habitat might be affected by a project related oil spill including information on species of importance to PFN.	A.2.6 Effects Assessment	5(1)(c) 19(1)(a)(b)(j)	5, 9	p 2
62	8B-5 (Results of Desktop Study and Literature Review) p4-1	*table 4.1*	Does not include areas significant to the PFN. In addition, the application does not identify fish and wildlife concentrations areas or other especially high-valued habitats, threats to rare and endangered species that might face regional extirpation or even extinction, or threats to high-value Aboriginal foraging areas. Also, chronic reliance on subjective ranking schemes for habitats and species vulnerabilities have little scientific basis presented, and often appear to reflect merely the opinions and prejudices of the authors.	This table and the related analysis need to include information relevant to PFN once the TMRU study is complete, as well as other information on high-valued habitats and rare and endangered species. All of this information needs to inform the selection of VCs and indicator species, the effects assessments and the significance determinations.	A.2.6 Effects Assessment	5(1)(c) 19(1)(a)(b)(j)	5, 9	p 2
63	Marine Resources v8B_1 p 3.3 (43pdf)	*Revised acoustic modeling will be undertaken and filed as supplemental information in early 2014 to confirm these predictions (see Section 4.5, Supplemental Studies).*	This statement highlights the deficiency of the application as filed. This information needs to be included in the application, and incorporated into the analysis. It should not be be filed separately as a "stand alone" document.	The analyses in the application need to be updated with the revised acoustic modeling data.	A.2.6 Effects Assessment	5(1)(c) 19(1)(a)(b)(j)	5, 9	p 2
64	Vol 8B 2_of_6 4.1.4 (Juan de Fuca Strait) p4-4	*Aboriginal use of the Juan de Fuca Strait area includes T'Sou-ke Nation, Scia'new First Nation and Songhees Nation fishing and marine harvesting activities at various locations around Victoria and Sooke (refer to Table 4.1 in the Traditional Marine Resource Use – Marine Transportation Technical Report of Volume 8B).*	The Proponent did not include PFN traditional territory. Specifically, the Juan de Fuca Strait also encompasses PFN's traditional territory.	PFN interests should not be excluded from the description of the Juan de Fuca Strait, or from the assessment of Project effects. The application needs to be revised to take into account PFN's interests, including Aboriginal rights and title.	A.2.6 Effects Assessment	5(1)(c) 19(1)(a)(b)(j)	5, 9	p 2
65	Vol 8B-5 5.9 (PFN First Nation) p 5-9	*Issues of concern, traditional use sites or features identified through ongoing engagement with PFN First Nation will be considered for incorporation into Project planning under the guidance of existing marine transport regulations and mitigation recommendations made to date. The results of these ongoing engagement efforts will be provided to the NEB.*	As stated above, information from PFN was not included in the application; therefore the application is deficient and does not contain a description of effects to Aboriginal interests specific to PFN. This proposal suggests that PFN information will only be considered for incorporation later in the planning process. This is not sufficient for the purposes of assessing project effects.	PFN's concerns and TMU data must be considered and incorporated into the application, to inform the selection of VCs and indicator species, the effects assessments and the significance determinations. It is not sufficient to consider this information after approval, as the information is needed to inform the assessment and the consideration of the public interest.	A.2.6 Effects Assessment	5(1)(c) 19(1)(a)(b)(j)	5, 9	p 2

ID	EIS Section	Application Wording	Pacheedaht Comment	Required Revision	NEB Filing Manual	CEAA 2012	LoI	Board Letter
66	Vol 8B 6.2 (Supplemental Studies) p6-3	*The progress of each participating community's TMRU study at the time of application filing is described in Section 5.0. Ongoing TMRU study work with participating Aboriginal communities is scheduled for completion prior to construction of the Project.*	The information collected through TMRU studies must be available for use in the regulatory and assessment process, to inform the effects assessment. It cannot be used to inform the effects assessment or the determination of the public interest if it is only made available after project approval.	PFN's concerns and TMU data must be considered and incorporated into the application, to inform the selection of VCs and indicator species, the effects assessments and the significance determinations.	A.2.6 Effects Assessment	5(1)(c) 19(1)(a)(b)(j)	5, 9	p 2
67	Vol8B 6 of 6 Screening Level Human Health Risk Assessment Report p3-14	*TABLE 3.7 No Aboriginal communities are located within Juan de Fuca Strait.*	The SLHHRA failed to identify Aboriginal communities within the Juan de Fuca Strait, including Pacheedaht.	The application needs to be revised to indicate that PFN's reserves and lands subject to assertions of aboriginal title are located along the Strait.	A.2.5 Description of the Environmental and Socio-Economic Setting	5(1)(c), 19(1)	5, 9	p 2
68	Vol8B 6 of 6 Screening Level Human Health Risk Assessment Report p3-14	*Aboriginal communities were identified in Region 1 (Burrard Inlet) and Region 3 (Boundary Passage and Haro Strait) of the SLHHRA LSA. Conversely, Aboriginal communities were not identified within Region 2 (Strait of Georgia) and Region 4 (Juan de Fuca).*	The SLHHRA failed to identify any Aboriginal communities along the Juan de Fuca Strait. A risk assessment cannot credibly predict risk to a community whose activities remain uncharacterized and whose existence is unrecognized.	The application needs to be revised to indicate that PFN's reserves and lands subject to assertions of aboriginal title are located along the Strait, and to assess potential effects to those areas.	A.2.5 Description of the Environmental and Socio-Economic Setting, A.2.6 Effects Assessment, A.2.7 Cumulative Effects Assessment	5(1)(c) 19(1)(a)(b)(j)	5, 9	p 2
69	Vol 8C TERMPOL 3.3 (Fishery Resources Survey) p17	*The marine study area is also widely used by Aboriginal communities for traditional and commercial fishing activities. Marine waters are travel corridors essential for conducting traditional activities, as well as accessing cultural landscape features and traditional use areas. Further information on traditional marine resource use is provided in Volume 8B Traditional Marine Resource Use – Marine*	There is no PFN specific information in TERMPOL 3.2.	PFN-specific information needs to be incorporated into the application, and considerd in the TERMPOL studies.	na	na	na	na
70	Vol 8C TERMPOL 3.3 (Fishery Resources Survey) p35	*Traditional use of the marine study area includes fishing and shellfish harvesting activities by the following First Nations:*	This is the extent of information relating to traditional use of the marine study area in TERMPOL 3.3, which is insufficient to inform an effects assessment.	PFN-specific information needs to be incorporated into the application, and considerd in the TERMPOL studies.	na	na	na	na
71	Vol 8C TERMPOL 3.2 (Origin, Destination and Marine Traffic Volume Survey) p57	*Study states that the additional traffic transitting to and from the Westridge Terminal in 2018 would be small compared with the total vessel traffic in the various segments.*	This statement is misleading as it references the total number of vessels transiting the area over the year (such as container ships, bulk carriers, ferry boats and a multitude of pleasure boats and fishing vessels), and not just tankers. In analyzing the effects of the proposed Project, it is important to acknowledge that it is oil tankers that pose by far the greatest risk of an ecological disaster, not the other types of vessels. As a result, increasing the number of laden oil tankers from 5 to 34 per month increases the ecological risks significantly.	The application and TERMPOL studies need to be revised to reflect the increased risks posed by an increase in the number of oil tankers if the Project is approved, compared to the number of oil tankers currently transiting the marine routes. The application and TERMPOL studies also need to analyze the risks that the number of other vessels, such as container ships, bulk carriers, fishing boats, pleasure craft and ferries, give rise to in relation to the possibility of a tanker collision or grounding. This is especially important in light of the recent findings in the federal Tanker Safety Panel Report that identify southern Vancouver Island as a high risk area for an oil spill due to the level of current vessel traffic. Adding 29 additional laden oil tankers (and 29 additional unladen tankers) to these marine routes a month will increase that risk.				

ID	EIS Section	Application Wording	Pacheedaht Comment	Required Revision	NEB Filing Manual	CEAA 2012	LoI	Board Letter
72	Vol 8C TERMPOL 3.5 3.12 Appendix C: Fast Time Simulation	*Summary Report of Manoeuvering Assessment Westridge Terminals Vancouver Expansion Design Options 11 and 12*	The simulations conducted are insufficient to validate the feasibility of the proposed ship maneuvers, because the simulations were not conducted on a full mission simulator in real time. A full mission simulator will enable the navigation team to interact, in real time, with the personnel on the tug or tugs that are assisting in maneuvering the ship. In addition, the simulation scenarios were only conducted in relation to the berthing and unberthing of tankers at the Westridge Terminals. To validate the safety of the Project, simulation scenarios need to be included for other areas such as the Straits of Juan de Fuca.	The application and TERMPOL studies need to incorporate the findings of full mission simulations in real time, and include simulations of loss of power and/or sterring of the ship in areas such as the Straits of Juan de Fuca. Further simulatons are needed to consider what would occur if a tanker were disabled in the Straits of Juan de Fuca in adverse weather conditions or other situations which could cause a vessel to drift or run aground.				

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October 15, 2013

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File No. 1062-010

Kinder Morgan Canada Inc.
2700, 300 – 5th Avenue S.W.
Calgary, AB T2P 5J2

Attention: Ian D. Anderson, President

Dear Sirs/Mesdames:

Re: Pacheedaht First Nation and Kinder Morgan Canada's TransMountain Project (the "Project")

We are legal counsel to Pacheedaht First Nation and are writing to raise some issues that have arisen in the pre-application process associated with the above-noted Project. We are copying representatives of the National Energy Board, Natural Resources Canada, Environment Canada and Transport Canada on this letter, as the issues are relevant to both the hearing process for the proposed Project, as well as consultation with Pacheedaht.

As you are no doubt aware, Pacheedaht has had some preliminary discussions with Kinder Morgan's representatives to discuss its participation in the pre-hearing and hearing processes associated with the Project. Through those discussions, some issues have arisen that we feel need to be brought to your attention, as they point to some serious deficiencies and gaps in the approach that Kinder Morgan appears to be taking in relation to the assessment of this proposed Project.

As has been previously communicated to Kinder Morgan by Pacheedaht, the proposed tanker routes for Kinder Morgan's Project will go through a large portion of the marine part of Pacheedaht's Traditional Territory. Pacheedaht's members have always relied on marine resources, and continue to do so, as part of the exercise of their Aboriginal rights and title. It is our understanding that the Project will cause a seven-fold increase in tanker traffic within the Straight of Juan de Fuca. Pacheedaht expects the increase in overall traffic in its Territory to be even higher, given other applied-for and reasonably foreseeable industrial development and related marine transportation in this area.

Traditional Marine Use Data

Pacheedaht has made it clear to Kinder Morgan's representatives, from the outset of discussions between the parties, that it is critically important that Pacheedaht's Traditional Marine Use ("TMU") data be collected and incorporated into the analysis in Kinder Morgan's application before it is filed with the National Energy Board ("NEB"). The TMU study is not a "stand alone" document that can merely be filed with the NEB, without incorporation into the various analyses in the application. The data in the TMU study must be incorporated into the Project application, so that it can help inform the analysis and conclusions in relation to potential Project effects. If the TMU data is not incorporated into the Project application, major gaps will result in the analysis of Project effects, making it difficult – if not impossible – for the NEB to assess Project effects. In our experience, once a Project application is filed, particularly without TMU data, a company will not revise conclusions related to project impacts and effects, irrespective of the TMU data.

Notwithstanding these serious concerns that Pacheedaht has expressed, we understand that Kinder Morgan is intending to file the application in December, before Pacheedaht's TMU study will be completed. We ask that Kinder Morgan revisit this decision. Pacheedaht is ready, willing and able to complete a TMU study, but has been awaiting a funding commitment from Kinder Morgan, given that the TMU data is required by Kinder Morgan to help meet NEB filing requirements.

Marine Biophysical Studies

We understand through our discussions with Kinder Morgan that Kinder Morgan does not intend to undertake any biophysical studies outside Burrard Inlet, and instead intends to rely on Traditional Land and Marine Resource studies and desktop reviews. This raises serious concerns for Pacheedaht.

Traditional Land or Marine Use studies are not equivalent to biophysical studies nor do they look at various valued components or indicators that would provide information on potential adverse impacts and effects to Pacheedaht's rights and culture (see discussion below). They are completely different types of studies, with completely different study subjects, objectives and outcomes. Pacheedaht believes it would be a major gap in any application for Kinder Morgan to fail to undertake biophysical studies outside Burrard Inlet. Desktop studies are not adequate to permit the potential effects from the proposed Project to be considered and analyzed, or for the NEB to undertake an assessment of the Project.

Once again, Pacheedaht asks that Kinder Morgan revisit its intentions. Given the devastating consequences that could result from an oil tanker spill of diluted bitumen, it is unacceptable to approach the assessment of potential effects to the marine environment, and to Aboriginal rights and interests, in half-measures. A robust approach to the assessment of potential effects from tanker traffic, including in the event of an oil spill, is critical given what is at stake along British Columbia's coast. Far more than desk-top reviews are required.

Pacheedaht welcomes an opportunity to discuss with Kinder Morgan the types of studies that could be undertaken to assist in understanding effects, such as coastal sensitivity mapping, marine mammal surveys, fishing and marine resource harvesting surveys, wake studies and oil spill modeling. Pacheedaht also would like to be involved in the undertaking of such studies, including the development of methodologies to properly incorporate such studies, together with TMU, into the Project application.

If this issue is not addressed, Pacheedaht is of the view that there will be insufficient information available for the NEB to assess potential Project effects. As a small First Nation, Pacheedaht is not in a financial position to fill the information gap that will result if Kinder Morgan fails to do the necessary work itself.

Fate and Behaviour of Diluted Bitumen

One issue of particular concern to Pacheedaht is the risk that spilled diluted bitumen could sink in a marine environment. We are unaware of Kinder Morgan's intentions with respect to dealing with this issue in its application. We would appreciate the opportunity to discuss this issue with Kinder Morgan, as it is critical that this issue be fully explored and analyzed in the application, including in the context of emergency response strategies in the event spilled diluted bitumen sank. We would also like to receive all information Kinder Morgan has in relation to this issue, including any studies it has undertaken. Again, given what is at stake along the coast, this is a critically important issue.

Selection of Valued Components, Criteria and Thresholds

Pacheedaht is unaware of what valued components ("VCs"), criteria and thresholds Kinder Morgan is intending to utilize in its application, as there has been no engagement on these issues to date. It is critical that there be meaningful engagement between Kinder Morgan and Pacheedaht in choosing VCs, criteria and thresholds, as they are directly relevant to how effects to Pacheedaht's aboriginal rights, current uses, culture and interests will be assessed in the NEB process.

Pacheedaht would welcome the opportunity to engage with Kinder Morgan in devising an appropriate methodology to assess potential impacts to Pacheedaht's aboriginal rights, including title. Standard approaches to assessing impacts to biophysical elements do not, in Pacheedaht's experience, result in a meaningful assessment of impacts to aboriginal rights because they do not consider impacts such as effects on harvesting activities; on culture and cultural transference of traditional ecological knowledge; and on preferred means and locations for exercising rights.

Alternative approaches to consider these types of effects are available. Given that Pacheedaht's constitutionally-protected rights are at stake, it is imperative that an appropriate methodology be used to consider potential impacts.

TERMPOL Process

Pacheedaht would like to learn more about the TERMPOL process to be undertaken in relation to this proposed Project. Has Kinder Morgan agreed to engage in such a process? If so, has a committee been struck and, if so, can Pacheedaht participate on the committee? What studies have been commissioned or undertaken in the TERMPOL process? Pacheedaht would like to be involved in the undertaking of these studies, given their direct relevance to understanding potential effects from the Project on Pacheedaht's rights, uses and interests.

Pacheedaht also would like to understand what Kinder Morgan's intentions are with respect to the TERMPOL studies and committee's recommendations. Does Kinder Morgan intend to incorporate those into its application? If not, how will the TERMPOL studies and recommendations be integrated and considered in the NEB process? Pacheedaht is of the view that it is critically important for the TERMPOL studies and recommendations to be incorporated into the analysis set out in Kinder Morgan's application to the NEB.

Consultation

It is unclear to Pacheedaht whether any aspects of Crown consultation have been delegated to Kinder Morgan. Can you please advise as to your understanding in this regard?

Pacheedaht is concerned about the complete lack of Crown consultation to date, and will be writing to various federal departments under cover of a separate letter to specifically raise those concerns and seek engagement on the design of a consultation process for this proposed Project.

Pacheedaht looks forward to hearing from you on these important matters.

Yours truly,

Janes Freedman Kyle Law Corporation

Per:

Rosanne M. Kyle

RMK/ejr

cc: Dorothy Hunt, Band Manager, Pacheedaht First Nation
Peter Forrester, Assistant General Counsel, Kinder Morgan: Peter_Forrester@kindermorgan.com
National Energy Board, att'n: Dr. Robert Steedman, Professional Leader/Chief Environmental Officer: (robert.steedman@neb-one.gc.ca)
Natural Resources Canada, att'n: Serge Dupont, Deputy Minister: (serge.dupont@nrcan.gc.ca)
Environment Canada, att'n: Paul Kluckner, Regional Director General: (paul.kluckner@ec.gc.ca)
Transport Canada, att'n: Michael Henderson, Regional Director General: (michael.henderson@tc.gc.ca)

Hwlitsum First Nation's Analysis of the effectiveness of the TERMPOL[1] Review of Trans Mountain Pipeline's Proposal

March 5, 2014

(Prepared by Alan Grove)

A Brief History of the TERMPOL Review Process

In 1977, Transport Canada implemented the TERMPOL process as "a means to of precisely and reliably measuring the risks associated with the location and of marine terminals for large oil tankers."[2] Five years later, the TERMPOL process was expanded to "include, on a voluntary basis, proposals for marine terminals designed to handle bulk shipments of liquefied natural gas (LNG), liquefied petroleum gas (LPS), and chemicals." [3]

In 1995, the Canadian *Environmental Assessment Act* came into force "making parts of the existing (TERMPOL) Code irrelevant to respond fully to the requirements of the new Act." And in 1999, the "Canadian Coast Guard joined the Department of Oceans and Fisheries" and Canada "decided that navigation assessments under the *Navigable Waters Protection Act* would be made by" Transport Canada. These changes caused Transport Canada, in 2001, to revise TERMPOL for a third time.

TERMPOL has not been revised since 2001.

A brief review of *Haida Nation v. British Columbia (Minister of Forests) 2004 SCC 73*

[1] TERMPOL is an acronym for "Technical Review Process of Marine Terminal Systems and Transshipment Sites".
[2] Transport Canada, TERMPOL Review Process 2001at 1.
[3] *Ibid.*

Since 2004, when the Supreme Court of Canada's ruled in *Haida*, proponents have a duty to consult with First Nations in British Columbia. The court found that the Crown has a "duty to consult with Aboriginal peoples and accommodate their interests".[4] This duty is grounded in the honour of the Crown, and applies even where title has not been proven. The scope of this duty will vary with the circumstances; the duty will escalate proportionately to the strength of the claim for a right or title and the seriousness of the potential effect upon the claimed right or title. However, regardless of what the scope of the duty is determined to be, consultation must always be meaningful.

Where there is a strong *prima facie* case for the claim and the adverse effects of the government's proposed actions impact it in a significant (and adverse) way, the government may be required to accommodate. This may require taking steps to avoid irreparable harm or minimize the effects of the infringement.

Does *Haida* apply to Transport Canada?

It is well known that First Nations in British Columbia have either laid a claim of aboriginal title or *section 35* interests to virtually all the land and waters in, and surrounding, British Columbia.

Equally well known is that First Nations in British Columbia continued to exercise their constitutional right fish and harvest in the coastal waters surrounding British Columbia. In the Salish Sea, waters that once were only travelled and harvested by First Nation people, ever increasing levels of vessel traffic now compete for space. Similarly, oil tankers and other vessels routinely anchor near beaches in the Gulf Islands that continue to be harvested by First Nation

[4] *Haida Nation v. British Columbia (Minister of Forests) 2004 SCC 73* at 16.

people. The increased vessel traffic and vessel anchoring has adversely impacted many First Nation's section 35 interests. For example, many Hwlitsum gill-net fish and each time a large vessel approaches their net, they have to pick it up out of the water or risk having it cut in half. Similarly, Hwlitsum harvesters routinely learn that clam beaches have been closed due to overharvesting or pollution.

Few, if any, would argue that the transport of oil by tankers does not have the potential to adversely impact First Nations' section 35 rights.

Thus, Transport Canada's failure to ensure that TERMPOL is consistent with the duty to consult required by Haida is dishonorable.

TERMPOL's Kinder Morgan review

The primary benefit of Trans Mountain's (Kinder Morgan) TERMPOL review was that it afforded Transport Canada and Trans Mountain an opportunity to conduct an informed and detailed review of the proposed project. For example, experts in the field were able to recommend measures that improve safety and the need for regulatory improvements or special measures.

Trans Mountain's (Kinder Morgan) TERMPOL review primary flaw is that First Nations were not consulted and the report does not consider or address their concerns.

Other, more general in nature, flaws are of the TERMPOL processes are:

1. It is a voluntary. Moving oil on water is a serious business and the review process should not be voluntary. Moreover, since all previous marine petroleum terminal projects have undergone TERMPOL, why not redraft the policy and make it mandatory? This would afford an opportunity to incorporate *Haida* (the duty to consult) into the review process

and thereby compel Transport Canada to hear and, where necessary, accommodate the voices of First Nations.

2. The TERMPOL process was basically conducted in secret. The documentation the proponent is tasked with furnished is kept confidential, with the public not having any access to it. Nor was there any public or First Nation input into the process. In short, there was absolutely no form of public consultation involved in this TERMPOL. This leaves First Nation leadership with the distinct impression that shippers and government regulators have a cozy relationship that only benefits big business.

3. Finally, the TERMPOL process did not take into account the effects of rapid expansion of container traffic vessels or coal barges travelling through the Salish Sea.

In summary, what at first glance appears to be rigorous independent government review of coastal development projects with a marine shipping component is actually a voluntary, industry led review. In the case of the Trans Mountain project, the evaluation of the marine component must be amended so that it incorporates First Nations' knowledge and perspective and addresses their concerns.

The Hwlitsum First Nation readily acknowledges that Kinder Morgan has reached out to both the Cowichan Nation Alliance and the Hwlitsum First Nation in an attempt to integrate their views of the TERMPOL report into their submission. Hopefully, by working together in good faith, we can reach agreement on the outstanding issues before appearing before the National Energy Board.

Specific Concerns, Comments and Questions

TERMPOL 3.5 & 3.12 – ROUTE ANALYSIS & ANCHORAGE ELEMENTS
Trans Mountain Expansion Project

1. In accordance with the Termpol Review Process (TRP) Guidelines, TP743E 2001, Section 3.5, "the objectives of this survey are to assess ship and route safety, the adverse effects of ship accidents and, when applicable, public safety matters associated with the transportation of bulk oil, liquefied gas, chemicals, or other cargoes in ships that serve the marine terminal or transhipment site." As the project deals with tanker shipping, the assessment shall be primarily focused on this one type of vessel.[5]

2. Currently, in a typical month, five vessels are loaded at the terminal. The expanded system will be capable of serving 34 Aframax class vessels per month, with actual demand driven by market conditions.

   Comment: Can Kinder Morgan provide a study of examining how much tanker traffic and large vessel traffic will increase over the next twenty years? Your traffic would increase by as much as 700% over the next 3 to 5 years. Our rough estimate is that all traffic will grow by 1000% in the next 10 years. Everyone needs accurate information to properly estimate the probability of a collision or spill.

3. The maximum size of vessels (Aframax class) served at the terminal will not change as part of the Project.[6]

   Comment: Washington State's ports will not allow any vessels larger that the Aframax class vessels into its ports. Since Kinder Morgan has committed to limiting their vessels to Aframax class vessels, it appears that the two jurisdictions will have an easier time in developing spill prevention and clean-up plans.

4. One of the main issues in transiting and clearing the First Narrows is interference caused by small pleasure craft fishing at the mouth of the Capilano River. A large ocean going vessel has limited manoeuvring room and has few options once committed to the transit, other than slowing down, the vessel is required to maintain course. The harbour patrol craft and/or one of the assisting tugs will assist the tanker in this matter.[7]

5. The small vessels fishing in the area of the Capilano River mouth are obliged by law to avoid hindering a large vessel in a navigation channel and restricted in its ability to manoeuvre by its deep draught. An event of this nature could have serious consequences for the small craft should a collision or capsizing occur as a result of a near miss or contact with a large ocean going vessel such as a tanker.[8]

   Comment: Is it Kinder Morgan's position that in instances where First Nation people are harvesting in small boats for section 35 purposes (food, social and ceremonial) that

[5] TERMPOL at 2.
[6] *Ibid.*
[7] *Ibid* at 8.
[8] *Ibid* at 8.

they are obliged by law to move so that an oil tanker can move through their traditional waters?

6. Tug & Barge and/or slow moving log tows are more likely to pose a hindrance, particularly in areas where they are obliged to cross the TSS corridors i.e. when approaching or leaving the mouth of the North Arm of the Fraser River, particularly so in restricted visibility. The use of AIS, good communications with MCTS, participation in VTS and the prudent use of radar are essential in such circumstances. Precautionary areas have been established in the areas where major traffic lanes converge and vessels cross.[9]

7. Once clear of English Bay and the mouth of the North Arm to the Fraser River the vessel is unlikely to meet with any conflicting marine traffic other than perhaps fishing vessels, tugs & barges, and recreational craft. However, these smaller vessels tend to stay well inshore and out of the way of large ocean going vessels.[10]

   Comment: What about the tugs and barges from Fraser Surrey Docks, VAFFC fuel barges, Delta Port Coal tankers, etc.? Similar to the point above, this is precisely the location where Hwlitsum small boats will be fishing? Is it Kinder Morgan's position that in instances where Hwlitsum are harvesting in small boats for section 35 purposes (food, social and ceremonial) that they are obliged by law to move so that an oil tanker can move through their traditional waters?

8. There is a regular flow of ferry traffic crossing the Strait of Georgia. However, the ferries are very familiar with traffic in this area and being highly manoeuvrable and manned by experienced officers remain clear of the larger vessels. The appropriate collision rules apply in case of a crossing situation developing between a tanker and a ferry. Consequently this is not viewed as a concern.[11]

   Comment: Actually, BC Ferries has had a number of accidents over the years, most notable Active Pass Collision between *Queen of Victoria* and *Sergey Yesenin* (1970) and the Queen of the North sinking (2006).

9. **6. NAVIGATIONAL HAZARDS**

   6.2 Segment 2

   Other marine traffic including arriving and departing traffic to Neptune Terminals, Vanterm Container Docks, the cross-harbour 'Seabus' ferry and local Tug & Barge traffic.

[9] *Ibid* at 10.
[10] *Ibid* at 11.
[11] *Ibid* at 11.

Vancouver Wharves immediately east of Calamity Point, in the First Narrows.

Small fishing and pleasure boats congesting the mouth and adjacent waters of the First Narrows immediately south of the Capilano River mouth. These small vessels frequently cause conflicting situations with the safe passage of large ocean going vessels when they obstruct the approach and departure channel.[12]

Comment: This illustrates our position that a comprehensive study of all current vessel traffic and a projection of future vessel traffic needs to be completed before a decision to increase oil tanker traffic is made.

6.3 SEGMENT 3

Outer Harbour anchorages, when occupied.

Other marine traffic including arriving and departing traffic to the Port of Vancouver, and local Tug & Barge, Log Tow traffic.

Small fishing and pleasure craft including sailing yachts. These small vessels frequently cause conflicting situations with the safe passage of large ocean going vessels when they obstruct or cross the specified TSS routes.

Comment: This also illustrates our position that a comprehensive study of all current vessel traffic and a projection of future vessel traffic needs to be completed before a decision to increase oil tanker traffic is made.

Tugs & barges, Log Tows, approaching or departing the North Arm of the Fraser River.[13]

10. **6.7 SEGMENT 7**

Fishing vessels (Drift nets, Purse Seine nets) likely concentrated in the area and may be encountered throughout the Juan de Fuca Strait from April to November.[14]

Comment: Fishing vessels (drift nets, trollers and purse seines) are also found in front of Canoe Pass (Hwlitsum), Fraser River, and other portions of the Salish Sea. Recommend we discuss how to manage this traffic.

11. **11.2 REAL TIME SIMULATIONS**

Real time simulations will be carried after completion of detailed design. These will be planned in consultation with PMV, PPA and BCCP. . .[15]

Comment: The Cowichan Nation Alliance should be consulted about taking part in these real time simulations.

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[12] *Ibid* at 25.
[13] *Ibid* at 26.
[14] *Ibid* at 26.
[15] *Ibid* at 36.

TERMPOL 3.11 – CARGO TRANSFER AND TRANSSHIPMENT SYSTEMS

1. The marine oil handling facility currently also handles jet fuel, which is normally received via barges. This activity is expected to continue in future as well and the types of vessels used to transport such a product to the terminal is not expected to change as part of the project.[16]

   Question: How many barges will be loaded? If the project is approved, will there be more or less barges than currently handled?

2. **2.2. TANKER AND BARGE SPECIFICATIONS**

Question: In Washington State, tanker size limited to 125,000 DWT east of Port Angeles;[17] will Trans Mountain (Kinder Morgan) commit to supporting a tanker size limit of 125,000 DWT in BC waters?

TERMPOL 3.19 - OIL HANDLING FACILITIES REQUIREMENTS

No comments (section is only 2 pages long).

TERMPOL 3.18 – CONTINGENCY PLANNING

1. Trans Mountain does not own or operate any of the vessels that call at Westridge Marine Terminal and is under law not responsible for responding to a vessel related incident. However, Trans Mountain is fully capable of responding in an adequate manner and of bearing all costs for a Westridge marine terminal related incident and has an agreement with WCMRC for on water response in case of an oil spill at the terminal. **Trans Mountain currently has $750 million of spill liability insurance and intends to continue to maintain similar levels of spill liability insurance over the life of the project.** On commissioning of the TMEP project, TM financial structure is projected at

[16] *Termpol 3.11: Cargo Transfer and Transshipment Systems* at 2.
[17] Chip Boothe, Washington State Department of Ecology, "Changing Risk Picture in the Pacific Northwest" paper presented to BC Ministry of Environment's 2013 BC Land Based Spill Preparedness and Response Symposium (March 2013) at 10.

$6.4 billion in assets (existing $1B plus increase of $5.4B for expansion) with $3.2 billion in equity (assuming 50/50 debt/equity ratio).[18]

Question: If the number of tankers increases from 5 to 34 per month, shouldn't Kinder Morgan increase its spill liability insurance proportionality?

2. Prior to arrival, the **vessel will enter into an arrangement with WCMRC for spill response** and upon notification by the Master of the vessel, or upon being called by a Government Agency such as the CCG, WCMRC will carry out oil spill response activities.[19]

   Comment: What kind of "arrangement"? We need to see details before commenting. It is important to note that Kinder Morgan and the Hwlitsum have agreed to work together on spill response and remediation plans.

3. For the purpose of project tankers, it is Trans Mountain's opinion that given the level of current risk mitigation measures in place and proposed future risk mitigation measures, including increased tug escort of the tankers, the probability of a tanker requiring salvage is not a credible risk. However, if such an event should occur, there are resources available in the region that could provide such a service; e.g. a rescue tug is based in Neah Bay, a large number of tugs used for harbour and vessel escort service as well as tugs of opportunity; as well, the presence of a number of globally reputed salvage companies with offices in this area.[20]

   Comment: The issues of salvage and spills are inextricably linked – if a tanker sinks there needs to be salvage operation and spill clean-up. Kinder Morgan asserts that a tanker requiring salvage is not a "credible risk". Yet, in Washington State, where they have much more experience, the state pays for a rescue tug to be available on a 24 hour basis. Should we rely on information provided by relatives in Neah Bay and Washington State officials, or this report?

4. Both Canada's and the international frameworks are based on the **principle of "polluter pays"**, which makes the polluter liable for all response costs and damages associated with an oil spill (Transport Canada 2013c). In the unlikely event of an oil spill from a tanker in Canadian waters, the owner of the tanker (*i.e.*, the Responsible Party) will be liable for the cost of clean-up and compensation to affected parties subject to established limits of liability.[21]

   Comment: The "polluter pays" model simply does not afford sufficient protection for First Nations. Look at, for example, Lac Magnatic, where the primary company simply declared bankruptcy and left the bulk of the bill to Canadian citizens.

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[18] TERMPOL 3.18 – CONTINGENCY PLANNING at 2.
[19] *Ibid* at 4.
[20] *Ibid* at 5.
[21] *Ibid* at 7.

5. As well, a widely defined class of parties in the Canadian fishing industry may claim against the SOPF for loss of income caused by an oil spill from a vessel and not recoverable otherwise under the *MLA* (Transport Canada 2013d).[22]

   Comment: It is my understanding that First Nations cannot access SOPF if their section 35 fisheries are adversely impacted. If I am correct, will Kinder Morgan commit to compensating our communities if there are adversely affected?

   Mike Davis provided me information on this issue that it was possible for First Nations to claim damages. Would like to discuss this in more detail.

TERMPOL 3.15 – GENERAL RISK ANALYSIS AND INTENDED METHODS OF REDUCING RISKS

Comment: Reserve comment on this section and all the other sections until Cowichan Nation Alliance comments.

[22] *Ibid*.

July 22, 2014

Tsawwassen First Nation

1926 Tsawwassen Drive
Tsawwassen, BC V4M 4G2

Attention: Tsawwassen First Nation

Dear Mr. Colin Ward:

Re: Technical Review Comments for TERMPOL Submission, Trans Mountain Pipeline ULC

Thank you for your letter of April 10, 2014 in which you provide Tsawwassen First Nation's ("Tsawwassen") comments on the TERMPOL Review of Trans Mountain Pipeline ULC's proposed Trans Mountain Project ("the Project"), as prepared by representatives of LGL Limited, Mr. Mike Demarchi and Mr. Bob Bocking.

We appreciate your input on the Project and have taken your comments into careful consideration. We are pleased to provide the following additional information in response to your concerns:

Risk Modelling

Request

Tsawwassen understands that the Marine Accident Risk Calculation System (MARCS) Model used by Det Noske Veritas (DNV) has been reviewed by the National Academy of Science. Tsawwassen would appreciate receiving digital copies of those reviews.

Response

Trans Mountain is aware that DNV has provided marine risk assessment services for other projects globally and has a solid reputation in this area of work. Trans Mountain conducted informal interviews with other project proponents and industry experts before engaging DNV. No formal evaluation of the MARCS model has been conducted.

The following is a comparison of DNV and Genivar results. Genivar prepared the risk assessment that informed the Tanker Safety Expert Panel Report:

The reports prepared by the Tanker Safety Panel as well as the risk assessment conducted by Genivar were released in December 2013, only a few weeks prior to Trans Mountain submitting its own Application to the National Energy Board. These reports were not available during the time when Trans Mountain's own risk assessment study was being completed and, therefore, the results of Trans Mountain's risk assessment have been arrived at independent of the information in the Genivar report. Since their release, the Tanker Safety Panel report as well as the risk assessment conducted by Genivar has been reviewed and the results and recommendations compared with Trans Mountain's own risk assessment. This is briefly discussed below.

The Genivar study estimates the risk of pollution from marine oil spills in Canadian waters south of the 60th parallel. A total of 77 zones were allocated a frequency of spill and an environmental sensitivity (derived from environmental geographic layers describing the physical, biological and human environments in each of the 77 zones), which were then applied to generate a risk estimate. The study showed that the probability of spills varies greatly across the country. Among its conclusions, it mentions that the largest marine traffic volumes are observed in the Pacific Coast sector where the probability of small size fuel spills is the highest. It calculates that in the case of a spill of cargo oil, 86% of spills would be less than 1000 m^3 in volume.

The Genivar report provides summaries of the estimated spill frequency for the Pacific Coast sector and its sub-sectors. Tables 5.1 to 5.3 in the report indicate the potential spill frequency for each of the three oil type (crude oil cargo, refined oil cargo, and oil carried as fuel), for each of the four spill size ranges, with a breakdown per sub-sector and zone (nearshore, intermediate and deep-sea). The Pacific Coast nearshore part of segment 5 in sector 1 is closest in comparison with the Marine study area of the Project and the area for which a quantitative risk assessment was completed by DNV GL (see the Facilities Application, Volume 8C – TERMPOL 3.15). Analysis of the results show that Genivar calculated the return period of an oil spill accident of any oil (crude or refined) occurring on the BC nearshore (within 12 NM from the coast) region based on present traffic is a one in 78 year occurrence. DNV GL was somewhat more conservative and calculated the return period of a cargo oil spill accident of any size as a one in 62 year event. Both risk assessments indicate that the majority of cargo oil spill volumes will be relatively small. It is interesting to note that both risk assessments, conducted independent of each other, using separate methodologies, provided similar results on the probability of a cargo oil spill accident within a similar (not same) area.

A summary table showing the similarity of the results from both models is shown below:

Estimated Oil Spill Frequency for the Marine Study Area - ***All tankers and oil carrying***					
Calculated by	***Conditions***	***Spill size****	***Return Period (once every "x" years)***		
			Crude oil	***Refined products***	***Cargo oil***
Genivar	***Current traffic*** with existing risk reducing measures	Any size	261	112	78
			Trans Mountain	***Other Oil Traffic***	***Cargo oil***
DNV GL	***2018 traffic without TMEP*** with existing risk reducing measures	Any size	310	77	62
	2018 traffic with TMEP with existing and proposed additional risk reducing measures in place	Any size	236	76	58

** 86 % of potential spill accidents will be less than 1000 m^3 size according to the Genivar report*

<u>Request</u>

The TERMPOL submission must provide a better accounting of the role of military vessels in the risk management framework so that collision risks are better understood.

<u>Response</u>

Information on the movement of naval submarines is not published and therefore cannot be provided. However naval vessels (including submarines) travelling on the water's surface will adhere to International rules such as COLREGS (The International Regulations for Preventing Collisions at Sea) and interact with other marine traffic as any other vessel is required to do. Should there be a naval exercise taking place, information on that will be publicised to all mariners through broadcast channels such as NAVAREA XII warnings. Whenever possible, such warnings are publicised at least five days prior to the scheduled event. Mariners would then be requested to keep clear of the area where the exercise is taking place. Interaction with naval vessels is not considered to be an item that would materially change the results of the marine quantitative risk assessment completed as part of the Project application by DNV.

Request

A range of output values from the MARCS model would have been anticipated, which would allow for the calculation of confidence intervals for those estimates. Absent this information, it is not possible to gauge either the precision of the estimate or the degree to which the change in the estimate is actually meaningful.

Response

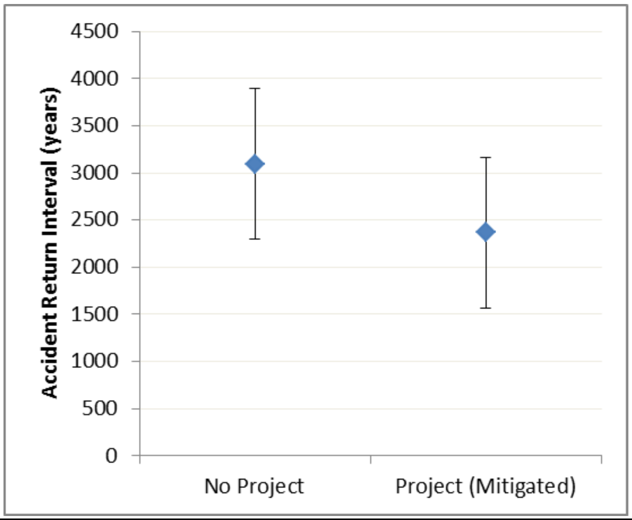
The MARCS model applies a mathematical incident calculation based on the distance to shore and other vessels in grid cells, which is combined with event trees. This type of accident modeling used in risk assessments does not provide any standard deviation estimates.

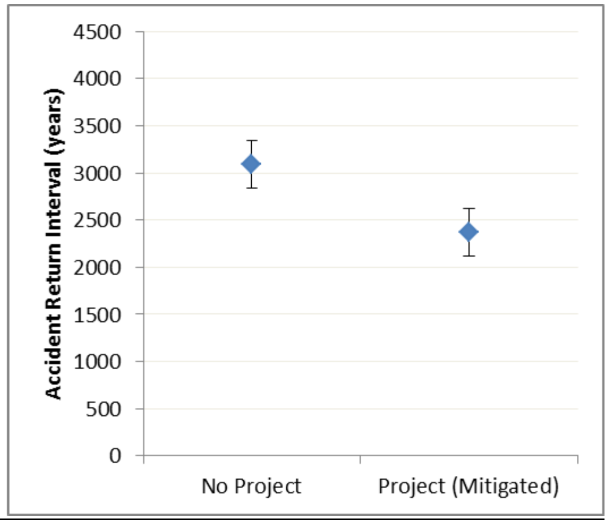
The probabilities of having an oil spill and the estimated outflow volumes given a collision or grounding are estimated using Monte Carlo simulations; 50,000 different outcomes were calculated. It is possible to calculate standard deviation from these data, such as the variation in P90 and P50 oil spill volumes can be shown. However, the variations are relatively small, and in order to evaluate a credible worst case spill, the highest spill volumes of the estimated P90 and P50 volumes for use in the analysis were selected. This is considered to be a conservative approach.

Request

The following charts illustrate the value in presenting information on estimate precision. Both charts show the DNV model point predictions for the probability (in 2018) of a credible worst case oil spill: 1 in every 3093 years assuming the project does not proceed [i.e., status quo operations and growth] and no additional safety enhancements are made 'No Project') and 1 in every 2366 years assuming the project proceeds and additional safety enhancements (mitigation) are implemented. Two sets of hypothetical confidence intervals are presented for illustrative purposes only. The sizes of the confidence intervals were arbitrarily set as equal for the two scenarios within each chart, but we expect that actual model output would show them to be different. On the left, the confidence intervals overlap to the point that the two scenarios might not be statistically different, whereas on the right, it is clear that statistical testing would reveal a difference. Beyond statistical hypothesis testing, the practical meaningfulness (e.g., for management purposes) of the difference between these values is another matter altogether

Interpretation of the meaningfulness of the difference can only be gained through completion of an impact assessment that examines the environmental, social, and economic implications of the outcomes of the risk analysis and the extent to which mitigation might serve to mitigate the risks and consequences of an oil spill.





Response

Regarding the second part of this information request, please note that the Facilities Application and the TERMPOL studies together comprise an impact assessment on the social, economic and environmental implications of the marine aspect of the project. Additional risk reducing measures proposed by Trans Mountain serves to reduce the probability of an accident and improved response readiness will better mitigate the consequences of a spill. It has been calculated statistically that should the project proceed, the probability of an oil spill in the region will remain similar to its current level, within 7%; while the size of the tankers and therefore the size of a credible worst case oil spill will remain the same as it is today, proposed significant enhancements to the existing oil spill response regime will more than double the resident capacity of spill response capacity in the region as well as significantly reduce response times at all locations along the tanker's route within Canadian territorial waters and will thereby mitigate the social, economic and environmental consequence of a spill..

Request

The modelling would be more meaningful for identifying appropriate mitigation measures if the accident risks and consequences were calculated and presented for each study segment as well as for each season.

Response

Please see the table below for the probability of a credible worst case oil spill by route segment:

Return period (years)	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7
Collision	811,570	26,640	862,250	466,850	21,920	960,380	45,860
Structural failure	1,481,040	249,650	1,727,120	1,098,900	58,940	3,378,380	198,060
Fire / Explosion	744,770	125,540	1,186,240	754,150	42,100	2,583,980	146,670
Powered grounding	1,858,740	470,300	79,490	N*	16,050	N*	N*
Drift grounding	N*	1,651,530	154,080	152,670	74,630	315,460	7,820
Overall	258,360	19,140	46,190	91,510	6,170	204,320	6,190

N* = negligible frequency

The oil spill modeling available in Volume 8C TR8C-12, S9 - Modeling the fate and behaviour of marine oil spills for the Trans Mountain Expansion Project provides certain quantitative information on the unmitigated effect of a credible worst case oil spill during different seasons. Various maps and tables have been provided for this purpose.

Liability

Request

Tsawwassen seeks confirmation that all tankers that presently call to Westridge Terminal, and those that would do so if the Project proceeded, are operated by companies that are capable of and prepared to cover the necessary costs of spill prevention, cleanup, rescue, rehabilitation, remediation, and monitoring.

To the extent that a given company or companies are unable to do this, Tsawwassen seeks assurances from Trans Mountain that adequate financial resources exist to address a full range of potential spill scenarios in a timely and effective manner.

Response

Trans Mountain understands that the Government of Canada is currently in the process of reviewing Canada's Marine Oil Spill Preparedness and Response Regime. In its recent report, *A Review of Canada's Ship Source Preparedness and Response Regime – Setting the Course for the*

Future, the Federal Tanker Safety Expert Panel recommended that the current limit of liability per incident within the Canadian Ship-source Oil Pollution Fund (SOPF) should be abolished.

On May 13, 2014, the Government of Canada announced it will enhance the liability and compensation regime by introducing legislative and regulatory amendments to:

- Allow the full balance of the SOPF, currently about $400 million, to be available in the event of an oil spill;
- In the event that all available sources of funds have been exhausted by spill-related claims, the Government of Canada will ensure compensation is provided to eligible claimants, and then recover those payments from the marine oil transport industry through a levy; and
- Align the SOPF with international funds by covering pure economic losses suffered by people who have had a loss of earnings but whose property has not been contaminated by an oil spill.

Trans Mountain notes that these recent federal government announcements regarding changes to tanker and pipeline liability and compensation were not accompanied by proposed legislation, and that the announcements were made during the information request response period. Accordingly, Trans Mountain has not had the opportunity to conduct a detailed analysis of these proposed legislative changes and it should be assumed that other information request responses related to these topics are being provided without the benefit of such analysis, unless otherwise indicated in the response.

See also Volume 8A, Section 1.4.1.6 of the Application which provides additional information about the *Marine Liability Act* and the SOPF.

Integration with Other Regional Initiatives

Request

Tsawwassen seeks assurances that the TERMPOL Review Committee will take the findings of these studies (the Tanker Safety Panel Secretariat, *A review of Canada's ship-source oil spill preparedness and response regime: Setting the course for the future* and the Puget Sound Partnership, *Preventing oil spills from large ships and barges in northern Puget Sound and Strait of Juan de Fuca: VTRA 2010 Final Report*) into consideration in preparing their report.

Response

Trans Mountain has reviewed both studies and so has the TERMPOL Review Committee. Trans Mountain believes that the marine risk assessment and recommendations, which includes additional preventative and consequence reducing measures, are suitably risk informed and in accordance with the National Energy Board's Letter, "Filing Requirements Related to the

Potential Environmental and Socio-Economic Effects of Increase Marine Shipping Activities, Trans Mountain Expansion Project" dated 10 September, 2013.
Additional information can be obtained directly from the TERMPOL Review Committee.

Fisheries

Request

Tsawwassen found the TERMPOL submission to be deficient in its consideration of potential effects of increased shipping on fishing ground activities. There is inadequate treatment of Aboriginal fisheries let alone Tsawwassen Treaty rights to fish.

Response

The marine traffic survey using AIS helps to establish good understanding of the types of vessels and their levels of use of the marine network. It also provides a sense of the potential for harm that could be caused by other traffic to Project tankers. It is used as an input to the quantitative risk assessment to calculate the probability of incidents, mainly collisions. In this respect, while the potential exists for a navigation conflict between a Project tanker and a small fishing vessel or recreational craft, the potential for damage to the tanker as a result of such an incident is minimal at best and will not lead to any damage to the cargo hull of a double hull tanker. As such, changes to the number of fishing vessels does not materially affect the results of the quantitative risk assessment, which can be found in Volume 8C TR 8C-12 TERMPOL 3.15.

Wildlife

Request

There is no mention of how the Project may contribute to the underwater soundscape. Tsawwassen expects that the matter of underwater noise and its associated implications will be fully addressed in the NEB Application.

Response

Although operating legally, the increase in Project-related marine vessel traffic will contribute additional underwater noise to the existing adverse acoustic conditions in the Marine RSA. This increase is expected to be proportionately small relative to overall current marine transportation activities in the region. For southern resident killer whales, it was determined that the current status of that population meant that any residual effect beyond current levels was undesirable.

Furthermore, the entire population spends much of its time in the Marine RSA. For that reason, effects on southern resident killer whales (SRKW) were determined to be significant. Please see Section 4.3.7.6 of Volume 8A for further details.

Trans Mountain is committed to working with DFO and other stakeholders on implementing the Action Plan for the Recovery of the Southern Resident Killer Whale as well as developing other strategies to assist in SRKW recovery.

Cumulative Effects

Request

It is not clear that the full extent of the cumulative effects of marine transportation in the future have been considered in the TERMPOL submission. Expansion of Deltaport and Westridge, and the concomitant cumulative increases in marine vessel traffic, present notable concerns for potential risks to marine biota and other Treaty interests of Tsawwassen that warrant a comprehensive assessment.

Response

Trans Mountain believes that the number of sailing shown in Volume 8C, TERMPOL 3.2, Tables 6-6 and 6-7 adequately captures the possible contribution of Delta Port expansion to the total number of sailings of Cargo/Carrier in 2018, 2020, and 2025.

We appreciate Tsawwassen's comments and look forward to continued engagement with Tsawwassen regarding the Project.

Sincerely,

Michael Davies
Senior Director, Marine Development
Trans Mountain Expansion Project

July 21, 2014

Janes Freedman Kyle Law Corporation
Suite 340-1122 Mainland Street
Vancouver, BC V6B 5L1

Attention: Rosanne M. Kyle

Dear Ms. Kyle:

Re: Trans Mountain Pipeline ULC's Proposed Trans Mountain Project ("the Project")

Thank you for your letter of February 18, 2014, in which you provide Pacheedaht First Nation's ("Pacheedaht") comments on the TERMPOL Review of Trans Mountain Pipeline ULC's proposed Trans Mountain Project ("the Project"). We appreciate your input on the Project and have taken your comments into careful consideration. We are pleased to provide the following additional information in response to your concerns:

Fishery Resources Survey

Request

Pacheedaht First Nation-specific information needs to be incorporated into the application and considered in the TERMPOL studies regarding traditional and commercial use of the marine study area, including fishing and shellfish harvesting.

Response

The primary purpose of the TERMPOL Review Process is to assess the navigational and operational safety of the proposed tanker traffic.

Through discussions with Transport Canada during the scoping process for the TERMPOL studies, it was recognized that there was a certain amount of overlap between the TERMPOL process and the NEB process. To avoid duplication it was agreed that the TERMPOL elements pertaining to fisheries should focus on vessel traffic and identifying the geographic areas where various species of commercial and recreational interests were harvested. Discussion of socio-economic issues including Aboriginal traditional and commercial fishing activities is provided in the Facilities Application in *Volume 8B Traditional Marine Resource Use – Marine Transportation Technical Report.*

Origin, Destination and Marine Traffic Volume Survey

Request

The application and TERMPOL studies need to be revised to reflect the increased risks posed by an increase in the number of oil tankers if the Project is approved compared to the number of oil tankers currently transiting the marine routes.

The application and TERMPOL studies also need to analyze the risks that the number of other vessels, such as container ships, bulk carriers, fishing boats, pleasure craft and ferries, give rise to in relation to the possibility of a tanker collision or grounding. This is especially important in light of the recent findings in the federal Tanker Safety Panel Report that identify southern Vancouver Island as a high risk area for an oil spill due to the level of current vessel traffic. Adding 29 additional laden oil tankers (and 29 additional unladen) will increase that risk.

Response

The statement in TERMPOL 3.2, Origin, Destination and Marine Traffic Volume Survey is accurate. It is not meant to indicate the relative risk of any one type of vessel to the marine network. This study also includes information of the different types of vessels in the marine network and their relative percentage of movement as well as miles travelled within the marine study area.

For the risk of an incident involving a Project tanker or the risk of an oil spill from a Project tanker in case it is involved in an incident, please see TERMPOL 3.115, General Risk Assessment and Intended Methods of Reducing Risks. That study shows that the Project will not change the route, size or type of vessels, or the type of cargo carried compared to existing traffic, and thus the nature of the navigation hazards will not change compared to the current situation. The Project will increase the number of tankers and therefore increase the probability of an incident compared to current levels. However, the various existing mitigation measures (such as the use of a double hull on tankers, pilotage practices, etc.) combined with additional proposed changes to the existing tug escort and collision avoidance protocols and improvements to spill response capability will mitigate the increased risk so that the net effect is that the overall risk will be similar to existing levels.

Fast Time Simulation

Request

The application and TERMPOL studies need to incorporate the findings of full mission simulations in real time, and include simulations of loss of power and/or steering of the ship in areas such as the Straits of Juan de Fuca.

Further simulations are needed to consider what would occur if a tanker were disabled in the Straits of Juan de Fuca in adverse weather conditions or other situations which could cause a vessel to drift or run aground.

Response

The navigation simulations completed to date were intended to provide an initial proof-of-concept for the preliminary berth layouts and to help inform the TERMPOL Review Committee during their review process. Additional simulations of the berthing and departure manoeuvres at the Westridge Terminal are planned in the future.

There will be no change to the route, size or type of vessels, or the type of cargo carried compared to existing traffic. Navigation of Aframax-class tanker vessels has taken place safely in these waters, including the Straits of Juan de Fuca, for many years and the safety issues and marine protocols are well understood by the marine community. The nature of the navigation hazards will not change compared to the current situation.

Therefore, additional navigation simulation scenarios for the Straits of Juan de Fuca are not deemed necessary and are not planned to be undertaken.

Regarding the second part of the request, the probability of a Project tanker becoming disabled in the Juan de Fuca Strait is of low likelihood. However, should it occur, the escort tug assigned to the Project tanker will prevent the vessel from drifting to shore and grounding. Simulation is not required for this purpose.

We appreciate Pacheedaht's comments and look forward to continued engagement with Pacheedaht regarding the Project.

Sincerely,

Michael Davies
Senior Director, Marine Development
Trans Mountain Expansion Project

July 20, 2014

Hwlitsum First Nation
2928 River Road West
Ladner, BC V4K 3N2

Attention: Hwlitsum First Nation

Dear Mr. Grove:

Re: Hwlitsum First Nation's Analysis of the effectiveness of the TERMPOL Review of Trans Mountain Pipeline's Proposal

Thank you for your letter of March 5, 2014 in which you provide Hwlitsum First Nation's ("Hwlitsum") comments on the TERMPOL Review of Trans Mountain Pipeline ULC's proposed Trans Mountain Project ("the Project").

We appreciate your input on the Project and have taken your comments into careful consideration. We are pleased to provide the following additional information in response to your concerns:

Route Analysis and Anchorage Elements

Request

Can Kinder Morgan provide a study examining how much tanker traffic and large vessel traffic will increase over the next twenty years?

Response

Using a combination of economic forecasting, regional project announcements, and interviews, the amount of future traffic has been forecast for 2018, 2020, 2025, 2030, and 2035. Interviews were conducted with individuals at a number of terminals east of Second Narrows (including Imperial Oil Company, Suncor Energy Inc. and Pacific Coast Terminals facilities, among others) to validate the estimated traffic of commercial vessels within the Central Harbour. These projected traffic volumes were used in TERMPOL 3.2 to estimate the increase in the number of vessel movements in the marine study area. This is described in Volume 8C – TERMPOL 3.2

Section 6.2.3. Traffic projections in various cross sections of the shipping lanes have been forecast. Selecting the cross section of traffic at Haro Strait (TERMPOL 3.2, Table 6-7) and projecting it forward to 2035 at the same rate of increase as in TERMPOL 3.2, Table 6-5 provides the following information:

Number of Tanker Sailings* at Cross Section 2 - Haro Strait projected to 2035

Year	2012	2018	2020	2025	2030	2035
Tanker**	391	495	515	568	627	692
TMEP		696	696	696	696	696
Total	391	1191	1211	1264	1323	1388

* Typically each vessel call would lead to two sailings at this Cross Section

** Includes all bulk liquid carriers including those transporting oil, chemicals, gas, etc.

Request

Is it Kinder Morgan's position that in instances where First Nation people are harvesting in small boats for section 35 purposes (food, social and ceremonial) that they are obliged by law to move so that an oil tanker can move through their traditional waters?

Response

All vessel traffic, commercial, recreational or otherwise, are subject to all maritime traffic regulatory requirements, which are designed to ensure the safety of all users of marine transportation lanes.

Trans Mountain does not own or operate the tankers that currently (or in future shall) call at Westridge Marine Terminal.

Trans Mountain is aware that the Canadian Coast Guard issues cautionary bulletins to all vessels through Notices to Mariners including announcements regarding fisheries opening. Commercial vessels, both with or without a pilot onboard, must exercise caution when navigating in areas with a high concentration of vessels engaged in fishing.

Trans Mountain is supportive of any additional rules of movement that may be established by Federal authorities, should they decide to do so, that could further regulate the movement of commercial vessels during periods when First Nation people are harvesting in small boats for section 35 purposes (food, social and ceremonial).

Navigational Hazards

Request

Small fishing and pleasure boats, including sailing yachts, frequently cause conflicting situations with the safe passage of large ocean going vessels when they obstruct or cross the specified Traffic Separation Scheme routes. A comprehensive study of all current vessel traffic and a projection of future vessel traffic needs to be completed before a decision to increase oil tanker traffic is made.

Response

Please see the response immediately above, in addition to the following:

A number of processes are already in place to ensure safety of all marine traffic. Although Trans Mountain is not an owner or operator of marine vessels, it has as an outcome of a comprehensive marine risk assessment recommended a number of additional measures that would further improve the safety of all marine traffic. Those recommendations include the assignment of a moving exclusion zone to all laden tankers that will help raise awareness of the movement of these vessels amongst all other waterway users.

Trans Mountain is supportive of working with marine stakeholders, including authorities and First Nations, who wish to develop processes that may further improve the safety of all marine traffic.

Real Time Simulations

Request

The Cowichan Nation Alliance should be consulted about taking part in these real time simulations.

Response

The real time navigation simulations will only focus on berthing and unberthing maneuvers of the vessels at the proposed Westridge facility and will be located east of Second Narrows. The simulations will be set up by PPA and BCCP and Trans Mountain shall inform them about the Cowichan Nation Alliance's willingness to consult and assist on this matter.

Cargo Transfer and Transshipment Systems

Request

The marine oil handling facility currently also handles jet fuel, which is normally received via barges. How many of these barges will be loaded? If the Project is approved, will there be more or less barges than currently handled?

Response

Two to three barges currently load from Westridge each month. This activity will continue at a similar level in the future.

Tanker and Barge Specifications

Request

In Washington State, tanker size is limited to 125,000 DWT east of Port Angeles[1]; will Trans Mountain commit to supporting a tanker size limit of 125,000 DWT in BC waters?

Response

Transport Canada is responsible for setting regulations about vessel movement in Canada, including any limitations on the sizes of vessels. Trans Mountain will ensure that Project tankers continue to meet all local and international rules and regulations.

Contingency Planning

Request

If the number of tankers increases from 5 to 34 per month, shouldn't Kinder Morgan increase its spill liability insurance proportionally?

[1] Chip Boothe, Washington State Department of Ecology, "Changing Risk Picture in the Pacific Northwest" paper presented to BC Ministry of Environment's 2013 BC Land Based Spill Preparedness and Response Symposium (March 2013) at 10.

Response

For information on the financial liability and compensation regime in the event of an oil spill of any crude oil exported by tanker from Westridge, please reference Volume 8A Section 5.5.3.

Trans Mountain understands that the Government of Canada is currently in the process of reviewing Canada's Marine Oil Spill Preparedness and Response Regime. In its recent report, *A Review of Canada's Ship Source Preparedness and Response Regime – Setting the Course for the Future*, the Federal Tanker Safety Expert Panel recommended that the current limit of liability per incident within the Canadian Ship-source Oil Pollution Fund (SOPF) should be abolished.

On May 13, 2014, the Government of Canada announced it will enhance the liability and compensation regime by introducing legislative and regulatory amendments to:

- Allow the full balance of the SOPF, currently about $400 million, to be available in the event of an oil spill;
- In the event that all available sources of funds have been exhausted by spill-related claims, the Government of Canada will ensure compensation is provided to eligible claimants, and then recover those payments from the marine oil transport industry through a levy; and
- Align the SOPF with international funds by covering pure economic losses suffered by people who have had a loss of earnings but whose property has not been contaminated by an oil spill.

Trans Mountain notes that these recent federal government announcements regarding changes to tanker and pipeline liability and compensation were not accompanied by proposed legislation, and that the announcements were made during the information request response period. Accordingly, Trans Mountain has not had the opportunity to conduct a detailed analysis of these proposed legislative changes and it should be assumed that other information request responses related to these topics are being provided without the benefit of such analysis, unless otherwise indicated in the response.

See also Volume 8A, Section 1.4.1.6 of the Application which provides additional information about the *Marine Liability Act* and the SOPF.

Request

What kind of "arrangement" will vessels have with WCMRC for spill response? We need to see details before commenting. It is important to note that Kinder Morgan and the Hwlitsum have agreed to work together on spill response and remediation plans.

Response

The word "arrangement" is the wording used in sections 167 and 168 of the *Canada Shipping Act, 2001,* to refer to a contract for spill response services. Copies of the standard WCRMC agreements for vessels are available on the BC Chamber of Shipping website. In particular, see the link for the "Ship (Bulk Oil) Membership Agreement": http://www.cosbc.ca/index.php/our-services/oil-spill-response/registration-process.

Request

Kinder Morgan asserts that a tanker requiring salvage is not a credible risk. Yet in Washington State, where they have much more experience, the State pays for a rescue tug to be available on a 24 hour basis. Should we rely on information provided by relatives in Neah Bay and Washington State officials, or this report?

Response

There have been no incidents so far of a total loss of a double hull tanker anywhere in the world and Trans Mountain has proposed that an escort tug is provided to all laden tankers as long as those vessels remain within Canadian territorial waters. Therefore, Trans Mountain does not consider a total loss scenario to be a viable or credible one.

Should a laden tanker become incapacitated, the escort tug will assist to maintain its safety and prevent the vessel from grounding. In this regard, the role of the Neah Bay tug is comparable to the proposed escort tugs, the difference being that the escort tugs would accompany the tanker rather than have to be dispatched to assist.

Request

Both Canada's and the international frameworks are based on the principle of "polluter pays," which makes the polluter liable for all response costs and damages associated with an oil spill. This model simply does not afford sufficient protection for First Nations.

Response

The probability of an oil spill from a Project tanker is of low likelihood. However, should it occur, the process to claim compensation is described in the website of the Ship-source Oil Pollution Fund. This can be found by accessing: http://ssopfund.gc.ca/en/how-to-file-a-claim/claims-eligibility.

Request

Is it correct that First Nations cannot access SOPF if their section 35 fisheries are adversely impacted by an oil spill from a vessel? If this is the case, will Kinder Morgan commit to compensating our communities if they are adversely affected?

Response

All claims relating to the consequence of an oil spill may be filed as per information available on the website of Canada's SOPF (Ship-source Oil Pollution Fund) at http://ssopfund.gc.ca/en/how-to-file-a-claim/claims-eligibility.

Trans Mountain understands the administration of the SOPF falls under the *Marine Liability Act*. Eligible claimants are defined in section 107 of the *Act* to include:

a) an individual who derives income from fishing, from the production, breeding, holding or rearing of fish, or from the culture or harvesting of marine plants; or,
d) an individual who fishes or hunts for food or animal skins for their own consumption or use.

Trans Mountain encourages Hwlitsum to contact the Administrator of the Ship-source Oil Pollution Fund directly for further information on the fund and claims eligibility.

We appreciate Hwlitsum's comments and look forward to continued engagement with Hwlitsum regarding the Project.

Sincerely,

Michael Davies
Senior Director, Marine Development
Trans Mountain Expansion Project

cc: Chief R. Wilson

PART 3:

TECHNICAL MEMO:
ASSESSMENT OF THE POTENTIAL HUMAN HEALTH EFFECTS ASSOCIATED WITH THE ADDITIONAL CALPUFF MODELLING COMPLETED IN RESPONSE TO NATIONAL ENERGY BOARD INFORMATION REQUEST NO. 2.024b

HHRA Memo (NEB IR No. 2.024b)

Technical Memo

Date:	September 3, 2014
To	Margaret Mears, Trans Mountain Expansion Project, Kinder Morgan Canada Inc.
From:	Christine McFarland and Donald Davies, Intrinsik Environmental Sciences Inc.
Re:	Assessment of the Potential Human Health Effects Associated with the Additional CALPUFF Modelling Completed in Response to National Energy Board Information Request No. 2.024b

1.0 Introduction

This technical memo describes the assessment of the potential human health effects associated with additional simulated oil spill scenarios at the Trans Mountain Westridge Marine Terminal based on wind conditions resulting in the transport of the chemical vapours released from the surface of the spilled oil inland toward the residential areas adjacent to the terminal. This memo serves as a supplement to the Qualitative Human Health Risk Assessment of Westridge Marine Terminal Spills presented in Volume 7 of the Application to the National Energy Board (NEB) on December 16, 2013 (NEB Filing ID A3S4X2), and the Human Health Risk Assessment of Facility and Marine Spill Scenarios filed with the NEB on June 16, 2014 (NEB Filing IDs A3Y1E9, A3Y1F0, A3Y1F1, and A3Y1F2). The earlier reports are referenced extensively, and serve as important companion documents. Readers are encouraged to refer to the original reports for important background information. These assessments included a set of simulated and unmitigated spill scenarios involving different sized spills resulting from an incident while loading a tanker at berth at the Westridge Marine Terminal. Scenario spill volumes represented a credible worst-case (CWC) and a smaller-sized spill. Emphasis was given to the types of health effects that people could potentially experience from exposure to hydrocarbon vapours released during the early stages of a spill, before the arrival of first responders and the implementation of emergency and spill response measures aimed at quickly isolating, containing and recovering the spilled oil.

For the purposes of the earlier reports, reliance was placed on the results of modelling completed by EBA, A Tetra Tech Company (EBA 2013, 2014) of the fate and behaviour of the spilled oil under each of the simulated spill scenarios (NEB Filing IDs A3S5I3, A3S5I4, A3S5I5, A3S5I6, A3S5I7, and A3Y3X9), with the findings ultimately used to derive estimates of the exposures to the chemical vapours that people might experience during the early stages of each incident. The modelling accounted for a number of different parameters affecting the fate and movement of the oil slick, including time of year, weather patterns, ocean currents and tides, and wave action. As the modelling evolved, refinements were introduced, with additional input parameters included, such as the thickness of the oil slick, the time the oil would be expected to remain on the water surface, the time of first contact with the shoreline, and the extent of shoreline oiling. Consideration also was given to the manner in which the components of the spilled oil would partition between the water column and the air in order to develop estimates of the airborne concentrations that could occur as a function of elapsed time. In order to compute the fate of the chemical vapours from the spilled oil and to derive estimates of the exposures to the chemical vapours that people might experience during the early stages of each incident, one set of environmental conditions was selected for comprehensive deterministic modelling. These conditions included weather conditions in which the winds were predominantly from the east.

On July 3, 2014, the NEB submitted an information request (IR) to Trans Mountain Pipeline ULC (Trans Mountain) requesting that additional air dispersion modelling be conducted that incorporates wind conditions that would transport the chemical vapours from the spilled oil inland toward

Mississauga	Calgary	Ottawa	Guelph	Halifax	Maine	California
6605 Hurontario Street	736 – 8th Avenue SW	1125 Colonel By Drive	294 Mill Street East	5121 Sackville Street	41 Campus Drive	1608 Pacific Avenue
Suite 500	Suite 1060	Suite 3600	Unit 110b	Suite 506	Suite 202	Suite 201
Mississauga, Ontario	Calgary, Alberta	Ottawa, Ontario	Elora, Ontario	Halifax, Nova Scotia	New Gloucester, Maine	Venice, California
Canada L5T 0A3	Canada T2P 1H4	Canada K1S 5R1	Canada N0B 1S0	Canada B3J 1K1	USA 04260	USA 90291

neighbouring residential areas (NEB IR No. 2.024b). In response to the NEB IR, EBA completed additional spill and air dispersion modelling assuming northerly and westerly wind conditions, with a focus on the CWC spill volume that was described and assessed in the previously filed reports (i.e., 160 m^3 of oil spilled). Full details surrounding the spill and air dispersion modelling used to estimate the airborne concentrations of the chemical vapours are provided in the supplemental memo entitled *Additional CALPUFF Wind Scenarios in Response to NEB IR 2.024* that was filed with the NEB on August 15, 2014 (NEB Filing ID A4A1Z9).

1.1 Objectives

The primary objectives of this memo are to:

- Further address the IR submitted by the NEB (NEB IR No. 2.024b), specifically the request relating to the assessment of the additional wind conditions that could transport the chemical vapours released from the surface of the spilled oil inland toward the residential areas adjacent to the terminal.
- Expand on the analyses completed as part of the previously filed assessments by providing an assessment of the potential health effects that might be experienced by people under additional simulated and unmitigated oil spill scenarios at the Westridge Marine Terminal.
- Determine the potential implications of the additional air dispersion modelling on the findings and conclusions of the previously filed human health risk assessment (HHRA) reports.

2.0 Methods

Consistent with the previously filed reports, the overall approach used for the assessment followed a paradigm adapted from that used for conventional HHRAs to reflect the emphasis on identifying the potential health consequences that could occur under the different simulated oil spill scenarios based on the premise that the spills had taken place (i.e., without regard for the low probability of occurrence of such spill events). The paradigm is shown in Figure 2.1 of Appendix A. It consists of a series of steps in which consideration is given to both the toxicological properties of the chemicals of potential concern (COPC) as well as the opportunities for exposure to these chemicals that might exist during the early stages of a spill to arrive at an understanding of the types of health effects that people might experience. A brief description of the various steps, as they pertain to the current assessment, is provided below. Complete details are provided in the Human Health Risk Assessment of Facility and Marine Spill Scenarios (NEB Filing IDs A3Y1E9, A3Y1F0, A3Y1F1, and A3Y1F2).

2.1 Problem Formulation

This step is concerned with defining the overall scope and boundaries of the assessment, and is meant to focus the work on the areas of principal interest and concern. It focuses on five major areas:

- Identification of the Project component(s) to be examined, with a specific focus on identifying component(s) that might reasonably be anticipated to contribute to chemical exposures through the release of chemicals into the environment.
- Identification of the exposure scenarios under which humans might reasonably be anticipated to be exposed to the chemical releases.
- Identification of the COPC found in the releases to which people could be exposed.

- Identification and characterization of the human "receptors" that could potentially be exposed to the COPC.
- Identification of the exposure routes and pathways by which the receptors might be exposed to the COPC.

The principal outcomes of the Problem Formulation step completed for the present assessment are the same as those described in the previous assessments. The exceptions are in the identification of the Project component and the exposure scenarios to be examined in the current assessment. As one of the principle findings of the previously filed reports was that the intensity of the potential health effects associated with the short-term inhalation of the chemical vapours would be greatest for the larger spill sizes due to the higher concentrations of the chemical vapours that could be encountered and the longer durations of exposure, it was determined that the current assessment would focus on the CWC spill scenario.

After considering the two additional exposure scenarios modelled by EBA (i.e., northerly and westerly wind conditions), it was determined that the assessment would focus on the exposure scenario that would result in the transport of the chemical vapours released from the surface of the spilled oil inland toward the residential areas adjacent to the Westridge Marine Terminal, as requested by the NEB.

The results of the air dispersion modelling revealed that the maximum one-hour average airborne concentrations of the COPC predicted under the westerly wind conditions were consistently lower than the concentrations previously revealed as part of the earlier dispersion modelling, and that the areal extent of the exceedances of the Exposure Limits remained exclusively over water (see Figures 3.3.1 to 3.3.3 of *Additional CALPUFF Wind Scenarios in Response to NEB IR 2.024* [NEB Filing ID A4A1Z9]). In the case of the northerly wind conditions, although the predicted maximum one-hour average airborne concentrations of the COPC again were below those previously assessed, the areal extent of the exceedances extend inland to the south-southwest of the Westridge Marine Terminal. On this basis, it was determined that the current assessment would focus on the exposure scenario based on the northerly wind conditions.

The principal outcomes of the Problem Formulation step are summarized in Table 2.1.

TABLE 2.1

SUMMARY OF THE PROBLEM FORMULATION STEP FOR THE ASSESSMENT

Project Component		Exposure Scenario	COPC	Receptors	Exposure Pathway
Spill Type	Spill Size				
Westridge Marine Terminal Spill Scenarios – Spill during loading of tanker at berth.	CWC – 160 m^3 of oil spilled; 20% (*i.e.*, 32 m^3) presumed to escape containment boom.[1]	Exposures received during the early stages of the spill before the arrival of first responders and the implementation of emergency and spill response measures Exposures based on northerly wind conditions that result in the transport of the chemical vapours inland toward the residential areas adjacent to the Westridge Marine Terminal.	Consisted principally of lighter-end, volatile and semi-volatile hydrocarbons (C_1 to C_{16}), including both aliphatic and aromatic constituents. The latter constituents included BTEX (benzene, toluene, ethylbenzene and xylenes), alkyl substituted benzenes, and polycyclic aromatic hydrocarbons (PAHs). The remaining COPC consisted of various combinations of sulphur-containing chemicals.	Members of the general public found near the terminal, specifically: i) people on the water in fishing boats, kayaks, and other pleasure craft; ii) people on shore; iii) people living in adjacent communities; and, iv) first responders.	Inhalation

Note:
1 At 160 m^3, this spill is larger than the CWC spill resulting from a rupture of a loading arm. It is also substantially smaller than the over 1,500 m^3 capacity of the precautionary boom that will be deployed around each berth while any cargo transfer activities are taking place and it is reasonable to expect that the spill would be entirely contained within the boom.

2.2 Exposure Assessment

This step involves estimating the level of exposure to the COPC that might be received by the receptor(s) via different exposure pathways. For the purposes of the present assessment, reliance was placed on the results of spill and air dispersion modelling performed by EBA in response to NEB IR No. 2.024b, and presented in the supplemental memo entitled *Additional CALPUFF Wind Scenarios in Response to NEB IR 2.024* (NEB Filing ID A4A1Z9). The model outputs for the northerly wind conditions were ultimately used to derive hour-by-hour estimates of the one-hour average vapour concentrations of the COPC at progressively increasing distances from the site of the oil spill. These hourly estimates were used to determine the extent to which people in the area could be exposed to the vapours during the early stages of the oil spill.

2.3 Toxicity Assessment

This step involves identifying and understanding the potential health effects that can be caused by each of the COPC (acting either singly or in combination), and the exposure conditions under which the effects can occur. The step revolves around the principle that the dose of a chemical largely dictates the nature and extent of any health effects that might be observed. Consideration is given to understanding the influence of the amount, duration and frequency of exposure on the types and severity of the health effects. Consistent with the Human Health Risk Assessment of Facility and Marine Spill Scenarios (NEB Filing IDs A3Y1E9, A3Y1F0, A3Y1F1, and A3Y1F2), the principal outcomes of this step are:

- The determination of Exposure Limits for the COPC, which refer to the levels of exposure that would not be expected to cause adverse health outcomes. The Exposure Limits are often based on guidelines, objectives or standards established by leading scientific and regulatory authorities charged with the protection of public health, with the level of protection afforded by the Exposure Limits set so as to be protective of even sub-populations who may show heightened responsiveness to chemical exposures. Emphasis was placed on Exposure Limits intended to be protective against health effects resulting from short-term exposures (referred to as "acute Exposure Limits") since the focus of the work was on determining the nature and extent of health effects that could occur among people from short-term inhalation exposure to the COPC vapours released from the surface of the oil slick during the early stages of the oil spill before the arrival of first responders and the implementation of emergency and spill response measures. The Exposure Limits were used to gauge the prospect for health effects to occur as an initial screening step in a multi-step process in which the nature and extent of any health effects were characterized (see Characterization of Potential Health Effects below). A list of the Exposure Limits chosen for use in the assessment is provided in Table 2.2. Complete details concerning the Exposure Limits and the manner in which they were developed were provided in Appendix B of the Human Health Risk Assessment of Facility and Marine Spill Scenarios (NEB Filing IDs A3Y1E9, A3Y1F0, A3Y1F1, and A3Y1F2). It is important to note that a high degree of conservatism is incorporated into the Exposure Limits by virtue of reliance on the most sensitive endpoint in the most sensitive species as the primary determinant, coupled with the use of uncertainty factors to arrive at the value. Due to this conservatism, the Exposure Limits represent exposure levels that are well below those known to cause adverse health effects.

- The identification of benchmarks other than conventional Exposure Limits, which may be better suited for health effects assessment purposes because of the particular exposure circumstances involved. For example, situations in which there can be rare, atypical accidental exposure of the general public to a chemical(s), such as during spills, fires or explosions, may be better addressed using benchmarks such as the Acute Exposure Guideline Levels (AEGLs) developed by the United States Environmental Protection Agency (US EPA) or the Emergency Response Planning Guidelines (ERPGs) developed by the American Industrial Hygiene Association (AIHA). These guidelines are specifically intended for use in determining the potential risks to the health of the general public from rare exposures to high concentrations of airborne chemicals for short durations. For the purposes of the present assessment, the one-hour AEGLs and ERPGs developed for the COPC provide added perspective *vis-à-vis* the prospect for people's health to be adversely affected from exposure to the chemical vapours released from the surface of the oil slick during the early stages of the spill(s). Both the AEGLs and ERPGs are constructed around three "tiers" distinguished by varying degrees of severity of health effects, with each tier representing a short-term exposure value corresponding to a threshold concentration below which specific categories or types of effects would not be expected to occur among members of the general public. With progressively increasing airborne concentrations above each tier, the prospect for occurrence of the particular effects becomes greater.

The AEGLs are defined as follows:

- AEGL-1 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

- AEGL-2 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

- AEGL-3 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

The ERPGs are defined as follows:

- ERPG-1 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild, transient health effects or perceiving a clearly defined, objectionable odour.

- ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

- ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

AEGLs and ERPGs were only identified for COPC for which exceedances of the Exposure Limits were noted. A listing of the AEGLs and ERPGs that were used for comparison purposes is provided in Table 2.3. Complete details concerning the AEGLs and ERPGs, including their meaning, derivation and use are provided elsewhere (AIHA 2013, NRC 2001, US EPA 2013).

- The determination of the relevant chemical mixtures given the fact that people are rarely exposed to chemicals in isolation, but rather exposure most commonly occurs to mixtures of chemicals. The latter situation applies to the oil spill scenarios in that the vapours released during the spill will consist of a mix of hydrocarbons and other chemicals emitted simultaneously from the surface of the oil slick. Accordingly, it was necessary that the assessment consider the health effects that might be experienced by people in the area at the time of the spill not only from exposure to the COPC acting singly, but also in combination. In accordance with the approach recommended by Health Canada (2010), the COPC acting through a similar mechanism of toxicity and/or affecting the same target tissues/organs (i.e., sharing a so-called "commonality of effect") were combined and assumed to act in an additive fashion. A series of different chemical mixtures were developed. Each mixture was assigned a specific designation (e.g., eye irritants, respiratory irritants, neurotoxicants) based on the common critical health endpoint affected by the COPC comprising the mixture that served as the basis for the development of their Exposure Limits. The specific mixtures examined as part of the assessment are listed in Table 2.4.

TABLE 2.2

SUMMARY OF ACUTE INHALATION EXPOSURE LIMITS

COPC	Duration	Value (µg/m³)	Critical Health Endpoint	Authority
Aliphatic C_1-C_4 group[1] (surrogate: *iso*-butane)	1-Hour	78,000	Neurological effects	TCEQ (2012)
Aliphatic C_5-C_8 group[2] (surrogate: *n*-pentane)	1-Hour	200,000	—	TCEQ (2011)
Aliphatic C_9-C_{16} group[3]	—	—	—	—
Aromatic C_9-C_{16} group[4] (surrogate: naphthalene)	1-Hour	2,000 (adjusted)	Eye irritation	ACGIH (2013)
Benzene	1-Hour	580	Immunological effects	TCEQ (2007)
Dibenzothiophenes[5]	—	—	—	—
Dimethyl sulphide group[6]	—	—	—	—
Ethanethiol group[7] (surrogate: ethanethiol)	1-Hour	2,500	Respiratory irritation	US EPA (2013)
Ethylbenzene	1-Hour	21,700	Neurological effects	ATSDR (2010)
Toluene	1-Hour	15,000	Eye irritation; Nasal irritation; Neurological effects	TCEQ (2008)
Trimethylbenzenes[8]	1-Hour	690,000	Neurological effects	US EPA (2007)
Xylenes	1-Hour	7,400	Respiratory irritation; Neurological effects	TCEQ (2009)

Notes:
— not available
1 Includes *iso*-butane, *n*-butane, and propane.
2 Includes *iso*-pentane, *n*-pentane, and aliphatics C_6-C_8.
3 Includes aliphatics >C_8-C_{10}, aliphatics >C_{10}-C_{12}, and aliphatics >C_{12}-C_{16}.
4 Includes aromatics >C_8-C_{10}, aromatics >C_{10}-C_{12}, and aromatics >C_{12}-C_{16}.
5 Includes dibenzothiophene, C1-dibenzothiophene, C2-dibenzothiophene, C3-dibenzothiophene, and C4-dibenzothiophene.
6 Includes dimethyl sulphide, and methyl ethyl sulphide.
7 Includes ethanethiol, *iso*-propanethiol, thiophene/*sec*-butanethiol, *n*-butanethiol, and *n*-hexanethiol.
8 Includes 1,2,4 Trimethylbenzene. Trimethylbenzene was assessed as an individual COPC as well as part of the aromatic C_9-C_{16} group.

Sources: America Conference of Governmental Industrial Hygienists (ACGIH) 2013; Agency for Toxic Substances and Disease Registry (ATSDR) 2010; Texas Commission on Environmental Quality (TCEQ) 2012, 2011, 2009, 2008, 2007; US EPA 2013, 2007.

TABLE 2.3

SUMMARY OF 1-HOUR AEGLS AND ERPGS

COPC	1-Hour AEGL (µg/m³)			1-Hour ERPG (µg/m³)		
	Tier-1	Tier-2	Tier-3	Tier-1	Tier-2	Tier-3
Aliphatic C_5-C_8 group	—	—	—	—	—	—
Aromatic C_9-C_{16} group	—	—	—	—	—	—
Benzene	166,131	2,555,858	12,779,288	159,741	479,223	3,194,822

Note:
— not available
Sources: AIHA 2013; US EPA 2013.

TABLE 2.4

CHEMICAL MIXTURES EXAMINED

Chemical Mixture Designation	Critical Health Endpoint	COPC Comprising Mixture
Eye irritants	Eye irritation	Aromatic C_9-C_{16} group, Toluene
Respiratory irritants	Respiratory irritation	Ethanethiol group, Xylenes
Neurotoxicants	Neurological effects	Trimethylbenzenes, Aliphatic C_1-C_4 group, Ethylbenzene, Toluene, Xylenes

Further details regarding the Toxicity Assessment are provided in the Human Health Risk Assessment of Facility and Marine Spill Scenarios (NEB Filing IDs A3Y1E9, A3Y1F0, A3Y1F1, and A3Y1F2).

2.4 Characterization of Potential Health Effects

This step involves comparing the estimates of the exposures to the COPC that might be experienced by the receptor(s) against the corresponding Exposure Limits and/or other comparison benchmarks to determine whether health effects might occur. Consistent with the previous assessment, the potential health effects were characterized using a multi-step approach: (i) screening against Exposure Limits; (ii) determination of the areal extent of the exceedances; (iii) determination of duration of exceedances; and, (iv) comparison against AEGLs and ERPGs.

2.5 Uncertainty Analysis

This step is focussed on acknowledging and understanding the uncertainties that can surround the assessment, with consideration given to the assumptions made to accommodate the uncertainties, which typically embrace a high degree of conservatism so as to avoid health effects being overlooked or understated. The analysis forms part of the interpretation of the findings of the assessment, especially in terms of gauging their meaning and relevance. Care must be taken to distinguish health effects for which the prospect for occurrence is tangible from effects that represent hypothetical constructs only because of the conservatism incorporated into the assessment. To facilitate the interpretation of the results, the major conservative assumptions that formed part of the assessment are listed below, followed by a list of the principal uncertainties that remained.

For the purposes of the assessment, it was conservatively assumed that:

- The oil spills had occurred despite being rare, unpredictable events, and without regard for the multitude of design, engineering, construction, inspection, maintenance and other spill prevention programs described in Volumes 7 and 8A of the Application (NEB Filing ID A56025) that will be in place to minimize the prospect for spills to occur.

- The spills would go unattended for at least two to three days, without regard for the various emergency and spill response measures described in Volumes 7 and 8A (NEB Filing ID A56025) that will be implemented quickly following a spill incident. The measures will include not only isolating, containing and recovering the spilled oil (i.e., removing the hazard from the people), but also notifying the public, restricting public access to the affected area(s), and possibly evacuating people if public health and safety is threatened (i.e., removing people from the hazard).

- Humans may be especially responsive to chemical exposures, including the COPC vapours that could be released from the surface of the oil slick. In this regard, reliance was placed on the use of health-based Exposure Limits developed by reputable scientific and regulatory authorities as comparison benchmarks to determine the nature and extent of any health effects that might be experienced by people from exposure to the vapours. As mentioned already, the Exposure Limits are deliberately set to afford a high degree of protection to the general public, including protection of sub-populations who may be particularly responsive to chemical exposures such as infants, young children, the elderly and individuals with compromised health. Due to the protection demanded, the Exposure Limits correspond to levels of exposure that are well below those known to cause health effects.

- People in the area at the time of the oil spill would be exposed to the maximum one-hour average concentrations of the COPC vapours predicted to occur anywhere within the study area at any given hour for 40 to 60 hours from the start of the spill incident, without regard for the time of day or locations at which the maximum concentrations were predicted to occur. Distinction was not made as to whether the predictions applied to locations over water or inhabited areas on land.

The principal uncertainties that remained were:

- The simulated oil spill scenario that was examined reflected specific circumstances *vis-à-vis* spill location and size, as well as water movement, water temperature, wave action, meteorological conditions and other physical parameters affecting the fate and behavior of the spilled oil and/or the dispersion of the chemical vapours released from the surface of the oil slick. The results of the assessment necessarily apply to the specific scenarios that were chosen. It is important to acknowledge that the scenario included CWC conditions in terms of the spill itself; and, ii) the deterministic model simulation that the assessment extensively relied upon was founded on the wind conditions contributing to the movement of the COPC vapours from the oil slick inland to the residential areas adjacent to the Westridge Marine Terminal. The combination of these items with the conservatism incorporated into the assessment, as outlined above, provide some measure of assurance that the results of the assessment are unlikely to underestimate the nature and extent of any health effects that people might experience. However, uncertainty remains as to how well the results reflect the potential exposures to the COPC vapours and associated health effects that could be experienced by people under different spills scenarios because of differences in circumstances.

- For certain of the COPC, acute inhalation Exposure Limits, AEGLs, ERPGs and/or health effects information on which to predict the types of health effects that could result from short-term exposure to them under the simulated oil spill scenarios were not available. Surrogate chemicals could not be identified to represent these COPC. As a result, they were removed from further consideration and not assessed. Other COPC required grouping on the basis of molecular/structural similarities to create a chemical group that could be represented by a surrogate chemical. These groups were assessed, but with some uncertainty surrounding how well their toxicity was reflected in the toxicological properties of the surrogate chemical. Some uncertainty remained even in cases in which the most toxic chemical in the group was chosen as the surrogate to represent the toxicity of the group as a whole.

3.0 Results

The results of the assessment are presented below. The results are segregated according to the findings that apply to the individual COPC and those pertaining to the chemical mixtures. The presentation of the results for the individual COPC follows the sequence described earlier in the Characterization of Potential Health Effects, beginning with the comparison of the predicted one-hour average COPC vapour concentrations against the corresponding acute inhalation Exposure Limits; proceeding to the assessment of the areal extent of the exceedances as well as the duration of the exceedances; and ending with the comparison of the vapour concentrations against the corresponding AEGL and ERPG guidelines. The results presented for the chemical mixtures consist primarily of discussion of the areal extent within the study area where people's health potentially could be affected by exposure to the combined vapours of the COPC comprising the mixtures.

3.1 Individual COPC

3.1.1 Comparison against Exposure Limits

The maximum one-hour average airborne concentrations of the COPC predicted to occur within the study area together with the corresponding acute inhalation Exposure Limits are provided in Table 3.1. The maximum one-hour average airborne concentrations of the COPC predicted in the current assessment are consistently lower that those predicted in the previously filed report (see Table 5.1 of the Human Health Risk Assessment of Facility and Marine Spill Scenarios [NEB Filing IDs A3Y1E9, A3Y1F0, A3Y1F1, and A3Y1F2]).

Due to the lower maximum one-hour average airborne concentrations of the COPC, fewer exceedances of the Exposure Limits were predicted compared to the previous assessment, with exceedances only occurring for the aliphatic C_5-C_8 and aromatic C_9-C_{16} groups, and benzene. In the previous assessment, exceedances of the Exposure Limits were predicted for the aliphatic C_1-C_4 group, toluene and xylenes as well. These exceedances indicate the possibility that people exposed to each of these COPC during the early stages of the spill incident could potentially experience adverse health effects. The nature, extent and relevance of the exceedances are examined in the following subsections. The predicted concentrations for the remaining COPC were consistently lower than the corresponding Exposure Limits, indicating no obvious prospect for people's health to be affected by exposures to these chemicals. As a result, these COPC were removed from further consideration.

TABLE 3.1

WESTRIDGE MARINE TERMINAL CWC ADDITIONAL SIMULATED SPILL SCENARIO 1-HOUR AVERAGE COPC VAPOUR CONCENTRATIONS AND CORRESPONDING EXPOSURE LIMITS

COPC[1]	Maximum Predicted 1-Hour Average Vapour Concentration (µg/m³)	Acute Inhalation Exposure Limit (µg/m³)
Aliphatic C_1-C_4 group	29,810	78,000
Aliphatic C_5-C_8 group	**440,700**	**200,000**
Aromatic C_9-C_{16} group	**4,991**	**2,000**
Benzene	**5,523**	**580**
Ethanethiol group	33	2,500
Ethylbenzene	954	21,700
Toluene	7,919	15,000
Trimethylbenzenes	493	690,000
Xylenes	7,107	7,400

Note:
1 COPC for which the maximum predicted one-hour average vapour concentrations exceeded the Exposure Limits are shown in bold font.

3.1.2 Areal Extent of Exceedances

Contour maps showing the predicted one-hour average concentrations of the COPC for which exceedances of the Exposure Limits were identified are provided as Figures 3.1 to 3.3 of Appendix A. Examination of the figures revealed the following:

- In all cases, the maximum predicted one-hour average concentrations of the COPC were seen to exceed the corresponding Exposure Limits over water, and over land within the perimeter of the Westridge Marine Terminal. This finding differs from the previously filed reports where the exceedances of the Exposure Limits were predicted to occur over water only.

- In all cases, the over land exceedances of the Exposure Limits were not predicted to extend beyond the perimeter of the Westridge Marine Terminal, suggesting that individuals living in the residential areas adjacent to the Westridge Marine Terminal would not experience any health effects as a result of the spill.

- Exceedances were generally predicted to occur in close proximity to the berth, where the general public would not reasonably be expected to spend time. In some cases, the exceedances occurred in areas where public access would be limited and/or restricted. In the case of the aliphatic C_5-C_8 and aromatic C_9-C_{16} groups and benzene, the exceedances extended over land by up to approximately 100 m, but not beyond the perimeter of the Westridge Marine Terminal.

3.1.3 Duration of Exceedances

Vapour concentration time plots showing the hour-by-hour maximum predicted one-hour average concentrations of the COPC as a function of time during the early stages of a spill event are provided as Figures 3.4 to 3.6 of Appendix A. These plots illustrate the predicted change in these maximum airborne concentrations over time, independent of the location within the study area at which they occurred. Examination of the figures revealed the following:

- With one exception, the maximum predicted one-hour average concentrations of the COPC were only seen to exceed the corresponding Exposure Limits within the first two hours following the occurrence of the spill.

- The exception was benzene for which exceedances were predicted to occur for up to 21 hours; however, it should be noted that the assessment did not allow for any emergency and spill response or other mitigation measures aimed at quickly isolating, containing and recovering the spilled oil or evacuating people from an area. These measures would be expected to reduce the time over which these exceedances might occur.

- These findings are consistent with the previously filed reports in that the exceedances identified for the majority of the COPC are not predicted to extend beyond the first few hours. In the previously filed reports, the exceptions included both the aromatic C_9-C_{16} group and benzene.

3.1.4 Comparison against other Health Based Benchmarks

The predicted maximum one-hour average airborne concentrations of the COPC predicted to occur within the study area together with the corresponding AEGL and ERPG guidelines are provided in Table 3.2. Examination reveals that the predicted concentrations of benzene were consistently lower than these guidelines, including the Tier-1 values, indicating that people in the area would not be expected to experience health effects other than mild, transient sensory and/or non-sensory effects. Examples of these effects are: discomfort, irritability, mild irritation of the eyes, nose and/or throat, mild cough, and symptoms consistent with nominal central nervous system (CNS) involvement such as mild headache, light headedness, minor vertigo, dizziness, and/or nausea. These effects would likely resolve quickly upon cessation of exposure, with no lingering after effects. Odours could be apparent to some individuals, especially those with a keen sense of smell. The odours would be dominated by a hydrocarbon like smell, with some potential for other distinct odours due to the presence of sulphur-containing chemicals in the vapour mix. The odours could contribute to added discomfort and irritability among these people.

TABLE 3.2

WESTRIDGE MARINE TERMINAL CWC ADDITIONAL SIMULATED SPILL SCENARIO - MAXIMUM PREDICTED 1-HOUR AVERAGE COPC VAPOUR CONCENTRATIONS AND CORRESPONDING AEGLS AND ERPGS

COPC	Predicted Maximum 1-Hour Average Vapour Concentration (µg/m³)	1-Hour AEGL (µg/m³)			1-Hour ERPG (µg/m³)		
		1	2	3	1	2	3
Aliphatic C_5-C_8 group	440,700	—	—	—	—	—	—
Aromatic C_9-C_{16} group	4,991	—	—	—	—	—	—
Benzene	5,523	166,131	2,555,858	12,779,288	159,741	479,223	3,194,822

Note:
— not available

AEGLs and ERPGs have not been developed for the aliphatic C_5-C_8 and aromatic C_9-C_{16} groups. In the case of the aliphatic C_5-C_8 group, evidence indicates that serious adverse health effects from exposure to this COPC would not be expected to occur, even at the maximum predicted concentrations that people in the area may experience during the early stages of the spill. More specifically, acute inhalation exposure of human subjects to a mixture of *n*-pentane, *iso*-pentane, hexane, and butane at concentrations up to 15,000,000 µg/m³ (i.e., approximately 34-fold higher than the maximum concentration predicted to occur from the spill for this group) resulted in no observed effects (ECB 2003). In the case of the aromatic C_9-C_{16} group, based on a review of available scientific literature, there is no evidence to indicate that people would experience health effects from exposure to this group at the concentrations predicted to occur during the early stages of a spill event. Acute inhalation exposure of human subjects to naphthalene (i.e., the surrogate chemical identified for the aromatic C_9-C_{16} group) reported noticeable irritation of the eyes at concentrations above 79,000 µg/m³ (ACGIH 2013) (i.e., approximately 16-fold higher than the maximum concentration predicted to occur from the spill for this group). However, information on the health effects that can follow acute inhalation exposure to the aromatic C_9-C_{16} group is quite limited.

These findings remain the same as those described in the previous assessments.

3.2 Chemical Mixtures

The intent of the chemical mixtures assessment was to allow for the fact that the COPC could possibly interact in an additive fashion, potentially increasing the prospect for people's health to be adversely affected by exposure to the vapours released from the oil slick during the early stages of a spill event. A series of chemical mixtures was defined based on commonality of effects, namely eye irritants, respiratory irritants and neurotoxicants. Each of these mixtures was examined as part of the assessment of the Westridge Marine Terminal CWC spill scenario. The examination focussed on establishing the area within the study area in which people's health could potentially be affected by exposure to these mixtures. Examination of the findings reveals the following:

- Consistent with the previous assessments, the areal extent was greatest for the eye irritants mixture, and less for the neurotoxicants. In the current assessment, however, the COPC comprising the respiratory irritants mixture (i.e., ethanethiols and xylenes) did not reach sufficiently high concentrations for people's health to be affected by combined exposure.

- For the eye irritants and neurotoxicants mixtures, the maximum areas that could be potentially affected were predicted to occur in close proximity to the berths, where public access would be limited and/or restricted. The maximum area predicted to be affected by the eye irritant mixture extended over land by up to approximately 100 m, but not beyond the perimeter of the Westridge Marine Terminal. As discussed previously for the individual COPC, this finding differs from the previously filed reports where the potentially affected area was predicted to occur over water only, with the spatial extent confined to an area in close proximity to the tanker berths. The maximum area predicted to be affected by the neurotoxicants mixture remained over water within the berths.

- The prospect for health effects to occur from exposure to the chemical mixtures did not materially differ in terms of areal extent from that predicted for the individual COPC.

- People in the area exposed to the mixtures would not be expected to experience health effects other than the mild, transient sensory and non-sensory effects described above for the individual COPC. The maximum predicted one-hour average concentrations of the individual COPC comprising the mixtures remained well below the corresponding acute inhalation Exposure Limits or the Tier-1 AEGL and/or ERPG guidelines. Because of this, even combining the COPC and assuming they would interact in an additive fashion would not materially change the manner and extent to which people would be affected.

4.0 Conclusions

Consistent with the previously filed reports, the major findings and conclusions that emerged from the current assessment are:

- Based on the weight-of-evidence, there is no obvious indication that people's health would be seriously adversely affected by short-term inhalation exposure to the chemical vapours released during the early stages of a spill under the additional simulated oil spill scenario examined.

- The evidence suggests that the health effects that could be experienced by people in the area would likely be confined to mild, transient sensory and/or non-sensory effects, attributable largely to the irritant and CNS depressant properties of the chemicals. Odours also might be noticed, which could contribute to added discomfort and irritability.

- The evidence indicates that these mild, transient health effects could be experienced under all of the simulated oil spill scenarios examined to date; however, the intensity of the effects would be greatest for the larger spill sizes because of the higher concentrations of the chemical vapours that could be encountered and the longer durations of exposure.

- Although mild and transient, the effects would still be annoying and discomforting, indicating the need for and importance of the spill prevention programs described in Volumes 7 and 8A (NEB Filing ID A56025) of the Application. Planning and preparedness around emergency and spill response also are critical to ensure timely and adequate response to any spill events in order to limit opportunities for chemical exposures such that public health is not threatened or compromised, again highlighting the need for and importance of the emergency and spill response programs described in Volumes 7 and 8A of the Application (NEB Filing ID A56025).

- The absence of any serious adverse health effects from exposure to the chemical vapours released from the surface of the oil slick during the early stages of the spill scenarios applies to people in general, including the general public as well as first responders arriving on scene. However, because the first responders could remain on scene for some time while working to isolate, contain and recover the spilled oil, and could face the prospect of direct physical contact with the oil and/or more prolonged exposure to the vapours, it is important that they be trained in emergency and spill response procedures, be equipped with personal protective equipment, and be alert to potential exposure opportunities so as to minimize any exposures they might receive.

5.0 References

America Conference of Governmental Industrial Hygienists. 2013. TLVs® and BEIs® Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. ISBN: 978-1-607260-59-2. ACGIH®. Cincinnati, OH.

American Industrial Hygiene Association. 2013. Emergency Response Planning Guidelines. 213 ERPG Update Set. Stock #AEAR13-561. ISBN 978-1-935082-39-2.

Agency for Toxic Substances and Disease Registry. 2010. Toxicological Profile for Ethylbenzene. Atlanta, GA: US Department of Health and Human Services, Public Health Service.

EBA, A Tetra Tech Company. 2013. Modelling the Fate and Behaviour of Diluted Bitumen Spills in the Marine Environment, at Westridge Terminal and in the Lower Fraser River for the Trans Mountain Expansion Project. December 2013 (NEB Filing IDs A3S5I3, A3S5I4, A3S5I5, A3S5I6, and A3S5I7).

EBA, A Tetra Tech Company. 2014. Addendum to Volume 8C: TR 8C-S10 Modelling the Fate and Behavior of Marine Oil Spills for the Trans Mountain Expansion Project Summary Report. June 2014 (NEB Filing ID A3Y3X9).

European Chemicals Bureau. 2003. European Union Risk Assessment Report for n-Pentane Volume: 40. European Commission Joint Research Centre.

Health Canada. 2010. Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0. September 2010. Contaminated Sites Division, Safe Environments Directorate, Health Canada. Ottawa, ON.

National Research Council. 2001. Standing Operating Procedures for Developing Acute Exposure Guideline Levels for Hazardous Chemicals. Subcommittee on Acute Exposure Guideline Levels, Committee on Toxicology. Washington, DC.

Texas Commission on Environmental Quality. 2012. N-Butane and Isobutane. CAS Registry Number: n Butane:106 97 8, Isobutane: 75 28 5. Final Development Support Document. Prepared by: Jong Song Lee, Toxicology Division.

Texas Commission on Environmental Quality. 2011. Pentane, All Isomers (CAS Registry Numbers: n Pentane: 109 66 0, Isopentane: 78 78 4, Neopentane: 463 82 1. Developmental Support Document, Final, July 29, 2011. Prepared by: Jong Song Lee, Ph.D. Toxicology Division, Chief Engineer's Office, Texas Commission on Environmental Quality.

Texas Commission on Environmental Quality. 2009. Xylenes. (CAS Registry Numbers: Xylenes mixture: 1330 20 7; m-Xylene: 108 38 3; o-Xylene: 95 47 6; p-Xylene: 106 42 3). Development Support Document, Final, February 2009. Prepared by: Manuel Reyna, Toxicology Division, Chief Engineer's Office, Texas Commission on Environmental Quality.

Texas Commission on Environmental Quality. 2008. Toluene (CAS Registry Number 108-88-3). Development Support Document, Final. April 15, 2008. Prepared by Manual Reyna Toxicology Section. Chief Engineer's Office.

Texas Commission on Environmental Quality. 2007. Benzene (CAS Registry Number: 71 43 2). Developmental Support Document, Final, October 2007. Prepared by: Haney, Joseph T. Jr. Toxicology Section, Chief Engineer's Office, Texas Commission on Environmental Quality.

United States Environmental Protection Agency. 2013. Acute Exposure Guideline Levels (AEGL) Chemicals. Website: http://www.epa.gov/opptintr/aegl/pubs/chemlist.htm.

United States Environmental Protection Agency. 2007. Provisional Peer Reviewed Toxicity Values for 1,2,4 trimethylbenzene. Superfund Health Risk Assessment Technical Center, National Center for Environmental Assessment. CASRN 95 63 6.

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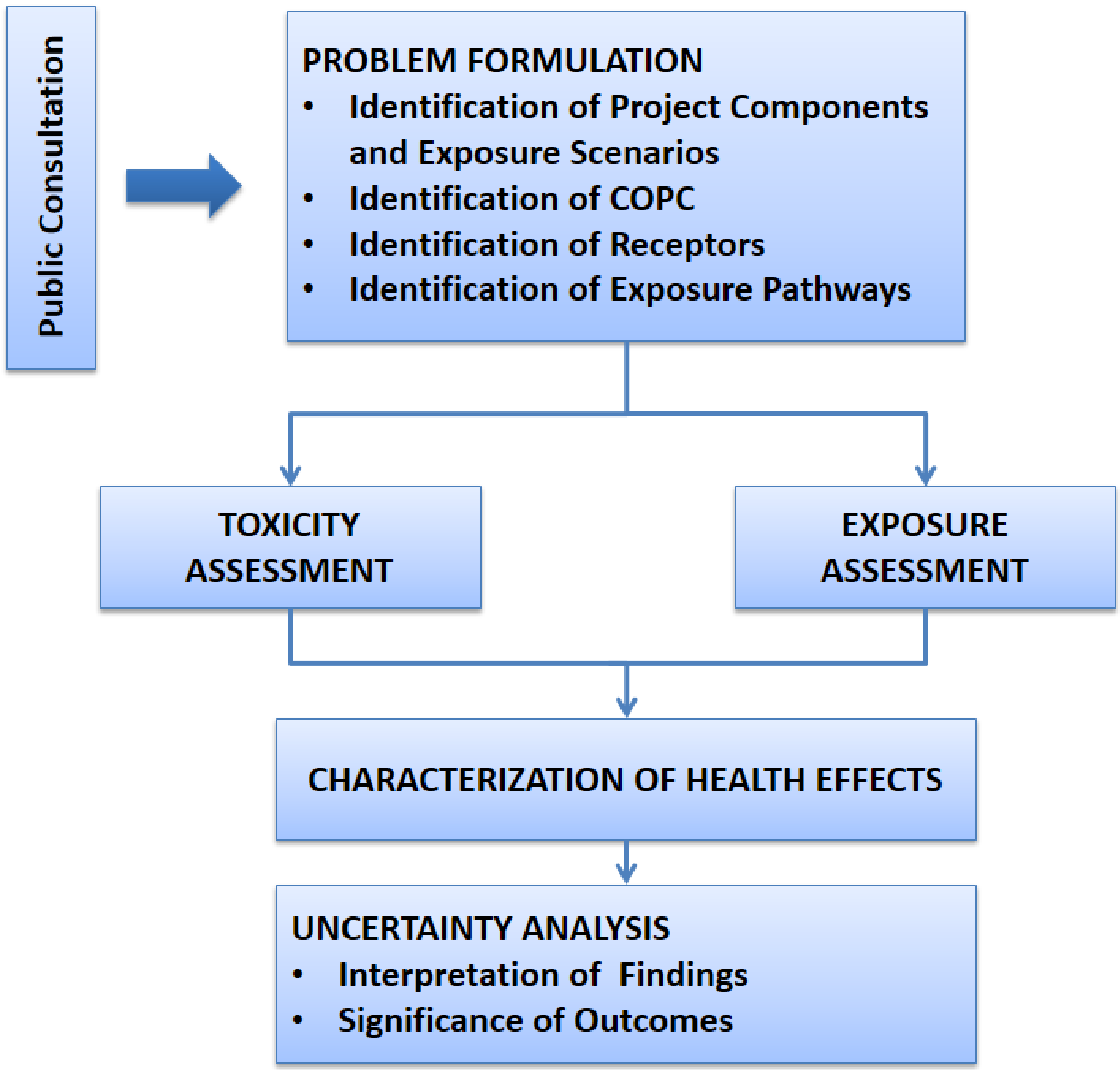

Figure 2.1 The Health Effects Assessment Paradigm

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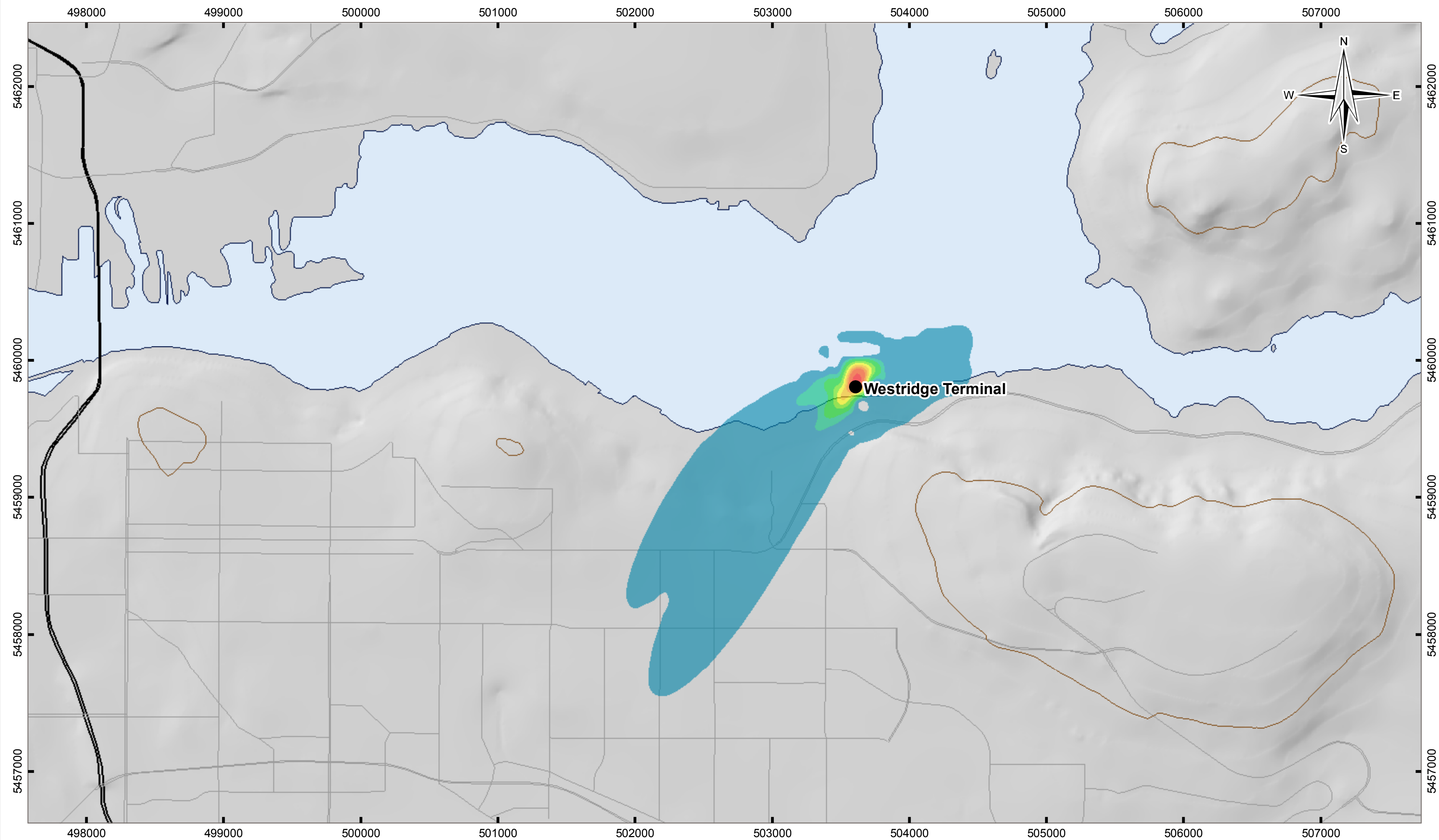

LEGEND

Aliphatics > C5-C8 Concentration (µg/m³)

- 1,000 - 25,000
- 25,000 - 50,000
- 50,000 - 100,000
- 100,000 - 150,000
- 150,000 - 200,000
- 200,000 - 250,000
- 250,000 - 300,000
- 300,000 - 400,000
- > 400,000
- Westridge Terminal
- Highway 1
- Road
- Contour (100 m)

NOTES

1. Base data source: BC Digital Road Atlas; CanVec.
2. 160 m³ spill originating at berth with 32 m³ escaping pre-deployed boom.
3. Maximum Point of Impingement: 440,700 µg/m³.

STATUS
ISSUED FOR USE

Scale: 1:40,000

500 250 0 500

Metres

PROJECTION UTM Zone 10

DATUM NAD83

FILE NO. V13203022_005_IR2001_North_AL_C5_8.mxd

CLIENT TRANSMOUNTAIN

TETRA TECH EBA

RESPONSE TO NEB IR NO. 2.024B

Northerly Wind Condition Aliphatics > C5-8 - Maximum 1-hour Average Ground Level Concentration in Air (µg/m³) - 160 m³ Spill

PROJECT NO.	DWN	CKD	APVD	REV
V13203022.005	SL	MEZ	TM	0

OFFICE	DATE
Tt EBA-VANC	August 26, 2014

Figure 3.1

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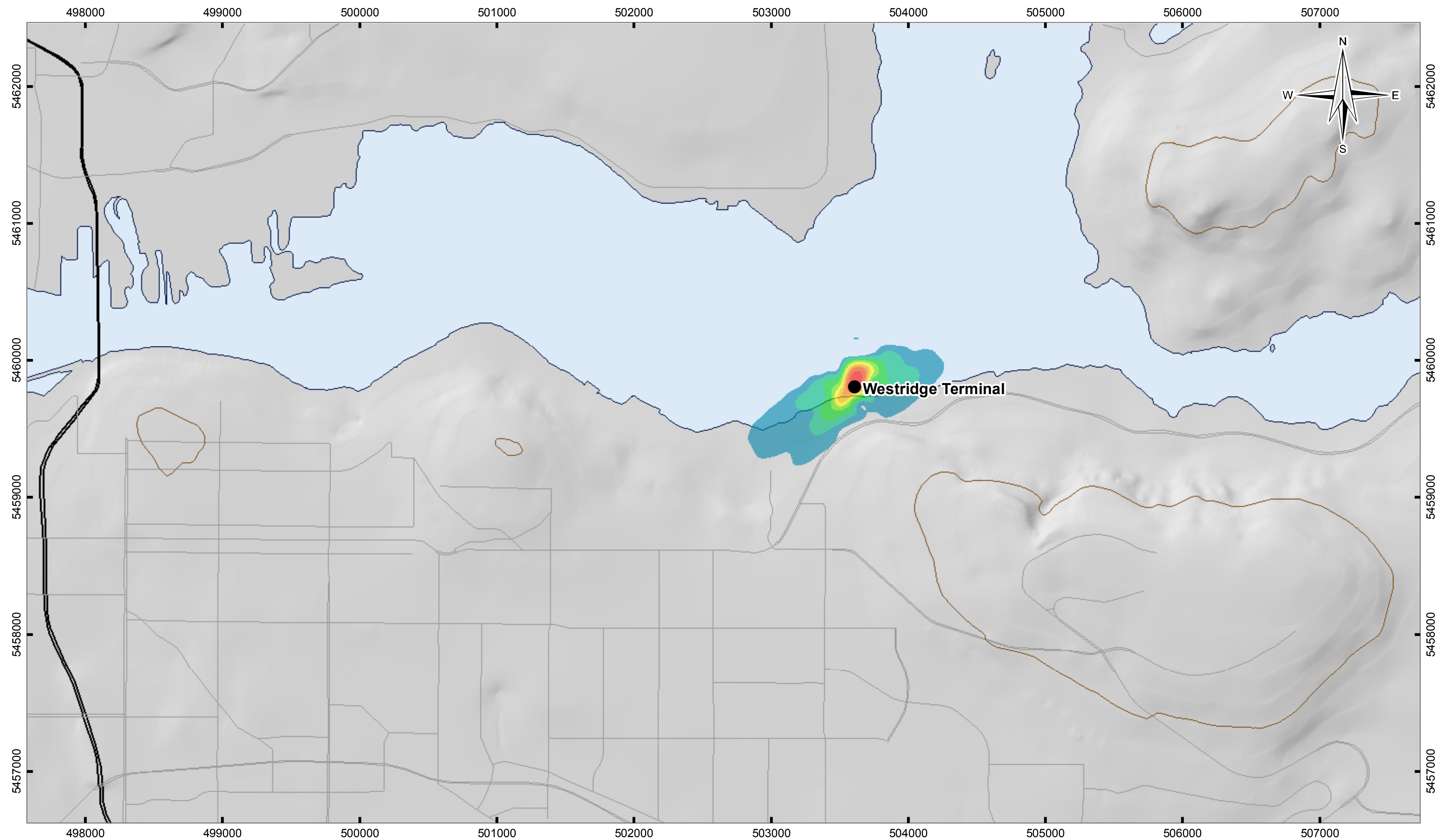


LEGEND

Aromatics > C9-C16 Concentration (μg/m³)

- 100 - 250
- 250 - 500
- 500 - 1,000
- 1,000 - 1,500
- 1,500 - 2,000
- 2,000 - 2,500
- 2,500 - 3,000
- 3,000 - 4,000
- > 4,000

- Westridge Terminal
- Highway 1
- Road
- Contour (100 m)

NOTES

1. Base data source: BC Digital Road Atlas; CanVec.
2. 160 m³ spill originating at berth with 32 m³ escaping pre-deployed boom.
3. Maximum Point of Impingement: 4,990 μg/m³.

STATUS
ISSUED FOR USE

Scale: 1:40,000

500 250 0 500

Metres

PROJECTION	DATUM
UTM Zone 10	NAD83

FILE NO.
V13203022_005_IR2002_North_AR_C9_16.mxd

CLIENT
TRANS MOUNTAIN

TETRA TECH EBA

RESPONSE TO NEB IR NO. 2.024B

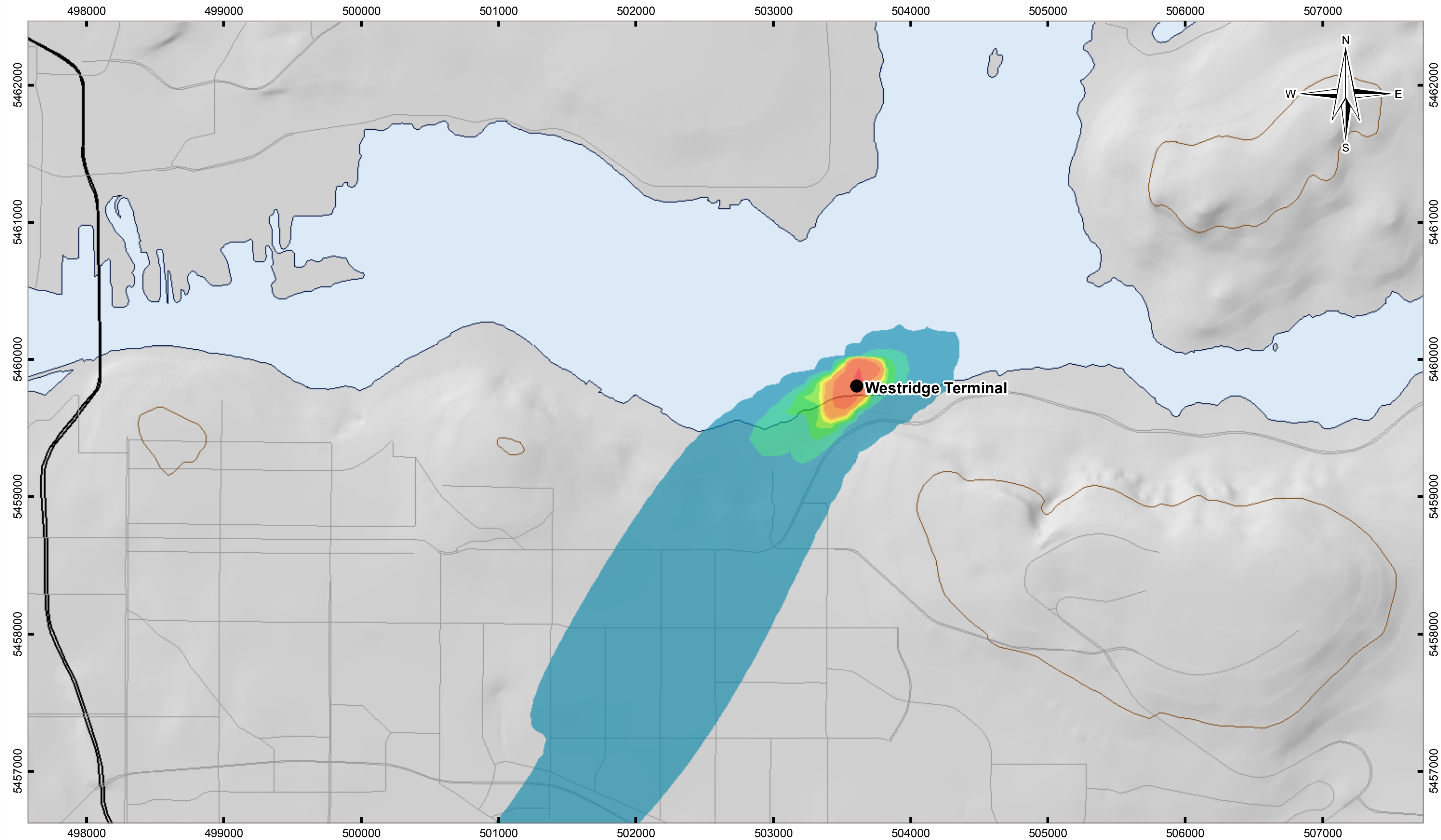
Northerly Wind Condition Aromatics > C9-16 - Maximum 1-hour Average Ground Level Concentration in Air (μg/m³) - 160 m³ Spill

PROJECT NO.	DWN	CKD	APVD	REV
V13203022.005	SL	MEZ	TM	0

OFFICE	DATE
Tt EBA-VANC	August 26, 2014

Figure 3.2

Q:\Vancouver\GIS\ENGINEERING\V132\V13203022\Maps\005\IR_Response02\V13203022_005_IR2003_North_Benzene.mxd modified 8/26/2014 by stephanie.leusink



LEGEND

Benzene Concentration (µg/m³)

- 5 - 100
- 100 - 200
- 200 - 300
- 300 - 400
- 400 - 500
- 500 - 580
- 580 - 1,000
- 1,000 - 4,000
- > 4,000
- Westridge Terminal
- Highway 1
- Road
- Contour (100 m)

NOTES

1. Base data source: BC Digital Road Atlas; CanVec.
2. 160 m³ spill originating at berth with 32 m³ escaping pre-deployed boom.
3. Maximum Point of Impingement: 5,520 µg/m³.

STATUS
ISSUED FOR USE

Scale: 1:40,000

500 250 0 500

Metres

PROJECTION	DATUM
UTM Zone 10	NAD83

FILE NO.
V13203022_005_IR2003_North_Benzene.mxd

CLIENT

TRANSMOUNTAIN

TETRA TECH EBA

RESPONSE TO NEB IR NO. 2.024B

Northerly Wind Condition Benzene - Maximum 1-hour Average Ground Level Concentration in Air (µg/m³) - 160 m³ Spill

PROJECT NO.	DWN	CKD	APVD	REV
V13203022.005	SL	MEZ	TM	0

OFFICE	DATE
Tt EBA-VANC	August 26, 2014

Figure 3.3

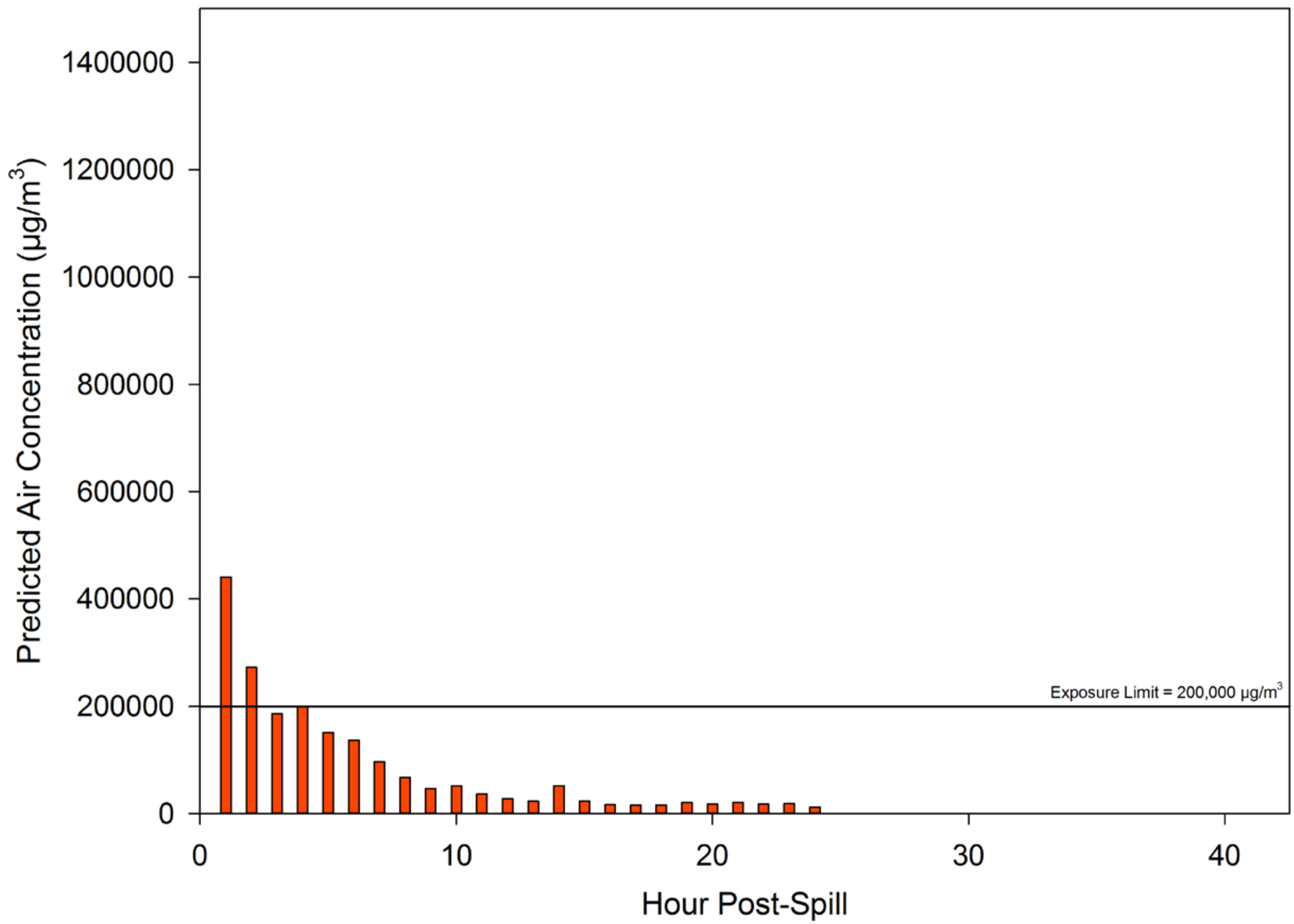


Figure 3.4 Westridge Marine Terminal - Credible Worst Case Simulated Spill Scenario - Aliphatic C_5-C_8 - Vapour Concentration-Time Plot

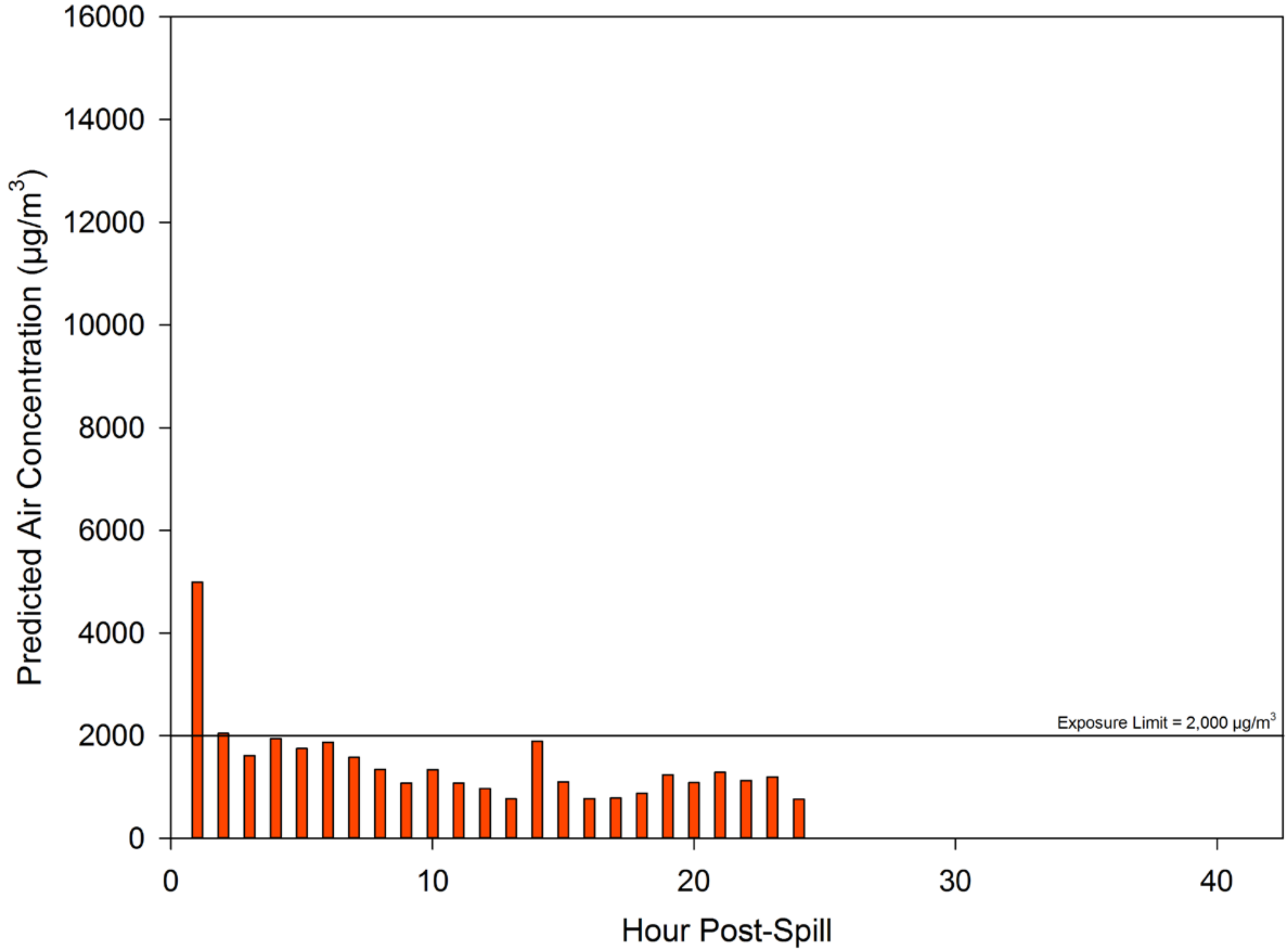


Figure 3.5 Westridge Marine Terminal - Credible Worst Case Simulated Spill Scenario - Aromatic C_9-C_{16} - Vapour Concentration-Time Plot

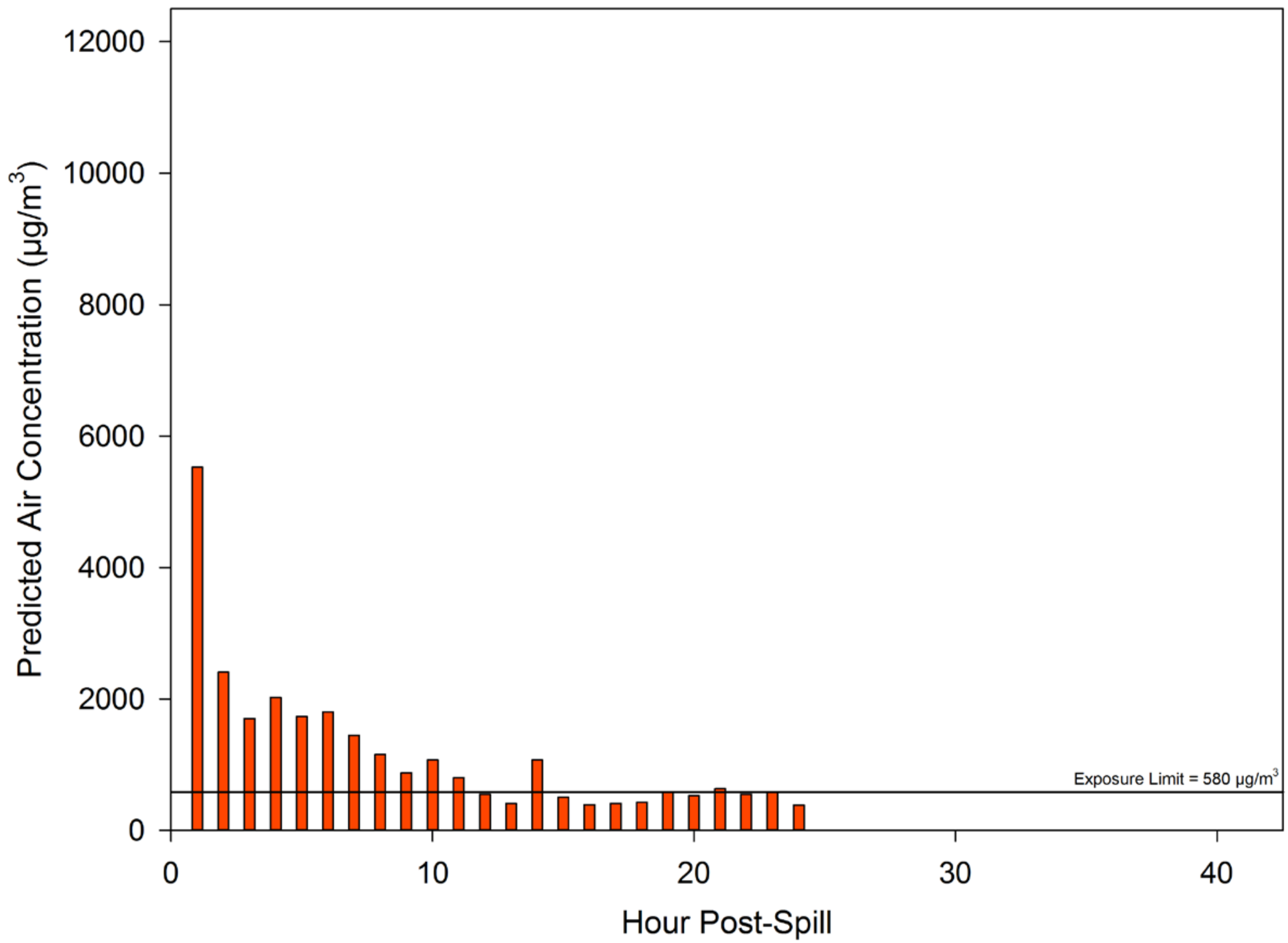


Figure 3.6 Westridge Marine Terminal - Credible Worst Case Simulated Spill Scenario - Benzene - Vapour Concentration-Time Plot

PART 4:

BRIDAL VEIL FALLS PROVINCIAL PARK:
DRAFT STAGE 2 DETAILED PROPOSAL REQUEST FOR BOUNDARY ADJUSTMENTS FOR
BC PROVINCIAL PROTECTED AREAS TRAVERSED BY THE
TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT

BC Parks Bridal Veil Falls Cover Letter (September 4, 2014)

TRANSMOUNTAIN

Trans Mountain Expansion Project
Email: info@transmountain.com | Phone: 1.866.514.6700 | Website: www.transmountain.com

September 4, 2014

National Energy Board
517 – 10th Avenue S.W.
Calgary, Alberta T2P 0A8

To: Ms. Sheri Young, Secretary National Energy Board

Dear: Ms. Young

Re: Trans Mountain Pipeline ULC – Bridal Veil Falls Provincial Park

At the Parks Workshop hosted by Trans Mountain Pipeline ULC (Trans Mountain) on March 27, 2014 in Chilliwack, BC, BC Provincial Parks Officials requested that Trans Mountain consider the use of a trenchless construction technique to avoid disturbance to the surface of the Bridal Veil Falls Provincial Park (BVFPP).

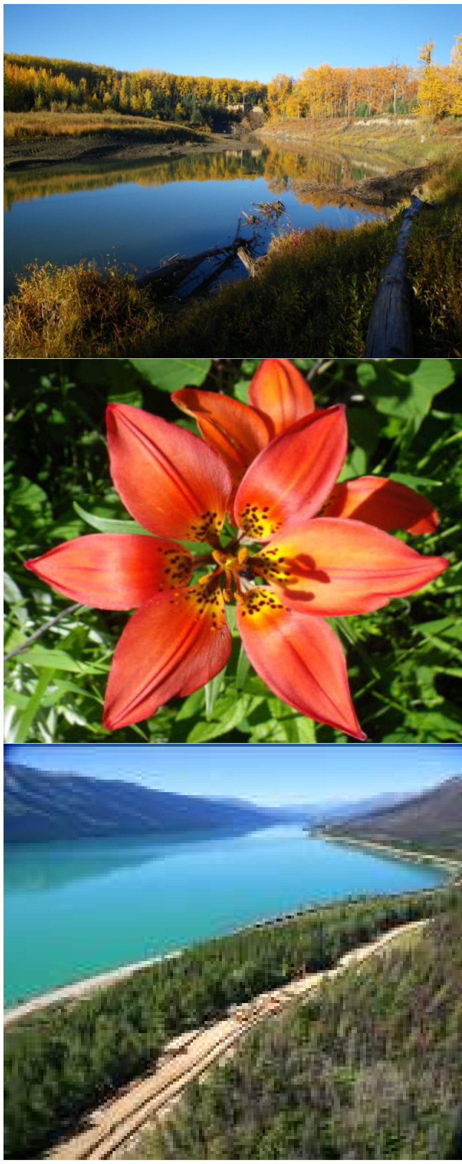
Given the level of protection afforded for BVFPP, Trans Mountain plans to assess this option and will propose to conduct geotechnical studies in 2015 to determine if a trenchless construction technique is feasible. If a trenchless construction technique is deemed to be geotechnically feasible, this option will be advanced. A trenchless alignment would follow the proposed revised pipeline corridor (BVFPP/Popkum Reserve No. 2) which includes the existing Trans Mountain Pipeline (TMPL) right-of-way.

If a trenchless construction technique is not technically feasible, then the proposed pipeline corridor remains the best option and would allow for the use of the existing cleared TMPL right-of-way and provide future operational synergies. Construction within BVFPP would use minimal impact techniques by narrowing the construction footprint where terrain and surface conditions allow. If possible, a trenchless construction technique would minimize the environmental effects that may occur within in BVFPP.

Yours truly,

Scott Stoness
Vice President, Finance and Regulatory Affairs
Kinder Morgan Canada
403 514 6525 Work
scott_stoness@kindermorgan.com

BC Parks - Intro to Stage 2



DRAFT STAGE 2 DETAILED PROPOSAL REQUEST FOR BOUNDARY ADJUSTMENTS FOR BC PROVINCIAL PROTECTED AREAS TRAVERSED BY THE TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT

August 2014
Rev. 0

APL-BCMOE-TERA-00009

Prepared for:

TRANSMOUNTAIN

Trans Mountain Pipeline ULC

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EXECUTIVE SUMMMARY

Trans Mountain Pipeline ULC (Trans Mountain) is a Canadian corporation with its head office located in Calgary, Alberta (AB). Trans Mountain is a general partner of Trans Mountain Pipeline L.P., which is operated by Kinder Morgan Canada Inc. (KMC) and fully owned by Kinder Morgan Energy Partners, L.P. (Kinder Morgan) Trans Mountain is the holder of the National Energy Board (NEB) certificates for the Trans Mountain Pipeline (TMPL) system.

The TMPL system commenced operations 61 years ago and now transports a range of crude oil and petroleum products from Western Canada to locations in central and southwestern British Columbia (BC), Washington state and offshore. Trans Mountain currently supplies much of the crude oil and refined products used in BC. TMPL is operated and maintained by staff located at Trans Mountain's regional and local offices in AB (Edmonton, Edson and Jasper) and BC (Clearwater, Kamloops, Hope, Abbotsford and Burnaby).

The TMPL system has an operating capacity of approximately 47,690 m^3/d (300,000 bbl/d), using 24 active pump stations and 40 tanks. The expansion will increase the capacity to 141,500 m^3/d (890,000 bbl/d).

The proposed expansion will comprise the following:

- pipeline facilities that complete a twinning (or "looping") of the pipeline in AB and BC with about 987 km of new buried pipeline;
- new and modified facilities, including pump stations and tanks; and
- a total of three new berths at the Westridge Marine Terminal in Burnaby, BC, each capable of handling Aframax tanker size.

The expansion has been developed in response to requests from Western Canadian oil producers and West Coast refiners for increased pipeline capacity in support of growing oil production and access to growing West Coast and offshore markets. The recent NEB decision RH-001-2012 reinforces market support for the expansion and provides Trans Mountain the necessary economic incentive to proceed with design, consultation and regulatory applications.

An application was submitted to the NEB on December 16, 2013, pursuant to Section 52 of the *NEB Act* for the proposed Trans Mountain Expansion Project (referred to as "TMEP" or "the Project"). The NEB completed a detailed review and will hold hearings to determine if it is in the public interest to recommend a Certificate of Public Convenience and Necessity for construction and operation of the Project. Subject to the outcome of the NEB Hearing Process, Trans Mountain plans to begin construction in 2016 and go in to service in 2018.

Trans Mountain has embarked on an extensive program to engage Aboriginal communities and to consult with landowners, government agencies (*e.g.,* regulators and municipalities), stakeholders and the general public. Information on the Project is also available at www.transmountain.com.

The existing TMPL was constructed in 1952 and 1953, prior to the establishment of provincial parks along the route. Over the subsequent years, eight protected areas have been established in areas through which the TMPL right-of-way passes. In each case, the 18 m TMPL right-of-way has been exempted or acknowledged within the protected areas by Orders in Council.

The existing TMPL right-of-way crosses through eight parks and operates on the basis of both a 1952 grant obtained through Orders in Council.

Route selection for the TMEP has avoided 3 of the 8 protected areas, including Rearguard Falls Provincial Park, Coldwater River Provincial Park and Coquihalla River Provincial Park. Four out of the 5 protected areas crossed will require a Draft Stage 2 Boundary Adjustment Detailed Proposal.

Aboriginal Engagement

Trans Mountain is engaging with a total of 24 Aboriginal communities in proximity to the proposed pipeline corridor within the four parks for the Draft Stage 2 Detailed Proposals that might have an interest in the four parks or have Aboriginal interests potentially affected by the TMEP.

ABORIGINAL COMMUNITIES AFFECTED BY THE PROPOSED BOUNDARY ADJUSTMENT WITH EACH PARK

Finn Creek Provincial Park	North Thompson River Provincial Park	Lac du Bois Grasslands Protected Area	Bridal Veil Falls Provincial Park
Adams Lake Indian Band Neskonlith Indian Band Simpcw First Nation	Adams Lake Indian Band Canim Lake Indian Band Neskonlith Indian Band Simpcw First Nation	Coldwater Indian Band Cook's Ferry Indian Band Esh-kn-am Cultural Services Lower Nicola Band Lytton First Nation Oregon Jack Creek Band Neskonlith Indian Band Nicola Tribal Association Nooaitch First Nation Shackan Indian Band Siska Indian Band Skeetchestn Indian Band Stk'emlupsemc te Secwepemc Nation Tk'emlups te Sewcepemc	Peters Indian Band Popkum First Nation Chawathil First Nation Cheam First Nation Seabird First Nation Shxw'ow'hamel First Nation Skwah First Nation Union Bar First Nations Skawahlook First Nation Kwah-Kwah-Aplit First Nation Soowahlie First Nation Yale First Nation

The Aboriginal Engagement Program for the Draft Stage 2 Detailed Proposals focuses on:

- explaining the potential impacts and implications of the Draft Stage 2 Detailed Proposal and long-term reclamation objectives;
- exploring and understanding potential impacts on Aboriginal communities and Aboriginal groups;
- exploring opportunities to minimize the footprint of potential impact as well as avoid impact and mitigate where that is not possible;
- understanding potential Aboriginal communities and Aboriginal groups roles in construction and reclamation activities; and
- identifying shared values or opportunities to collaborate in support of net benefits to the Parks following construction.

Public Consultation

In March 2014, Trans Mountain conducted a series of Parks Workshops to:

- share information on the proposed approach for undertaking the Draft Stage 2 Detailed Proposal;
- share information on the proposed route along the Trans Mountain study corridor;
- identify local environmental and socio-economic topics of concern; and
- identify potential parks benefits.

At the workshops, the Project team provided attendees with a proposed overview of the proposed pipeline corridor and alternatives in each park, sought feedback of attendees on particular concerns relating to human activity and environment in the parks as well as discussed parks benefits, in break-out groups.

Feedback received at these sessions and afterwards, was shared with the relevant Trans Mountain disciplines and was considered in setting the scope for the Draft Stage 2 Detailed Proposal. Event reports and proposed benefits were submitted to BC Parks for consideration against Park priorities.

Invitations to participate in the workshops were sent to groups identified by BC Parks, including:

- Aboriginal communities and groups;
- stakeholders and environmental subject matter experts;
- senior local government staff and elected officials;
- local Environmental Non-Governmental Organizations (ENGOs) with knowledge of environmentally sensitive sites;
- regional and federal ENGOs;
- park recreation users;
- park tenure holders; and
- regional representatives from provincial and federal regulatory agencies including BC Parks.

Environmental and Socio-Economic Assessment

Trans Mountain submitted to BC Ministry of Environment (MOE) a Stage 1 Request for the Boundary Adjustment Process in accordance with the *Provincial Protected Area Boundary Adjustment Policy, Process and Guidelines*. The Stage 1 Request for a Boundary Adjustment was submitted to BC Parks on March 5, 2013 for Lac Du Bois Grasslands Protected Area and on June 13, 2013 for the remaining four protected areas.

In October 2013, Trans Mountain was provided approval to proceed to the second stage of the Boundary Adjustment Process, the preparation and submission of a Detailed Proposal (Draft Stage 2 of the Boundary Adjustment Process) for four of the five protected areas. It was deemed by BC Parks that Coquihalla Summit Recreation Area would require a Resource Use Permit instead of the Draft Stage 2 Detailed Proposal because of its class designation. BC Parks did request that the proposed work within Coquihalla Summit Recreation Area undergo the same level of environmental assessment as the other protected areas. Trans Mountain has committed to completing an environmental assessment for the Coquihalla Summit Recreation Area.

This report has been prepared in support of Trans Mountain's formal request to temporarily adjust the boundary of the following parks to allow for construction of the TMEP and the use of temporary associated facilities, including access to the right-of-way. The four parks requiring Boundary Adjustments are:

- Finn Creek Provincial Park;
- North Thompson River Provincial Park;
- Lac Du Bois Grasslands Protected Area; and
- Bridal Veil Falls Provincial Park.

Finn Creek Provincial Park

The proposed pipeline corridor through Finn Creek Provincial Parks parallels the existing TMPL right-of-way for its entire length as well as the transportation corridor (i.e., Highway 5). A horizontal directional drill of the park was assessed and was deemed to not be geo-technically feasible. To route around the park would entail approximately 2 km of new right-of-way along the edges of the park boundaries and would require a new pipeline crossing of Finn Creek at a deeply incised portion of the creek.

Finn Creek will be crossed during the least risk window to fish species using an isolated pipeline crossing technique. There are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect that cannot be technically or economically mitigated. It is concluded that the residual environmental effects of pipeline construction and operations on conservational and recreational values of Finn Creek Provincial Park related will be not significant. This Environmental and Socio-Economic Assessment (ESA) considered the management objectives of Finn Creek Provincial Park.

North Thompson River Provincial Park

The proposed pipeline corridor through North Thompson River Provincial Park involves a trenchless crossing of the Clearwater River and a paralleling of the existing TMPL right-of-way for most of its length through the park. During consultation with BC Parks officials it was recommended that the contingency watercourse crossing method (*i.e.*, open cut) also be considered into the route selection in the event that a trenchless crossing was not successful. Both these alternates propose to parallel the existing TMPL right-of-way through the park. In order to avoid the park, 1.8 km of new right-of-way would need to be created along the west boundary of the park within a previously undisturbed mature forest.

There are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect that cannot be technically or economically mitigated. It is concluded that the residual environmental effects of pipeline construction and operations on conservational and recreational values of North Thompson River Provincial Park will be not significant. This Environmental and Socio-Economic Assessment (ESA) considered the management objectives of North Thompson River Provincial Park.

Lac du Bois Grasslands Protected Area

Trans Mountain proposed two routes in the vicinity of Lac du Bois Grasslands Protected area; the first to parallel the existing TMPL right-of-way and the second, to parallel the Telus Fiber Optic Transmission System (FOTS) through the protected area. Paralleling the existing TMPL right-of-way would involve disrupting 74 private landowners in the community of Westsyde. During Trans Mountain's consultation process, strong community support was expressed by some stakeholders for a corridor west of Westsyde through the protected area following the existing FOTS right-of-way, while others raised concerns about the environmental impacts to the unique nature of the grasslands. Trans Mountain evaluated both alternates from an environmental and socio-economic perspective and proposed to parallel the FOTS right-of-way as the preferred alternative.

With the implementation of industry-accepted mitigation practices, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect that cannot be technically or economically mitigated. It is concluded that the residual environmental effects of pipeline construction and operations on conservational and recreational values of Lac du Bois Grasslands Protected Area will be not significant. This Environmental and Socio-Economic Assessment (ESA) considered the management objectives of Lac du Bois Grasslands Protected Area.

Bridal Veil Falls Provincial Park

The proposed pipeline corridor through Bridal Veil Falls Provincial Park parallels the existing TMPL right-of-way for its entire length, as one of Trans Mountain's main routing criteria involved paralleling the existing TMPL right-of-way where possible. A route outside the existing TMPL right-of-way would lose the benefit of important operational synergies and negate the environmental merits of following the existing pipeline. The alternative route around the park avoids the park as well as the Popkum Reserve #2. Early discussions with BC Ministry of Transportation and Infrastructure indicated reluctance to allow use of their easement. BC Parks Officials requested that Trans Mountain consider the use of a trenchless construction technique to avoid disturbance to the surface of the park. If a trenchless construction technique is deemed to be geotechnically feasible, this option will be advanced.

There are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect that cannot be technically or economically mitigated. It is concluded that the residual environmental effects of pipeline construction and operations on conservational and recreational values of Bridal Veil Falls Provincial Park will be not significant. This Environmental and Socio-Economic Assessment (ESA) considered the management objectives of Bridal Veil Falls Provincial Park.

Benefits to Province of BC

In May 2013, pursuant to the NEB Reasons for Decision RH-001-2012, the Project received approval pursuant to Part IV of the *NEB Act* for the toll methodology, terms and conditions that would apply to the Project. This approval reinforces market support for the Project and provided Trans Mountain with the necessary economic incentive to proceed with design, consultation and regulatory applications.

The economic benefits to the Province of BC that result from the Project include both short and long-term benefits to both the region surrounding the parks and the province as a whole.

Overall, the proposed expansion will enhance Canada's ability to reach diversified markets with its oil, while also increasing tax revenues that can be used to fund government projects and services that Canadians depend on such as health care, education, roads and infrastructure.

Trans Mountain plans to spend $5.4 billion by the end of 2018 to construct the line and associated facilities, and a further $2.4 billion to operate it for the first 20 years. BC's economy is forecast to grow by $2.8 billion (GDP) through construction-related spending and up to $11.3 billion including Project operations through 2038.

The Project is also anticipated to generate substantial provincial and municipal tax revenue. Provincial governments' revenues associated with the Project are anticipated to be in the order of $1.7 billion, with the BC government receiving $1 billion in provincial taxes. Municipal tax revenues that can support community services and infrastructure are estimated to increase approximately $23 million annually or $460 million over 20 years of operations.

The estimated tax revenues to the Government of Canada are $2.1 billion over the life of the Project. Construction is scheduled in 2016 to 2018 with an estimated 4,500 workers at peak manpower. Trans Mountain expects to create 108,000 person-years of employment, from construction and the first 20 years of operations across Canada; of this, at least 66,000 person years of employment will be in BC.

The proposed expanded operations are anticipated to create 50 new full time permanent positions in BC.

A TMEP goal is that the Project produces no net loss of native biodiversity and the integrity of ecosystems in the regions of the four BC provincial parks and one recreation area through which the Trans Mountain pipeline corridor passes. Further, where practical the Project shall strive to produce a net benefit to native biodiversity and ecological integrity in those regions. This goal demonstrates TMEPs commitment to exceed minimum standards in areas with acknowledged biodiversity values.

The Project has pursued its goal by employing a three step strategy, conventionally known as "the mitigation hierarchy": Avoidance, Mitigation, and Offsetting.

This mitigation hierarchy provides independent recommendations for an approach that TMEP could apply to achieve no net loss of native biodiversity and ecological integrity in BC provincial parks and recreation area. This biodiversity offset program assumes that irreplaceable habitat has been avoided.

PROVINCIAL PROTECTED AREA BOUNDARY ADJUSMENT POLICY, PROCESS AND GUIDLINES CHECKLIST

GUIDELINES FOR DETAILED PROPOSAL

The following table identifies where information requested in the Guidelines for Detailed Proposals checklist may be found in the various sections of the Application for the Trans Mountain Expansion Project.

No.	Requirement	In Application? References
Alternatives to avoid the protected area have been considered.		
1.	Proponents must consider and document alternatives that would avoid a protected area boundary adjustment.	Section 2.0 of Draft Draft Stage 2 Introduction Section 2.0 of each respective Parks Tab
Overall economic benefits to the Province have been documented		
2.	An overall analysis of the economic benefits and costs, if any, associated with the proposed boundary adjustment will inform the assessment process. The economic analysis should include a summary of the short-term and long-term employment benefits, regional infrastructure impacts, and potential revenues to Government.	Section 6.0 of Draft Stage 2 Introduction
Social and environmental impacts have been documented.		
3.	All potential impacts of the proposed development on the social and environmental values of the protected area must be identified. This should include consideration of how the proposal may benefit traditional user activities, visitor enjoyment and safety, identification and impacts to natural values in the area and associated risks to natural values. Broader environmental impacts or benefits, beyond the protected area, should also be identified. The assessment of socio and environmental impacts will assist in identifying potential mitigation, restoration or compensation measures that would preserve the recreation and/or conservation values of the protected area.	Section 7.0 of Draft Stage 2 Introduction Section 7.0 of each respective Parks Tab Section 4.0 of Draft Stage 2 Introduction Section 4.0 of each respective Parks Tab
Mitigation and restoration measures have been identified.		
4.	Proponents will identify ways to avoid, minimize or compensate for the impacts the proposed development may have on protected area values. This will inform the assessment process of opportunities to retain or add to protected area values.	Section 7.0 of Draft Stage 2 Introduction Section 7.0 of each respective Parks Tab Section 8.0 of each respective Parks Tab
First Nations have been adequately consulted		
5.	Proponents need to discuss the proposed development and potential impacts on protected area values with the appropriate First Nations and include a summary of the discussions with the detailed proposal. This will provide an indication of the degree of First Nations acceptance (or lack thereof) of the proposal. Inclusion of this information in the proposal will assist the Ministry staff in meeting the Crown's duties to consult with First Nations, and if necessary, accommodate any infringement on asserted rights or title.	Section 3.0 of Draft Stage 2 Introduction Section 3.0 of each respective Parks Tab
Local Community (including local governments) have been consulted.		
6.	Proponents must assess the level of support to opposition among the key community, local government and public groups that may have an interest in the potential impacts of the proposed development on protected area boundaries. The proponent should identify whether this indication of public response was obtained through direct consultation or through indirect means such as review of media reports, interest group newsletters, or other appropriate means. This information will assist in identifying whether adequate public and/or local government consultation has occurred.	Section 4.0 of Draft Stage 2 Introduction Section 4.0 of each respective Parks Tab
Provincial and Federal Agencies have been consulted.		
7.	The proponent, with advice from BC Parks, should make contact with appropriate and provincial agencies that may have an interest in the proposal and seek input or comment.	Section 4.0 of Draft Stage 2 Introduction Section 4.0 of each respective Parks Tab

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DEFINITIONS AND ACRONYM LIST

Definition/Acronym	Full Name
AADT	Annual Average Daily Traffic
AB	Alberta
AK	alternate kilometre post
AIA	Archaeological Impact Assessment
Alliance	Alliance Pipeline Limited Partnership
avoidance	A means to prevent a potential adverse effect through routing/siting of the Project, changes to project design or construction timing.
BC	British Columbia
BC CDC	BC Conservation Data Centre
BC MFLNRO	BC Ministry of Forests, Lands and Natural Resource Operations
BC MLPH	BC Ministry of Lands, Parks and Housing
BC MOE	BC Ministry of Environment
BC MOF	BC Ministry of Forests
BC MWLAP	BC Ministry of Water, Land and Air Protection
BC OGC	BC Oil and Gas Commission
BBOP	Business and Biodiversity Offsets Programme
BGC	biogeoclimatic
bunchgrass	bunchgrass
BVFPP	Bridal Veil Falls Provincial Park
CAC	criteria air contaminants
CAPP	Canadian Association of Petroleum Producers
CCME	Canadian Council of Ministers of the Environment
CLI	Canada Land Inventory
CO	carbon monoxide
CO_2	carbon dioxide
compensation	A means intended to compensate unavoidable and potentially significant or unacceptable effects any may consist of offsets (no net loss), research, education programs and financial compensation (considered only when all other options have been exhausted).
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSA	Canadian Standards Association
CWH	Costal Western Hemlock
DFO	Fisheries and Oceans Canada
DUC	Ducks Unlimited Canada
EEBMA	Emergency Bark Beetle Management Area
element	A technical discipline or discrete component of the biophysical or human environment identified in the National Energy Board *Filing Manual.*
ENGO	environmental nongovernment organization
EPP	Environmental Protection Plan
ESA	Environmental and Socio-Economic Assessment
FEARO	Federal Environmental Assessment Review Office
FOTS	Fiber Optic Transmission System
GBPU	grizzly bear population unit
GDP	gross domestic product
GHG	greenhouse gas
H_2S	hydrogen sulphide
HDD	horizontal directional drill
HORU	human occupancy and resource use
IBA	Important Bird Areas
IDF	Interior Douglas-fir

Definition/Acronym	Full Name
indicator	A biophysical, social or economic property or variable that society considers to be important and is assessed to predict Project-related changes and focus the impact assessment on key issues. One or more indicators are selected and used as surrogates to describe the present and predicted future condition of an element. Societal views reflect published information such as management plans and engagement with regulators, public, Aboriginal and other interested groups.
IHC	Interior Cedar-Hemlock
IPL	Interprovincial Pipe Line Inc.
KMC	Kinder Morgan Canada Inc.
KP	kilometre post
Local Study Area	The zone of influence or area where the element and associated indicators are most likely to be affected by Project construction and operation This generally represents a buffer from the centre of the proposed pipeline corridor.
LSA	Local Study Area
LRMP	land and resource management plan
MADT	monthly average daily traffic
mitigation	The elimination, reduction or control of the adverse environmental effects of the Project and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means.
N_2O	nitrogen dioxide
NEB	National Energy Board
NEB OPR	*National Energy Board Onshore Pipeline Regulations*
NOVA Gas	NOVA Gas Transmission Ltd
NRC	Natural Resources Canada
NTU	nephelometric turbidity units
OGMA	Old Growth Management Area
OHV	off highway vehicle
OIC	Orders in Council
PPV	particle velocity
PCEM	Post-Construction Environmental Monitoring
post-construction monitoring	A type of monitoring program that may be used to verify that mitigation measures were properly implemented and that such measures effectively mitigate the predicted adverse environmental effects.
PM	particulate matter
PP	Ponderosa pine
proposed pipeline corridor	Generally a 150 m wide corridor encompassing the pipeline construction right-of-way, temporary workspace and valves.
QEP	Qualified Environmental Professional
Regional Study Area	The area extending beyond the Local Study Area boundary where the direct and indirect influence of other activities could overlap with Project-specific effects and cause cumulative effects on the environmental or socio-economic indicator.
RK	reference kilometre post
RSA	Regional Study Area
SARA	*Species at Risk Act*
SEMP	Socio-economic Management Plan
SIWMC	Southern Interior Weed Management Committee
SO_2	sulphur dioxide
SSN	Stk'emlupsemc te Secwepemc
supplemental studies	Studies to be conducted post submission of the Application to address data gaps.
TEK	Traditional Ecological Knowledge
TERA	TERA Environmental Consultants
TLRU	traditional land and resource use
TMEP	Trans Mountain Expansion Project
TMPL	Trans Mountain Pipeline
TNRD	Thompson-Nicola Regional District

Definition/Acronym	Full Name
Trans Mountain	Trans Mountain Pipeline ULC
TSS	turbidity/total suspended solids
TWS	temporary workspace
the Project	Trans Mountain Expansion Project
VOC	volatile organic compound
WHSRN	Western Hemisphere Shorebird Reserves Network
ZOI	zone of influence

1.0 INTRODUCTION

Trans Mountain Pipeline ULC (Trans Mountain) is a Canadian corporation with its head office located in Calgary, Alberta (AB). Trans Mountain is a general partner of Trans Mountain Pipeline L.P., which is operated by Kinder Morgan Canada Inc. (KMC) and fully owned by Kinder Morgan Energy Partners, L.P. (Kinder Morgan) Trans Mountain is the holder of the National Energy Board (NEB) certificates for the Trans Mountain Pipeline (TMPL) system.

The TMPL system commenced operations 61 years ago and now transports a range of crude oil and petroleum products from Western Canada to locations in central and southwestern British Columbia (BC), Washington state and offshore. Trans Mountain currently supplies much of the crude oil and refined products used in BC. TMPL is operated and maintained by staff located at Trans Mountain's regional and local offices in AB (Edmonton, Edson and Jasper) and BC (Clearwater, Kamloops, Hope, Abbotsford and Burnaby).

The TMPL system has an operating capacity of approximately 47,690 m^3/d (300,000 bbl/d), using 24 active pump stations and 40 tanks. The expansion will increase the capacity to 141,500 m^3/d (890,000 bbl/d).

The proposed expansion will comprise the following:

- pipeline facilities that complete a twinning (or "looping") of the pipeline in AB and BC with about 987 km of new buried pipeline;
- new and modified facilities, including pump stations and tanks; and
- a total of three new berths at the Westridge Marine Terminal in Burnaby, BC, each capable of handling Aframax tanker size.

The expansion has been developed in response to requests from Western Canadian oil producers and West Coast refiners for increased pipeline capacity in support of growing oil production and access to growing West Coast and offshore markets. The recent NEB decision RH-001-2012 reinforces market support for the expansion and provides Trans Mountain the necessary economic incentive to proceed with design, consultation and regulatory applications.

An application was submitted to the NEB on December 16, 2013, pursuant to Section 52 of the *NEB Act* for the proposed Trans Mountain Expansion Project (referred to as "TMEP" or "the Project"). The NEB completed a detailed review and will hold hearings to determine if it is in the public interest to recommend a Certificate of Public Convenience and Necessity for construction and operation of the Project. Subject to the outcome of the NEB Hearing Process, Trans Mountain plans to begin construction in 2016 and go in to service in 2018.

Trans Mountain has embarked on an extensive program to engage Aboriginal communities and to consult with landowners, government agencies (*e.g.,* regulators and municipalities), stakeholders and the general public. Information on the Project is also available at www.transmountain.com.

1.1 Proponent

Kinder Morgan is the largest midstream and the third largest energy company (based on combined enterprise value) in North America. Kinder Morgan owns an interest in or operates approximately 130,000 km of pipelines transporting natural gas, refined petroleum products, crude oil and carbon dioxide (CO_2).

Kinder Morgan, through its operating company Kinder Morgan Canada Inc., has owned and operated the TMPL since 2005. Trans Mountain is the holder of the operating certificate from the NEB for the TMPL and it is the Applicant for the Trans Mountain Expansion Project.

1.2 Purpose of Boundary Adjustment Request

The existing TMPL was constructed in 1952 and 1953, prior to the establishment of protected areas along the route. Over the subsequent years, eight protected areas have been established in areas through which TMPL passes. In each case, the 18 m TMPL right-of-way has been exempted or acknowledged within the protected areas by Orders in Council (OIC), which grants Trans Mountain the following rights:

> "*For laying down, construction, operation, maintenance, inspection, alteration, removal, replacement, reconstruction, and/or repair of one or more pipelines, together with all works of Trans Mountain Oil Pipe Line Company necessary for its undertaking, herein referred to as installations, including but not limiting the generality of the foregoing all such pumping and other stations, structures, communication systems, including pole lines, drips, valves, fittings, meters, and other equipment and appurtenances as may be necessary or convenient in connection herewith the carriage, conveyance, transportation, storage and/or handling of oil and/or any by-products thereof together with the right of ingress and egress to and from the same for its servants, agents, contractors and subcontractors with vehicles, supplies and equipment for all purposes necessary or incidental to its undertaking, over, on, under and/or through a strip of Crown Land.*"

The existing TMPL crosses through eight protected areas and operates on the basis of both a 1952 grant obtained through Orders in Council.

In the summer of 2012, Trans Mountain began a preliminary route assessment of the existing TMPL corridor to identify routing options for the Project. In conducting this assessment, Trans Mountain was assisted by consultants to acquire detailed and site-specific information about the environmental, geological and geotechnical conditions along each corridor. Corridor selection is based on a number of criteria, including limiting creation of new right-of-way by paralleling existing rights-of-way, where practical. The routing criteria for the Project is presented in Section 2.1. Through the process of examining corridor options along the existing TMPL, Trans Mountain proposed alternatives that completely avoid three of the eight protected areas.

The proposed pipeline corridor traverses five protected areas (three provincial parks, one *Environment and Land Use Act* Protected Area and one Recreation Area) in BC (Table 1.2-1). The proposed pipeline corridor is a 150 m wide corridor encompassing the pipeline construction right-of-way and temporary workspace.

TABLE 1.2-1

PROTECTED AREAS TRAVERSED BY THE EXISTING TMPL AND THE PROPOSED PIPELINE CORRIDOR

Protected Areas	Lead Regulatory Agency	Class Designation	Orders In Council	RK/AK Range	Length of TMPL Right-of-Way (km)	Length of proposed TMEP Right-of-Way (km)	Boundary Adjustment Requested
Finn Creek Provincial Park	BC Parks	Class A	2412	AK 638.6 to AK 639.3	0.7	0.7	Temporary
North Thompson River Provincial Park	BC Parks	Class A	2925	AK 725.4 to AK 727.8	1.7	1.9	Temporary
Lac Du Bois Grasslands Protected Area	BC Parks	*Environment and Land Use* Act Protected Area	578 547	RK 828.4 to RK 836.9 RK 842.3 to RK 843.9	0.4	10.1	Temporary
Coquihalla Summit Recreational Area	BC Parks	Recreation Area	1705	RK 992.3 to RK 1005.2	12.6	13.3	Not applicable
Bridal Veil Falls Provincial Park	BC Parks	Class A	Easement #152475C (same clause as the OICs)	AK 1079.4 to AK 1079.8	0.4	0.4	Temporary

Trans Mountain submitted to BC Ministry of Environment (MOE) a Stage 1 Request for the Boundary Adjustment Process in accordance with the *Provincial Protected Area Boundary Adjustment Policy, Process and Guidelines*. The Stage 1 Request for a Boundary Adjustment was submitted to BC Parks on March 5, 2013 for Lac Du Bois Grasslands Protected Area and on June 13, 2013 for the remaining four protected areas.

In October 2013, Trans Mountain was provided approval to proceed to the second stage of the Boundary Adjustment Process, the preparation and submission of a Detailed Proposal (Draft Stage 2 of the Boundary Adjustment Process) for four of the five protected areas. It was deemed by BC Parks that Coquihalla Summit Recreation Area would require a Resource Use Permit instead of the Draft Stage 2 Detailed Proposal because of its class designation. BC Parks did request that the proposed work within Coquihalla Summit Recreation Area undergo the same level of environmental assessment as the other protected areas. Trans Mountain has committed to completing an environmental assessment for the Coquihalla Summit Recreation Area.

The Draft Stage 2 Boundary Adjustment Proposal is a detailed proposal to adjust the boundaries of the protected areas to permit the construction and operation of the TMEP. Trans Mountain will submit a final Stage 2 Boundary Adjustment Application in late 2014. This proposal, along with the results of the consultation with communities, First Nations and local governments, will be considered by the Minister of Environment. The Minister may recommend to Cabinet that the protected areas' boundaries be adjusted to enable the Project to proceed. The final decision on whether to amend the parks boundaries is made by the BC Legislature. The final decision about whether to amend the boundary of Lac du Bois Grasslands Protected Area is made by the Cabinet.

If the lands required for the Project are removed from the three provincial parks, the Ministry of Environment may seek government approval to establish those lands as a protected area under the *Environment and Land Use Act*, to allow the Minister of Environment to continue to manage those areas.

Following completion of Project construction, the lands removed from the parks through the boundary adjustment may be returned to park or protected area status, with operations authorized under a park use permit.

This report has been prepared in support of Trans Mountain's formal request to adjust the boundary of the following protected areas to allow for construction of the TMEP and the use of temporary associated facilities, including access to the right-of-way. The protected areas are:

- Finn Creek Provincial Park;
- North Thompson River Provincial Park;
- Lac Du Bois Grasslands Protected Area; and
- Bridal Veil Falls Provincial Park.

This report has been structured and prepared to comply with the BC MOE's *Provincial Park Boundary Adjustment Policy, Process and Guidelines* dated March 2010 (BC MOE 2010b).

1.3 Outline of the Draft Stage 2 Detailed Proposal

This introduction discusses the Project, the engagement and consultation conducted for the Draft Stage 2 Detailed Proposal, the economic benefits to BC, and the methodology for identifying and assessing effects. This introduction is followed by site-specific environmental and socio-economic assessments (also referred to as the Impact Assessment Reports) for the four protected areas as follows.

- Tab A – Finn Creek Provincial Park.
- Tab B – North Thompson River Provincial Park.
- Tab C – Lac Du Bois Grasslands Protected Area.
- Tab D – Bridal Veil Falls Provincial Park.

Each of the four Impact Assessment Reports are divided into the following sections.

1.0 **Introduction:** Provides a general overview of the park.

2.0 **Corridor Selection and Project Activities:** Provides a detailed description of the proposed pipeline corridor selection process within the park and the construction activities planned.

3.0 **Aboriginal Engagement:** Provides a summary of Aboriginal engagement activities conducted in preparation of the Draft Stage 2 Detailed Proposal for the proposed pipeline corridor within the park.

4.0 **Public Consultation:** Provides a summary of the public consultation activities conducted in preparation of the Draft Stage 2 Detailed Proposal for the proposed pipeline corridor within the park. The section also identifies key environmental issues raised during the consultation program.

5.0 **Economic Benefit:** Provides a summary of the estimated workforce requirements to construct the proposed pipeline within the park.

6.0 **Setting:** Provides a description of the current environmental and socio-economic conditions present along the proposed pipeline corridor within the park.

7.0 **Environmental and Socio-economic Effects and Mitigation:** Describes the effects assessment and identifies the potential environmental and socio-economic effects of the construction and operations of the proposed pipeline within the park, mitigation measures and potential residual effects, including an assessment of their significance.

8.0 **Reclamation:** Provides a Reclamation Framework for each park that identifies additional measures and activities to re-establish the ecological integrity of each park during Project construction. The section also identifies the reclamation objectives and goals for the park.

Also accompanying the Draft Stage 2 Detailed Proposal are photomosaic Environmental Alignment Sheets (EAS) outlining mitigation measures as described in this Proposal as well as the Pipeline EPP to be implemented during construction of the Project. The EAS provide information pertaining to the environmental socio-economic setting, the potential environmental and socio-economic issues identified during Project planning, and their corresponding mitigation measures.

2.0 CORRIDOR SELECTION AND PROJECT ACTIVITIES

2.1 General Routing Objectives and Criteria

Early in the Project planning process, Trans Mountain elected to be contiguous with the 18 m wide TMPL easement to the greatest extent practical while using the existing easement where possible for the TMEP and to minimize environmental and socio-economic effects, and facilitate efficient pipeline operations. While this was determined to be feasible for over 70% of the distance, it was not suitable in all locations. As engineering, environmental and other disciplines examined maps, completed field observations and consulted with Aboriginal groups, regulatory authorities, municipalities, landowners, stakeholders and public members, a hierarchy of routing criteria was established. In descending order of preference, these were:

- where feasible, install the TMEP segments on or adjacent to the existing TMPL easement;
- where that proves not feasible, install the TMEP segments adjacent to easements or rights-of-way of other linear facilities including other pipelines, power lines, highways, roads, railways, fiber optic transmission systems and other utilities;
- or if that is not feasible, install the TMEP segments in a new easement (*i.e.,* not parallel to other easements) selected to balance a number of engineering, construction, environmental and socio-economic factors; and
- lastly, in the event a new easement is necessary, minimize the length of the new easement before returning to the TMPL easement or other easements.

In the context of the hierarchy of routing criteria, feasibility includes consideration of a range of factors including constructability, long-term geotechnical stability, environmental and socio-economic suitability and others. Specific factors that could result in a deviation from the TMPL easement are listed in Table 2.1-1: The routing specific to each park is described in Section 2.0 of each respective assessment (*i.e.*, Parks Tab).

TABLE 2.1-1

FACTORS THAT COULD RESULT IN DEVIATION FROM EXISTING TMPL EASEMENT

Factor
1. Safety – minimize areas posing hazards to: a. construction/operations workers – workspace, overhead hazards, geotechnical hazards; and b. public – traffic interaction, proximity to excavations and heavy equipment.
2. Pipeline integrity – minimize crossing areas with geotechnical hazards, high potential for third-party contact and poor maintenance access.
3. Environment – minimize environmental impacts by attempting to reduce the following as much as practical: a. the total number of watercourse crossings; b. length in the riparian reserve zone; c. difficult reclamation areas and unstable terrain; d. length within protected areas and other designated protected areas; e. the total number of wetland crossings; and f. creating new access in areas considered to be ecologically important.
4. Constructability – avoid factors negatively affecting construction efficiency.
5. Terrain – minimize crossing side slopes, geohazards, rock, waterbodies, wetlands and high water table areas.
6. Infrastructure – minimize encroachment on existing and planned infrastructure.
7. Access – avoid limited or difficult existing access roads (stability, turn radius, local interference).
8. Stakeholders and socio-economic requirements: a. review and be consistent with land use policy documents; b. landowner – consider landowner concerns; c. protected areas – avoid where practical; d. recreational areas – avoid where practical; e. infrastructure – dependant on meetings with representatives of applicable utility; and f. residential density – reduce length in high density areas where other options are available.

TABLE 2.1-1 Cont'd

Factor
9. Aboriginal impact: a. reserve lands dependant on consultations; provide alternate routing for planning; and b. Traditional Lands – dependant on consultation.
10. Cost and schedule – reduced length is preferred; schedule reduction due to improved constructability over a longer distance should be considered.

2.2 Construction

2.2.1 Pipeline Installation

Pipeline installation will involve the following standard activities: engineering; construction surveying; clearing of vegetation; topsoil or root zone material salvage; grading (if required); stringing; bending and welding; trenching; lowering-in; backfilling; hydrostatic testing; clean-up/reclamation; and wetland and watercourse crossings.

TABLE 2.2.1-1

ACTIVITIES ASSOCIATED WITH PIPELINE INSTALLATION

Pipeline Construction Phase	Associated Activities
Engineering	The pipeline will be designed and constructed in accordance with all applicable Canadian Standards Association (CSA) standards and the *National Energy Board Onshore Pipeline Regulations* (*NEB OPR*).
Construction Survey	Activities include line-of-sight clearing with chain saws (where needed), flagging and staking of the boundaries of the construction right-of-way and temporary workspace, as well as marking trench line and existing utilities. Avoidance areas will be appropriately fenced or flagged.
Clearing	Vegetation (trees, stumps, brush, grasses and other vegetation) and snow will be mowed or cleared from the construction right-of-way and temporary workspace. Equipment used during clearing activities may include chainsaws, rotary grinders, feller-bunchers, hydro-axes or other tree-clearing and brushing equipment, as well as skidders, bulldozers and excavators. A stump mulcher will be utilized rather than grubbing on areas where topsoil or root zone material salvage and grading is not necessary.
Disposal	Timber and brush disposal options will be subject to agreements with BC Parks. Merchantable timber will be salvaged as determined in the Timber Salvage Plan (Pipeline Environmental Protection Plan [EPP) in Appendix A of the Draft Stage 2 Detailed Proposal. Residual woody materials will be disposed of by burning or chipping, unless otherwise directed by the Lead Environmental Inspector, Inspector(s) or the appropriate regulatory authority (*e.g.,* BC Ministry of Forests, Lands and Natural Resource Operations and/or BC MOE).
Topsoil or Root Zone Material Salvage	In general, topsoil will be salvaged to ensure that the soil productivity is maintained in grassland areas and root zone material will be salvaged where grading is necessary on treed lands. The width and depth of topsoil or root zone material salvage depends on a number of factors including the land use, soil conditions, microtopography and BC Parks requests, and grading requirements. Equipment used during topsoil or root zone material handling activities may include bulldozers, graders and excavators.
Grading (if required)	Following topsoil or root zone material salvage, although not anticipated, grading may be necessary on irregular ground surfaces (including temporary workspace) to provide a safe work surface. Graders, backhoes and bulldozers may be used for this activity.
Stringing, Bending and Welding	The pipe will be transported by truck from stockpile sites to the construction right-of-way. The pipe will be bent, lined up, welded, joint-coated and inspected prior to being lowered into the trench. It is anticipated that a mix of manual and mechanized welding will be used depending on terrain and anticipated productivity. Equipment used during stringing, bending and welding activities includes pipe trucks, booms, pick-up trucks, excavators and x-ray or ultrasonic inspection equipment mounted on pick-up trucks or skids.
Trenching	The trench will be excavated using tracked excavators to a depth sufficient to ensure the depth of cover is in accordance or in excess of applicable codes. The minimum depth cover for the pipeline will generally be 0.9 m (the pipeline trench will be deeper at watercourse crossings, highway crossings, etc.). Paved road crossings will generally be bored.
Lowering-in	The pipe will be lowered into the trench using sideboom tractors and excavators. Trench dewatering may be necessary at certain locations during lowering-in (*e.g.*, to ensure acceptable bedding for pipe, to prevent the pipe from floating or performing tie-in welds).
Backfilling	Prior to backfilling, subsurface erosion control structures such as trench breakers will be installed on steep slopes or long continuous slopes, along with subdrains, where warranted, to control subsurface drainage along the trench. The trench will be backfilled using excavators, graders, bulldozers or specialized backfilling equipment. Backfill material will generally consist of native trench spoil material. Displaced subsoils will be crowned over the trench to compensate for settlement and any excess trench spoil will be feathered out over adjacent portions of the construction right-of-way where topsoil or root zone material salvage has occurred.

TABLE 2.2.1-1 Cont'd

Pipeline Construction Phase	Associated Activities
Testing	The pipeline will be hydrostatically pressure-tested in accordance with the *NEB OPR*, provincial legislation and guidelines, as well as the latest version of CSA Z662. Test water will be withdrawn and released in accordance with BC *Water Act* approval conditions. Upon completion, test water will be returned to its source basin. A detailed hydrostatic test plan will be developed and reviewed before the start of the hydrostatic pressure testing program.
Clean-up and Reclamation	Initial clean-up and reclamation activities along disturbed portions of the construction right-of-way and temporary access trails (once weather and soil conditions permit. Debris remaining following construction will be removed and disposed of in compliance with local regulations. The construction right-of-way will be graded to restore pre-construction contours, where practical, and returned to a stable condition. The topsoil or root zone material will be replaced, with cross ditches and diversion berms installed on moderate and steep slopes to reduce the risk of erosion. On treed lands where erosion is not expected, natural revegetation will be the preferred method of reclamation. Native grassland areas will be seeded with an appropriate seed approved by BC Parks.
Wetland Crossings	Ground-level cutting/mowing will be conducted for wetland vegetation. Wetland areas will be allowed to regenerate naturally. Non-wetland areas will be seeded with an appropriate seed mix and special reclamation measures will be applied, where warranted.
Watercourse Crossings	Options available for crossing watercourses include trenched (*e.g.,* isolation [dam and pump, flume] and open cut) and trenchless (horizontal directional drill [HDD] and bore) methods. The crossing method chosen will be based on the width, streamflow, channel morphology, subsurface geology, sensitivity and approach slopes.

There is no associated above ground piping for the proposed Project in park areas. All Project components will be buried and installed within the proposed pipeline right-of-way.

2.2.2 Construction Schedule

Pending regulatory approval, construction is scheduled to commence during first half of 2016 with an estimated 2 year construction period and an in-service date in 2018 following the completion of construction. Detailed construction schedules within each park are provided in Section 2.0 of the respective Parks Tab.

Pipeline construction activities are progressive, commencing with survey and proposed right-of-way preparation, and continuing through pipe stringing, welding, pipe inspection, trenching, lowering-in, backfilling, clean-up and reclamation. These activities are performed sequentially and move along the construction right-of-way. Construction activities are expected to take place over a 2 year period. Final clean-up and reclamation may be postponed until suitable weather and soil conditions occur.

2.2.3 Inspection

The involvement of full-time, qualified and trained Environmental Inspector(s) is a key component of Trans Mountain's environmental compliance strategy. The Environmental Compliance Manager, Supervisor of Environmental Inspection, Lead Activity Inspector(s) and the Environmental Inspector(s) will enforce continuous and consistent compliance with this application, all permit/approval conditions, environmental laws and guidelines, and other environmental commitments.

2.3 Post-Construction Monitoring, Operations and Maintenance

KMC has a fully developed preventative maintenance program in place for the existing TMPL system pipelines and right-of-way, pump station, terminals and ancillary facilities. The program will be enhanced to fully integrate the TMEP pipelines and facilities sufficiently in advance of the start-up of the expanded TMPL system to allow for implementation and appropriate training to take place.

Preventative maintenance will be managed in accordance with the existing KMC Maintenance Management Program. The existing KMC Pipeline Integrity Management Program will be enhanced and applied to all reactivated and new pipeline segments

KMC is committed to operating in a manner which minimizes environmental impacts and ensures that the operation of the TMPL system complies with all environmental regulations, applicable permit conditions and the requirements of the appropriate regulatory authorities. Environmental requirements are incorporated into all business decisions and operational activities. KMC has fully implemented the KMC *Environment, Health and Safety Policy* and will amend the policy as necessary to include all assets, personnel and processes, constructed, added or developed as part of TMEP.

After all the construction and reclamation phases are completed, limited activity and access to the proposed pipeline right-of-way is expected in each park.

Trans Mountain will develop a Post-Construction Environmental Monitoring (PCEM) Program for the Project to assess the effectiveness of mitigation and reclamation measures on the topographic condition, soils, vegetation, riparian areas, instream habitat, air, noise, wetlands, wildlife habitat, human access and water wells (if warranted) along the construction right-of-way, temporary access areas and other areas disturbed during construction. Trans Mountain will conduct monitoring and prepare maintenance plans and quality assurance/control plans to address any potential adverse environmental effects.

Monitoring during operations and maintenance activities will be composed of regular aerial patrols with ground reconnaissance to assess any issues raised during the aerial patrols, issues raised by Aboriginal communities, BC Parks, leaseholders or regulatory authorities, or potential issues. Operational and environment personnel will ensure that any mitigation measures that are warranted are implemented in a timely basis. In-line investigation tools will be run at regular intervals in order to monitor the pipeline. Investigative and/or integrity digs will be conducted as warranted. Monitoring will be conducted at facilities pursuant to permitting conditions. Upon completion of the PCEM Program, monitoring by Trans Mountain personnel will occur regularly throughout the life of the pipeline.

Trans Mountain will conduct the PCEM Program during a period up to the first five complete growing seasons (or during years one, three and five) following commissioning of the Project as per certificate conditions and approval of the Draft Stage 2 Detailed Proposal. The PCEM Program will be initiated following clean-up, in order to identify any unresolved issues upon the completion of construction. The first PCEM report will be the Environmental As-Built Report.

3.0 ABORIGINAL ENGAGEMENT

Trans Mountain is committed to establishing and maintaining effective relationships with Aboriginal communities in proximity to new or existing operations. Establishing mutually beneficial working relationships with Aboriginal communities and Aboriginal groups is key to successfully maintaining Trans Mountain's existing operations and the expansion.

3.1 Principles and Goals

Maintaining effective relationships with Aboriginal communities and Aboriginal groups is, in part, done through engagement programs, which are specific to concerns and issues raised by Aboriginal communities and Aboriginal groups. Trans Mountain's Aboriginal Engagement Program for the Project has been developed and operates under the following principles:

- **Build trust and respect** – These values form the basis of Trans Mountain's engagement with Aboriginal peoples.
- **Ensure meaningful engagement** – Conduct meaningful engagement with Aboriginal peoples who assert Aboriginal and treaty rights.
- **Address legal requirements** – Carry out Trans Mountain's legal requirements as a regulated company under the NEB jurisdiction to consult with and mitigate, where necessary, there are Project impacts.
- **Provide capacity funding** – Provide funding, as appropriate, to Aboriginal communities and Aboriginal groups who have an interest in the Project and who wish to engage in the Aboriginal Engagement Program.
- **Gather Aboriginal perspectives** – Gather Aboriginal perspectives on rights and asserted rights and identify issues and concerns relating to those rights and the Project.
- **Assess Project impacts** – In partnership with Aboriginal communities and Aboriginal groups, potential impacts will be identified and assessed and mitigation measures will be implemented where necessary.
- **Reach understandings** – Reach understandings or agreements that address potential infringement of Aboriginal rights affected by the Project.
- **Provide benefits** – Provide procurement, employment and workforce development opportunities to Aboriginal communities and Aboriginal groups affected by the Project and consider Mutual Benefit Agreements.

3.2 Aboriginal Engagement Program

3.2.1 Vision

The vision for the Aboriginal Engagement Program is to work with Aboriginal communities and Aboriginal groups in the spirit of co-operation and shared responsibility, and to build and sustain effective relationships based on mutual respect and trust to achieve respective business and community objectives.

Since 2012, Trans Mountain has engaged over 100 Aboriginal communities and Aboriginal groups along the Trans Mountain proposed pipeline corridor from Edmonton, AB to Burnaby, BC. Engagement activities include:

- invitation to participate in archaeological work and contribute to the Traditional Ecological Knowledge along the proposed pipeline corridor;
- funding of Traditional Land Use studies;
- invitation to engage with Trans Mountain on proposed geotechnical bore hole applications, permitted through the BC Oil and Gas Commission (OGC), which were under Fraser, North Thompson and Vedder rivers near the protected areas in

question. The BC OGC also led consultation with affected Aboriginal communities and Aboriginal groups;

- invitation to engage and discussions related to the Research Park Use Permit; and
- agreements with Aboriginal corporations which provide project services related to on-the-ground support directly related to an activity in or near a part of the TMEP right-of-way access.

Most Aboriginal communities and Aboriginal groups have an elevated awareness of the Project, resulting from Trans Mountain's 2013 Research and Education Park Use Permit application engagement, which was conducted to allow for biophysical studies to be carried out in the protected areas.

3.2.2 Identification of Aboriginal Communities and Aboriginal Groups

Using an inclusive approach beginning in 2012, Trans Mountain worked in collaboration with provincial ministries and BC Parks to identify Aboriginal communities and Aboriginal groups for engagement.

For the purposes of identifying Aboriginal communities and Aboriginal groups that might have an interest in the Project or have Aboriginal interests potentially affected the Project, two key considerations were initially taken into account.

1. The BC Ministry of Aboriginal Relations and Reconciliation and the Ministry of Natural Resource Operations Consultative Areas Database Public Map Service, which allows for identification of Aboriginal communities and Aboriginal groups who have treaty rights or asserted or proven rights or title on the land base. A list was generated by BC Parks through the Consultative Areas Database Public Map Service and was provided to Trans Mountain in 2013 as a preliminary list of engagement of affected Aboriginal communities and Aboriginal groups. Updated engagement lists were received from BC Parks in 2014, specifically for engagement of affected Aboriginal communities and Aboriginal groups for the Draft Stage 2 Detailed Proposals.
2. Direct engagement between Trans Mountain and individual Aboriginal communities, Aboriginal groups and tribal organizations.

Trans Mountain is engaging with a total of 24 Aboriginal communities in proximity to the proposed pipeline corridor within the four protected areas for the Draft Stage 2 Detailed Proposals (Tables 3.2-1, 3.2-2, 3.2-3, and 3.2-4.) that might have an interest in the four protected areas or have Aboriginal interests potential to be affected by the TMEP.

TABLE 3.2-1

ABORIGINAL COMMUNITIES AFFECTED BY THE PROPOSED BOUNDARY ADJUSTMENT IN FINN CREEK PROVINCIAL PARK

Simpcw First Nation
Adams Lake Indian Band
Neskonlith Indian Band

TABLE 3.2-2

ABORIGINAL COMMUNITIES AFFECTED BY THE PROPOSED BOUNDARY ADJUSTMENT IN NORTH THOMPSON RIVER PROVINCIAL PARK

Simpcw First Nation
Adams Lake Indian Band
Canim Lake Indian Band
Neskonlith Indian Band

TABLE 3.2-3

**ABORIGINAL COMMUNITIES AFFECTED BY
THE PROPOSED BOUNDARY ADJUSTMENT IN LAC DU BOIS GRASSLANDS PROTECTED AREA**

Tk'emlups te Secwepemc
Skeetchestn Indian Band
Stk'emlupsemc te Secwepemc Nation
Coldwater Indian Band
Siska Indian Band
Cook's Ferry Indian Band
Lower Nicola Band
Lytton First Nation
Nicola Tribal Association
Nooaitch First Nation
Shackan Indian Band
Oregon Jack Creek Band
Neskonlith Indian Band

TABLE 3.2-4

**ABORIGINAL COMMUNITIES AFFECTED BY
THE PROPOSED BOUNDARY ADJUSMENT IN BRIDAL VEIL FALLS PROVINCIAL PARK**

Peters Indian Band
Popkum First Nation
Cheam First Nation
Seabird First Nation
Shxw'ow'hamel First Nation
Skwah First Nation
Union Bar First Nations
Skawahlook First Nation
Kwah-Kwah-Aplit First Nation
Soowahlie First Nation
Yale First Nation
Chawathil First Nation

Trans Mountain understands early engagement with Aboriginal communities and Aboriginal groups is fundamental to ensuring Project success. In some cases, Aboriginal communities and Aboriginal groups have made arrangements for engagement through specific tribal or First Nation groups. These unique arrangements were honored and identified.

3.2.3 Engagement Methods

The Aboriginal Engagement Program uses a comprehensive engagement process led by professional and experienced engagement Advisors. The process for engagement with Trans Mountain about the Project and the Draft Stage 2 Detailed Proposal is flexible, allowing each community and group to engage in meaningful dialogue in the manner they choose, and in a way that meets their objectives and values.

In March 2012, the Trans Mountain Aboriginal Engagement Team was created and Aboriginal Engagement Team Field Advisors were assigned to each of the groups based on their knowledge and experience. In addition to the Field Advisors, the Aboriginal Engagement Team is made up of professionals working the in the areas of Aboriginal relations, economic development, education, training, employment and procurement.

The Aboriginal Engagement Program for the Draft Stage 2 Detailed Proposals focuses on:

- fully explaining the potential impacts and implications of the Draft Stage 2 Detailed Proposal and long-term reclamation objectives;
- exploring and understanding potential impacts on Aboriginal communities and Aboriginal groups;
- exploring opportunities to minimize the footprint of potential impact as well as avoid impact and mitigate where that is not possible;
- understanding potential Aboriginal communities and Aboriginal groups roles in construction and reclamation activities; and
- identifying shared values or opportunities to collaborate in support of net benefits to the protected areas following construction.

3.2.3.1 Comprehensive Aboriginal Engagement Process

Acting as a framework for the engagement process, the following activities provide guidance to ensure a comprehensive and consistent process in working with each of the affected Aboriginal communities and Aboriginal groups:

- letter sent to all affected Aboriginal communities specifically explaining the Boundary Adjustment Process;
- initial contact with Aboriginal community or Aboriginal group;
- e-mail invitation sent to identified Aboriginal communities requesting face-to-face consultation to meet with Project staff and technical staff;
- invitation to participate in the Parks Workshops;
- technical meetings or workshops with Chief and Council and / or technical staff;
- site visits and tours with technical team members;
- address capacity needs through augmentation of existing agreements or explore and conclude new agreements;
- identify interests and concerns; and
- review key mitigation options.

3.2.4 Engagement Time Frame

For the purpose of this application, the feedback reported for the Draft Stage 2 Detailed Proposal includes engagement activities conducted from January 2014 to mid-June 2014. Updates to engagement initiatives are ongoing and will continue to occur.

3.2.5 Implementation

As outlined in Section 3.1, the Trans Mountain Aboriginal Engagement Program is designed to allow for meaningful engagement with Aboriginal communities and Aboriginal groups using multiple forms of engagement including Project letters, meetings, phone conversations, email dialogue, community workshops and the Project website.

3.3 Summary of Engagement

Trans Mountain is actively engaging with many Aboriginal communities to gain support for the overall Project through a variety of processes that will seek to provide mutual benefits in the long term. Trans Mountain does not report on levels of support for individual permits. Aboriginal communities engage as governments and in general do not express “support” for permits.

Trans Mountain will continue to engage with identified Aboriginal communities on the Draft Stage 2 Detailed Proposal. As an overall key project principle, Aboriginal communities have been involved in sharing traditional uses and identifying impacts to support development of mitigation measures. As the Project progresses, Aboriginal communities are being invited to participate in field work and provide contractual services along the proposed pipeline corridor. They will also have opportunities to contribute to the development of mitigation measures and provide construction and archaeological monitoring services.

The following subsections provide summaries of engagement activities conducted from January 2014 to mid-June 2014 relating to the Draft Stage 2 Detailed Proposal. Updates to engagement initiatives are ongoing and will continue to occur.

3.3.1 Simpcw First Nation

Simpcw First Nation was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor in Finn Creek Provincial Park and North Thompson River Provincial Park or have Aboriginal interests potentially affected by the proposed pipeline corridor in these protected areas. Simpcw First Nation is a member of the Shuswap Nation Tribal Council.

Trans Mountain has been engaging in a meaningful and transparent relationship with Simpcw Nation since February 21, 2012, which has developed into a strong and ongoing working relationship. Specifically, Trans Mountain has been working closely with Simpcw First Nation in all aspects of existing and future relations to ensure complete discretion. Attention to this critical relationship has resulted in an enhanced project understanding by Simpcw First Nation, and subsequently they have agreed to participate in biophysical studies and to conduct a third-party Traditional Land Use study. Trans Mountain has also contracted Estsek Environmental Services and Simpcw Resources (both Simpcw First Nation-owned businesses) to participate in various field studies, such as watercourse assessments, vegetation, wetlands, wildlife and archaeology surveys, along the narrowed pipeline corridor since May 2012 and have been a part of various permit applications to support geotechnical programs and survey activities. Simpcw First Nation and their consultants are also engaged on the archaeology impact assessment.

As part of the Aboriginal Engagement Program, Trans Mountain met with Simpcw First Nation on February 25, 2014 to present the boundary adjustments process in Finn Creek Provincial Park and introduce the Draft Stage 2 Detailed Proposal, and has had continued correspondence through emails and letters. On March 4, 2014, Trans Mountain met with Simpcw First Nation and provided a presentation of the proposed approach for undertaking the Draft Stage 2 Detailed Proposal in Finn Creek Provincial Park, as well as the proposed routing options associated with this protected areas. The meeting was focused on the types of field studies that have been conducted in the protected areas to date. Simpcw First Nation received a formal letter on March 13, 2014, explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the protected areas in order to form the basis of the environmental and socio-economic assessment for the Draft Stage 2 Detailed Proposal. On March 16, 2014, Simpcw First Nation was invited to participate in a Parks Workshop in Clearwater, BC (described in Section 4.2 of the Finn Creek Provincial Park Tab). Information gathered in this workshop would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning. Simpcw First Nation was not in attendance.

3.3.2 Adams Lake Indian Band

Adams Lake Indian Band was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor in Finn Creek Provincial Park and North Thompson River Provincial Park or have Aboriginal interests potentially affected by the proposed pipeline corridor in these protected areas.

On March 13, 2014, Adams Lake Indian Band received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the protected areas in order to form the basis of the environmental and socio-economic assessment for the Draft Stage 2 Detailed Proposal. On March 17, Adams Lake Indian Band was invited to attend a Parks Workshop in Clearwater, BC, to discuss anticipated impacts of the proposed pipeline corridor through Finn Creek Provincial Park. Information gathered in this workshop would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning. Adams Lake Indian Band was not in attendance.

To date, Adams Lake Indian Band has not expressed interest to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed activity in the proposed pipeline corridor.

3.3.3 Neskonlith Indian Band

Neskonlith Indian Band was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor in Finn Creek Provincial Park, North Thompson River and Lac du Bois Grasslands Protected Area or have Aboriginal interests potentially affected by the proposed pipeline corridor in these protected areas.

On March 13, 2014, Neskonlith Indian Band received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the protected areas in order to form the basis of the environmental and socio-economic assessment for the Draft Stage 2 Detailed Proposal. On March 24, 2014, Neskonlith Indian Band was invited to attend a Parks Workshop in Clearwater, BC and Kamloops, BC,, to discuss anticipated impacts of the proposed pipeline corridor through Finn Creek Provincial Park, North Thompson River Provincial Park and Lac du Bois Grasslands Protected Area. The Parks Workshops occurred on April 1, 2014, and April 2, 2014. Information gathered in these workshops would be included into the Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning. Neskonlith Indian Band was not in attendance at either workshop.

To date, Neskonlith Indian Band has not expressed interest to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed activity in the proposed pipeline corridor.

3.3.4 Canim Lake Indian Band

Canim Lake Indian Band was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor in North Thompson River Provincial Park or have Aboriginal interests potentially affected by the proposed pipeline corridor in the park.

On March 13, 2014, Canim Lake Indian Band received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the park in order to form the basis of the environmental and socio-economic assessment for the Detailed Proposal. On April 24, 2014, Trans Mountain extended an invitation to Canim Lake Indian Band for a briefing on the proposed pipeline corridor in North Thompson River Provincial Park, the boundary adjustment process and the Draft Stage 2 Detailed Proposal. A meeting was held on May 16, 2014 with Canim Lake Indian Band. The discussion focused around field studies conducted in the park and post-construction reclamation and mitigation opportunities. Canim Lake Indian Band was concerned with native vegetation in the reclamation process and the development of program to mitigate for potential invasive species in the park.

Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed activity in the proposed pipeline corridor.

3.3.5 Tk'emlups te Secwepemc (formerly known as Kamloops Indian Band)

Tk'emlups te Secwepemc was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor in Lac du Bois Grasslands Protected Area and may have Aboriginal interests potentially affected by the proposed pipeline corridor in Lac du Bois Grasslands Protected Area. Tk'emlups te Secwepemc has a long history of engagement with Trans Mountain via KMC as the existing TMPL system runs through the Tk'emlups Reserve No. 4. Tk'emlups is one of the two members of the governing entity, Stk'emlupsemc te Secwepemc Nation and they work together with Skeetchestn Indian Band on projects such as TMEP where there is a shared territory.

On March 13, 2014 Tk'emlups te Secwepemc received a letter explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the protected area in order to form the basis of the environmental and socio-economic assessment for the Detailed Proposal. On March 17, 2014, Trans Mountain extended an invitation to Tk'emlups te Secwepemc to attend a Protected Areas Workshop in Kamloops (described in Section 4.4 of the Lac du Bois Grasslands Protected Area), which occurred on April 2, 2014 with Tk'emlups te Secwepemc in attendance. Information gathered in this workshop would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning. On March 20, 2014, Trans Mountain met with Tk'emlups te Secwepemc and reiterated the purpose of the Protected Areas Workshop on April 2, 2014, and encouraged members to attend. At the workshop, Trans Mountain inquired if Tk'emlups te Secwepemc participants would be interested in a Lac du Bois tour with subject matter experts. A specific commitment was not provided.

On April 16, 2014, Trans Mountain and Tk'emlups te Secwepemc met to review potential field work in Lac du Bois Grasslands Protected Area, as well as discuss archaeological and reclamation interests in the protected area. Trans Mountain and Tk'emlups te Secwepemc subsequently met on April 24, April 25 and April 30, 2014, to advance planning on Cultural and Heritage study work, and planned to undertake field study work particularly in Lac du Bois Grasslands Protected Area.

After a number of meetings and emails in April, on May 7, 2014, Tk'emlups te Secwepemc entered into general services agreement with Trans Mountain to undertake field work led by Tk'emlups te Secwepemc, in collaboration with TERA Environmental Consultants, within their territory. Trans Mountain extended an invitation for an additional technical workshop on the boundary adjustment process in early May, if Tk'emlups te Secwepemc would like to share their issues and concerns on the proposed pipeline corridor through Lac du Bois Grasslands Protected Area. On May 17, 2014, Tk'emlups te Secwepemc participated in an eight day vegetation survey with Trans Mountain crews in Lac du Bois Grasslands Protected Area. As described in Section 4.4.3, Trans Mountain is working with Thompson Rivers University and Tk'emlups te Secwepemc in order to collect and possibly propagate enough seed stock to support Trans Mountain's reclamation needs. Tk'emlups te Secwepemc and Trans Mountain are currently in discussions regarding the mutual interest to address field studies and cultural and heritage studies in the region. This concept was discussed between Trans Mountain and Tk'emlups te Secwepemc at a meeting on June 12, 2014, and mutual commitments were made to pursue understanding potential business opportunities and role for Tk'emlups te Secwepemc in the reclamation process and reclamation monitoring of Lac du Bois Grasslands Protected Area. On June 18, 2014, Tk'emlups te Secwepemc was informed of a native seed gathering contract opportunity, and offered a bid on a Joint Venture with a Kamloops based partner. The project would require gathering seed on the Indian Reserve and Chief and Council were asked to review the concept and provide a land use permit. Seed collection has been initiated.

3.3.6 Skeetchestn Indian Band

Skeetchestn Indian Band was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor through Lac du Bois Grasslands Protected Area or have Aboriginal interests potentially affected by the proposed pipeline corridor in Lac du Bois Grasslands Protected Area.

On March 13, 2014, Skeetchestn Indian Band received a letter explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the protected area in order to form the basis of the environmental and socio-economic assessment for the Detailed Proposal. On March 17, 2014, Trans Mountain extended an invitation to Skeetchestn Indian Band to attend a Protected Areas Workshop in Kamloops (described in Section 4.4 of the Lac du Bois Grassland Protected Area Tab). On March 18, KMC attended a meeting with Skeetchestn Indian Band Council, staff and a representative of the Stk'emlupsemc te Secwepemc (SSN), to clarify consultation processes, review the Draft Stage 2 Detailed Proposal requirements, inform members of the April 2nd workshop and review upcoming field studies in the territory. Participants were reminded of the opportunity for a specific technical workshop with the community, similar to that attended by members in fall 2013. The Protected Areas Workshop occurred on April 2, 2014 with Skeetchestn Indian Band in attendance. Information gathered in this workshop would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning. At the workshop, Skeetchestn Indian Band confirmed that they wish to work through SSN, complete a four season culture and heritage study as well as lead or participate in field work in their territory.

Trans Mountain also inquired if Skeetchestn Indian Band would be interested in a Lac du Bois tour with subject matter experts.

To date, Skeetchestn Indian Band has not provided a response to the invitation to meet specifically to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed activity in the proposed pipeline corridor.

3.3.7 Stk'emlupsemc te Secwepemc

SSN is an organization comprised of both Skeetchestn Indian Band and Tk'emlups te Secwepemc. As a group, SSN has been identified by Trans Mountain and BC Parks as an entity that will have an interest in the proposed pipeline corridor through Lac du Bois Grasslands Protected Area or have Aboriginal interests potentially affected by the proposed pipeline corridor in the Lac du Bois Grasslands Protected Area.

As an administrative body with communities with shared territories, Trans Mountain is engaged with both communities independently. Skeetchestn has provided direction to work with SSN, while Tk'emlups has provided direction to work directly with them as a First Nation. With mixed direction from SSN, and overlapping interests, KMC has pursued sharing information with SSN, inviting representatives to workshops, offering to meet and provide technical information. .

SSN members attended in Lac du Bois tour (described in Section 4.4.1 of the Lac du Bois Grasslands Protected Area Tab) in fall 2013 and participated in a field visit. Attempts to schedule a second field visit were unsuccessful due to SSN schedules and winter weather.

For the purposes of the Aboriginal Engagement Program, Trans Mountain contacted SSN to discuss next steps of project engagement and permitting relating to the Lac du Bois Grasslands Protected Area. SSN attended a March 18, 2014 meeting with Skeetchestn Indian Band, referenced above. A hard copy of the Lac du Bois routing map was provided, the permit discussed and an invitation to the workshop April 2nd offered. A SSN representative attended the Protected Areas Workshop (described in Section 4.4 of the Lac du Bois Grasslands Protected Area Tab) in Kamloops on April 2, 2014. The SSN representative was requested to confirm if SSN Council remains interested in another field visit of Lac du Bois and a technical workshop. No response was provided. On June 18, 2014, SSN requested the electronic shape files for Lac du Bois routing and KMC undertook to do this, and shared again the hard copy maps previously provided to SSN and indicated the route had not changed.

3.3.8 Coldwater Indian Band

Coldwater Indian Band was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor through Lac du Bois Grasslands Protected Area or have Aboriginal interests potentially affected by the proposed pipeline corridor in this protected area. Coldwater Indian Band has a long history of engagement with Trans Mountain via KMC as the TMPL system runs through the Coldwater Reserve No. 1 in which members of the Coldwater Indian Band reside.

On March 7, 2014, Coldwater Indian Band received a letter explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the protected areas in order to form the basis of the environmental and socio-economic assessment for the Detailed Proposal. On March 16 and 19, 2014, Trans Mountain extended an invitation to Coldwater Indian Band to attend a Protected Areas Workshop in Kamloops (described in Section 4.4 of the Lac du Bois Grasslands Protected Area Tab). Information gathered in these workshops would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning. The workshop occurred on April 2, 2014 in Kamloops (described in Section 4.2 of the Lac du Bois Grasslands Protected Area), however, Coldwater Indian Band was not able to attend. On April 22, 2014, Trans Mountain extended an invitation to Coldwater Indian Band to revisit the Draft Stage 2 Boundary Adjustment Process and also to note any issues and concerns that Coldwater Indian Band may have with the proposed pipeline corridor through Lac du Bois Grasslands Protected Area.

To date, Coldwater Indian Band has not provided a response to the invitation to meet specifically to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed pipeline corridor.

3.3.9 Siska Indian Band

Siska Indian Band was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor through Lac du Bois Grasslands Protected Area or have Aboriginal interests potentially affected by the proposed pipeline corridor in this protected area.

On March 7, 2014, Siska Indian Band received a letter explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in these protected areas in order to form the basis of the environmental and socio-economic assessment for the Detailed Proposal. On April 28, 2014, Trans Mountain extended an invitation to Siska Indian Band to meet and revisit the Draft Stage 2 Boundary Adjustment Process and also to note any issues and concerns that Siska Indian Band may have with the proposed pipeline corridor through Lac du Bois Grasslands Protected Area. Information gathered in this meeting would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning.

To date, Siska Indian Band has not provided a response to the invitation to meet specifically to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal potentially affected by the proposed pipeline corridor.

3.3.10 Cook's Ferry Indian Band

Cook's Ferry Indian Band was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor through Lac du Bois Grasslands Protected Area or have Aboriginal interests potentially affected by the proposed pipeline corridor in Lac du Bois Grasslands Protected Area.

On March 13, 2014, Cook's Ferry Indian Band received a letter explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the protected area in order to form the basis of the environmental and socio-economic assessment for the Detailed Proposal. On March 19, 2014, Trans Mountain extended an invitation to Cook's Ferry Indian Band to attend a Protected Areas Workshop in Kamloops on April 2, 2014 (described in Section 4.4 of the Lac du Bois Grasslands Protected Area Tab). Cook's Ferry Indian Band could not attend. On April 28, 2014, Trans Mountain extended an invitation to Cook's Ferry Indian Band to revisit the Draft Stage 2 Boundary Adjustment Process and also to note any issues and concerns that Cook's Ferry Indian Band may have with the proposed pipeline corridor through Lac du Bois Grasslands Protected Area. Information gathered in this meeting would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning.

To date, Cook's Ferry Indian Band has not provided a response to the invitation to meet specifically to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed pipeline corridor.

3.3.11 Lower Nicola Indian Band

Lower Nicola Indian Band was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor through Lac du Bois Grasslands Protected Area or have Aboriginal interests potentially affected by the proposed pipeline corridor in Lac du Bois Grasslands Protected Area. Lower Nicola Indian Band has a long-standing relationship with KMC as the existing TMPL system runs through the Joeyaska Reserve No. 2, in which members of the Lower Nicola Indian Band reside.

On March 13, 2014, Lower Nicola Indian Band received a letter explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the protected area in order to form the basis of the environmental and socio-economic assessment for the Detailed Proposal. On March 18, 2014, Trans Mountain extended an invitation to Lower Nicola Indian Band to attend a Protected Areas Workshop (described in Section 4.4 of the Lac du Bois Grasslands Protected Area Tab) in Kamloops, BC, on April 2, 2014; in which Lower Nicola Indian Band was in attendance. Lower Nicola Indian Band raised concerns relating to grasslands and indigenous plants and animals. Information gathered in this workshop would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning. Trans Mountain extended an invitation to Lower Nicola Indian Band on April 28, 2014, to meet and revisit the Draft Stage 2 Boundary Adjustment Process and also to note any issues and concerns that Lower Nicola Indian Band may have with the proposed pipeline corridor through Lac du Bois Grasslands Protected Area.

To date, Lower Nicola Indian Band has not expressed interest to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests in the future impacts associated with activity in the proposed corridor.

3.3.12 Lytton First Nation

Lytton First Nation was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor through Lac du Bois Grasslands Protected Area or have Aboriginal interests potentially affected by the proposed pipeline corridor in Lac du Bois Grasslands Protected Area.

On March 13, 2014, Lytton First Nation received a letter explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the protected area in order to form the basis of the environmental and socio-economic assessment for the Detailed Proposal.

To date, Lytton First Nation has not expressed interest to discuss the Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed activity in the proposed pipeline corridor.

3.3.13 Nicola Tribal Association

The Nicola Tribal Association is an organization identified by Trans Mountain and BC Parks as an entity that will have an interest in the proposed pipeline corridor in Lac du Bois Grasslands Protected Area or have Aboriginal interests potentially affected by the proposed pipeline corridor in Lac du Bois Grasslands Protected Area. Made up of seven member nations, for the purposes of the proposed Draft Stage 2 Detailed Proposal, Trans Mountain is engaged with the following Nicola Tribal Association member communities who have indicated an interest in the Project:

- Nooaitch Indian Band;
- Shackan Indian Band; and
- Nicomen Indian Band.

On March 13, 2014, Nicola Tribal Association received a letter explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the protected area in order to form the basis of the environmental and socio-economic assessment for the Draft Stage 2 Detailed Proposal.

On March 17, 2014, Trans Mountain extended an invitation to Nicola Tribal Association to attend a Protected Areas Workshop in Kamloops (described in Section 4.2 of the Lac du Bois Grassland Protected Area Tab). Information gathered in this workshop will be included in the BC Parks Draft Stage 2 Detailed Proposal and will also be used in Trans Mountain's continued engineering, construction and reclamation planning. The workshop occurred on April 2, 2014; however, Nicola Tribal Association was not in attendance. A meeting was held on May 21, 2014, in which Nicola Tribal Association raised concerns regarding pipeline vibrations and the effects of this on wildlife. As well, concerns were raised regarding the elevational change along the pipeline route.

Trans Mountain remains open to continuing to meet and discuss the Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed activity in the proposed pipeline corridor.

3.3.14 Nooaitch Indian Band

Nooaitch Indian Band was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor through Lac du Bois Grasslands Protected Area or have Aboriginal interests potentially affected by the proposed pipeline corridor in the protected area.

On March 13, 2014, Nooaitch Indian Band received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks and a proposed schedule of field studies that would occur in the protected area in order to form the basis of the environmental and socio-economic assessment of the Detailed Proposal. On March 19, 2014, Trans Mountain extended an invitation to Nooaitch Indian Band to attend a Parks Workshop in Kamloops, BC (described in Section 4.4 of Lac du Bois Grasslands Protected Area Tab). Information gathered in this workshop would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain’s continued engineering, construction and reclamation planning. On March 20, 2014, Nooaitch Indian Band expressed discontent regarding the inadequate notice for the workshop and also noted that there was no workshop planned in the Merritt area. Trans Mountain indicated that the locations of workshops were chosen for their proximity to protected areas and offered to meet with Nooaitch Indian Band at their convenience and provide a technical briefing of the Draft Stage 2 Boundary Adjustment process. On April 30, 2014, Trans Mountain extended an invitation to meet regarding the BC Parks Draft Stage 2 Detailed Proposal in Lac du Bois Grasslands Protected Area, if Nooaitch Indian Band desired further information. On May 21, 2014, a meeting was held with Nooaitch First Nation to discuss the Parks Draft Stage 2 Detailed Proposal and address any concerns or issues. Nooaitch Indian Band representatives had concerns regarding impacts to wetlands due to pipeline construction and inquired about the types of reclamation efforts that would take place post-construction. Another concern expressed was in regards to the adequacy of the archaeology work that has been conducted in connection to the TMEP and concerns were raised regarding the water quality monitoring activities that would occur post-construction.

Trans Mountain remains open to continuing to meet and discuss the Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed activity in the proposed pipeline corridor.

3.3.15 Shackan Indian Band

Shackan Indian Band was identified by Trans Mountain as a community that will have an interest in the proposed pipeline corridor through Lac du Bois Grasslands Protected Area or have Aboriginal interests potentially affected by the proposed pipeline corridor in the protected area.

On April 30, 2014, Trans Mountain extended an invitation to meet regarding the BC Parks Draft Stage 2 Detailed Proposal in Lac du Bois Grasslands Protected Area, if Shackan Indian Band desired further information. On May 21, 2014, a meeting was held with Shackan Indian Band representatives to discuss the Draft Stage 2 Detailed Proposal and address any concerns or issues. Shackan Indian Band representatives expressed concerns regarding the new route and explained that they would prefer the route follow the existing line where possible so that new area is not disturbed. As well, concerns were raised regarding the timelines and ensuring vegetation will be monitored post-construction. Shackan Indian Band also explained that due to the volume of Projects moving through traditional territory, that there will eventually be a major resistance from First Nations.

Trans Mountain remains open to continuing to meet and discuss the Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed activity in the proposed pipeline corridor.

3.3.16 Oregon Jack Creek Band

Oregon Jack Creek Band was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor through Lac du Bois Grasslands Protected Area or have Aboriginal interests potentially affected by the proposed pipeline corridor in Lac du Bois Grasslands Protected Area.

On March 13, 2014, Oregon Jack Creek Band received a letter explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in Lac du Bois Grasslands Protected Area in order to form the basis of the environmental and socio-economic assessment for the Detailed Proposal.

To date, Oregon Jack Creek Band has not expressed interest to discuss the Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed activity in the proposed pipeline corridor.

3.3.17 Popkum First Nation

Popkum First Nation was identified by Trans Mountain and BC Parks as community that will have an interest in the proposed pipeline corridor through Bridal Veil Falls Provincial Park and may have Aboriginal interests potentially affected by the proposed pipeline corridor in the park area. Popkum First Nation is a member of the Stó:lō Nation and is a member of the Tit Tribe. Popkum First Nation has a long-standing relationship with KMC as the existing TMPL system runs through the Popkum Reserve #1 and Popkum Reserve #2, in which members of Popkum First Nation have an interest.

On March 13, 2014, Popkum First Nation received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the park in order to form the basis of the environmental and socio-economic assessment for the Detailed Proposal. On March 17, 2014, Trans Mountain extended an invitation to Popkum First Nation to attend a Parks Workshop in Chilliwack, BC (described in Section 4.2 of the Bridal Veil Falls Provincial Park Tab), which occurred on March 27, 2014. Information gathered in this workshop would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning and a representative from Popkum First Nation did attend. On April 28, 2014, Trans Mountain extended an invitation to Popkum First Nation for a briefing on the proposed pipeline corridor in Bridal Veil Falls Provincial Park, the boundary adjustment process and the Draft Stage 2 Detailed Proposal. On May 7, 2014, Trans Mountain held a meeting with Popkum First Nation to discuss the boundary adjustment process and identify any issues and concerns raised by Popkum First Nation. Popkum First Nation discussed the mitigation efforts that would be considered by Trans Mountain in regards to the endangered Oregon forestsnail. As well, a representative explained that the access road to the park encroaches on the Popkum Reserve #1. Popkum First Nation requested that this be considered so that this road can be moved off-reserve lands.

Trans Mountain remains open to continuing to meet and discuss the Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed activity in the proposed pipeline corridor.

3.3.18 Peters Band

Peters Band was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor within Bridal Veil Falls Provincial Park and have Aboriginal interests potentially affected by the proposed pipeline corridor in the park. Peters Band is a member of the of the Stó:lō Nation and is a member of the Tit Tribe and has a long-standing relationship with KMC as the existing TMPL system runs through the Peters Reserve #1 and Peters Reserve #1a, two reserves in which the members of the Peters Band reside.

On March 13, 2014, Peters Band received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the park in order to form the basis of the environmental and socio-economic assessment for the Detailed Proposal. On March 17, 2014, Trans Mountain extended an invitation to Peters Band to attend a Parks Workshop in Chilliwack, BC (described in Section 4.2 of the Bridal Veil Falls Provincial Park Tab), which occurred on March 27, 2014. Information gathered in this workshop would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning. However, Peters Band was unable to attend.

To date, Peters Band has not expressed interest to discuss the Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Stage

2 Detailed Proposal and Aboriginal interests potentially affected by the proposed activity in the proposed pipeline corridor.

3.3.19 Seabird Island Nation

Seabird Island Band was identified by Trans Mountain as a community that will have an interest in the proposed pipeline corridor through Bridal Veil Falls Provincial Park or have Aboriginal interests potentially affected by the proposed pipeline corridor in the park.

On March 13, 2014, Seabird Island Nation received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the park in order to form the basis of the environmental and socio-economic assessment for the Detailed Proposal. On March 17, 2014, Trans Mountain extended an invitation to Seabird Island Nation to attend a Parks Workshop in Chilliwack, BC (described in Section 4.2 of the Bridal Veil Falls Provincial Park Tab), which occurred on March 27, 2014. Information gathered in this workshop would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning. However, Seabird Island Nation was unable to attend. On April 28, 2014, Trans Mountain extended an invitation to Seabird Island Nation to revisit the Draft Stage 2 Boundary Adjustment Process and also to note any issues and concerns that Seabird Island Nation may have with the proposed pipeline corridor through Bridal Veil Falls Provincial Park.

To date, Seabird Island Nation has not provided a response to the invitation to meet specifically to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed activity in the proposed pipeline corridor.

3.3.20 Shxw'ow'hamel First Nation

Shxw'ow'hamel First Nation was identified by Trans Mountain as a community that will have an interest in the proposed pipeline corridor through Bridal Veil Falls Provincial Park or may have Aboriginal interests potentially affected by the proposed pipeline corridor in this park. Shxw'ow'hamel First Nation is a member of the Stó:lō Tribal Council and is also an entity within the Tit Tribe. Shxw'ow'hamel First Nation has a long-standing relationship with KMC as the existing TMPL system runs through the Ohamil Reserve #1, in which members of the Shxw'ow'hamel First Nation reside.

As part of the Aboriginal Engagement Program, Shxw'ow'hamel First Nation received a letter on March 13, 2014 explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks, and a proposed schedule of field studies that would occur in the park in order to form the basis of the environmental and socio-economic assessment for the Detailed Proposal. On March 17, 2014, Trans Mountain extended an invitation to Shxw'ow'hamel First Nation to attend a Parks Workshop in Chilliwack, BC (described in Section 4.2 of the Bridal Veil Falls Provincial Park Tab), which occurred on March 27, 2014 in which Shxw'ow'hamel First Nation was in attendance. Information gathered in this workshop would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning. On April 28, 2014, Trans Mountain extended an invitation to Shxw'ow'hamel First Nation to revisit the Draft Stage 2 Boundary Adjustment Process and also to note any issues and concerns that Shxw'ow'hamel First Nation may have with the proposed pipeline corridor through Bridal Veil Falls Provincial Park.

To date, Shw'ow'hamel First Nation has not provided a response to the invitation to meet specifically to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests in the future impacts associated with activity in the proposed corridor.

3.3.21 Cheam First Nation

Cheam First Nation was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor through Bridal Veil Falls Provincial Park or may have Aboriginal interests potentially affected by the proposed pipeline corridor through the park. Cheam First Nation is a member of the Stó:lō Tribal Council and the Pilalt Tribe, and associated with the People of the River Referral Office.

On March 13, 2014, Cheam First Nation received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks and a proposed schedule of field studies that would occur in the park in order to form the basis of the environmental and socio-economic assessment of the Detailed Proposal. On March 17, 2014, Trans Mountain extended an invitation to Cheam First Nation to attend a Parks Workshop in Chilliwack, BC (described in Section 4.2 of the Bridal Veil Falls Provincial Park Tab), which occurred on March 27, 2014, in which Cheam First Nation was in attendance. Information gathered in this workshop would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning. At the workshop, Cheam First Nation requested maps of Bridal Veil Falls Provincial Park and raised concerns about sensitive plants and archaeological resources within the park. Cheam First Nation discussed the need for a specific information package about Bridal Veil Falls Provincial Park. On April 28, 2014, Trans Mountain extended an invitation to Cheam First Nation to revisit the Draft Stage 2 Boundary Adjustment Process and also to note any issues and concerns that Cheam First Nation may have with the proposed pipeline corridor through Bridal Veil Falls Provincial Park.

To date, Cheam First Nation has not provided a response to the invitation to meet specifically to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests in the future impacts associated with activity in the proposed corridor.

3.3.22 Skwah First Nation

Skwah First Nation was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor through Bridal Veil Falls Provincial Park and have Aboriginal interests potentially affected by the proposed pipeline corridor in the park. Skwah First Nation is a member of the Pilalt Tribe. Skwah First Nation has a long-standing relationship with KMC as the existing TMPL system runs through the Grass Reserve #1, in which members of the Skwah First Nation have an interest.

On March 13, 2014, Skwah First Nation received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks and a proposed schedule of field studies that would occur in the park in order to form the basis of the environmental and socio-economic assessment of the Detailed Proposal. On May 8, 2014, Trans Mountain extended an invitation to Skwah First Nation via the Tselxweyeqw Tribe, to revisit the Draft Stage 2 Boundary Adjustment Process and also to note any issues and concerns that Skwah First Nation may have with the proposed pipeline corridor through Bridal Veil Falls Provincial Park.

To date, Skwah First Nation has not provided a response to the invitation to meet specifically to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests in the future impacts associated with activity in the proposed corridor.

3.3.23 Union Bar First Nations

Union Bar First Nations was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor through Bridal Veil Falls Provincial Park and may have Aboriginal interests potentially affected by proposed pipeline corridor in the park. Union Bar First Nations has a long history of engagement with Trans Mountain via KMC as the existing TMPL system runs through the Kawakawa Lake Reserve #16, in which members of Union Bar First Nations reside.

On March 13, 2014, Union Bar First Nations received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks and a proposed schedule of field studies that would occur in the park in order to form the basis of the environmental and socio-economic assessment of the Detailed Proposal. On March 17, 2014, Trans Mountain extended an invitation to Union Bar First Nations to attend a Parks Workshop in Chilliwack, BC (described in Section 4.2 of the Bridal Veil Falls Provincial Park Tab), which occurred on March 27, 2014. Information gathered in this workshop will be included in the BC Parks Draft Stage 2 Detailed Proposal and will also be used in Trans Mountain's continued engineering, construction and reclamation planning. However, Union Bar First Nations was unable to attend. On April 29, 2014, Trans Mountain extended an invitation to Union Bar First Nation to revisit the Draft Stage 2 Boundary Adjustment Process and also to note any issues and concerns that Union Bar First Nation may have with the proposed pipeline corridor through Bridal Veil Falls Provincial Park.

To date, Union Bar First Nations has not provided a response to the invitation to meet specifically to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests in the future impacts associated with activity in the proposed corridor.

3.3.24 Yale First Nation

Yale First Nation that was identified by Trans Mountain as a community that will have an interest in the proposed pipeline corridor through Bridal Veil Falls Provincial Park or have Aboriginal interests potentially affected by the proposed pipeline corridor in the park.

On March 13, 2014, Yale First Nation received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks and a proposed schedule of field studies that would occur in the park in order to form the basis of the environmental and socio-economic assessment of the Detailed Proposal. On March 17, 2014, Trans Mountain extended an invitation to Yale First Nation to attend a Parks Workshop in Chilliwack, BC (described in Section 4.2 of the Bridal Veil Falls Provincial Park Tab). Information gathered in this workshop would be included in the BC Parks Draft Stage 2 Detailed Proposal and will also be used in Trans Mountain's continued engineering, construction and reclamation planning. The workshop occurred on March 27, 2014; however, Yale First Nation was unable to attend. On April 28, 2014, Trans Mountain extended an invitation to a meeting regarding the BC Parks Draft Stage 2 Detailed Proposal in Bridal Veil Falls Provincial Park, if Yale First Nation desired further information. A meeting was arranged for May 14, 2014 in which Yale First Nation inquired if the proposed pipeline corridor was traversing through Cheam wetlands and when the archaeology findings would be filed. Yale First Nation also expressed interest in participating in traditional ecological knowledge (TEK) and biophysical studies. Trans Mountain has notified Yale First Nation regarding potential opportunities for archaeological monitoring positions during the archaeology impact assessment being conducted for the Project.

Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests potentially affected by the proposed activity in the proposed pipeline corridor.

3.3.25 Skawahlook First Nation

Skawahlook First Nation was identified by Trans Mountain as a community that will have an interest in the proposed pipeline corridor through Bridal Veil Falls Provincial Park or have Aboriginal interests potentially affected by the proposed pipeline corridor in the park.

On March 13, 2014, Skawahlook First Nation received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks and a proposed schedule of field studies that would occur in the park in order to form the basis of the environmental and socio-economic assessment of the Detailed Proposal. On March 17, 2014, Trans Mountain extended an invitation to Skawahlook First Nation to attend a Parks Workshop in Chilliwack, BC (described in Section 4.2 of the Bridal Veil Falls Provincial Park Tab). Information gathered in this workshop would be included in the BC Parks Draft Stage 2 Detailed Proposal and would also be used in Trans Mountain's continued engineering, construction and reclamation planning. The workshop occurred on March 27, 2014; however, Skawahlook First Nation was not in attendance. On May 9, 2014, Trans Mountain extended an invitation to a meeting regarding the BC Parks Draft Stage 2 Detailed Proposal in Bridal Veil Falls Provincial Park, if Skawahlook First Nation desired further information.

To date, Skawahlook First Nation has not provided a response to the invitation to meet specifically to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests in the future impacts associated with activity in the proposed corridor.

3.3.26 Kwah-kwah-Aplit First Nation

Kwah-kwah-Aplit First Nation was identified by Trans Mountain and BC Parks as a community that will have an interest in the proposed pipeline corridor through Bridal Veil Falls Provincial Park or may have Aboriginal interests potentially affected by the proposed pipeline corridor in this park. Kwah-kwah-Aplit First Nation is a member of the Stó:lō Tribal Council and the Pilalt Tribe. Kwah-kwah-Aplit First Nation has a long-standing relationship with KMC as the existing TMPL system runs through the Grass Reserve #1, in which members of Kwah-kwah-Aplit First Nation have an interest in.

On March 13, 2014, Kwah-kwah-Aplit First Nation received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks and a proposed schedule of field studies that would occur in the park in order to form the basis of the environmental and socio-economic assessment of the Detailed Proposal. On May 9, 2014, Trans Mountain extended an invitation to a meeting regarding the BC Parks Draft Stage 2 Detailed Proposal in Bridal Veil Falls Provincial Park, if Kwah-kwah-Apilt First Nation desired further information.

To date, Kwah-kwah-Aplit First Nation has not provided a response to the invitation to meet specifically to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests in the future impacts associated with activity in the proposed corridor.

3.3.27 Soowahlie Indian Band

Soowahlie First Nation was identified by Trans Mountain and BC Parks as a community that will have potential interests in the proposed pipeline corridor through Bridal Veil Falls Provincial Park or have Aboriginal interests potentially affected by the proposed pipeline corridor in the park. Soowahlie Indian Band is a member of the Stó:lō Nation and is a First Nation with the Ts'elxweyeqw Tribe. Soowahlie Indian Band has a long-standing relationship with KMC as the existing TMPL system runs through the Grass Reserve #1, in which members of the Soowahlie Indian Band have an interest.

On March 13, 2014, Soowahlie Indian Band received a letter from Trans Mountain explaining the purpose of the Draft Stage 2 Detailed Proposal, timelines for submission to BC Parks and a proposed schedule of field studies that would occur in the park in order to form the basis of the environmental and socio-economic assessment of the Detailed Proposal. On May 9, 2014, Trans Mountain extended an invitation to a meeting regarding the BC Parks Draft Stage 2 Detailed Proposal in Bridal Veil Falls Provincial Park, if Soowahlie Indian Band desired further information.

To date, Soowahlie Indian Band has not provided a response to the invitation to meet specifically to discuss the Draft Stage 2 Detailed Proposal or to provide information to Trans Mountain. Trans Mountain remains open to continuing to meet and discuss the Draft Stage 2 Detailed Proposal and Aboriginal interests in the future impacts associated with activity in the proposed corridor.

3.4 Ongoing Engagement

The Aboriginal Engagement Team also includes dedicated resource persons to continue to engage Aboriginal communities and identify Aboriginal interests in relation to the Project from an environmental and field study planning perspective for future jobs. The Aboriginal Engagement Team also continues to identify Aboriginal businesses that may be interested in contracting opportunities on the existing Trans Mountain system and Project. Trans Mountain has completed three procurement workshops (described in Section 4.2 of each individual Parks Tab) throughout BC, with all Aboriginal communities along the corridor invited to learn about how to become prepared for contracting and subcontracting opportunities through the Project. KMC requires direct contractors to be registered with the ISN Network. Ten Aboriginal businesses that have IS Networld that provides them with qualification to seek contract opportunities. A number of other companies are able to subcontract to KMC Contractors are preparing for their own ISN Networld certification. The identification of additional qualified businesses will continue to through the pre-application and regulatory review process.

4.0 PUBLIC CONSULTATION

Trans Mountain is committed to providing opportunities for stakeholders to become informed and provide input into projects which have potential to affect them. The policy is based on a belief that consultation builds trust and relationships between the company and its external stakeholder communities and improves Project decisions.

4.1 Principals and Goals

There are 11 principles that provide the framework for Trans Mountain's public consultation programs.

- **Accountability** – Address issues as they emerge. Trans Mountain believes that effective problem-solving and mitigation strategies can be identified through consultation with stakeholders.
- **Communication** – Facilitate the involvement of potentially affected parties, listen, gather input and work collaboratively to resolve concerns. Use multiple channels for communication to meet communication needs of diverse stakeholder groups.
- **Local Focus** – Seek local input and understanding of the region, its people, the environment, and reflect local values and attitudes in Trans Mountain's communications with stakeholders.
- **Mutual Benefit** – Seek solutions to challenges that result in shared benefits for all interests.
- **Relationship Building** – Instill confidence in the public by remaining committed to being a good neighbour with the goal of establishing and maintaining positive long-term relationships with stakeholders.
- **Respect** – Respect individual values, recognize the legitimacy of people's concerns and value the input they can provide.
- **Responsiveness** – Utilize input and provide timely feedback to participants on how their input has affected plans and decisions, where feasible.
- **Shared Process** – Design engagement program based on public input, taking into consideration various stakeholder groups' interests, knowledge levels, time and preferred method of engagement.
- **Sustainable** – Report on a triple bottom line of social, environmental and economic concerns raised and identify how these concerns will be addressed.
- **Timeliness** – Initiate consultation processes as early as possible to provide adequate time for stakeholders to assess information and provide input.
- **Transparency** – Commitments made to stakeholders will be documented and carried out. Where Trans Mountain is unable to act on input received, Trans Mountain will explain why.

4.2 Public Consultation Program

4.2.1 Vision

When developing the TMEP stakeholder engagement program, the Project team adopted KMC's Community Relations philosophy, which states:

> *"At KMC, we believe Aboriginal communities, our neighbours, governments and local communities play an important role in how we conduct our business. Our success depends on earning trust, respect and cooperation of all community members. We are committed to respectful, transparent and collaborative interactions with communities to develop long-term effective relationships. To honour this commitment, we participate in local communities by hosting facility open houses, providing newsletters and Project updates, making safety and public awareness presentations, participating in community events, regulatory processes, and informal meetings."*

4.2.2 Identification of Stakeholders

Early in the Project, Trans Mountain identified a number of stakeholder groups that may have an interest in the Project. For the purposes of the Draft Stage 2 Detailed Proposal, two key considerations were taken into account:

1. A stakeholder list generated by BC Parks and provided to Trans Mountain in 2014
2. Additional stakeholders identified by Trans Mountain through a review of stakeholder databases and identification of park users and interest groups.

Trans Mountain has engaged a total of approximately 60 stakeholders in proximity to the proposed pipeline corridor within the four protected areas for the Draft Stage 2 Detailed Proposals that might have an interest in the protected areas or have interests potentially affected by the protected areas.

4.2.3 Engagement Methods

As part of the public consultation program, Trans Mountain has implemented an open, extensive and thorough consultation process. The public consultation program was designed to take into account the unique and varying needs of communities, and be responsive and adaptive to the feedback received. In addition, the feedback received has been incorporated into the Draft Stage 2 Detailed Proposal.

4.2.3.1 Community Workshops

From February to July 2013, Trans Mountain conducted a series of community workshops, ESA workshops and routing open houses to share information on the proposed approach for undertaking the ESA, and the proposed route along the Trans Mountain study corridor. The workshops also aimed to provide information on the proposed route alternatives where it is likely that the route will deviate from the existing Trans Mountain right-of-way and to discuss preliminary community benefits. The discussions also focused on the route in the protected areas. See Section 4.0 for a detailed description of these workshops in each respective Parks Tab.

4.2.3.2 Parks Workshops

In March 2014, Trans Mountain conducted a series of workshops to reach out to:

- share information on the proposed approach for undertaking the Draft Stage 2 Detailed Proposal;
- share information on the proposed route along the Trans Mountain study corridor;
- identify local environmental and socio-economic topics of concern; and
- identify potential protected areas benefits.

At the workshops, the Project team provided attendees with a proposed overview of the selected study corridor in each park, sought feedback of attendees on particular concerns relating to human activity and environment in the protected area as well as discussed protected area benefits, in break-out groups.

Feedback received at these sessions and afterwards, was shared with the relevant Trans Mountain disciplines and was considered in setting the scope for the Draft Stage 2 Detailed Proposal. Event reports and proposed benefits were submitted to BC Parks for consideration against Park benefit priorities.

Invitations to participate in the workshops were sent to groups identified by BC Parks and:

- Aboriginal communities and groups;
- stakeholders and environmental subject matter experts;
- senior local government staff and elected officials;

- local Environmental Non-Governmental Organizations (ENGOs) with knowledge of environmentally sensitive sites;
- regional and federal ENGOs;
- park recreation users;
- park tenure holders; and
- regional representatives from provincial and federal regulatory agencies including BC Parks.

4.2.3.3 Communication Opportunities

The communication initiatives supported engagement activities by providing notification about various engagement opportunities including the public open houses, community workshops and online discussion activities. From producing printed newsletters, to talking about the Project details on social media channels, to answering public and media inquiries, the communications programs used a variety of methods to reach various audiences.

To broaden the reach of the public consultation program, Trans Mountain launched digital engagement opportunities to parallel and complement each in-person engagement opportunity. Digital engagement included information posted to a Project website, such as power point presentations, route maps and a website forum where visitors could ask questions and submit feedback. Stakeholders were notified through an e-blast update indicating the posting of information relating to the protected areas and routing updates. A toll-free phone line and Project email address were both launched early in the Project to broaden the outreach.

4.2.3.4 Access to the Application

Trans Mountain launched a Project website, www.transmountain.com, on May 29, 2012, which continues to be a living communications tool and is updated with more detailed information on a weekly basis. Once submitted, Trans Mountain intends to post the Draft Stage 2 Detailed Proposals onto the website and stakeholders will be able to submit comments on the proposal to Trans Mountain, of if they prefer, directly to BC Parks. BC Parks will be provided with a summary of all comments received by Trans Mountain during the 45 day publc review period. BC Parks will provide Trans Mountain with copies of all comments received by BC Parks to enable Trans Mountain to respond to issues or concerns that are raised.

4.2.4 Implementation

As outlined in Section 4.1, the Trans Mountain Public Consultation Program is designed to allow for meaningful engagement with stakeholders through a series of community workshops, in-person meetings, phone conversations, email dialogue, and the Project website.

A detailed summary of issues and concerns raised in the Parks Workshops is available in Section 4.1 of each of the respective Parks Tab.

5.0 ECONOMIC BENEFITS

In May 2013, pursuant to the NEB Reasons for Decision RH-001-2012, the Project received approval pursuant to Part IV of the *NEB Act* for the toll methodology, terms and conditions that would apply to the Project. This approval reinforces market support for the Project and provided Trans Mountain with the necessary economic incentive to proceed with design, consultation and regulatory applications.

The economic benefits to the Province of BC that result from the Project include both short and long-term benefits to both the region surrounding the protected areas and the province as a whole.

5.1 Description of Economic Impact Analysis

Trans Mountain conducted an economic impact analysis of the Project as part of its Application to the NEB, the details of which are summarized in part below. In conducting the economic impact analysis, Trans Mountain considered various aspects of metrics, both direct and indirect, including the:

- estimated total expenditures attributable to construction of the Project;
- value added (*i.e.*, revenue less the value of purchased inputs) to the economy attributable to construction of the Project (the Gross Domestic Product [GDP]);
- employment that would result from the Project, measured in “full-time equivalent”;
- labour income being the amount of income that would accrue to households because of employment generated by construction of the Project;
- revenues that would accrue to the federal government (*i.e.*, personal and goods and service taxes and excise duty) as a result of the Project;
- revenues that would accrue to both the AB and BC governments (*i.e.*, personal, corporate, commodity and provincial taxes) as a result of the Project; and
- revenues that would accrue to municipal governments (*i.e.*, licences, fees, permits and business taxes) as a result of the Project.

5.2 Overall Estimated Economic Impact to British Columbia

Overall, the proposed expansion will enhance Canada’s ability to reach diversified markets with its oil, while also increasing tax revenues that can be used to fund government projects and services that Canadians depend on such as health care, education, roads and infrastructure.

Trans Mountain plans to spend $5.4 billion by 2018 to construct the line and associated facilities, and a further $2.4 billion to operate it for the first 20 years. BC’s economy is forecast to grow by $2.8 billion (GDP) through construction-related spending and up to $11.3 billion including Project operations through 2038.

The Project is also anticipated to generate substantial provincial and municipal tax revenue. Provincial governments’ revenues associated with the Project are anticipated to be in the order of $1.7 billion, with the BC government receiving $1 billion in provincial taxes. Municipal tax revenues that can support community services and infrastructure are estimated to increase approximately $23 million annually or $460 million over 20 years of operations.

The estimated tax revenues to the Government of Canada are $2.1 billion over the life of the Project. Construction is scheduled in 2016 through to 2018 with an estimated 4,500 workers at peak manpower. Trans Mountain expects to create 108,000 person-years of employment, from construction and the first 20 years of operations across Canada; of this, at least 66,000 person years of employment will be in BC.

The proposed expanded operations are anticipated to create 50 new full time permanent positions in BC.

The economic impact to BC that is estimated to result from the Project is summarized in Table 5.2-1. Once operational, the Project is also expected to generate substantial economic and fiscal impacts. Operational impacts of the Project are assessed over its first 20 years of service under two scenarios. Economic modeling focused on a 20 year operating period given certainty of shipper contracts during this period, and thus should be considered conservative given that the operating life of the Project is anticipated to be over 50 years or more. The first scenario considers the impacts of only the long-term contracts that have been signed and can be considered the minimum impact (minimum scenario). The second considers the scenario where the spot capacity in the pipeline is fully utilized and can be considered the maximum impact (maximum scenario).

TABLE 5.2-1

PROJECT CONTRIBUTIONS TO BRITISH COLUMBIA OUTPUT, GDP, AND PROJECT RELATED EMPLOYMENT, LABOUR INCOME AND TAC REVENUES

Area	Direct Effects	Indirect Effects	Induced Effects	Total Effects
Construction Phase				
Gross Output Generated ($2012 – thousands)	3,206,359	902,379	1,165,250	5,273,988
GDP Generated ($2012 – thousands)	1,518,005	514,761	765,298	2,789,063
Employment (Person-Years)	20,675	6,599	8,590	35,864
Labour Income ($2012 – thousands)	1,226,085	358,745	323,496	1,908,327
Federal Taxes ($2012 – millions)				85.6
Provincial Taxes ($2012 – millions)				308.7
Operations Phase – Minimum Scenario				
Gross Output Generated ($2012 – thousands)	8,938,720	2,637,387	936,178	12,512,285
GDP Generated ($2012 – thousands)	6,427,793	1,505,554	606,810	8,540,156
Employment (Person-Years)	4,837	18,558	6,868	30,263
Labour Income ($2012 – thousands)	400,036	1,013,940	259,493	1,673,019
Federal Taxes ($2012 – millions)				191.8
Provincial Taxes ($2012 – millions)				727.0
Operations Phase – Maximum Scenario				
Gross Output Generated ($2012 – thousands)	11,589,801	3,419,594	1,213,833	16,223,229
GDP Generated ($2012 – thousands)	8,334,173	1,952,077	786,780	11,073,030
Employment (Person-Years)	6,271	24,062	8,905	39,238
Labour Income ($2012 – thousands)	518,681	1,314,075	336,454	2,169,210
Federal Taxes ($2012 – millions)				248.7

5.3 Conservation Offsets

5.3.1 Design of the Valuation Model

A TMEP goal is that the Project produces no net loss of native biodiversity and the integrity of ecosystems in the regions of the four protected areas through which the Trans Mountain pipeline corridor passes. Further, where practical the Project shall strive to produce a net benefit to native biodiversity and ecological integrity in those regions. This goal demonstrates TMEPs commitment to exceed minimum standards in areas with acknowledged biodiversity values.

The Project has pursued its goal by employing a three step strategy, conventionally known as “the mitigation hierarchy”:

5.3.1.1 Avoidance

Through route selection and Project design, TMEP has consulted with potentially affected individuals and groups and selected a corridor that avoids environmental and socio-economic effects, including unnecessary disturbance and negative impacts to ecosystems in the protected areas through which the proposed corridor passes. An evaluation of alternatives to the selected corridor is provided in Section 2.0 of each respective Parks Tab.

5.3.1.2 Mitigation

Industry-leading mitigation techniques, including on-site reclamation and restoration, has been proposed for those disturbances and negative impacts which cannot be avoided in the protected area. These measures are described in Section 7.0 of each respective park assessment (*i.e.*, Parks Tab).

5.3.1.3 Offsetting

Disturbances and negative impacts that can neither be avoided nor mitigated were identified in Section 7.0 of each respective Parks Tab. TMEP proposes to adopt the Business and Biodiversity Offsets Programme [BBOP] (BBOP 2012a) to identify and undertake an offset Project, or suite of Projects, in order to produce a measurable ecological benefit of a comparable nature and extent, so as to result in no net loss of native biodiversity and ecological integrity on a regional basis. TMEP will work with land managers, stakeholders, and Aboriginal groups, with the advice of internationally-recognized experts to identify and select the most appropriate Project(s). Where possible the offset Project will be designed to result in a net benefit to native biodiversity and ecological integrity.

The third step of the mitigation hierarchy provides independent recommendations for an approach that TMEP could apply to achieve no net loss of native biodiversity and ecological integrity in the protected areas. This biodiversity offset program assumes that irreplaceable habitat has been avoided.

5.3.2 BBOP Offset Design Process

The BBOP process for designing biodiversity offsets includes the following steps (BBOP 2012b,c,d).

1. Review Project scope and activities.
2. Review the legal framework and /or policy context for a biodiversity offset.
3. Initiate a stakeholder participation process.
4. Determine the need for an offset based on residual adverse effects.
5. Choose methods to calculate loss/gain and quantify residual losses.
6. Review potential offset locations and activities and assess the biodiversity gains which could be achieved at each.
7. Calculate offset gains and select appropriate offset locations and activities.
8. Record the offset design and enter the offset implementation process.

Trans Mountain conducted a series of Parks Workshops (as described in Section 4.2.3 of this Introduction and in Section 4.0 of each respective Parks Tab) in which stakeholder participation was encouraged to determine potential community benefits to BC Parks for consideration against Park management and benefit priorities. The process and results of this part of the workshops is currently being reviewed by BC Parks.

6.0 ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT

Trans Mountain prepared a comprehensive ESA of the Project for the proposed construction and operations of the pipeline in the protected areas. The environmental effects assessment uses the information provided in the environmental setting to:

- evaluate the environmental effects of importance in the protected area;
- identify and evaluate potential effects associated with each environmental element of importance and park management objectives;
- develop appropriate technically and economically feasible site-specific mitigation;
- identify residual effects (after mitigation) associated with each environmental and socio-economic element of importance; and
- identify the effects of the Project on the environment in the protected area.

6.1 Assessment Methodology

In preparing the ESA, Trans Mountain undertook a comprehensive process to identify the environmental and socio-economic elements and the effects on those elements as a result of the Project. The assessment evaluated the environmental effects of the construction, operations, decommissioning and abandonment phases of the Project. The assessment method includes the following steps.

1. Describe the environmental setting.
2. Identify key environmental elements that could be affected.
3. Define the indicators and measurement endpoints to be used to assess each element.
4. Determine spatial and temporal boundaries for each element.
5. Identify potential environmental effects for each indicator.
6. Develop appropriate technically and economically feasible site-specific mitigation and, where warranted, restitution measures that are technically and economically feasible.
7. Predict anticipated residual effects.
8. Determine the significance of residual effects.

6.2 Environmental and Socio-Economic Elements

The potential (*i.e.,* biophysical and socio-economic) elements interacting with the Project have been identified through: consultation and engagement with Aboriginal communities, landowners, regulatory authorities and the general public; experience during previous pipeline Projects with similar conditions/potential issues (*e.g.,* TMX Anchor Loop Project, Trans Mountain Pump Station Expansion Project, Blue River Pump Station Project); scientific studies; and the professional judgement of the assessment team. Issues noted during consultation/engagement with Aboriginal communities, landowners, federal and municipal regulatory authorities, stakeholders and the general public were essential in the determination of element interactions in the protected area.

Potential elements potentially interacting in the protected area include:

- physical elements such as the physical and meteorological environment, soil and soil productivity, water quality and quantity, air emissions, and the acoustic environment;
- biological elements such as fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat, and species at risk; and
- socio-economic elements such as heritage resources, traditional land and resource use, and visitor enjoyment and safety.

6.2.1 Assessment Indicators and Measurement Endpoints

Beanlands and Duinker (1983) suggest that is it impossible for an impact assessment to address all potential environmental effects of a Project. Therefore, it is necessary that the environmental attributes considered to be important in Project decisions be identified. Environmental impact assessments should be required to identify at the beginning of the assessment an initial set of indicators (sometimes called Valued Ecosystem Components or Valued Social Components) to provide a focus for subsequent study and evaluation (Beanlands and Duinker 1983).

For this assessment, an indicator is defined as a biophysical, social or economic property variable that society considers to be important and is assessed to predict Project-related changes and focus the impact assessment on key issues. One or more indicators are selected to describe the present and predicted future condition of an element. Societal views are understood by the assessment team through published information, such as management plans, and engagement with regulators, the public, Aboriginal communities and other interested groups.

The indicators for each element have been identified based on: the NEB *Filing Manual* (2014), BC Parks Impact Assessment Process and other regulatory guidelines; experience gained during previous Projects with similar conditions/potential issues; feedback from Aboriginal communities, landowners, regulatory authorities, stakeholders and the general public; public issues raised through media; available research literature; and professional judgement of the assessment team.

One or more ‘measurement endpoints’ (measurable parameters) are identified for each indicator to allow quantitative or qualitative measurement of potential Project effects. The endpoints have been selected based on: the NEB *Filing Manual*, BC Parks Impact Assessment Process; experience gained through previous Projects with similar conditions/potential issues; feedback from regulatory authorities and stakeholders; available research literature; and the professional judgement of the assessment team. The degree of change in these measureable parameters is used to characterize and evaluate the magnitude of Project-related effects. A selection of measurement endpoints may also be the focus of monitoring and follow-up programs, where applicable.

A summary of the indicators selected for each element is provided in Table 6.2.1-1.

TABLE 6.2.1-1

SELECTED INDICATORS FOR BIOPHYSICAL AND SOCIO-ECONOMIC ELEMENTS

Element	Indicators
Physical and Meteorological Environment	• Terrain instability. • Topographic change. • Acid-generating rock.
Soil and Soil Productivity	• Soil productivity. • Soil degradation. • Bedrock and stone disposal. • Soil contamination.
Water Quality and Quantity	• Surface water quality. • Surface water quantity. • Groundwater quality. • Groundwater quantity.
Air Emissions	• Primary emissions of criteria air contaminants (particulate matter [PM], carbon monoxide [CO], nitrous oxide [N_2O] and sulphur dioxide [SO_2]) and volatile organic compounds (benzene, toluene, ethylbenzene and xylene). • Formation of secondary ozone. • Hydrogen sulphide (H_2S) and mercaptans emissions which have the potential to cause nuisance odours
Acoustic Environment	• Sound levels. • Vibrations.
Fish and Fish Habitat	• Riparian habitat. • Instream habitat. • Fish mortality or injury. • Indicator species include: • BC: bull trout/Dolly Varden; Chinook salmon; coho salmon; cutthroat trout; and rainbow trout/steelhead.

TABLE 6.2.1-1 Cont'd

Element	Indicators
Wetland Loss or Alteration	• Wetland function.
Vegetation	• Vegetation communities of concern. • Plant and lichen species of concern. • Presence of infestations of provincial weed species and other invasive non-native species identified as a concern.
Wildlife and Wildlife Habitat	• Mammals: grizzly bear; moose; woodland caribou; forest furbearers; coastal riparian small mammals; and bats. • Birds: grassland/shrub-steppe birds; mature/old forest birds; early seral forest birds; riparian and wetland birds; wood warblers; short-eared owl; rusty blackbird; flammulated owl; Lewis's woodpecker; Williamson's sapsucker; western screech-owl; great blue heron; spotted owl; bald eagle; common nighthawk; northern goshawk; and olive-sided flycatcher. • Reptiles: arid habitat snakes. • Amphibians: lentic (pond-dwelling) amphibians; and lotic (stream-dwelling) amphibians.
Species at Risk	• Fish species at risk (*i.e.,* bull trout and coho salmon). • Vegetation species at risk. • Wildlife species at risk (*i.e.,* grizzly bear, woodland caribou, short-eared owl, rusty blackbird, flammulated owl, Lewis's woodpecker, Williamson's sapsucker, western screech-owl, great blue heron [*fannini* ssp.], spotted owl, common nighthawk, northern goshawk [*laingi* ssp.] and olive-sided flycatcher).
Heritage Resources	• Archaeology sites. • Historic sites. • Palaeontology sites.
Traditional Land Use	• Subsistence activities and sites. • Cultural sites.
Visitor Enjoyment and Safety	• Visitor enjoyment. • Safety.

6.2.2 Spatial and Temporal Boundaries

The environmental effects assessment considers the potential effects of the Project on the environment in the context of defined spatial and temporal boundaries. These boundaries vary with the issues and environmental elements or interactions to be considered, and reflect:

- the construction, operations and decommissioning and abandonment phases of the proposed physical works and physical activities;
- the natural variation or a population of environmental indicator;
- the timing of sensitive life cycle phases of various biotic elements in relation to the scheduling of the proposed physical works and physical activities;
- the time required for an effect to become evident;
- the time required for a population or environment indicator to recover from an effect and return to a natural condition;
- the area directly affected by the proposed physical works and physical activities; and
- the area in which a population or environmental indicator functions and within which a Project effect may be experienced.

<u>Temporal Boundaries</u>

The time frames of the assessment of the Project include the planning, construction, operations and decommissioning and abandonment phases. The planning phase includes all environmental studies, engineering surveys and land surveys conducted in support of the Project application and prior to construction. The construction phase for the TMEP includes surveying, clearing, soil handling, grading, pipeline trenching, testing and reclamation. Pending regulatory approval of the Project, construction of the pipeline is schedule over an approximately 24 month period to achieve the planned in-service date in 2018

The operations phase commences following completion of construction in 2018 and is anticipated to extend for 50 years or more. The decommissioning and abandonment phase would occur at the end of the useful life of the pipeline.

Spatial Boundaries

The assessment of the Project was conducted in the context of one or more of the following spatial boundaries: the Footprint; Local Study Area (LSA); Regional Study Area (RSA); Provincial Area; National Area; and International Area. The LSAs and RSAs were developed on an element-specific basis and, therefore, may vary between environmental and socio-economic elements. The Footprint of the Project assumes certain quantitative values for the area that will directly be disturbed by Project facilities and activities within the proposed pipeline corridor, including a 45 m pipeline construction right-of-way (assumed conservative average value including permanent easement and temporary workspace), temporary access roads (assumed to use existing access, where practical). The spatial boundaries considered for the protected areas can be found in Figures 6.2.2-1 to 6.2.2-6.

Ecological boundaries have been individually established for each applicable element. Spatial ecological boundaries were determined by distribution, movement patterns and potential zones of interaction between an element and the Project. The ecological boundary may be limited to the Footprint (*e.g.*, proposed pipeline construction right-of-way) or extend beyond the physical boundaries of the area of the Project component since the distribution of movement of an element can be local, regional or provincial, national or international.

6.2.3 Potential Environmental and Socio-Economic Effects

The potential effects resulting from the Project are identified through engagement with Aboriginal communities, landowners, regulatory authorities, stakeholders, general public; through experience gained during previous pipeline Projects with similar conditions/potential issues; through scientific studies; and the professional judgement of the assessment team.

This assessment is based on preliminary engineering designs. In general conservative assumptions have been used. In order to confirm the predictions on environmental effects, further technical development will be carried out in the engineering and detailed design phase.

6.2.4 Mitigation Measures

Mitigation measures, as defined under the *Canadian Environmental Assessment Act, 2012*, means measures for the elimination, reduction of control of a Project's adverse environmental effects, including restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means.

To ensure that the potential adverse environmental effects are reduced, general and site-specific mitigation measures are recommended based on current industry-accepted standards, consultation with regulatory authorities, interested groups and individuals, engagement with Aboriginal communities and the professional judgement of the assessment team. Mitigation measures, suggested by regulatory authorities or other stakeholders have been incorporated into this assessment.

Mitigation measures are outlined in each of the Parks Tabs, as well as in the Project-specific EPP (Appendix A). Various federal and provincial regulatory authorities, and industry-accepted standards and guidelines are considered in the ESA, and are referenced for each element in the Parks Tabs.

Accompanying the EPP are Environmental Alignment Sheets which identify where some site-specific mitigation measures are to be implemented. Inspector(s) will be retained by Trans Mountain to help ensure that the mitigation measures within the EPP are understood and properly implemented during construction.

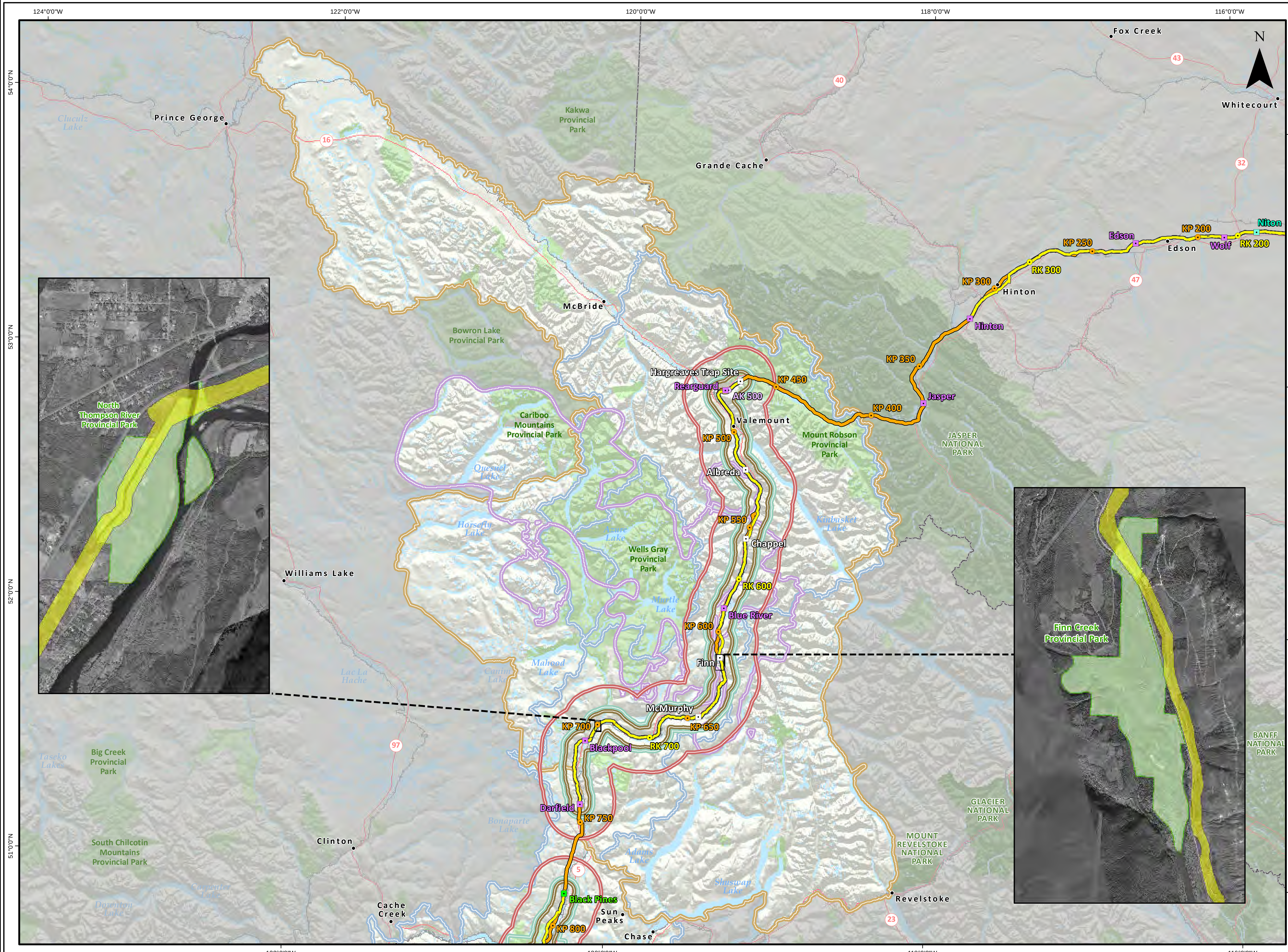

FIGURE 6.2.2-1

BIOPHYSICAL REGIONAL STUDY AREAS

TRANS MOUNTAIN EXPANSION PROJECT

- City / Town
- Kilometre Post (KP)
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Revised Pipeline Corridor
- Terminal
- Pump Station (Pump Additions, Station Modifications and/or Scraper Facilities)
- Pump Station (Reactivated)
- Existing Pump Station
- Road
- Railway
- National Park
- Provincial Park
- Natural Area / Provincial Recreation Area / Wilderness Provincial Park
- Provincial Boundary

Regional Study Areas

- RSA - Acoustic Environment
- RSA - Air Quality
- RSA - Fish and Fish Habitat/ Wetland Loss or Alteration
- RSA - Caribou
- RSA - Grizzly Bear
- RSA - Wildlife and Wildlife Habitat

***Note: RSA - Vegetation too small to show at this scale.**

Projection: UTM Zone 11N. Routing: Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor V9, provided by UPI, March 19, 2014; Reference Line & RK/AK VF, provided by UPI March 25 & 28, 2014; Transportation: IHS Inc., ESRI, 2005; Geopolitical Boundaries: Natural Resources Canada, 2003, AltaLIS, 2012, IHS Inc., 2011; First Nation Lands: Government of Canada, 2012, AltaLIS, 2010 & IHS Inc., 2011; Hydrology: Natural Resources Canada, 2007 & BC Crown Registry and Geographic Base Branch, 2008; Parks and Protected Areas: Natural Resources Canada, 2014, AltaLIS, 2012 & BC FLNRO, 2008; ATS Grid: AltaLIS, 2009; Canadian Hillshade: TERA Environmental Consultants, 2008; US Hillshade: ESRI, 2009.

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ALL LOCATIONS APPROXIMATE

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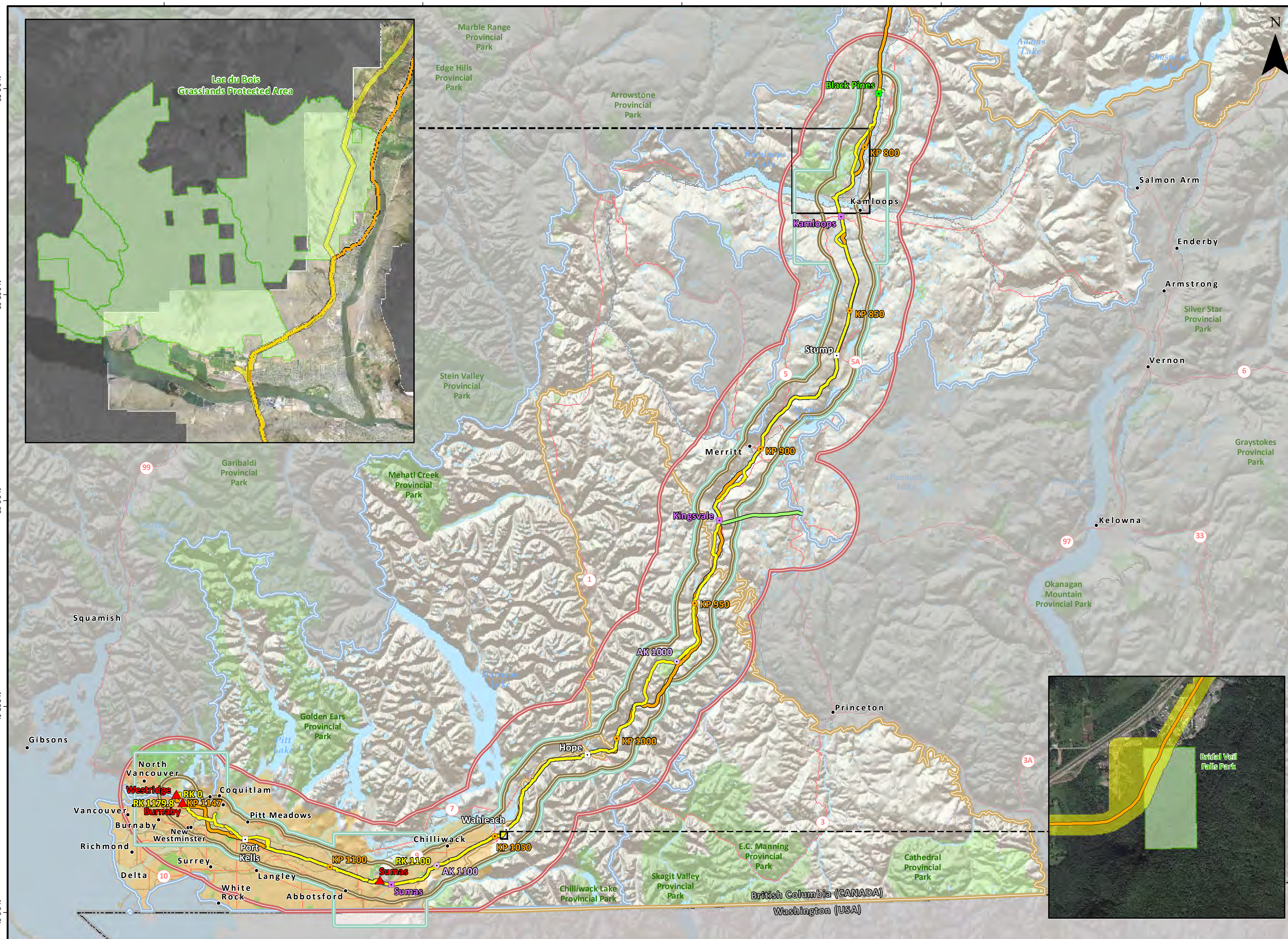
TRANS MOUNTAIN

FIGURE 6.2.2-1

BIOPHYSICAL REGIONAL STUDY AREAS

TRANS MOUNTAIN EXPANSION PROJECT



- City / Town
- Kilometre Post (KP)
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- Proposed Power Line
- Terminal
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- Pump Station (Reactivated)
- Existing Pump Station
- Road
- Railway
- National Park
- Provincial Park
- Natural Area / Provincial Recreation Area / Wilderness Provincial Park
- Provincial Boundary

Regional Study Areas

- RSA - Acoustic Environment
- RSA - Air Quality
- RSA - Fish and Fish Habitat/ Wetland Loss or Alteration
- RSA - Grizzly Bear
- RSA - Wildlife and Wildlife Habitat

***Note: RSA - Vegetation too small to show at this scale.**

Projection: UTM Zone 11N. Routing: Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor V9, provided by UPI, March 19, 2014; Reference Line & RK/AK VF, provided by UPI March 25 & 28, 2014; Transportation: IHS Inc., ESRI, 2005; Geopolitical Boundaries: Natural Resources Canada, 2003, AltaLIS, 2012, IHS Inc., 2011; First Nation Lands: Government of Canada, 2012, AltaLIS, 2010 & IHS Inc., 2011; Hydrology: Natural Resources Canada, 2007 & BC Crown Registry and Geographic Base Branch, 2008; Parks and Protected Areas: Natural Resources Canada, 2014, AltaLIS, 2012 & BC FLNRO, 2008; ATS Grid: AltaLIS, 2009; Canadian Hillshade: TERA Environmental Consultants, 2008; US Hillshade: ESRI, 2009.

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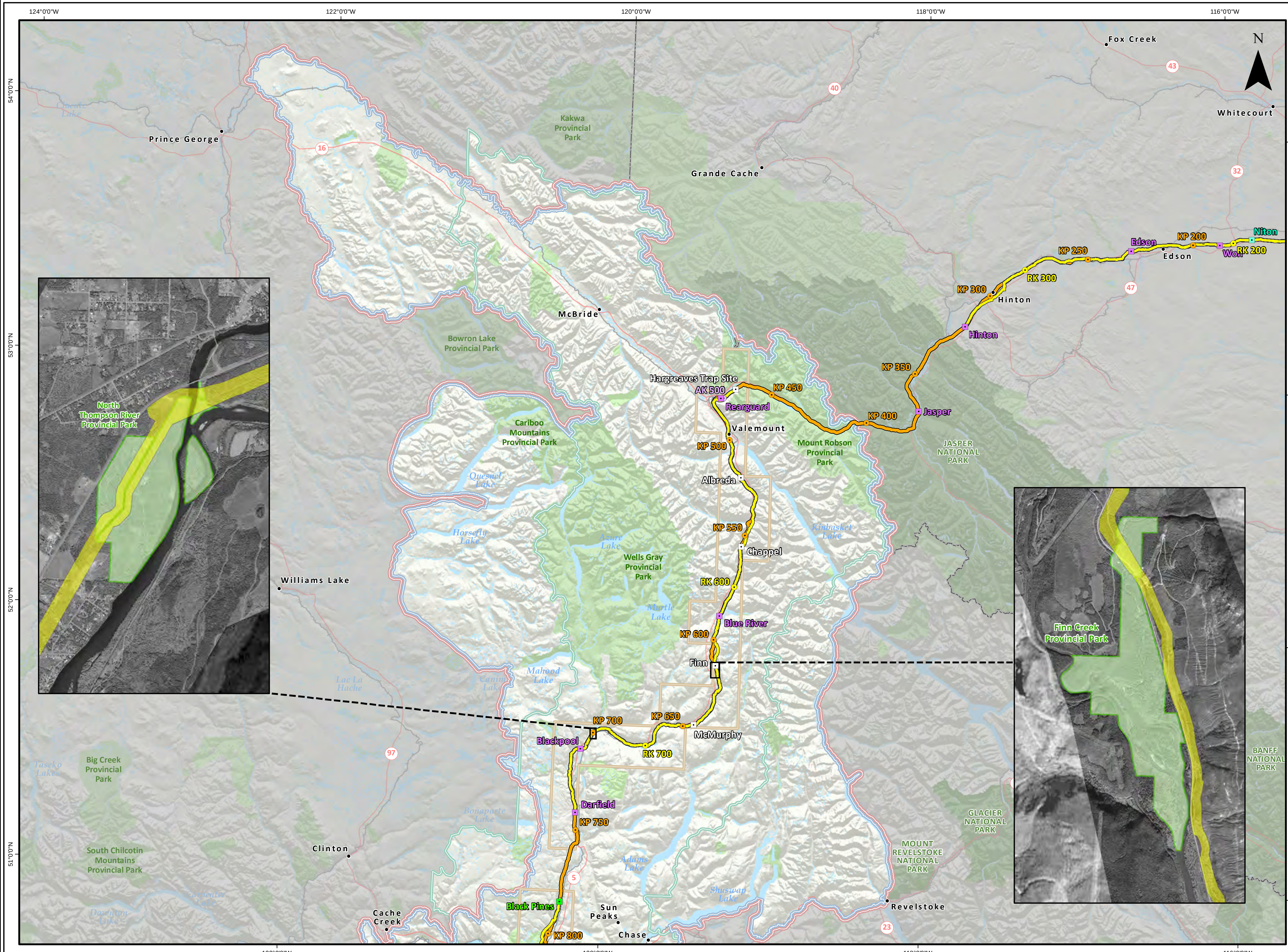

TRANS MOUNTAIN

FIGURE 6.2.2-2

SOCIO-ECONOMIC REGIONAL STUDY AREAS

TRANS MOUNTAIN EXPANSION PROJECT

- City / Town
- Kilometre Post (KP)
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Revised Pipeline Corridor
- Terminal
- Pump Station (Pump Additions, Station Modifications and/or Scraper Facilities)
- Pump Station (Reactivated)
- Existing Pump Station
- Road
- Railway
- National Park
- Provincial Park
- Natural Area / Provincial Recreation Area / Wilderness Provincial Park
- Provincial Boundary

Regional Study Areas

- RSA - Heritage Resource
- RSA - HORU
- RSA - Socio-Economic
- RSA - TLRU

Projection: UTM Zone 11N. Routing: Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor V9, provided by UPI, March 19, 2014; Transportation: IHS Inc., ESRI, 2005; Geopolitical Boundaries: Natural Resources Canada, 2003, AltaLIS, 2012, IHS Inc., 2011; First Nation Lands: Government of Canada, 2012, AltaLIS, 2010 & IHS Inc., 2011; Hydrology: Natural Resources Canada, 2007 & BC Crown Registry and Geographic Base Branch, 2008; Parks and Protected Areas: Natural Resources Canada, 2012, AltaLIS, 2012 & BC FLNRO, 2008; ATS Grid: AltaLIS, 2009; Canadian Hillshade: TERA Environmental Consultants, 2008; US Hillshade: ESRI, 2009.

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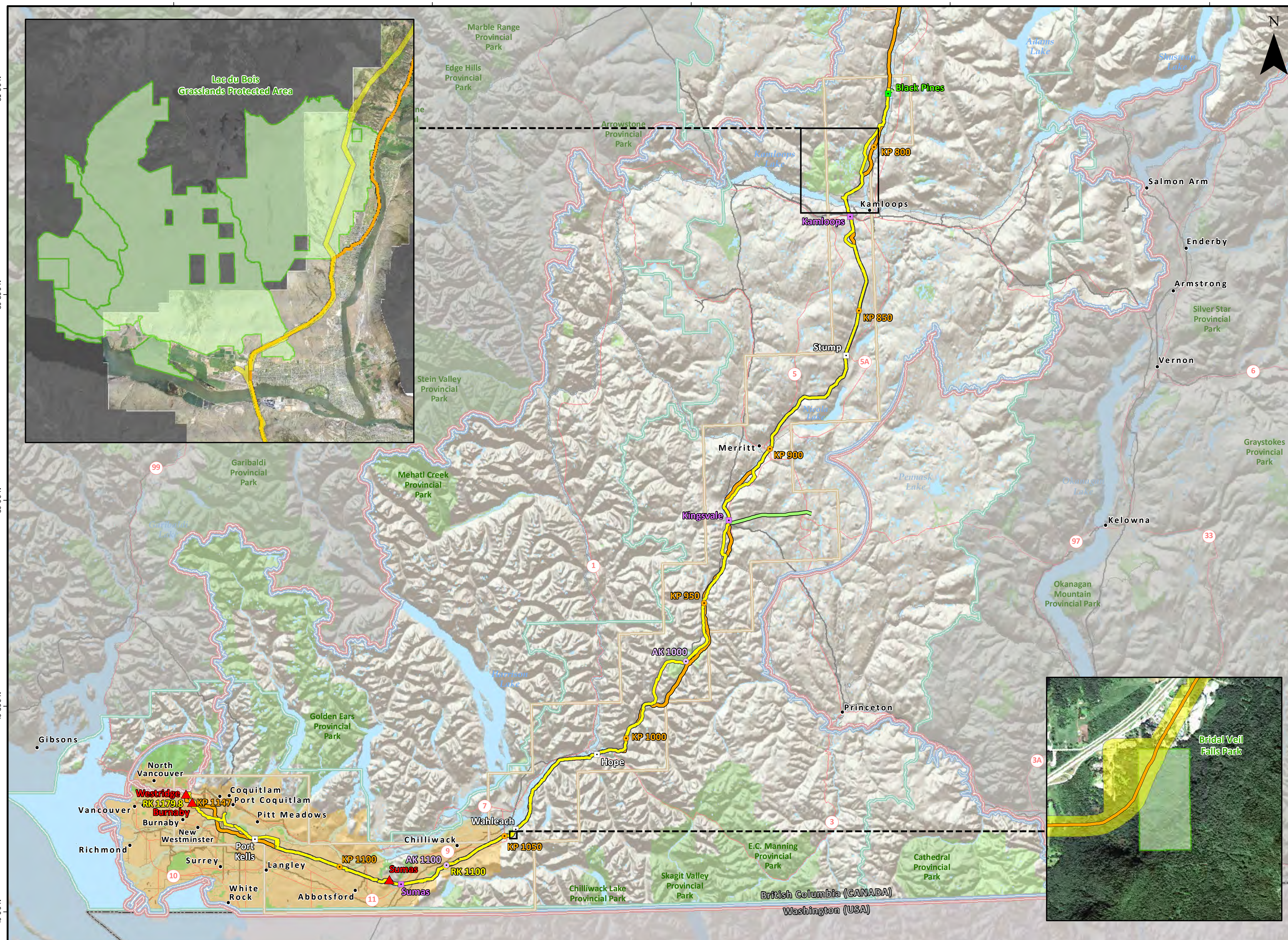

TRANS MOUNTAIN

FIGURE 6.2.2-2

SOCIO-ECONOMIC REGIONAL STUDY AREAS

TRANS MOUNTAIN EXPANSION PROJECT

- City / Town
- Kilometre Post (KP)
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
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- Trans Mountain Expansion Project Proposed Revised Pipeline Corridor
- Proposed Power Line
- Terminal
- Pump Station (Pump Additions, Station Modifications and/or Scraper Facilities)
- Pump Station (Reactivated)
- Existing Pump Station
- Road
- Railway
- National Park
- Provincial Park
- Natural Area / Provincial Recreation Area / Wilderness Provincial Park
- Provincial Boundary

Regional Study Areas

- RSA - Heritage Resource
- RSA - HORU
- RSA - Socio-Economic
- RSA - TLRU

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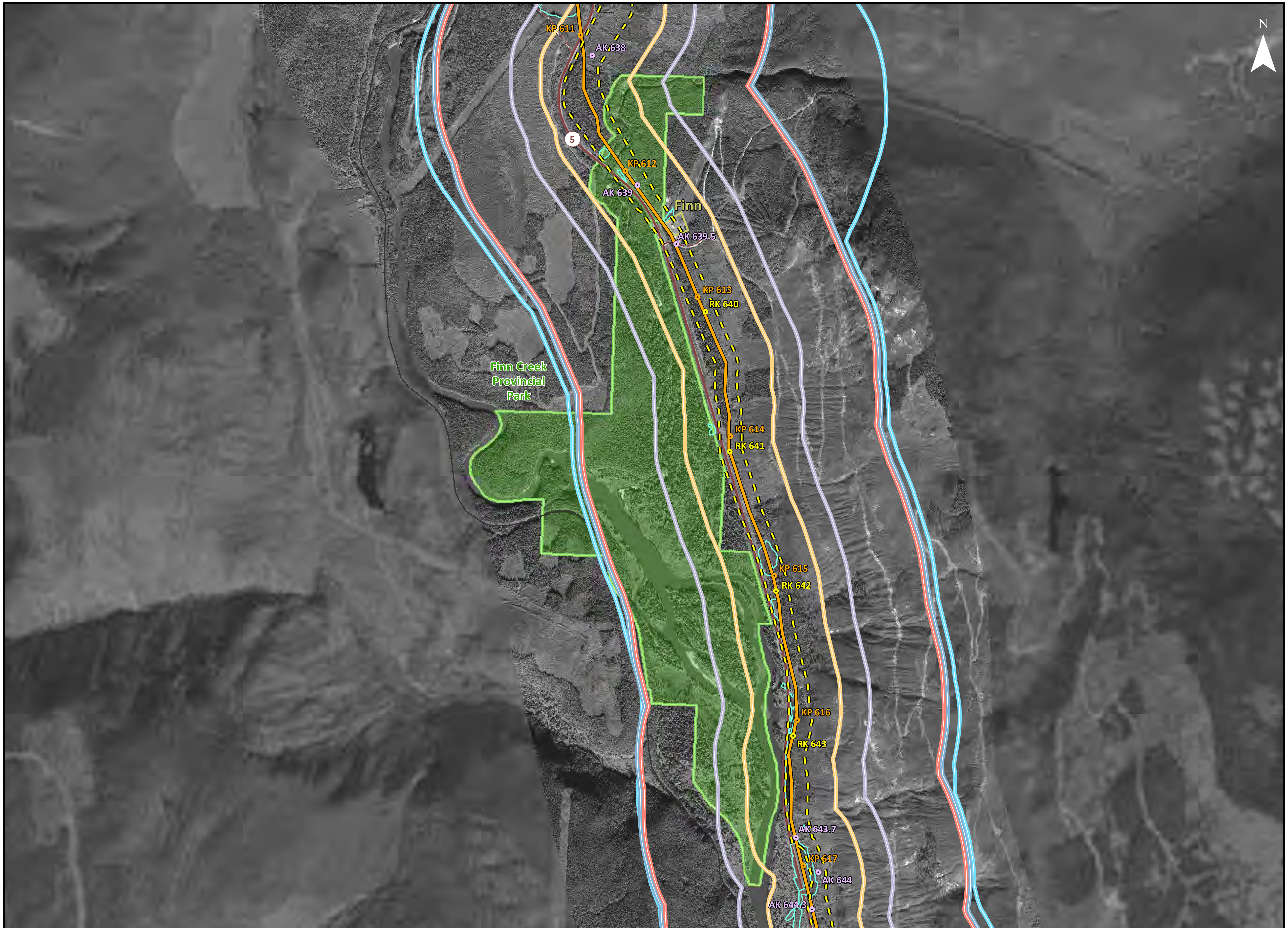

TRANS MOUNTAIN

FIGURE 6.2.2-3

FINN CREEK PROVINCIAL PARK AND LOCAL STUDY AREAS

TRANS MOUNTAIN EXPANSION PROJECT

- City / Town
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- TMEP Proposed Revised Pipeline Corridor
- Facility Property Boundary
- Highway
- Paved Road
- Resource Road
- Railway
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- Park / Protected Area
- Provincial Boundary

Local Study Areas

- LSA - Water Quality and Quantity
- LSA - Soil and Soil Productivity/ Physical Environment
- LSA - TLRU
- LSA - Air
- LSA - Wetland Loss or Alteration
- LSA - Wildlife and Wildlife Habitat/ Vegetation RSA

***Note: Vegetation LSA same shape as TMEP Proposed Revised Pipeline Corridor.**

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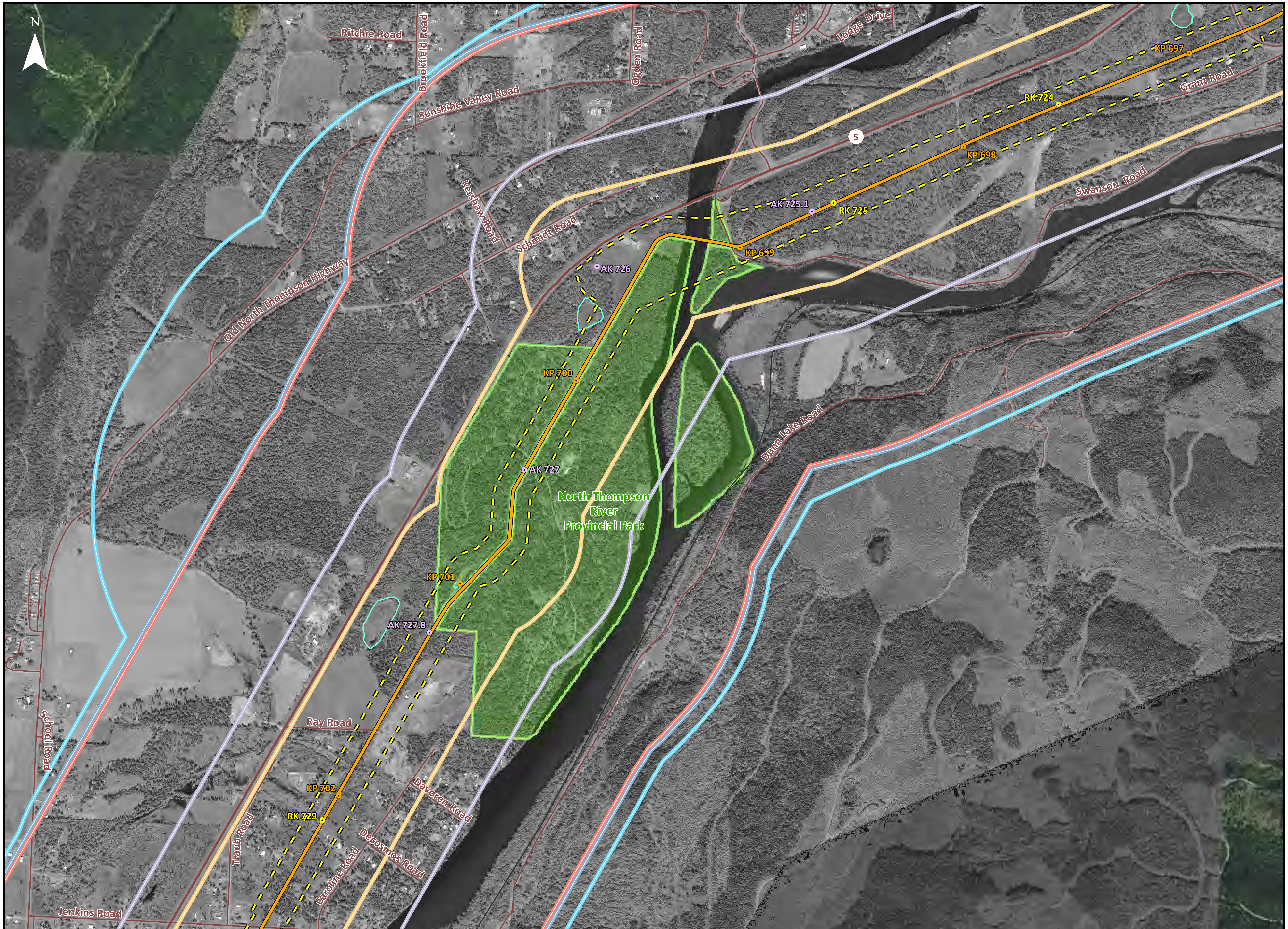

TRANS MOUNTAIN

FIGURE 6.2.2-4

NORTH THOMPSON RIVER PROVINCIAL PARK AND LOCAL STUDY AREAS

TRANS MOUNTAIN EXPANSION PROJECT

- City / Town
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- TMEP Proposed Revised Pipeline Corridor
- Highway
- Paved Road
- Resource Road
- Railway
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- Park / Protected Area
- Provincial Boundary

Local Study Areas

- LSA - Water Quality and Quantity
- LSA - Soil and Soil Productivity/ Physical Environment
- LSA - TLRU
- LSA - Air
- LSA - Wetland Loss or Alteration
- LSA - Wildlife and Wildlife Habitat/ Vegetation RSA

***Note: Vegetation LSA same shape as TMEP Proposed Revised Pipeline Corridor.**

Projection: UTM Zone 11N. Routing: Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor V9, provided by UPI, March 19, 2014; Reference Line & RK/AK VF, provided by UPI March 25 & 28, 2014; Transportation: IHS Inc., ESRI, 2005; Geopolitical Boundaries: Natural Resources Canada, 2003, AltaLIS, 2012, IHS Inc., 2011; First Nation Lands: Government of Canada, 2013, AltaLIS, 2010 & IHS Inc., 2011; Hydrology: Natural Resources Canada, 2007 & BC Crown Registry and Geographic Base Branch, 2008; Parks and Protected Areas: Natural Resources Canada, 2012, AltaLIS, 2012 & BC FLNRO, 2008; ATS Grid: AltaLIS, 2009; B/W & Colour Imagery: 2008-2011: Provided by KMC, 2012, and ESRI, 2014 (Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community).

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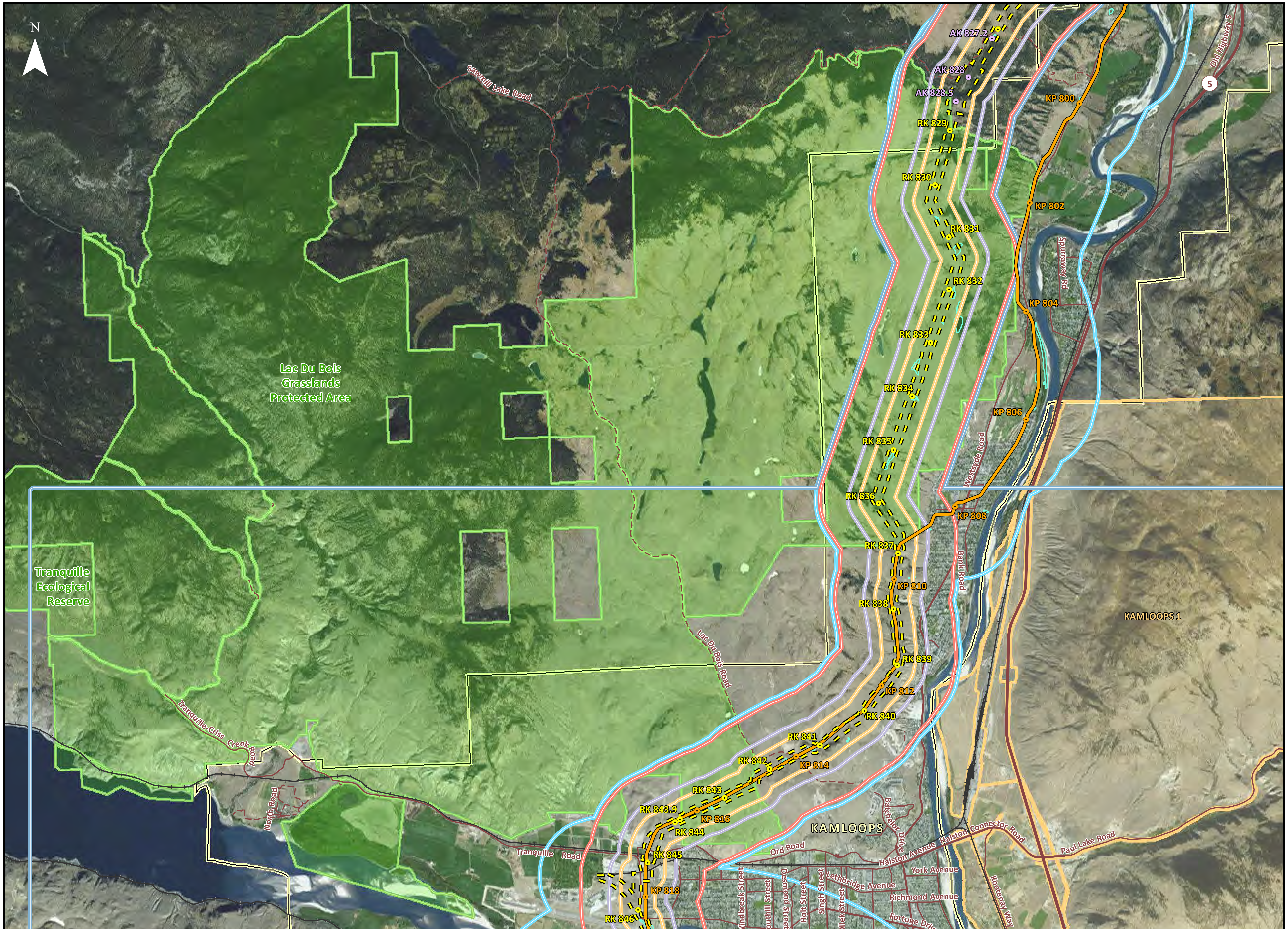

TRANS MOUNTAIN

FIGURE 6.2.2-5

LAC DU BOIS GRASSLANDS PROTECTED AREA AND LOCAL STUDY AREAS

TRANS MOUNTAIN EXPANSION PROJECT

- City / Town
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
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- Resource Road
- Railway
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- Park / Protected Area
- Provincial Boundary

Local Study Areas

- LSA - Water Quality and Quantity
- LSA - Soil and Soil Productivity/ Physical Environment
- LSA - TLRU
- LSA - Air
- LSA - Wetland Loss or Alteration
- LSA - Wildlife and Wildlife Habitat/ Vegetation RSA

***Note: Vegetation LSA same shape as TMEP Proposed Revised Pipeline Corridor.**

Projection: UTM Zone 11N. Routing: Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor V9, provided by UPI, March 19, 2014; Reference Line & RK/AK VF, provided by UPI March 25 & 28, 2014; Transportation: IHS Inc., ESRI, 2005; Geopolitical Boundaries: Natural Resources Canada, 2003, AltaLIS, 2012, IHS Inc., 2011; First Nation Lands: Government of Canada, 2013, AltaLIS, 2010 & IHS Inc., 2011; Hydrology: Natural Resources Canada, 2007 & BC Crown Registry and Geographic Base Branch, 2008; Parks and Protected Areas: Natural Resources Canada, 2012, AltaLIS, 2012 & BC FLNRO, 2008; ATS Grid: AltaLIS, 2009; B/W & Colour Imagery: 2008-2011: Provided by KMC, 2012, and ESRI, 2014 (Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community).

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ALL LOCATIONS APPROXIMATE

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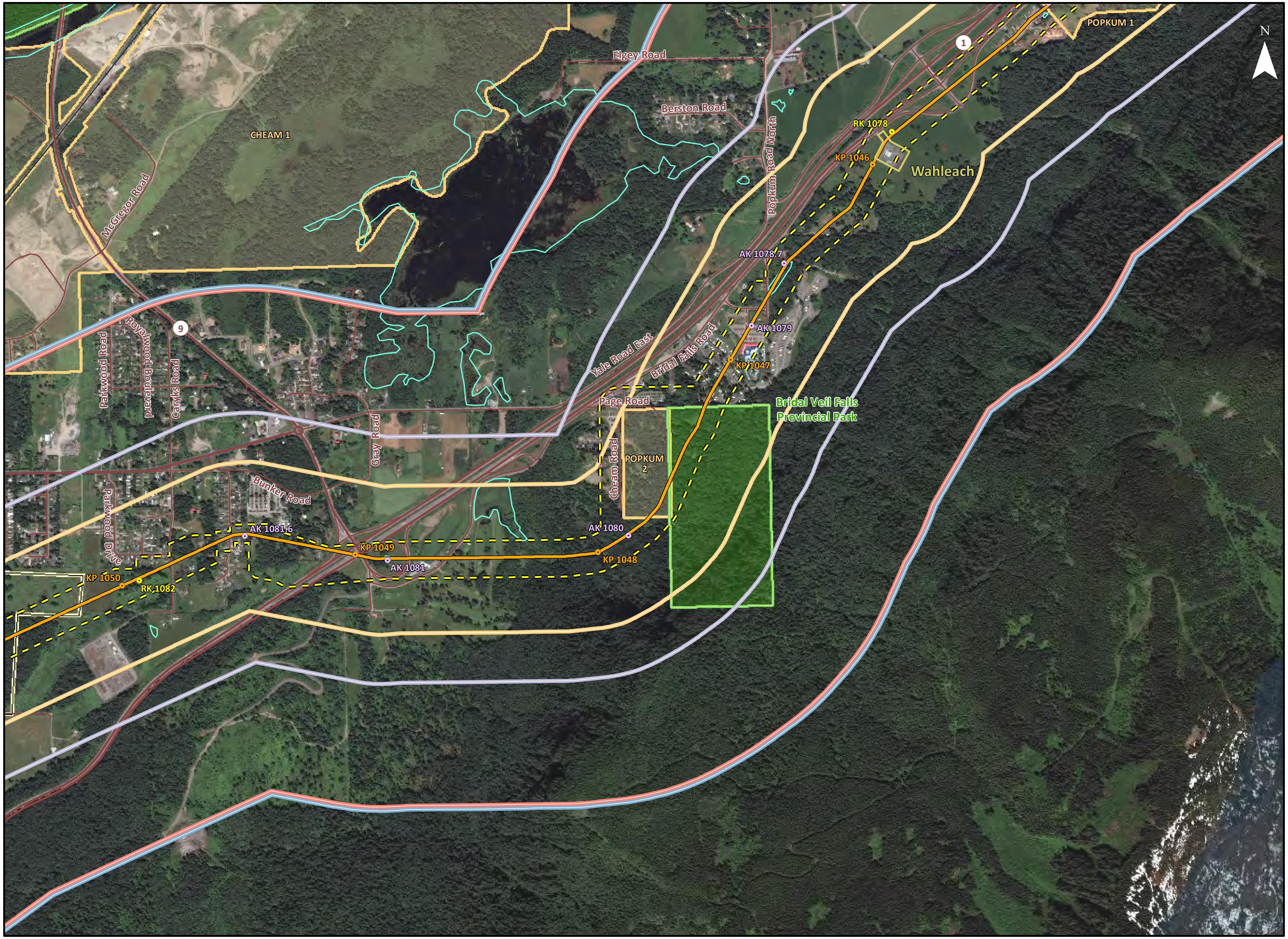

TRANS MOUNTAIN

FIGURE 6.2.2-6

BRIDAL VEIL FALLS PROVINCIAL PARK AND LOCAL STUDY AREAS

TRANS MOUNTAIN EXPANSION PROJECT

- City / Town
- Reference Kilometre Post (RK)
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- Park / Protected Area
- Provincial Boundary

Local Study Areas

- LSA - Water Quality and Quantity
- LSA - Soil and Soil Productivity/ Physical Environment
- LSA - TLRU
- LSA - Air
- LSA - Wetland Loss or Alteration
- LSA - Wildlife and Wildlife Habitat/ Vegetation RSA

***Note: Vegetation LSA same shape as TMEP Proposed Revised Pipeline Corridor.**

Projection: UTM Zone 11N. Routing: Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor V9, provided by UPI, March 19, 2014; Reference Line & RK/AK VF, provided by UPI March 25 & 28, 2014; Transportation: IHS Inc., ESRI, 2005; Geopolitical Boundaries: Natural Resources Canada, 2003, AltaLIS, 2012, IHS Inc., 2011; First Nation Lands: Government of Canada, 2013, AltaLIS, 2010 & IHS Inc., 2011; Hydrology: Natural Resources Canada, 2007 & BC Crown Registry and Geographic Base Branch, 2008; Parks and Protected Areas: Natural Resources Canada, 2012, AltaLIS, 2012 & BC FLNRO, 2008; ATS Grid: AltaLIS, 2009; B/W & Colour Imagery: 2008-2011: Provided by KMC, 2012, and ESRI, 2014 (Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community).

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Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER		PAGE
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6.2.5 Residual Effects

As defined in the NEB *Filing Manual* and the BC Parks Impact Assessment Process (BC MOE 1999), residual effects are the environmental effects that are present after mitigation measures are applied. In many situations, the mitigation measures are predicted to eliminate the potential adverse effects while in other situations, the mitigation measures are predicted to lessen the effects but do not entirely eliminate them. Elements for which no residual effects are predicted require no further analysis (*i.e.*, significance evaluation).

6.2.6 Significance Evaluation of Potential Residual Effects

The determination of the significance of potential residual effects generally followed the guidelines and principles provided by the NEB, Canadian Environmental Assessment Agency, BC Parks Impact Assessment Process and Federal Environmental Assessment and Review Office (FEARO) documents. The agencies identified several possible methods for determining whether residual effects are significant. These include:

- the use of regulatory environmental standards, guidelines or objectives in relation to potential residual effects;
- quantitative assessment of residual effects; and
- qualitative assessment of residual effects.

The NEB *Filing Manual* and the BC Parks Impact Assessment Process indicates that the quantitative method should be used where possible; otherwise the qualitative method can be used. Some elements can be assessed quantitatively using regulatory standards and guidelines. Where there are no standards, guidelines, objectives or other established and accepted thresholds to define quantitative rating criteria or where quantitative thresholds are not appropriate, the qualitative method that is based on available literature is considered to be the appropriate method for determining the significance of most of the potential residual effects. Consequently, the significance is evaluated by developing a set of qualitative criteria based on those identified by Hegmann *et al*. (1999). These criteria are identified below and their definitions are presented in Table 6.2-1.

- spatial boundary (*i.e.*, the geographic extent in the Footprint, LSA, RSA, Provincial, National, International);
- temporal context (*i.e.,* duration and frequency of the event causing the residual effect, reversibility of the residual effect);
- magnitude (*i.e.,* severity of the residual effect in relation to environmental and/or regulatory standards or to modification in the socio-economic environment);
- probability or likelihood of occurrence of the residual effect; and
- level of confidence or uncertainty (*i.e.,* availability of data to substantiate the assessment conclusion, previous success of mitigation measures).

TABLE 6.2.6-1

EVALUATION OF THE SIGNIFICANCE OF RESIDUAL EFFECTS - ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT CRITERIA[1]

Assessment Criteria	Definition
IMPACT BALANCE – of the Residual Effect	
Positive	Residual effect is considered to have a net benefit to the environmental and socio-economic indicator.
Neutral	Residual effect is considered to have no net benefit or loss to the environmental and socio-economic indicator.
Negative	Residual effect is considered to be a net loss or a detriment to the environmental and socio-economic indicator.

TABLE 6.2.6-1 Cont'd

Assessment Criteria		Definition
SPATIAL BOUNDARY – Location of Residual Effect		
Footprint		The area directly disturbed by surveying, construction and clean-up of the pipeline, and associated physical works and activities (including, where appropriate, the permanent right-of-way, temporary construction workspace, temporary stockpile sites, temporary staging sites, construction camps, access roads).
LSA		The zone of influence or area where the element and associated indicators are most likely to be affected by Project construction and operations. This generally represents a buffer from the centre of the proposed pipeline corridor.
RSA		The area extending beyond the LSA boundary where the direct and indirect influence of other activities could overlap with Project-specific effects and cause cumulative effects on the environmental or socio-economic indicator. This varies for each element.
Provincial		The area extending beyond regional or administrative boundaries but confined BC (*e.g.*, provincial permitting boundaries).
National		The area extending beyond BC but confined to Canada.
International		The area extending beyond Canada.
TEMPORAL CONTEXT		
Duration – (period of the event causing the effect)	Immediate	Event is limited to less than or equal to two days during either the construction phase or operations phase.
	Short-term	Event occurs during the construction phase or is completed within any 1 year during the operations phase.
	Long-term	Ongoing event that is initiated during the construction phase and extends beyond the first year of the operations phase or is initiated during the operations phase and extends for the life of the Project.
Frequency[2] - (how often would the event that caused the effect occur)	Accidental	Event occurs rarely over assessment period.
	Isolated	Event is confined to a specified phase of the assessment period.
	Occasional	Event occurs intermittently and sporadically over the assessment period.
	Periodic	Event occurs intermittently but repeatedly over the assessment period.
	Continuous	Event occurs continually over the assessment period.
Reversibility - Environmental (period of time over which the residual effect extends)	Immediate	Residual effect is alleviated in less than or equal to 2 days.
	Short-term	Greater than 2 days and less than or equal to 1 year to reverse residual effect.
	Medium-term	Greater than 1 year and less than or equal to 10 years to reverse residual effect.
	Long-term	Greater than 10 years to reverse residual effects.
	Permanent	Residual effects are irreversible.
Reversibility – Socio-economic (period of time over which the residual effect extends)	Short-term	Residual effect limited to the construction phase or to less than any 1 year during operations phase.
	Medium-term	Residual effect extends more than 1 year but less than or equal to 10 years into the operations phase.
	Long-term	Residual effect extends beyond the first 10 years of the operations phase.
	Permanent	Residual effects are irreversible.
MAGNITUDE[3] – of the Residual Environmental Effect		
Negligible		Residual effects are not detectable from existing (baseline) conditions.
Low		Residual effects are detectable, but well within environmental and/or regulatory standards.
Medium		Residual effects are detectable and may approach, but are still within the environmental and/or regulatory standards.
High		Residual effects are beyond environmental and/or regulatory standards.
MAGNITUDE[3] – of the Residual Socio-economic Effect		
Negligible		No detectable change from existing (baseline) conditions.
Low		Change is detectable, but has no effect on the socio-economic environment beyond that of an inconvenience or nuisance value.
Medium		Change is detectable and results in moderate modification in the socio-economic environment.
High		Change is detectable and is large enough to result in a severe modification in the socio-economic environment.
PROBABILITY OF OCCURRENCE – Likelihood of Residual Effect		
High		Likely.
Low		Unlikely.
LEVEL OF CONFIDENCE[4] – Degree of Certainty Related to Significance Evaluation		
Low		Determination of significance based on incomplete understanding of cause-effect relationships and incomplete data pertinent to the Project area.
Moderate		Determination of significance based on good understanding of cause-effect relationships using data from outside the Project area or incompletely understood cause-effect relationships using data pertinent to the Project area.
High		Determination of significance based on good understanding of cause-effect relationships and data pertinent to the Project area.

Notes: 1 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Significant Residual Socio-economic Effect: A residual socio-economic effect is considered significant if the effect is predicted to be:

- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

2 The assessment period for the effects assessment includes planning, construction, operations and decommissioning and abandonment phases for the Project while the assessment period for the cumulative effects assessment includes the above interval as well as the development, construction and operations phases of activities or Projects that have previously occurred and those that are planned (publicly disclosed).

3 In consideration of magnitude, there is no environmental standard, threshold, guideline or objective for many of the construction/operations issues under evaluation. Therefore, the determination of magnitude of the adverse residual effect often entailed a historical consideration of the assessment of magnitude made by regulators, land authorities, lessees, other stakeholders and the assessment team to adverse effects. The assessment team was also aware of the increasingly stringent societal norms related to environmental and socio-economic effects.

4 Level of confidence was affected by availability of data, precedence and degree of scientific uncertainty or other factors beyond the control of the assessment team.

For environmental elements, a significant residual effect has a high probability of occurrence, is permanent or reversible in the long-term, is of high magnitude and cannot be technically or economically mitigated. A residual socio-economic effect is considered significant if the effect is predicted to be:

- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent and cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility, within any spatial boundary and cannot be technically or economically mitigated.

The impact balance or direction (*i.e.,* determination as to whether the effect is positive, neutral or negative) was also established for each predicted environmental or socio-economic residual effect. A positive impact balance is considered to have a net benefit to the environmental or socio-economic indicator. A neutral impact balance is defined as having no net benefit or loss to the environmental or socio-economic indicator. A negative balance is considered to be a net loss or detriment to the environmental or socio-economic indicator.

All significance assessment criteria (*e.g.,* temporal context, magnitude) are considered by the assessment team for each residual environmental or socio-economic effect. Where appropriate, the key or most influential assessment criteria used to determine the significance of each residual effect are noted. It should be noted that the determination of a "*not significant residual effect*" is based on a pre-defined approach that incorporates magnitude, probability and reversibility, but a "*not significant residual effect*" determination does not mean that the potential residual effect is not important to one or more Aboriginal communities, landowners, regulatory authorities or stakeholders.

The extent to which the professional judgment of the assessment team is used to evaluate the significance of potential environmental or socio-economic residual effects is provided within the relevant section of the assessment for each element. For this Project, the assessment team consisted of discipline experts, the TERA Project Manager, experienced assessment practitioners and senior reviewers. For some elements, the evaluation of significance benefited from a review of select publically available PCEM reports from previous Trans Mountain Projects and other Projects that encountered environmental settings and associated issues similar to those of the Project.

The Impact Assessment Reports for Finn Creek Provincial Park, North Thompson River Provincial Park, Lac Du Bois Grasslands Protected Area and Bridal Veil Falls Provincial Park are provided in Tabs A, B, C and D of this report, respectively.

7.0 RECLAMATION

The Reclamation Framework is built upon the Pipeline EPP and identifies additional measures and activities to re-establish the ecological integrity of each park during Project construction.

7.1 Reclamation Objectives and Goals

The primary goals of reclamation are to re-establish a recovery trajectory for the ecological integrity, biodiversity and self-sustainability of key vegetation communities, wildlife habitat, wildlife movement corridors, riparian ecosystems and sensitive or unique landforms that have been affected by the Project. The overall objective of the reclamation strategy is to maintain and, where applicable, improve terrestrial and aquatic ecosystems and landscapes by re-establishing ecological processes and functionality. Reclamation activities will be in keeping with park management objectives.

7.2 General Reclamation Measures

7.2.1 Natural Regeneration

Where the potential for soil erosion and non-native invasive species infestation is low, and where it is anticipated that the topsoil or root zone material contains a propagule bank (*e.g.,* seed, stem or root pieces) of suitable species, it may in some cases be preferable to not reseed the disturbed area. This will facilitate establishment of pre-disturbance vegetation through germination or sprouting of native propagules present on the disturbed area following clean-up and topsoil/root zone material replacement. In areas with potential erosion and weed concerns, a native grass seed mix will be applied where woody vegetation establishment is not a goal. The seed mix will contain a rapidly-establishing grass species along with other native grass species. Alternatively, where woody vegetation establishment through natural regeneration is a goal, a cover crop containing a native short-lived perennial species will be applied to control erosion, reduce weed growth and limit competition to naturally regenerating pre-disturbance woody vegetation.

Natural regeneration is preferred over seeding with commercially available native seed where it is practical, under the right circumstances, allowing only the pre-disturbance vegetation to re-establish on the disturbed area. However, care must be taken when using natural regeneration techniques to avoid invasion of non-native invasive species, as is often the case when paralleling other linear disturbances. Riparian, wetlands and other high moisture/low-lying areas that will regenerate rapidly in a short time frame are prime candidates for natural regeneration. Trans Mountain will avoid the use of Douglas-fir and spruce for rollback within Las du Bois Provincial Park. Select tree species (*e.g.,* pine) felled during construction will be used in these locations as rollback, to the extent allowable, to provide erosion control and habitat enhancement.

7.2.2 Woody Species Revegetation

Revegetation using native tree and shrub species will occur in select areas (*e.g.,* temporary work space [TWS] and riparian zones) in accordance with KMC operations and maintenance procedures (*i.e.,* revegetation is allowed as long as the trench line is not obscured from aerial monitoring or access to the pipeline right-of-way for maintenance and regular inspections is not compromised).

<u>Installation of Nursery-Grown Plant Plugs</u>

TWS, riparian and special reclamation areas will be surveyed for evidence of naturally regenerating trees, specifically sites that are cleared of coniferous vegetation. If suitable levels of naturally regenerating (from seed or vegetative propagules) deciduous or coniferous trees are not observed, then these and other areas will be considered for the installation of nursery-grown plant plugs (*e.g.,* rooted stock plugs). Native seed will be secured (through either purchase or collection) and dormant woody species cuttings will be collected, as required for propagation. Deciduous and coniferous rooted plugs will be installed at pre-selected sites (*e.g.,* TWS, riparian areas or for line-of-sight breaks) as determined in consultation with BC Parks conservation specialists. Under the guidance of a Reclamation Specialist (or other qualified professional), planting crews will install the rooted stock plugs using standardized silviculture planting equipment and techniques. The rooted stock plugs will be installed at a specified density/distribution with the purpose of initiating an early ecological recovery trajectory that will, in time, emulate the adjacent undisturbed vegetation in form and function where not influenced by KMC's operation and maintenance procedures.

Where it is determined that ungulate species may damage (browse or up-root) newly installed deciduous plants, protection of the trees via chemical (*e.g.,* animal repellent [DeerGuard]) or mechanical (*e.g.,* tree shields) methods may be warranted at the time of installation.

Installation of Locally Sourced Dormant Woody Species Transplants

At pre-determined locations where vegetation is disturbed by construction, the use of plant transplants may be considered. The use of dormant woody transfers is a cost effective and efficient method of re-establishing vegetation to disturbed locations. Unlike salvaging and storing dormant woody material during construction, transfers are dug when dormant, where warranted, from a location adjacent to the reclamation site that contains select plant species of a suitable size (conifers < 45 cm in height, deciduous trees < 2 cm stem calliper at ground level or 90 cm in height). Where a donor plant community is located adjacent to a potential reclamation site outside of park boundaries, a survey of the donor plant community will be completed to determine the level of plant extraction that could be achieved without affecting the form and/or function of the donor plant community.

A permit for harvesting transplants from the adjacent plant community will be discussed with the appropriate personnel.

Seeding of Native Grass Species

Seed mixes will be developed in consultation with the BC Parks conservation specialist and will consist of species native to the park. Multiple seed mixes may be required to account for areas of special concern (*e.g.,* riparian areas) and/or soil and moisture conditions as well as plant associations. Seeding will be conducted as soon as practical following topsoil/root zone material replacement.

Drill or broadcast seeding of native seed mixes or a grass cover crop species will be conducted on the majority of the right-of-way, except where tree and shrub plantings occur. The locations where each seed mix/cover crop species is to be applied is identified on the Environmental Alignment Sheets.

7.2.3 Rollback

Trans Mountain will avoid the use of Douglas-fir and spruce for rollback within Lac du Bois Grasslands Protected Area. Select tree species (*e.g.,* pine) felled during construction will be used in these locations as rollback, to the extent allowable, to provide erosion control and habitat enhancement. The woody material felled during construction will be used as rollback, to the extent allowable, to prevent excessive fuel buildup. The woody rollback will provide microsites to aid in the re-establishment of woody vegetation and assist in the control of soil erosion along the proposed right-of-way where woody vegetation was cleared. To obtain material required for rollback, woody slash will be salvaged during construction clearing activities in suitable quantities to allow for the placement of rollback at select locations onto the construction right-of-way following topsoil/root zone material replacement.

7.3 Management Objectives and Desired End Results

Table 7.3-1 summarizes the management objectives / desired end results (MO/DERS) that Trans Mountain expects to achieve through the Reclamation Program in protected areas.

TABLE 7.3-1

**BRITISH COLUMBIA PROVINCIAL PROTECTED AREAS
MANAGEMENT OBJECTIVES / DESIRED END RESULTS (MO/DERS)**

VEGETATION RECLAMATION
General: Vegetation of all disturbed areas is reclaimed to conditions that reflect the natural undisturbed range of variability in terrestrial and riparian areas regarding composition, function, and dynamics of native plant communities). Trans Mountain will typically be responsible for the establishment of an early seral stage and successional trajectory thereof, when agreed to by BC Parks, or alternatively for previously disturbed areas that are used for stockpile/storage, the reclamation is to be baseline conditions and successional trajectory (at a minimum) with compatibility with the above-noted conditions as the ultimate target. For the purposes of pursuing appropriate reclamation targets, vegetation is to be characterized to the level of 'vegetation types' in consultation with BC Parks.
Vegetation Success: Mitigation measures achieve the following accepted standard for revegetation success on the right-of-way and temporary work areas: • The ground cover of mulch (plant litter) and native herbaceous vegetation is sufficient to stabilize soils and minimize erosion by wind and water. • Vegetation is capable of maintaining cover and density without the aid of applied fertilizers beyond the time when residual effects have ceased.
Vegetation Composition: Highway rights-of-way are revegetated successfully with native species of grasses, shrubs and forbs that are adapted to these ecosites but that have reduced attractiveness to grazing wildlife (*e.g.,* ungulates, bears).
Vegetation Processes: Within the constraints of accomplishing specific reclamation targets, native plant species establish (either by active measures by Trans Mountain or by natural regeneration) such that there is overlap in total plant species composition between the right-of-way and temporary work areas and similar open area plant communities within five years (commencing with the first partial or full growing season as year 0) following pipeline construction.
Vegetation Processes: Future land disturbance for maintenance purposes does not affect the composition, structure, quantity, function, or dynamics of the reclaimed system.
Vegetation Processes: The probability and extent of forest insect and disease occurrence is no higher in the right-of-way or active/reclaimed temporary work areas than what would occur within forests, based on knowledge of the historic range of variability or concerns of adjacent land management agencies.
Final conditions do not hinder establishment of native plant communities, or alter natural surface drainage patterns.
Natural habitat conditions (including hydrological patterns and regimes) for rare plant species/communities are maintained or restored.
NON-NATIVE AND INVASIVE (WEED) SPECIES AND PROBLEM SPECIES
Vegetation Composition: High priority (*i.e.,* more invasive) non-native plant species do not become established or set seed on the Trans Mountain right-of-way or temporary work areas, or spread off the right-of-way or temporary work areas. Existing infestations are controlled and ideally eradicated prior to construction.
Proposed project does not facilitate the growth and spread of forest pathogens, beyond natural rates and patterns.
Material obtained from outside of the protected areas does not contribute to the weed problem within the park.
Management of weed species is consistent with BC Parks Invasive Species Vegetation Management Programs.
SOILS
General: Soils of the right-of-way and temporary work areas provide natural undisturbed growing conditions, and continue the natural rates and patterns of cycling of biomass and nutrients and other ecological functions, or alternatively for previously disturbed areas that are used for stockpile/storage, the reclamation is to be baseline conditions and successional trajectory (at a minimum) with compatibility with the above-noted pre-construction conditions as the ultimate target.
There is no smothering of native plant communities, no alteration of soil pH, no creation of phytochemical leaching, no soil compaction, and no creation of nitrogen deficiencies, to the detriment of native vegetation, growing conditions, or ecological functions.
Soil Erosion: No acceleration of soil erosion rates, beyond predisturbance levels within the Project area and on specific soil conditions.
Site Contours: Post-construction contours of the right-of-way and temporary work areas (including the trench subsidence or crowning) match surrounding topography, and do not create conditions that would hinder establishment of native plant communities or alter natural drainage patterns.
AQUATIC ECOSYSTEMS
Wetlands: Maintain natural levels and patterns of surface and subsurface hydrologic flow, with no unnatural impoundment of waters. Maintain natural composition, structure, quantity, and dynamics of wetland vegetation and growing conditions.
No release into watercourses of sediments in levels that are deleterious to fish or other aquatic life. Similarly there is to be no sediment release into areas of vegetation growth or sensitive areas of sediments in levels that would adversely alter growing or hydraulic conditions.
Natural form, pattern, frequency, productivity, and function of aquatic ecological integrity, with fish-bearing and nonfish-bearing watercourses given equal importance.

TABLE 7.3-1 Cont'd

WILDLIFE
The primary management objective of Finn Creek Provincial Park is to protect the ecological integrity of the river riparian and associated upland environments (BC MOE 1999). Other wildlife-related management objectives include maintaining the diversity of wildlife species and habitats and providing for continued recreation use with opportunities for activities such as wildlife viewing (BC MOE 1999). The primary management objective of North Thompson River Provincial Park is to provide an overnight and stay use stopover site for the public (i.e., travellers on Highway 5) (BC MOE 2013a). A management objective for the park includes conservation of river riparian habitats and a small, but relatively important example of the IDFmw2 subzone/variant (BC MOE 2013a). The vision statement in the draft Lac du Bois Grasslands Provincial Protected Area Management Plan identifies the following primary objectives: protecting and presenting representative native grassland ecosystems, managing grazing use for protected area biodiversity objectives, and maintaining conservation as a high priority (BC MELP 2004). An emphasis is placed on recognizing the fragile nature of grasslands, wetlands and riparian areas, and their importance for wildlife habitat and species at risk (BC MELP 2004). The Bridal Veil Falls Park Master Plan identifies the primary management objectives of Bridal Veil Falls Provincial Park as conservation and preservation of the park for recreation and scenic viewing (BC Ministry of Lands, Parks and Housing [MLPH] 1984). Although wildlife are known to frequent the park, there are no specific objectives that pertain to wildlife due to its small size and low resource diversity (BC MLPH 1984). The Bridal Veil Falls Provincial Park website identifies bird habitat as being present within the park, in addition to habitat suitable for transient species such as Columbia blacktail deer and black bear (BC MOE 2013a).
Management objectives for protected areas along the proposed route include protecting ecological integrity of habitats, including conservation of wildlife and providing recreational opportunities such as wildlife viewing.
Desired end results for habitat include: habitat disturbance is reduced to the extent feasible by utilizing the existing TMPL right-of-way and other disturbances; and disturbed habitat is reclaimed in a manner that allows for regeneration of natural vegetation communities and successional trajectory.
Desired end results for effects on wildlife inhabiting parks include: reduced disturbance during sensitive periods by adhering to recommended timing windows; avoiding direct mortality through implementation of mitigation; and avoiding barriers to movement by implementing mitigation.
Desired end results for effects on species at risk and critical habitats include: minimizing habitat disturbance where avoidance cannot be achieved; implementing best practices and standard mitigation, in addition to species-specific mitigation plans to be developed in consultation with regulatory agencies for select species at risk.
CULTURAL RESOURCES MANAGEMENT
Maintain with minimal disturbance the distinguishing historic features.
In cases where the disturbance of a cultural resource is proven to be unavoidable and can, therefore, be justified, there is to be no loss of the information, knowledge and records that is provided by the *in situ* cultural resource, for the future understanding, appreciation and study for the benefit of present and future generations.
PARK MANAGEMENT - GENERAL
The TMEP Project does not add or facilitate increased visitor access within BC parks or access by off-road vehicles after construction of the proposed pipeline is completed.
There is to be no expansion of recreational opportunities as a direct result of the proposed Project, unless BC Parks requests otherwise.
No contamination of soil, water, air, vegetation, wildlife, or people.
During construction and operations, the target is no leaks or spills.
Public Safety: no increase in the risk of injury or mortality to BC Parks visitors, residents, or staff in relation to the construction, operation, and maintenance of the pipeline.
No notable disturbance, relocation or safety concerns to visitors at campgrounds.
Wells in the vicinity of the Project continue to have a secure, clean water supply as indicated by appropriate potable water testing, and are perceived as such (to the same extent as baseline societal perception) by users of those wells.
MONITORING
That future conditions can be conclusively (including quantification as appropriate) shown (either directly or through reasonable surrogates) to have accomplished all desired end results that are stated here or that have been committed to by the proponent. Time frame for showing this accomplishment is a function of the recovery time normally anticipated or specific recovery time found to be necessary for each desired end result and associated ecological and recreational value. It is anticipated that some components may require a minimum of 5-10 years of monitoring. Yearly status reports will be required in the interim.

7.4 Specific Reclamation Issues

Site-specific Reclamation Frameworks for each park is provided in Section 8.0 of the each of the respective Parks Tab.

8.0 REFERENCES

8.1 Personal Communication

TERA wishes to acknowledge those people identified in the Personal Communications for their assistance in supplying information and/or comments incorporated in to this report.

Fryer, G. Senior Environmental Planner/Principal, TERA Environmental Consultants. Calgary, AB.

Hanlan, P. Manager of Planning and Development, Parkland County. Parkland County, AB.

Hannah, L. Chief Administration Officer, Village of Wabamun. Wabamun, AB.

Harrison, B. Head Conservation Science & Planning (BC), Ducks Unlimited Canada. Kamloops, BC.

Humphreys, B. Mayor, District of Barriere. Barriere, BC.

Fraser, L. Professor and Canada Research Chair in Community and Ecosystem Ecology. Thompsoon River University. Kamloops, BC.

Kreiner, B. Town Manager, Town of Hinton. Hinton, AB.

Surgenor, J. Wildlife Biologist. British Columbia Ministry of Forests, Lands and Natural Resource Operations. Kamloops, BC.

8.2 Literature Cited

Alberta Sustainable Resource Development. 2012. Bull Trout Conservation Management Plan, 2012 2017. Alberta Sustainable Resource Development, Alberta Species at Risk Recovery Plan No. 8. Edmonton, AB. 90 pp.

Alliance Pipeline Limited Partnership. 2000a. Post Construction Environmental Report for Spread 5SA. Prepared by TERA Environmental Consultants.

Alliance Pipeline Limited Partnership. 2000b. Post Construction Monitoring Report. Prepared by TERA Environmental Consultants.

Alliance Pipeline Limited Partnership. 2000c. Post Construction Environmental Report for Spread 8SA. Prepared by TERA Environmental Consultants.

Alliance Pipeline Limited Partnership. 2002. Year 2001 Post Construction Monitoring Report for the Alliance Pipeline Project. Prepared by TERA Environmental Consultants.British Columbia Ministry of Environment. 2010. Terms and Conditions for changes in and about a stream specified by Ministry of Environment Habitat Officers, Peace Sub-Region (Version 1.2). Website: http://www.env.gov.bc.ca/wsd/regions/nor/wateract/terms_conditions_per.pdf. Access Date: April 2014.

Anderson, P.G., B.R. Taylor and G.C. Balch. 1996. Quantifying the Effects of Sediment Release on Fish and Their Habitats. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2346. Department of Fisheries and Oceans, Habitat and Enhancement Branch, Vancouver, BC and Alberta Area Habitat Management Division, Winnipeg, MB. ix + 90 pp.

Andrén, H. 1994. Effects of habitat fragmentation on birds and mammals in landscapes with different proportions of suitable habitat: a review. Oikos 71:355 366.

Apps, C.D., B.N. McLellan, T.A. Kinley, R. Serrouya, D.R. Seip and H.U. Wittmer. 2013. Spatial factors related to mortality and population decline of endangered mountain caribou. Journal of Wildlife Management 77(7):1409-1419.

Baisley, S.A. 2012. Effect of drying induced afforestation on peatland ecohydrology: implications for wildlife vulnerability. M.Sc. Thesis, McMaster University. Hamilton, ON.

Bayne, E.M., S. Boutin, B. Tracz and K. Charest. 2005. Functional and numerical responses of ovenbirds (Seiurus aurocapilla) to changing seismic exploration practices in Alberta's boreal forest. Ecoscience. 12(2):216-222.

Beanlands, G.E. and P.N. Duinker. 1983. An Ecological Framework for Environmental Impact Assessment in Canada. Institute for Resource and Environmental Studies, Dalhousie University, Halifax, Nova Scotia, and Federal Environmental Assessment Review office. Hull, QC. 132 pp.

Bednarksi, J. M. 2009. Surficial Geology Clearwater Open File 1486A. Geological Survey of Canada.

Bélisle, M. and C.C. St. Clair. 2001. Cumulative effects of barriers on the movements of forest birds. Conservation Ecology 5(2):9.

Belnap, J. 1993. Recovery Rates of Cryptobiotic Crusts: Inoculant Use and Assessment Methods. Great Basin Naturalist. 53 (1): 89-95.

BGC Engineering Inc. 2013. DRAFT Kinder Morgan Trans Mountain Expansion Project Terrain Mapping and Geohazard Inventory. Prepared for Trans Mountain Pipeline ULC. Calgary, AB.

Bird, B.L., L.C. Branch and D.L. Miller. 2004. Effects of coastal lighting on foraging behaviour of beach mice. Conservation Biology 18(5):1435-1439.

Bird Studies Canada and Nature Canada. 2012. Important Bird Areas. Website: http://www.ibacanada.com/. Accessed: June 2014.

Birtwell, I.K. 1999. Effects of sediment on fish and their habitat. Pacific Scientific Advice Review Committee Research Document HAB 99 1. Fisheries and Oceans Canada, Canadian Stock Assessment Secretariat, Ottawa. 34 pp. Website: http://www.dfo-mpo.gc.ca/csas/Csas/DocREC/1999/pdf/99_139e.pdf. Accessed: June 2014.

Brewin, M.K., A. J. Paul and M. Monita (Eds.). 2001. Ecology and Management of Northwest Salmonids, Bull Trout II Conference Proceedings c/o Trout Unlimited Canada. Calgary, AB. 276 pp.

Borden, C.E. and W. Duff. 1952. "A Uniform Site Designation Scheme for Canada" Anthropology in British Columbia 3:44-48.

British Columbia Conservation Data Centre. 2012. BC Species and Ecosystems Explorer. British Columbia Ministry of Environment. Victoria, BC. Website: http://a100.gov.bc.ca/pub/eswp/. Accessed: June 2014.

British Columbia Conservation Data Centre. 2014. BC Species and Ecosystems Explorer. Ministry of Environment. Website: http://www.env.gov.bc.ca/atrisk/toolintro.html. Accessed: June 2014.

British Columbia Ministry of Environment, Lands and Parks. 1999. Thompson River District Management Direction Statement for Finn Creek Provincial Park. BC Parks Division. Victoria, BC. 7 pp.

British Columbia Ministry of Environment. 1999. BC Parks Impact Assessment Process – Part 2 Users Guide.Website: http://www.env.gov.bc.ca/bcparks/conserve/impact/ia_proc/ia_guid.pdf Accessed January 2014.

British Columbia Ministry of Environment. 2003. North Thompson River Provincial Park Purpose Statement and Zoning Plan. Website: http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/nthomp_riv/nthomp.pdf. Accessed May 2014.

British Columbia Ministry of Environment. 2009. Recovery strategy for cliff paintbrush (Castilleja rupicola) in British Columbia. Victoria, BC. 18 pp.

British Columbia Ministry of Environment. 2010a. Caribou Distribution in British Columbia by Ecotype. Website: http://www.env.gov.bc.ca/wld/speciesconservation/caribou_by_ecotype.html. Accessed: June 2014.

British Columbia Ministry of Environment. 2010b. Provincial Park Boundary Adjustment Policy, Process and Guidelines. March 2010. Website: http://www.env.gov.bc.ca/bcparks/planning/docs/boundary_adj_guide.pdf (accessed January 2014).

British Columbia Ministry of Environment. 2010c. Terms and Conditions for changes in and about a stream specified by Ministry of Environment Habitat Officers, Peace Sub-Region (Version 1.2). Website: http://www.env.gov.bc.ca/wsd/regions/nor/wateract/terms_conditions_per.pdf. Access Date: April 2014.

British Columbia Ministry of Environment. 2012a. Develop with Care 2012: Environmental Guidelines for Urban and Rural Land Development in British Columbia. Website: http://www.env.gov.bc.ca/wld/documents/bmp/devwithcare2012/index.html. Accessed: July 2013.

British Columbia Ministry of Environment. 2013a. BC Parks – Find a Park. Website: http://www.env.gov.bc.ca/bcparks/explore/. Accessed: June 2014.

British Columbia Ministry of Environment. 2013b. British Columbia Ambient Air Quality Objectives. Updated August 12, 2013. 14 pp. Website: http://www.bcairquality.ca/reports/pdfs/aqotable.pdf. Accessed: June 2014.

British Columbia Ministry of Environment, Lands and Parks. 1999. Management Direction Statement for Finn Creek Provincial Park. Website: http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/finn/finn.pdf. Accessed: June 2014.

British Columbia Ministry of Environment, Lands and Parks. 2000. Lac Du Bois Grasslands Park Management Plan Background Document. Website: http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/lacdubois/lacdubois.pdf Accessed: June 2014.

British Columbia Ministry of Environment, Lands and Parks. 2004. Draft Lac du Bois Grasslands Provincial Park Management Plan. BC Parks. Kamloops, BC. 81 pp.

British Columbia Ministry of Forests. 1995. Riparian Management Area Guidebook. Forest Practices Branch, BC Ministry of Forests, Victoria, BC.68 pp.

British Columbia Ministry of Forests. 1996a. The Ecology of the Interior Cedar-Hemlock Zone. Victoria, BC. Website: http://www.for.gov.bc.ca/hfd/pubs/docs/Bro/bro48.pdf. Accessed: June 2014.

British Columbia Ministry of Forests. 1996b. The Ecology of the Interior Douglas-fir Zone. Victoria, BC. Website: http://www.for.gov.bc.ca/hfd/pubs/docs/Bro/bro47.pdf. Accessed: Accessed: June 2014.

British Columbia Ministry of Forests. 1998a. The Ecology of the Bunchgrass Zone. Victoria, BC. Website: http://www.for.gov.bc.ca/hfd/pubs/docs/Bro/bro54.pdf. Accessed: June 2014.

British Columbia Ministry of Forests. 1998b. The Ecology of the Ponderosa Pine Zone. Victoria, BC. Website: http://www.for.gov.bc.ca/hfd/pubs/docs/Bro/bro60.pdf. Accessed: June 2014.

British Columbia Ministry of Forests. 1999. The Ecology of the Coastal Western Hemlock Zone. Victoria, BC. Website: http://www.for.gov.bc.ca/hfd/pubs/docs/Bro/bro31.pdf. Accessed: Accessed: June 2014.

British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2010. Emergency Bark Beetle Management Area and Strategic Planning Maps. Website: http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/maps/ebbma/ Accessed: June 2014.

British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2012a. Biogeoclimatic Zones of British Columbia. Government of British Columbia. Victoria, British Columbia. Website: ftp://ftp.for.gov.bc.ca/HRE/external/!publish/becmaps/PaperMaps/BGCzones.8x11.pdf. Accessed: June 2014.

British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2012b. British Columbia Grizzly Bear Population Estimate for 2012. April 2012. Website: http://www.env.gov.bc.ca/fw/wildlife/docs/Grizzly_Bear_Pop_Est_Report_Final_2012.pdf. Accessed: June 2014.

British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2013a. 2013-2015 Freshwater Fishing Regulations Synopsis. Website: http://www.env.gov.bc.ca/fw/fish/regulations/docs/1315/fishing_synopsis_2013-15.pdf. Accessed: June 2014.

British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2013b. VRI - Forest Vegetation Composite Polygons and Rank 1 Layer (digital file). Victoria, BC. Available: https://apps.gov.bc.ca/pub/dwds/home.so. Acquired: July 2013. Last Update Check: July 4, 2013. (Note that “VRI – Forest Vegetation Composite Polygons and Rank 1 Layer” is a digital file that is not optimized for printing or saving offline.).

British Columbia Ministry of Lands, Parks and Housing. 1984. Bridal Veil Falls Provincial Park Master Plan. Parks and Outdoor Recreation Division. South Coast Region. http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/bridal_veil/bridal_veil_falls_mp.pdf. Accessed: June 2014.

British Columbia Ministry of Water, Land and Air Protection. 2004. Standards and Best Practices for Instream Works. Ecosystem Standards and Planning Biodiversity Branch. British Columbia Ministry of Water, Land and Air Protection Best Management Practices Series. March 2004. 168 pp. Website: http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf. Accessed: June 2014.

British Columbia Oil and Gas Commission. 2009. British Columbia Noise Control Best Practices Guideline, March 2009. Website: http://www.bcogc.ca/node/8152/download. Accessed: June 2014.

British Columbia Oil and Gas Commission. 2010. Environmental Protection and Management Guidebook. October 2010. Website: http://www.bcogc.ca/document.aspx?documentID=927&type=.pdf. Accessed: June 2014.

British Columbia Oil and Gas Commission. 2013. Environmental Protection and Management Guide. June 2013 (Version 1.9) 96 pp. Website: http://www.bcogc.ca/document.aspx?documentID=927&type=.pdf. Accessed: June 2014.

British Columbia Parks. n.d. McQueen Creek. ER #110. 3pp.

British Columbia Parks. 2000. Lac Du Bois Grasslands Park Management Plan Background Document. 114pp.

British Columbia Parks. 2014. BC Parks. Website: http://www.env.gov.bc.ca/bcparks/. Accessed: June 2014.

British Columbia Parks. 2013. Finn Creek Park, Management Direction Statement Amendment. Kamloops, BC. 5 pp.

Bureau of the Convention on Wetlands. 2014. The Ramsar List: The List of Wetlands of International Importance. Website: http://www.ramsar.org/pdf/sitelist.pdf. Accessed: June 2014.

Business and Biodiversity Offsets Programme. 2012a. Standard on biodiversity offsets. Available online at: http://www.forest-trends.org/documents/files/doc_3103.pdf (accessed March 2014).

Business and Biodiversity Offsets Programme. 2012a. Biodiversity offset design handbook. Available online at: http://www.forest-trends.org/documents/files/doc_3103.pdf (accessed March 2014).

Business and Biodiversity Offsets Programme. 2012b. Biodiversity offset design handbook appendices. Available online at: http://www.forest-trends.org/documents/files/doc_3103.pdf (accessed March 2014).

Business and Biodiversity Offsets Programme. 2012c. Guidance notes to the standard on biodiversity offsets. Available online at: http://www.forest-trends.org/documents/files/doc_3103.pdf (accessed March 2014).

Canadian Association of Petroleum Producers. 1996. Hydrostatic test water management guidelines. Canadian Association of Petroleum Producers Publication No. 19960014. 175 pp. Prepared by TERA Environmental Consultants and CH2M Gore and Storrie Ltd. (CH2M Hill).

Canadian Association of Petroleum Producers. 1999. Environmental operating practices of the upstream petroleum industry Alberta operations - Pipelines Volume.

Canadian Association of Petroleum Producers. 2001. Environmental operating practices of the upstream petroleum industry BC operations - Pipelines Volume.

Canadian Association of Petroleum Producers. 2004. Planning Horizontal Directional Drilling for Pipeline Construction. CAPP Pub. #2004-0022. Prepared by Entec Consulting Limited, TERA Environmental Consultants, Canadian Horizontal Drilling Ltd., Geo-Engineering (M.S.T.) Ltd. and Applied Aquatic Research Ltd. Calgary, AB. 82 pp.

Canadian Association of Petroleum Producers. 2008. Best Management Practices Clubroot Disease Management. Canadian Association of Petroleum Producers Publication 2008 1030. 7 pp. Prepared by the Canadian Association of Petroleum Producers Clubroot Management Plan Committee.

Canadian Association of Petroleum Producers, Canadian Energy Pipeline Association and Canadian Gas Association. 2012. Pipeline Associated Watercourse Crossings 4th Edition. Prepared by TERA Environmental Consultants, Salmo Consulting Inc. and Applied Aquatic Research Ltd. Calgary AB. 217 pp.

Canadian Council of Ministers of the Environment. 2002. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Total Particulate Matter. Updated 2002. In: Canadian Environmental Quality Guidelines, 1999, Canadian Council of Ministers of the Environment. Winnipeg, MB. 13 pp.

Canadian Council of Ministers of the Environment. 2007. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Summary Table. Updated December 2007. In: Canadian Environmental Quality Guidelines, 1999, Canadian Council of Ministers of the Environment. Winnipeg, MB.

City of Kamloops. 2004. KAMPLAN 2004: Official Community Plan. Adopted June 2005, last updated August 2008. Website: http://www.city.kamloops.bc.ca/kamplan/index.shtml. Accessed: June 2014.

Collister, D.M, J.L. Kansas, T. Antoniuk and B.J. Power. 2003. Review and Assessment of Environmental Effects Information for Wildlife and Fish Indicators in the Regional Sustainable Development Strategy (RSDS) Study Area within the Athabasca Oil Sands Region. Wildlife and Fish Sub Group, Cumulative Environmental Management Association. 432 pp.

Committee on the Status of Endangered Wildlife in Canada. 2002. Committee on the Status of Endangered Wildlife in Canada assessment and status report on the western toad Bufo boreas in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vi + 31pp.

Committee on the Status of Endangered Wildlife in Canada. 2006. Committee on the Status of Endangered Wildlife in Canada Assessment and Update Status Report on the Chinook salmon *Oncorhynchus tshawytscha* (Okanagan population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vii + 41 pp.

COSEWIC 2007 - Committee on the Status of Endangered Wildlife in Canada. 2007. Committee on the Status of Endangered Wildlife in Canada assessment and status report on the Great Basin spadefoot Spea intermontana in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vii + 34 pp.

Committee on the Status of Endangered Wildlife in Canada. 2008. Committee on the Status of Endangered Wildlife in Canada assessment and update status report on the Spotted Owl Strix occidentalis caurina Caurina subspecies, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. vii + 48 pp.

Committee on the Status of Endangered Wildlife in Canada. 2010. Committee on the Status of Endangered Wildlife in Canada assessment and status report on the Lewis's Woodpecker Melanerpes lewis in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. x + 23 pp.

Committee on the Status of Endangered Wildlife in Canada. 2011. Committee on the Status of Endangered Wildlife in Canada assessment and status report on the peacock vinyl lichen Leptogium polycarpum in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. xi + 24 pp. Website: http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_peacock_vinyl_lichen_0911_eng.pdf. Accessed: June 2014.

Committee on the Status of Endangered Wildlife in Canada. 2013. Canadian Species at Risk. Website: http://www.cosewic.gc.ca/eng/sct5/index_e.cfm. Accessed: June 2014.

Committee on the Status of Endangered Wildlife in Canada. 2014. Canadian Species at Risk. Website: http://www.cosewic.gc.ca/eng/sct5/index_e.cfm. Accessed: June 2014.

Critchley, D. and A.L. Foote. 2009. Wetland Follow Up Monitoring Program Second Year Activities Summary for the TMX – Anchor Loop Project. Prepared for Kinder Morgan Canada Inc.

Demarchi, D.A. 2011. The British Columbia Ecoregion Classification. Third Edition, March 2011. Ecosystem Information Section, Ministry of Environment. Victoria, BC. Website: http://www.env.gov.bc.ca/ecology/ecoregions/index.html. Accessed: June 2014.

Desrochers, A. and S. Hannon. 1997. Gap crossing decisions by forest songbirds during the post-fledging period. Conservation Biology 11(5):1204-1210.

Ducks Unlimited Canada. 2014. International Conservation Plan Canadian Conservation Priority Regions. Website: http://www.ducks.ca/what-we-do/where-work/. Accessed: June 2014.

Dunne, B.M. and M.S. Quinn. 2009. Effectiveness of above ground pipeline mitigation for moose (Alces alces) and other large mammals. Biological Conservation 142:332-343.

Dyer, S.J. 1999. Movement and Distribution of Woodland Caribou (Rangifer tarandus caribou) in Response to Industrial Development in Northeastern Alberta. M.Sc. Thesis. University of Alberta. 106 pp.

Dyer, S.J., J.P. O'Niell, S.M. Wasel and S. Boutin. 2002. Quantifying barrier effects of roads and seismic lines on movements of female woodland caribou in northeastern Alberta. Canadian Journal of Zoology 80:839-845.

Ecological Stratification Working Group. 1995. A National Ecological Framework of Canada. Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research and Environment Canada, State of the Environment Directorate, Ecozone Analysis Branch. Ottawa, Ontario/Hull, QC. Website: http://sis.agr.gc.ca/cansis/publications/ecostrat/cad_report.pdf. Accessed: June 2014.

Edworthy et al. 2012 - Edworthy, A.B., Steensma, K.M.M., Zandberg, H.M. and P.L. Lilley. 2012. Dispersal, home-range size, and habitat use of an endangered land snail, the Oregon forestsnail (Allogona townsendiana). Canadian Journal of Zoology 90:875-884.

Enbridge Pipelines Inc. 2000. As built Environmental Report for the Terrace Phase I Expansion Program. Spreads A, B and C.

Enbridge Pipelines Inc. 2002. Post Construction Environmental Report Terrace Phase II Pipeline Construction.

Environment Canada. 1991. The Federal Policy on Wetland Conservation. Available from the Canadian Wildlife Service, Environment Canada. Ottawa, ON.

Environment Canada. 2012. Recovery Strategy for the Burrowing Owl (Athene cunicularia) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada. Ottawa, ON. viii + 34 pp.

Environment Canada. 2013. Map of Environment Canada's Protected Areas in British Columbia. Website: http://www.ec.gc.ca/ap-pa/default.asp?lang=En&n=0D0A02C4-1. Accessed: June 2014.

Environment Canada. 2014a. Proposed, Candidate and Early Candidate Critical Habitat Maps for the Proposed Trans Mountain Expansion Project. Hard copy maps provided by the Canadian Wildlife Service, Pacific and Yukon Region. April 2014.

Environment Canada. 2014b. Species at Risk Public Registry. Website: http://www.sararegistry.gc.ca/default_e.cfm. Accessed: June 2014.

Environment Canada. 2014c. Recovery Strategy for the Woodland Caribou, Southern Mountain population (Rangifer tarandus caribou) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. viii + 103 pp.

Fisheries and Oceans Canada. 1995. Freshwater intake end of pipe fish screen guidelines. Prepared by Department of Fisheries and Oceans Canada. Ottawa, ON. 27 pp. Website: http://www.dfo-mpo.gc.ca/library/223669.pdf. Accessed: June 2014.

Fisheries and Oceans Canada. 1999. Fish Screening Directive. Last updated July 26, 1999.

Fisheries and Oceans Canada. 2000. Effects of sediment on fish and their habitat. Fisheries and Oceans Canada Pacific Habitat Status Report 2000/01.

Fisheries and Oceans Canada. 2013a. Projects Near Water. Measures to Avoid Causing Harm to Fish and Fish Habitat. Website: http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html. Accessed: June 2014.

Fisheries and Oceans Canada. 2013b. Fisheries Protection Policy Statement. Catalogue No. Fs23-595/2013E-PDF. Ottawa ON. 22 pp.

Fisheries and Oceans Canada. 2014. DFO Self-Assessment - Projects Near Water. Website: http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html. Accessed: June 2014.

Fleming, W. and F.K.A. Schmiegelow. 2002. Response of bird communities to pipeline rights-of-way in the boreal forest of Alberta. in: J.W. Goodrich-Mahoney, D.F. Mutrie and C.A. Guild (eds.) Environmental Concerns in Rights-of-Way Management: Seventh International Symposium. Pp. 431-437.

Fulton, R. J. 1984. Surficial geology Seymour Arm Open File 1609A.Geological Survey of Canada.

Gartman, D.K. 1991. Pipeline Construction Techniques to Minimize Wetland Impacts in Wetlands and Pipelines: Proceedings of the INGAA Foundation First Annual National Environmental Symposium. October. Chadds Ford, Pennsylvania, USA. Pp.1-24.

Green, R.N. and K. Klinka. 1994. A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region. Land Management Handbook No. 28. BC Ministry of Forests, Research Branch. Victoria, BC. 285 pp.

Government of Canada. 1986. Canada: Wetland Regions. National Atlas of Canada 5th Edition. Map. Website: http://ftp2.cits.rncan.gc.ca/pub/geott/atlas/archives/english/5thedition/environment/ecology/mcr4108.pdf. Accessed: June 2014.

Grasslands Conservation Council of British Columbia. 2009. An Ecological Area Assessment for the Lac du Bois Grasslands, Kamloops, BC. Prepared for the City of Kamloops. 58 pp. Website: http://www.webkil.com/gcc/images/stories/learnmore/Our%20Publications/lacdubois_eaa.pdf. Accessed: June 2014.

Habib, L., E.M. Bayne and S. Boutin. 2007. Chronic industrial noise affects pairing success and age structure of ovenbirds Seiurus aurcapilla. Journal of Applied Ecology 44:176-184.

Hammond, J. 2004. Bull Trout Salvelinus confluentus. pp 13-28 in Identified Wildlife Management Strategy: Accounts and Measure for Managing Identified Wildlife. Northern Interior Forest Region. Version 2004. British Columbia Ministry of Water, Land and Air Protection. Victoria, BC.

Harper, W.L., J.M. Cooper, K. Simpson, J. Hamilton, K.A. Dunham and D.S. Eastman. 2001. Guidelinesfor Evaluating, Avoiding and Mitigating Impacts of Major Development Projects on Wildlife in British Columbia. Draft dated May 2001. 204 pp.

Hebblewhite, M., M. Musiani, N. DeCesare, S. Hazenberg, W. Peters, H. Robinson and B. Weckworth. 2010. Linear Features, Forestry and Wolf Predation of Caribou and Other Prey in West Central Alberta. Final report to the Petroleum Technology Alliance of Canada. 84 pp.

Hegmann, G., C. Cocklin, R. Creasey, S. Dupuis, A. Kennedy, L. Kingsley, W. Ross, H. Spaling and D. Stalker. 1999. Cumulative Effects Assessment Practitioners Guide. Prepared by AXYS Environmental Consulting Ltd. and the CEA Working Group for the Canadian Environmental Assessment Agency. Hull, Quebec. Website: http://www.ceaa.gc.ca/013/0001/0004/index_e.htm. Accessed: November 2013.

Hein, C.D., S.B. Castleberry and K.V. Miller. 2009. Site-occupancy of bats in relation to forested corridors. Forest Ecology and Management 257:1200-1207.

Holland, S.S. 1976. Landforms of British Columbia: A Physiographic Outline. Bulletin 48. The Government of the Province of British Columbia. 138 pp.

Identified Wildlife Management Strategy. 2004. Order – Category of Species at Risk. British Columbia Ministry of Water, Land and Air Protection. Victoria, BC. 2 pp.

Insurance Corporation of British Columbia. 2012a. Abbotsford Road Safety Snapshot. North Vancouver, BC. 2 pp.

Insurance Corporation of British Columbia. 2012b. Burnaby Road Safety Snapshot. North Vancouver, BC. 2 pp.

Insurance Corporation of British Columbia. 2012c. Chilliwack Road Safety Snapshot. North Vancouver, BC. 2 pp.

Insurance Corporation of British Columbia. 2012d. Kamloops Road Safety Snapshot. North Vancouver, BC. 2pp.

Insurance Corporation of British Columbia. 2012e. Langley Road Safety Snapshot. North Vancouver, BC. 2 pp.

Insurance Corporation of British Columbia. 2012f. Maple Ridge/Pitt Meadows Road Safety Snapshot. North Vancouver, BC. 2 pp.

Insurance Corporation of British Columbia. 2012g. New Westminster Road Safety Snapshot. North Vancouver, BC. 2 pp.

Insurance Corporation of British Columbia. 2012h. Richmond Road Safety Snapshot. North Vancouver, BC. 2 pp.

Insurance Corporation of British Columbia. 2012i. Surrey Road Safety Snapshot. North Vancouver, BC. 2 pp.

Insurance Corporation of British Columbia. 2012j. Tri-cities Road Safety Snapshot. North Vancouver, BC. 2 pp.

Insurance Corporation of British Columbia. 2012k. Vancouver Road Safety Snapshot. North Vancouver, BC. 2 pp.

Interprovincial Pipe Line Inc. 1995. As Built Environmental Report Capacity Expansion Program. Prepared by TERA Environmental Consultants (Alta.) Ltd.

Jalkotzy, M.G., P.I. Ross and M.D. Nasserden. 1997. The Effects of Linear Developments on Wildlife: A Review of Selected Scientific Literature. Prepared for Canadian Association of Petroleum Producers. Arc Wildlife Services Ltd., Calgary, AB. 115 pp.

James, A.R.C. 1999. Effects of industrial development on the predator prey relationship between wolves and caribou in northeastern Alberta. Ph.D. Dissertation, University of Alberta. Edmonton, AB.

Jeffersonii Badger Recovery Team 2008 - Jeffersonii Badger Recovery Team. 2008. Recovery Strategy for the Badger (Taxidea taxus) in British Columbia. Prepared for the BC Ministry of Environment. Victoria, BC. 45 pp.

Joint Pipeline Office. 1999. Evaluation of the Aleyska Pipeline Service Company's Operation of the Trans-Alaska Pipeline System. Comprehensive Monitoring Program Report February 1999. 41 pp.

Jones, J. and C.M. Francis. 2003. The effects of light characteristics on avian mortality at lighthouses. Journal of Avian Biology (34):328-333.

Journeay, J.M., S.P. Williams and J.O. Wheeler. 2000b. Tectonic assemblage map, Kootenay Lake, British Columbia GSC Open File 2948b. Geological Survey of Canada. Kotowska, A.M. 2012. The long term effects of drainage on carbon cycling in a boreal fen. M.Sc. Thesis, University of Guelph. Guelph, ON.

Kamloops Land and Resource Management Plan Mountain Caribou Subcommittee. 2006. Kamloops LRMP appendix 10: objectives and considerations for managing mountain caribou. Draft February 15, 2006. 24 pp.

Kestrel Research Inc. and Gramineae Services Ltd. 2011. Long Term Recovery of Native Prairie from Industrial Disturbance: Express Pipeline Revegetation Monitoring Project 2010. September 2011. 349 pp. Website: http://www.foothillsrestorationforum.ca/express-pipeline-revegetation. Accessed: June 2014.

Kotowska, A.M. 2012. The long term effects of drainage on carbon cycling in a boreal fen. M.Sc. Thesis, University of Guelph. Guelph, ON.

Laiho, R., H. Vasander, T. Pentilla and J. Laine. 2003. Dynamics of plant mediated organic matter and nutrient cycling following water level drawdown in boreal peatlands. Global Biogeochemical Cycles 17(2):1053.

Lawrence, D.P. 2007. Impact significance determination – Back to basics. Environmental Impact Assessment Review 27:755-769.

Lloyd, D., K. Angrove, G. Hope and C. Thompson. 1990. A Guide to Identification and Interpretation for the Kamloops Forest Region. Land Management Handbook no. 23. BC Ministry of Forests. Victoria, BC. Website: http://www.for.gov.bc.ca/hfd/pubs/docs/lmh/lmh23.htm. Accessed: June 2014.

Lord, D. and F. Mannering. 2010. The statistical analysis of crash-frequency data: A review and assessment of methodological alternatives. Transportation Research Part A: Policy and Practice 44(5):291-305.

Lyons, L.J. and C.E. Jensen. 1980. Management implications of elk and deer use of clear cuts in Montana. Journal of Wildlife Management 44(2):352 62.

Marklevitz. M.P. 2003. Potential effects of pipeline rights of way on the densities and movements of boreal mammals. M.Sc. Thesis, University of Alberta. Edmonton, AB.

McKay, T. K. Graham and G. Stenhouse. 2013. Grizzly bears and pipelines: response to unique linear features. Year 1 (2012) Final Report. Alberta Upstream Petroleum Research Fund (#09-9203-50).

McLatchey, G.P. and K.R. Reddy. 1998. Regulation of organic matter decomposition and nutrient release in a wetland soil. Journal of Environmental Quality 27:1268-1274.

Meidinger, D. and J. Pojar. 1991. Ecosystems of British Columbia. Special Report Series No. 6. Research Branch and Forest Sciences Section of the BC Ministry of Forests. Victoria, BC.

Miller, C.A. 2011. The effect of long term drainage on plant community structure and function in boreal continental peatlands. M.Sc. Thesis, University of Guelph. Guelph, ON.

Miller, C.A., B.W. Benscoter and M.R. Turetsky. In Prep. The effect of long term drainage on plant community composition and productivity in boreal peatlands. Submitted to Canadian Journal of Forest Research.

Motor Vehicle Branch. 2007. Traffic Collision Statistics: Police-attended Injury and Fatal Collisions. Government of British Columbia. 161 pp.

National Energy Board. 2014. Filing Manual. Inclusive of Release 2014-01 (January 2014). Calgary, Alberta.

National Wetland Working Group. 1997. The Canadian Wetland Classification System. Edited by B.G. Warner and C.D.A. Rubec. Wetlands Research Centre, University of Waterloo. Waterloo, ON.

Natural Resources Canada 2003a. Map of permafrost in Canada. Website: http://atlas.nrcan.gc.ca/site/english/maps/environment/land/permafrost. Accessed: June 2014.

Natural Resources Canada. 2003b. Map of wind erosion risk and climate sensitivity in Canada. Website: http://atlas.nrcan.gc.ca/site/english/maps/climatechange/potnetial impacts/winderosionclimatesensitivity. Accessed: June 2014.

Natural Resources Canada 2007a. Map of major floods, 1905-20005. Website: http://atlas.nrcan.gc.ca/site/english/maps/environm,ent/naturalhazards/floods/majorfloods. Accessed: June 2014.

Natural Resources Canada. 2007b. Map of major landslides causing fatalities. Website: http://atlas.nrcan.gc.ca/site/english/maps/environment/naturalhazards/landslides/landslides. Accessed: June 2014.

Natural Resources Canada. 2008. Map of significant earthquakes and seismic hazard. Website: http://atlas.nrcan.gc.ca/site/engligh/maps/environment/naturalhazards/floods/majorfloods. Accessed: June 2014.

Natural Resources Canada. 2009. Map of major avalanches in Canada. Website: http://atlas.nrcan.gc.ca/site/english/maps/environment/naturalhazards/naturalhazards1999/majoravalanches. Accessed: June 2014.

Natural Resources Canada. 2010a. Map of wind erosion in Canada. Online map. The Atlas of Canada, Sixth Edition. Website: http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/df3aaf11-8893-11e0-aaa0-6cf049291510.html. Accessed: June 2014.

Natural Resources Canada. 2010b. Map of major tornadoes in Canada. Online map. The Atlas of Canada, Sixth Edition. Website: http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/dddde30-8893-11e0-8cfe-6cf049291510.html. Accessed: June 2014.

Natural Resources Canada. 2010c. Map of major hailstorms in Canada. Online map. The Atlas of Canada, Sixth Edition. Website: http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/ddbbfe4f-8893-11e0-b366-6cf049291510.html. Accessed: June 2014.

Natural Resources Canada. 2013a. Earthquakes in or near Canada, 1627-2010. Online map. Website: http://www.earthquakescanada.nrcan.gc.ca/historic-historique/caneqmap-eng.php. Accessed: June 2014.

Natural Resources Canada. 2013b. Canada Lands Administrative Boundaries Level 1 (digital file). Ottawa, ON. Website: http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/eb3757cc-d08b-5e62-9a44-3a8534ff3249.html. Acquired: June 2013. Accessed: June 2014.

Natural Resources Conservation Service. 2000. Rainbow trout (*Oncorhynchus mykiss*). United States Department of Agriculture. Wildlife Habitat Management Institute. Fish and Wildlife Habitat Management Leaflet. Number 13.

Newcombe, C.P.1994. Suspended Sediment in Aquatic Ecosystems: Ill Effects as a Function of Concentration and Duration of Exposure. Habitat Protection Branch, British Columbia Ministry of Environment, Lands and Parks. Victoria, BC. 298 pp.

Newcombe, C.P. and D.D. Macdonald. 1991. Effects of suspended sediments on aquatic ecosystems. North American Journal of Fisheries Management 11:(1)72-82

North Cascades Grizzly Bear Recovery Team. 2004. Recovery plan for grizzly bears in the North Cascades of British Columbia. 54 pp.

Oberg, P. R. 2001. Responses of Mountain Caribou to Linear Features in a West-central Alberta Landscape. M.Sc. Thesis, University of Alberta. Edmonton, AB. 126 pp.

Pacific Giant Salamander Recovery Team. 2010. Recovery strategy for the Pacific Giant Salamander(Dicamptodon tenebrosus) in British Columbia. Prepared for the BC Ministry of Environment. Victoria, BC. 42 pp.

Parisien, J. 2012. Development of safety performance functions and a GIS based spatial analysis of collision data for the City of Saskatoon. M.Sc. Thesis, University of Saskatchewan. Saskatoon, SK.

Penny, J. 2004. Tall Bugbane (Cimicifuga elata) in Accounts and Measures for Managing Identified Wildlife – Accounts V. 2004. British Columbia Ministry of Water, Land and Air Protection. Victoria, BC.

Poot, H., B.J. Ens, H. De Vries, M.A.H. Donners, M.R. Wernand and J.M. Marquenie. 2008. Green light for nocturnally migrating birds. Ecology and Society 13(2):47.

Post, J. R. and F. D. Johnston. 2002. Status of the Bull Trout (Salvelinus confluentus) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association, Wildlife Status Report No. 39. Edmonton, AB. 40 pp. Website:

http://srd.alberta.ca/FishWildlife/SpeciesAtRisk/DetailedStatus/documents/StatusOfTheBullTrout39-Jan-2002.pdf. Accessed: June 2014.

Price, W.A. and J. Errington. 1998. Guidelines for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia. British Columbia Ministry of Energy and Mines. Victoria, BC. Website: http://www.empr.gov/bc.ca/Mining/Permitting-Reclamation/ML-ARD/Pages/Guidelines.aspx. Accessed: June 2014.

Price, J.S., B.A. Branfireun, J.M. Waddington and K.J. Devito. 2005. Advances in Canadian Wetland Hydrology, 1999 2003. Website: www.interscience.wiley.com. DOI: 10.1002/hyp.5774. Accessed: June 2014.

Reid, S.M., S. Stoklosar, S. Metikosh, J. Evans and T. Huffman. 2002. Effects of natural gas pipeline water crossing replacement on the benthic invertebrates and fish communities of Big Darby Creek, OH. 7th International Symposium on Environmental Concerns in Right of Way Management. Calgary, AB.

Rempel, R.S., P.C. Elkie, A.R. Rodgers and M.J. Gluck. 1997. Timber management and natural disturbance effects on moose habitat: landscape evaluation. Journal of Wildlife Management 61:517-524.

Ryder, A., D. Taylor and F. Walters. 2005. Pipeline and Peat: A Review of Peat Formation, Pipeline Construction and Reinstatement Options. Terrain and Geohazard Challenges Facing Onshore Oil and Gas Pipelines. International Conference, Thomas Telford Ltd. London, England. Pp. 576 595.

Santillo, D.J. 1993. Observations on the effects of construction of a natural gas pipeline right of way on wetland vegetation and birds. Proceedings of the Fifth International Symposium on Environmental Concerns in Rights of Way Management. September. Montreal, QC. (eds) G.J. Doucet, C. Séguin and M. Giguère. Pp. 325-329.

Schwartz, C.C. and A.W. Franzmann. 1991. Interrelationship of black bears to moose and forest succession in the northern coniferous forest. Wildlife Monographs 113:1-58.

Shem, L.M., R.E. Zimmerman, S.D. Sellmer, G.D. Van Dyke and J.R. Rastofer. 1993. Regeneration of Vegetation on Wetland Crossings for Gas Pipeline Rights of Way One Year After Construction. Proceedings of the Fifth International Symposium on Environmental Concerns in Rights of Way Management. September. Montreal, Québec, Canada. (Eds) G.J. Doucet, C. Séguin and M. Giguère. Pp. 183-190.

Sherwood, J.H. 2012. Ecohydrological response to peatland drainage and wildlife. M.Sc. Thesis, McMaster University. Hamilton, ON.

Stuart-Smith, A.K., C. Bradshaw, S. Boutin, D. Hebert and A.B. Rippin. 1997. Woodland caribou relative to landscape patterns in Northeastern Alberta. Journal of Wildlife Management 61(3):622-633.

Steensma et al. 2009 - Steensma, K.M.M., P.L. Lilley and H.M. Zandberg. 2009. Life history and habitat requirements of the Oregon forestsnail, Allogona townsendiana (Mollusca, Gastropoda, Pulmonata, Polygyridae), in a British Columbia population. Invertebrate Biology 128(3):232-242.

TERA Environmental Consultants. 2004. Terrace Phase II Expansion Program 2004 Post-Construction Monitoring Report. Prepared for Enbridge Pipelines Inc.

TERA Environmental Consultants. 2005. 2002 Fort Nelson Mainline Looping Three Year After Post Construction Monitoring Environmental Report. Prepared for Spectra Energy Corporation.

TERA Environmental Consultants. 2009a. Post Construction Environmental As Built Report – Pipeline for Trans Mountain Pipeline L.P. TMX – Anchor Loop Project. Prepared for Kinder Morgan Canada Inc. January 2009. Calgary, AB.

TERA Environmental Consultants. 2009b. 2009 Post Construction Monitoring Report for Trans Mountain Pipeline L.P. TMX – Anchor Loop Project. Prepared for Kinder Morgan Canada Inc. December 2009. Calgary, AB.

TERA Environmental Consultants. 2011a. 2010 Post-Construction Environmental Monitoring Report for Trans Mountain Pipeline L.P. TMX-Anchor Loop Project. Prepared for Kinder Morgan Canada Inc. January 2011. Calgary AB.

TERA Environmental Consultants. 2011b. 2010 Wetland Follow-up Post-construction Monitoring Report for the Kinder Morgan Canada Inc. TMX – Anchor Loop Project. Third Year. Prepared for Kinder Morgan Canada Inc.

TERA Environmental Consultants. 2011c. 2010 Supplemental Wetland Function Study Report for the Kinder Morgan Canada Inc. TMX – Anchor Loop Project. Second Year. Prepared for Kinder Morgan Canada Inc.

TERA Environmental Consultants. 2011d. 2011 Post-Construction Monitoring Report for Trans Mountain Pipeline L.P. TMX – Anchor Loop Project. Prepared for Kinder Morgan Canada Inc. December 2011. Calgary, AB.

TERA Environmental Consultants. 2011e. 2011 Supplemental Wetland Function Study Monitoring Report for the Trans Mountain Pipeline L.P. TMX – Anchor Loop Project. Third Year. Prepared for Kinder Morgan Canada Inc.

TERA Environmental Consultants. 2011f. 2011 Wetland Follow-up Study Post-construction Monitoring Report for the Kinder Morgan Canada Inc. TMX – Anchor Loop Project. Fourth Year. Prepared for Kinder Morgan Canada Inc.

TERA Environmental Consultants. 2011g. Wetlands Post-Construction Monitoring Plan for the Proposed NOVA Gas Transmission Ltd. Groundbirch Mainline Project. Prepared for NOVA Gas Transmission Ltd.

TERA Environmental Consultants. 2011h. Wetland Function Post Construction Monitoring Report for the Enbridge Pipelines Inc. Line 4 Extension – First Year. Prepared for Enbridge Pipelines Inc.

TERA Environmental Consultants. 2011i. Wetland Function Post Construction Monitoring Report for the Enbridge Pipelines Inc. Alberta Clipper Project – First Year. Prepared for Enbridge Pipelines Inc.

TERA Environmental Consultants. 2012a. 2012 Supplemental Wetland Function Study Post-construction Monitoring Report for the Kinder Morgan Canada Inc. TMX – Anchor Loop Project. Fourth Year. Prepared for Kinder Morgan Canada Inc.

TERA Environmental Consultants. 2012b. 2012 Wetland Function Post-Construction Monitoring Report for the NOVA Gas Transmission Ltd. Tanghe Creek lateral Loop No. 2 (Sloat Creek Section). Prepared for NOVA Gas Transmission Ltd.

TERA Environmental Consultants. 2012c. First Year Post Construction Monitoring Program for the NOVA Gas Transmission Limited Groundbirch Mainline Project. Calgary, AB. Prepared for NOVA Gas Transmission Limited.

TERA Environmental Consultants. 2012d. Post Construction Environmental Monitoring Report – Year 3 for the Enbridge Pipelines Inc. Line 4 Extension Project. Prepared for Enbridge Pipelines Inc. January 2012.

TERA Environmental Consultants. 2012e. Wetland Function Post-Construction Monitoring Report for the Enbridge Pipelines Inc. Southern Lights Project – Second Year. Prepared for Enbridge Pipelines Inc.

TERA Environmental Consultants. 2013a. 2012 Post Construction Monitoring Report for Trans Mountain Pipeline L.P. TMX – Anchor Loop Project. Prepared for Kinder Morgan Canada Inc. January 2013. Calgary, AB.

TERA Environmental Consultants. 2013b. 2012 Wetland Follow-up Monitoring Program Report for the Trans Mountain Pipeline L.P. TMX – Anchor Loop Project. Prepared for Kinder Morgan Canada Inc.

TERA Environmental Consultants. 2013c. 2013 Post-Construction Monitoring Report for Trans Mountain Pipeline L.P. TMX – Anchor Loop Project. Prepared for Kinder Morgan Canada Inc. January 2013. Calgary, AB.

TERA Environmental Consultants. 2013d. 2013 Supplemental Wetland Function Study Monitoring Program Report for the Trans Mountain Pipeline L.P. TMX – Anchor Loop Project. Prepared for Kinder Morgan Canada Inc.

TERA Environmental Consultants. 2013e. 2012 Wetland Follow up Monitoring Program Report for the Trans Mountain Pipeline L.P. TMX – Anchor Loop Project. Prepared for Kinder Morgan Canada Inc.

TERA Environmental Consultants. 2013f. Environmental and Socio-Economic Assessment for the Trans Mountain Expansion Project. Prepared for Trans Mountain Pipeline ULC. Burnaby, BC.

TERA Environmental Consultants. 2013g. Post Construction Monitoring Report – Year 4 for the Enbridge Pipelines Inc. Line 4 Extension Project. Prepared for Enbridge Pipelines Inc. January 2013.

Tipper, H.W. 1971. 92P, Surficial geology, Bonaparte Lake, British Columbia, Geological Survey of Canada. "A" Series Map Issue: 1293A. Website: http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/474d8f28-e9d2-5818-98b1-70216570c580.html. Accessed: June 2014.

Thompson-Nicola Regional District. 2000. Thompson-Nicola Regional District Regional Growth Strategy. Website: https://tnrd.civicweb.net/Documents/DocumentList.aspx?ID=62718. Accessed: June 2014.

Thompson-Nicola Regional District. 2011a. Blue River Official Community Plan. Website: https://tnrd.civicweb.net/Documents/DocumentDisplay.aspx?Id=60551. Accessed: June 2014.

Thompson-Nicola Regional District. 2011b. Kamloops North Official Community Plan. Website: https://tnrd.civicweb.net/Documents/DocumentList.aspx?ID=60554. Accessed: June 2014.

Thompson-Nicola Regional District. 2011c. Kamloops South Official Community Plan. Website: https://tnrd.civicweb.net/Documents/DocumentList.aspx?ID=60555. Accessed: June 2014.

Thompson-Nicola Regional District. 2011d. Avola Official Community Plan. Website: https://tnrd.civicweb.net/Documents/DocumentDisplay.aspx?Id=60549. Accessed: June 2014.

Thompson-Nicola Regional District. 2011e. Nicola Valley Official Community Plan – Bylaw No. 1450.

Thurber, J.M., R.O. Peterson, T.D. Drummer and S.A. Thomasma. 1994. Gray wolf response to refuge boundaries and roads in Alaska. Wildlife Society Bulletin 22:61-68.

TransCanada Keystone Pipeline GP Ltd. 2012. Keystone Pipeline Project Year 2 Post-Construction Environmental Monitoring. January 31, 2012. Website: https://www.neb-one.gc.ca/lleng/Livelink.exe?func=ll&objId=786796&objAction=browse. Accessed: June 2014.

Van Dyke, G.D., L.M. Shem, P.L. Wilkey, R.E. Zimmerman and S.K. Alsum. 1994. Pipeline Corridors Through Wetlands: Summary of Seventeen Plant Community Studies at Ten Wetland Crossings. December. Gas Research Institute. GTI 1770. Chicago, IL. 96 pp.

Verboom, B. and H. Huitema. 1997. The importance of linear landscape elements for pipistrelle Pipistrellus pipistrellus and the serotine bat Eptesicus serotinus. Landscape Ecology 12(2):117-125.

Wallmo, O.C., W.L. Regelin and D.W. Reichert. 1972. Forage use by mule deer relative to logging in Colorado. Journal of Wildlife Management 36(4):1025-33.

Wasser, S.K., J.L. Keim, M.L. Taper and S.R. Lele. 2011. The influences of wolf predation, habitat loss, and human activity on caribou and moose in the Alberta oil sands. Frontiers in Ecology and the Environment 9:546-551.

Western Hemisphere Shorebird Reserve Network. 2014. Sites in the Western Hemisphere Shorebird Reserve Network. Website: http://www.whsrn.org/sites/map-sites/sites-western-hemisphere-shorebird-reserve-network. Accessed: June 2014.

Wetland Stewardship Partnership. 2009. Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia. Environmental Stewardship Branch, British Columbia Ministry of Environment. Website: http://www.env.gov.bc.ca/wld/documents/bmp/wetlandways2009/wetlandways_docintro.html. Accessed: June 2014.

Wiacek, R., M. Nietfeld and H. Lazaruk. 2002. A Review and Assessment of Existing Information for Key Wildlife and Fish Species in the Regional Sustainable Development Strategy Study Area. Volume 1: Wildlife. Prepared by Westworth Associated Environmental Ltd. for the Cumulative Environmental Management Association Wildlife and Fish Working Group.

Wright, J.D. and J. Ernst. 2004. Effects of mid-winter snow depth on stand selection by wolverines Gulo gulo luscus, in the boreal forest. Canadian Field Naturalist 118(1):56-60.

Zimmerman, R.E. and P.L. Wilkey. 1992. Pipeline Corridors through Wetlands. Proceedings of the 1992 International Gas Research Conference. November. Orlando, Florida, USA. H.A. Thompson (ed.) Pp. 478 491.

Zevit et al. 2012 - Zevit, P., Ovaska, K. and L. Sopuck. 2012. BC's coast region: Species & ecosystems of conservation concern. Oregon forestsnail (Allogona townsendiana), Pacific sideband (Monadenia fidelis). South Coast Conservation Program, Coquitlam BC.

8.3 GIS Data and Mapping References

This subsection includes references cited on the figures accompanying this report.

BC Hydro. 2011. Transmission Circuit (digital file). Previously available: http://transmission.bchydro.com/transmission_system/maps/, no longer on website. Acquired: September 2011. Last Update Check: May 23, 2013.

Black Pines and Kingsvale Transmission lines: TERA Environmental Consultants, 2013, for Kinder Morgan Canada

British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2007. Tantalis Regional Districts (digital file). Victoria, BC. Available:https://apps.gov.bc.ca/pub/dwds/home.so. Acquired: March 2011. Last Update Check: May 16, 2014.

British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2008. BC Freshwater Atlas Stream Network (digital file). Victoria, BC. Available: https://apps.gov.bc.ca/pub/dwds/home.so. Acquired: July 2011. Last Update Check: January 20, 2014.

British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2008. Freshwater Atlas Lakes (digital file). Victoria, BC. Available: https://apps.gov.bc.ca/pub/dwds/home.so. Acquired: August 2011. Last Update Check: January 20, 2014.

British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2008. Tantalis Parks, Ecological Reserves and Protected Areas (digital file). Victoria, BC. Available:https://apps.gov.bc.ca/pub/dwds/home.so. Acquired: May 2014. Last Update Check: May 16, 2014.

BC Ministry of Forests, Lands and Natural Resource Operations. 2012. Digital Road Atlas (DRA) - Master Partially Attributed Road Data (digital file). Victoria, BC. Available: https://apps.gov.bc.ca/pub/dwds/home.so. Acquired: June 2014. Last Update Check: June 9, 2014.

ESRI. 2005. Canada Major Roads (digital data). Redlands, CA. Received: via DVD with ArcGIS software, visit http://www.esri.com/data/data-maps for more info. Acquired: September 2006. Last update check: N/A.

ESRI. 2005. U.S. State Boundaries (digital data). Redlands, CA. Received: via DVD with ArcGIS software, visit http://www.esri.com/data/data-maps for more info. Acquired: September 2006. Last update check: N/A.

ESRI. Inc. 2014. World Imagery map service (digital file). Redlands, CA. Available: via ArcGIS Online, visit http://www.arcgis.com/home/item.html?id=10df2279f9684e4a9f6a7f08febac2a9. Acquired: June 2013. Last Accessed: July 3, 2014.

Government of Canada. 2014. Aboriginal Lands, Canada (digital file). Edmonton, AB. Available: http://www.geobase.ca. Acquired: June 2014. Last Update Check: June 19, 2014.

IHS Inc. 2010. IHS Provincial Boundaries (digital file). Calgary, AB. Received: via DVD, visit http://www.ihs.comfor more info. Acquired: June 2011. Last Update Check: April 21, 2014.

IHS Inc. 2013. IHS Cities and Towns (digital file). Calgary, AB. Received: via DVD, visit http://www.ihs.comfor more info.Acquired: October 2013. Last Update Check: April 21, 2014.

IHS Inc. 2013. IHS First Nations (digital file). Calgary, AB. Received: via DVD, visit http://www.ihs.comfor more info. Acquired: October 2013. Last Update Check: April 21, 2014.

IHS Inc. 2013. IHS Railways (digital file). Calgary, AB. Received: via DVD, visit http://www.ihs.comfor more info. Acquired: January 2014. Last Update Check: April 21, 2014.

IHS Inc. 2014. IHS Road Segments (digital file). Calgary, AB. Received: via DVD, visit http://www.ihs.com for more info. Acquired: June 23, 2014. Update Interval: Monthly.

Kinder Morgan Canada, 2005-2013. Black & White and Colour imagery (digital files). Calgary, AB. Used by permission. Acquired: May & October, 2012 via SWiMAP (ftp://ftp.SWiMap.com).

Kinder Morgan Canada, 2005-2013. Black & White and Colour imagery (digital files). Calgary, AB. Used by permission. Acquired: May & October, 2012 via SWiMAP (ftp://ftp.SWiMap.com).

Kinder Morgan Canada. 2012. Baseline Routing (digital file). Calgary, AB. Received via FTP. Acquired: May 9, 2012. Last Update Check: N/A.

NASA Geospatial Interoperability Program. 2005. Landsat7 Panchromatic Mosaic Imagery (digital file). Available: http://onearth.jpl.nasa.gov. Acquired: January 2007.

Natural Resources Canada. 2003. Canadian Geographical Names (digital file). Ottawa, ON. Available: http://geobase.ca/geobase/en/data/cgn/index.html. Acquired: June 2014. Last Update Check: June 5, 2014.

Natural Resources Canada. 2007-2011. National Hydro Network (digital files). Sherbrooke, QC. Available: http://www.geobase.ca/geobase/en/data/nhn/index.html. Acquired: April 2012. Last Update Check: May 2012.

Natural Resources Canada. 2012. CanVec - Relief and Landforms - 1030009 Contour (digital file). Sherbrooke, QC. Available: http://geogratis.cgdi.gc.ca/geogratis/en/download/topographic.html. Acquired: June 2012. Last Update Check: November 2012.

Natural Resources Canada. 2012. CanVec -Transportation - 1020009 Railway (digital file). Sherbrooke, QC. Available: http://geogratis.cgdi.gc.ca/geogratis/en/download/topographic.html. Acquired: June 2012. Last Update Check: November 2012.

Natural Resources Canada. 2013. National Road Network - Alberta (digital file). Sherbrooke, QC. Available: http://www.geobase.ca/geobase/en/data/nrn/index.html. Acquired: June 2013. Last Update Check: June 13, 2014.

Natural Resources Canada. 2013. National Road Network - British Columbia (digital file). Sherbrooke, QC. Available: http://www.geobase.ca/geobase/en/data/nrn/index.html. Acquired: September 2013. Last Update Check: June 13, 2014.

Natural Resources Canada. 2014. Canada Lands Administrative Boundaries Level 1 (digital file). Ottawa, ON. Available: http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/eb3757cc-d08b-5e62-9a44-3a8534ff3249.html. Acquired: June 2014. Last Update Check:June 9, 2014.

UniversalPegasus International. 2014. Rev 9 Routing (digital file). Calgary, AB. Received via FTP. Acquired: March 19. Last Update Check: N/A.

UniversalPegasus International. 2014. Rev 9.2 Routing (digital file). Calgary, AB. Received via FTP. Acquired: June 5. Last Update Check: N/A.

UniversalPegasus International. 2014. Rev F Routing - reference line RK/AK (digital file). Calgary, AB. Received via FTP. Acquired: March 28. Last Update Check: N/A.

UniversalPegasus International. 2014. Rev F Routing - reference line (digital file). Calgary, AB. Received via FTP. Acquired: March 25. Last Update Check: N/A.

USNIMA. 2000. Vector Map Level 0, Digital Chart of the World, Railroads (digital file). Bethesda, MD. Available: http://geoengine.nima.mil/ftpdir/archive/vpf_data/v0noa.tar.gz. Acquired: September 2009. Last Update Check: March 21, 2014

BC Parks - Finn Creek

TAB A – FINN CREEK PROVINCIAL PARK

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1.0 FINN CREEK PROVINCIAL PARK

Finn Creek Provincial Park, established in 1996, protects the lower Finn Creek and a portion of the North Thompson River lowlands in British Columbia (BC). The 303 ha park is situated approximately 215 km north of Kamloops on Highway 5 and encompasses the braided, lower Finn Creek, a deep meandering channel and islands in the North Thompson River.

Finn Creek Provincial Park's primary role is to protect the ecological integrity of the river riparian and associated upland environments. Spawning and rearing habitats for bull trout, coho and Chinook salmon are of particular importance. The wet bottomlands include old growth cottonwoods, western red cedar, hybrid spruce and birch, while the forested uplands provide a protective buffer to enhance the wetland and spawning values.

A secondary role of the park is to serve local recreation interests for cross country skiing, hiking, nature interpretation and access to the North Thompson River for rafting and canoeing. Along the west side of the park are remnants of the Old Highway No. 5 as well as old homesteads. Surveyors used Pinkie Park adjacent to the east park boundary as a lookout point for up and down the valley.

According to the *Finn Creek Provincial Park Management Direction Statement, 1999*, the management objectives for Finn Creek Provincial Park include: maintaining the natural qualities, conditions and aesthetic beauty of the park; fostering and maintaining relationships with First Nations; maintaining the diverse wildlife species and habitats; limiting the introduction of invasive species; and providing continued recreational opportunities for park users.

This environmental and socio-economic assessment (ESA) took into consideration the management objectives of Finn Creek Provincial Park.

2.0 CORRIDOR SELECTION AND PROJECT ACTIVITIES

Early in 2012, Trans Mountain Pipeline ULC (Trans Mountain) conducted a preliminary route assessment of the existing Trans Mountain Pipeline (TMPL) alignment to identify potential routing options for the Trans Mountain Expansion Project (TMEP or the Project) in Finn Creek Provincial Park. As one of the core routing criteria, Trans Mountain sought to follow the existing TMPL system right-of-way to the maximum extent practical, deviating from the TMPL right-of-way only where necessary to reduce environmental and socio-economic impacts or to address technical or safety issues.

2.1 Existing Trans Mountain Pipeline Route

The existing TMPL, constructed in 1952, crosses Finn Creek Provincial Park (established as a designated Park in 1996) for approximately 0.7 km. Trans Mountain holds Order in Council 2412, describing the status of the existing right-of-way through the park.

2.2 Alternatives Considered

Trans Mountain considered three alternatives in Finn Creek Provincial Park and surrounding area:

- an East Alternative that avoids Finn Creek Provincial Park;
- a TMPL Trenchless Alternative that parallels the existing TMPL right-of-way that involves trenchless pipeline construction through the Park; and
- a TMPL Conventional Alternative (*i.e.*, narrowed pipeline corridor) that parallels the existing TMPL right-of-way that involves conventional pipeline construction through the park.

Initially, the TMPL Trenchless Alternative was the preferred alternative, however, geotechnical studies conducted on this alternative corridor have indicated that this option is not technically feasible and is therefore not considered further as an alternative.

An evaluation of the proposed and alternative corridors alternatives is shown in Table A2.2-1 and on Figure A2.2.1. Figure A2.2.-1 also shows the narrowed pipeline corridor, which identifies the land that would be required for the purposes of constructing the Project within Finn Creek Provincial Park.

TABLE A2.2-1

**EVALUATION OF ALTERNATIVE CORRIDORS –
FINN CREEK PROVINCIAL PARK AND SURROUNDING AREAS
(AK 638.0 TO AK 639.5)[1]**

Factors	Narrowed Pipeline Corridor	East Alternative
LENGTHS		
Length through Finn Creek Provincial Park (km)(name)[1]	0.7 (Finn Creek Provincial Park)	0
Length of pipeline corridor (km)	1.5	2.1
Length following existing TMPL right-of-way (km)	1.4	0.1
Length following other linear features (other pipelines, power lines, highways, roads, FOTS[2], railways, etc.) (km)	0.7	1.3
Length of "new" corridor (km)	0.1	0.7
Total parallels (km)	1.4	1.4
CROSSINGS		
No. of highway crossings	0	0
No. of road (arterial, collector, local) crossings	0	0
No. of railway crossings	0	0
Crossings of named rivers (No.)	0	0
Crossings of named creeks (No.)	1 (Finn Creek)	1 (Finn Creek)
Crossings of other watercourses (No.)	1 (seasonal)	1
Total watercourses (No.)	1	2

TABLE A2.2-1 Cont'd

Factors	Narrowed pipeline corridor	East Alternative
GEOTECHNICAL		
Length crossing slopes > 50% on the fall line (km)	0	0
Length crossing slopes > 50% on sidehill (km)	0	0.1
Natural hazard potential (km)	High: 0.0 Medium: 0.0 Low: 1.5	High: 0.0 Medium: 0.0 Low: 2.1
Length of thin veneer of overburden or exposed bedrock (km)	0.0	0.0
HYDRAULIC ACCEPTABILITY	Yes	Yes
LAND		
Indian Reserve (km) (name)	0	0
Provincial Crown (km)	1.5	2.1
Private (km)	0	0
ENVIRONMENT		
Old Growth Management Area (OGMA) (legal) (km)	0	0.3
OGMA (non-legal) (km)	0.1	0
Late winter or early winter habitat for mountain caribou (km) (Wells Gray or Groundhog)	0.8	0
Length within Riparian Reserve Zone (km), wetlands crossed (km), community forests crossed (km), woodlots crossed (km), designated Ungulate Winter Range (km), and Wildlife Habitat Areas (km) (species)	0	0
SOCIO-ECONOMIC		
Agricultural Land Reserve (km)	0	0
Community watersheds (No.)	0	0
LRMP[2] area (km) (name)	1.5 (Kamloops LRMP)	2.1 (Kamloops LRMP)
LRMP Resource Management Zones crossed (km)(name)	1.5 (Visually Sensitive Areas)	2.1 (Visually Sensitive Areas)
ABORIGINAL AND STAKEHOLDER ENGAGEMENT		
Aboriginal Support	No major comments received to date. Engagement ongoing.	No major comments received to date. Engagement ongoing.
Stakeholder Support	General support for alternatives that avoid or reduce effects on provincial parks.	General support for alternatives that avoid or reduce effects on provincial parks.
CONSTRUCTABILITY AND COST		
Constructability	Flow isolation crossing of Finn Creek and conventional trench construction through the balance of Finn Creek Provincial Park. Relatively flat terrain through the park south of the creek.	Isolated crossing of Finn Creek and conventional trench construction bypassing Finn Creek Provincial Park to the east. Difficult terrain with extensive grade work on steep slopes in close proximity to BC Hydro line.
Estimated Construction Cost ($ millions)	$2.9	$4.9

Notes: 1 The total length of the pipeline corridor denotes a point along the corridor where it would be necessary to deviate to avoid Finn Creek Provincial Park and then rejoin the existing TMPL. It does not represent the total length through Finn Creek Provincial Park. This length is needed to compare the full extent of the route alternatives for comparison purposes.

2 FOTS = Fiber Optic Transmission System; LRMP = land and resource management plan.

Orthomosaic maps that identify the land that would be required in Finn Creek Provincial Park (*i.e,* narrowed pipeline corridor) for the purposes of constructing the Project are provided in Figure A2.2-2.

2.2.1 East Alternative that Avoids the Park

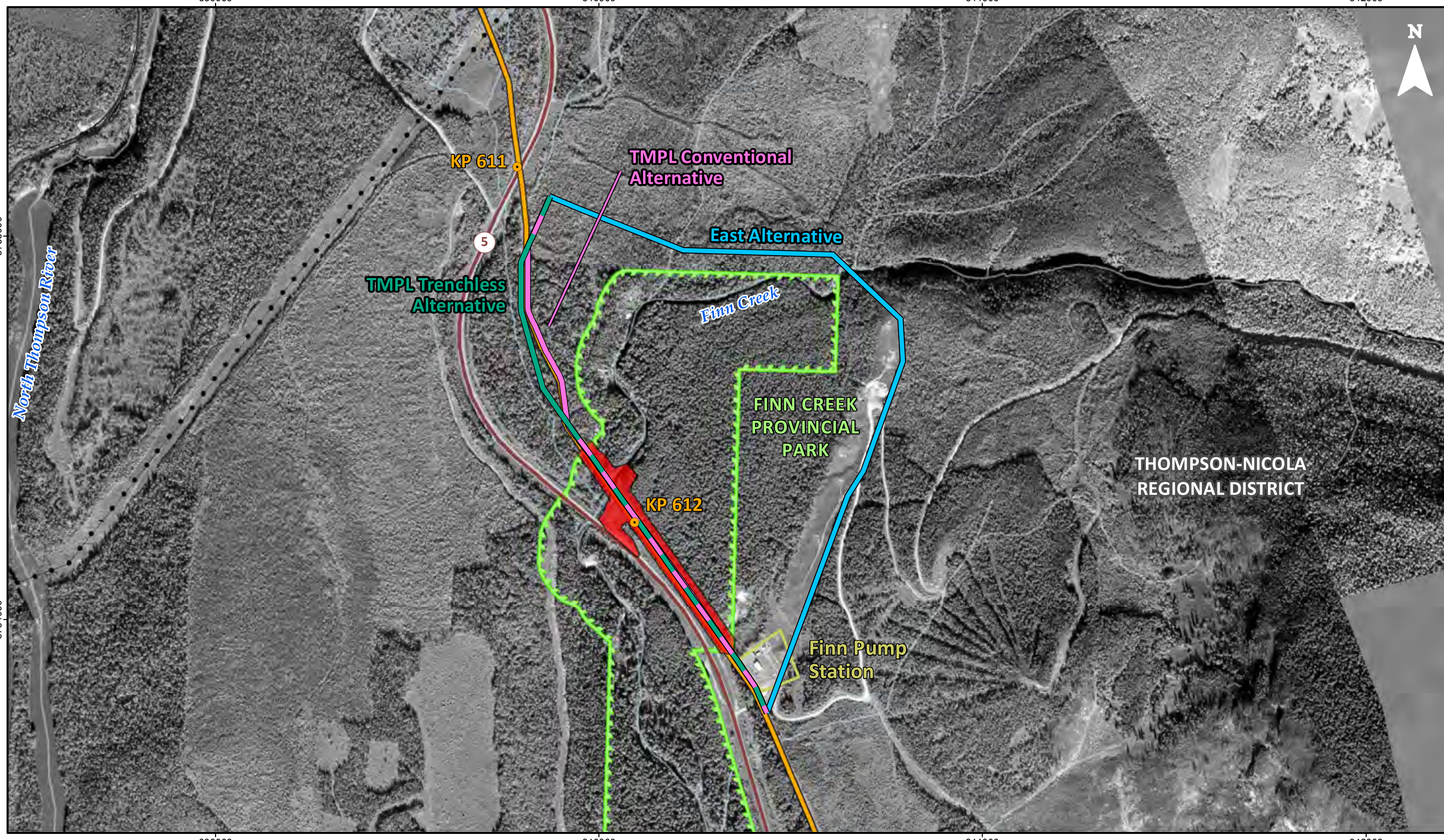
The East Alternative would involve an isolated crossing of Finn Creek and conventional trench construction bypassing Finn Creek Provincial Park to the east. This alternative increases the total pipeline length by 1.5 km when compared to the options that traverse Finn Creek Provincial Park and creates new right-of-way for approximately 1 km for a total length of 2.2 km through forested areas that surround the park. This alternative also follows difficult terrain such as a deep incised valley within which extensive grade work would be required and would create visual impacts not already present. The East Alternative would be located in close proximity to a BC Hydro transmission line and would traverse through an OGMA.

2.2.2 Narrowed Pipeline Corridor (TMPL Conventional Alternative)

The narrowed pipeline corridor parallels the existing TMPL right-of-way and would involve the conventional installation of the pipeline through the park including an isolation pipeline installation technique for the crossing of Finn Creek. This narrowed pipeline corridor crosses less Crown land than the East Alternative and would result in less disturbance to the OGMA. Fewer watercourses would be crossed and by way of following the existing TMPL right-of-way, the visual impacts will be reduced.

2.3 Preferred Alternative

A TMPL Trenchless Alternative was assessed, however, geotechnical investigations have concluded that this trenchless option is not feasible. The narrowed pipeline corridor (TMPL Conventional Alternative) is the preferred alternative which parallels the existing TMPL right-of-way and would entail an isolated watercourse crossing of Finn Creek within Finn Creek Provincial Park. It is the shortest route, parallels an existing right-of-way, avoids an unnamed creek and does not involve a new corridor to the east. Trans Mountain made efforts to further minimize the preferred corridor in Finn Creek Provincial Park (*i.e.,* the narrowed pipeline corridor) in order to reduce the impacts to the park. Trans Mountain will be able to make use of their existing right-of-way through the park for temporary workspace (TWS) during construction, which will further reduce the amount of new disturbance associated with the Project. The terrain encountered within the park is less undulating than would be encountered by the East Alternative, which will result in less grading and overall disturbance during construction of the pipeline.



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Alternative Routing

- TMPL Conventional Alternative
- TMPL Trenchless Alternative
- East Alternative
- Narrowed Pipeline Corridor within Finn Creek Provincial Park
- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Transmission Line
- Watercourse
- Highway
- Railway
- Finn Creek Provincial Park

Projection: NAD 1983 UTM Zone 11N. Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Route Alternates provided by UPI, 2013-2014; Transportation: IHS Inc., 2007, BC FLNRO, 2012; Geopolitical Boundaries: Natural Resources Canada, 2003, IHS Inc., 2011, BC FLNRO; Hydrology: BC FLNRO, 2008; Imagery: Provided by KMC, 2013, NASA Geospatial Interoperability Program 2005.

TRANS MOUNTAIN

FIGURE A2.2.1

FINN CREEK PROVINCIAL PARK ALTERNATIVE CORRIDORS

TRANS MOUNTAIN EXPANSION PROJECT

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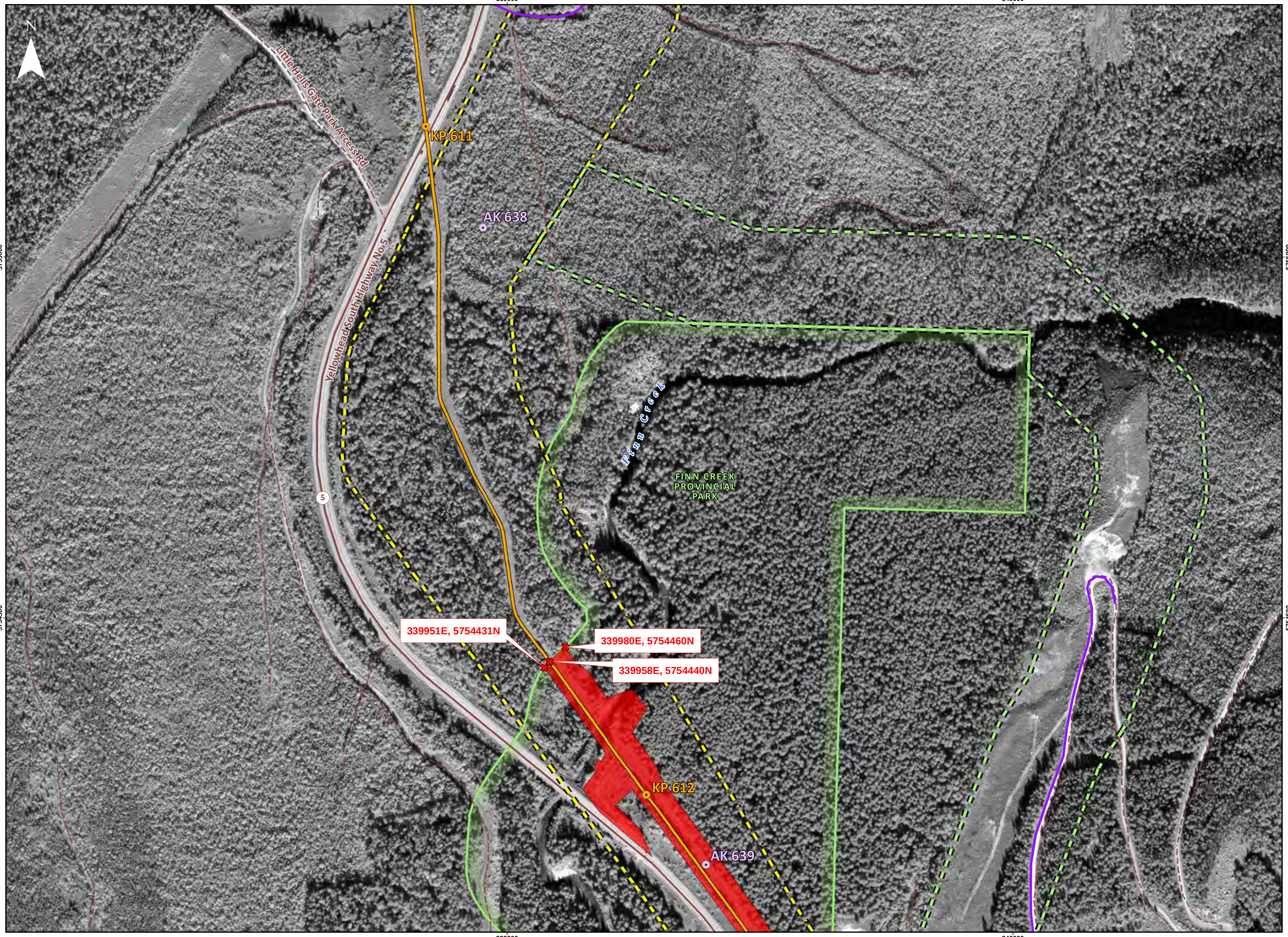

TRANS MOUNTAIN

FIGURE A.2.2-2
ORTHOMOSAIC MAPPING OF FINN CREEK PROVINCIAL PARK
SHEET 1 OF 5
TRANS MOUNTAIN EXPANSION PROJECT

- Start/End UTM Coordinate
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- TMPL Kilometre Post (KP)
- Existing Major Access
- Existing Secondary Access
- New Permanent Access
- New Temporary Access
- Deactivated Overgrown Access
- Narrowed Pipeline Corridor within Finn Creek Provincial Park
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Revised Pipeline Corridor
- Trans Mountain Expansion Project Proposed Alternative Pipeline Corridor
- Facility Property Boundary
- Highway
- Paved Road
- Resource Road
- Railway
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- Park / Protected Area

Projection: NAD 1983 UTM Zone 11N. Routing: Baseline TMPL & Facilities provided by KMC, 2012; Proposed Corridor V9.2 provided by UPI, June 5, 2014; RK/AK VF provided by UPI, March 28, 2014; Narrowed Pipeline Corridor provided by UPI, July 24, 2014; Access Roads: UPI, Jan. 24, 2014; Transportation: IHS Inc., 2013, Natural Resources Canada, 2012; Geopolitical Boundaries: IHS Inc., 2013; First Nation Lands: Government of Canada, 2014; Hydrology: Natural Resources Canada, 2007-2011 & BC FLNRO, 2008; Parks and Protected Areas: Natural Resources Canada, 2014, FLNRO, 2008; B/W & Colour Imagery: 2008-2011: Provided by KMC, 2012; NASA Geospatial Interoperability Program, 2005.

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ALL LOCATIONS APPROXIMATE

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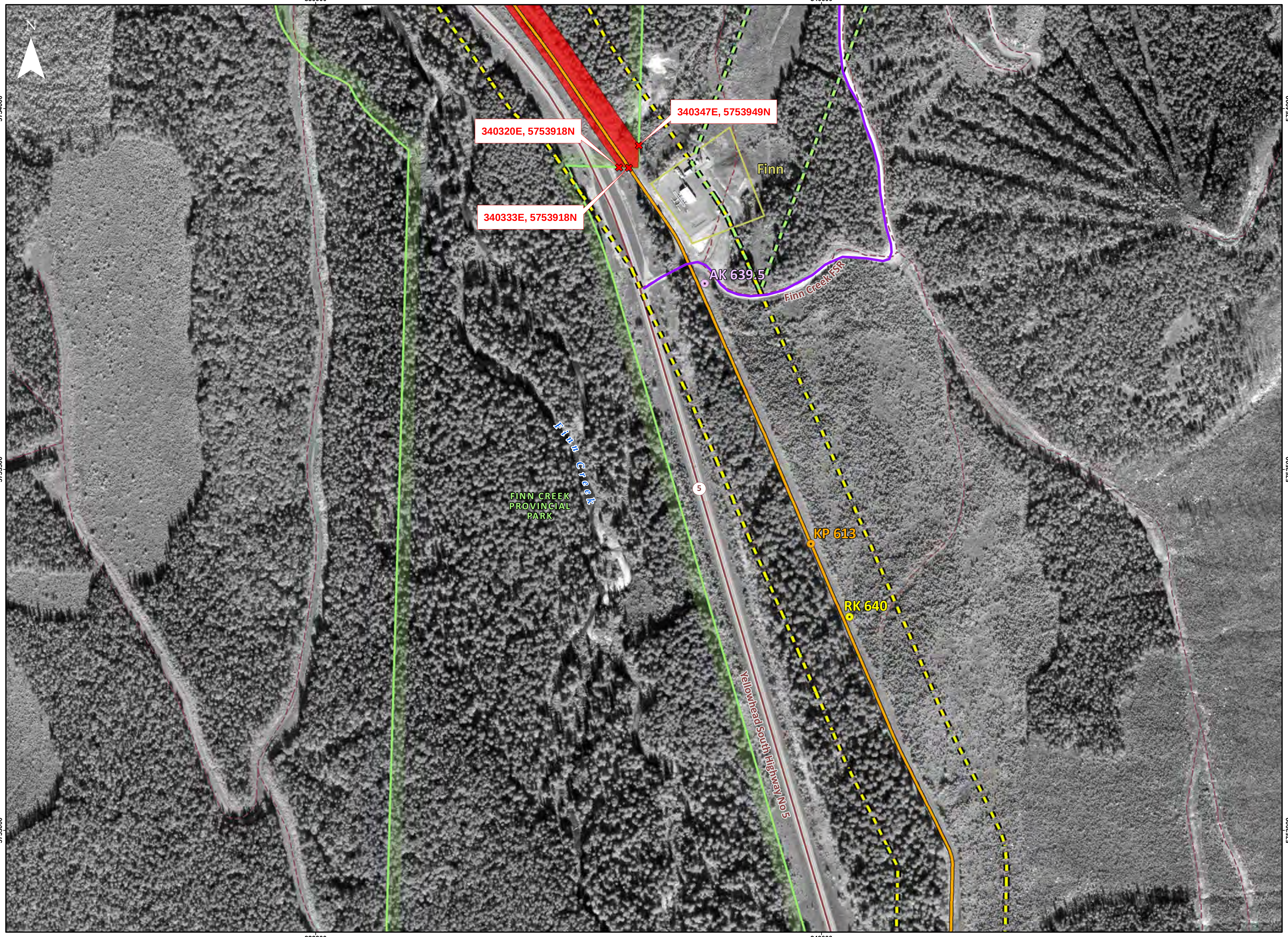
TRANS MOUNTAIN

FIGURE A.2.2-2
ORTHOMOSAIC MAPPING OF FINN CREEK PROVINCIAL PARK
SHEET 2 OF 5
TRANS MOUNTAIN EXPANSION PROJECT



Start/End UTM Coordinate
Reference Kilometre Post (RK)
Alternate Kilometre Post (AK)
TMPL Kilometre Post (KP)
Existing Major Access
Existing Secondary Access
New Permanent Access
New Temporary Access
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Trans Mountain Pipeline (TMPL)
Trans Mountain Expansion Project Proposed Revised Pipeline Corridor
Trans Mountain Expansion Project Proposed Alternative Pipeline Corridor
Facility Property Boundary
Highway
Paved Road
Resource Road
Railway
City / Town / District Municipality
Indian Reserve / Métis Settlement
Park / Protected Area

Projection: NAD 1983 UTM Zone 11N. Routing: Baseline TMPL & Facilities provided by KMC, 2012; Proposed Corridor V9.2 provided by UPI, June 5, 2014; RK/AK VF provided by UPI, March 28, 2014; Narrowed Pipeline Corridor provided by UPI, July 24, 2014; Access Roads: UPI, Jan. 24, 2014; Transportation: IHS Inc., 2013, Natural Resources Canada, 2012; Geopolitical Boundaries: IHS Inc., 2013; First Nation Lands: Government of Canada, 2014; Hydrology: Natural Resources Canada, 2007-2011 & BC FLNRO, 2008; Parks and Protected Areas: Natural Resources Canada, 2014, FLNRO, 2008; B/W & Colour Imagery: 2008-2011: Provided by KMC, 2012; NASA Geospatial Interoperability Program, 2005.

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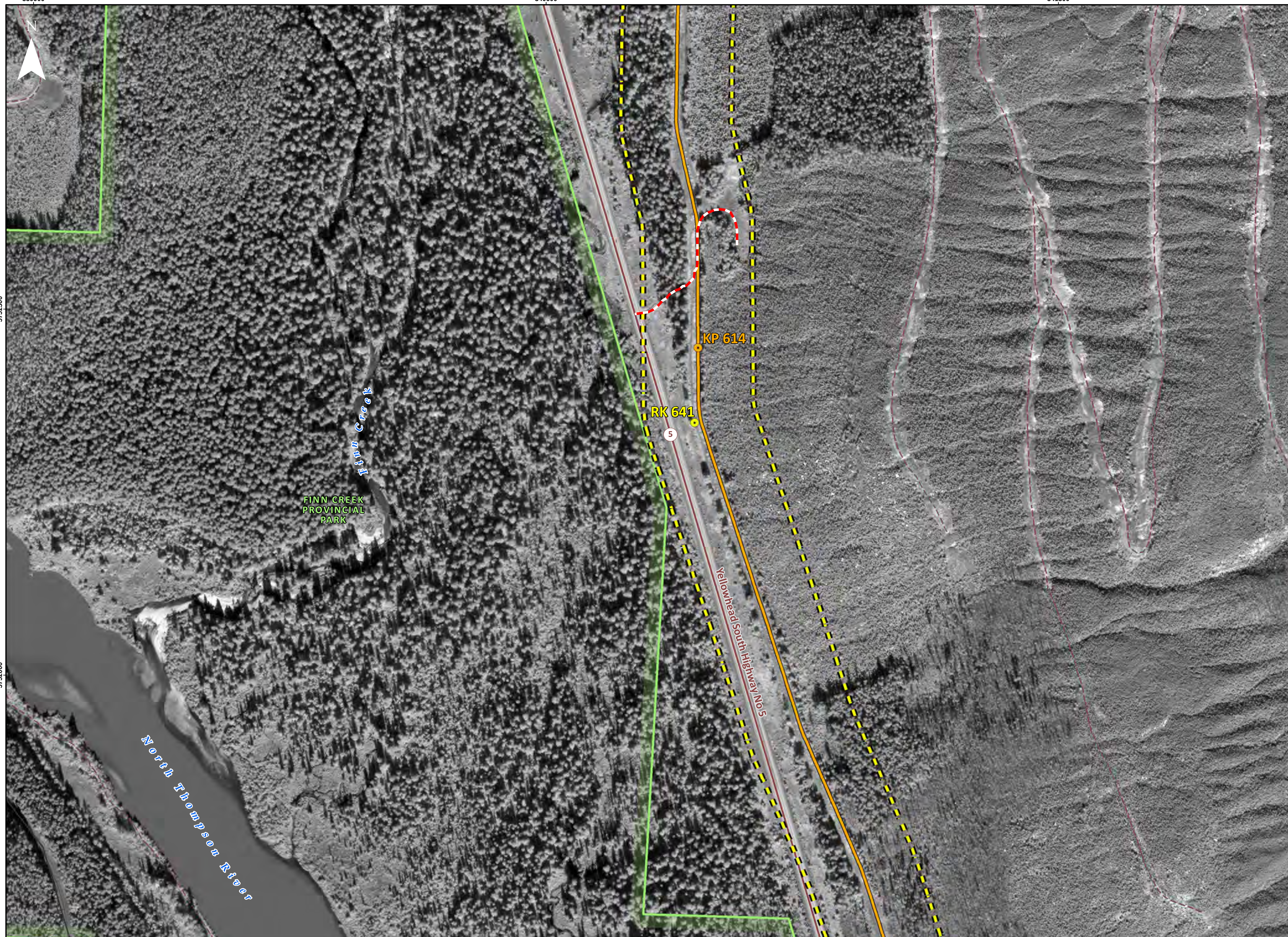

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339900 340600 341300

TRANS MOUNTAIN

FIGURE A.2.2-2
ORTHOMOSAIC MAPPING OF
FINN CREEK PROVINCIAL PARK
SHEET 3 OF 5
TRANS MOUNTAIN EXPANSION PROJECT

- Start/End UTM Coordinate
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- TMPL Kilometre Post (KP)
- Existing Major Access
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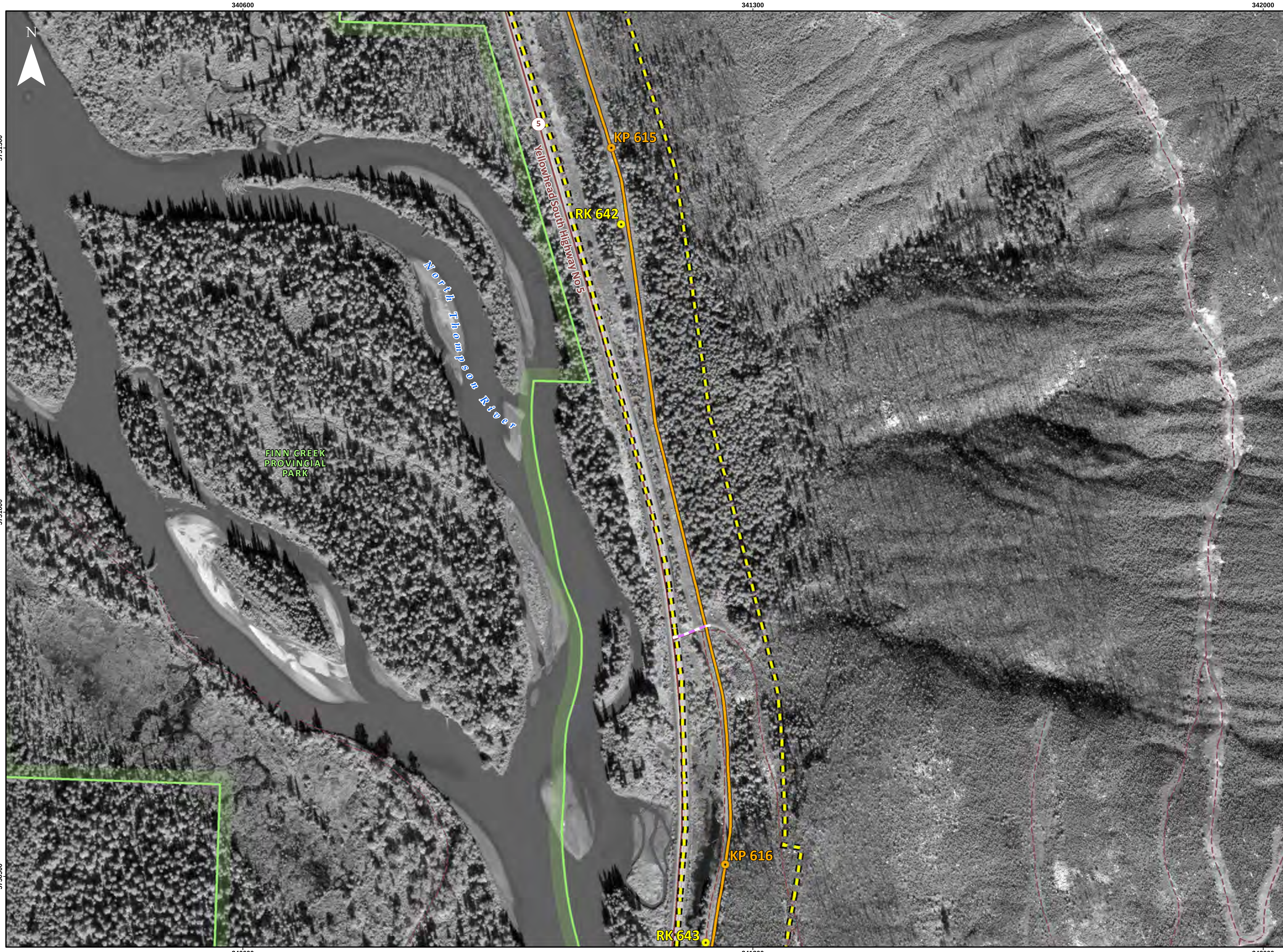

TRANS MOUNTAIN

FIGURE A.2.2-2
ORTHOMOSAIC MAPPING OF FINN CREEK PROVINCIAL PARK
SHEET 4 OF 5
TRANS MOUNTAIN EXPANSION PROJECT

- Start/End UTM Coordinate
- Reference Kilometre Post (RK)
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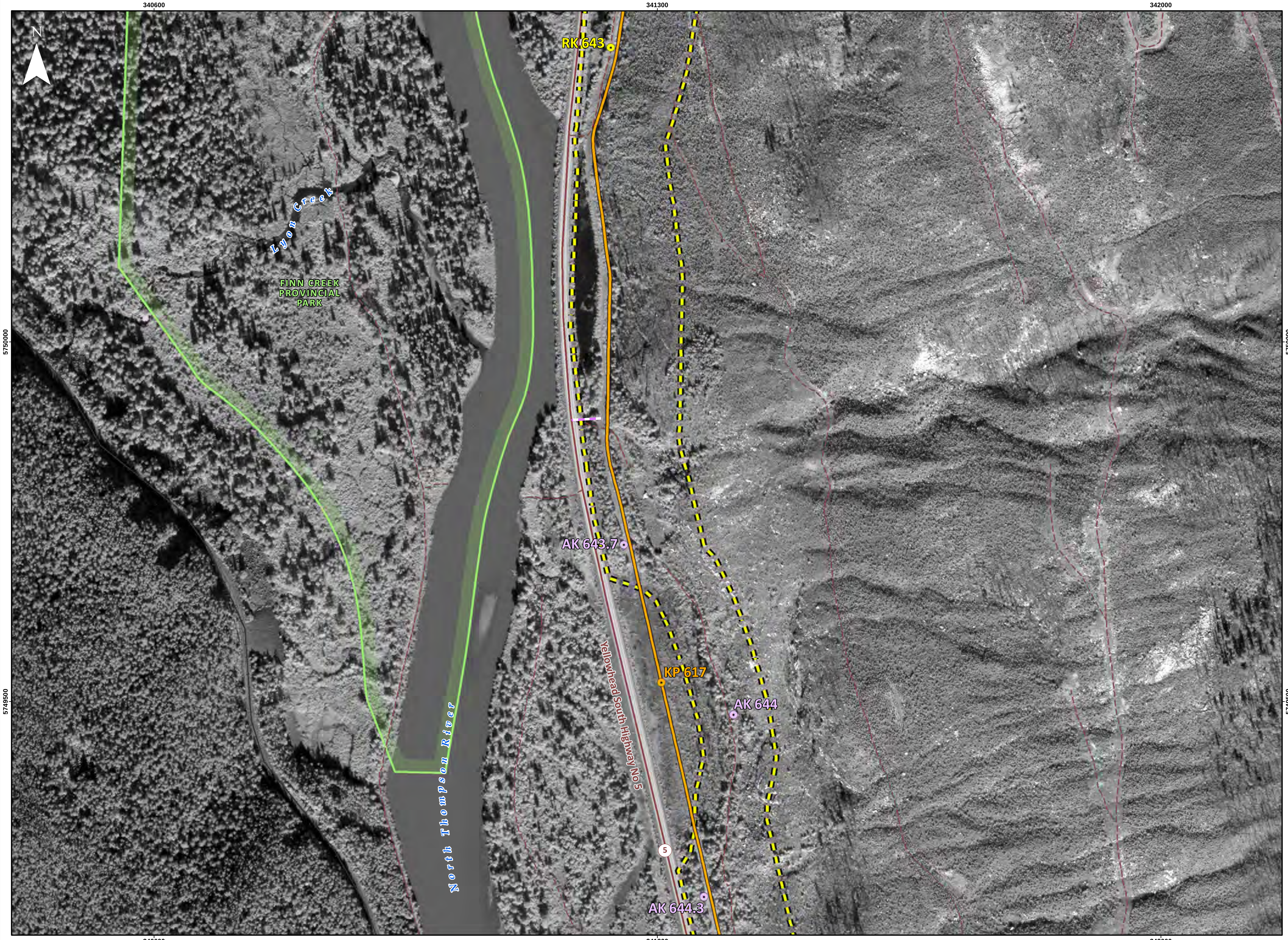

TRANS MOUNTAIN

FIGURE A.2.2-2
ORTHOMOSAIC MAPPING OF FINN CREEK PROVINCIAL PARK
SHEET 5 OF 5
TRANS MOUNTAIN EXPANSION PROJECT

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- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- TMPL Kilometre Post (KP)
- Existing Major Access
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ALL LOCATIONS APPROXIMATE

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2.4 Project Components

The technical details of the components of the Project are summarized in Section 2.2.1 of the Introduction to the Stage 2 Detailed Proposal.

The total land required to construct the proposed Project within Finn Creek Provincial Park is approximately 3.27 ha, of which 0.72 ha is disturbance on the existing TMPL right-of-way. Pipeline construction in this area will generally occur on a reduced width right-of-way (*e.g.,* reduced from typical 40 m to 30 m, incorporating an 18 m permanent right-of-way and 12 m temporary workspace) to minimize disturbance. However, approximately 100 m of land would be required in order to support the isolated Finn Creek crossing (see Figure A2.2-1).

Construction equipment will access the proposed construction right-of-way via existing access roads and will travel along the construction right-of-way to the site. No new access will be needed. Design, construction and operation of the pipeline will be in compliance with all applicable codes, standards and regulations.

2.5 Construction Schedule in Finn Creek Provincial Park

Pending regulatory approval of the Project and approval of the Stage 2 Detailed Proposal, mainline construction in Finn Creek Provincial Park is tentatively scheduled to commence in Q2 2017 and extend through Q4 2017, with clearing activities scheduled to commence prior to the start of construction in Q2 2017, but outside of the migratory birds breeding and nesting period. Construction will be conducted as expeditiously as practical in order to avoid the caribou range from November 1 to January 15. Intensive construction activities including trenching, lowering-in and backfilling, will be conducted as quickly as possible in order to reduce the amount of time the trench is open. Proposed construction activities in Finn Creek Provincial Park are expected to take place over a 14 day period including clearing (see Table A2.5-1). However, within that period, the various phases of construction will occur consecutively. A description of the construction activities is provided in Section 2.2.1 of the Introduction of the Stage 2 Detailed Proposal.

TABLE A2.5-1

ESTIMATED PROJECT CONSTRUCTION AND OPERATIONS SCHEDULE

Major Activity	Anticipated Commencement of Major Activity	Estimated Duration of Major Activity
Pipeline Construction	Pending regulatory approval	14 days
Construction Survey	Q2 2017 / Q4 2017 prior to clearing	1 day
Clearing	Q2 2017 to Q4 2017	1 day
Topsoil or Root Zone Material Salvage	Q2 2017 to Q4 2017	1 day
Grading (if required)	Q2 2017 to Q4 2017	1 day
Stringing, Bending and Welding	Q2 2017 to Q4 2017	2 days
Trenching	Q2 2017 to Q4 2017	1 day
Lowering-in	Q2 2017 to Q4 2017	1 day
Backfilling	Q2 2017 to Q4 2017	1 day
Testing	Q4 2017	2 days
Clean-up and Reclamation	Q4 2017	2 days
Operations	In-Service: Q4 2018	Over the first and second complete growing seasons following construction
Post-Construction Monitoring	--	5 years (growing seasons)
Line Patrols	--	Regular intervals
In-Line Inspections	--	As required
Vegetation/Weed Management	--	As required during lifespan
Maintenance Digs	Pending regulatory approval	As required during lifespan

3.0 ABORIGINAL ENGAGEMENT IN FINN CREEK PROVINCIAL PARK

As described in Section 3.0 of the Introduction of the Stage 2 Detailed Proposal, the Aboriginal Engagement Program in Finn Creek Provincial Park included three First Nations groups that are potentially affected by Project activities in the park. Section 3.3 of the Introduction to the Stage 2 Detailed Proposal documents Trans Mountain's engagement efforts with the following Aboriginal communities who have Aboriginal interests potentially affected by the proposed pipeline corridor in Finn Creek Provincial Park:

- Simpcw First Nation;
- Adams Lake Indian Band; and
- Neskonlith Indian Band.

4.0 PUBLIC CONSULTATION IN FINN CREEK PROVINCIAL PARK

As described in Section 4.2.3 of the Introduction of the Stage 2 Detailed Proposal, the public consultation program in Finn Creek Provincial Park consisted of a Community Workshop and a Parks Workshop. The following subsections provide a summary of the attendees invited and interests and concerns raised at the workshops relating to Finn Creek Provincial Park.

4.1 Community Workshop

On May 29, 2013, Trans Mountain held a Community Workshop in Blue River, BC for identified stakeholders to provide an opportunity for local stakeholders to receive updated information and provide feedback on issues and concerns relative to their community especially as it related to routing and environmental studies. Some concerns raised were specific to provincial parks which provided a reference point for those attending Parks Workshops in 2014.

Interested stakeholders were contacted by phone and email and invited to participate. A number of follow-up phone calls were made to encourage invitees to participate. Of the 22 community representatives that were invited, 11 attended. In some cases, organizations were represented by more than one attendee.

Table A4.1-1 provides information on the attendees at the Blue River Community Workshop.

TABLE A4.1-1

PARTICIPANTS IN THE COMMUNITY WORKSHOP – FINN CREEK PROVINCIAL PARK

Group Type	Group
Business	Blue River Powder Packers
	Mike Wiegele Heli-Skiing
	River Safar (Wild Westjets)
Community	Blue River Community Association
Local Government	Thompson Headwaters Services Committee
	Thompson-Nicola Regional District - Director
	Thompson-Nicola Regional District – Services Coordinator

Interested stakeholders that were invited but did not attend the event include:

- Central North Thompson Rod & Gun Club;
- Clearwater Yellowhead Ecological Society;
- Concerned Citizen;
- Cubs and Scouts;
- District of Clearwater;
- Elks;
- Evergreen Anglers (Seniors);
- Grizzly Anglers Society;
- Royal Canadian Legion;
- Thompson Nicola Regional District;
- Vavenby Trail Rides; and
- Wells Gray Outdoor Club.

4.1.1 Summary of Consultation Outcomes at Community Workshop

Table A4.1-2 provides information on key topics, interests and concerns raised relating to Finn Creek Provincial Park at the Blue River Community Workshop.

TABLE A4.1-2

COMMUNITY WORKSHOP – FINN CREEK PROVINCIAL PARK

Topic	Summary of Concern	Finn Creek Provincial Park Detailed Proposal Section
Air	None	N/A
Land	None	N/A
Human Activity and Land Use	Some traplines may be active in Finn Creek near Avola.	Section 7.1.12 of this tab
	There is a large parking lot at Finn Creek Provincial Park that could be used for summer construction.	N/A
Water	Salmon spawning as early as July/August and Chinook in September. There is salmon habitat in Finn Creek Provincial Park.	Section 7.1.6 of this tab

4.2 Parks Workshops

On April 1, 2014, Trans Mountain held a Parks Workshop for selected participants in Clearwater, BC to discuss the proposed routing through both Finn Creek Provincial Park and North Thompson River Provincial Park. Stakeholders were contacted by phone and email and invited to participate. An introductory email was sent to all selected participants on March 17, 2014, and a reminder to RSVP email was sent on March 24, 2014. Interested stakeholders who were unable to attend the event were invited to provide feedback through the online posting of workshop information. An agenda was distributed to all attendees on March 31, 2014.

Attendees consisted of representatives from regional and municipal regulatory agencies, key community and local recreation groups and park users. Of the 20 stakeholder groups that were invited, 10 attended, with some groups having more than one attendee. A total of 26 attendees were present for the event. Local First Nations (Simpcw First Nation, Adams Lake First Nation and Neskonlith First Nation) were provided an opportunity to review and comment on the proposed Parks routing, impacts and benefits through a parallel process, described in Section 3.2.3 of the Stage 2 Introduction. The list of attendees is provided in Table A4.2-1.

TABLE A4.2-1

PARTICIPANTS IN THE PARKS WORKSHOP – FINN CREEK PROVINCIAL PARK

Group Type	Group
Business	Blue River Powder Packers
	Naklin Ltd.
Community	Blue River Community Association
	Little Fort Recreation
	Wells Grey Outdoor Club
Local Government	District of Clearwater
	Thompson Headwaters Services Committee
	Thompson Nicola Regional District
Provincial Government	Ministry of Environment, BC Parks, Thompson Region
	Ministry of Transportation and Infrastructure

Interested stakeholders and Aboriginal communities who were invited but did not attend the event include:

- Adams Lake First Nation;
- Avola Recreation Society;

- Central North Thompson Rod & Gun Club;
- Clearwater ATV Club;
- Clearwater Yellowhead Ecological Society;
- Fisheries and Oceans Canada (DFO);
- Neskonlith Indian Band;
- Simpcw First Nation;
- Tourism Wells Grey; and
- Vavenby Trails Rides.

4.2.1 Summary of Outcomes of Consultation at Parks Workshop

4.2.1.1 Concerns Raised

Table A4.2-2 provides information on the key topics, interests and concerns relating to Finn Creek Provincial Park at the Parks Workshop.

TABLE A4.2-2

PARKS WORKSHOP – FINN CREEK PROVINCIAL PARK

Topic	Summary of Concern	Finn Creek Provincial Park Detailed Proposal Section
Air	None	N/A
Land	Old Growth forests on the east side of the right-of-way in Finn Creek Provincial Park.	Section 7.1.8 of this tab
	Weed introduction in Finn Creek Provincial Park.	Section 7.1.8 of this tab
	Sedimentation and erosion in the valley where the alternate route being proposed through Finn Creek Provincial Park. Soil erosion impacts can already be seen where the power line was placed.	N/A for the purposes of the Stage 2 Detailed Proposal as East Alternate is not being considered in this Proposal.
	Caribou movement extending into Finn Creek Provincial Park from caribou habitat north of the Park.	Section 7.1.9 of this tab
Water	Do not increase drainage into Ministry of Transportation and Infrastructure (MOTI) right-of-way during construction.	N/A for the purposes of the Stage 2 Detailed Proposal as East Alternate is not being considered in this proposal.
	Bull trout are common to Finn Creek in the Park area. Finn Creek Fish study was complete in 1990 by Weyerhaeuser.	Section 7.1.6 of this tab
	The restoration completed in 2012 where a bypass was created and First Nations participated in the mitigation planning should be standard for any mitigation of Finn Creek.	Section 7.1.3 of this tab
Human Activity and Land Use	Need to make clear contractor roles and what materials they can and cannot use around the site. In the past, a contractor had used gravel from Lucerne gravel pit which was not authorized.	Pipeline EPP (Appendix A of this Proposal)
	Alternate route corridor through Finn Creek Provincial Park goes over top of an access corridor to the mountain and groomed trail. They have access agreements between November 15 and April 15.	N/A for the purposes of the Stage 2 Detailed Proposal as East Alternate is not being considered in this proposal.

Trans Mountain will consider all feedback raised to date and will work under the guidance of BC Parks to address concerns through construction, mitigation and reclamation techniques.

4.2.1.2 Park Benefits

Table A4.2-3 provides information on key ideas raised by stakeholders for identifying benefits to Finn Creek Provincial Park. Trans Mountain has submitted this list of possible benefits to BC Parks for consideration against Park management and benefit priorities. Participants were asked to prioritize the benefits that they believed were the most important to the park using a series of criteria which included:

- groups which would benefit (Community, Parks and Trans Mountain);

- impact to ecological value;
- ease of implementation;
- cost effectiveness; and
- ability to partner with existing initiatives.

Based on the number of criteria items the idea applied to, ideas that benefited the greatest number of groups and were easy to implement were determined and are outlined in Table A4.2-3.

TABLE A4.2-3

POTENTIAL PARK BENEFITS – FINN CREEK PROVINCIAL PARK

Summary of Potential Park Benefits	Priority
Restore the old rest area that is unused at the edge of Finn Creek back to a natural area (includes asphalt pad).	High
Signage of right-of-way to notify off highway vehicles of its use.	High
Expansion of snowmobile parking lot by Kinder Morgan Canada Inc. (KMC) Pump Station (KP 612) to get parked vehicles off the highway.	High
Development of walking and biking trails at Little Hell's Gate (outside of Park).	Low

4.3 Other Consultation Activities

4.3.1 Local Government

Trans Mountain shared proposed routing with the Directors for Thompson Nicola Regional District Area B who is responsible for Finn Creek Provincial Park during project and routing briefings. The Area B Director attended, and provided input to, Parks Workshop. Project briefing and proposed routing was provided to Thompson Nicola Regional District staff including the Chief Administrative Officer (CAO) and representatives from Regional Planning, Finance and Emergency Response departments. Through these consultation activities the Thompson Nicola Regional District provided feedback about preferred construction schedules and recreational activity within the park.

While Thompson Nicola Regional District representatives did not take a position in relation to the proposed pipeline route through Finn Creek Provincial Park, no concerns were raised.

Table A4.3.1-1 outlines the Trans Mountain's public consultation activities with the Thompson Nicola Regional District.

TABLE A4.3.1-1

KEY CONSULTATION ACTIVITES WITH LOCAL GOVERNMENT STAKEHOLDERS FROM THOMPSON NICOLA REGIONAL DISTRICT

Stakeholder Group / Agency Name	Title of Contact	Method of Engagement Activity	Date of Consultation Activity	Reason for Engagement
Thompson Nicola Regional District	Chief Administrative Officer	Letter	June 14, 2012	Provide information about the Project
Thompson Nicola Regional District	Chief Administrative Officer	Email	October 22, 2012	Invitation to upcoming public information session in Valemount.
Thompson Nicola Regional District	Chief Administrative Officer	In-person	April 29, 2013	Discuss routing within the Thompson Nicola Regional District
Thompson Nicola Regional District	Chief Administrative Officer	In-person	May 29, 2013	Community Workshop (Refer to Table A4.1-2 for comments provided from stakeholders during this event).
Thompson Nicola Regional District	Chief Administrative Officer	In-person	April 1, 2014	Parks Workshop (Refer to Table A4.2-2 for comments provided from stakeholders during this event).

5.0 ECONOMIC BENEFIT TO FINN CREEK PROVINCIAL PARK

A high level description of economic benefits to the province of BC resulting from the Project is provided in Section 5.0 of the Introduction of the Stage 2 Detailed Proposal.

5.1 Estimated Workforce Requirements

The construction of the Project will involve a workforce of approximately 200 workers onsite at any given time for the duration of construction from Albreda River #2 crossing to the North side of the Thompson River, which includes Finn Creek Provincial Park. The skills of the anticipated workforce will include heavy equipment operators, welders, labourers, mechanics, foremen, surveyors, inspectors and field office support personnel. Generally, during pipeline construction, pipeline crews and workers will use a combination of accommodation resources including: local commercial motels and hotels; private boarding arrangements; temporary work camps; and temporary or permanent RV sites. While a worker accommodation strategy will be developed closer to construction, for workers involved in pipeline construction in Finn Creek Provincial Park, it is anticipated they may stay in a work camp established in the Valemount/Blue River area.

6.0 SETTING OF FINN CREEK PROVINCIAL PARK

The environmental and socio-economic setting along the proposed and narrowed pipeline corridor within Finn Creek Provincial Park is described in Table A6.0-1. Information collected for the setting was obtained both from desktop overviews and field assessments.

TABLE A6.0-1

SUMMARY OF BIOPHYSICAL AND SOCIO-ECONOMIC ELEMENTS AND CONSIDERATIONS IN FINN CREEK PROVINCIAL PARK

Biophysical and Socio-Economic Element	Summary of Considerations
Physical and Meteorological Environment	• Finn Creek Provincial Park lies within the Shuswap Highland subregion of the Interior Plateau Physiographic Region (Holland 1976). • Finn Creek Provincial Park lies in the North Thompson River Valley that separates the Cariboo Mountains Physiographic subdivision to west from the Monashee Mountains Physiographic Subdivision to the east (Holland 1976). • The dominant surficial features in the Shuswap Highlands physiographic region are till, fluvial, glaciofluvial, colluviums, bedrock outcrops and glaciolacustrine (Bednarski 2009, Fulton 1984). • The narrowed pipeline corridor is underlain by the Shuswap Assemblage which is characterized by quartzofeldspathic gneiss and biotite-quartz schist, with lesser amounts of amphibolites, quartzites, marbles, skarns and pegmatites. • Topography along the narrowed pipeline corridor is characterized by gently to moderately sloping rolling highland, rounded ridges, incised fluvial channels and plains. The elevation is approximately 100 m above sea level (asl). • The narrowed pipeline corridor does not encounter any areas of permafrost (Natural Resources Canada [NRC] 2003b), ground instability (NRC 2007b, 2008, 2009) or major flooding (NRC 2007a). • Notable watercourse crossings within Finn Creek Provincial Park include Finn Creek with a catchment area of 124 km^2. • NRC has rated the risk of wind erosion in the Physical Environment LSA as low or negligible (NRC 2003a).
Soil and Soil Productivity	• A soils survey was conducted in April 2014 along the narrowed pipeline corridor within Finn Creek Provincial Park. The soils along the narrowed pipeline corridor in Finn Creek Provincial Park are classified as Typic Mesisols, Orthic Regosols and Orthic Dystric Brunisols. Locations of these soils series along the narrowed pipeline corridor area are presented on the accompanying Environmental Alignment Sheets. • Typic Mesisols (Ghita 2) soils are characterized by semi-decomposed moss peat that exceeds a depth of 1 m. The underlying mineral material may still be encountered within trench depth and is likely stone-free silts or sands. These soils occur in very poorly drained to depressional levels; the water table is at or near the surface. • Eluviated and Orthic Dystric Brunisols (Kwikoit 2) soils are mainly loam sand with no topsoil horizon. Instead, there is a thin duff layer overlying a light coloured Ae horizon and a bright coloured Bm horizon. These sandy textured soils lack cohesion properties. • Orthic Regosol (Alluvium) soils are found on the fluvial floodplain of Finn Creek. These soils are usually coarse-textured and lack cohesion properties. • The narrowed pipeline corridor traverses lands the Canada Land Inventory (CLI) has rated as having no capability for arable culture (Class 7) due to topographic and stoniness limitations and non-irrigated farming as Class 4 due to topographic and soil moisture limitations (CLI 1980).
Water Quality and Quantity	• The narrowed pipeline corridor through the park is located in the Upper North Thompson River Watershed of the Fraser River Basin. • The narrowed pipeline corridor crosses one fish-bearing watercourse (Finn Creek) and a single non-classified drainage/wetland. • Finn Creek is provincially rated as an S2 perennial watercourse. During fisheries field studies conducted in August 2012, stream flow at Finn Creek was measured at 1.46 m^3/s and mean channel width and mean bank height was measured at 18.7 m and 0.9 m, respectively. • The least biological risk window for Finn Creek is July 22 to August 15. • No provincial or federal surficial geology mapping is available within Finn Creek Provincial Park. However mapping completed by BGC Engineering (2013) indicates that the surficial material of the North Thompson River valley consists of recent fluvial sediments, whereas the surficial materials on the valley slopes consist of morainal sediments. • The bedrock underlying the pipeline consists of Shuswap Assemblage metamorphic rocks. • No aquifers were mapped by the BC Ministry of Environment (MOE) within the Finn Creek Provincial Park boundaries. • Groundwater flows generally follow local topography with recharge occurring either directly over the unmapped aquifers or from the valley walls (mountain sides) and discharge feeding the North Thompson River and three local tributaries. Groundwater flow within fluvial sediments is likely direct down gradient, sub-parallel to the valley axis. • No major watercourse crossings occur within the park boundaries. Finn Creek is crossed at AK 638.8.

TABLE A6.0-1 Cont'd

Biophysical and Socio-Economic Element	Summary of Considerations
Water Quality and Quantity (cont'd)	• One water well (BC MOE #54357) was noted in the BC WELLs database within the park boundaries and on the edge of the narrowed pipeline corridor. The well was completed in unconsolidated sediments. • The area is susceptible to changes in groundwater flow patterns (*i.e.,* areas where the pipeline cuts across a slope) on the east side of the park (just outside of the park boundary to the east).
Air Emissions and Greenhouse Gas Emissions(GHG)	• There are no known permanent residences within 250 m of the narrowed pipeline corridor in Finn Creek Provincial Park. • Existing factors affecting air quality in Finn Creek Provincial Park include emissions from intermittent vehicle traffic exhaust from Highway 5, nearby forestry roads and use of the site by BC Ministry of Transportation and its contractors and the Finn Creek Pump Station. The Finn Creek Pump Station is electric and, therefore, produces limited emissions. • The primary source of air emissions (criteria air contaminants [CACs]) during construction will be from fuel combustion related to the use of transportation vehicles and heavy equipment. During operation, emissions will be limited to transportation and equipment use during maintenance activities. CACs expected to be emitted from Project-related activities include sulphur oxides, volatile compounds, carbon monoxide and particulate matter. • A temporary increase in airborne emissions is anticipated during pipeline construction but will not result in an increase in airborne emissions during operations and maintenance. Therefore, a detailed assessment of air and GHG emissions is not warranted.
Acoustic Environment	• Current sources of noise emissions in Finn Creek Provincial Park are from intermittent sources such as vehicle traffic on Highway 5, nearby forestry roads and the Finn Creek Pump Station. • There are no known permanent residences within 250 m of the narrowed pipeline corridor in Finn Creek Provincial Park. • Clearing and construction is scheduled between Q2 2017 to Q4 2017, however, construction will occur as expeditiously as practical in order to avoid the caribou range from November 1 to January 15. • A temporary increase in noise levels is anticipated during pipeline construction. Noise from construction activities will be in compliance with the BC Oil and Gas Commission (BC OGC) BC *Noise Control Best Practices Guideline* (BC OGC 2009). • Noise arising from construction activities and the potential effect on wildlife are discussed in Section 7.1.9. • Noise generated during operations is expected to be undetectable and will not contribute to ambient noise levels. A quantitative assessment of the acoustic environment is, therefore, not warranted.
Fish and Fish Habitat	• The narrowed pipeline corridor crosses one fish-bearing watercourse (Finn Creek) and a single non-classified drainage/wetland. Finn Creek has been rated as having moderate to high levels of fish habitat potential for spawning, rearing, overwintering and migration of salmonids. It contains resident populations of rainbow trout and bull trout and provides known spawning habitat for Thompson River coho, Chinook and sockeye salmon species. • Water quality at the proposed crossing was found to be within Canadian Council of Ministers of the Environment (CCME) (2007) guidelines for pH, and exceeded dissolved oxygen requirements for coldwater and coolwater species of all life stages.
Wetlands Loss or Alteration	• Finn Creek Provincial Park is located within the boundaries of the Columbia Mountains and Highlands Ecoregion of the Montane Cordillera Ecozone. Wetlands in this ecoregion tend to be restricted to mountain slopes where non-forested bogs, marshes and swamps occur (Ecological Stratification Working Group 1995). • Finn Creek Provincial Park is located within the South Interior Mountain Wetland Region. Wetlands characteristic of this region include flat bogs, basin bogs and shallow basin marshes. Within alpine areas, small basin fens and basin bogs can be found (Government of Canada 1986). • Finn Creek Provincial Park is located within the Interior Cedar-Hemlock (ICH) Biogeoclimatic (BGC) Zone of BC. In this BGC Zone, wetlands are not common due to the mountainous terrain. However, marshes associated with lakes and streams in valley bottoms tend to be more common along with small swamps and transitional bogs and fens (BC Ministry of Forests [BC MOF] 1996, Meidinger and Pojar 1991). • Wetlands provide habitat for native plants and wildlife species, including nesting and foraging habitat for a variety of bird species, forage and cover for ungulates and fur-bearers and breeding habitat for amphibians. Wetlands provide water storage, groundwater recharge and natural filtering of sediments. • There are no Ramsar Wetlands of International Importance (Bureau of the Convention of Wetlands 2014), Important Bird Areas (Bird Studies Canada and Nature Canada 2012), Western Hemisphere Shorebird Reserves 2014), Migratory Bird Sanctuaries (Environment Canada 2013) or Ducks Unlimited Canada (DUC) Priority Landscapes (DUC 2014). No DUC projects are crossed by the narrowed pipeline corridor within Finn Creek Provincial Park (Harrison pers. comm.); therefore, no additional mitigation or consultation is recommended.

TABLE A6.0-1 Cont'd

Biophysical and Socio-Economic Element	Summary of Considerations
Wetlands Loss or Alteration (cont'd)	• There is one riparian swamp (mixedwood treed swamp), classified according to the Canadian Wetland Classification System (National Wetland Working Group 1997), and one mountain alder-common horsetail flood association encountered by the narrowed pipeline corridor within Finn Creek Provincial Park and were determined through a combination of helicopter reconnaissance, satellite imagery review and ground-based wetland surveys. Flood associations are ecosystems that possess some wetland characteristics but they do not meet the definition of a wetland as they either do not meet the vegetation and/or soil requirements to be considered a wetland. Although these ecosystems are not considered to be wetlands, standard pipeline practices and mitigation will ensure the appropriate recontouring will occur so that hydrology is maintained. Ground-based wetland surveys were conducted on May 5, 2014 within Finn Creek Provincial Park. See Table A6.0-2 for detailed information on the riparian swamp.
Vegetation	• The narrowed pipeline corridor within Finn Creek Provincial Park is located entirely on Crown-owned land in the Thompson Moist Warm Interior Cedar – Hemlock variant (ICHmw3) and parallels existing disturbance for the entirety of the route through the park. Mature zonal sites in this variant are dominated by western red cedar and western hemlock with a moss carpet beneath (Lloyd *et al*. 1990). It is common for a few shrubs to be present. • The narrowed pipeline corridor crosses a forested/shrubby area. • A search of the BC Conservation Data Centre (CDC) database identified no historical observations of rare plants or rare ecological communities within the RSA (BC CDC 2012). There was one rare ecological community within the Vegetation LSA that was observed during the 2013 field surveys; a common cat-tail marsh. • No plant species designated under the BC *Wildlife Act* are identified as potentially occurring in the Thompson Moist Warm Interior Cedar – Hemlock variant (ICHmw3). No previously recorded Element Occurrences of plant species listed pursuant to the BC *Wildlife Act* are known to occur within the Vegetation RSA (BC CDC 2012). There were no rare plant species designated by the BC CDC observed during the biophysical field surveys in 2013 within Finn Creek Provincial Park. • Terrestrial Ecosystem Mapping from the Project identified the following site series within the park that are crossed by the narrowed pipeline corridor: ICHm w3/01, ICHm w3/01ms, ICHmw3/05, ICHm w3/06, ICHm w3/08 as well as Rural and Road site series. • The TMPL Alternative (Conventional) cross 0.1 km of non-legal OGMA and no legal OGMA. The age range of trees in this park area is projected to be between 61 to 250 years old (BC Ministry of Forests, Lands and Natural Resource Operations [BC MFLNRO] 2013b). • BC Parks suggests that Trans Mountain consult with BC MFLNRO regarding the timber salvaged from the OGMA in Finn Creek Provincial Park. • Finn Creek Provincial Park is located within the Salvage/Limited Action Emergency Bark Beetle Management Area for Mountain Pine Beetle and within the Aggressive management areas for Douglas-Fir Beetle and Spruce Beetle (BC MFLNRO 2010).
Wildlife and Wildlife Habitat	• The narrowed pipeline corridor in Finn Creek Provincial Park is located in the Groundhog caribou range for approximately 587 m (BC MOE 2010a). Groundhog caribou are included in the Wells Gray-Thompson local population unit of southern mountain caribou (Environment Canada 2014c). The narrowed pipeline corridor within Finn Creek Provincial Park crosses 650 m of matrix range critical habitat as currently mapped in the Recovery Strategy for Southern Mountain Caribou (Environment Canada 2014c). The matrix range extends beyond the Groundhog caribou range boundary. • Habitat types in the park include wet bottomlands with old growth cottonwoods, western red cedar, hybrid spruce and birch, and riparian areas associated with Finn Creek and the North Thompson River (BC MOE 2013a). • The park contains habitat for a variety of species including grizzly bear and moose (BC MOE 2013a). • The primary management objective of Finn Creek Provincial Park is to protect the ecological integrity of the river riparian and associated upland environments (BC MOE 1999). Other wildlife-related management objectives include maintaining the diversity of wildlife species and habitats and providing for continued recreation use with opportunities for activities such as wildlife viewing (BC MOE 1999).
Species at Risk	• The following wildlife species at risk have the potential to occur in Finn Creek Provincial Park based on range and habitat availability (BC CDC 2014, Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2014, Environment Canada 2014b). Species at risk are defined here to include those species listed federally under Schedule 1 of *Species at Risk Act* (*SARA*) or by COSEWIC. Species of concern that are listed provincially are provided at the end of the list. – Common nighthawk: Threatened by *SARA* and COSEWIC; – Olive-sided flycatcher: Threatened by *SARA* and COSEWIC, Blue-listed; – Grizzly bear, western population: Special Concern by COSEWIC, Blue-listed; – Little brown myotis: Endangered by COSEWIC; – Northern myotis: Endangered by COSEWIC, Blue-listed; – Wolverine: Special Concern by COSEWIC, Blue-listed; – Woodland caribou, southern mountain population: Threatened by *SARA*, Endangered by COSEWIC, Red-listed; and – Western toad: Special Concern by *SARA* and COSEWIC, Blue-listed.

TABLE A6.0-1 Cont'd

Biophysical and Socio-Economic Element	Summary of Considerations
Species at Risk (cont'd)	– Provincially listed species: American bittern (Blue-listed); California gull (Blue-listed); long-tailed duck (Blue-listed); surf scoter (Blue-listed); upland sandpiper (Red-listed); fisher (Blue-listed); and Townsend's big-eared bat (Blue-listed). • The following vegetation species at risk have the potential to occur in Finn Creek Provincial Park based on historical occurrences of the species (BC CDC 2014, COSEWIC 2014, Environment Canada 2014b). Species at risk are defined here to include those species listed federally under Schedule 1 of *SARA* or by COSEWIC. Species of concern that are listed provincially are provided at the end of the list. – Haller's apple moss: Threatened by *SARA* and COSEWIC, Red-listed; and – Mexican mosquito fern: Threatened by *SARA* and COSEWIC, Red-listed. – Provincially listed species: pink Agoseris (Blue-listed) • The following fish species at risk have the potential to occur in Finn Creek Provincial Park based on historical and/or known occurrences of the species (BC CDC 2014, COSEWIC 2014, Environment Canada 2014b). Species at risk are defined here to include those species listed federally under Schedule 1 of *SARA* or by COSEWIC. Species of concern that are listed provincially are provided at the end of the list. – Coho salmon: Endangered by COSEWIC (Interior Fraser River populations); and – Bull trout: Special Concern by COSEWIC (South Coast BC populations), Blue-listed.
Heritage Resources	• There is archaeological potential throughout the narrowed pipeline corridor in Finn Creek Provincial Park due to proximity to Finn Creek and Culturally Modified Trees (CMT) potential. • There are no previously recorded archaeological sites in Finn Creek Provincial Park. • In accordance with provincial legislation, in the event that any historical, archaeological or palaeontological resources are discovered during construction, construction activity in the vicinity of the discovery will be suspended until provincial authorities allow work to resume. • Approval under the BC *Heritage Act* will be acquired prior to commencement of construction.
Traditional Land Use	• Simpcw First Nation winter home sites are located at Finn Creek, located approximately 0.5 km west of AK 641 (outside park boundaries). • Simpcw First Nation traditional hunting sites are located at Finn Creek, located approximately 809 m southwest of AK 641 (outside park boundaries).
Visitor Enjoyment and Safety	• The narrowed pipeline corridor crosses a paved parking lot in Finn Creek Provincial Park (approximately AK 638.8). • Outdoor recreational uses include canoeing, skiing, snowshoeing, wildlife viewing and fishing activities.

TABLE A6.0-2

WETLAND CLASS ENCOUNTERED ALONG THE NARROWED PIPELINE CORRIDOR THROUGH FINN CREEK PROVINCIAL PARK

Wetland Class	Start AK	End AK	Legal Location
Riparian Swamp (mixedwood treed swamp)	638.8	639.0	c-96-F/82-M-14

7.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS AND MITIGATION

Using the assessment methodology described in Section 6.1 of the Introduction of the Stage 2 Detailed Proposal of this report, the following subsections evaluate the potential environmental and socio-economic effects associated with construction and operations of the pipeline.

Environmental and socio-economic elements potentially interacting with the construction and operations of the pipeline in Finn Creek Provincial Park are identified in Table A7.0-1.

TABLE A7.0-1

ELEMENT INTERACTION WITH PROPOSED PIPELINE COMPONENT IN FINN CREEK PROVINCIAL PARK

Element	Interaction with Pipeline Component	
	Construction	Operations
Conservational Values of Finn Creek Provincial Park		
Physical and Meteorological Environment	Yes	Yes
Soil and Soil Productivity	Yes	Yes
Water Quality and Quantity	Yes	Yes
Air Emissions	Yes	Yes
Acoustic Environment	Yes	Yes
Fish and Fish Habitat	Yes	Yes
Wetlands	Yes	Yes
Vegetation	Yes	Yes
Wildlife and Wildlife Habitat	Yes	Yes
Species at Risk	Yes	Yes
Heritage Resources	Yes	No – since surface or buried heritage resource sites, if present, would have been disturbed as a result of construction activities, no interaction is anticipated during operations of the pipeline in Finn Creek Provincial Park.
Traditional Land and Resource Use	Yes	Yes
Recreational Values of Finn Creek Provincial Park		
Visitor Enjoyment and Safety	Yes	Yes

The potential environmental and socio-economic effects associated with the pipeline, as well as the accompanying proposed mitigation measures and resulting residual effects are presented for each environmental and socio-economic element. In addition, using the criteria presented in Table 6.2.6-1 of the Introduction of the Stage 2 Detailed Proposal of this report, the evaluation of significance is provided for each potential residual effect associated with the applicable environmental and socio-economic element in the subsections below.

Many of the mitigation measures recommended in Section 7.0 and 8.0 are considered industry accepted best practices in pipeline construction, reclamation and operations. However, a number enhanced measures are also recommended specific for Finn Creek Provincial Park. The measures are discussed further in Sections 7.0 and 8.0, and are summarized in Table A7.0-2. The entirety of the wildlife mitigation presented in Table A7.1.9-2 is intended to be specific to Finn Creek Provincial Park and, therefore, has not been repeated in Table A7.0-2.

TABLE A7.0-2

ENHANCED MITIGATION MEASURES RECOMMENDED IN FINN CREEK PROVINCIAL PARK

Element/Topic	Recommendations	Section Discussed
Wetlands	• As per the *Finn Creek Provincial Park Management Statement Direction*, 1999, a weed management plan will be implemented at all wetlands crossed within the Park.	Section 7.1.7
Reclamation	<u>Natural Regeneration</u> • Allow for natural regeneration in areas where potential soil erosion and non-native invasive species infestation is low, and where it is anticipated that the topsoil or root zone material contains a propagule bank (*e.g.,* seed, stem or root pieces) of suitable species. • Apply a native perennial or non-native annual grass cover crop species in areas with potential erosion and weed concerns. <u>Woody Species Revegetation</u> *Installation of Nursery-Grown Plant Plugs* • Install nursery-grown plant plugs (*e.g.,* rooted stock plugs) in TWS, riparian and special reclamation areas, where suitable levels of naturally regenerating (from seed or vegetative propagules) deciduous or coniferous trees are not observed. • Secure native seed and collect dormant woody species cuttings, as warranted. • Install deciduous and coniferous rooted plugs at pre-selected sites (*e.g.,* TWS, riparian areas or for line-of-sight breaks) as determined in consultation with BC Parks Conservation Specialists. *Installation of Locally Sourced Dormant Woody Species Transplants* • Use plant transplants at pre-determined locations where vegetation is disturbed by construction. • A permit for harvesting transplants from the adjacent plant community will be discussed with the appropriate personnel. <u>Nutrient Management on Disturbed Forested Areas</u> • Apply a slow-release nitrogen fertilizer on lands that contain woody debris and/or wood chips mixed into the salvaged and replaced root zone material or that have been placed on cleared and ungrubbed portions of the construction right-of-way. <u>Seeding of Native Grass Species</u> • Develop seed mixes in consultation with BC Parks and consist of species native to the park or within the vicinity of the park. • Drill or broadcast seed native seed mixes or grass cover crop species on most of the construction right-of-way or at locations indicated on the Environmental Alignment Sheets, unless otherwise requested by BC Parks Area Supervisor or Conservation Specialist. <u>Specific Erosion and Sediment Control</u> • Install coir logs, erosion control blankets and sediment fences following clearing. Monitor and maintain following construction until vegetation establishment occurs. • Install diversion berms to reduce slope length and runoff velocities, and divert runoff away from watercourses/waterbodies and into well-vegetated areas. • Implement rollback using select tree species (*e.g.,* pine) felled during construction (avoid the use of Douglas-fir, grand fir and spruce) within riparian zones and TWS areas to provide erosion control and habitat enhancement. • Seed (drill or broadcast seeded) using an appropriate native grass seed mix, native perennial or annual non-native cover crop, along the disturbed areas following root zone material replacement at an appropriate prescribed rate. <u>Watercourses</u> • Stabilize banks and slopes of watercourse and riparian areas prior to and immediately following construction (crib structures, erosion control matting, revegetation grass rolls, sediment fences, biodegradable coir geotextile wraps, coniferous tree revetments, cobble or riprap armouring). <u>Weed Management</u> • Utilize Trans Mountain's integrated vegetation management (IVM) approach to manage weeds and problem vegetation. • Develop detailed weed and problem vegetation reports for site-specific locations, as required, following a pre-construction weed survey (scheduled for spring 2015) and consultation with BC Parks Conservation Specialists. Weed and problem vegetation infestations and recommended mitigation measures will be incorporated into the Environmental Alignment Sheets.	Section 8.0

7.1 Conservational Values of Finn Creek Provincial Park

7.1.1 Physical and Meteorological Environment

This subsection describes the potential Project effects on the physical environment in Finn Creek Provincial Park. The Physical Environment LSA consists of a 1 km wide band generally extending from the centre of the proposed pipeline corridor and facilities (*i.e.,* 500 m on both sides of the proposed pipeline corridor centre); as shown on Figure 6.2.2-3 of the Stage 2 Detailed Proposal.

All physical environment indicators (Table 6.2.1-1 of Introduction to Stage 2 Detailed Proposal) were considered in this evaluation, however, only terrain instability was determined to interact with pipeline construction and operations in Finn Creek Provincial Park. There are no sites within Finn Creek Provincial Park with the potential for acid rock drainage. The topography within Finn Creek Provincial Park is relatively stable with no steep slopes along the narrowed pipeline corridor.

7.1.1.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on the physical environment indicator is listed in Table A7.1.1-1.

A summary of mitigation measures provided in Table A7.1.1-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines including BC OGC (2013) and BC Ministry of Energy and Mines (Price and Errington 1998).

TABLE A7.1.1-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECT OF PIPELINE CONSTRUCTION AND OPERATIONS ON PHYSICAL ENVIRONMENT FOR FINN CREEK PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Physical Environment Indicator – Terrain Instability			
1.1 General Measures	LSA	• Assess the need for special trench compaction measures or equipment prior to commencement of backfilling [Section 8.4]. See additional backfilling measures in Section 8.4 of the Pipeline EPP. • Recontour the construction right-of-way and re-establish the pre-construction grades and drainage channels if frozen soil conditions prevented completion of this task during backfilling [Section 8.6]. • Revegetate as soon as feasible to reduce or avoid soil erosion and establish long-term cover. Seed immediately following root zone material replacement [Section 8.6]. See additional erosion control and revegetation measures in Section 8.6 of the Pipeline EPP.	• Areas of terrain instability may occur as a result of construction activities.

Notes: 1 LSA = Physical Environment LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.1.2 Significance Evaluation of Potential Residual Effects

Table A7.1.1-2 provides a summary of the significance evaluation of the potential residual environmental effect of the construction and operations of the proposed pipeline in Finn Creek Provincial Park on the physical environment. The rationale used to evaluate the significance of the residual environmental effect is provided below.

TABLE A7.1.1-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECT OF PIPELINE CONSTRUCTION AND OPERATIONS ON PHYSICAL ENVIRONMENT FOR FINN CREEK PROVINCIAL PARK

Potential Residual Effect		Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
				Duration	Frequency	Reversibility				
1	Physical Environment Indicator – Terrain Instability									
1(a)	Areas of terrain instability may occur as a result of construction activities.	Negative	LSA	Short-term	Isolated	Short to medium-term	Low	High	High	Not significant

Notes: 1 LSA = Physical Environment LSA.
2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Physical Environment Indicator – Terrain Instability

Terrain Instability

Minor areas of terrain instability may occur along areas of the narrowed pipeline corridor as a result of the proposed construction activities (*e.g.,* grading, trenching and backfilling). The impact balance of this residual effect is considered negative since terrain instability could affect the safety of the pipe and result in surface erosion. Terrain along most of the narrowed pipeline corridor in Finn Creek Provincial Park is considered to be stable, based on observations and operating experience of the existing TMPL system to date, as well as the results of the Terrain Mapping and Geohazard Inventory (Volume 4A of the Facilities Application).

During construction of the pipeline, removal of vegetation and root mass, grading, cut and fills and runoff controls could lead to localized areas of potential instability. Monitoring during construction will ensure any observed instability issues will be resolved early before potentially severe instability problems arise. Grade material will be replaced to a stable contour that will approximate the pre-construction contour, except where it is not practical or safe from a pipe integrity perspective or for public safety.

Regular aerial and ground patrols will be conducted to examine vegetation establishment and confirm mitigation measures are functioning as intended, as well as identify any new areas of potential instability. At any areas where erosion is observed, appropriate measures will be implemented to clean-up and stabilize the site. Monitoring of the reclaimed sites will continue until the site is determined to be in a stable condition.

The residual effect of terrain instability occurring as a result of planned construction activity is reversible in the short to medium-term and of low magnitude (Table A7.1.1-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Physical Environment LSA - terrain instability as a result of construction activities may extend beyond the construction workspace.
- Duration: short-term – the event causing potential terrain instability is construction of the pipeline (*e.g.,* grading, and rough clean-up).
- Frequency: isolated – the event causing potential terrain instability (*i.e.,* construction of the pipeline) is confined to a specific period.
- Reversibility: short to medium-term – most areas of terrain instability will be remediated within a year, however, some areas may require a second or third year of remedial effort to fully stabilize.

- Magnitude: low – the implementation of the proposed mitigation measures in addition to detailed engineering design is expected to effectively reduce the severity and extent of potential effects on terrain instability within Finn Creek Provincial Park.
- Probability: high – terrain instability is likely to result from pipeline construction at localized areas.
- Confidence: high – based on data pertinent to the Project area and the experience of the assessment team.

7.1.1.3 Summary

As identified in Table A7.1.1-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on the physical environment indicator of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Finn Creek Provincial Park related to physical environment will be not significant.

7.1.2 Soil and Soil Productivity

This subsection describes the potential Project effects on the soil and soil productivity in Finn Creek Provincial Park. The Soil LSA consists of a 1 km wide band from the centre of the proposed pipeline corridor and facilities (*i.e.,* 500 m on both sides of the proposed pipeline corridor centre); shown on Figure 6.2.2-3 of the Stage 2 Detailed Proposal.

All soil and soil productivity indicators (Table 6.2.1-1 of Introduction to Stage 2 Detailed Proposal) were considered in this evaluation, however, only soil productivity, soil degradation and soil contamination indicators were determined to interact with pipeline construction and operations in Finn Creek Provincial Park. Soils in Finn Creek Provincial Park are not stony and, therefore, pipeline construction and operations does not interact with the bedrock and stone disposal indicator.

7.1.2.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on soil and soil productivity indicators are listed in Table A7.1.2-1.

A summary of mitigation measures provided in Table A7.1.2-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines including BC OGC (2010a) and Canadian Association of Petroleum Producers (CAPP) (1996, 1999, 2008).

TABLE A7.1.2-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON SOIL AND SOIL PRODUCTIVITY FOR FINN CREEK PROVINCIAL PARK

	Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.	Soil Indicator – Soil Productivity				
1.1	Decreased root zone material productivity during root zone material salvaging	Soil series: Ghita 1, Kwikoit 2, Alluvium	Footprint	<u>Root Zone Material Depth</u> • Soils in Finn Creek Provincial Park crossed by the narrowed pipeline corridor lack topsoil, therefore, root zone material (15-20 cm) should be salvaged for replacement. <u>Root Zone Material Salvage (General)</u> • Implement the Wet/Thawed Soils Contingency Plan (See Appendix B of the Pipeline EPP) during wet/thawed soil conditions in the event wet or thawed soils are encountered during construction [Section 8.2]. • Accommodate BC Parks root zone material salvage requests. Record any locations where BC Parks has requested soil handling which differs from the planned method [Section 8.2]. • Salvage root zone material from areas to be graded and windrow to the closest edge of the construction right-of-way. Avoid overstripping. The area salvaged is to correspond to the area to be graded [Section 8.2]. See additional grading measures in Section 8.2 of the Pipeline EPP. • Store root zone material prior to grading along the nearest pipeline construction right-of-way boundary taking into consideration space requirements for grade and trench spoil, local topography and drainage [Section 8.2]. • Keep trench spoil pile separate from root zone material pile [Section 8.3]. <u>Root Zone Material Salvage (Non-frozen)</u> • Salvage root zone material from the entire construction right-of-way (see Drawing [Topsoil or Root Zone Material Salvage in Forest – Full Right-of-Way] provided in Appendix R of the Pipeline EPP) where grading is necessary and at locations indicated on the accompanying Environmental Alignment Sheets [Section 8.2]. • Salvage a blade width of root zone material centered over the trench (see Drawing [Topsoil or Root Zone Material Salvage – Blade Width/Frozen] provided in Appendix R of the Pipeline EPP) at locations indicated on the accompanying Environmental Alignment Sheets. Disc well-sodded lands prior to root zone material salvage in order to facilitate root zone material salvage operations [Section 8.2]. • See additional root zone material salvage measures in Section 8.2 of the Pipeline EPP <u>Root Zone Materials Replacement</u> • Follow mitigation measures for backfilling as outlined in Section 8.4 of the Pipeline EPP. • Postpone replacement during wet conditions or high winds to prevent damage to soil structure or erosion of root zone material [Section 8.6]. • Replace root zone material evenly over all portions of the construction right-of-way that have been stripped. • Revegetate as soon as feasible to reduce or avoid soil erosion and establish long-term cover. Seed immediately following root zone material replacement [Section 8.6]. • See additional root zone material replacement mitigation measures in Section 8.6 of the Pipeline EPP.	• Mixing of root zone material and subsoil.

TABLE A7.1.2-1 Cont'd

	Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.2	Decreased root zone material productivity through trench instability during trenching	Soil series: Kwikoit 2, Alluvium	Footprint	• Suspend trenching and salvage a wider area of root zone material if the trench walls slough into the trench and the potential for root zone material/subsoil mixing exists. Backslope the trench walls until stable. Equip backhoe with a swamp bucket, if practical, to avoid or reduce trench sloughing [Section 8.3]. • Weld up pipe prior to trenching at locations with soils prone to sloughing in order to reduce the time the trench is left open [Section 8.3]. • Limit the length of open trench and the time the trench will be left open to reduce the amount of trench sloughing, frost penetration and interference with wildlife and park visitors [Section 8.3]. • Store salvaged root zone material at a sufficient distance from the trench so that root zone material is not lost in the trench, if trench instability is anticipated [Section 8.3]. • Delay trenching until immediately prior to lowering-in at locations with a high water table or where there is a risk of sloughing [Section 8.3].	• Mixing of root zone material and subsoil due to trench instability.
1.3	Decreased soil productivity from trench subsidence	Soil series: Kwikoit 2, Alluvium	Footprint	• Compact the backfill to reduce trench settlement by running a grader wheel over the backfill when the trench has been backfilled to the level of the surrounding ground. Take extra care to compact the trench at banks of Finn Creek [Section 8.4]. • Feather-out existing trench spoil over the salvaged portion of the construction right-of-way to avoid the creation of a permanent trench crown. Excess spoil will not be feathered-out over the salvaged area to an extent that may cause excessive subsidence of the trench [Section 8.4]. • Postpone feathering-out of excess spoil along segments of the route constructed during frozen soil conditions until after the spring breakup and the trench has settled [Section 8.4]. • See additional measures in Section 8.4 of the Pipeline EPP.	• Excessive trench subsidence or known remnant crown.
1.4	Decreased soil productivity from disturbance (*e.g.,* maintenance dig activities) during operations	Soil series: Ghita 1, Kwikoit 2, Alluvium	Footprint	• Implement the recommended soil handling procedures outlined in the Pipeline EPP to reduce the potential for a reduction in soil productivity when construction activities involving soil disturbance are necessary during operations of the pipeline. • Monitor areas along the construction right-of-way that are disturbed during operations and maintenance activities. Implement remedial measures, where warranted.	• Mixing of root zone material and subsoil.
1.5	Decreased soil productivity resulting from changes in evaporation and transpiration rates	Soil series: Alluvium, Ghita 2, Kwikoit 2	Footprint	• Implement mitigation measures provided in points 2.2 of this table to reduce the loss of topsoil/root zone material through wind erosion for Alluvium, Ghita 2 and Kwikoit soils. • Use only Certified Canada No. 1 or best available seed for cover crop. For native seed, the highest seed grade available will be obtained [Section 8.6].	• Reduction in soil productivity on forested areas resulting from changes in evaporation and transpiration rates.

TABLE A7.1.2-1 Cont'd

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2. Soil Indicator – Soil Degradation				
2.1 Degradation of soil structure due to compaction and rutting	Soil series: Ghita 2, Alluvium, Kwikoit 2	Footprint	• Implement the Wet/Thawed Soils Contingency Plan (see Appendix B of Pipeline EPP) during wet/thawed soil conditions in the event wet or thawed soils are encountered during construction [Section 8.2]. • Determine locations where subsoil compaction has occurred by comparing compaction levels on and off the construction right-of-way. Sites compared will be in close proximity and have similar drainage, soil moisture, aspect and land use, if feasible [Section 8.6]. • Rip compacted subsoils on the construction right-of-way adjacent to the ditchline and along shoo-flies with a multi-shank ripper or breaking disc to a depth of 30 cm or the depth of compaction, whichever is deeper. If soils are moist, postpone ripping of subsoils until soils dry to ensure that the soils fracture when ripped [Section 8.6]. • Employ a subsoiler plow (*e.g.,* Paratiller) along segments of the construction right-of-way adjacent to the ditchline where root zone material salvage did not occur and subsoil compaction is severe [Section 8.6]. • Disc or chisel plow and harrow ripped subsoils to smooth the surface. Limit discing to that necessary to break up clods in order to prevent further compaction of the subsoils or to increase the potential for soil erosion by wind [Section 8.6]. • See additional measures to reduce compaction and rutting in Section 8.6 of the Pipeline EPP.	• Degradation of soil structure and impairment of rooting zone due to compaction and rutting.
2.2 Loss of root zone material through wind erosion	Soil series: Alluvium, Ghita 2, Kwikoit 2	Footprint	General • Tackify or apply water or pack the root zone material windrow with a sheep foot packer or other approved equipment, if the assessment by the Environmental Inspector(s) indicates that soils are likely to be prone to erosion by wind (see Soil Erosion and Sediment Control Contingency Plan in Appendix B of the Pipeline EPP) [Section 8.2]. • Apply water or approved tackifier to exposed soil piles if wind erosion occurs in Finn Creek Provincial Park [Section 8.2]. • Monitor soil windrows during the growing season for wind and water erosion, and weed growth until the soils are replaced. Implement additional mitigation measures to control erosion (see Soil Erosion and Sediment Control Contingency Plan in Appendix B of the Pipeline EPP) and weed growth when warranted (see Weed and Vegetation Management Plan in Appendix C of Pipeline EPP) [Section 8.2]. • Avoid removing excess small diameter slash in wooded areas with erodible soils [Section 8.6]. • Seed disturbed erodible soils on with a mixture of approved native seed and cover crop seed such as fall rye if seeding in late summer or annual oats if seeding in the winter, spring or early summer [Section 8.6]. • See additional measures in the Soil Erosion and Sediment Control Contingency Plan and Soil/Sod Pulverization Contingency Plan in Appendix B of the Pipeline EPP. Highly Erodible Soils • Install erosion control blanket, coir/straw logs or rollback on exposed moderately to highly erodible soils where there is potential for water or wind erosion prior to re-establishment of vegetation (see Drawings [Rollback] and [Erosion Control – Rollback in Riparian Areas] and [Coir/Straw Log Installation] and [Erosion Control Matting/Blanket] provided in Appendix R of Pipeline EPP) [Section 8.6]. • Install temporary fences to restrict trampling of the seeded construction right-of-way until vegetation becomes established or less palatable [Section 8.6].	• Surface erosion of root zone material can be expected until a vegetative cover is established.

TABLE A7.1.2-1 Cont'd

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2.3 Loss of root zone material through water erosion	Soil series: Kwikoit 2	Footprint	• Postpone root grubbing until immediately prior to grading along segments of the construction right-of-way where pre-clearing occurred and where there is a potential for soil erosion to occur, due to sloping terrain and erodible soils [Section 8.1]. See additional grubbing measures in Section 8.1 of the Pipeline EPP. • Leave breaks in the trench crown at obvious drainages and wherever seepage occurs to reduce or avoid interference with natural drainage. • Install temporary sediment fences, where warranted, to control sedimentation prior to final clean-up and the establishment of permanent erosion and sediment control measures (see Drawing [Sediment Fence] provided in Appendix R of Pipeline EPP) [Section 8.6.2]. • Implement the Soil Erosion and Sediment Control Contingency Plan [Section 8.0 of Appendix B of the Pipeline EPP]. • Replace grade material to a stable contour that will approximate the pre-construction contour, except where it is not practical or safe to do so [Section 8.4]. • Regrade areas with vehicle ruts, erosion gullies or where the trench has settled [Section 8.6]. • See additional measures to reduce water erosion at watercourses and wetlands in Sections 8.6 and 8.7 of the Pipeline EPP.	• Surface erosion of root zone material can be expected until a vegetative cover is established.
2.4 Degradation of soil structure due to pulverization of soil and sod	Soil series: Ghita 1, Kwikoit 2, Alluvium	Footprint	• Retain sod and the vegetation mat on all lands if a competent sod layer exists. In these areas, grade only where safety considerations dictate in order to reduce disturbance to sod and the vegetation mat. Grading of well-sodded lands will not be permitted on level terrain [Section 8.2]. • Assess the wind erosion hazard, competency of the sod and potential for soil pulverization due to droughty soils. Implement measures applicable to droughty, wind erodible soils to reduce the impact of soil pulverization and wind erosion (see Soil/Sod Pulverization Contingency Plan in Appendix B) [Section 8.2]. • Apply water or approved tackifier to disturbed areas if traffic and wind conditions result in pulverized soils and dust problems [Section 8.2]. • Cultivate or rip the full width of the construction right-of-way on bush or woodlands where poor sod development exists to a depth adequate to alleviate surface compaction and in a manner acceptable to BC Parks. Do not cultivate into the subsoil [Section 8.6]. • Limit cultivation in areas of fine textured soils to prevent pulverization of the soil (see Soil/Sod Pulverization Contingency Plan in Appendix B) [Section 8.6]. • Disc and harrow only if the site is to be seeded immediately; otherwise, leave the ripped topsoil in a rough condition to reduce wind erosion potential [Section 8.6]. • Disc or rip disturbed soils on hay where the sod layer has been broken or where topsoils are compacted and reseeding is warranted [Section 8.6].	• Pulverization resulting in fugitive dust and loss of soil structure can be expected during dry conditions.
2.5 Loss of root zone material from disturbance (*e.g.*, maintenance dig activities) during operations	Soil series: Ghita 1, Kwikoit 2, Alluvium	Footprint	• Implement the recommended soil handling procedures outlined in the Pipeline EPP to reduce the potential for soil degradation when maintenance activities involving soil disturbance are necessary during operations of the pipeline. • Monitor areas along the right-of-way that are disturbed during operations and maintenance activities. Implement remedial measures, where warranted.	• Surface erosion of root zone material can be expected until a vegetative cover is established.

TABLE A7.1.2-1 Cont'd

	Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
3.	Soil Indicator – Soil Contamination				
3.1	Soil contamination due to spot spills during construction	Soil series: Ghita 1, Kwikoit 2, Alluvium	LSA	• Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into watercourses/wetlands/lakes. In the event of a spill, implement the Spill Contingency Plan (see Appendix B of the Pipeline EPP) [Section 7.0]. • Place tarps or other impermeable material on the ground to catch drippings from coating application at weld joints and areas where repairs to the coating are made. Dispose of spilled coating at approved locations [Section 8.3]. • Avoid locating test pumps, generators and fuel storage within park boundaries, if feasible. If not feasible, install test pumps, generators and fuel storage tanks with impermeable lined dike or depression to capture and retain any spills of fuels or lubricants [Section 8.5].	• No residual effect identified.

Notes: 1 LSA = Soil LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.2.2 Significance Evaluation of Potential Residual Effects

Table A7.1.2-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Finn Creek Provincial Park on the soil and soil productivity. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE A7.1.2-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON SOIL AND SOIL PRODUCTIVITY FOR FINN CREEK PROVINCIAL PARK

	Potential Residual Effects	Impact Balance	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
				Duration	Frequency	Reversibility				
1.	Soil Indicator – Soil Productivity									
1(a)	Mixing of root zone material and subsoil.	Negative	Footprint	Short-term	Periodic	Medium-term	Low	High	High	Not significant
1(b)	Reduction in soil productivity in forested areas from changes in evaporation and transpiration rates.	Negative	Footprint	Short-term	Periodic	Short to medium-term	Low	High	Moderate	Not significant
1(c)	Excessive trench subsidence or a remnant crown.	Negative	Footprint	Short-term	Isolated	Short to medium-term	Low	High	High	Not significant
2.	Soil Indicator – Soil Degradation									
2(a)	Degradation of soil structure and impairment of rooting zone due to compaction and rutting.	Negative	Footprint	Short-term	Periodic	Short to medium-term	Low	High	High	Not significant
2(b)	Pulverization resulting in fugitive dust and loss of soil structure can be expected during dry conditions.	Negative	Footprint	Short-term	Isolated	Short to medium-term	Low	Low to High	High	Not significant
2(c)	Surface erosion of root zone material can be expected until a vegetation cover is established.	Negative	Footprint	Short-term	Periodic	Medium-term	Low	High	High	Not significant
3.	Soil Indicator – Soil Contamination									
No residual effects identified.		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: 1 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Soil Indicator – Soil Productivity

Root Zone Material and Subsoil Mixing

During the construction of the pipeline and, to a lesser extent, during maintenance activities, it is likely that a minor amount of root zone material and subsoil mixing will occur along the proposed construction right-of-way. The impact balance of this residual effect is considered negative since admixing could decrease soil productivity. A summary of the rationale for all of the significance criteria is provided in Table A7.1.2-2 (point 1[a]) and below.

- Spatial Boundary: Footprint – admixing is confined to the area of disturbance along the construction right-of-way.
- Duration: short-term – the events causing potential admixing are construction of the pipeline and maintenance-related activities, the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events causing potential admixing (*i.e.,* construction and maintenance-related activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: medium-term – loss of soil productivity due to minor root zone material and subsoil mixing is expected to be reversed within 10 years given the implementation of mitigation measures during construction and, if necessary, the application of soil amendments post-construction. The results of recent post-construction environmental monitoring (PCEM) programs in forested and mountainous areas demonstrate that root zone material mixing with subsoil is alleviated within a few years post-construction.

- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table A7.1.2-1 and, if necessary, soil amendments applied post-construction. The results of recent PCEM programs in forested areas demonstrate that root zone material mixing with subsoil is generally minor in severity and limited in extent.

- Probability: high – admixing is a common residual effect of pipeline construction and may also occur during maintenance activities.

- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and soil productivity

Evaporation and Transpiration

Loss of vegetation and soil disturbance will result in changes to evaporation and transpiration rates in forested areas following construction potentially reducing soil productivity.

Following tilling and seeding activities, evaporation and transpiration rates on the construction right-of-way will not differ from off the construction right-of-way unless compaction or lower nutrient levels from admixing reduce vegetation yield. Mitigation measures outlined in Table A7.1.2-1 and the Pipeline EPP will reduce the potential for changes of soil structure and available environmental nutrients. Furthermore, any notable decrease in soil productivity will be identified during post-construction environmental monitoring and appropriate procedures will be implemented (*e.g.,* soil compaction alleviation, fertilization, consultation with BC Parks).

The loss of vegetation in forested areas will not result in any considerable alteration of wind patterns and resultant changes in evaporation rates of adjacent vegetation, nor are increased surface temperatures of bare soil resulting from losses in evaporative cooling expected to affect adjacent vegetation. In general, post-construction environmental monitoring reports for a recent large pipeline project on forested areas demonstrate that soil productivity on right-of-way and off right-of-way are comparable with proper revegetation (TERA 2009a,b, 2011a,b,c, 2012a, 2013a,b). Locations along the construction right-of-way where seeding or natural revegetation have not been as successful will be recorded and appropriate measures will be implemented (*e.g.,* fencing to prevent grazing, reseeding, soil decompaction, fertilization).

Through appropriate scheduling and implementation of soil conservation and vegetation management measures in Table A7.1.2-1 and the Pipeline EPP (Appendix A of this Proposal), the magnitude of changes in evaporation and transpiration resulting from pipeline construction is considered to be low. A reduction in soil productivity resulting from changes in evaporation and transpiration rates is considered reversible in the short to medium-term depending on land use, vegetation type and the success of soil handling and revegetation efforts (Table A7.1.2-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – reduction in soil productivity in forested areas resulting from changes in evaporation and transpiration rates are confined to the area of disturbance along the construction right-of-way.

- Duration: short-term – the events causing potential evaporation and transpiration rates are construction of the pipeline and maintenance-related activities, the latter of which are limited to any one year during the operations phase.

- Frequency: periodic – the events causing reduction in soil productivity in forested areas resulting from changes in evaporation and transpiration rates (*i.e.*, construction and maintenance-related activities) occur intermittently but repeatedly over the assessment period.

- Reversibility: short to medium-term – depending on vegetation type and success of soil handling and revegetation efforts, potential reduction in soil productivity resulting from changes in evaporation and transpiration rates may take up to or more than one year but less than 10 years to alleviate.

- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table A7.1.2-1 and, if necessary, soil amendments applied post-construction. The results of recent post-construction environmental monitoring programs in forested areas demonstrate that changes in evaporation and transpiration rates are generally minor in severity and limited in extent.

- Probability: high – changes in evaporation and transpiration rates are common residual effects of pipeline construction and may also occur during maintenance activities.
- Confidence: moderate – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and changes in evaporation and transpiration rates from data outside of the Project area. Since the understanding is not from data within the Project area, the confidence is rated as moderate.

Trench Subsidence or Remnant Crown

Construction activities may result in localized areas of excessive trench subsidence and/or a remnant crown over the trench. The impact balance of this residual effect is considered negative since excessive trench subsidence or a remnant crown may reduce soil productivity through erosion and drainage issues. Trench subsidence and a remnant crown do not always occur during the year following construction and reclamation, and will be greatly influenced by the amount of precipitation. The reversibility of trench subsidence and/or a remnant crown is considered to be short to medium-term since remedial work associated with trench subsidence and/or a remnant crown typically occurs within a year of construction, however, localized trench subsidence may arise 2 to 3 years following construction (TERA 2009a,b, 2011a,h,i, 2012d, 2013c,g). With effective compaction of the backfilled trench and feathering out any remaining material over the trench, the magnitude of the effect of trench subsidence on soil and soil productivity is considered to be low (Table A7.1.2-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – trench subsidence or a remnant crown is confined to the trench line within the construction right-of-way.
- Duration: short-term – the event causing potential trench subsidence or a remnant crown is construction of the pipeline which is limited to the construction phase.
- Frequency: isolated – the event causing potential trench subsidence or a remnant crown (*i.e.,* construction activities) is confined to a specified phase of the assessment period.
- Reversibility: short to medium-term – remedial work associated with a remnant crown and trench subsidence typically is conducted within a year of construction, however, localized trench subsidence may also arise 2 to 3 years after construction.
- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table A7.1.2-1 and, if necessary, soil amendments applied post-construction. The results of recent PCEM programs in forested areas demonstrate that trench subsidence or a remnant crown is generally minor and limited in extent.
- Probability: high – trench subsidence or a remnant crown is a common residual effect of pipeline construction.
- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and trench subsidence/remnant crowns.

Soil Indicator – Soil Degradation

Degradation of Soil Structure from Compaction and Rutting

Soil compaction, as a result of construction activities, can result in the reduction of soil pore space and an increase of soil bulk density or mass. Plant roots have greater difficulty penetrating compacted soil which can reduce the productivity of plant communities. Rutting can occur by vehicle traffic during wet conditions. The impact balance of this residual effect is considered negative since compaction and rutting could decrease the structure of the soil and, therefore, reduce soil productivity.

The impact balance of this residual effect is considered negative since compaction and rutting could decrease the structure of the soil and, therefore, reduce soil productivity.

Given the proven effectiveness of the mitigation measures to reduce admixing along the construction right-of-way, it is anticipated that the extent and severity of compaction and rutting will be minor. As a result, this residual effect is considered to be of low magnitude (Table A7.1.2-2, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – degradation of soil structure from compaction and rutting is confined to the area of disturbance along the construction right-of-way.
- Duration: short-term – the events causing potential degradation of soil structure from compaction and rutting are construction of the pipeline and maintenance-related activities, the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events causing potential degradation of soil structure from compaction and rutting (*i.e.,* construction and maintenance-related activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: short to medium-term – degradation of soil structure from compaction and rutting is expected to be reversed within a few years given the implementation of mitigation measures during construction and, if necessary, the application of soil amendments post-construction.
- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table A7.1.2-1 and, if necessary, soil amendments applied post-construction.
- Probability: high – degradation of soil structure from compaction and rutting is a common residual effect of pipeline construction and may also occur during maintenance activities.
- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and soil degradation.

Degradation of Soil Structure from Pulverization

Construction activities during dry conditions may result in pulverization of soil and sod along the narrowed pipeline corridor in Finn Creek Provincial Park. The impact balance of this residual effect is negative since pulverization of soil and sod could lead to increased fugitive dust and loss of soil structure. Given the mitigation measures in Table A7.1.2-1 to reduce soil/sod pulverization, including the Soil/Sod Pulverization Contingency Plan, degradation of soil structure from pulverization is considered to be reversible in the short to medium-term (Table A7.1.2-2, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – degradation of soil structure from pulverization is confined to the area of disturbance along the construction right-of-way.
- Duration: short-term – the event causing degradation of soil structure from pulverization is construction of the pipeline.
- Frequency: isolated – the event causing degradation of soil structure from pulverization (*i.e.,* construction of the pipeline) is confined to a specified phase of the assessment period.
- Reversibility: short to medium-term – effects related to dust are reversible in less than one year (short-term); while the effects related to loss of soil structure is expected to take more than one year but less than 10 years to reverse the effect (medium-term).
- Magnitude: low – given the implementation of mitigation measures outlined in Table A7.1.2-1 and, if necessary, soil amendments applied post-construction.

- Probability: low to high – degradation of soil structure from pulverization is a common residual effect of pipeline construction but only in dry conditions so the likelihood varies by location along the construction right-of-way and weather conditions.
- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

Surface Erosion of Root Zone Material

Construction and maintenance activities which disturb the soil will likely result in some surface erosion of root zone material until a stable vegetative cover can be established, particularly on slopes which are more susceptible to water erosion, such as the alluvium soils on the slopes of Finn Creek. The impact balance of this residual effect is considered negative since erosion could decrease soil productivity. Based on the results of post-construction monitoring programs for pipeline projects in forested settings, issues related to erosion can generally be resolved within 2 to 3 years following final clean-up (TERA 2009a,b, 2011a,h,i, 2012d, 2013c,g). Similar measures are planned for the construction of the proposed pipeline. Consequently, minor surface erosion of root zone material is considered to be reversible in the medium-term (Table A7.1.2-2, point 2[c]). A summary of the rationale for all the significance criteria is provided below.

- Spatial Boundary: Footprint – surface erosion is confined to the area of disturbance along the construction right-of-way.
- Duration: short-term – the events causing surface erosion are construction of the pipeline and maintenance-related activities, the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events causing surface erosion (*i.e.,* construction and maintenance-related activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: medium-term – surface erosion is generally expected to be reversed within 2 to 3 years given the implementation of mitigation measures during construction and, if necessary, the application of soil amendments post-construction.
- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table A7.1.2-1 and, if necessary, soil amendments applied post-construction.
- Probability: high – surface erosion is a common residual effect of pipeline construction which can be addressed during PCEM and may also occur during maintenance activities.
- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and soil degradation.

Soil Indicator – Soil Contamination

No residual effects of the construction and operations of the proposed pipeline were identified for the soil contamination indicator (Table A7.1.2-2). Consequently, no further assessment is warranted.

7.1.2.3 Summary

As identified in Table A7.1.2-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on soil and soil productivity indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Finn Creek Provincial Park related to soil and soil productivity will be not significant.

7.1.3 Water Quality and Quantity

This subsection describes the potential Project effects on water quality and quantity in Finn Creek Provincial Park. The Water Quality and Quantity LSA is the area generally extending 100 m upstream of the centre of the proposed pipeline corridor to a minimum of 300 m downstream of the centre of the proposed pipeline corridor, as well as within 300 m of the proposed pipeline corridor in consideration of surface water drainage patterns along the pipeline corridor; shown in Figure 6.2.2-3 of the Introduction to the Stage 2 Detailed Proposal. The Aquatics RSA includes all watersheds directly affected by the proposed pipeline corridor and applies to surface water; shown in Figure 6.2.2-1 of the Introduction to the Stage 2 Detailed Proposal.

All water quality and quantity indicators (Table 6.2.1-1 of Introduction to Stage 2 Detailed Proposal) were considered in this evaluation; and all of them were determined to interact with pipeline construction and operations in Finn Creek Provincial Park.

7.1.3.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on water quality and quantity indicators are listed in Table A7.1.3-1.

A summary of mitigation measures provided in Table A7.1.3-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial and federal regulatory guidelines including BC MOE (2010), BC MOF (1995), BC Ministry of Water, Land and Air Protection (BC MWLAP) (2004), BC OGC (2013), CAPP *et al*. (2012) and DFO (1995, 1999, 2013), as well as groundwater legislation under the *Oil and Gas Activities Act* (*Environmental Protection and Management Regulation*) and the *BC Environmental Assessment Act.* Table A7.1.3-2 provides the pipeline and vehicle crossing methods for watercourses encountered within Finn Creek Provincial Park.

TABLE A7.1.3-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WATER QUALITY AND QUANTITY FOR FINN CREEK PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Water Quality and Quantity Indicator – Surface Water Quality			
1.1 Suspended sediment concentrations in the water column during instream activities	LSA	<u>Pipeline Crossing</u> • An isolated watercourse crossing method (*i.e*., if water is present) and open-cut contingency method (*i.e.,* if dry or frozen to the bottom) have been selected in consideration of the size, environmental sensitivities of Finn Creek and the unnamed drainage and the period of construction (see Table A7.1.3-2). • Confirm with the Inspector(s) that all notifications and approvals and/or letters of advice are in place prior to commencing instream construction at Finn Creek and the unnamed drainage [Section 8.7]. • Grade away from the watercourses in Finn Creek Provincial Park to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in the watercourse during grading [Section 8.2]. • Install a temporary sediment barrier (*e.g.,* sediment fences), where warranted, to eliminate the flow of sediment from spoil piles and disturbed areas into Finn Creek [Section 8.7]. • Inspect temporary sediment control structures (*e.g.,* sediment fences, subsoil berms) installed on approach slopes, on a daily basis throughout crossing construction. Repair the structures before the end of the working day [Section 8.7]. • Develop a water quality monitoring plan to monitor for sediment events during the isolated trenched crossing of Finn Creek or during open-cut crossing construction if flow is present. If monitoring reveals that sediment values are approaching threshold values, the water quality monitors will notify the Lead Environmental Inspector and Inspector(s) who, with the Construction Manager and contractor, will develop corrective actions [Section 8.7]. • Construct the crossing in accordance with applicable existing provincial and federal guidelines (*e.g.,* mitigation measures recommended in the *Fisheries Act* self-assessment) as well as the conditions of the *Fisheries Act* authorization, if applicable. • Dewater the segment of the watercourse between the dams, id safe to do so. Pump any silt-laden water out between the dams to well-vegetated lands, away from the watercourse or to settling ponds [Section 8.7]. • Remove any accumulations of sediment within the isolation areas that resulted from crossing construction. Spread all sediment and unused trench spoil removed from the watercourse at a location above the high water mark where the materials will not directly re-enter the watercourse [Section 8.7]. • Install sack trench breakers back from the edge of watercourses where the banks consist of organic material to prevent sloughing of backfill into the channel [Section 8.7]. • Ensure that water from flumes, dam and pumps, diversion or other methods does not cause erosion or introduce sediment into the channel. Place rock rip rap, tarpaulins, plywood sheeting or other materials to control erosion at the outlet of pump hoses and flumes. Supplement the erosion control materials to control any erosion [Section 8.7]. <u>Vehicle Crossing</u> • Finn Creek and the non-classified drainage will be crossed using a clear-span bridge (see Table A7.1.3-2). • Ensure the bridge is clean prior to installation. • Implement erosion control measures as soon as disturbance of the vegetation mat occurs. • Ensure stormwater from the bridge deck, side slopes and bridge approaches is directed away from the watercourse onto a well vegetated area [Section 8.7]. • Stabilize and revegetate areas disturbed during installation and removal of the bridge; install erosion control measures, where warranted, to control surface erosion until vegetation is established.	• Reduction in surface water quality due to suspended sediment during instream activities during construction and site-specific maintenance activities.

TABLE A7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.1 Suspended sediment concentrations in the water column during instream activities (cont'd)	See above	Operations • Implement measures similar to construction under direction of Trans Mountain's Environmental, Health and Safety Management System to reduce suspended sediment released during integrity digs conducted instream.	• See above
1.2 Erosion from approach slopes	LSA	Pipeline Crossing • Prohibit clearing of extra TWS within the riparian buffer, only the trench and TWS areas will be cleared. Ensure staging areas for watercourse crossing construction and spoil storage areas are located a minimum of 10 m from the banks of the watercourse boundaries. This distance may be reduced by the Lead Environmental Inspector and the Inspector(s) where appropriate controls are in place [Section 8.1]. • Restrict root grubbing to the area outside of the vegetated riparian buffer adjacent to the watercourse [Section 8.1]. • Install erosion control measures, where warranted, prior to commencing grading in the vicinity of the watercourse crossing [Section 8.2]. • Grade away from the watercourse to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in the watercourse during grading [Section 8.2]. • Install temporary berms on approach slopes to the watercourse and erect sediment fence(s) near the base of approach slopes following grading. Inspect the temporary sediment control structures on a daily basis and repair before the end of each working day [Section 8.2]. • Install sack trench breakers back from the edge of watercourses where the banks consist of organic material to prevent sloughing of backfill into the channel (see Trench Breaker – Watercourse/Wetland Drawing in Appendix R of the Pipeline EPP] [Section 8.4]. • Install temporary erosion and sediment control structures (*e.g.*, sediment fences, coir logs) immediately following the completion of backfilling lands adjacent to the watercourse crossing where the potential for sedimentation of the watercourse exists (see Sediment Fence and Coir/Straw Log Installation Drawings provided in Appendix R of the Pipeline EPP) [Section 8.4]. • Seed riparian areas with an approved annual or perennial grass cover crop or native grass mix as soon as is feasible after construction (see Table A7.1.3-2). • Transplant dormant shrubs, or install dormant willow stakes or commercially grown rooted stock plants (plugs), where warranted, during reclamation of streambanks where riparian vegetation is present prior to construction (see Table A7.1.3-2). • Install permanent erosion control measures, as outlined in Table A7.1.3-2, unless otherwise approved by Trans Mountain to adjust for site conditions and suitability [Section 8.6]. • Install temporary fencing to allow the revegetation treatments to become established and avoid damage to the banks and riparian area by wildlife [Section 8.7]. • Monitor watercourse after construction to assess the success of construction and reclamation mitigation measures following the temporary disturbance. Implement remedial measures, where warranted. Vehicle Crossings • Ensure that equipment used during construction of the vehicle crossing is used in a manner that reduces disturbance of the bed and banks and ensure bridge installation does not alter the stream bed or banks or require infilling of the channel [Section 8.7]. • Seed disturbed areas on the banks and approaches as soon as practical with an approved grass cover crop species or native grass seed mix and implement sediment control measures to stabilize watercourse banks and prevent sedimentation of the watercourse, respectively. Follow measures see Table A7.1.3-2. Operations • Implement measures similar to construction under direction of Trans Mountain's Environmental, Health and Safety Management System for controlling erosion from banks and approach slopes during integrity digs conducted instream or in vicinity to the watercourse.	• Reduction in surface water quality due to erosion from banks and approach slopes.

TABLE A7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.3 Reduction of surface water quality due to small spill during construction or site-specific maintenance activities	LSA	• Ensure the following separation distances are maintained between the watercourse when planning and constructing the pipeline, unless otherwise approved: – fuel or hazardous material storage site - 300 m; – burning site - 100 m; and – oil change area - 100 m [Section 7.0]. • Refer to the Pipeline EPP for additional measures for hazardous materials storage, servicing vehicles and spill equipment needs as well as cleaning of equipment. • Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into waterbodies. In the event of a spill, implement the Spill Contingency Plan [Appendix B] [Section 7.0]. • Conduct refuelling a minimum of 100 m from any watercourse unless otherwise approved by the appropriate regulatory authority [Section 7.0]. See additional measures for refuelling near waterbodies in Section 7.0 of the Pipeline EPP.	• Contamination of surface water due to a small spill during construction or site-specific maintenance activities.
2. Water Quality and Quantity Indicator – Surface Water Quantity			
2.1 Alteration of natural surface drainage patterns	LSA	• Maintain drainage across the construction right-of-way during all phases of construction [Section 7.0]. • Ensure the potential for soil erosion by water is reduced during construction activities by avoiding ponding of water or the unintentional channelization of surface water flow [Section 7.0]. • Provide surface drainage of adequate capacity across the construction right-of-way [Section 7.0]. • Reduce grading along the construction right-of-way, especially within watercourse/wetland vegetated buffers [Section 8.2]. • Leave breaks in the trench crown at obvious drainages and wherever seepage occurs to reduce or avoid interference with natural drainage [Section 8.4]. • Recontour the construction right-of-way and stabilize approach slopes at watercourse crossings. Where reclamation of the pre-construction grade is not feasible due to risk of failure of fill on slopes or maintenance of an access trail, recontour to grades as directed by the Geotechnical Engineer [Section 8.6]. • Regrade areas with vehicle ruts, erosion gullies or where the trench has settled [Section 8.6]. Implement similar mitigation measures during site-specific maintenance activities during operations.	• Localized alteration of natural surface drainage patterns until trench settlement is complete.
2.2 Disruption or alteration of stream flow	LSA	• Adhere to clearing guidelines for protection of streams provided the Riparian Management Area Guidebook [Section 8.1]. • Fell trees away from the watercourse and away from limits of the construction right-of-way to reduce damage to the streambanks, bed and adjacent trees. Hand clear the area, if necessary, to reduce disturbance. Any trees, debris and soil inadvertently deposited within the ordinary high watermark will be promptly removed in a manner that avoids or reduces disturbance of the bed and banks. Trees will not be stood or hauled across the watercourse [Section 8.1]. • Do not place windrowed or fill material in the watercourse during grading [Section 8.2]. • Ensure stream flow, if present, is maintained at all times when trenching through Finn Creek [Section 8.7]. • Ensure that new vehicle crossing structures are appropriate for the watercourse approaches, channel width and configuration, anticipated stream flow during the period of use, planned vehicle loads, and overall period/duration of use [Section 8.7]. • Re-establish streambanks and approaches immediately following construction of the watercourse crossing as outlined in Table A7.1.3-2.	• Disruption and alteration of natural stream flow from instream activities.

TABLE A7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
3. Water Quality and Quantity – Groundwater Quality			
3.1 Shallow groundwater with existing contamination encountered during trench construction	LSA	• Ensure contaminated soil and water are not transported off-site or disposed until analytical results have been received as per federal and provincial regulations. The Construction Manager and Environmental Inspector will provide notification as to when excavations can be backfilled [Section 8.3]. • Notify and adhere to the advice of the Trans Mountain Environment, Health and Safety Department or Trans Mountain's Lead Environmental Inspector and Environmental Inspector(s) at locations where water potentially contaminated with hydrocarbons or other materials is to be discharged from the trench. Measures may include the use of tank trucks to haul discharged water to an appropriate disposal facility/site, ensuring the intake is submerged below the surface sheen, lab testing and use of sorbent booms to hold the sheen away from the pump intake [Section 8.3].	• No residual effect identified.
3.2 Groundwater or wells vulnerable to possible future contamination from a spill during construction	LSA	• Utilize Best Management Practices for spill prevention outlined in the Pipeline EPP including in areas where higher vulnerability wells and aquifers are identified. • Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into waterbodies. In the event of a spill, implement the Spill Contingency Plan (see Appendix B of Pipeline EPP) [Section 7.0]. • Re-establish or replace a potable water supply as required should a registered or known water well located within 30 m of the construction right-of-way be damaged (*i.e.,* diminishment in quantity and/or quality) during pipeline installation [Section 7.0].	• Contamination of groundwater as a result of a spill during construction.
4. Water Quality and Quantity Indicator – Groundwater Quantity			
4.1 Areas susceptible to changes in groundwater flow patterns	LSA	• Monitor water encountered in the trench during trenching to determine if groundwater flow is being intercepted. If spring flow has been disrupted, seek and follow the advice of the Hydrogeological or Geotechnical Resource Specialist to maintain cross drainage within the trench (*e.g.,* installation of subdrains, trench breakers, etc.) [Section 8.3]. • Assess the need for well points or other dewatering methods, prior to commencing trenching, to intercept groundwater at site-specific locations before it enters the trench [Section 8.3]. • Prevent the pipeline trench and bedding from becoming a conduit for increased groundwater flow. • Install trench breakers to force groundwater seepage along the pipeline trench to the surface, if springs are encountered along the route. Install subdrains to divert shallow groundwater flow from the right-of-way [Section 8.4]. • Install subdrains in association with trench breakers as directed by Trans Mountain's Engineer where there is evidence of seepage or a flowing spring on a slope once the trench is excavated (see Subdrains Drawing in Appendix R of the Pipeline EPP) [Section 8.4]. • Backfill clay/mineral soil first, if salvaged separately from organic material in shallow peatland areas, to ensure that cross drainage is maintained [Section 8.4].	• Flooding on the up-gradient side of the pipeline may result in creation of wet zones on ground surface. • Reduction of baseflow to local streams.
4.2 Areas where dewatering may be necessary during pipeline construction activities	LSA	• Dewater the trench when laying pipe in areas with high water tables. Place pumps on a tray or within an excavated sump lined with polyethylene sheeting above the ordinary high water level of the watercourse. Pump water onto stable and well vegetated areas, tarpaulins or sheeting at least 50 m from the nearest waterbody in a manner that does not cause erosion or any unfiltered or silted water to re-enter a watercourse [Section 8.3]. See additional dewatering measures in Section 8.3 of the Pipeline EPP. • Use floating suction hose and elevated intake, or other measures approved by Trans Mountain's Environmental Inspector(s), to prevent sediment from being sucked from the bottom of the trench. Secure the pump intake a minimum of 30 cm above the bottom of the trench [Section 8.3].	• Change in natural groundwater levels and stream recharge due to the discharge of groundwater to surface water systems if not practical to discharge trench water to ground.

Notes: 1 LSA = Water Quality and Quantity LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

TABLE A7.1.3-2

PROPOSED PIPELINE AND VEHICLE WATERCROSSING METHODS ALONG THE NARROWED PIPELINE CORRIDOR THROUGH FINN CREEK PROVINCIAL PARK

Watercourse Name	AK	Fish Presence Captured or Observed (Previously Documented)	Sensitivity Rating	Provincial Instream Work Window	Least Biological Risk Window Proposed	Pipeline Crossing Method		Vehicle Crossing Method		Reclamation
						Recommended Primary	Recommended Contingency	Recommended Crossing Method (Flowing)	Recommended Crossing Method (Dry/Frozen)	
Finn Creek	638.8	RB, BT, (CH, CO, SK, RB, BT, MW/CCG, CAS)	High	July 22 – August 15	Open	Isolation with fish salvage and water quality monitoring during low flow	Open-cut with water quality monitoring inside timing window	Clear-span bridge	Clear-span bridge	*Prior to Instream Work* • Identify any instream site-specific features at the crossing proposed and record their location *(e.g.,* root wad, large woody debris, large boulders). Salvage these for use later. *During Instream Work* • Salvage upper coarse-textured substrate material from the channel and banks, and stockpile separately from lower substrate. *At the Completion of Instream Work* • Return the watercourse (or wetland) bed and banks to their preconstruction configuration and alignment. • Cap disturbed area of the channel and banks with salvaged substrate; extend replacement of cobbles and boulders to the ordinary high water level (OHWL) if adequate material is available. • Replace any site-specific features that are important for fishes or other aquatic organisms (*i.e.,* as initially salvaged or as directed by Trans Mountain's Environmental Inspector). • Install the appropriate temporary erosion and sediment control measures, where warranted (*e.g.,* sediment fence, erosion control blanket, coir logs, etc.). • Seed with an appropriate grass mix and/or cover crop species as directed in the Reclamation Management Plan for the Project.
Unnamed Drainage	639.1	None (None)	Low	None	Open	Isolation if water present	Open-cut if dry or frozen to bottom	Ramp and culvert	Snow/icefill or other regulatory approved crossing method	• Adhere to reclamation measures for Finn Creek above. • Salvage dormant riparian vegetation along the trench line (and vehicle crossing locations, where grading is required), keeping roots intact (*i.e.,* with a sufficient soil root-ball). Store salvaged dormant plants and plant material away from construction activities for replacement or installation during reclamation. Replace salvaged dormant riparian plants and plant material (stakes and brush) during reclamation (see Drawing [Shrub Staking and Transplanting] provided in Appendix R). • Install rooted stock shrubs/trees and/or dormant tree/shrub stakes/brush in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate vegetation recovery (see Drawing [Shrub Staking and Transplanting] and [Rooted Stock Selection and Installation] provided in Appendix R of the Pipeline EPP).

7.1.3.2 Significance Evaluation of Potential Residual Effects

Table A7.1.3-3 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Finn Creek Provincial Park on water quality and quantity. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE A7.1.3-3

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WATER QUALITY AND QUANTITY FOR FINN CREEK PROVINCIAL PARK

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1	Water Quality and Quantity Indicator – Surface Water Quality									
1(a)	Reduction in surface water quality due to suspended sediment during instream activities during construction and site-specific maintenance activities.	Negative	LSA	Immediate to short-term	Isolated to occasional	Immediate	Low	High	High	Not significant
1(b)	Reduction in surface water quality due to erosion from banks and approach slopes.	Negative	LSA	Immediate to short-term	Isolated to occasional	Short to medium-term	Low to medium	Low	High	Not significant
1(c)	Contamination of surface water due to a small spill during construction or site-specific maintenance activities.	Negative	LSA	Immediate	Accidental	Short to medium-term	Low to high	Low	Moderate	Not significant
2	Water Quality and Quantity Indicator – Surface Water Quantity									
2(a)	Localized alteration of natural surface drainage patterns until trench settlement is complete.	Negative	LSA	Short-term	Isolated to occasional	Short to medium-term	Low	High	High	Not significant
2(b)	Disruption and alteration of natural stream flow from instream activities.	Negative	LSA	Immediate to short-term	Isolated to occasional	Short to medium-term	Low to medium	High	High	Not significant
3	Water Quality and Quantity Indicator – Groundwater Quality									
3(a)	Contamination of groundwater as a result of a spill.	Negative	LSA	Immediate	Accidental	Short to medium-term	Low to high	Low	Moderate	Not significant
4	Water Quality and Quantity Indicator – Groundwater Quantity									
4(a)	Flooding on the up-gradient side of the pipeline may result in the creation of wet zones on ground surface.	Negative	LSA	Short-term	Periodic	Short-term	Low	Low	Moderate	Not significant
4(b)	Reduction of base flow to local streams.	Negative	LSA	Short-term	Periodic	Short-term	Low	Low	Moderate	Not significant
4(c)	Change in natural groundwater levels and stream recharge due to the discharge of groundwater to surface water systems if not practical to discharge trench water to ground.	Negative	LSA	Short-term	Isolated	Short-term	Low	Low	Moderate	Not significant

Notes: 1 LSA = Water Quality and Quantity LSA.
2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Water Quality and Quantity Indicator – Surface Water Quality

Instream Construction

Sediment runoff and increased turbidity/total suspended solids (TSS) from pipeline construction was noted as a concern during many of the stakeholder engagement events for the Project, including the Parks Workshop in Clearwater in April 2014 and the Clearwater Community Workshop in June 2013. The selection of appropriate watercourse crossing techniques designed to meet federal and provincial regulatory requirements, as well as implementation of erosion controls on the approaches to the watercourse crossing and riparian revegetation, are likely to substantially reduce the potential for adverse effects on surface water quality at Finn Creek and the unnamed drainage. During construction of the trenched crossing, a minor and short-term sediment release is expected during installation and removal of the pipeline crossing structures. Trenched crossings are considered to have a negative impact balance since sediment input can temporarily decrease surface water quality.

Turbidity/TSS guidelines have been established for instream activities. At the federal level, DFO (2000) discusses ‘levels of risk’ associated with increases in TSS concentration in watercourses and indicates increases of < 100 mg/L above background present low risk to fish and their habitat, while an increase of 100-200 mg/L presents a moderate risk. An excess of 400 mg/L was an unacceptable risk, but duration of exposure also needs to be taken into account (also see Birtwell 1999). The CCME guideline value for protection of aquatic life from short-term (24 hour) exposure is no more than 25 mg/L above existing levels (CCME 2007). Aquatic resources are protected by ensuring that concentration of TSS does not exceed CCME (2007) guidelines. BC guidelines specify that induced turbidity may not exceed background by more than 8 nephelometric turbidity units (NTU) during any 24 hour period or by more than 2 NTU when the duration of sediment input is between 24 hours and 30 days. Where flow is naturally turbid, induced turbidity may not exceed background by more than 8 NTU at any time when background is between 8 and 80 NTU, or by 10% at any time when background is greater than 80 NTU (BC MWLAP 2004).

When compared to the open cut technique, isolated crossing techniques reduce the amount of sediment introduced to flowing watercourses. During a completely isolated crossing by dam and pump or flume, a minor sediment release is expected during installation of the dams prior to the isolation and during removal of the downstream dam at the conclusion of the isolation. Recent evidence demonstrates that smaller watercourses that lack substantial subsurface flow can be readily isolated with minimal sediment introduction when proper design, construction and mitigation measures are applied (CAPP *et al*. 2012, Reid *et al.* 2002). Consequently, it is anticipated that average TSS levels during instream construction at Finn Creek will be below turbidity/TSS guidelines.

Open cut crossings are typically only utilized when a watercourse is dry or frozen to the bottom at the time of construction. Under these conditions, sediment release is not expected to occur, however, in the event the recommended isolated crossing technique is not feasible at Finn Creek, an open cut or partial isolation technique may be required. Monitoring will be conducted under flowing conditions to document downstream turbidity and any exceedances of the relevant guidelines will be reported to the appropriate regulatory authorities.

Partial isolation techniques by coffer dams or partial bypass may release more sediment than a completely isolated crossing, but are more effective than unrestricted open cut crossings in reducing instream sediment loads. For example, at one watercourse crossing during construction of the TMX Anchor Loop Project, upstream pumps were used to redirect a portion of the clean flows around the crossing site, thereby reducing the amount of sediment introduced into the watercourse (TERA 2009a).

Measures in Table A7.1.3-1 and the Pipeline EPP, including continual monitoring of sediment release (*i.e.,* turbidity and TSS), will be implemented during crossing design and construction to reduce the magnitude and duration of the sediment pulse.

Minor releases of sediment may be associated with use of a temporary vehicle crossing (*i.e.,* clear-span bridge) at Finn Creek, if required. However, given the recommended mitigation measures, elevated suspended sediment concentrations will be minimal and since pulses of suspended solids are generally expected to settle out of the water column within the zone of influence (ZOI) in a timeframe measuring from minutes to a few hours (*i.e.,* less than CCME’s short-term guideline of 24 hours). Water quality monitoring will be used when activities occur that have the potential to cause events that may exceed the guidelines. Any exceedances of the relevant guidelines will be reported to the appropriate regulatory authorities.

Given that suspended sediments are expected to settle out of the water column within the ZOI in a timeframe measuring from minutes to a few hours (*i.e.,* less than CCME’s short-term guideline of 24 hours), residual effects on the surface water quality indicator during the trench crossing and temporary vehicle crossing, if required, are reversible in the immediate-term and of low magnitude (Table A7.1.3-3, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – suspended sediments released during construction activities will be carried downstream until they disperse and/or naturally settle out within the predicted ZOI.
- Duration: immediate to short-term – the events causing the release of suspended sediments into surface water are instream construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.
- Frequency: isolated to occasional – the events causing the release of suspended sediments into Finn Creek (*i.e.,* pipeline construction and maintenance activities) occur during construction and, for operations activities, intermittently and sporadically over the assessment period.
- Reversibility: immediate – an increase in suspended sediments is confined to a specific period not exceeding 24 hours after construction.
- Magnitude: low – an increase in suspended sediments is anticipated for a short timeframe and anticipated to be within CCME guidelines given the implementation of mitigation measures to reduce sedimentation.
- Probability: high – a trenched crossing method is recommended during potentially flowing conditions at the time of pipeline construction through Finn Creek.
- Confidence: high – based on available research literature, data pertinent to previous crossings along the existing TMPL right-of-way and the professional experience of the assessment team.

Erosion from Approach Slopes and Banks

Following grading, it is possible for some erosion to occur on approach slopes and banks and cause sediment to enter the watercourse. The impact balance of this potential residual effect is considered negative since sediment input could decrease surface water quality.

The long-term conservation concern of protecting riparian habitat within the park will be supported through proper reclamation and post-construction monitoring. Mitigation measures will be identified on a site-specific basis and may include, for example: installation of temporary erosion control structures (*e.g.,* sediment fences); restoration to stabilize the banks (*e.g.,* soil wraps, brush layers, willow plantings and matting); seeding the disturbed banks and approaches with the appropriate cover crop species and native grass mix; installation of coir or other biodegradable erosion control fabric on the banks of the watercourse; installation of live dormant willow stakes or salvaged willow/shrub transplants or commercially grown rooted stock plugs in the banks of the watercourse; and monitoring to assess the success of construction and reclamation mitigation measures and implementation remedial measures, where warranted.

Proposed mitigation measures are expected to reduce the magnitude of erosion from approach slopes and banks on the surface water quality indicator to low to medium levels. This residual effect is reversible in the short to medium-term (Table A7.1.3-3, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – any sedimentation caused by erosion will be carried downstream until it disperses and/or naturally settles out within the predicted ZOI.
- Duration: immediate to short-term – the events causing the erosion and sedimentation of surface water are instream construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited any one year during the operations phase.
- Frequency: isolated to occasional – the events resulting in sedimentation caused by erosion of approach slopes and banks (*i.e.,* pipeline construction and operations activities [*e.g.,* integrity digs]) occur intermittently and sporadically in the event the crossing is unstable until mitigated.

- Reversibility: short to medium-term – vegetation may be re-established within one year of construction on gentle banks and approach slopes while revegetation of steeper approach slopes and banks may take longer than one growing season.
- Magnitude: low to medium – depending upon the amount of erosion that occurs.
- Probability: low – proven and effective industry standard mitigation measures are expected to control erosion on slopes and banks and prevent sediment from entering the watercourse.
- Confidence: high – based on data pertinent to the proposed crossing location at Finn Creek and the professional experience of the assessment team.

Contamination of Surface Water Due to Small Spills

A spill during construction or site-specific maintenance activities could cause contamination of the surface water and would be considered to have a negative impact balance, however, with proper implementation of industry and government recommended mitigation measures, the effects can be limited. For example, during the construction of the TMX Anchor Loop Project, all fuel trucks, service trucks and pick-ups with box-mounted fuel tanks were required to carry spill prevention, containment and clean up materials. Furthermore, all hazardous material storage and oil changes, refuelling, and lubrication of industrial equipment were required to occur more than 100 m from a waterbody or watercourse except where secondary containment was provided. Spills or accidental release of potentially harmful materials (*i.e.,* oil or diesel fuel) were recorded. The Spill Contingency Plan was implemented on each spot spill and all spills were cleaned up as soon as they were discovered. During the TMX Anchor Loop Project, all spills were terrestrial, and no spills or leaks occurred in, or reached, a waterbody or watercourse (TERA 2009a).

Similar spill prevention mitigation is planned for the Project and spill prevention measures outlined in Table A7.1.3-1 and the Pipeline EPP will be followed. Fuel storage and handling practices will be monitored throughout construction of the Project to reduce spill risk. Should a leak be spotted or detected during construction of the pipeline, Trans Mountain will implement the Spill Contingency Plan. Depending on the nature and volume of a spill, the magnitude of change to water quality could vary from low to high. This residual effect is reversible in the short to medium-term and is of low probability (Table A7.1.3-3, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – a spill during construction or site-specific maintenance activities may extend beyond the narrowed pipeline corridor and evidence suggests that effect of most minor spills is localized.
- Duration: immediate – the event causing a potential reduction in surface water quality is a spill, the period of which is less than or equal to 2 days.
- Frequency: accidental – a spill into surface water occurs rarely over the assessment period.
- Reversibility: short to medium-term – the effects of a spill are not expected to last beyond one year, but may last longer depending on seasonal conditions and the extent and source of the spill.
- Magnitude: low to high – depending upon the volume, location and contaminant released.
- Probability: low – due to mitigation measures in place to reduce the potential for spills reaching Finn Creek and affecting surface water quality.
- Confidence: moderate – spill location and effects of accidental spills cannot be accurately predicted.

Water Quality and Quantity Indicator – Surface Water Quantity

Alteration of Natural Drainage Patterns

With proper implementation of the industry-accepted standard mitigation practices that are proposed, disruption of surface flow patterns following construction or maintenance activities is expected to be minor through Finn Creek Provincial Park. By paralleling the existing TMPL right-of-way and narrowing the construction right-of-way to the extent feasible through the park, effects to natural drainage patterns will be further reduced in support of the management objective to maintain the natural qualities and conditions of the park. Nevertheless, construction activities may contribute to some localized alteration of natural surface drainage patterns until trench settlement is complete. The impact balance of this potential residual effect is considered negative since it could alter or disrupt natural above ground hydrologic conditions within the park.

In the event that construction or maintenance activities result in changes in surface water regimes, corrective action, in consultation with the appropriate regulatory authorities, will be implemented to resolve the issue. The PCEM program will identify any locations in the park with altered drainage patterns (*e.g.,* ponded water) and remedial work will be conducted, where warranted. Consequently, the residual effect is reversible in the short to medium-term. Some minor incidents (*e.g.,* ponding, minor flooding, erosion) are expected following construction and are considered to be within environmental standards, and therefore, of low magnitude (Table A7.1.3-3, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – although alteration of natural drainage patterns is generally confined to the disturbed portion of the construction right-of-way, potential changes in hydrology may extend beyond the pipeline right-of-way.
- Duration: short-term – the events causing alteration of natural drainage are pipeline construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year of the operations phase.
- Frequency: isolated to occasional – the events causing alteration of natural drainage (*i.e.,* pipeline construction and maintenance activities) occur during construction and, for operations activities, intermittently and sporadically over the assessment period.
- Reversibility: short to medium-term – it may take more than one year plus adequate precipitation levels in order for the trench crown to settle and natural drainage patterns to be restored.
- Magnitude: low – the potential for minor ponding, flooding or erosion exists until the natural drainage patterns are restored.
- Probability: high – minor trench settlement or a remnant crown are likely to occur as a result of pipeline construction or site-specific maintenance activities and, consequently, are likely to affect natural drainage patterns in localized areas.
- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

Alteration of Stream Flow

Trenched pipeline crossing methods (*i.e.,* isolated or open cut) have the potential to result in alterations of natural stream flow.

Crossing activities may contribute to some localized alteration of watercourse bed and banks until complete and stable restoration is achieved following construction. The impact balance of this potential residual effect is considered negative since it could alter or disrupt hydrologic conditions of the watercourse. However, with proper implementation of the industry-accepted standard mitigation practices that are proposed, alteration of natural stream flow resulting from an isolated or open cut pipeline crossing of Finn Creek is expected to be minor.

In the event that construction or maintenance activities result in alterations to watercourse hydrology, corrective action, in consultation with the appropriate regulatory authorities, will be conducted to resolve the issue. The PCEM program will identify locations of altered stream flow (*e.g.,* damaged bed and banks) and remedial work will be conducted. Consequently, the residual effect is reversible in the short to medium-term. Generally, the residual effect of altered bed and banks is considered to be within environmental standards for pipeline construction and, therefore, is of low to medium magnitude (Table A7.1.3-3, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – although alteration of natural stream flow is generally confined to the disturbed portion of watercourse bed and banks, potential changes in watercourse hydrology may extend beyond the pipeline right-of-way.
- Duration: immediate to short-term – the events causing alteration of natural stream flow are pipeline construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year of the operations phase.
- Frequency: isolated to occasional – the events causing alteration of natural stream flow (*i.e.,* pipeline construction and maintenance activities) occur during construction and, for operations activities, intermittently and sporadically over the assessment period.
- Reversibility: short to medium-term – it may take more than one year to fully restore and stabilize watercourse channel and associated flow conditions.
- Magnitude: low to medium – the potential for changes to stream flow exists but experience with past projects demonstrates that proper design and remedial work will reduce effect magnitude.
- Probability: high – alteration of bed and banks from an isolated or open cut crossing of Finn Creek will result from pipeline construction or site-specific maintenance activities and, consequently, alteration of natural stream flow is likely to occur.
- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

Water Quality and Quantity Indicator – Groundwater Quality

Contamination of Groundwater as a Result of a Spill During Construction

Contamination of groundwater may result if the spilled material migrates through the developed soil near the surface through the surficial materials into the first water-bearing unit. The rate of migration is dependent upon the permeability of the materials, presence or absence of fractures, the properties of the spilled contaminant (density, viscosity) and the vertical hydraulic gradients. A spill during the construction phase of the Project is likely to be noted quickly and be of small volume, and evidence suggests that the effects of most minor spills are localized.

The impact balance of this residual effect is considered negative since this could potentially affect groundwater quality. This residual effect is unlikely to extend beyond the Water Quality and Quantity LSA; it is considered to represent a short to long-term influence on the natural groundwater and surface water systems depending upon the volume of the spill, and the properties of the groundwater and overlying material. Spills where the spilled material contaminates groundwater within the Water Quality and Quantity LSA may occur accidentally over the construction phase of the Project (Table A7.1.3-3, point 3[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – a spill during construction activities may extend beyond the narrowed pipeline corridor but based on professional experience the effects of most minor spills are localized.
- Duration: immediate – the event causing potential contamination of groundwater is a spill, the period of which is less than one day.
- Frequency: accidental – a spill into groundwater during construction is rare.
- Reversibility: short to medium-term – the effects of a spill are not expected to last beyond one year, but may last longer depending upon the extent and source of the spill.
- Magnitude: low to high – depending upon the volume, location and contaminant released.

- Probability: low – due to mitigation measures in place to reduce the potential for spills migrating into the subsurface and affecting groundwater quality.
- Confidence: moderate – spill location and effects of accidental spills cannot be accurately predicted.

Water Quality and Quantity Indicator – Groundwater Quantity

Flooding on the Up-Gradient Side of the Pipeline May Result in Creation of Wet Zones on Ground Surface

A reduction in the permeability of materials along the groundwater flow path may result in a rise in the groundwater table to the extent that ground to surface flooding occurs. This may occur if the trench spoil is not backfilled in the correct order or soils are not properly salvaged resulting in a change in permeability of the upper trench materials and blocking of near surface groundwater flows. The impact balance of this residual effect is considered negative since this could potentially affect recharge to Finn Creek and create permanently wet areas. This residual effect is considered to have a short-term influence on the natural groundwater and surface water systems as long as mitigation measures are applied (Table A7.1.3-3, point 4[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge away from the Footprint could affect an area within the LSA.
- Duration: short-term – the events causing the potential alteration of groundwater flow are construction of the pipeline and maintenance activities, the latter of which are limited to any one year during operations.
- Frequency: periodic – the events causing alteration of natural groundwater flow (*i.e.,* pipeline construction and maintenance activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: short-term – the effects of pipeline trench construction are not expected to last beyond one year once the trench has been backfilled as long as mitigation measures are applied.
- Magnitude: low – the potential for changes to groundwater flow exists but professional experience demonstrates that proper design and remedial work will reduce the effect.
- Probability: low – the proper construction of the pipeline trench and native backfill will reduce the occurrence of this effect.
- Confidence: moderate – based on previous experience and on data pertinent to the Project area.

Reduction of Base Flow to Local Streams

Dewatering of the pipeline trench during construction may result in lowering of the local water table which in the case of local waterbodies may reduce the groundwater inflow (base flow) to Finn Creek. The impact balance of this residual effect is considered negative due to the potential decrease of groundwater flow into Finn Creek. This residual effect likely will not extend beyond the Water Quality and Quantity LSA to the watershed level, and it is considered to represent a low magnitude, short-term influence on the natural groundwater and surface water systems (Table A7.1.3-3, point 4[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge away from the Footprint could affect an area within the LSA.
- Duration: short-term – the events causing the reduction in baseflow are the result of discharge during dewatering and occur while the trench is being constructed (either for pipeline installation or for pipeline daylighting during integrity digs).

- Frequency: periodic – the events causing alteration of natural groundwater flow (*i.e.,* pipeline construction and maintenance activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: short-term – the effects of pipeline trench construction are not expected to last beyond one year once the trench has been backfilled.
- Magnitude: low – the potential for changes to groundwater flow exists but professional experience demonstrates that proper design and remedial work will reduce effect magnitude.
- Probability: low – the proper construction of the pipeline trench and the use of native backfill will reduce the occurrence of this effect.
- Confidence: moderate – based on previous experience and on data pertinent to the Project area.

Change in Natural Groundwater Levels and Stream Recharge Due to the Discharge of Groundwater to Surface Water Systems if Not Practical to Discharge Trench Water to Ground

Shallow groundwater will be present in the subsurface in many areas along the narrowed pipeline corridor; at Finn Creek, it is likely to occur within the vicinity of the creek crossing. During pipeline construction, it is common practice to dewater the trench to allow the pipe to be laid down in a dry environment. Extracted groundwater from the dewatering operations will be disposed to ground where possible, but in areas where this is not practical, the water may be discharged away from the area, directly into a water body or vegetated area (post-treatment), or stormwater discharge system causing local groundwater levels and flow patterns to be temporarily disrupted. The impact balance of this residual effect is considered negative since this could potentially affect recharge to Finn Creek. This residual effect is confined to the Water Quality and Quantity LSA and is considered to represent a short-term influence on the natural groundwater and surface water systems. Dewatering activities where the extracted groundwater cannot be returned to ground are unlikely to occur given the proposed mitigation measures in Table A7.1.3-1 and in the Pipeline EPP. The residual effects in areas of discharge of collected groundwater are expected to reverse within one year when seasonal precipitation replenishes groundwater levels (Table A7.1.3-3, point 4[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge away from the Footprint could extend to the LSA.
- Duration: short-term – the event causing the discharge of groundwater from the trench is the construction of the pipeline.
- Frequency: isolated – dewatering activities are expected to occur at specific locations/times over the construction phase of the Project.
- Reversibility: short-term – residual effects are expected to reverse within one year once seasonal precipitation recharges groundwater levels.
- Magnitude: low – it is not expected that dewatering activities will noticeably affect groundwater flow patterns given the implementation of mitigation measures.
- Probability: low – it is unlikely that groundwater flow patterns will be affected by dewatering activities given the implementation of proposed mitigation measures.
- Confidence: moderate – available provincial mapping and existing reports are no completed enough to confirm the presence of shallow groundwater but it is likely to exist within the vicinity of the creek crossing.

7.1.3.3 Summary

As identified in Table A7.1.3-3, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on water quality and quantity indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Finn Creek Provincial Park related to water quality and quantity will be not significant.

7.1.4 Air Emissions

This subsection describes the potential Project effects on the air emissions in Finn Creek Provincial Park. The Air Quality RSA consists of a 5 km wide band generally extending from the Footprint (*i.e.,* 2.5 km on both sides of the Footprint); shown in Figure 6.2.2-1 of the Introduction to the Stage 2 Detailed Proposal.

All air quality indicators (Table 6.2.1-1 of Introduction to Stage 2 Detailed Proposal) were considered in this evaluation, however, only primary emissions of CACs was determined to interact with pipeline construction and operations in Finn Creek Provincial Park. Formation of secondary ozone and emissions which have the potential to cause nuisance odours are associated with facilities, and since there are no Project facilities in Finn Creek Provincial Park, these indicators do not interact with pipeline construction and operations.

7.1.4.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on air emissions indicators are listed in Table A7.1.4-1.

A summary of mitigation measures provided in Table A7.1.4-1 was principally developed in accordance with industry accepted best practices and accepted pipeline construction methods for construction-related activities.

TABLE A7.1.4-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON AIR EMISSIONS FOR FINN CREEK PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Air Emissions Indicator – Primary Emissions of CACs and Volatile Organic Compounds (VOCs)			
1.1 Project contribution to emissions	RSA	• Restrict the duration that vehicles and equipment are allowed to sit and idle to less than 1 hour, unless air temperatures are less than 0°C [Section 7.0]. • Ensure equipment is well-maintained during construction to minimize air emissions [Section 7.0]. • Use multi-passenger vehicles for the transportation of crews to and from the job sites, where feasible [Section 7.0].	• Increase in air emissions during construction. • Increase in air emissions during site-specific maintenance and inspection activities.
1.2 Smoke during construction	RSA	• Conduct burning in accordance with burning permit requirements and A Smoke Management Framework for BC, as applicable. Comply with local government bylaws, the *Forest*, *Open Burning Smoke Control Regulation* (BC) and the *Forest Fire Prevention and Suppression Regulation* (BC) when burning slash [Section 7.0]. • Limit smoke production during slash disposal by limiting pile size, reducing fuel moisture content, maintenance of loose burning piles free of soil and by using burning sloops or large capacity shredders [Section 7.1]. • Permit burning only when conditions exist that allow for adequate dispersion of smoke so that high concentrations of smoke do not locally affect human health or wildlife. Avoid burning when temperature inversions are present or predicted [Section 8.1]. • Water down construction sites and access roads, when warranted, as directed by Trans Mountain, to reduce or avoid the potential for dust emissions [Section 8.2].	• Increase in fugitive dust and smoke during construction.

Notes: 1 RSA = Air Quality RSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.4.2 Significance Evaluation of Potential Residual Effects

Table A7.1.4-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Finn Creek Provincial Park on air emissions. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE A7.1.4-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON AIR EMISSIONS FOR FINN CREEK PROVINCIAL PARK

Potential Residual Effects		Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
				Duration	Frequency	Reversibility				
1.	Air Emissions Indicator – Primary Emissions of CACs and VOCs									
1(a)	Increase in air emissions during construction.	Negative	RSA	Short-term	Isolated	Short-term	Medium	High	Moderate	Not significant
1(b)	Increase in air emissions during site-specific inspection and maintenance activities.	Negative	RSA	Short-term	Periodic	Short-term	Low	High	Moderate	Not significant
1(c)	Increase in fugitive dust and smoke during construction.	Negative	RSA	Short-term	Isolated	Short-term	Low	High	Moderate	Not significant

Notes: 1 RSA = Air Quality RSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Air Emissions Indicator – Primary Emissions of Criteria Air Contaminants (CACs) and Volatile Organic Compounds (VOCs)

Increase in Air Emissions During Construction

The primary sources of air emissions during construction will be from fuel combustion while transporting crews to and from the work site and along the narrowed pipeline corridor, as well as from the operation of heavy equipment required for construction. Implementation of accepted pipeline construction methods as outlined in Table A7.1.4-1 is the preferred approach to reducing air emissions from pipeline construction.

The amount of CAC and VOC emissions associated with construction activities will be reduced by using multi-passenger vehicles for the transportation of crews to and from the job sites, to the extent feasible, as well as using well-maintained equipment. The residual effects of increased air emissions during construction are considered to have a negative impact balance, but they are expected to dissipate within the Air Quality RSA. Ambient concentrations of CAC and VOC are expected to be within provincial objectives and standards (BC MOE 2013b) and, therefore, of medium magnitude. Air emissions resulting from construction activities are considered to be reversible in the short-term (Table A7.1.4-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Air Quality RSA – potential increases in air emissions resulting from construction activities will dissipate within the Air Quality RSA.
- Duration: short-term – the event resulting in increased air emissions is construction of the pipeline.
- Frequency: isolated – the event resulting in increases in air emissions (*i.e.,* construction of the pipeline) is confined to a specific period.
- Reversibility: short-term – the residual effects are expected to reverse within less than one year for all contaminants after completion of construction.
- Magnitude: medium – an increase in air emissions will occur and may approach but are not expected to exceed environmental or regulatory standards; the increase will be short-lived and localized to the construction area.
- Probability: high – the equipment and vehicles used for construction will emit air contaminants.

- Confidence: moderate – based on a good understanding of the cause-effect relationship but reliant on vehicle and equipment estimates from previous projects.

Increase in Air Emissions During Site-Specific Inspection and Maintenance Activities

The primary sources of air emissions during operations will be from fuel combustion while transporting crews to and from the narrowed pipeline corridor during site-specific maintenance activities. Aerial patrols along the pipeline segments are unlikely to cause measurable increases of near-surface ambient CAC concentrations above background levels. Furthermore, it was assumed that the current frequency and duration of aerial patrols will be sufficient to serve the pipeline expansion associated with the Project.

The amount of air emissions associated with site-specific maintenance activities will be reduced by using multi-passenger vehicles for the transportation of crews to and from the job sites, to the extent feasible, as well as using well-maintained equipment. The residual effects of increased air emissions during site-specific maintenance activities are considered to have a negative impact balance. However, they are expected to dissipate within the Air Quality RSA and be well within provincial objectives and standards (BC MOE 2013b) and, therefore, will be of low magnitude. Air emissions resulting from site-specific inspections and maintenance activities are considered to be reversible in the short-term (Table A7.1.4-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Air Quality RSA – potential increases in air emissions resulting from site-specific maintenance activities (*e.g.,* vegetation management, integrity digs) will dissipate within the Air Quality RSA.
- Duration: short-term – the events resulting in increases in air emissions, are individual maintenance activities (*e.g.,* vegetation management, integrity digs) and each maintenance event will be completed within one year.
- Frequency: periodic – maintenance and operations-related activities (*e.g.,* vegetation management, integrity digs) will occur intermittently but repeatedly over the assessment period.
- Reversibility: short-term – the residual effects are expected to reverse within less than one year for all contaminants after completion of individual maintenance activities.
- Magnitude: low – periodic increases in air emissions during site-specific maintenance will be detectable but within normal variability of existing conditions with the implementation of proposed mitigation measures.
- Probability: high – the equipment and vehicles used for site-specific activities (*e.g.,* vegetation management, integrity digs) will emit air contaminants.
- Confidence: moderate – based on a good understanding of the cause-effect relationship and from current pipeline operations in the same regions, however, detailed information on equipment and vehicle usage for site-specific activities and the duration and frequency of future aerial patrol are not available.

Increase in Fugitive Dust and Smoke During Construction

Emissions of particulate matter related to earth moving activities and use of heavy equipment during pipeline construction are expected to be greater than particulate matter emissions during pipeline operation. Fugitive dust from equipment travelling on disturbed soil can be a major dust contributor during dry periods. Implementing accepted pipeline construction methods as outlined in Table A7.1.4-1 is the preferred approach to reducing air emissions from pipeline construction.

The impact balance of this potential residual effect is considered to be negative since dust could reduce air quality. However, given the short period of construction within Finn Creek Provincial Park and with the implementation of the recommended mitigation measures provided in Table A7.1.4-1, dust during construction will be reduced; therefore, the magnitude is rated as low (Table A7.1.4-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

Smoke will be associated with the burning of slash along discrete segments of the narrowed pipeline corridor. In accordance with applicable provincial legislation pertaining to mulching depth requirements, not all non-merchantable timber can be disposed of by mechanical means; therefore, slash burning is required. Since the maximum depth of mulch will not exceed 5 cm or will be in accordance with the applicable provincial legislation, whichever is less, any remaining vegetation and non-salvageable timber not retained for rollback will be burned. The impact balance of this potential residual effect is considered to be negative since smoke could reduce local air quality. This residual effect is reversible immediately or in the short-term after cessation of burning, depending on the size of the slash piles and conditions during burning, and of medium magnitude given the anticipated volume of slash along the narrowed pipeline corridor.

Larger particles of smoke will settle out via gravitational settling within a relatively short timeframe at any given location, while finer particles might remain suspended for more than 2 days. Therefore, this residual effect is reversible in the short-term. With the implementation of the recommended mitigation measures provided in Table A7.1.4-1, smoke during construction will be reduced and, therefore, the magnitude is rated as low (Table A7.1.4-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Air Quality RSA – potential increases in fugitive dust and smoke resulting from construction may extend beyond the Footprint and into the Air Quality RSA.
- Duration: short-term – the event resulting in increases in fugitive dust and smoke is construction of the pipeline.
- Frequency: isolated – the event resulting in increases in fugitive dust and smoke (*i.e.,* construction of the pipeline) is confined to a specific period.
- Reversibility: short-term – the effects are expected to reverse within several days once construction or the maintenance activity is complete.
- Magnitude: low – a small volume of slash along the narrowed pipeline corridor with Finn Creek Provincial Park is expected, and the mitigation measures provided in Table A7.1.4-1 will reduce dust and smoke during construction.
- Probability: high – disposal of slash by burning is planned.
- Confidence: moderate – based on the professional experience of the assessment team.

7.1.4.3 Summary

As identified in Table A7.1.4-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on air emissions indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Finn Creek Provincial Park related to air emissions will be not significant.

7.1.5 Acoustic Environment

This subsection describes the potential Project effects on the acoustic environment in Finn Creek Provincial Park. The Acoustic Environment LSA consists of a 1.5 km band on both sides of the proposed pipeline corridor (*i.e.,* for a total width of 3.15 km).

All acoustic environment indicators (Table 6.2.1-1 of Introduction to Stage 2 Detailed Proposal) were considered in this evaluation, however, only sound levels was determined to interact with pipeline construction and operations in Finn Creek Provincial Park. There is no blasting proposed for Finn Creek Provincial Park and, therefore, the vibrations indicator is not anticipated to interact with pipeline construction.

7.1.5.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on acoustic environment indicators are listed in Table A7.1.5-1.

A summary of mitigation measures provided in Table A7.1.5-1 was principally developed in accordance with industry accepted best practices and accepted pipeline construction methods for construction-related activities.

TABLE A7.1.5-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON ACOUSTIC ENVIRONMENT FOR FINN CREEK PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Acoustic Environment Indicator – Sound levels			
1.1 Changes in sound levels during construction	LSA	• Adhere to all federal (*i.e.*, Environment Canada, *Motor Vehicle Safety Act*, *Oil and Gas Occupational Safety and Health Regulations*, Health Canada) and provincial (*i.e.*, BC *Noise Control Guideline Best Practices Guideline*, *Worker's Compensation Act*, section 7.2 of the *Occupational Health and Safety Regulations* [BC Reg 296/97 as amended] Section 7.2 [BC Reg. 382/2004, s.1]) guidelines and regulations and legislation for noise management [Section 7.0]. • Schedule intermittent noise producing events to avoid, where feasible, important habitat of wildlife species at risk/sensitive species during sensitive periods, where feasible [Section 7.0]. • Enforce vehicle speed limits and inform contractor truck drivers and equipment operators that engine retarder braking in urban areas is prohibited [Section 7.0]. • Maintain equipment in good working condition and in accordance with manufacturer guidelines [Section 7.0]. • Maintain noise suppression equipment on all construction machinery and vehicles in good order [Section 7.0]. • Use only the size and power of tools necessary limit noise from power tool operations. Locate stationary equipment, such as compressors and generators located away from noise receptors, to the extent feasible, and follow applicable municipal, provincial and federal guidelines [Section 7.0].	• Increase in sound levels during construction period.
1.2 Changes in sound level during operation	LSA	• Limit helicopter inspections to weekdays only to the extent practical. • Use of off-road vehicles for inspection should be limited to weekdays if feasible. • Maintain equipment in good working condition and in accordance with manufacturer guidelines. • Maintain noise suppression equipment on all construction machinery and vehicles in good order.	• Periodic noise events due to maintenance and inspections.

Notes: 1 LSA = Acoustic Environment LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.5.2 Significance Evaluation of Potential Residual Effects

Table A7.1.5-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline on the acoustic environment. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE A7.1.5-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON ACOUSTIC ENVIRONMENT FOR FINN CREEK PROVINCIAL PARK

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
				Duration	Frequency	Reversibility				
1.	Acoustic Environment Indicator – Sound Levels									
1(a)	Increase in sound levels during construction period.	Negative	LSA	Short-term	Isolated	Short-term	Low	High	High	Not significant
1(b)	Periodic noise events due to maintenance and inspections.	Negative	LSA	Short-term	Periodic	Immediate to short-term	Negligible to medium	High	Moderate	Not significant

Notes: 1 LSA = Acoustic Environment LSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Acoustic Environment Indicator – Sound levels

Increase in Sound Levels During Construction

Noise arising from construction and clearing activities will occur along the narrowed pipeline corridor in Finn Creek Provincial Park and this residual effect is considered to have a negative impact balance. Clearing and construction has been scheduled between Q2 2017 to Q4 2017, however, construction will be conducted as expeditiously as practical in order to avoid the caribou range (November 1 to January 15). Clearing activities will also avoid the migratory bird breeding and nesting period.

As described in Section 2.0, construction is expected to last for approximately 14 days along the narrowed pipeline corridor in Finn Creek Provincial Park. In addition, construction equipment and vehicles will be equipped with noise abatement equipment (*e.g.,* mufflers). There may be some situations where after hours noise such as generators or pumps may be used. A summary of the rationale for all of the significance criteria is provided below (Table A7.1.5-2, point 1[a]).

- Spatial Boundary: Acoustic Environment LSA – noise resulting from construction activities may transmit beyond the construction right-of-way;
- Duration: short-term – the events causing changes in sound levels will occur only during the construction phase.
- Frequency: isolated – the event causing changes in sound levels will occur only during the construction phase.
- Reversibility: short-term - the period over which the change in sound level extends is the construction period. However, along the narrowed pipeline corridor, all sound level changes will cease when construction activities have finished.
- Magnitude: low – the increased nuisance noise may affect recreational users.
- Probability: high – heavy machinery and other construction equipment required for construction will produce noise above baseline conditions while in use.
- Confidence: high – based on the professional experience of the assessment team.

Periodic Noise Events Due to Maintenance and Inspection

Noise from pipeline operations is limited to regular aerial and ground patrols, vegetation management and integrity digs. Sounds would be similar to those already heard in areas where the narrowed pipeline corridor is adjacent to the existing TMPL right-of-way. Similar to noise during construction, noise resulting from periodic site-specific maintenance will be limited to the same receptors in close proximity to the narrowed pipeline corridor.

The spatial extent of the change in sound levels is limited to the Acoustic Environment LSA. Since maintenance activities are typically completed at any given location within a few minutes to hours (aerial patrols, vegetation management) or within several weeks (*e.g.,* integrity digs), the duration of the maintenance and inspection activities is short-term. The frequency of maintenance activities occur intermittently but repeatedly over the assessment period and, therefore, are considered to be periodic. The effect is reversible in the immediate to short-term as sound level changes due to maintenance activity will cease as soon as the maintenance activity stops.

While aerial patrols or vegetation management during operations may cause momentary sound levels to increase, the day and night average levels are not expected to change due to such short duration events. Although integrity digs may extend over several weeks, the amount and size of the equipment used during this activity is generally smaller than that used during pipeline construction. Nevertheless, the magnitude of the change in sound level during operations of the pipeline is considered to be of negligible magnitude for most operational activities with the exception of integrity digs near residents which may be of medium magnitude. The inspections and maintenance are essential to safe pipeline operations so the probability of occurrence is rated as high. A summary of the rationale for all of the significance criteria is provided below (Table A7.1.5-2, point 1[b]).

- Spatial Boundary: Acoustic Environment LSA – the change in sound level during operations is confined to the Acoustic Environment LSA.
- Duration: short-term – the events causing changes in sound levels during operations (*i.e.,* maintenance activities) are completed within any one year during operations.
- Frequency: periodic – the events causing changes in sound levels during operations (*i.e.,* aerial patrols, vegetation management, integrity digs) occur intermittently but repeatedly over the assessment period.
- Reversibility: immediate to short-term – the changes in sound level associated with maintenance activities at any given location range from a few minutes to hours for aerial patrols and vegetation management (immediate) to a few weeks for integrity digs (short-term). All sound level changes are reversible as the sound will cease when the inspection/maintenance is finished.
- Magnitude: negligible to medium – the sound level events associated with aerial patrols and vegetation management will have a short timeline, so changes to the day or night average levels are not expected. However, integrity digs that occur near residents may result in sound level changes that could affect day or night average levels.
- Probability: high – changes to sound levels will occur since inspections and maintenance are essential to safe pipeline operation.
- Confidence: high – based on the professional experience of the assessment team.

7.1.5.3 Summary

As identified in Table A7.1.5-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on the acoustic environment indicator of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Finn Creek Provincial Park related to acoustic environment will be not significant.

7.1.6 Fish and Fish Habitat

This subsection describes the potential Project effects on the fish and fish habitat in Finn Creek Provincial Park. The Fish and Fish Habitat LSA consists of the area extending 100 m upstream from the centre of the proposed pipeline corridor to a minimum of 300 m downstream from the centre of the proposed pipeline corridor at defined watercourses. The Fish and Fish Habitat LSA also includes the area of riparian vegetation to a width of 30 m back from each bank edge within the width of the construction right-of-way. The Aquatics RSA includes all watersheds directly affected by the Project; shown in Figure 6.2.2-1 of the Introduction to the Stage 2 Detailed Proposal.

Fish and fish habitat indicators (*i.e.,* riparian habitat, instream habitat and fish mortality or injury) (Table 6.2.1-1 of Introduction to Stage 2 Detailed Proposal) were considered in this evaluation; each of which were determined to interact with pipeline construction and operations in Finn Creek Provincial Park. Fish and fish habitat species indicators (*i.e.,* bull trout, coho salmon, Chinook salmon and rainbow trout) found within Finn Creek Provincial Park were also considered in this evaluation and are discussed in Section 7.1.6.2 Effects to Fish Species of Concern.

7.1.6.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on fish and fish habitat indicators are listed in Table A7.1.6-1.

A summary of mitigation measures provided in Table A7.1.6-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines including BC MWLAP (2004), CAPP (2004), CAPP *et al.* (2012), and DFO (1995, 2013a, 2014).

TABLE A7.1.6-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON FISH AND FISH HABITAT FOR FINN CREEK PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Fish and Fish Habitat Indicator – Riparian Habitat			
1.1 Riparian habitat loss or alteration during construction	Footprint	• Seed riparian areas with an approved annual or perennial grass cover crop or native grass mix as soon as feasible after construction. Install temporary erosion control measures such as temporary berms, sediment fences, mounds or cross ditches within 24 hours of backfilling banks and approach slopes of water crossings at any location where runoff from the construction right-of-way may flow into Finn Creek or the unnamed drainage in Finn Creek Provincial Park [Section 8.6]. • Seed disturbed areas on the banks and approaches as soon as practical with an approved grass cover crop species or native grass seed mix and implement sediment control measures to stabilize the banks of Finn Creek and the unnamed drainage and prevent sedimentation of these watercourses, respectively [Section 8.7]. • Maintain sediment fences or equivalent sediment control structure in place at the base of approach slopes until revegetation of the construction right-of-way is complete. • Install mounds on contours in riparian areas, to reduce erosion and to enhance woody vegetation establishment [Section 8.6]. • Install rollback on the construction right-of-way within riparian areas to prevent erosion and sedimentation into watercourses and provide micro-sites to enhance woody vegetation establishment [Section 8.6].	• Riparian habitat loss or alteration due to construction activities.
1.2 Riparian habitat alteration during maintenance and operation	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• Clearing or disturbance of riparian habitat during maintenance and operation.

TABLE A7.1.6-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.3 Contamination from spills during construction and maintenance	RSA	• Review and adhere to the general mitigation measures provided in Section 7.0 of the Pipeline EPP related to equipment washing, inspection of hydraulic, fuel and lubrication systems of equipment, equipment servicing and refuelling as well as fuel storage in proximity to watercourses crosses by the narrowed pipeline corridor (*i.e.,* Finn Creek and unnamed drainage) in Finn Creek Provincial Park during water crossing construction [Section 8.7]. • Use non-toxic, biodegradable hydraulic fluids in all equipment that will work instream if/when flowing water will be encountered during construction if requested by the Inspector(s) [Section 8.7]. • Do not store fuel, oil or hazardous material within 300 m of a watercourse [Section 7.0]. • Ensure pump intakes are placed in a manner that reduces or avoids disturbance to the streambed and are screened in accordance with the DFO screening requirements, to prevent the entrapment of fish or wildlife (*Freshwater Intake End-of-Pipe Fish Screen Guideline)* [Section 8.5]. • Utilize screen pump intakes with a maximum mesh size of 2.54 mm and with a maximum approach velocity of 0.038 m/s, where fish habitat is present [Section 8.5].	• Contamination of riparian habitat from spills during construction and maintenance.
2. Fish and Fish Habitat Indicator – Instream Habitat			
2.1 Instream habitat alteration	RSA	<u>General</u> • An isolated watercourse crossing method and contingency open-cut method have been selected for Finn Creek, in consideration of the size, environmental sensitivities and the period of construction. • Trans Mountain will work with regulatory authorities to determine the necessary approvals, licenses and permits needed for construction of the pipeline or associated components prior to the commencement of the permitted activity in Finn Creek Provincial Park. The contractor(s), subcontractors and the Inspector(s) will be provided with copies of all approvals/licenses and permits including the most recent updates and revisions, and will comply with all conditions presented to Trans Mountain. Trans Mountain will resolve any inconsistencies between approval/permit conditions and contract documents prior to commencement of the construction activity [Section 3.0]. • Review and adhere to applicable instream timing constraints (least-risk window) and all resource-specific measures outlined in Table A7.1.3-2. • Follow the DFO Self-Assessment Process and applicable Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a, 2014) outlining conditions and measures to avoid serious harm to fish or any permanent alteration to, or destruction of, fish habitat when working in or near Finn Creek [Section 8.7]. • Ensure all necessary equipment, personnel and materials are on-site and ready for installation prior to commencing instream work. Complete all work as quickly as practical to limit the duration of disturbance [Section 8.7]. • Re-establish streambanks and approaches of Finn Creek immediately following construction as outlined in Table A7.1.3-2. <u>Pipeline Crossings</u> • At Finn Creek, conduct an isolated crossing if water is present at the time of construction or an open cut if crossing is dry or frozen to bottom (see Drawing [Watercourse Crossing – Open Cut Method for Dry/Frozen Watercourses] provided in Appendix R of the Pipeline EPP) [Section 8.7] (see Table A7.1.3-2). • Dewater the segment of the watercourse between the dams/diversion channel, if safe to do so. Pump any sediment-laden water out between the dams to well-vegetated lands, away from the watercourse or to settling ponds [Section 8.7]. • Remove any accumulations of sediment within the isolation areas that resulted from crossing construction. Spread all sediment and unused trench spoil removed from the watercourse at a location above the high water mark where the materials will not directly re-enter the watercourse [Section 8.7]. • Ensure that water from flumes, dam and pumps, diversion or other methods does not cause erosion or introduce sediment into the channel. Place rock rip rap, tarpaulins, plywood sheeting or other materials to control erosion at the outlet of pump hoses and flumes. Supplement the erosion control materials to control any erosion [Section 8.7].	• Alteration of instream habitat within the ZOI.

TABLE A7.1.6-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2.1 Instream habitat alteration (cont'd)	See above	Vehicle Crossings • At Finn Creek and the unnamed drainage, install a clear span bridge for vehicle and equipment crossing during construction. Install, use and remove bridges in accordance with the measures identified in the DFO Self-Assessment Process (DFO 2014) [Section 8.7]. • Ensure bridge is clean prior to installation and dispose of soil at an appropriate location [Section 8.7]. • Implement erosion control measures as soon as a disturbance of the vegetation mat occurs [Section 8.7]. • Stabilize and revegetate areas disturbed during installation and removal of a bridge; install erosion control measures, where warranted, to control surface erosion until vegetation is established [Section 8.7].	• See above.
2.2 Contamination from spills during construction	RSA	• Review and adhere to the general mitigation measures in Section 7.0 of the Pipeline EPP related to equipment washing, inspection of hydraulic, fuel and lubrication systems of equipment, equipment servicing and refuelling as well as fuel storage in proximity to watercourses during water crossing construction [Section 8.7]. • Do not store fuel, oil, or hazardous material within 300 m of a watercourse/wetland/lake [Section 7.0]. • Use non-toxic, biodegradable hydraulic fluids in all equipment that will work instream if/when flowing water will be encountered during construction or in wetland and/or lakes if requested by the Inspector(s) [Section 8.7]. • See recommended mitigation measures for potential effect 1.3 of this table.	• Contamination of instream habitat from spills during construction.
3. Fish and Fish Habitat Indicator – Fish Mortality or Injury			
3.1 Fish mortality or injury during construction	RSA	• Determine the presence of any aquatic or riparian plants and pests prior to the commencement of construction activities within the riparian buffer. Notify the contractor of any special measures to be implemented to prevent the transfer of these organisms from one watercourse to another [Section 8.7]. • Follow the DFO Self-Assessment Process and applicable DFO Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a, 2014) and measures outlined Section 8.7 of Pipeline EPP, when working in or near Finn Creek. • Prohibit recreational fishing by Project personnel on or in the vicinity of the construction right-of-way. The use of the construction right-of-way to access fishing sites is prohibited [Section 7.0]. • Ensure all water intakes are screened in accordance with the DFO's *Freshwater End-of-Pipe Fish Screen Guideline*. Ensure the screens are free of debris during pumping [Section 8.7]. • Monitor to assess the immediate effects of crossing construction. Also monitor sediment release (*i.e.,* turbidity and TSS) throughout the crossing construction period, if required [Section 8.7]. • Assign a qualified environmental professional (QEP)to salvage fish with an electrofishing unit from the isolated area prior to and during dewatering and trenching at isolated water crossings in accordance the Fish Collection Permit (see Appendix D) if those permits are determined to be necessary. Note that the application for a Fish Collection Permit is to be submitted 10 working days (minimum) prior to the scheduled isolation of the watercourse. Release all captured fish to areas downstream of the crossing that provide suitable habitat [Section 8.7]. • Clean fish salvage equipment (*e.g.,* waders, boots, nets) of soil, and disinfect with 100 mg/L chlorine bleach before using in any watercourse to prevent the spread of pathogens (*e.g.,* whirling disease) and/or invasive plant species. Ensure that washed off soil is disposed of at a location that will prevent the reintroduction of these untreated materials into Finn Creek [Section 8.7]. • See recommended mitigation measures outlined in potential effects 1.3 and 2.1 of this table.	• Increased fish mortality or injury due to construction activities.
3.2 Fish mortality or injury from spills during construction	RSA	• See recommended mitigation measures outlined in potential effect 3.1 of this table.	• Increased fish mortality or injury from spills during construction activities.

TABLE A7.1.6-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
3.3 Increased suspended sediment concentrations within the ZOI during instream construction	LSA	General • Grade away from watercourses/wetlands to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in watercourses during grading [Section 8.2]. • Ensure temporary berms and/or sediment fence installed following grading (see Section 8.2 of the Pipeline EPP) will adequately control runoff from entering the open trench in the vicinity of water crossings [Section 8.3]. • Install a temporary sediment barrier (*e.g.,* sediment fences), where warranted, to eliminate the flow of sediment from spoil piles and disturbed areas into nearby watercourses (see Drawing [Sediment Fence] provided in Appendix R of the Pipeline EPP) [Section 8.7]. • Inspect temporary sediment control structures (*e.g.,* sediment fences, subsoil berms) installed on approach slopes, on a daily basis throughout crossing construction. Repair the structures before the end of the working day [Section 8.7]. • Ensure all necessary equipment, personnel and materials are on-site and ready for installation prior to commencing instream work. Complete all work as quickly as practical to limit the duration of disturbance [Section 8.7]. • Monitor temporary vehicle crossings (*i.e.,* clear span bridge for Finn Creek and ramp/culvert for unnamed drainage) to ensure that erosion control measures are adequate and stream flow is not disrupted [Section 8.7]. • See additional monitoring measures in Section 8.7 of the Pipeline EPP. • Dewater the segment of the watercourse between the dams, if safe to do so. Pump any sediment-laden water out between the dams to well-vegetated lands, away from the watercourse or to settling ponds [Section 8.7]. • Remove any accumulations of sediment within the isolation areas that resulted from crossing construction. Spread all sediment and unused trench spoil removed from the watercourse at a location above the high water mark where the materials will not directly re-enter the watercourse [Section 8.7]. • Ensure that water from flumes, dam and pumps, diversion or other methods does not cause erosion or introduce sediment into the channel. Place rock rip rap, tarpaulins, plywood sheeting or other materials to control erosion at the outlet of pump hoses and flumes. Supplement the erosion control materials to control any erosion [Section 8.7]. Vehicle Crossings • Implement erosion control measures as soon as a disturbance of the vegetation mat occurs [Section 8.7]. • Stabilize and revegetate areas disturbed during installation and removal of a bridge; install erosion control measures, where warranted, to control surface erosion until vegetation is established [Section 8.7]. • See recommended mitigation measures for potential effect 1.2 outlined in Table A7.1.3-1 Water Quality and Quantity.	• Increased fish mortality or injury due to increased suspended sediment concentrations within the ZOI during instream construction.
3.4 Interbasin transfer of aquatic organisms	RSA	• Determine the presence of any aquatic or riparian plants and pests prior to the commencement of construction activities within the riparian buffer. Notify the contractor of any special measures to be implemented to prevent the transfer of these organisms from one watercourse to another [Section 8.7]. • Ensure that test water withdrawn from one drainage basin is not allowed to enter natural waters of another drainage basin [Section 8.5].	• No residual effect identified.
3.5 Blockage of fish movements	LSA	• Ensure maintenance of downstream flow conditions (*i.e.,* quantity and quality) at all times when constructing an isolated crossing at Finn Creek. If a pump-around method is used to maintain downstream flow, back-up pumping capacity must be onsite and ready to take over pumping immediately if operating pumps fail. Pumps are to be continuously monitored to ensure flow is maintained at all times until the dam materials are removed and normal flow is restored to the channel [Section 8.7]. Vehicle Crossings • Ensure temporary vehicle crossing structures do not disrupt fish passage at Finn Creek and do not interfere with or impede flow or navigation at any location [Section 8.7]. • Construct or install temporary vehicle access across Finn Creek in a manner that follows provincial and federal guidelines [Section 8.7].	• Temporary blockage of fish movements.

TABLE A7.1.6-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
3.6 Effects on fish species of concern	RSA	• Implement applicable measures from the Fish Species of Concern Contingency Plan (see Appendix B of the Pipeline EPP) should fish species of concern be discovered during construction [Section 8.7]. • See recommended mitigation measures outlined in potential effects 3.1 to 3.5 of this table. • See recommended mitigation measures outlined in potential effect 2.2 of this table.	• Fish species of concern may be affected by an increase in suspended sediment concentration, habitat alteration within the ZOI and increased potential for mortality and injury.

Notes: 1 LSA = Fish and Fish Habitat LSA; RSA = Aquatics RSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.6.2 Significance Evaluation of Potential Residual Effects

Table A7.1.6-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the pipeline on fish and fish habitat indicators. The rationale used in the evaluation of significance of each of the residual environmental effects is provided below. An evaluation of significance is not required for those potential effects where no residual effect is identified (*i.e.,* interbasin transfer of aquatic organisms).

TABLE A7.1.6-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON FISH AND FISH HABITAT FOR FINN CREEK PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1 Fish and Fish Habitat Indicator – Riparian Habitat									
1(a) Riparian habitat loss or alteration due to construction activities.	Negative	Footprint	Short-term	Isolated	Medium to long-term	Low	High	High	Not significant
1(b) Clearing or disturbance of riparian habitat during maintenance and operations.	Negative	Footprint	Immediate to short-term	Occasional	Medium to long-term	Low	Low	High	Not significant
1(c) Contamination of riparian habitat from spills during construction and maintenance.	Negative	RSA	Immediate	Accidental	Short to long-term	Low to high	Low	Moderate	Not significant
2. Fish and Fish Habitat Indicator – Instream Habitat									
2(a) Alteration of instream habitat within the ZOI.	Negative	RSA	Short-term	Isolated	Short to medium-term	Low	High	High	Not significant
2(b) Contamination of instream habitat from spills during construction.	Negative	RSA	Immediate	Accidental	Short to medium-term	Low to high	Low	High	Not significant
3. Fish and Fish Habitat Indicator – Fish Mortality and Injury									
3(a) Increased fish mortality or injury due to construction activities.	Negative	RSA	Immediate to short-term	Isolated	Medium-term	Low	Low	High	Not significant
3(b) Increased fish mortality or injury from spills during construction activities.	Negative	RSA	Immediate	Accidental	Short to long-term	Low to high	Low	High	Not significant
3(c) Increased fish mortality or injury due to increased suspended sediment concentrations within the ZOI during instream construction.	Negative	LSA	Immediate to short-term	Isolated	Medium-term	Low to medium	Low	High	Not significant
3(d) Temporary blockage of fish movements.	Negative	LSA	Immediate to short-term	Isolated	Immediate to short-term	Low	Low	High	Not significant

TABLE A7.1.6-2 Cont'd

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
3(e)	Fish species of concern may be affected by an increase in suspended sediment concentration, habitat alteration within the ZOI and increased potential for mortality or injury.	Negative	RSA	Immediate to short-term	Isolated	Short-term	Low	Low	Moderate	Not significant

Notes: 1 LSA = Fish and Fish Habitat LSA; RSA = Aquatics RSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Fish and Fish Habitat Indicator – Riparian Habitat

Riparian Habitat Loss or Alteration Due to Construction Activities

Riparian vegetation within the construction right-of-way and TWS will be disturbed at all trenched (*i.e.,* isolated or open cut) watercourse crossings and watercourses where a temporary vehicle crossing will be installed (*i.e.,* Finn Creek). The impact balance of this residual effect is considered to be negative. During construction, disturbance to riparian vegetation will be kept to a minimum, leaving as much existing riparian vegetation intact as practical and efforts to control erosion and sedimentation in disturbed areas will be implemented. Disturbed riparian areas will be seeded following construction with appropriate native seed mix along with a quick establishing cover crop. Riparian areas of both banks will be re-vegetated with woody plant material to match species found within the park. Grasses are expected to be restored within the growing season following construction, however, canopy restoration will be long-term. Revegetation mitigation measures are presented in the Pipeline EPP.

The maximum potential disturbance would be 2,700 m^2 as a result of pipeline construction if the entire riparian area, to the width of the construction right-of-way and 30 m from the top of the bank was removed at the Finn Creek crossing, however, the actual disturbance to riparian habitat is expected to be less. Clearing of riparian vegetation will only occur within the pipeline easement and TWS will not be cleared within the riparian buffer.

The residual effect of pipeline construction on clearing riparian vegetation, although negative, is considered to be of low magnitude given the implementation of industry standard and provincially and federally recommended mitigation measures and monitoring of revegetation success at water crossings post-construction. The residual effect is considered to be reversible in the medium to long-term, depending on the pre-existing vegetation community (*e.g.,* shrubs regenerate within several years, however, tree regrowth is expected to extend into the long-term) (Table A7.1.6-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – clearing or disturbance of riparian vegetation is confined to the Footprint.
- Duration: short-term – the event causing the alteration of riparian vegetation is construction of the pipeline and temporary vehicle crossings.
- Frequency: isolated – the event causing clearing or disturbance of riparian vegetation (*i.e.,* construction of the pipeline and temporary vehicle crossings) is confined to a specific period.
- Reversibility: medium to long-term – depending upon the pre-existing vegetation community (*e.g.,* grasses, shrubs and/or trees).
- Magnitude: low – based on implementation of mitigation measures, including revegetation, and the results of PCEM programs which demonstrate the effectiveness of the measures proposed.

- Probability: high – alteration of riparian vegetation is expected to occur at both the watercourse crossings and vehicle crossings.
- Confidence: high – based on a good understanding by the assessment team of trenched (isolated) and vehicle crossing methods and associated effects on riparian vegetation.

Clearing or Disturbance of Riparian Habitat During Maintenance and Operations

Routine vegetation control at the proposed crossing along the proposed pipeline right-of-way and during operations will exclude riparian areas. However, a situation may occur during the life of the operating pipeline where riparian vegetation disturbance may be necessary to accommodate maintenance activities (*e.g.,* in the event of a flood event that causes scouring over the pipeline trench that would require measures to restore depth of cover and pipe integrity). The residual effect of clearing riparian habitat during pipeline operations is of low magnitude and reversible in the medium to long-term (Table A7.1.6-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – clearing or disturbance of riparian vegetation is confined to the Footprint.
- Duration: immediate to short-term – the event causing alteration of riparian vegetation during operations is maintenance activities which may take less than 2 days (*i.e.,* immediate) or may take more than 2 days but less than one year (*i.e.,* short-term).
- Frequency: occasional – any maintenance activities required at the watercourse crossing will occur intermittently and sporadically over the assessment period.
- Reversibility: medium to long-term – depending upon the pre-existing vegetation community (*e.g.,* shrubs or trees) and the extent of clearing or alteration of riparian vegetation required for maintenance activities to take place.
- Magnitude: low – based on the implementation of industry standard and provincially and federally recommended mitigation measures during operations phases of the Project and the results of PCEM programs which demonstrate the effectiveness of the measures proposed.
- Probability: low – clearing within the riparian area is not expected to occur during operations.
- Confidence: high – based on the professional experience of the assessment team.

Contamination of Riparian Habitat from Spills During Construction and Maintenance

In the event of a spot spills, or a more serious fuel truck release, the adverse residual effects would, depending on the volume of the spill and the sensitivity of the receiving environment, range from low to high magnitude with potentially long lasting ramifications to riparian vegetation. However, spill contingency and clean up measures would reduce the magnitude and reversibility of the residual effects.

Spills are cleaned up immediately within the construction right-of-way during construction and maintenance activities, and occur even more rarely in riparian habitat, the probability of a significant adverse residual effect is low (Table A7.1.6-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – spills resulting in the contamination of riparian habitat may extend beyond the construction right-of-way and, consequently, beyond the Fish and Fish Habitat LSA.
- Duration: immediate – the event causing contamination is a spill, the period of which is less than or equal to 2 days.
- Frequency: accidental – contamination from spills occurs rarely over the assessment period.
- Reversibility: short to long-term – depending on the nature and volume of the spill as well as the level of sensitivity of the receiving environment and the pre-existing vegetation community (*e.g.,* shrubs or trees).

- Magnitude: low to high – depending on the sensitivity of the receiving environment and volume of the spill.
- Probability: low – based on established mitigation measures to prevent a spill.
- Confidence: moderate – based on the professional experience of the assessment team.

Fish and Fish Habitat Indicator – Instream Habitat

Alteration of Instream Habitat within the Zone of Influence

The pipeline corridor selection criteria included reducing the number of watercourse crossings to the extent practical, crossing watercourses perpendicular to the banks and paralleling an existing right-of-way. The proposed crossing techniques and mitigation measures have taken into consideration the sensitivity of the watercourse, including habitat characteristics, fish species present, and instream work windows, in addition to the construction schedule, and technical and economic feasibility of the crossing. The introduction of fine sediment to watercourses from instream activities, right-of-way runoff and erosion can have sub-lethal (*e.g.,* irritation of gill tissue) or lethal (*e.g.,* suffocation of developing embryos) effects on fish, and can also cause downstream sediment deposition that alters substrate composition and modifies the availability and suitability of habitat for spawning, overwintering and/or rearing (Anderson *et al.* 1996, Newcombe and MacDonald 1991).

Bank stabilization through the application of native seed mixes with quick germinating cover crops, in addition to enhanced revegetation efforts including geotextiles or biostabilization, will be the preferred methods of stabilizing watercourse banks disturbed as a result of pipeline construction.

The implementation of the proposed mitigation measures, in accordance with the DFO Self-Assessment Process and applicable DFO Measures to Avoid Causing Harm to Fish and Fish Habitat will reduce the potential for serious harm to fish or any permanent alteration to, or destruction of, fish habitat as a result of trenched pipeline crossings and temporary vehicle crossings. Nevertheless, a Section 35 Authorization from DFO will be applied for, and fish habitat compensation/offset will be implemented as defined in the Authorization, should serious harm to fish or any permanent alteration to, or destruction of, fish habitat be expected as a result of construction activities. In the event that serious harm to fish or any permanent alteration to, or destruction of, fish habitat is expected and a fish habitat compensation/offset plan is required, the fish habitat compensation/offset plan will be used to ensure compliance with DFO's Fisheries Protection Policy (DFO 2013a).

The maximum area of instream habitat that may be disturbed by construction of the proposed pipeline in Finn Creek Provincial Park is 748 m^2, however, the actual disturbance to instream habitat is expected to be less. Instream habitat may also be disturbed during the construction of vehicle crossings (clear span bridge) however, the disturbed area is anticipated to be minor.

The residual effects of the Project on instream habitat are expected to be of low magnitude and reversible in the short to medium-term for the watercourse crossings encountered in Finn Creek Provincial Park. In addition, with the successful implementation of mitigation proposed the effects will be reduced to low magnitude (Table A7.1.6-2, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – alteration of instream habitat may extend beyond the Fish and Fish Habitat LSA for some activities (*e.g.,* for hydrostatic testing).
- Duration: short-term– the event causing alteration of instream habitat is watercourse crossing construction.
- Frequency: isolated – the event causing alteration of instream habitat is confined to the construction phase.
- Reversibility: short to medium-term – any sediments that result in deposition on the substrate of a watercourse are expected to be flushed from the system following the first annual flushing event after construction and, if any fish habitat compensation/offset measures are implemented, they should be

implemented during construction and/or within the first year following construction of the watercourse crossing.

- Magnitude: low – based on the effectiveness of the proposed mitigation, the anticipated level of effects of the alteration of instream habitat and the implementation of a compensation/offset plan if serious harm to fish or any permanent alteration to, or destruction of, fish habitat is anticipated.
- Probability: high – watercourses (*i.e.,* Finn Creek) with documented fish presence will be crossed using trenched (*i.e.,* isolated or open cut) crossing methods.
- Confidence: high – based on a good understanding by the assessment team of trenched crossing methods and associated effects on instream habitat.

Contamination of Instream Habitat from Spills During Construction

In the event of spot spills, or a more serious fuel truck release in or near a stream, the adverse residual effects could, depending on the volume of the spill and the sensitivity of the receiving environment, be of high magnitude with potentially long lasting ramifications to the health of the watercourse. Such an event has the potential to occur during any activities in or near a watercourse. Although spill contingency and clean up measures would reduce the magnitude and reversibility of the residual effects, such an incident could be considered of high magnitude due to adverse residual effects if it were to occur in a highly sensitive environment, such as Finn Creek.

Since spills rarely occur within the construction right-of-way during construction activities, and occur even more rarely instream, the probability of a significant adverse residual effect is low (Table A7.1.6-2, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatic RSA – spills resulting in the contamination of instream habitat may extend beyond the Footprint and the Fish and Fish Habitat LSA.
- Duration: immediate – the event causing contamination is an accidental spill during construction, the period of which is less than or equal to 2 days.
- Frequency: accidental – contamination from spills occurs rarely, if at all, during the assessment period.
- Reversibility: short to medium-term – depending on the nature and volume of the spill as well as the level of sensitivity of Finn Creek to adverse residual effects resulting from contamination.
- Magnitude: low to high – depending on the sensitivity of the receiving environment and the volume of the spill.
- Probability: low – based on established mitigation measures to prevent a spill.
- Confidence: high – based on the professional experience of the assessment team.

Fish and Fish Habitat Indicator – Fish Mortality and Injury

Increased Fish Mortality or Injury Due to Construction Activities

Some construction activities may lead to an increase in fish mortality or injury. Efforts to remove fish from isolated areas prior to construction may contribute to fish injury and lead to increased fish mortality. Increased sedimentation from construction activities may cause behavioural or sub-lethal/lethal effects to fish and is discussed in the subsection Increased Fish Mortality or Injury Due to Increased Suspended Sediment Concentrations Within the ZOI During Instream Construction.

With the successful implementation of the recommended mitigation measures, the residual effects of construction activities on fish mortality and injury is considered reversible in the medium-term, is of low magnitude based upon the extent, timing and duration of construction activities, and is of low probability (Table A7.1.6-2, point 3[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – fish mortality or injury may result from watercourse crossing construction activities and fish rescue and from construction of the temporary vehicle crossing, which may occur outside the Fish and Fish Habitat LSA.
- Duration: immediate to short-term – the event causing fish mortality or injury is construction of the watercourse crossing which will take less than one year but may take more than 2 days at the Finn Creek crossing location.
- Frequency: isolated – the event causing fish mortality or injury (*i.e.,* construction of the pipeline) is confined to a specific period.
- Reversibility: medium-term – loss of one or more individuals could affect population scale for several years, or until those individuals can be replaced.
- Magnitude: low – based on the implementation of mitigation measures proven to be effective, extent, timing and duration of construction activities, and with appropriate regulatory authorizations, if applicable.
- Probability: low – mitigation measures will be implemented to prevent fish mortality or injury.
- Confidence: high – based on the professional experience of the assessment team.

Increased Fish Mortality or Injury from Spills During Construction Activities

A potential spot spill, or a more serious fuel truck release at Finn Creek during construction activities, could cause behavioural or sub-lethal/lethal effects on fish within the ZOI. A spill, such as a fuel truck rollover in or near a stream, during construction could cause increased fish mortality or injury and would be considered to have a negative impact balance, however, proper spill contingency and clean up measures would reduce the magnitude and increase the reversibility of the residual effects. Depending on the volume of the spill and the sensitivity of the receiving environment, the adverse residual effects could range from low to high magnitude with potentially increased fish mortality or injury.

Since spills rarely occur within the construction right-of-way during construction activities, and occur even more rarely instream, the probability of a significant adverse residual effect is low (Table A7.1.6-2 point 3[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – Depending on the flow conditions of the contaminated water body the effects of a spill could extend beyond the Fish and Fish Habitat LSA.
- Duration: immediate – the event causing increased fish mortality or injury is a spill, the period of which is less than or equal to 2 days.
- Frequency: accidental – fish mortality of injury from spills occurs rarely over the assessment period.
- Reversibility: short to long-term – depending upon the nature and volume of the spill as well as the level of sensitivity of the receiving population.
- Magnitude: low to high – depending on the sensitivity of the receiving indicators and volume of the spill.
- Probability: low – mitigation measures will be implemented to prevent fish mortality or injury.
- Confidence: high – based on the professional experience of the assessment team.

Increased Fish Mortality or Injury Due to Increased Suspended Sediment Concentration Within the ZOI During Instream Construction

Pipeline corridor selection criteria included reducing the number of waterbody crossings, and temporary vehicle crossings, to the extent practical. An evaluation of increased suspended solid concentrations during instream construction is provided in Section 7.1.3 Water Quality and Quantity. Through the selection of appropriate watercourse crossing techniques, vehicle crossing methods and the implementation of surface erosion controls and riparian area revegetation as outlined in Table A7.1.6-1 and in the Pipeline EPP, the potential for adverse effects on aquatic systems in Finn Creek due to suspended solids in the water column is reduced.

Suspended sediment released at isolated crossings during instream activities could cause behavioural or sub-lethal/lethal effects on fish within the ZOI. Suspended sediment concentrations will, be monitored during instream activity to confirm that TSS averages remain below the CCME standard of 25 mg/L above baseline (CCME 2007). This is the level, based on 24 hours exposure, when mortalities of the most sensitive life history stage can begin to occur (Newcombe 1994).

There is a level of risk to aquatic resources as a result of high levels of sediment discharge caused by instream construction activities. The Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2002) are often used to ensure aquatic resources are protected during instream activities. These guidelines indicate that a biologically important average increase in TSS concentration over a short-term period (*i.e.,* 24 h) is 25 mg/L above the background level (CCME 2002). DFO (2000) has identified risk levels to protect aquatic resources. The risk levels are determined based on the relationship between increasing suspended sediment concentrations and the level of risk that increasing sediment concentrations can have on fish and fish habitat. DFO (2000) indicates that concentrations < 25 mg/L, 25-100 mg/L, 100-200 mg/L, 200-400 mg/L and > 400 mg/L have very low, low, moderate, high and unacceptable risk, respectively. Additional background on these risk levels is discussed in Birtwell (1999).

Minor releases of sediment may be associated with the use of temporary vehicle crossings. Although elevated suspended sediment concentrations may result from instream construction and vehicle crossing use, pulses of suspended solids are generally expected to settle out of the water column within the ZOI in a timeframe measuring from minutes to a few hours.

With the implementation of mitigation measures outlined in Table A7.1.6-1 and the Pipeline EPP, the likelihood of fish mortality or injury in Finn Creek arising from suspended sediment during instream construction is low (Table A7.1.6-2, point 3[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Fish and Fish Habitat LSA – Project activities causing an increase in suspended sediment will be limited to the Fish and Fish Habitat LSA associated with Finn Creek.
- Duration: immediate to short-term – the event causing fish mortality or injury due to suspended sediment is instream construction, the period of which is likely to be of short term duration (several days) due to the assumption that flowing water will be present at time of construction.
- Frequency: isolated – the event causing fish mortality or injury is confined to a specific period.
- Reversibility: medium-term – loss of one or more individuals could affect population scale for several years, or until those individuals can be replaced.
- Magnitude: low to medium – based on the implementation of mitigation measures proven to be effective, regulatory authorizations and, where warranted, the implementation of fish habitat compensation/offset.
- Probability: low – mitigation measures will be implemented to prevent fish mortality or injury and are anticipated to be effective.
- Confidence: high – based on available research literature and the professional experience of the assessment team.

Temporary Blockage of Fish Movements

As a result of construction activities using traditional methods to isolate sections of channel, localized blockage of fish movements may occur for the duration of instream construction. The impact balance of this potential residual effect is considered negative since it could affect the ability of fish species to migrate upstream or downstream of the crossings. The use of a diversion channel would remove any potential barrier to fish movements.

The mitigation measures outlined in Table A7.1.6-1 and the Pipeline EPP will reduce the potential for blockage of fish movements by instream construction. The residual effect of the blockage of fish movements is considered to be reversible in the immediate to short-term and well within environmental standards and, consequently, of low magnitude (Table A7.1-6.2, point 3[d]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Fish and Fish Habitat LSA – blockage of fish movements may extend immediately upstream and downstream of the construction right-of-way during instream construction along the pipeline corridor.
- Duration: immediate to short-term – the event causing blockage of fish movements is pipeline construction (*i.e.,* instream construction of the pipeline), the period of which is less than one year at the Finn Creek watercourse crossing.
- Frequency: isolated – the event causing blockage of fish movements (*i.e.,* construction of the watercourse crossing) is confined to a specific period at a given watercourse.
- Reversibility: immediate to short-term – any blockage due to instream watercourse construction would be removed upon completion of construction of the Finn Creek watercourse crossing, which may take a couple days (*i.e.,* immediate) but may take longer (*i.e.,* short-term).
- Magnitude: low – the implementation of the proposed mitigation measures is expected to effectively reduce the potential effects on fish movements.
- Probability: low – a proposed diversion channel crossing is recommended which would remove any potential temporary fish blockages.
- Confidence: high – based on the professional experience of the assessment team.

Effects to Fish Species of Concern

Several fish species of concern (*i.e.,* federally and/or provincially listed or a fish and fish habitat indicator species) are known to occur in the Finn Creek Provincial Park Aquatics RSA. COSEWIC and provincially listed species within the Aquatics RSA include, bull trout and coho salmon. Fish and fish habitat indicator species within the Aquatics RSA include, bull trout, coho salmon, Chinook salmon and rainbow trout. Bull trout are provincially Blue-listed (BC CDC 2014) as well as listed as a species of Special Concern by COSEWIC (COSEWIC 2014). Coho salmon (*i.e.,* Interior Fraser River population) have been identified by COSEWIC as Endangered (COSEWIC 2014). Chinook salmon and rainbow trout are neither provincially nor federally listed.

Vehicle and pipeline crossing methods have been selected to reduce Project-specific effects in consideration of presence and use by fish species of concern in Finn Creek. The crossing will be conducted using an isolated crossing method (*i.e.,* if water is present) or open cut crossing (*i.e.,* if dry or frozen to bottom). Although not stated in the original application, the use of a diversion channel is being considered to successfully isolate the section of channel at the crossing location. If used during a period of low flow (*e.g.,* fall), a diversion would allow fall spawning species, such as bull trout, to continue a migration upstream to spawning habitat, unaffected by instream construction.

Bull trout are piscivores, distributed in cool waters throughout the interior of BC and are absent from many shorter coastal rivers (McPhail 2007). Bull trout, in particular, are susceptible to degraded water and habitat conditions from land disturbance (*i.e.,* roads, oil and gas developments, forest harvesting, mining developments) (ASRD 2012, Brewin *et al*. 2001, Hammond 2004). Hybridization and competitive interactions with other species (*e.g.,* non-native brook) can also cause declines in bull trout populations (McPhail 2007). Contamination, loss or alteration of instream habitat is the greatest contributor of effects to this indicator.

Coho salmon have an extensive distribution within BC. Coho salmon are susceptible to natural and anthropogenic habitat degradation (COSEWIC 2002a). However, according to TEK participants, coho are more durable than other salmon varieties and are best at adapting to changing conditions. Contamination, loss or alteration of instream habitat and riparian habitat are both equal contributors of effects to this indicator.

Chinook salmon are the largest anadromous species to complete life-history events (*i.e.,* spawning and rearing) in the Fraser River mainstem and associated tributaries. Chinook may migrate as far as 600 km inland (McPhail 2007). Chinook salmon are susceptible to direct and indirect habitat loss (COSEWIC 2006) which makes contamination, loss or alteration of instream habitat and riparian habitat both equal contributors of effects to this indicator.

Rainbow trout are a cool water salmonid species with widespread distribution throughout BC. Rainbow trout have not been considered a conservation concern (McPhail 2007); however, the species is representative of overall effects to fish and fish habitat. Rainbow trout are migratory in nature and will swim to new areas should habitat conditions change (Natural Resources Conservation Service 2000); however, contamination, loss or alteration of instream habitat would still be the major contributor to effects on this species.

With the successful implementation of recommended mitigation strategies, the residual effect of the construction of the pipeline on fish species of concern is considered to be reversible in the short-term and of low magnitude (Table A7.1.6-2, point 3[e]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – fish species of concern may be affected by an increase in suspended sediment concentrations downstream of watercourse crossings or habitat alteration from trenched (*i.e.,* isolated or open cut) crossing methods.
- Duration: immediate to short-term – the event causing fish species of concern to be affected is instream construction of the pipeline.
- Frequency: isolated – the event causing fish species of concern to be affected (*i.e.,* watercourse crossing construction) is confined to a specific period.
- Reversibility: short-term – the residual effects of pipeline construction on fish species of concern is limited to the construction phase and a short time thereafter until habitat conditions are restored to their original state.
- Magnitude: low – the implementation of the proposed mitigation measures is expected to effectively reduce the potential effects on fish species of concern.
- Probability: low – construction timing, the proposed crossing methods and implementation of the mitigation outlined in Table A7.1.6-1 will reduce the probability of effects to fish species of concern.
- Confidence: moderate – based on the professional experience of the assessment team.

7.1.6.3 Summary

As identified in Table A7.1.6-1, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on fish and fish habitat indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Finn Creek Provincial Park related to fish and fish habitat will be not significant.

7.1.7 Wetlands

This subsection describes the potential Project effects on the wetland loss or alteration in Finn Creek Provincial Park. The Wetland LSA consists of a 300 m wide band generally from the proposed pipeline corridor (*i.e.,* 150 m on both sides of the proposed pipeline corridor centre); shown in Figure 6.2.2-3 of the Introduction of the Stage 2 Detailed Proposal. The Wetland RSA includes all watersheds affected by the Project; shown in Figure 6.2.2-1 of the Introduction to the Stage 2 Detailed Proposal.

The measurement endpoint for the wetland loss or alteration indicator, wetland function, includes quantitative measurements of potential Project effects. Wetland function was evaluated at each wetland where ground-based field work was conducted along the narrowed pipeline corridor in 2014 (*i.e.,* one riparian swamp in Finn Creek Provincial Park). The functions of wetlands crossed by the narrowed pipeline corridor are reported on the premise that wetlands temporarily disturbed during construction would be revisited in the years following pipeline construction to document the progress of function returning to the wetland ecosystem and to ensure wetlands are on the trajectory of reaching pre-construction (*i.e.,* existing) conditions. Wetland functions documented during the evaluation of existing conditions (*i.e.,* pre-construction) will be compared to wetland functions observed along the reclaimed (*i.e.,* post-construction) construction right-of-way. The results of this comparison will be used to measure the effectiveness and efficiency of mitigation and reclamation measures, and provide support to the determination of loss or "no net loss" of wetland function. Details on each of the wetland functional categories are as follows.

- High Functional Conditions: wetlands that demonstrate many wetland functions expected for their class, with little to no anthropogenic disturbance, are high functioning wetlands. These wetlands are performing all expected wetland functions for their class (e.g., vegetation and wildlife habitat function, hydrological function as well as water quality and substrate functions). Following construction, these wetlands are likely to recover to their wetland class, and no alterations to the existing wetland function qualities provided are anticipated.

- High-Moderate Functional Conditions: wetlands that demonstrate many wetland functions expected for their class, with light anthropogenic disturbance, are high-moderate functioning wetlands. These wetlands are mildly disturbed, which reduces the efficacy of the wetland to perform all wetland functions expected for the wetland class (e.g., vegetation and wildlife habitat function, hydrological function as well as water quality and substrate functions). Following construction, these wetlands are likely to recover to their wetland class, and no alterations to the existing wetland function qualities provided are anticipated.

- Low-Moderate Functional Conditions: wetlands that demonstrate some the wetland functions expected for their class, with moderate anthropogenic disturbance are low-moderate functioning wetlands. They are moderately disturbed throughout or have considerable disturbance to the wetland margins and riparian area. The disturbance reduces the efficacy of the wetland to perform wetland functions expected for the wetland class (e.g., vegetation and wildlife habitat function, hydrological function as well as water quality and substrate function). Following construction, these wetlands may recover to their wetland class. However, the potential for a land use change (e.g., cultivation) following construction may alter the wetland's ability to recover its wetland function qualities, which may impact the recovery trajectory.

- Low Functional Conditions: wetlands that demonstrate limited wetland functions expected for their class due to severe anthropogenic disturbance. These wetlands are severely disturbed, which impacts the efficacy of the wetland to perform wetland functions expected for the wetland class (e.g., vegetation and wildlife habitat function, hydrological function as well as substrate function). Following construction, these wetlands have unlikely potential to recover to their wetland class, which will alter the type of wetland functions that were documented during existing surveys. Alternatively, these wetlands may not recover as functional wetlands (i.e., necessary hydrology, soil and vegetation characteristics).

7.1.7.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on the wetland loss or alteration indicator are listed in Table A7.1.7-1.

A summary of mitigation measures provided in Table A7.1.7-1 was principally developed in accordance with industry accepted best practices as well as industry, federal and provincial regulatory guidelines including the Federal Policy on Wetland Conservation (Environment Canada 1991), Wetland Ways (Wetland Stewardship Partnership 2009), as well as learnings from wetland PCEM for previous pipeline projects (*e.g.,* Enbridge Pipelines Inc. [Enbridge] [TERA 2012bc], KMC [Critchley and Foote 2009, TERA 2011a,b,c,d, 2012a, 2013a,b,c] and NOVA Gas Transmission Ltd. [NOVA Gas] [TERA 2011e, 2012c]) and peer-reviewed publications on wetland function (Price *et al.* 2005, Ryder *et al.* 2005, Shem *et al.* 1993, Van Dyke *et al.* 1994).

TABLE A7.1.7-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WETLAND LOSS OR ALTERATION FOR FINN CREEK PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Wetland Loss or Alteration Indicator – Wetland Function			
1.1 Loss or alteration of wetlands of High Functional, High-Moderate, Low-Moderate and Low Functional Condition (*i.e.,* habitat, hydrology, biogeochemistry)	LSA	<u>Habitat</u> • Ensure that all applicable approvals, licenses and permits are in place prior to commencing applicable construction activities [Section 6.0]. • Adhere to applicable clearing guidelines for the protection of streams and wetlands provided in the *Forest Practices Code*, Riparian Management Area Guidebook in BC, where riparian management zones (widths) are identified based on stream or wetland class [Section 8.1]. • Follow applicable measures to avoid serious harm to fish or any permanent alteration to, or destruction of, fish habitat when working in or near Finn Creek [Section 8.7.1]. • Fell all timber within the staked construction boundaries during survey line clearing. No fallen or leaning trees will be permitted outside of the staked construction boundaries or into Finn Creek and or the riparian swamp [Section 6.0]. • Protect vegetation mat from construction disturbance. Any TWS located within the boundary of a wetland must be approved by Trans Mountain's Inspector(s) [Section 7.0]. • Reduce the removal of vegetation in the riparian swamp in Finn Creek Provincial Park to the extent practical. Conduct ground level cutting, mowing or mulching or walking-down of wetland vegetation instead of grubbing. The method of removal of wetland vegetation is subject to approval by the Inspector(s) and Resource Specialist [Section 7.0]. • Narrow down the area of disturbance to the extent practical and clearly mark the area to be cleared [Section 7.0]. • Salvage flagged or fenced live trees or shrubs from the banks of the riparian swamp if requested by the Inspector(s) or noted on the Environmental Alignment Sheets. Store salvaged trees and shrubs along the side of the construction right-of-way in a manner such that they do not dry out before replanting during reclamation [Section 7.0]. • Prohibit clearing of extra TWS within the riparian buffer, only the trench and TWS areas will be cleared. Ensure staging areas for Finn Creek and the riparian swamp crossing construction, grade/borrow areas for wetland ramps and spoil storage areas are located a minimum of 10 m from the banks of Finn Creek and the riparian swamp boundaries. This distance may be reduced by the Lead Environmental Inspector and the Inspector(s) where appropriate controls are in place and where no riparian area is present (*e.g.,* disturbed lands that abut the banks of Finn Creek or boundaries of the riparian swamp) [Section 8.1]. • Restrict root grubbing in wet areas to avoid creation of bog holes [Section 8.1].	• Alteration of wetland habitat function during and following construction and maintenance activities until vegetation is re-established. • Alteration of wetland hydrological function during and following construction and maintenance activities until vegetation is re-established. • Alteration of wetland biogeochemical function during and following construction and maintenance activities until sedimentation is controlled and vegetation is re-established.

TABLE A7.1.7-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.1 Loss or alteration of wetlands of High Functional, High-Moderate, Low-Moderate and Low Functional Condition (*i.e.,* habitat, hydrology, biogeochemistry) (cont'd)	See above	• Restrict root grubbing to the area located outside of the vegetated riparian buffer adjacent to Finn Creek and the riparian swamp. There will be no grubbing within vegetated buffers adjacent to Finn Creek and the riparian swamp except along the trench line and, where warranted, at vehicle crossing areas. See additional grubbing measures in Section 8.1 of the Pipeline EPP. • Allow the riparian swamp to recover naturally (*i.e.,* do not seed wetland areas) [Section 8.6.3]. • Replant salvaged trees/shrubs along the disturbed riparian margins of the riparian swamp as directed by Trans Mountain's Inspector(s). • See Weed Management Plan in Appendix C of the Pipeline EPP. • See additional wetland measures in the Pipeline EPP. <u>Hydrology</u> • Install berms and/or cross ditches on approach slopes to the riparian swamp, where warranted [Section 7.0]. • Maintain drainage across the construction right-of-way during all phases of construction [Section 7.0]. • Grade away from Finn Creek and the riparian swamp to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in Finn Creek or the riparian swamp during grading. Keep wetland soils separate from upland soils [Section 8.2]. • Install sack trench breakers back from the edge of Finn Creek where the banks consist of organic material to prevent sloughing of backfill into the channel (see Trench Breaker – Watercourse/Wetland Drawing in Appendix R of the Pipeline EPP) [Section 8.4]. • Do not dewater the riparian swamp during isolated crossing construction [Section 8.7.4]. • Ensure that the riparian swamp is reclaimed to its pre-construction profile. Remove all corduroy and ramps through sloughs or wetlands, in all circumstances [Section 8.4]. • Leave a trench crown during clean-up wetlands to allow for settlement of backfilled material within the trench [Section 8.6.3]. • Re-establish surface drainage patterns in the riparian swamp to as close to the pre-construction contours as practical during reclamation. [Section 8.6.3]. • Excavate the trench with wide pad, low-ground-pressure equipment or operate standard equipment from mats [Section 8.7.4]. • Store excavated material in a manner that does not interfere with natural drainage patterns. If necessary, haul spoil to a nearby location for storage (*e.g.,* for wet spoil that does not stack well) [Section 8.7.4]. • See additional wetland measures in the Pipeline EPP. <u>Biogeochemistry</u> • Install a temporary sediment barrier (*e.g.,* sediment fences), where warranted, to eliminate the flow of sediment from spoil piles and disturbed areas into Finn Creek and the riparian swamp (see Sediment Fence Drawing in Appendix R of the Pipeline EPP) [Section 8.7.1]. • Implement the Wet/Thawed Soils Contingency Plan (see Appendix B of the Pipeline EPP) during wet/thawed soil conditions when wet or thawed soils are encountered during construction [Section 8.2]. • Avoid rutting and admixing of wetland soils during non-frozen soil conditions. Install appropriate ramps using mats (*e.g.,* swamp mats) or geotextile and spoil ramps [Section 8.7.4]. • Salvage the upper layer of root zone material (maximum of 0.5 m) over the trench area and retain for use in capping the trench following backfilling [Section 8.7.4].	• See above.

TABLE A7.1.7-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.1 Loss or alteration of wetlands of High Functional, High-Moderate, Low-Moderate and Low Functional Condition (*i.e.,* habitat, hydrology, biogeochemistry) (cont'd)	See above	• Use salvaged surface material or trench spoil as a containment/barrier (see Watercourse Crossing – Open Cut Method for Flowing Watercourses Drawing in Appendix R of the Pipeline EPP) if deep water is encountered and the trench area warrants isolation. Consider using spoil material from the trench line as a containment barrier where salvaged surface material is primarily composed of organic material and is likely not able to support a berm/barrier. Location to be determined by Inspector(s). Alternate dam devices such as an Aquadam or meter bags may also be used to isolate the trench area. Pump excess water from work area and trench to opposite side of berm or work ramp [Section 8.7.4]. • Pump water into stable and well-vegetated areas. Monitor discharge areas and change the hose discharge location if adequate natural filtration is no longer feasible and sedimentation could occur [Section 8.7.4]. • Backfill the trench with excavated trench spoil. Remove any excess trench spoil to an upland location approved by the appropriate regulatory authorities [Section 8.7.4]. • Replace any remaining salvaged upper soil (root zone) material over the trench area. Reclaim the riparian swamp to as close as feasible to its pre-construction profile and ensure no permanent trench crown is left following trench crown subsidence [Section 8.7.4]. • Install temporary erosion and sediment control structures (*e.g.,* sediment fences, coir logs) immediately following the completion of backfilling lands adjacent to Finn Creek and the riparian swamp where the potential for sedimentation exists (see Sediment Fence Drawing and Coir/Straw Log Installation Drawing in Appendix R of the Pipeline EPP) [Section 8.4]. • See additional measures in the Pipeline EPP. <u>Monitoring</u> • Conduct Wetland Function PCEM to review the recovery of wetland function within the construction right-of-way. <u>Operations</u> • Implement mitigation measures provided in this table during operations activities within a wetland.	• See above.
1.2 Contamination of wetland function (*i.e.,* habitat, hydrology, biogeochemistry) due to a spill during construction	LSA	▪ Bulk hazardous materials in temporary construction yards or other designated areas except for quantities required for the daily construction activities. Wastes will be stored in temporary construction yards or other designated areas and removed during final clean-up. Fuel, oil or hazardous materials required to be stored on-site will be stored within secondary containment that is to be located greater than 300 m from a watercourse, wetland or lake [Section 7.0]. ▪ Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into waterbodies. In the event of a spill, implement the Spill Contingency Plan (see Appendix B of the Pipeline EPP) [Section 7.0]. ▪ Do not store fuel, oil or hazardous material within 300 m of a watercourse or waterbody [Section 7.0]. • Do not wash equipment or machinery in watercourses, wetlands or lakes. Control wastewater from construction activities, such as equipment washing or cement mixing, to avoid discharge directly into any body of water [Section 7.0].	• Reduction of wetland habitat, hydrological and biogeochemical function in the event of a spill during construction (depending on the volume and type of substance spilled).

Notes: 1 LSA = Wetland LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.7.2 Significance Evaluation of Potential Residual Effects

The quantitative analysis revealed that there are approximately 0.14 ha of wetlands located within the Wetland LSA within Finn Creek Provincial Park. Of this, approximately 0.08 ha of wetlands are encountered by the narrowed pipeline corridor. It is estimated within the narrowed pipeline corridor there are approximately 0.08 ha of wetlands with High-Moderate Functional Condition (*i.e.,* the riparian swamp). Table A7.1.7-2 provides a summary of the area of wetland disturbed by the narrowed pipeline corridor within Finn Creek Provincial Park.

TABLE A7.1.7-2

PROJECT DISTURBANCE OF WETLAND FUNCTION WITHIN THE NARROWED PIPELINE CORRIDOR AND WETLAND LOCAL STUDY AREA IN FINN CREEK PROVINCIAL PARK

Total Wetland Area (Within Corridor and LSA) (ha)	Area of Wetlands within Corridor (ha)	Narrowed Pipeline Corridor (ha)			
		High Functional	High-Moderate Functional	Low-Moderate Functional	Low Functional
0.14 ha	0.08 ha	--	0.08 ha	--	--

Table A7.1.7-3 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Finn Creek Provincial Park on wetland loss or alteration. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE A7.1.7-3

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WETLAND LOSS OR ALTERATION FOR FINN CREEK PROVINCIAL PARK

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1	Wetland Loss or Alteration Indicator – Wetland Function									
1(a)	Alteration of wetland habitat, hydrological and biogeochemical functions during and following construction and maintenance activities until vegetation is re-established, grade and natural flow patterns are restored and sedimentation is controlled.	Negative	LSA	Short-term	Periodic	Short to long-term	Low	High	High	Not significant
1(b)	Reduction of wetland habitat, hydrological and biogeochemical functions in the event of a spill during construction.	Negative	LSA	Immediate	Accidental	Short to long-term	Low to high	Low	High	Not significant

Notes: 1 LSA = Wetland LSA.
2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Wetland Loss or Alteration Indicator – Wetland Function

The evaluation of wetland functional condition was used to assess the level of significance of the potential residual effects associated with the narrowed pipeline corridor. Functional condition (*i.e.,* High Function, High-Moderate Function, Low-Moderate Function or Low Function) was determined based on the level of existing disturbance to the wetland, the class of wetland (*i.e.,* riparian swamp) and its capacity to provide certain functions on a landscape level. The evaluation of significance was based on the anticipated level of residual effect the pipeline construction and operations will have on the wetland based on its pre-construction functional condition. Three components of wetland function (*i.e.,* wetland habitat, hydrological and biogeochemical) were used in this analysis.

Alteration of Wetland Habitat Function

Pipeline construction and maintenance activities within wetlands will likely result in some disruption of the function of wetlands, and this is considered to have a negative impact balance. Examples of potential adverse environmental effects on wetland habitat function are: potential changes in species composition; stress on plant species; interruption of wildlife movements; and fragmentation of natural habitats.

With proper construction methods and mitigation measures (*i.e.,* profile contours returned and the appropriate protection and use of the seedbank), these adverse effects can be successfully reduced. For example, Zimmerman and Wilkey (1992) monitored wetlands for effects on vegetation for 20 years post-disruption from pipeline construction. Findings of these long-term monitoring programs show that:

adjacent natural wetland areas were not altered in type when the proper construction and mitigation measures were carried out (*i.e.,* wetland contours and elevations match those off the construction right-of-way); no non-native plant species invaded natural areas; and the right-of-way increased diversity.

Additional studies on the effects of pipeline construction on wetland vegetation (Shem *et al.* 1993, Van Dyke *et al.* 1994) report the following observations.

- *Wetland community effects*: at most sites, many plants from adjacent natural areas re-establish themselves on the right-of-way. Rights-of-way that have been constructed in a manner that wetland function is not lost (*e.g.,* profile contours returned and the appropriate restoration or maintenance of the seedbank through ensuring equipment arrives on-site clean and kept free of vegetative debris during construction) appear to have little effect on vegetation in the natural areas.

- *Wetland species diversity*: A greater number of wetland plants have been observed on the right-of-way than in the adjacent natural area. Rights-of-way increase the number and types of habitats in wetlands due to the growth of a variety of succession species. Although the impact balance on wetlands resulting from the disturbance created by the pipeline construction is negative (see Table A7.1.7-3), increased biodiversity is viewed positively since the plants that are regenerating on the right-of-way are native species that occur within the natural wetland habitat, and the result is that habitat function is not negatively impacted.

- *Construction and management practices*: Overall, vegetative cover on rights-of-way in wetlands in a variety of control plots (*i.e.,* various wetland types in areas throughout the US) is generally well-established within 1 to 3 years after pipeline construction when mitigation measures included returning wetland contours and elevations to pre-construction conditions. Minor differences in the final right-of-way surface elevation can strongly influence the type of vegetation that re-establishes on the right-of-way. Other examples of construction and management practices that ensure wetland vegetation will re-establish include conducting ground-level cutting, mowing or mulching of wetland vegetation instead of grubbing, directing grading away from wetlands and allowing natural recovery (*i.e.,* not seeding wetlands).

The effects of construction of a pipeline right-of-way on wetland vegetation and bird communities were investigated up to 2 years following construction by Santillo (1993). Results showed that at 2 years post-construction, wetlands were dominated by native hydrophytic graminoids. Also, in wetlands with no standing water, plant community composition and structure were found to be similar at the end of 2 years post-construction to what was observed pre-construction. Finally, results also showed that no new bird species were introduced as a result of the different habitat provided by the right-of-way after pipeline construction was conducted using appropriate mitigation measures (*e.g.,* re-establishing pre-construction contours within wetland boundary to ensure cross right-of-way drainage) that ensured seedbanks were restored on the construction right-of-way.

Increased plant diversity is discussed here as a finding of research presented in peer-reviewed available research literature (Santillo 1993, Shem *et al.* 1993, Van Dyke *et al.* 1994, Zimmerman and Wilkey 1992). The conclusion of the research was that although there was increased native plant diversity as a result of pipeline construction, the overall habitat function of the wetlands was not negatively impacted.

Increased biodiversity is viewed positively since the plants that are regenerating on the right-of-way are native wetland species, therefore, wetland habitat is not substantially altered. By opening up the canopy, plant species that generally cannot grow beneath a tree or shrub overstory will return to begin the plant succession stages and additional species will begin to inhabit the area.

Past construction projects in similar ecoregions have successfully reduced effects on wetlands. PCEM of wetland function (TERA 2011a,b,c,d,e, 2012a,b,c) at wetlands along recent large pipeline projects have shown that mitigation measures implemented during construction (*e.g.,* profile reconstruction, allowing natural regeneration) can be successful; wetlands have proven to be resilient. In addition, the absence of environmental issues pertaining to wetland function restoration has been observed and documented in As-built Environmental Reports for the first, second and third-year Wetland Function PCEM reports for numerous past pipeline projects (TERA Environmental Consultants 2011a,b,c,d,e, 2012a,b,c).

Mitigation measures will be employed to reduce residual effects on wetlands, depending on site-specific conditions and requirements (Table A7.1.7-1 and the Pipeline EPP). With the implementation of the proposed mitigation measures, the potential alteration of wetland habitat function is considered to be reversible in the medium to long-term for wetlands depending on the pre-construction vegetative cover, and of low magnitude. The proposed mitigation measures (*e.g.,* Weed Management Plan in Appendix C of the Pipeline EPP) that will be used to reduce the residual effects on wetlands within Finn Creek Provincial Park aligns with the management objective of the park to maintain the natural quality and existing conditions of the park as the ultimate goal is to return wetlands to their pre-construction functional conditions.

Alteration of Wetland Hydrological Function

Pipeline installation or maintenance may cause potential changes to the hydrologic flow (*i.e.,* surface or groundwater flow) of a wetland by diverting water away from the wetland and/or impeding natural flow through the wetland. Excessive water diversion will result in an unnatural decrease of water flow within the wetland while flow impedance (*i.e.,* inadequate drainage) results in a more saturated wetland habitat.

Each of these alterations is an interruption to the natural hydrologic regime and is considered to have a negative impact balance. The vertical and horizontal water movements in wetlands are readily disrupted by any berm-like structure. For example, linear disturbances, such as pipelines and roads, can impound water on the upstream side of a wetland resulting in drying downstream and flooding upstream. Drying on the downslope face in treed wetlands (*e.g.,* treed swamps) can increase tree productivity, water demand and evapotranspiration, which facilitates further drying (Baisley 2012, Miller *et al. in prep.*). In mineral wetlands, this type of disturbance (*i.e.,* drying downstream) may also result in increases in productivity of drought tolerant wetland plant species (*e.g.,* grasses, some sedges and rushes) and water demand, which, similar to treed wetlands, can lead to further drying. The compounded drying can result in permanent alteration of mineral wetland hydrologic regime, overall wetland function and potentially ecosystem type (*e.g.,* treed wetland to forest or marsh to wet meadow or moist grassland) (Baisley 2012, Miller *et al. in prep.,* Sherwood 2012). On the upstream side, increased saturation from impounded water can result in the loss of trees and other woody vegetation, while allowing for the establishment of emergent vegetation in peatlands (Miller 2011) whereas in seasonal mineral wetlands, increased inundation may result in the decrease of emergent vegetation, the increase in aquatic vegetation and open water characteristics. Prolonged impoundment may potentially convert a treed wetland to an open water or marsh wetland and a more seasonal mineral wetland into a more permanent open water wetland.

The hydraulic conductivity of the wetland's substrate can also be affected by salvaging, compacting or mixing of the soil structure. In mineral wetlands, improper handling (*i.e.,* admixing, salvaged material drying) of salvaged mineral soil and wetland substrate can result in loss of salvaged material through wind erosion (*i.e.,* drying of material while stockpiled). Improper replacement of bottom soils can affect the permeability of the material (*i.e.,* permeable substrate becoming impermeable) as the result of admixing and compaction. These issues can affect a wetland's ability to retain and slowly release flood waters to the groundwater, increase evaporative losses of stored water and limit a wetland's storage capacity (*i.e.,* volume of water a wetland can retain). Storing salvaged material separately (*i.e.,* mineral soil separate from wetland substrate) and maintaining the moisture content can mitigate the effect of wind erosion while replacing salvaged material in the correct order (*i.e.,* mineral soil followed by wetland substrate) following construction can help to maintain bottom soil permeability, therefore, maintaining a wetland's hydraulic conductivity capability.

Among the most important considerations for limiting disturbances to hydrological function are assuring that the restoration of pre-construction elevations and contours are achieved (Gartman 1991), and that there will be no unnatural impedance to flow. Short-term disturbances to wetlands are expected during pipeline construction. Some alteration of hydrological function in wetlands can be expected during trenching, however, the Q4 of 2016 or Q1 of 2017 construction schedule will reduce potential hydrologic changes since water flow is likely to be diminishing from peak levels. Surface materials at shallow depth (*i.e.,* the mineral soil) should be salvaged and stored separately from other material and sequentially replaced. This will reduce potential changes in the hydrological function of wetlands. If the construction right-of-way in the wetland is restored to its pre-construction profile and proper hydrologic throughflow is ensured by replacement of salvaged wetland substrates/upper soils, long-term effects on wetland hydrological function are not expected. Seedbank moisture regime recovery (*i.e.,* vegetation growth due to moisture), however, has proven to occur more slowly since surface material moisture levels are regulated either from vegetation removal (resulting in a wetter moisture regime than previous) or the drier conditions commonly present at wetland margins.

Standard pipeline construction and operational activities are designed to avoid circumstances that result in diversion and/or natural flow impedance of water in wetlands. With the implementation of the proposed mitigation measures, the residual effect of pipeline construction and maintenance activities on wetland hydrology is considered to be reversible in the medium to long-term and of low magnitude.

Alteration of Wetland Biogeochemical Function

Changes in wetland hydrologic regime can directly and indirectly affect wetland biogeochemical function. Directly, hydrologic regime can affect soil processes, nutrient availability and water chemistry. For example, soil decomposition rates are controlled by microbial respiration, which is affected by temperature and oxygen availability. Microbes preferentially use oxygen, however, under anaerobic, saturated conditions, the rate and type of respiration is altered (McLatchey and Reddy 1998). Additionally, the heat capacity of saturated soils is higher than that of dry soils. Therefore, decomposition rates are maintained by hydrologic regime through saturated conditions.

Impounding water flow due to linear disturbance can also directly impact wetland biogeochemistry. For example, in wetlands that receive nutrient inputs primarily from surface and groundwater sources, impeding water flow can result in nutrient delivery to downstream parts of the wetland being limited. However, recontouring and/or installing trench crown breaks may alleviate some of this nutrient stress.

Activity in or near wetlands during pipeline construction may result in an increased sediment supply and turbidity of surface waters (particularly in mineral wetlands), thereby, affecting biogeochemical function of the wetland. However, given the implementation of sedimentation control mitigation measures (*i.e.,* sediment fencing), the likelihood of alteration in this manner is reduced.

Indirectly, hydrologic regime can impact biogeochemical function by altering wetland habitat function. For example, decreases in water table position can increase tree productivity rates, which could decrease the quality of litter deposited to soil to increase nutrient turnover-times. This can change understory community composition due to nutrient and light limitations, soil processes (*e.g.,* decomposition rates), as well as further stimulating changes in wetland hydrologic regime through increased transpiration and interception by root systems (Baisley 2012, Kotowska 2012, Laiho *et al.* 2003).

Mitigation measures employed during construction and maintenance activities will reduce the residual effect. Consequently, the residual effect of pipeline construction and maintenance activities on wetland biogeochemistry is considered to be reversible in the medium to long-term and is of low magnitude.

A summary of the rationale for all of the significance criteria for all three components of wetland function (*i.e.,* habitat, hydrological and biogeochemical) is provided below (Table A7.1.7-3, point 1[a]).

- Spatial Boundary: Wetland LSA - alteration of habitat (*e.g.,* changes in vegetation species composition, stress on plant species, interruption of wildlife movements and fragmentation of natural habitats), hydrological (*e.g.,* changes in water level, impeded drainage) and biogeochemical function (*e.g.,* water quality, nutrient uptake) resulting from pipeline construction or maintenance activities may extend beyond the construction right-of-way.

- Duration: short-term – the events causing alteration of habitat, hydrological and biogeochemical function are construction of the pipeline and maintenance activities, the latter of which will be completed within any one year during the operations phase.

- Frequency: periodic - the events causing alteration of habitat, hydrological and biogeochemical function (*i.e.,* construction of the pipeline and maintenance activities) occur intermittently but repeatedly over the assessment period.

- Reversibility: short to long-term – depending on the growth time of wetland species (short to medium-term) found along the narrowed pipeline corridor, the time required to reclaim pre-construction elevation and contours (medium-term) and the time for biogeochemical processes to be reclaimed (medium to long-term), the reversibility of the residual effect may take less than or greater than one year with the possibility of being greater than 10 years.

- Magnitude: low – based on the proposed mitigation measures (*i.e.,* substrate being restored to pre-construction profile and allowing natural regeneration in wetlands) and the PCEM literature demonstrates that wetlands are resilient provided habitat function is not permanently altered. If permanent loss or alteration of wetland habitat function is identified upon completion of the Wetland Function PCEM Program, Trans Mountain will consult with Environment Canada regarding potential remedial or compensatory measures to offset functional loss. However, permanent loss or alteration of wetland function is not anticipated at the riparian swamp crossed by the proposed pipeline construction right-of-way within Finn Creek Provincial Park since pipeline construction through wetlands is considered a temporary disturbance and experience indicates that residual effects on wetland function can be mitigated.
- Probability: high – the narrowed pipeline corridor crosses a riparian swamp within Finn Creek Provincial Park and disturbances within this wetland will likely occur during pipeline construction and site-specific maintenance activities.
- Confidence: high – based on available research literature, results of mitigation measures and PCEM programs of past pipeline projects and the professional experience of the assessment team.

Effects on Wetlands from Spills During Construction

In the unlikely event of a fuel spill from equipment or a fuel truck near a wetland during construction, infiltration of fuel into surficial deposits and surface water is possible, and the effects would be considered to have a negative impact balance. The implementation of prevention measures (Table A7.1.7-1 and Pipeline EPP is expected to mitigate small spills in wetlands. Spill mitigation is expected to result in some loss or disturbance of soil and vegetation. With the implementation of mitigation efforts, the effects of small spills on wetland function (*i.e.,* habitat, hydrological and biogeochemical) are considered to be of low to high magnitude and reversible in the short to long-term (Table A7.1.7-3, point 1[b]).

- Spatial Boundary: Wetland LSA – alteration of wetland function (*i.e.,* habitat, hydrologic and biogeochemical) resulting from a spill during pipeline construction or maintenance activities may extend beyond the construction right-of-way.
- Duration: immediate – the event causing reduction of wetland function is a spill during construction, the period of which is less than or equal to 2 days.
- Frequency: accidental – contamination of wetlands from spills occurs rarely over the assessment period.
- Reversibility: short to long-term – depending on the volume and area affected by the spill.
- Magnitude: low to high – for potential reduction of wetland habitat, hydrological and biogeochemical functions.
- Probability: low – spills are unlikely to occur within the wetland.
- Confidence: high – based on available research literature, results of mitigation measures and PCEM programs of past pipeline projects and the professional experience of the assessment team.

7.1.7.3 Summary

As identified in Table A7.1.7-3, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on wetland loss or alteration of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Finn Creek Provincial Park related to wetland loss or alteration will be not significant.

7.1.8 Vegetation

This subsection describes the potential Project effects on vegetation in Finn Creek Provincial Park. The Vegetation LSA generally consists of a 300 m wide band from the centre of the proposed pipeline corridor (*e.g.,* 150 m on both sides of the centre of the proposed pipeline corridor); shown in Figure 6.2.2-3 of the Introduction to the Stage 2 Detailed Proposal. The Vegetation RSA consists of a 2 km wide band generally from the centre of the proposed pipeline corridor centre and facilities (*i.e.,* 1,000 m on both sides of the centre of the proposed pipeline corridor).

All vegetation indicators were considered in this evaluation (Table 6.2.1-1 of the Introduction to the Stage 2 Detailed Proposal); and all of them were determined to interact with pipeline construction and operations in Finn Creek Provincial Park.

7.1.8.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on vegetation indicators are listed in Table A7.1.8-1.

A summary of mitigation measures provided in Table A7.1.8-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines.

TABLE A7.1.8-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VEGETATION FOR FINN CREEK PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Vegetation Indicator – Vegetation Communities of Concern			
1.1 Loss or alteration of native vegetation	Footprint	• Confine all pre-clearing/mowing and general clearing activities within the staked/flagged construction right-of-way boundaries. Adhere to clearing/mowing restrictions associated with Finn Creek, the riparian swamp, sensitive environmental features and buffer areas (at Finn Creek and the riparian swamp crossings). • Maintain low vegetation or vegetated ground mat within the riparian buffer zone of Finn Creek and the vegetated buffer zone of the riparian swamp, to the extent practical, by clearing only trees, walking-down low vegetation so low-lying vegetation remains intact. Limit grubbing of cleared/mowed trees/shrubs only to the trench line and work side area needed for the vehicle crossing to protect riparian areas [Section 8.1]. • Use hand clearing methods where directed by Trans Mountain's Lead Environmental Inspector and Inspector(s) to avoid or reduce disturbance to the ground surface on sensitive terrain [Section 8.1]. • Restrict root grubbing to the trench line and restrict root grubbing in wet areas to avoid creation of bog holes, minimize surface disturbance and encourage re-sprouting/natural regeneration of deciduous trees and shrubs. See additional clearing and grubbing measures in Section 8.1 of the Pipeline EPP. • Use natural recovery as the preferred method of reclamation of the riparian swamp [Section 8.6]. • Within the vicinity of the construction right-of-way, collect dormant woody plant material (deciduous stakes/brush) and select suitably sized transplants (small conifer/deciduous trees/shrubs) from a suitable donor site following approval from the applicable land manager [Section 7.0 of Appendix C]. • Use a grass cover crop and/or native grass seed mix that has been developed for use at riparian areas to support the establishment of installed and naturally regenerating native woody plant material and plants and to provide erosion protection in the short-term [Section 7.0 of Appendix C]. • Seed disturbed lands with land uses that support native plant communities with native grass mixtures and rates, respectively, as identified in the Drawing C-01 of the Stage 2 Detailed Proposal. • For native seed, the highest seed grade available will be obtained. Do not accept seed lots that contain any Prohibited Noxious or Noxious weeds as identified in the Certificate of Analysis. Retain the Certificates of Analysis obtained for native seed for future documentation. The Certificates of Analysis will be presented to BC Parks upon request [Section 8.6].	• Alteration of the composition of approximately 2.2 ha of native vegetation.

TABLE A7.1.8-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.1 Loss or alteration of native vegetation (cont'd)	See above	• Minimize foot traffic on newly seeded areas until grass establishment has taken place. Vehicle traffic will be avoided on seeded areas until the sod is re-established [Section 8.6, Section 10.0 of Appendix C]. • Plant native shrub/tree species, where warranted, depending on the site-specific objectives [Section 14.0 of Appendix C]. • Remove problem vegetation (*i.e.,* weeds or invasive species) when adjacent to or crossing the riparian swamp or Finn Creek and replace it with compatible, low-growing plant species that will out-compete problem vegetation [Section 14.0 of Appendix C]. • Refer to the Problem Vegetation Management Plan [Section 14.0 of Appendix C] for management of non-native or invasive species. • See potential effect 3.1 of this table for mitigation regarding non-native or invasive species during construction and operations. • Monitor the effectiveness of revegetation efforts during the post-construction environmental monitoring program of the construction right-of-way. Conduct additional remedial work, where warranted.	• See above.
1.2 Loss or alteration of rare ecological communities	LSA	• See potential effect 1.1 of this table for mitigation regarding alteration of native vegetation. • See recommended mitigation measures for wetland ecological communities of concern outlined in Table A7.1.7-1 Wetland Loss or Alteration. • Supplemental vegetation and rare plant surveys will be conducted prior to construction in Finn Creek Provincial Park in August 2014. • Avoid environmentally sensitive areas, such as areas likely to have rare plant species or rare ecological communities. Where avoidance is impractical, implement site-specific mitigation measures in accordance with the Rare Ecological Community and Rare Plant Population Management Plan [Section 6.0 of Appendix C]. • If previously unidentified occurrences of vegetation communities of concern are found during supplemental rare plant surveys, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan [Section 6.0 of Appendix C]. • Site-specific mitigation will include avoidance, narrowing the construction right-of-way, fencing or protecting [Section 6.0 of Appendix C, Appendix J]. • Flag or fence-off resource-specific environmental features (*e.g.,* rare plant species, rare ecological communities) prior to commencing construction in the vicinity of the resource site. See additional mitigation in Section 6.0 of the Pipeline EPP. • Implement the resource-specific mitigation measures associated with vascular and non-vascular plant species of concern as well as rare and unique plant communities on or adjacent to the staked construction boundaries. • Suspend activity if previously unidentified rare ecological communities are found on or adjacent to the construction right-of-way. Implement the Rare Ecological Communities or Rare Plant or Species Discovery Contingency Plan [Section 7.0 of Appendix B]. • Recontour the landscape to pre-construction conditions [Section 7.0 of Appendix C]. • Restrict the application of herbicide within 30 m of known rare plant populations or rare ecological communities. Spot spraying, wicking, mowing or hand-picking are acceptable weed control measures in proximity to rare plants, rare lichens and vegetation communities of concern [Section 7.0]. • Monitor the effectiveness of revegetation efforts during the post-construction environmental monitoring program of the construction right-of-way. Conduct additional remedial work, where warranted.	• Some disturbance or alteration of a rare ecological community, if avoidance is not practical and mitigation measures do not completely protect a site. • If rare ecological communities are located adjacent to the construction right-of-way, they may be indirectly affected by changes in hydrology or light levels.
2. Vegetation Indicator – Plant and Lichen Species of Concern			
2.1 Loss or alteration of rare plant and/or lichen occurrences	LSA	• Supplemental vegetation and rare plant surveys will be conducted prior to construction in Finn Creek Provincial Park in August 2014. • See potential effect 1.4 of this table for mitigation applicable to the loss or alteration of rare ecological communities. • Flag or fence-off resource-specific environmental features (*e.g.,* rare plant species, rare ecological communities) prior to commencing construction in the vicinity of the resource site See additional measures in Section 6.0 of the Pipeline EPP. • Recontour the landscape to pre-construction conditions [Section 7.0 of Appendix C]. • Monitor the effectiveness of revegetation efforts during the post-construction environmental monitoring program of the construction right-of-way. Conduct additional remedial work, where warranted.	• Some disturbance or alteration of a rare plant occurrence, if avoidance is not practical and mitigation measures do not completely protect a site.

TABLE A7.1.8-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2.1 Loss or alteration of rare plant and/or lichen occurrences (cont'd)	See above	• See above.	• Some disturbance or alteration of a rare lichen occurrence, if avoidance is not practical and mitigation measures do not completely protect a site. • If rare plant or lichen sub-populations are located adjacent to the construction right-of-way they may be affected by changes in hydrology or light levels.
3. Vegetation Indicator – Presence of Infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern			
3.1 Weed introduction and spread	RSA	• Conduct a pre-construction weed survey and record problem vegetation (designated weeds) infestations on and immediately adjacent to the construction right-of-way [Section 6.0, Section 14.0 of Appendix C]. • Implement weed management in consultation with BC Parks (*i.e.,* using proper application of chemical, mechanical or manual measures, or a combination of all) at locations identified within the pre-construction weed survey to a level that is consistent with weed management observed adjacent to the eventual construction right-of-way to reduce the potential for weed infestations following construction [Section 6.0]. Also refer to the Weed and Vegetation Management Plan [Section 14.0 of Appendix C]. • Ensure equipment arrives at all construction sites clean and free of soil or vegetative debris. Do not allow any equipment arriving in a dirty condition on site until it has been cleaned [Section 7.0]. • Power wash and misting stations will be established, where required, to clean equipment used during clearing and root zone material handling activities [Appendix F]... In addition, shovel and compressed air cleaning stations for root zone material handling equipment will be established at selected locations to prevent the spread of weeds [Appendix J, Section 5.2]. • Restrict all vehicular traffic to the approved and staked construction right-of-way, workspace and access roads [Section 6.0]. • Monitor the root zone material and other soil piles for weed growth frequently during the growing season. Direct the contractor when warranted to take proactive measures to control weed growth [Section 7.0]. • Consider placing mats (*i.e.,* construction mats or swamp mats) over infested areas to reduce construction equipment transporting weed or plant material. Where mats are used, ensure they are free of soil, vegetation and debris prior to removing from the site [Section 7.0]. • Clean equipment (*i.e.,* shovel and sweep, pressurized water or compressed air) involved in root zone material handling at weed-infested sites prior to leaving the location unless full right-of-way root zone material salvage has been conducted. Clean equipment involved in root zone material handling at weed-infested sites prior to leaving the location [Section 7.0]. • For native seed, the highest seed grade available will be obtained. Do not accept seed lots that contain any Prohibited Noxious or Noxious weeds as identified in the Certificate of Analysis. Retain the Certificates of Analysis obtained for future documentation. The Certificates of Analysis will be presented to the Crown land authority upon request [Section 8.6]. • Limit vehicle travel through problem vegetation infested areas [Section 14.0 of Appendix C of the Pipeline EPP]. • The Weed and Vegetation Management Plan consists of vegetation management measures to be implemented in the short-term, during the pre-construction, construction and post-construction environmental monitoring program phases of Project construction and the long-term, during the regular operations and maintenance phase of the Project. Vegetation management measures to be implemented during both short-term and long-term periods in consultation with BC Parks [Section 14.0 of Appendix C of the Pipeline EPP].	• Weed introduction and spread.

TABLE A7.1.8-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
3.1 Weed introduction and spread (cont'd)	See above	• The use of herbicides for problem vegetation management along the construction right-of-way during construction and operations within the province of BC will be conducted in accordance with the *Integrated Pest Management Regulation* of BC as part of the BC *Integrated Pest Management Act* and in consultation with BC Parks [Section 14.0 of Appendix C of the Pipeline EPP]. • Monitor the effectiveness of revegetation efforts during the post-construction environmental monitoring program of the construction right-of-way. Conduct additional remedial work, where warranted. • During regular maintenance and operations activities, incidental ground inspections for problem vegetation along the construction right-of-way may be conducted to determine the extent (percent cover, composition, distribution, location of infestations) of problem vegetation (*i.e.,* presence of mature brush and trees, and weeds). Areas of new infestations, recommended treatment sites and will also be identified and documented during monitoring. To assist monitoring efforts, the baseline data collected during the pre-construction weed survey and the results of the post-construction environmental monitoring program will assist in establishing thresholds and determining if objectives of the Weed and Vegetation Management Plan are being met [Section 14.0].	• See above.

Notes: 1 LSA = Vegetation LSA; RSA = Vegetation RSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of the Stage 2 Detailed Proposal).

7.1.8.2 Significance Evaluation of Potential Residual Effects

Table A7.1.8-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Finn Creek Provincial Park on vegetation. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE A7.1.8-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VEGETATION FOR FINN CREEK PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1 Vegetation Indicator – Vegetation Communities of Concern									
1(a) Alteration of the composition of approximately 2.2 ha of native vegetation.	Negative	Footprint	Short-term	Periodic	Medium to long-term	Low to medium	High	High	Not significant
1(b) Some disturbance or alteration of a rare ecological community, if avoidance is not practical and mitigation measures do not completely protect a site.	Negative	Footprint	Short-term	Periodic	Short to long-term	Medium	Low	High	Not significant
1(c) If rare ecological communities are located adjacent to the construction right-of-way they may be indirectly affected by changes in hydrology or light levels.	Negative	LSA	Short-term	Periodic	Medium to long-term	Low	High	Moderate	Not significant
2 Vegetation Indicator – Plant and Lichen Species of Concern									
2(a) Some disturbance or alteration of a rare plant occurrence, if avoidance is not practical and mitigation measures do not completely protect a site.	Negative	Footprint	Short-term	Periodic	Medium to long-term	Medium	Low	High	Not significant
2(b) Some disturbance or alteration of a rare lichen occurrence, if avoidance is not practical and mitigation measures do not completely protect a site.	Negative	Footprint	Short-term	Periodic	Short to medium-term	Medium	Low	High	Not significant

TABLE A7.1.8-2 Cont'd

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
				Duration	Frequency	Reversibility				
2(c)	If rare plant or lichen sub-populations are located adjacent to the construction right-of-way, they may be affected by changes hydrology or light levels	Negative	LSA	Short-term	Periodic	Short to long-term	Low	Low	High	Not significant
3	Vegetation Indicator – Presence of infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern									
3(a)	Weed introduction and spread.	Negative	RSA	Short-term	Periodic	Short to medium-term	Low to medium	High	High	Not significant

Notes: 1 LSA = Vegetation LSA; RSA = Vegetation RSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Vegetation Indicator – Alteration of Vegetation Communities of Concern

Alteration of Native Vegetation

The Project parallels existing disturbance for the whole of its length of Finn Creek Provincial Park. The proposed route was sited along existing right-of-way to the extent practical. Using a disturbance layer on GIS imagery to calculate undisturbed native vegetation, approximately 2.2 ha of native vegetation may be disturbed or altered on the Footprint during construction and operations of the proposed pipeline crossing Finn Creek Provincial Park. The alteration of native vegetation is considered to have a negative impact balance.

Disturbed areas through native vegetation in parks and protected areas will be seeded with the appropriate native seed mix. Although areas disturbed during construction and periodic maintenance activities will revegetate with the appropriate native species, species composition in the disturbed Footprint will be altered. Clearing of the right-of-way and TWS and the maintenance of the right-of-way will result in the perpetuation of early seral vegetation. The extent of altered vegetation communities will be limited by the implementation of mitigation measures outlined in Table A7.1.8-1 and reclamation measures will speed the recovery.

Specific learnings from the TMX Anchor Loop Project post-construction monitoring (TERA 2013b) relevant to the alteration of native vegetation, such as the native vegetation found within Finn Creek Provincial Park include the following.

- Localized broadcast-seeding of native forb species resulted in limited establishment success.
- Timely salvage, storage and replacement of topsoil/root zone material allowed for the preservation of propagules (*e.g.,* seed, root pieces, spores) located in the surface soil to remain viable.
- Where grubbing was avoided in riparian areas adjacent to crossings of streams and wetlands, native deciduous plants re-sprouted the spring after clearing and native plants established from seed located within the undisturbed surface soil.
- Willow staking was an effective means of re-vegetating the banks of watercourses when coordinated with construction clean-up and reclamation.
- Protection of installed woody plant species from ungulate browsing was achieved through the use of constructive panel fencing.
- The establishment success of installed woody plant species and naturally-regenerating native forb species was observed in riparian areas with limited grass establishment due to dry and/or low nutrient

soils (*i.e.,* gravelly or with high woody debris content) or where a native riparian seed mix was not applied. To improve survival success of installed woody species and to encourage species diversity through the natural regeneration of native plants from the soil seed bank, seed riparian areas with a short-lived perennial native grass species to stabilize surface soils and reduce competition to installed and naturally-regenerating plants.

- Alteration of native vegetation due to competition for light, soil nutrients and moisture may occur while the Footprint is revegetating. However, the establishment of early successional communities during reclamation and operations will resemble revegetation following natural disturbance since the species composition will favour early successional/colonial species, which are adapted for greater competition pressure for light, nutrients and moisture (excepting the competition resulting from weedy non-native species).

- During construction, operations and reclamation of the Project, there will be a decrease in woody species richness and abundance due to site clearing within the Footprint, but due to edge effects there may be increases in woody species richness and abundance in areas adjacent to the Footprint. The extra TWS will be allowed to revegetate after construction. Forb and graminoid species richness and abundance will increase over the operations phase of the Project as natural, low growing vegetation regenerates, but the Footprint will be maintained free of higher growing vegetation. During abandonment, the Footprint will be returned to an equivalent land capability compared to the pre-construction conditions.

No locally or regionally adopted threshold or standard exists against which the incremental change in vegetation composition can be assessed. This residual effect is limited to the Footprint, reversible in the medium to long-term and of low to medium magnitude (Table A7.1.8-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – effects of pipeline construction and operations on the alteration of native vegetation is confined to the construction right-of-way.

- Duration: short-term – the events contributing to the alteration of native vegetation are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation management), the latter of which are limited to any one year during the operations phase.

- Frequency: periodic – the events resulting alteration of native vegetation (*i.e.,* pipeline construction and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.

- Reversibility: medium to long-term – depending upon the associated land use and the growth time required for species in each affected area (*e.g.,* forb versus tree), changes to native vegetation community composition are considered reversible in the medium to long-term. The effects of the proposed pipeline on forb and graminoid species (*e.g.,* grasses, bunchberry) is expected to be reversible in the medium-term, whereas the effects on tree species (*e.g.,* western red cedar, black spruce) are expected to be reversible in the long-term (more than 10 years) because the full right-of-way will be maintained free of higher growing vegetation until abandonment. Therefore, the overall alteration of the composition of vegetation along the Footprint will persist in the medium to long-term.

- Magnitude: low to medium – the narrowed pipeline corridor is located adjacent to existing disturbances for its entire length within the park and the construction of the pipeline will result in the clearing of approximately 2.2 ha of vegetation on the Footprint, which is considered to be within environmental standards given that best practices, objectives and provincial guidelines are being followed. Permanent loss of native vegetation is not anticipated to result from either the construction or operations of the proposed pipeline (low), however, returning the Footprint to an equivalent land capability during the abandonment phase could take years, as discussed under reversibility (medium). The indirect effects of Project construction and maintenance due to edge effects such as changes in light and moisture will be of low magnitude since they will not result in the loss of vegetation but only a localized change in vegetation community composition.

- Probability: high – the Footprint crosses native vegetation.

- Confidence: high – based on past pipeline projects and the professional experience of the assessment team.

Some Disturbance or Alteration of a Rare Ecological Community, if Avoidance is Not Practical and Mitigation Measures Do Not Completely Protect a Site

Rare plant surveys were conducted during the growing season in June 2013 on lands where access was granted as a component of the vegetation surveys. Supplemental ground-based rare plant surveys are planned to be conducted in August 2014. In the event that additional rare ecological communities are identified in the Footprint during supplemental surveys, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan in Section 5.0 of Appendix C of the Pipeline EPP.

During the 2013 rare plant surveys, no BC CDC-listed rare ecological communities were observed in Finn Creek Provincial Park. Mitigation measures for rare ecological communities generally fall into categories of avoidance, (*e.g.,* realignment, change of work side, narrowing), reducing disturbance (*e.g.,* narrowing, adjusting workspaces, ramping/matting over) and alternative construction/reclamation techniques (*e.g.,* salvaging seed or sod, plant propagation, transplanting component species, separate root zone material salvage, delayed clearing, access management) (Appendix C of the Pipeline EPP for more details). These proposed mitigation measures have been used previously on other major pipeline construction projects with good success.

Learnings from the TMX Anchor Loop Project (TERA 2013b) pertinent to rare ecological communities (including wetland communities of concern) include the following.

- Natural regeneration is an effective means of revegetation in wetlands where construction disturbance is limited to the trench area and where accurate separation and replacement of trench materials is achieved.
- In wetlands, transplanting of sedge and bulrush species from local undisturbed donor sites into construction disturbed areas proved to be an effective method of revegetation as transfers established and spread within their respective habitats.

Mitigation is developed with a number of factors taken into account that include, however, are not limited to:

- component species;
- community size;
- rarity;
- construction timing;
- location of the community with respect to the proposed right-of-way;
- primary mode of component species reproduction;
- habitat and proximity of available habitat; and
- past mitigation success (of the community or similar communities).

Based on the assessment of potential rare ecological communities that will be encountered during construction within Finn Creek Provincial Park, the mitigation measures described above are considered to be appropriate and applicable to the Project. If mitigation measures do not completely protect the site, a disturbance or alteration of a portion of the community may occur and is considered to have a negative impact balance. By basing mitigation on community ranking and abundance, in addition to its location on the construction right-of-way and the community type, any alteration of the local community, particularly S1 communities, will be reduced to a level such that the local community is not placed at risk. Consequently, the residual effect of pipeline construction on rare ecological communities and unique communities are of medium magnitude (Table A7.1.8-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – the potential disturbance or alteration of a rare ecological community is confined to the construction right-of-way.
- Duration: short-term – the events resulting in potential disturbance or alteration of a rare ecological community are construction of the pipeline or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in potential disturbance or alteration of a rare ecological community (*i.e.,* construction of the pipeline and maintenance activities) occur intermittently, however, repeatedly during the operations phase of the Project.
- Reversibility: short to long-term – depending on the component species, the construction method (*e.g.,* narrowing the right-of-way or matting over) and the landscape. For example, common cattails (common cattail marsh) can recolonize or re-establish in one growing season if the seed bank and habitat is available. Treed communities take more than 10 years to re-establish due to the length of time required for trees to grow to full height which provides the appropriate light for other component species.
- Magnitude: medium – the potential disturbance or alteration of a rare ecological community is of medium magnitude since the effect is still within environmental standards given that best practices, objectives and provincial guidelines are being followed. Returning the footprint to an equivalent land capability and regrowth of a rare ecological community could take more than 10 years, as discussed under reversibility.
- Probability: low – there were no rare ecological communities identified within the narrowed pipeline corridor in Finn Creek Provincial Park during the vegetation survey in June 2013. It is unlikely that rare ecological communities will be found within the Footprint.
- Confidence: high – based on past pipeline projects, the professional experience of the assessment team and the results of PCEM.

Indirect Effects to Rare Ecological Communities

With proper implementation of the industry-accepted standard mitigation practices that are proposed, disruption of surface flow patterns and light levels following construction or maintenance activities are expected to be minor along the narrowed pipeline corridor. However, construction and maintenance activities (*e.g.,* integrity digs) may contribute to some localized alteration of light levels and natural surface drainage patterns until trench settlement is complete and seeded and/or naturally regenerated vegetation has matured. The impact balance of this potential residual effect is considered negative since it could alter the moisture regime and light levels.

Indirect alteration of rare ecological communities adjacent to the Footprint may occur due to soil erosion. Some rare ecological communities may be more susceptible to erosion than others. Since the areas with greatest erosion risk will be seeded with native species or an annual cover crop (or otherwise stabilized with erosion control blankets, coir matting or woody slash, [Section 6.0 of Appendix C and Section 8.6.3 of the Pipeline EPP]), the indirect alteration of native vegetation as a result of erosion will not measurably contribute to the overall effect of pipeline construction on the alteration of rare ecological communities.

Increased distance of light penetration due to clearing will result in an indirect alteration of native vegetation (*i.e.,* the native species making up the rare ecological community). For example, some forested communities are characterized by low light penetration due to dense tree canopy. If part of the community is cleared, the light penetrating to the understory will change the species composition along the edges of the community where clearing occurred. However, this effect will not substantially contribute to the alteration of native vegetation beyond the effects detailed in relation to the clearing of native vegetation. Additionally, during the course of reclamation, as revegetation progresses, light penetration will generally decrease over time.

Given that indirect effects are, in part, caused by disturbance to vegetation structure associated with clearing activities, allowing disturbed areas to naturally revegetate may not alleviate indirect effects where vegetation management is conducted or long-term persistence of the disturbance exists. Consequently, indirect effects to vegetation are expected to persist until the pre-existing vegetation composition and structure is restored for the Footprint.

During the construction and operations of the pipeline, there will be a decrease in woody species richness and abundance due to clearing within the footprint, but due to edge effects there may be increases in woody species richness and abundance in areas adjacent to the Footprint. Forb and graminoid species richness and abundance will increase following construction as natural vegetation regenerates.

Alteration of native vegetation due to competition for light, soil nutrients and moisture may occur while the Footprint is revegetating. However, the establishment of early successional communities following construction will resemble revegetation following natural disturbance since the species composition will favour early successional/colonial species, which are adapted for greater competition pressure for light, nutrients and moisture (excepting the competition resulting from weedy non-native species).

The PCEM program will identify any locations with altered drainage patterns (*e.g.,* ponded water) and remedial work will be conducted. Once pre-construction hydrology regimes are returned to a site, regeneration or revegetation of rare ecological communities will be more likely.

The effect of construction on adjacent rare ecological communities is deemed to have a negative impact balance. This residual effect is limited to the Vegetation LSA, reversible in the medium to long-term and of low magnitude since the narrowed pipeline corridor parallels other pipeline rights-of-way and disturbance for its entire length within the park (Table A7.1.8-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Vegetation LSA – although alteration of rare ecological communities is generally confined to the construction right-of-way, potential changes in hydrology, light levels and species composition may extend beyond the pipeline right-of-way.
- Duration: short-term – the events resulting in alteration of adjacent rare ecological communities are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation management), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in alteration of adjacent rare ecological communities (*i.e.,* pipeline construction and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.
- Reversibility: medium to long-term – it may take more than one year plus adequate precipitation levels in order for the trench crown to settle and natural drainage patterns to be restored, and it could take more than 10 years for vegetation to grow back to former heights depending on the species, which will prevent increased light from reaching surrounding plants in the ecological community.
- Magnitude: low – the narrowed pipeline corridor is located adjacent to existing disturbances to the extent practical and the residual effects are detectable but are still considered to be within environmental standards given that best practices, objectives and provincial guidelines are being followed.
- Probability: high – the narrowed pipeline corridor is adjacent to native vegetation with high potential to support rare ecological communities, including forested areas that will be affected by clearing vegetation during construction.
- Confidence: moderate – based on data pertinent to the Project area and the professional experience of the assessment team.

Vegetation Indicator – Plant and Lichen Species of Concern

Some Disturbance or Alteration of a Rare Plant Occurrence, if Avoidance is Not Practical and Mitigation Measures Do Not Completely Protect a Site

During the June 2013 rare plant surveys conducted in Finn Creek Provincial Park, which were a component of the vegetation surveys, no occurrences of BC CDC-listed rare plant species were observed. Supplemental ground-based rare plant surveys are planned to be conducted in August 2014. In the event that additional rare plant species are identified in the Footprint, during supplemental surveys, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan (Section 7.0 of Appendix C of the Pipeline EPP). In the event that additional rare plant species are identified on or within 30 m of the construction right-of-way during construction, refer to the Rare Ecological Community and Rare Plant Population Discovery Contingency Plan (Section 7.0 of Appendix B of the Pipeline EPP). Protection measures and environmental management techniques for rare plants are provided in Appendix C of the Pipeline EPP. Mitigation measures for rare plant species generally fall into categories of avoidance, (*e.g.,* realignment, change of work side, narrowing), reducing disturbance (*e.g.,* narrowing, adjusting workspaces, ramping/matting over) and alternative construction/reclamation techniques (*e.g.,* salvaging seed or sod, plant propagation, transplanting, separate strippings salvage, delay clearing, access management). These proposed mitigation measures have been used previously on other major pipeline construction projects with good success.

Based on the assessment of the rare plants with potential to be encountered during construction, the mitigation measures described above are considered likely to be appropriate and applicable to the Project. However, if mitigation measures do not completely protect the site, a disturbance or alteration of a portion of the population or community may occur. Mitigation is developed with a number of factors taken into account that include, however, are not limited to:

- species;
- population size;
- rarity;
- growth form of the plant (*i.e.,* annual, biennial, perennial);
- construction timing;
- location of the population with respect to the proposed footprint;
- primary mode of species reproduction;
- mode and magnitude of propagule dispersal;
- habitat and proximity of available habitat; and
- past mitigation success (of the species or similar species).

By basing mitigation on these factors, any disturbance or alteration of a rare plant population, particularly those ranked S1, would be reduced to a level such that the population is not placed at risk (Table A7.1.8-2 point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – the potential disturbance or alteration of a rare plant population is confined to the construction right-of-way.
- Duration: short-term – the events resulting in potential disturbance or alteration of a rare plant population are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation maintenance), the latter of which are limited to any one year during the operations phase.

- Frequency: periodic – the events causing potential disturbance or alteration of a rare plant population (*i.e.,* construction of the pipeline and maintenance activities) occur intermittently but repeatedly at some locations during the operations phase of the Project.
- Reversibility: medium to long-term – depending on the species, the construction method (*e.g.,* narrowing the right-of-way or matting over, compared to transplanting) and the landscape.
- Magnitude: medium – the potential disturbance or alteration of a rare plant population is of medium magnitude since the effect is considered to be within environmental standards given that best practices, objectives and provincial guidelines are being followed.
- Probability: low – there were no rare plant populations identified within the narrowed pipeline corridor in Finn Creek Provincial Park during the rare plant surveys in 2013. It is unlikely that rare plant populations will be found within the Footprint.
- Confidence: high – based on past pipeline projects, the experience of the assessment team and the results of the rare plant surveys.

Some Disturbance or Alteration of a Rare Lichen Occurrence, if Avoidance is Not Practical and Mitigation Measures Do Not Completely Protect a Site

During the June 2013 rare plant surveys in Finn Creek Provincial Park, which were a component of the vegetation surveys, no BC CDC-listed rare lichen populations were observed. Supplemental ground-based rare plant surveys are planned to be conducted in August 2014. In the event that rare lichen species are identified in the Footprint, during supplemental surveys, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan (Section 7.0 of Appendix C of the Pipeline EPP). In the event that additional rare lichen species are identified on or within 30 m of the construction right-of-way during construction, refer to the Rare Ecological Community and Rare Plant Population Discovery Contingency Plan (Section 7.0 of Appendix B of the Pipeline EPP). Protection measures and environmental management techniques for rare lichens are provided in Appendix C of the Pipeline EPP. Mitigation measures for rare lichen species generally fall into categories of avoidance, (*e.g.,* realignment, change of work side, narrowing), reducing disturbance (*e.g.,* narrowing, protective matting) and alternative construction/reclamation techniques (*e.g.,* relocation of substrates, transplanting of thalli or peds, inoculation using vegetative fragments). These proposed mitigation measures have been used previously on other major pipeline construction projects with good success, but in general, fencing and avoiding is the mitigation that has the greatest likelihood of success, as compared to transplanting, and is the preferred conservation strategy.

Avoidance was highly successful in protecting rare species along the TMX Anchor Loop Project. Of the sites monitored in 2010 where fence and avoid procedures were employed, 93% had retained the rare lichen species targeted for mitigation (TERA 2011a).

Based on the assessment of the rare lichens with potential to be encountered during pipeline construction, the mitigation measures described above are considered likely to be appropriate and applicable to the Project. However, if mitigation measures do not completely protect the site, a disturbance or alteration of a portion of the population may occur. Mitigation is developed with a number of factors taken into account that include, but are not limited to:

- species;
- population size;
- rarity;
- construction timing;
- location of the population with respect to the proposed footprint;
- preference substrate and proximity of available substrates; and

- past mitigation success (of the species or similar species).

By basing mitigation on these factors, any disturbance or alteration of a rare lichen population, particularly those ranked S1, would be reduced to a level such that the population is not placed at risk.

The effect of construction on rare lichen populations is deemed to have a negative impact balance. This residual effect is limited to the Footprint, reversible in the short to medium-term and of medium magnitude since the narrowed pipeline corridor parallels other pipeline projects and disturbance for its entire length within the park (Table A7.1.8-2, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – the potential disturbance or alteration of a rare lichen population is confined to the construction right-of-way.

- Duration: short-term – the events resulting in potential disturbance or alteration of a rare lichen population are construction of the pipeline or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.

- Frequency: periodic – the events resulting in potential disturbance or alteration of a rare lichen population (*i.e.,* construction of the pipeline and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.

- Reversibility: short to medium-term – depending on the species and the mitigation measures applied. Based on PCEM results from TMX Anchor Loop, effects on rare lichens were generally resolved in 3 to 5 years (*i.e.,* it was apparent in 3 to 5 years of PCEM whether the population would survive or not) (TERA 2011b).

- Magnitude: medium – the potential disturbance or alteration of a rare lichen population is of medium magnitude since the effect is still within environmental standards given that best practices, objectives and provincial guidelines are being followed.

- Probability: low – there were no rare lichen populations identified within the narrowed pipeline corridor in Finn Creek Provincial Park during the rare plant surveys in 2013 and it is unlikely that rare lichen populations will be found within the Footprint.

- Confidence: high – based on past pipeline projects, the experience of the assessment team and the results of the rare plant surveys.

Indirect Effects to Rare Plant and Lichen Sub-Populations

With proper implementation of the industry-accepted standard mitigation practices that are proposed, disruption of surface flow patterns and light levels following construction or maintenance activities is expected to be minor along the narrowed pipeline corridor. However, construction activities may contribute to some localized alteration of light levels and natural surface drainage patterns until trench settlement is complete and vegetation has matured. The impact balance of this potential residual effect is considered negative since it could alter the moisture regime and light levels. In addition, dust deposition and the chemicals used to suppress dust have the potential to impact rare plants and lichens.

Indirect alteration of rare plant and lichen populations adjacent to the Project may occur due to soil erosion. Since the areas with greatest erosion risk will be seeded with native species or an annual cover crop (or otherwise stabilized with mulch, straw, crimping), the indirect alteration of native vegetation as a result of erosion will not measurably contribute to the overall effect of the Project on the alteration of rare plant populations.

Increased distance of light penetration due to clearing will result in an indirect alteration of native vegetation (*i.e.,* the native species making up the habitat for rare plant populations). For example, some rare species are only found in forested communities characterized by low light penetration due to dense tree canopy and a specific amount of humidity. If part of the treed community is cleared, the light penetrating to the understory will change the species composition along the edges of the community where clearing occurred and the increased air flow will alter humidity within the area. However, this effect will not substantially contribute to the alteration of native vegetation beyond the effects detailed in relation to the clearing of native vegetation. Additionally, during the course of reclamation, as revegetation progresses, light penetration and air flow will generally decrease over time.

Given that indirect effects are, in part, caused by disturbance to vegetation structure associated with clearing activities, allowing disturbed areas to naturally revegetate may not alleviate indirect effects where vegetation management is conducted or long-term persistence of the disturbance exists. Consequently, indirect effects to rare plant and lichen populations are expected to persist until the pre-existing vegetation composition and structure is restored for the Footprint.

Alteration of native vegetation due to competition for light, soil nutrients and moisture may occur while the Footprint is revegetating. However, the establishment of early successional communities following construction will resemble revegetation following natural disturbance since the species composition will favour early successional/colonial species, which are adapted for greater competition pressure for light, nutrients and moisture (excepting the competition resulting from weedy non-native species).

Many rare species inhibit areas with specific hydrology and light regimes. If hydrology of an area is altered, rare plant or lichen species located adjacent to the construction right-of-way may be affected. For example, golden saxifrage requires moist but not submerged substrate to grow on. The PCEM program will identify any locations with altered drainage patterns (*e.g.,* ponded water) and remedial work will be conducted. Consequently, the residual effect is reversible in the short to long-term. This residual effect is of low magnitude since the narrowed pipeline corridor parallels other pipeline rights-of-way and disturbance for its entire length within the park (Table A7.1.8-2, point 2[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Vegetation LSA – although alteration of rare plant and lichen populations is generally confined to the disturbed portion of the construction right-of-way, potential changes in hydrology, dust and light levels may extend beyond the pipeline right-of-way.
- Duration: short-term – the events resulting in alteration of rare plant and lichen populations are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation management), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in alteration of rare plant and lichen populations via disruption of drainage patterns and altered light levels (*i.e.,* construction of the pipeline and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.
- Reversibility: short to long-term – it may take more than one year plus adequate precipitation levels in order for the trench crown to settle and natural drainage patterns to be restored and along extra TWS it will take years for vegetation to grow back to former heights, which is what affects the light levels reaching surrounding plants. The full right-of-way will be maintained free of higher growing vegetation until abandonment (long-term). The potential for effects from dust and dust suppressants exist until construction and reclamation activities are completed.
- Magnitude: low – the narrowed pipeline corridor is located adjacent to existing disturbances. Residual effects are detectable, but are still considered to be within environmental standards given that best practices, objectives and provincial guidelines are being followed.
- Probability: low – there are no rare plant or rare lichen species historically known to occur within 5 km of the proposed pipeline corridor in Finn Creek Provincial Park. Given the distance and size of the footprint and based on the results of the 2013 surveys, it is not expected that populations of rare plant or lichen species will be encountered.
- Confidence: high – based on past pipeline projects, the experience of the assessment team and the results of the rare plant surveys.

Vegetation Indicator – Presence of Infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern

Weed Introduction and Spread

Non-native and invasive species tend to be pioneer species with characteristics that can exploit recently disturbed ecosystems. Non-native and invasive species that occur at high densities on the landscape can exert competitive pressure on native vegetation and result in alteration of native vegetation.

In general, invasive species are most prevalent where the ground has been disturbed by anthropogenic activity. During the 2013 vegetation surveys, any weed species encountered were noted and their density/distribution was recorded. The information collected during the vegetation surveys allows for an understanding of baseline weed conditions and the magnitude of weed infestations encountered in areas supporting native vegetation along the narrowed pipeline corridor.

Mitigation measures outlined in Table A7.1.8-1 and in the Pipeline EPP are effective industry standard measures to reduce the potential for the introduction and spread of weeds. These measures will be implemented during both construction and maintenance of the Project. All problem vegetation along the construction right-of-way will be monitored during all pipeline construction phases (*i.e.,* pre-construction and construction) and the operations phase (*i.e.,* PCEM) (Section 12.0 of Appendix C of the Pipeline EPP).

Experience during past pipeline construction programs has shown that, while weed infestations were encountered, the implementation of appropriate mitigation measures during construction resulted in limited weed issues (Alliance 2002, Interprovincial Pipe Line Inc. [IPL] 1995, Enbridge 2000, 2002, TERA 2012a).

Specific learnings from the TMX Anchor Loop Project (TERA 2013a) regarding weed introduction and spread include:

- chemical and mechanical weed treatments were effective at controlling or suppressing non-native invasive broadleaf species of concern along and off the right-of-way, at temporary facilities and permanent facilities; and
- hand (manual) removal of vegetation in riparian areas (areas where chemical treatment was not allowed due to proximity to water) was effective in controlling or suppressing non-native broadleaf weeds.

In addition, the final PCEM report for the TMX Anchor Loop Project indicated that after 5 years, the post-construction vegetation management program had effectively controlled or suppressed non-native invasive broadleaf species of concern, identified during the pre-construction survey, along the right-of-way (TERA 2013a).

The potential introduction or spread of Noxious weeds and invasive, non-native species may vary in the period required to reverse the effect depending on the land use affected and the species. Consequently, the residual effect is considered to be reversible in the short to medium-term and of low to medium magnitude (Table A7.1.8-2, point 3[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Vegetation RSA – potential weed introduction and spread resulting from pipeline construction and maintenance activities may extend beyond the Footprint and Vegetation LSA to the Vegetation RSA.
- Duration: short-term – the events resulting in potential weed introduction and spread are construction of the pipeline or site-specific maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in potential weed introduction and spread (*i.e.,* pipeline construction, operations and maintenance activities) occur during construction and intermittently, but repeatedly over the assessment period.

- Reversibility: short to medium-term – depending on the weed species, the size/location of the weed occurrence and the associated land use.
- Magnitude: low to medium – the narrowed pipeline corridor parallels existing disturbances for its entire length within the park boundaries and weeds are known to be widespread throughout the park. Based on consultation, weeds are a concern in populated areas. Magnitude varies from low to medium depending on the weed or invasive plant species, affected land use and density/distribution of associated weed occurrences.
- Probability: high – pipeline construction is expected to cause some weed introduction and spread.
- Confidence: high – based on past pipeline projects, the professional experience of the assessment team and PCEM results.

7.1.8.3 Summary

As identified in Table A7.1.8-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on vegetation indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Finn Creek Provincial Park related to vegetation will be not significant.

7.1.9 Wildlife and Wildlife Habitat

This subsection describes the potential Project effects on wildlife and wildlife habitat in Finn Creek Provincial Park. The Wildlife LSA is defined as the area within a 1 km buffer of the centre of the proposed pipeline corridor; shown in Figure 6.2.2-3 of the Introduction to the Stage 2 Detailed Proposal. The Wildlife RSA is defined as the area within a 15 km buffer of the centre of the proposed pipeline corridor; shown in Figure 6.2.2-1 of the Introduction to the Stage 2 Detailed Proposal

Wildlife and wildlife habitat indicators (Table 6.2.1-1 of the Introduction to Stage 2 Detailed Proposal) were considered in this evaluation and the following indicators may occur in Finn Creek Provincial Park: grizzly bear, woodland caribou, moose, forest furbearers, bats, mature/old forest birds, early seral forest birds, riparian and wetland birds, great blue heron, bald eagle, common nighthawk, olive-sided flycatcher and pond-dwelling amphibians.

7.1.9.1 Identified Potential Effects

Project construction and operational activities have the potential to affect wildlife and wildlife habitat through changes to habitat, movement and mortality risk. A summarized discussion of potential Project effects on wildlife and wildlife habitat specific to Finn Creek Provincial Park is provided below. Potential effects associated with the construction and operations of the proposed pipeline on wildlife and wildlife habitat are listed in Table A7.1.9-1.

TABLE A7.1.9-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATION ON WILDLIFE AND WILDLIFE HABITAT FOR FINN CREEK PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures	Potential Residual Effect(s)
1 Change in habitat	LSA	• Refer to Table A7.1.9-2 below: habitat loss/alteration, wildlife disturbance and attraction of wildlife during construction, sensory disturbance, mammal dens, species with special conservation status, mountain caribou range, mineral licks, bats, migratory birds, raptor/owl nest, amphibian breeding pond, reptiles, beaver dams/lodges.	• Combined Project effects on wildlife and wildlife habitat in Finn Creek Provincial Park.

TABLE A7.1.9-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures	Potential Residual Effect(s)
2 Change in movement	LSA	• Refer to Table A7.1.9-2 below: habitat loss/alteration, access and line-of-sight management, barriers to wildlife movement, wildlife disturbance and attraction of wildlife during construction, mountain caribou range, mineral licks, mammal dens, bats, migratory birds, raptor/owl nest, amphibian breeding pond, reptiles, beaver dams/lodges.	• See above
3 Increased mortality risk	LSA	• Refer to Table A7.1.9-2 below: habitat loss/alteration, access and line-of-sight management, disturbance and attraction of wildlife during construction, mammal dens, species with special conservation status, mountain caribou range, bats, migratory birds, raptor/owl nest, amphibian breeding pond, reptiles, beaver dams/lodges.	

Notes: 1 LSA = Wildlife LSA.

Mitigation measures (as shown in the Pipeline EPP) that are particularly relevant to potential Project effects on wildlife and wildlife habitat in Finn Creek Provincial Park are identified in Table A7.1.9-2. The mitigation measures were principally developed in accordance with industry accepted best practices, as well as industry and provincial regulatory guidelines.

TABLE A7.1.9-2

RECOMMENDED MITIGATION FOR WILDLIFE AND WILDLIFE HABITAT FOR FINN CREEK PROVINCIAL PARK

Concern	Recommended Mitigation[1]
Habitat Loss/Alteration	• Avoid activity during sensitive time periods for wildlife species to the extent feasible. • Share workspace with the adjacent existing TMPL right-of-way or other existing rights-of-way to reduce the construction right-of-way-width. • Do not clear timber, stumps, brush or other vegetation beyond the marked construction right-of-way boundary. • Where grading is not required, cut/mow/walk down shrubs and small diameter deciduous trees at ground level to facilitate rapid regeneration. • Use natural recovery as the preferred method of reclamation on level terrain and at the riparian swamp unless otherwise requested by the regulator and where bio-engineering (*e.g.,* shrub staking/planting) will be conducted. • Plant native tree seedlings and/or shrubs at select locations to be determined in the field by the Environmental Inspector, in consultation with the Wildlife Resource Specialist. • Avoid the use of pesticides (except for herbicides to control invasive plants or noxious weeds; only use as spot treatments and outside the migratory bird breeding season) (BC MOE 2012a). • Reduce the width of grubbing near Finn Creek and the riparian swamp and through other wet areas to facilitate the restoration of shrub communities. • Reduce disturbance at riparian areas or cut/mow/walk down shrubs and small diameter deciduous trees at ground level to facilitate rapid regeneration. • Limit vegetation control along the right-of-way and allow natural regeneration during the operations phase to the extent feasible. • Conduct pre-construction surveys to identify site-specific habitat features (*e.g.,* mineral licks) and implement the appropriate setbacks and/or timing windows.
Access and Line-of-Sight Management	• Implement the measures included in the Traffic and Access Control Management Plan prepared for the Project (Appendix C of the Pipeline EPP). • Implement measures to reduce access (human and predator) along the right-of-way following construction. Measures may include but are not limited to planting tree seedlings and/or shrubs in select locations to facilitate rapid regeneration of natural vegetation, and blocking access entry points by mounding, rollback, boulder barriers, earth berms or locked gates. The locations of access control measures along the right-of-way will be determined in consideration of consultation with provincial regulatory authorities. • Where rollback and coarse woody debris are needed for access management, erosion control and habitat enhancement, ensure that a sufficient supply of suitable material is set aside for this purpose (Douglas-fir, grand fir and spruce will not be used for rollback in Finn Creek Provincial Park). • Consider the following at the proposed crossing of roads, railways, other pipelines or watercourses: extend the length of an HDD or bored crossings where this crossing technique has been proposed to leave a vegetated screen and/or narrow the right-of-way width.

TABLE A7.1.9-2 Cont'd

Concern	Recommended Mitigation[1]
Access and Line-of-Sight Management (cont'd)	• Use existing roads to access the pipeline right-of-way. Deactivate and reclaim any temporary roads that are no longer needed with native vegetation. Implement measures to reduce access (human and predator) along these temporary roads, as required. • Install educational signs as needed at selected locations.
Barriers to Wildlife Movement	• Conduct work as expeditiously as practical (*i.e.,* interval between front-end work activities such as grading and back-end activities such as clean-up) to reduce the length and duration of the open trench and to reduce potential barriers and hazards to wildlife. Refer to Table A2.5-1 for the length and duration of the construction activities. • Locate gaps in pipe to allow wildlife movement in places that also facilitate construction such as at slope changes, crossings (*i.e.,* watercourse, road, pipeline right-of-way) and bends. The locations of the gaps should coincide with gaps in spoil and slash piles. The locations can be determined in the field by the Environmental Inspector. • Restore habitat connectivity by redistributing large-diameter slash (rollback) over select locations on the pipeline right-of-way (e.g., where high levels of coarse woody debris occur prior to construction), to provide cover and facilitate movement of wildlife (e.g., furbearers). Specific locations are to be determined in the field by the Environmental Inspector and Wildlife Resource Specialist in discussion with provincial regulatory authorities. Trans Mountain will avoid the use of Douglas-fir, grand fir and spruce for rollback within Finn Creek Provincial Park.
Wildlife Disturbance and Attraction of Wildlife During Construction	• Schedule clearing and construction activities to avoid sensitive wildlife timing windows wherever feasible. • Minimize traffic and prohibit recreational use of all-terrain vehicles or snowmobiles by construction personnel on the pipeline right-of-way and at facilities. • Prohibit personnel from having pets on the pipeline right-of-way and at facilities. • Prohibit personnel from feeding or harassing wildlife. • Obey speed limits along access roads and the right-of-way. • Ensure that food waste and industrial waste are disposed of properly. • Report any issues related to wildlife encountered during construction and operations to the Environmental Inspector, who will report it to the appropriate regulatory authorities. • Implement the measures in the Wildlife Conflict Management Plan to prevent human/wildlife conflict and wildlife mortality (Appendix C of the Pipeline EPP).
Migratory Birds	• The migratory bird nesting period within Finn Creek Provincial Park is identified as the end of March to mid-August (Environment Canada 2014). • In the event that clearing or construction activities are scheduled during the migratory bird nesting period conduct nest sweeps within 7 days of activity. Use non-intrusive methods to conduct an area search for evidence of nesting (*e.g.,* presence of singing birds, territorial males, alarm calls, distraction displays). In the event an active nest is found, it will be subject to site-specific mitigation measures (*i.e.,* clearly marked protective buffer around the nest and/or non-intrusive monitoring).
Mountain Caribou Range	• Align route to parallel existing corridors to the extent feasible to reduce habitat disturbance. • BC MFLNRO recommends that activity within caribou range be avoided during early to mid-winter (i.e., November 1 to January 15) (Surgenor pers. comm.). Construction is scheduled to occur between Q2 to Q4 of 2014. However, construction will be conducted as expeditiously as practical in order to avoid the caridou range.. Any activities that occur within the period of November 1 to January 15 will be discussed with BC MFLNRO. • Implement line-of-sight breaks along segments not sharing a right-of-way boundary with another linear corridor such as a road or power line. Line-of-sight measures may include: bends in the right-of-way; doglegs at intersections with access roads; woody debris or earth berms; tree or shrub planting to create vegetation screens across the right-of-way. • Avoid creating early seral habitat that will provide forage for moose (*e.g.,* do not plant willow or red osier dogwood) (Surgenor pers. comm.). • Avoid creation of new access within caribou range. Use existing roads/linear corridors for access (BC OGC 2013). • Conduct work expeditiously to maintain a tight construction spread (*i.e.,* interval between front-end work activities such as grading and back-end activities such as clean-up) to reduce the duration of the open trench and to reduce potential barriers and hazards to wildlife. Refer to Table A2.5-1 for the length and duration of the construction activities. • Locate gaps in pipe to facilitate wildlife movement in places that also facilitate construction such as at slope changes, crossings (*i.e.,* watercourse) and bends. The locations of the gaps should coincide with gaps in spoil and slash piles. The locations can be determined in the field by the Environmental Inspector. • Where segments of the right-of-way require rollback for access management or erosion control, ensure sufficient timber is set aside for this purpose during final clean-up. • Implement minimum surface disturbance construction techniques that will facilitate natural revegetation in areas where grading or blasting is not required in areas of upland deciduous and mixedwood forests and in graminoid and shrub-dominated wetland communities.

TABLE A7.1.9-2 Cont'd

Concern	Recommended Mitigation[1]
Mountain Caribou Range (cont'd)	• Minimize the width of the pipeline right-of-way to the extent practical by utilizing shared workspace, avoiding clearing large diameter trees on the edge of the right-of-way; minimizing extra temporary workspace (*e.g.,* place log decks, storage areas, other temporary construction areas outside of caribou range). • Maintain root layer integrity on the right-of-way by clearing vegetation above ground level and restricting grubbing to the trench width. • Avoid using seed mixtures that will attract other ungulates (deer, moose) during reclamation (Hoekstra pers. comm.), to reduce potential effects associated with predator-prey interactions with caribou. • Implement measures to reduce access (human and predator) along the pipeline right-of-way following construction. Measures include using woody debris as rollback, mounding, planting trees and/or shrubs for visual screens, and rock piles or berms across the right-of-way. The locations of access control measures along the pipeline right-of-way will be determined in consideration of consultation with provincial regulatory authorities. • Monitor the effectiveness of access control measures and reclamation during post-construction environmental monitoring. Implement remedial measures. Schedule remedial work outside of the period of early to mid-winter when caribou are more likely to be in the area • Limit vegetation control along the right-of-way and allow natural regeneration during the operations phase to the extent feasible. • Limit operational access along the pipeline right-of-way within caribou range. • Report any sightings of caribou during construction and operations to Trans Mountain's Lead Environmental Inspector or Environmental Inspector(s).
Raptor Nest	• Schedule clearing and construction activities outside of sensitive time periods for raptors (generally March to August), to the extent feasible. • In the event clearing is scheduled at a time when raptor nests will be active, in areas of suitable habitat conduct raptor nest searches prior to clearing to locate active raptor nests. In the event an active raptor nest is discovered, consult with the appropriate regulatory authorities to discuss practical options and mitigation measures. • Eagle, peregrine falcon, gyrfalcon, osprey and burrowing owl nests are protected year-round by the BC W*ildlife Act* and may not be cleared. The Guidelines for Raptor Conservation (BC MOE 2013e) provides information on sensitive breeding and nesting time periods and buffers for raptor nests according to their tolerance to human disturbance. These buffers range from 50 m to 500 m depending on the surrounding land use and species. During the breeding season, an additional 100 m "quiet" buffer is recommended. Clearly mark the appropriate buffers with fencing to prevent access to the nest. • If construction is unavoidable within the recommended year-round and breeding buffers, a Nest Management Plan addressing various mitigation (including nest monitoring during the breeding period) is recommended. • If construction activities require the removal of a raptor nest that is protected year-round under the BC *Wildlife Act* (*i.e.,* eagle, peregrine falcon, gyrfalcon, osprey and burrowing owl), Trans Mountain will work with the appropriate regulatory authorities to develop a Nest Removal Management and Compensation Plan. Upon confirmation the nest is inactive, nest removal should occur during the least risk window of August through December. When a nest is removed the installation of a replacement structure (*i.e.,* a platform on a pole or transplanted tree) should be erected in nearby suitable habitat (BC MOE 2013e).
Amphibian Breeding Pond	• Clearing and construction activities have been scheduled outside of the breeding and seasonal migration periods for amphibians (mid-April to mid-June). • Protect identified amphibian breeding ponds by implementing appropriate buffers (150 m undeveloped; 100 m rural; 30 m urban) (BC MOE 2012a). • If the proposed pipeline right-of-way is located within the recommended setback distance of an amphibian breeding pond, consult with the appropriate regulatory authorities to discuss practical options and mitigation strategies. • Apply standard wetland construction and reclamation mitigation (*e.g.,* minimal disturbance, recontouring, reclamation, monitoring and remedial measures) to support habitat reclamation as needed. • Use mats to avoid excessive soil compaction in the proximity of the riparian swamp, Finn Creek and the unnamed drainage. • Maintain natural hydrology of streams and wetlands during clearing, construction and clean-up activities. • Do not mow/brush vegetation within wetland riparian (fringe) areas during operation. • Conduct an amphibian salvage prior to clearing and construction activities at known amphibian breeding pond locations. Ensure the appropriate permit is obtained.
Reptiles	• In the event an active snake hibernacula is identified, implement a 150 m buffer (BC MOE 2012a), and avoid activity during the period of April 15 to September 30 (BC MWLAP 2004b), to the extent feasible. • Consult with BC MFLNRO to determine the location and need for additional site-specific mitigation measures (*e.g.,* exclusion fencing for the open trench or along vehicle travel lanes) at identified locations. • All workers will receive education prior to commencing work, which will include best practices for avoiding snakes and appropriate protocols in the event a snake is detected at the work site. Refer to the Wildlife Conflict Management Plan in Appendix C of the Pipeline EPP.

TABLE A7.1.9-2 Cont'd

Concern	Recommended Mitigation[1]
Bats	• Protect bat roosts from disturbance by humans and other sensory disturbances (BC MOE 2012a). Implement a 125 m buffer from bat hibernacula (from October 1 to April 30 or maternity roost (from May 1 to August 31) (BC MWLAP 2004b). Consult with BC MFLNRO where disturbance of a hibernacula or maternity roost is unavoidable to discuss practical options and mitigation strategies.
Mammal Dens	• Contact provincial regulatory authorities to discuss the appropriate mitigation in the event an active den is discovered on or near the work site. Mitigation may include establishing protective buffers, monitoring the den and/or modifying the construction schedule to avoid activity until the den is inactive. • A setback of 50 m from active bear dens is recommended (BC OGC 2013).
Mineral Licks	• Implement a 100 m setback in the event a mineral lick is identified (BC OGC 2013). In the event that shifting/narrowing the pipeline right-of-way is not feasible to maintain the minimum setback from a mineral lick, consult with BC MFLNRO to discuss practical options and mitigation strategies. • Do not block well-used game trails to/from a mineral lick. • Avoid activities (*i.e.,* clearing, construction, helicopter overflights) near mineral licks during critical periods (May to November) (BC MWLAP 2004b), to the extent feasible. • Leave a gap in set-up pipe within the area of the mineral lick to allow wildlife to access the mineral lick. The locations of the gaps in strung pipe should coincide with gaps in strippings, spoil, and rollback windrows.
Beaver Dams/Lodges	• In the event that beaver dams or lodges will be disturbed, submit a notification to the appropriate regional Habitat Officer of the BC MFLNRO at least 45 days prior to beaver dam removal, as per Section 40 of the Water Regulation. Following this notification, obtain a Ministry of Natural Resource Operations Wildlife Sundry Permit to remove a beaver dam. Standards and best practices for beaver dam removal identified in the BC Standards and Best Practices for Instream Works (BC MWLAP 2004a) will be applied.
Species with Special Conservation Status	• In the event that a species with special conservation status is observed during construction, the appropriate regulatory authorities will be contacted to determine if additional mitigation measures are warranted. • Implement the Wildlife Species of Concern Discovery Contingency Plan in the event that wildlife species of concern are identified during construction.

Note: 1 Detailed mitigation measures are outlined in Table L-2 of Appendix L in the Pipeline EPP (Appendix A of this Proposal).

7.1.9.2 Significance Evaluation of Potential Residual Effects on Wildlife and Wildlife Habitat

The assessment of the residual combined effect on wildlife and wildlife habitat in Finn Creek Provincial Park considered all of the assessment criteria defined in Table 6.2.1-1 of the Introduction to the Stage 2 Detailed Proposal. The significance determination incorporates professional judgment, which allows integration of all of the effects criteria ratings to provide relevant significance conclusions that are sensitive to context and facilitate decision-making (Lawrence 2007).

The sensitivity of wildlife species that may occur in or near the park was considered in the determination of magnitude. In the absence of biological thresholds or standards, the magnitude evaluation also considered relevant land use planning objectives and strategies, and previous environmental assessments reviewed and approved under provincial and federal environmental regulatory processes, where appropriate. These sources provide useful information on social values and risk tolerance, which are an essential component of significance determination.

Table A7.1.9-3 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Finn Creek Provincial Park on wildlife and wildlife habitat. The rationale used to evaluate the significance of the residual effect on wildlife and wildlife habitat in Finn Creek Provincial Park is provided below.

TABLE A7.1.9-3

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WILDLIFE AND WILDLIFE HABITAT FOR FINN CREEK PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1[a] Combined Project effects on wildlife and wildlife habitat in Finn Creek Provincial Park.	Negative	LSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant

Notes: 1 LSA = Wildlife LSA.
2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Change in Habitat

Finn Creek Provincial Park comprises various habitat types that support wildlife, including wet bottomlands with old growth cottonwoods, western red cedar, hybrid spruce and birch, and riparian areas associated with Finn Creek and the North Thompson River (BC MOE 2013a). The Project will change the amount of available effective habitat for wildlife in Finn Creek Provincial Park. The likely mechanisms for changes in effective wildlife habitat include vegetation clearing, sensory disturbance (*e.g.,* human activity and noise), the crossing of Finn Creek, and soil handling (including trenching). The Project will increase the existing corridor width (since it parallels the existing TMPL right-of-way within Finn Creek Provincial Park) and require ongoing clearing as part of vegetation management during operations. Habitat loss and reduced habitat effectiveness can cause displacement of wildlife, and potentially result in the use of less suitable habitat, reduced foraging ability (Bird *et al.* 2004), increased energy expenditure (Jalkotzy *et al.* 1997) and lower reproductive success (Habib *et al.* 2007).

Clearing activities during construction of the Project will alter habitat structure, and result in direct habitat loss or alteration. Operations of the Project will also require ongoing vegetation management, resulting in the maintenance of forest habitat in earlier seral stages (herbaceous and shrub stages) until the pipeline is abandoned and the disturbed areas are reclaimed. Clearing of the construction right-of-way and TWS will reduce cover habitat and temporarily reduce forage availability. As cleared areas regenerate with early seral vegetation, forage availability will increase for some species (*e.g.,* browse for moose and deer; increased forage for bears and early seral habitat species). Vegetation clearing for the Project will decrease available habitat for forest and shrub-reliant species over the medium to long-term. The openings created by the Project may increase certain habitat types for species that use open areas (*e.g.,* common nighthawk foraging) and for habitat generalists (*e.g.,* corvids, some songbirds such as dark-eyed junco) (Jalkotzy *et al.* 1997). Vegetation clearing for the Project will disturb both wetland and terrestrial amphibian habitat. Possible mechanisms for changing effective amphibian habitat include site clearing (wetland and terrestrial habitats), watercourse crossings and soil handling (including trenching).

Indirect habitat loss or alteration occurs when habitat is available but the quality or effectiveness of the habitat is changed such that wildlife avoid the habitat or reduce their use of it. Reduced habitat effectiveness can occur as a result of fragmentation, creation of edges, or sensory disturbance (*e.g.,* noise, artificial light, proximity to facilities and infrastructure, human activity and traffic). Habitat fragmentation can cause habitat to become unsuitable for species with large territories or home ranges, alter predator-prey dynamics and allow for increased invasive or parasitic species abundance (*e.g.,* cowbird parasitism of songbird nests near forest edges). Changes in habitat suitability may also result from changes in vegetation communities due to increased light penetration at clearing edges that causes increased understory vegetation growth, or from changes in water quality (*e.g.,* sedimentation, deposition of airborne contaminants).

Within Finn Creek Provincial Park, the Project crosses critical habitat for southern mountain caribou in Wells Gray-Thompson local population unit of southern mountain caribou, as mapped by the Recovery Strategy for the Woodland Caribou, Southern Mountain Population (*Rangifer tarandus caribou*) in Canada

(Environment Canada 2014c). Within this local population unit, the proposed corridor crosses the Groundhog caribou range. Long-term reduction in habitat effectiveness adjacent to linear features may occur as caribou have been shown to partially avoid habitats near rights-of-way (Dyer 1999, Oberg 2001). The current habitat value of the proposed corridor within Finn Creek Provincial Park for caribou is reduced by the existing TMPL right-of-way, Highway 5, and the recreational use of the park. Supplemental field surveys will be completed for the Project within the park, which will allow for an evaluation of the biophysical attributes of the habitat within the proposed corridor, as it relates to the attributes of critical habitat defined in the federal Recovery Strategy. This information will be used to inform mitigation planning.

Snowmobilers use the existing TMPL right-of-way to access areas surrounding the park, including higher elevation areas that are used by caribou (BC Parks 2013). During operations, the Project is not expected to measurably change snowmobile use of the area, since the proposed corridor is adjacent to the existing TMPL right-of-way.

To minimize vegetation clearing and reduce the fragmentation and isolation of habitat patches, the narrowed pipeline corridor parallels the existing TMPL right-of-way within Finn Creek Provincial Park. The proposed mitigation measures (Table A7.1.9-2 and the Pipeline EPP) are expected to reduce residual Project effects on wildlife and wildlife habitat. The proposed crossing of Finn Creek will be designed to limit disturbance to the stream channel and riparian area to the extent feasible, and to prevent erosion and sedimentation.

Change in Movement

Project construction and operations can alter wildlife movement by reducing habitat connectivity and creating barriers or filters to movement. A disturbance is considered a barrier when no movement occurs across it, or a filter if the rate of movement through the disturbance is less than it would be through intact habitat (Jalkotzy *et al.* 1997). Habitat fragmentation results when barriers to movement cause functional separation of habitats into smaller, isolated habitat patches (Andrén 1994, Jalkotzy *et al.* 1997). Species that have late age of first reproduction, low population densities, low reproductive rates, large home ranges, low fecundity, and move over large distances to disperse, find food and mate, display low resilience to habitat fragmentation (Dunne and Quinn 2009).

The increased corridor width may cause an incremental barrier effect for some wildlife species. In some cases, linear developments have been shown to block, delay or deflect ungulate movements, potentially restricting or reducing access to some parts of their range (Harper *et al.* 2001). However, studies have concluded that buried pipelines do not create a movement barrier to boreal caribou (Carruthers and Jakimchuk 1987 in Dyer *et al.* 2002, Joint Pipeline Office 1999), except where they parallel roads with traffic (Curatolo and Murphy 1986 in Dyer *et al.* 2002). Studies on small mammal movements in the boreal forest have concluded that pipeline rights-of-way may act as barriers or filters to movement of flying squirrels, red squirrels and marten (Marklevitz 2003). Forest gaps have been shown to affect movements of forest birds (Bayne *et al.* 2005, Desrochers and Hannon 1997, Fleming and Schmiegelow 2002) and owls (COSEWIC 2008). Wider corridor widths increase barrier effects on bird movements more than narrower corridors (Desrochers and Hannon 1997), and parallel forest openings can cause a cumulative barrier effect at the landscape scale for some species (Bélisle and St. Clair 2001). Construction of the Project may create barriers to amphibian movement (*e.g.,* spoil piles, brush piles, traffic, strung pipe, open trench).

Changes in movement patterns can also occur since some species may be attracted to the rights-of-way. The Footprint will create increased forage availability for some wildlife species once vegetation communities regenerate to early seral vegetation after reclamation (*e.g.,* grasses/shrubs and potential for greater berry productivity at clearing edges). This may attract some wildlife to the right-of-way and, therefore, affect their normal movement patterns. For example, moose have been shown to select habitat based on forage over security, often preferring early seral, shrub dominated habitats (Wasser *et al.* 2011) with lower densities of coniferous tree cover (Hebblewhite *et al.* 2010, Rempel *et al.* 1997, Schwartz and Franzmann 1991). Deer are also known to be attracted to recently cleared, linear disturbances (Lyons and Jensen 1980) given the increased production of forage (Wallmo *et al.* 1972). Rights-of-way may also provide travel routes for predators such as wolves (James 1999, Stuart-Smith *et al.* 1997, Thurber *et al.* 1994) and grizzly bears (McKay *et al.* 2013).. Bats have also been shown to use linear landscape features for movement, which provide navigational references and flight corridors for some bat species (Hein *et al.* 2009, Verboom and Huitema 1997). Birds that use open spaces for hunting, foraging or nesting may also benefit.

Application of the proposed mitigation measures (Table A7.1.9-2 and the Pipeline EPP) is expected to reduce the magnitude of potential residual effects of Project construction and operations on wildlife movement. Limiting the length of open trench, and maintaining periodic gaps in soil, slash, and pipe, where feasible, will limit barriers to wildlife movement during construction. Limiting the construction right-of-way by utilizing shared workspace on the existing TMPL right-of-way will reduce the Project's potential for habitat fragmentation. Redistributing large-diameter slash (coarse woody debris) over select locations on the right-of-way and promoting regeneration of native vegetation, including shrubs and trees, will contribute to maintaining habitat connectivity by reducing limitations to movement of wildlife across the right-of-way. The Project is expected to result in a filter, but not complete barrier to movement of some wildlife species.

Increased Mortality Risk

The Project has potential to increase wildlife mortality risk during construction as a result of loss or disruption of habitat (*e.g.,* nests, dens), changes to predator/prey dynamics (*i.e.,* attracting prey species to early seral vegetation establishing on the disturbance), wildlife collisions with vehicles or equipment, and sensory disturbance (*e.g.,* nest abandonment).

Project construction (clearing, soil handling) may affect the mortality risk of some wildlife species. Pre-construction surveys will identify any site-specific habitat features (*e.g.,* active dens) that warrant additional mitigation to avoid disruption or mortality of wildlife. Scheduling of clearing activities will consider the migratory bird breeding season. Otherwise, potential effects of clearing and construction on bird mortality risk during the nesting period will be mitigated by conducting non-intrusive area searches for evidence of nesting (*e.g.,* presence of singing birds, territorial males, alarm calls, distraction displays). Any active nests will be subject to site-specific mitigation measures.

Linear corridors create improved access for predators, and may increase ungulate predation risk, since both prey and predators may be attracted to revegetating linear corridors. Linear corridors can potentially affect wildlife mortality risk from trapping, hunting and poaching due to access development, since these activities are often associated with roads or other linear corridors that create access (Collister *et al.* 2003, Wiacek *et al.* 2002). The Project does not create a new linear corridor within the park.

Vehicle traffic due to construction and operations of the Project may increase the risk of wildlife mortality due to vehicle collisions. With posting of low traffic speeds, signage and education of construction and operations contractors and employees, risk of wildlife injury or mortality associated with vehicle collisions is not expected to increase substantially as a result of the Project. Wildlife conflicts with personnel may occur during construction and operations of the pipeline, such as wildlife attraction to garbage and debris, and human encroachment. Trans Mountain has developed a Wildlife Conflict Management Plan (see Section 15 of Appendix C of the Pipeline EPP to reduce and address the potential conflict between Project personnel and the wildlife species most likely to be encountered along the Project and associated facilities.

Artificial night-time light sources attract songbirds that migrate at night and can increase bird mortality risk from collisions, excessive energy expenditure and predation (Jones and Francis 2003, Poot *et al.* 2008). The possible use of artificial night-time light sources within Finn Creek Provincial Park will be short-term in duration and occur either during construction or during site-specific operations and maintenance activities. There are no permanent facilities planned within Finn Creek Provincial Park that would require permanent artificial night-time light.

Summary of Effects Characterization Rationale for Wildlife and Wildlife Habitat

The following provides the evaluation of significance of potential residual effects on wildlife and wildlife habitat within Finn Creek Provincial Park (Table A7.1.9-3, point 1[a]).

- Spatial Boundary: Wildlife LSA – habitat changes (*e.g.,* clearing), alteration of movement (*e.g.,* barriers during construction) and mortality risk (*e.g.,* disturbance of occupied habitat feature) are primarily limited to the Wildlife LSA.

- Duration: short-term – the events causing effects are construction and operational activities (*e.g.,* monitoring, vegetation management and site-specific maintenance), the latter of which are limited to any one year during operations.

- Frequency: periodic – the events causing effects (*i.e.,* clearing of the Footprint, traffic and activity) will occur during construction and intermittently during operations for monitoring, vegetation control and maintenance.

- Reversibility: long-term – effects are reversible in the long-term following decommissioning and abandonment, once native vegetation regenerates over the Project Footprint. Herbaceous and shrub-dominant habitats are expected to regenerate to similar ecological stages and habitat function in the medium-term following completion of reclamation. However, restoration of forested habitat will take longer than 10 years (*i.e.,* long-term). Sensory disturbance and mortality risk associated with construction is reversible immediately upon completion of activities.

- Magnitude: medium – regulatory and ecological context are key considerations in the characterization of magnitude for residual effects of the Project on wildlife in Finn Creek Provincial Park. The stated management objectives of the park relevant to wildlife include protection of the ecological integrity of the river riparian and associated upland environments, maintaining the diversity of wildlife species and habitats, and providing for recreational opportunities such as wildlife viewing. Residual effects on ecological integrity (*e.g.,* habitat intactness and connectivity) are reduced by paralleling the existing TMPL right-of-way, minimizing the footprint, and reclamation of the footprint to native vegetation. The park has potential to provide habitat for wildlife species at risk, which, in general, often have low resilience to habitat disturbance. Most notably, the narrowed pipeline corridor crosses critical habitat for southern mountain caribou in the Wells Gray-Thompson local population unit (Groundhog caribou range). The current habitat value of the narrowed pipeline corridor in Finn Creek Provincial Park for caribou is reduced by the existing TMPL right-of-way, Highway 5, and the recreational use of the park. Trans Mountain will use information from field surveys and consultation with provincial regulatory authorities to develop appropriate mitigation, including a caribou habitat restoration plan, to reduce the Project's residual effect on caribou. Through development of mitigation in consultation with regulatory authorities, and implementation of mitigation and monitoring, including adaptive measures where warranted, the residual Project effects on wildlife in Finn Creek Provincial Park are expected to remain within regulatory and ecological tolerance. Therefore, the magnitude of the residual effect is concluded to be medium.

- Probability: high – the Project will affect wildlife in the park through changes in habitat, movement and mortality risk.

- Confidence: moderate – the assessment is based on a good understanding of cause-effect relationships and relevant data. Limitations and uncertainty associated with available data pertinent to the Project area reduce the confidence level to moderate.

7.1.9.3 Summary

As identified in Table A7.1.9-3, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on wildlife and wildlife habitat indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Finn Creek Provincial Park related to wildlife and wildlife habitat will be not significant.

7.1.10 Species at Risk

For the purpose of the assessment, species at risk are considered to include all federally-listed species of conservation concern (*i.e.,* COSEWIC or *SARA* Schedule 1 designation) (COSEWIC 2013, Environment Canada 2014b). Species identified as having the potential to occur along the narrowed pipeline corridor and in the element-specific RSAs are based on previous field assessments and existing data.

This subsection discusses the species at risk that have been identified as likely to occur within each element-specific RSA. The list of federal species at risk in the vicinity of Finn Creek Provincial Park includes two fish species within the Aquatics RSA, two vegetation species within the Vegetation RSA and eight wildlife species within the Wildlife RSA.

The two fish species include:

- coho salmon: Endangered by COSEWIC (Interior Fraser River populations); and
- bull trout: Special Concern by COSEWIC (South Coast BC populations) (Blue-listed).

The two vegetation species include:

- Haller's apple moss: Threatened by *SARA* and COSEWIC, Red-listed; and
- Mexican mosquito fern: Threatened by *SARA* and COSEWIC, Red-listed.

The eight wildlife species include:

- Common nighthawk: Threatened by *SARA* and COSEWIC;
- Olive-sided flycatcher: Threatened by *SARA* and COSEWIC, Blue-listed;
- Grizzly bear, western population: Special Concern by COSEWIC, Blue-listed;
- Little brown myotis: Endangered by COSEWIC;
- Northern myotis: Endangered by COSEWIC, Blue-listed;
- Wolverine: Special Concern by COSEWIC, Blue-listed;
- Woodland caribou, southern mountain population: Threatened by *SARA*, Endangered by COSEWIC, Red-listed; and
- Western toad: Special Concern by *SARA* and COSEWIC, Blue-listed.

Potential effects of the Project on these species are assessed through the use of indicators in Sections 7.1.6, 7.1.8 and 7.1.9, respectively.

7.1.11 Heritage Resources

This subsection describes the potential Project effects on the heritage resources in Finn Creek Provincial Park. The Heritage Resources RSA consists of the broader landscape context extending beyond the Project Footprint, defined as an area of intersecting Borden Blocks (Borden and Duff 1952); shown in Figure 6.2.2-2 of the Introduction to the Stage 2 Detailed Proposal. A Borden Block measures 10 minutes of latitude by 10 minutes of longitude.

Trans Mountain recognizes that a long term cultural issue and concern with Finn Creek Provincial Park includes the inventory and protection of archaeological sites (BC MELP 1999). The potential for encountering heritage resources in Finn Creek Provincial Park has been reduced by aligning the narrowed pipeline corridor to parallel the existing TMPL right-of-way. Qualified archaeologists commenced an Archaeological Impact Assessment (AIA) for the BC portion of the narrowed pipeline corridor in July 2013 under Archaeological Research Permit 2013-165. The AIA within Finn Creek Provincial Park is expected to be conducted in October 2014. For the AIA, background data is reviewed and then complemented with ground reconnaissance with targeted areas for more intensive visual inspection, and where warranted, shovel testing. The ground reconnaissance and shovel testing programs focus on areas along the narrowed pipeline corridor that are of moderate to high potential for archaeological, historic and palaeontological sites.

7.1.11.1 Identified Potential Effects

The potential effects associated with pipeline construction and operations on heritage resources indicators are listed in Table A7.1.11-1. A summary of mitigation measures provided in Table A7.1.11-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines including BC OGC (2010) and CAPP (1999, 2001).

TABLE A7.1.11-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON HERITAGE RESOURCES FOR FINN CREEK PROVINCIAL PARK

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][1]	Potential Residual Effect(s)
1. Heritage Resources Indicator – Archaeological Sites			
1.1 Disruption to previously unidentified archaeological sites during AIA.	Footprint	• Follow any conditions or recommendations identified in the permits for the AIA for BC. • Suspend work in proximity (*i.e.*, within 30 m) to archaeological, palaeontological or historical sites (*e.g.*, modified bone, pottery fragments, fossils) discovered during construction. No work at that particular location shall continue until permission is granted by the appropriate regulatory authority. Follow the contingency measures identified in the Heritage Discovery Contingency Plan [Appendix B of the Pipeline EPP]. • Arrange for emergency archaeological excavation of previously unidentified sites endangered by pipeline construction wherever such sites warrant attention and can be excavated without interfering with the construction schedule. When for practical reasons, the sites cannot be investigated, map and suitably flag these sites for later investigation [Section 7.0]. • Prohibit the collection of any historical, archaeological or palaeontological resources by Project personnel [Section 7.0]. • Avoid, where possible, disturbance of geodetic or legal survey monuments, to the extent feasible during construction of the pipeline, Trans Mountain's Construction Manager will immediately report such disturbance to the appropriate regulatory authority. The contractor will restore or re-establish the monument, where feasible, in accordance with the instructions of the Dominion Geodesist [Section 7.0].	• No residual effect identified.
1.2 Disturbance to known archaeological sites during AIA.	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
1.3 Disturbance of previously unidentified archaeological sites during construction.	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
2. Heritage Resources Indicator – Historic Sites			
2.1 Disturbance to previously unidentified historic sites during AIA.	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
2.2 Disturbance of previously unidentified historic sites during AIA.	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
3. Heritage Resources Indicator – Palaeontological Sites			
3.1 Disturbance of previously unidentified palaeontological sites during construction.	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.

Note: 1 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.11.2 Potential Residual Effects

Heritage resources provide a window into past human experiences and the geological record, and by their very nature, are non-renewable. Once disturbed, the resource may be altered or even lost. Consequently, the primary mitigation measure in protecting heritage resources is avoidance, and secondly, site-specific mitigation developed in consultation with appropriate provincial regulatory authorities and approved by these authorities in fulfillment of Permit obligations may also be used. In order to better understand heritage resources and the historical information associated with these resources, disturbing the resource through excavations is an acceptable practice and, in many cases, the only method to collect in situ information to add to the archaeological record. Regardless of whether the excavation of the site is for academic or development purposes, the loss of heritage resource sites is generally offset by the recovery of knowledge about the site gained through meticulous identifying, cataloguing and preserving of artifacts and features in compliance with provincial guidelines.

7.1.11.3 Summary

Given that disturbances to heritage resources by the Project in Finn Creek Provincial Park are effectively offset by knowledge gained through the mitigation approved by the provincial regulatory authorities, no residual effects on heritage resource indicators have been identified and, consequently, no further evaluation of the effects of the Project on heritage resources is warranted.

7.1.12 Traditional Land and Resource Use

This subsection describes the potential Project effects on potential traditional land and resource use (TLRU) sites in Finn Creek Provincial Park. The TLRU LSA includes the zones of influence of water quality and quantity, air emissions, acoustic environment, fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat and heritage resources since TLRU is dependent on these resources; shown in Figure 6.2.2-3 of the Introduction to the Stage 2 Detailed Proposal. The TLRU RSA includes the RSA boundaries of water quality and quantity, air emissions, acoustic environment, fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat and heritage resources; shown in Figure 6.2.2-2 of the Introduction to the Stage 2 Detailed Proposal.

7.1.12.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on subsistence activities and sites and cultural sites indicators are listed in Table A7.1.12-1.

To date, no TLRU sites have been identified along the narrowed pipeline corridor in Finn Creek Provincial Park. However, Trans Mountain will continue to engage Aboriginal communities through all phases of the Project. TLRU information received from participating communities will be reviewed in order to confirm literature results and mitigation measures including those found in the Pipeline EPP. Any additional site-specific mitigation measures resulting from these studies will be provided in the updated Pipeline EPP to be filed with the NEB 90 days prior to construction.

The construction of the Project has the potential to directly and indirectly disrupt subsistence sites and activities, as well as the broader ecological system, through the temporary physical disturbance of land or resources. Subsistence sites and activities may also be affected by Project activities resulting from limited access and/or increased public access to traditional harvesting areas and increased pressure on environmental resources.

The operations phase of the Project will affect TLRU primarily through disturbances related to site-specific maintenance.

A summary of mitigation measures provided in Table A7.1.12-1 was principally developed in accordance with industry accepted best practices as well as industry accepted best practices and procedures and provincial regulatory authority guidelines related to specific elements such as fish and fish habitat, vegetation, wetland loss or alteration, wildlife and wildlife habitat, and heritage resources.

TABLE A7.1.12-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON TRADITIONAL LAND AND RESOURCE USE FOR FINN CREEK PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Traditional Land and Resource Use Indicator – Subsistence Activities and Sites			
1.1 Disruption of use of trails and travelways	Footprint	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Upon Footprint finalization, applicable mitigation options listed below for previously identified trails and travelways within the narrowed pipeline corridor will be confirmed based on the following criteria: the location of the site with respect to the proposed area of development, the relative importance of the site to the community, and the potential for an alternative mitigation strategy to reduce or avoid sensory disturbance. • Should additional trails and travelways be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: – detailed recording and mapping to within 100 m on both sides of the pipeline right-of-way; in partnership with community representatives, a decision is then made about the relative importance of the trail and how best to maintain and control access; – signage or scheduling construction during periods of least impact; and/or – alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • Implement appropriate measures identified in the Heritage Resources Discovery Contingency Plan [Appendix B]. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Disturbance of trails and travelways during construction and site-specific maintenance.
	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during the construction and site-specific maintenance activities (refer to Section 7.2.1).

TABLE A7.1.12-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.2 Alteration of plant harvesting sites	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Ensure equipment arrives at all construction sites clean and free of soil or vegetative debris. Inspect and identify equipment deemed to be acceptable with a suitable marker, such as a sticker. Do not allow any equipment arriving in a dirty condition onsite until it has been cleaned [Section 7.0]. • Should additional plant harvesting sites be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: – limiting the use of chemical applications; – replacement of plant species during reclamation; – avoidance of the site; and/or – alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • See Section 7.1.8 Vegetation for additional mitigation measures. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.
1.3 Disruption of subsistence hunting activities	LSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • See Section 7.1.9 Wildlife and Wildlife Habitat for mitigation relevant to sensory disturbance, loss or alteration of wildlife habitat, injury and mortality. • Should additional hunting sites be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: – adhering to species specific timing constraints to the extent feasible; – leaving breaks in the pipeline trench to allow animals to cross; – limiting the use of chemical applications; and/or – alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • See Section 7.1.5 Acoustic Environment for additional mitigation measures. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.

TABLE A7.1.12-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.4 Disruption of subsistence trapping activities	LSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Prohibit the vandalism or theft of trapper equipment or trapped animals if they are observed on the construction right of way or the construction site prior to clearing [Section 7.0]. • Should additional trapping sites or trap line equipment be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: – maintaining access to the trap line; – moving of trap line equipment by the trapper prior to construction; and/or – alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • See Section 7.1.5 Acoustic Environment for additional mitigation measures. • See Section 7.1.9 Wildlife and Wildlife for mitigation relevant to sensory disturbance, loss or alteration of wildlife habitat, and wildlife mortality. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.
1.5 Disruption of subsistence fishing activities	LSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Prohibit recreational fishing by Project personnel on or in the vicinity of the construction right of way. The use of the construction right of way to access fishing sites is prohibited [Section 7.0]. • Should additional fishing sites be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: – recording and mapping of fishing locales; – strict adherence to the legislation, standards and guidelines set by provincial and federal regulatory authorities for watercourse crossings; and/or – alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • See Section 7.1.3 Water Quality and Quantity for mitigation measures relevant to potential effects on water quality and quantity. • See Section 7.1.6 Fish and Fish Habitat for mitigation measures relevant to potential effects on fish and fish habitat. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.

TABLE A7.1.12-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2. Traditional Land and Resource Use Indicator – Cultural Sites			
2.1 Disturbance of gathering places	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • See Section 7.1.4 Air Emissions and Section 7.1.5 Acoustic Environment for measures pertaining to nuisance air and noise emissions, respectively. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.*, integrity digs).	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site specific maintenance activities (refer to Section 7.2.1).
2.2 Disturbance of sacred sites	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • See Section 7.1.4 Air Emissions and Section 7.1.5 Acoustic Environment for measures pertaining to nuisance air and noise emissions, respectively. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.*, integrity digs).	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site specific maintenance activities (refer to Section 7.2.1).

Notes: 1 LSA = TLRU LSA; RSA = TLRU RSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.12.2 Significance Evaluation of Potential Residual Effects

To date, Trans Mountain has not been made aware of any use of the lands within Finn Creek Provincial Park for traditional activities. Nevertheless, Trans Mountain assumes that TLRU activities could be potentially practiced within the park.

Table A7.1.12-2 provides a summary of the significance evaluation of the potential residual socio-economic effects of the construction and operations of the proposed pipeline in Finn Creek Provincial Park on TLRU indicators. The rationale used to evaluate the significance of each of the residual socio-economic effects is provided below.

TABLE A7.1.12-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON TRADITIONAL LAND AND RESOURCE USE FOR FINN CREEK PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1 Traditional Land and Resource Use Indicator – Subsistence Activities and Sites									
1(a) Disturbance of trails and travelways during construction and site-specific maintenance.	Negative	Footprint	Short-term	Periodic	Short-term	Medium	Low	Moderate	Not significant

TABLE A7.1.12-2 Cont'd

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
				Duration	Frequency	Reversibility				
1(b)	Alteration of subsistence resources.	Negative	RSA	Short-term	Periodic	Long-term	Medium	Low	Moderate	Not significant
1(c)	Disruption of subsistence activities during construction and site-specific maintenance.	Negative	RSA	Short-term	Periodic	Long-term	Medium	Low	Moderate	Not significant
1(d)	Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site-specific maintenance activities.	Negative	RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant
2	Traditional Land and Resource Use Indicator – Cultural Sites									
2(a)	Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site-specific maintenance activities.	Negative	RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant

Notes: 1 RSA = TLRU RSA.

2 Significant Residual Socio-economic Effect: A residual socio-economic effect is considered significant if the effect is predicted to be:

- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

Traditional Land and Resource Use Indicator – Subsistence Activities and Sites

Disturbance of Trails and Travelways During Construction and Site-Specific Maintenance

Disturbance of trails and travelways during construction is anticipated to result from short-term physical disturbance of land and access limitations that may affect the practice of traditional activities by Aboriginal communities. Similar effects of reduced access may occur during periods of site-specific maintenance.

To date, no trails and travelways have been identified along the narrowed pipeline corridor within Finn Creek Provincial Park. If trails and travelways are identified along the narrowed pipeline corridor within Finn Creek Provincial Park during ongoing engagement with Aboriginal communities, the proposed mitigation measures described in Table A7.1.12-1 will be implemented to mitigate the potential adverse effects of the Project on these site types and will be dependent upon the type of site identified.

Additional measures to reduce the disruption of trails and travelways include notification regarding construction schedules and pipeline route maps, installing signage notifying of construction activities in the area and working with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members.

Despite the implementation of the proposed mitigation measures, traditional land and resource users may still be unable to use, or be deterred from using, certain areas at times during construction and periods of site-specific maintenance and consequently, the magnitude of the residual effect is considered to be medium (Table A7.1.12-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – trails, and travelways may be physically disturbed if occurring within the construction right-of-way and TWS.
- Duration: short-term – events causing the effects will be construction activity or site-specific maintenance that would occur within any one year period during operations.

- Frequency: periodic – construction and site-specific maintenance activities will occur intermittently but repeatedly throughout the assessment period.
- Reversibility: short-term – effects will be focused on the construction phase or site-specific maintenance that would occur within any one year period during operations.
- Magnitude: medium – it is expected that Project-related disturbances would be temporary through the implementation of the proposed mitigation measures during construction and operations to reduce, but not eliminate, potential effects on disturbance of trails and travelways. Mitigation strategies are also in place in the event any unidentified subsistence sites are discovered.
- Probability: low - to date no trails and travelways have been identified within the narrowed pipeline corridor in Finn Creek Provincial Park.
- Confidence: moderate – based on Project information and the professional experience of the assessment team.

Alteration of Subsistence Resources

Subsistence resources may be disturbed or altered during construction and operations of the Project. The alteration of subsistence activities could manifest itself through changes to local harvesting locales, behavioral alteration or sensory disturbance of environmental resources or increased public access to traditional harvesting areas and increased pressure on environmental resources. The operations of the proposed pipeline will affect subsistence resources primarily due to temporary disturbances related to maintenance activities.

To date, no subsistence harvesting sites have been identified within the narrowed pipeline corridor in Finn Creek Provincial Park. If subsistence harvesting sites are identified in Finn Creek Provincial Park during ongoing engagement with Aboriginal communities, the proposed mitigation measures described in Table A7.1.12-1 will be implemented to mitigate the potential adverse effects of the Project on these site types and include measures outlined under the assessment of relevant environmental resources (*e.g.,* air emissions, acoustic environment, fish and fish habitat, wildlife and wildlife habitat, vegetation, wetlands).

Despite the implementation of the proposed mitigation measures, traditional land and resource users may still be unable to use, or be deterred from using, certain areas at times during construction and periods of site-specific maintenance. Changes to the distribution and abundance of resources could in turn result in loss or alteration of harvesting areas, which could result in indirect effects such as harvesters having to spend more time and money to travel further for subsistence activities. Therefore the magnitude of the residual effect is considered to be medium (Table A7.1.12-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: TLRU RSA – potential effects may extend beyond the Footprint into ZOI of target environmental resources.
- Duration: short-term – events causing the effects will be construction activity or site-specific maintenance that would occur within any one year period during operations.
- Frequency: periodic – construction and site-specific maintenance activities will occur intermittently but repeatedly throughout the assessment period.
- Reversibility: long-term – the effects of disturbance to traditionally harvested resources will be dependent on each target species' sensitivities and could extend greater than 10 years following decommissioning and abandonment, once native vegetation regenerates over the Footprint.
- Magnitude: medium – the effects assessment results for fish and fish habitat, wildlife and wildlife habitat, vegetation, wetlands indicates that effects to traditionally harvested resources may be detectable and is dependent on each target species' sensitivities.

- Probability: low – to date no subsistence resources have been identified by Aboriginal communities within the narrowed pipeline corridor in Finn Creek Provincial Park.
- Confidence: moderate – based on Project information and the professional experience of the assessment team.

Disruption of Subsistence Activities During Construction and Site-Specific Maintenance

The disruption of subsistence hunting, fishing, trapping and plant gathering activities is a potential residual effect of interactions between traditional resource users and construction and operations activities of the Project. In the event that subsistence activities are disrupted by the construction or operations of the Project, the interruption could mean that the traditional resource user misses the harvest opportunity or that their participation is curtailed. The disruption of subsistence activities also refers to the possibility that traditional resource users could be prevented from accessing key harvesting areas resulting from limited access or increased public access to traditional harvesting areas. The operations of the proposed Project will affect subsistence activities primarily due to temporary disturbances related to site-specific maintenance.

To date, Trans Mountain has not been made aware of any subsistence activities along the narrowed pipeline corridor within Finn Creek Provincial Park. Nevertheless, Trans Mountain assumes that subsistence activities could be potentially practiced within the park, although of low probability (Table A7.1.12-2, point 1[c]).

Aboriginal communities will be provided with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities. Signage will be installed, notifying of construction activities in the area. Trans Mountain will work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members. A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: TLRU RSA – the proposed Project may affect subsistence activities beyond the construction footprint and may also indirectly affect the distribution of traditional resource users in other areas of the TLRU RSA.
- Duration: short-term – events causing the effects will be construction activity or site-specific maintenance that would occur within any one year period during operations.
- Frequency: periodic – construction and site-specific maintenance activities will occur intermittently but repeatedly throughout the assessment period.
- Reversibility: long-term – the disruption of subsistence hunting, trapping, fishing and plant gathering activities during construction is limited to the construction phase of the Project, however, changes to preferred harvesting locales could result in indirect effects such as harvesters having to spend more time and money to travel further for subsistence activities, and could extend greater than 10 years following decommissioning and abandonment, once native vegetation regenerates over the Footprint.
- Magnitude: medium – mitigation measures are in place in the event any unidentified subsistence activities and land users are discovered and given that the effects assessment results for fish and fish habitat, vegetation, wetlands, and wildlife and wildlife habitat demonstrate that equivalent land use capability will be maintained by the application of the mitigation strategies described in Table A7.1.12-1 and in the Pipeline EPP. It is expected that Project-related disruptions would be temporary through the implementation of the proposed mitigation measures during the construction and operations phases to reduce, but not eliminate, the potential effects on subsistence activities.
- Probability: low – to date no subsistence activities and land users have been identified along the narrowed pipeline corridor within Finn Creek Provincial Park.
- Confidence: moderate – based on Project information and the professional experience of the assessment team.

Sensory Disturbance for Aboriginal and Non-Aboriginal Local Residents and Land Users (from Nuisance Air Emissions and Noise)

The construction and site-specific maintenance of the Project may result in the sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (Table A7.1.12-2, point 1[d]). This potential residual effect is assessed under the Visitor Enjoyment indicator of Recreational Values in Section 7.2.1. The significance evaluation of this residual effect is provided in Section 7.2.1 which includes all land and resource users, provides an explanation of the rationale and significance criteria.

Traditional Land and Resource Use Indicator – Cultural Sites

Sensory Disturbance for Aboriginal and Non-Aboriginal Local Residents and Land Users (from Nuisance Air Emissions and Noise)

The construction and site-specific maintenance of the Project may result in the sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (Table A7.1.12-2, point 2[a]). This potential residual effect is assessed under the Visitor Enjoyment indicator of Recreational Values in Section 7.2.1. The significance evaluation of this residual effect is provided in Section 7.2.1 which includes all land and resource users, provides an explanation of the rationale and significance criteria.

7.1.12.3 Summary

As identified in Table A7.1.12-2, there are no situations for TLRU indicators that would result in a significant residual socio-economic effect. Consequently, it is concluded that the residual socio-economic effects of Project construction and operations on conservational values of Finn Creek Provincial Park related to TLRU will be not significant.

7.2 Recreational Values of Finn Creek Provincial Park

As per the *Finn Creek Provincial Park Management Direction Statement, 1999*, Finn Creek Provincial Park has many viewing spots for wildlife and Chinook spawning. Canoeing, kayaking and fishing are some of the recreational opportunities that are offered by the park. Permitted winter recreational opportunities include back country skiing and snowshoeing. Snowmobiling is permitted on the existing TMPL right-of-way.

7.2.1 Visitor Enjoyment and Safety

This subsection describes the potential Project effects on visitor enjoyment and safety values within Finn Creek Provincial Park. This refers to the use of the land and resources by people, in both a consumptive and non-consumptive manner. Aesthetic attributes of human use areas are also considered in this discussion (*e.g.,* sensory disturbance, changes in viewshed).

Visitor enjoyment and safety amalgamates relevant components from the human occupancy and resource use (HORU) and infrastructure and services elements in Volume 5B of the Facilities Application, particularly indicators related to parks and protected areas, outdoor recreation use and transportation infrastructure. Spatial boundaries for visitor enjoyment follow the spatial boundaries outlined for the HORU element. Spatial boundaries for visitor safety follow the spatial boundaries outlined for the infrastructure and services element; shown in Figure 6.2.2-2 of the Introduction to the Stage 2 Detailed Proposal.

7.2.1.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline in Finn Creek Provincial Park on visitor enjoyment and safety indicators are listed in Table A7.2.1-1.

A summary of mitigation measures provided in Table A7.2.1-1 was principally developed in accordance with industry accepted best practices and industry best practices. A full list of socio-economic mitigation measures is found in the Socio-Economic Management Plan (SEMP) (Section 8.0) of the Pipeline EPP.

TABLE A7.2.1-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VISITOR ENJOYMENT AND SAFETY FOR FINN CREEK PROVINCIAL PARK

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][1]	Potential Residual Effect(s)
1. Visitor Enjoyment and Safety Indicator – Visitor Enjoyment			
1.1 Physical disturbance to Finn Creek Provincial Park	Footprint	• Minimize disturbance of valued natural features with a non-traditional human use (*e.g.*, recreational trails, recreational use areas, key use areas within Finn Creek Provincial Park) during final route refinement to the extent practical [SEMP Section 8.4.6]. • Provide provincial and federal regulatory authorities, municipal/regional governments; Aboriginal communities; BC Parks and recreational organizations with final routing information, including maps, as well as construction schedule information [SEMP Section 8.4.6]. • Install signs in Finn Creek Provincial Park and known recreational use areas in the vicinity notifying users of construction activities and timing [SEMP Section 8.4.6]. • Develop and implement a communication plan for sharing information about key Project construction milestones and information with the general public in affected areas [SEMP Section 8.4.6]. • Ensure any changes in planned timing or location of construction activities is communicated to the public, relevant municipal and regional governments, Aboriginal communities, BC Parks and formal recreation organizations in affected areas [SEMP Section 8.4.6]. • Apply all measures pertaining to HORU in the SEMP and all measures pertaining to notification and vegetation in the Pipeline EPP.	• Physical disturbance to natural and built features in protected areas during construction and site-specific maintenance.
1.2 Physical disturbance to facilities, including trails and trailheads, parking lot, within Finn Creek Provincial Park	HORU RSA	• Avoid disturbance of built features during final route refinement, to the extent practical [SEMP Section 8.4.6]. • Narrow the construction right-of-way at key locations to avoid valued built or natural features, to the extent practical [SEMP Section 8.4.6]. • Ensure closure signage is placed on affected established trails or trailheads. • Contact appropriate regulatory authorities and municipal tourism offices prior to construction activities and provide maps and schedules of the proposed construction activities to enable them relay information about possible trail and recreational use area closures [SEMP Section 8.4.6]. • Develop and implement a communication plan for sharing information about key Project construction milestones and information with the general public in affected areas [SEMP Section 8.4.6]. • Apply all measures pertaining to HORU in the SEMP and all measures pertaining to notification and vegetation in the Pipeline EPP.	• Decrease in quality of the outdoor recreational experience of Aboriginal and non-Aboriginal resource users during construction.
1.3 Change to access of protected area	HORU RSA	• Maintain access to established recreation features, through the clearing, construction and reclamation period [SEMP Section 8.4.6]. • Place signage on access roads in the vicinity of construction activities to ensure users are aware that construction activities are taking place [SEMP Section 8.4.6]. • Bore under paved and high use roads [SEMP Section 8.4.6]. • Where minor roads are crossed that may affect established community use/access routes, complete an open cut crossing within one day, to the extent practical [SEMP Section 8.4.6]. • Provide provincial and federal regulatory authorities, municipal/regional governments; Aboriginal communities; BC Parks and recreational organizations with final routing information, including maps, as well as construction schedule information [SEMP Section 8.4.3]. • Develop Traffic Control Plans for site specific sections of roads affected by the Project [SEMP Section 8.4.3]. • Develop a communication plan for activities that impact normal traffic flow, such as road closures, detours [SEMP Section 8.4.3]. • Develop and implement a communication plan for sharing information about key Project construction milestones and information with the general public in affected areas [SEMP Section 8.4.6]. • Ensure any changes in planned timing or location of construction activities is communicated to the public, relevant municipal and regional governments, Aboriginal communities, BC Parks and formal recreation organizations in affected areas. • Apply all other measures pertaining to notification and access in the SEMP.	• Change in land use patterns during construction and site-specific maintenance.

TABLE A7.2.1-1 Cont'd

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][1]	Potential Residual Effect(s)
1.4 Sensory disturbance of land and resource users	HORU RSA	• Adhere to all federal and provincial guidelines and legislation for noise management. • Use only the size and power of tools necessary to limit noise from power tool operations. Ensure stationary equipment, such as compressors and generators, will be located away from noise receptors, to the extent feasible. • Maintain noise suppression equipment (*e.g.*, silencers) on all construction machinery and vehicles. • Enclose noisy equipment and use baffles such as material storage and subsoil piles, where and when feasible, to limit the transmission of noise beyond the construction site. • Restrict the duration that vehicles and equipment are allowed to site and idle to less than 1 hour, unless air temperature is less than 0°C. • To reduce air and noise emissions from Project-related vehicles, use multi-passenger vehicles for the transportation of crews to and from the job sites, where feasible. Actively encourage car-pooling when shuttle bus services are not practical.	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions, noise and visual effects) during construction and site-specific maintenance activities.
2. Visitor Enjoyment and Safety Indicator – Visitor Safety			
2.1 Increased traffic due to transportation of workers and supplies	Socio-economic RSA	• Develop estimates of Project-related traffic volumes associated with all Project components, related to both the movement of workers and the movement of equipment and materials. • Continue to consult with the BC Ministry of Transportation and relevant municipalities regarding traffic volumes anticipated and the traffic management protocols. • Develop a traffic and Access Control Management Plan for the Project and Traffic Control Plans for particular contracts. • Where possible, provide daily shuttle bus service from designated staging areas to work sites. • Actively encourage carpooling for times when shuttles/buses is not practical or available. • Communicate with local police and emergency services personnel to keep these organizations informed of traffic schedules. • Develop a communication plan for activities that impact normal traffic flow, such as road closures, detours. • Apply all other transportation and traffic related measures outlined in the Pipeline EPP.	• Increase in traffic on highways and access roads during construction. • Sensory disturbances for Aboriginal local residents and land use (refer to potential effect 1.4 of this table). • Increase in traffic related injury and mortality.

Note: 1 Detailed mitigation measures are outlined in the SEMP and the Pipeline EPP (Appendix A of this Proposal).

7.2.1.2 Significance Evaluation of Potential Residual Effects

Table A7.2.1-2 provides a summary of the significance evaluation of the potential residual effects of the construction and operations of the Project on visitor enjoyment and safety indicators. The rationale used to value the significance of each of the residual socio-economic effects is provided below.

TABLE A7.2.1-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VISITOR ENJOYMENT AND SAFETY FOR FINN CREEK PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
1. Visitor Enjoyment and Safety Indicator - Visitor Enjoyment									
1(a) Physical disturbance to natural and built features in protected areas during construction and site-specific maintenance.	Negative	Footprint	Short-term	Periodic	Short to medium-term	Medium	High	Moderate	Not significant

TABLE A7.2.1-2 Cont'd

Potential Residual Effects	Impact Balance	Spatial Boundary	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[1]
1(b) Decrease in quality of the outdoor recreational experience of Aboriginal and non-Aboriginal resource users during construction.	Negative	HORU RSA	Short-term	Isolated	Short-term	Low	High	High	Not significant
1(c) Change in land use patterns during construction and site-specific maintenance.	Negative	HORU RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant
1(d) Sensory disturbances for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions, noise and visual effects) during construction and site-specific maintenance.	Negative	HORU RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant
2. Visitor Enjoyment and Safety Indicator – Visitor Safety									
2(a) Increase in traffic on highways and access roads during construction.	Negative	Socio-economic RSA	Short-term	Isolated	Short-term	Moderate	High	High	Not significant
2(b) Increase in traffic related injury and mortality.	Negative	Socio-economic RSA	Short-term	Isolated	Short-term	Negligible to medium	Low	High	Not significant

Note: 1 Significant Residual Socio-economic Effect: A residual socio-economic effect is considered significant if the effect is predicted to be:

- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

Visitor Enjoyment and Safety Indicator – Visitor Enjoyment

Physical Disturbance to Natural and Built Features in Protected Areas During Construction and Site-Specific Maintenance

Finn Creek Provincial Park will be crossed by the narrowed pipeline corridor during construction activities, as well as during periods of site-specific maintenance (*i.e.*, integrity digs).

Natural and built features within Finn Creek Provincial Park - such as interpretive signs, parking lots, picnic areas, trees, rocks, watercourses and trails - may have intrinsic, interpretive and recreational value, which may be disturbed as a result of pipeline construction and site-specific maintenance. The narrowed pipeline corridor crosses a paved parking lot in Finn Creek Provincial Park (approximately AK 638.8) and a snowmobile route that uses the existing TMPL right-of-way (approximately AK 638.7 to AK 639.3).

Mitigation measures related to vegetation, wetlands, wildlife and wildlife habitat and fish and fish habitat have been designed to reduce the amount of land disturbed in any park or protected area. Other key mitigation measures includes avoiding key valued natural or built features during right-of-way finalization, narrowing the right-of-way in certain areas, and restoring any trails or other valued features that may be disturbed. Even with the implementation of mitigation measures to reduce land disturbance, certain natural features with intrinsic value may be disrupted depending on the final right-of-way selection, resulting in a residual adverse effect. Assuming the implementation of all mitigation measures, the residual effect of the Project on natural and built features in protected areas is considered to be reversible in the short to medium-term (*i.e.*, residual effects will primarily occur during construction, but restoration of valued features or areas may extend into the first several years of operations). The magnitude of the effect is considered medium; though the effect may be primarily that of an inconvenience or nuisance, parks and protected areas have an intrinsic value to many users (Table A7.2.1-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below

- Spatial Boundary: Footprint – natural and built features within parks and protected areas will be directly affected by construction of the pipeline.

- Duration: short-term – the residual effect will be caused by construction and site-specific maintenance that may occur within any one year during operations.
- Frequency: periodic – the disturbance to natural and built features in parks and protected areas will be caused by construction and periods of site-specific maintenance that would occur intermittently but repeatedly during the assessment period.
- Reversibility: short to medium-term – disturbance to natural and built features will be primarily limited to the construction phase and periods of site-specific maintenance; but post-construction restoration of natural areas and features may extend into the first several years of operations.
- Magnitude: medium – given the intrinsic value of parks and protected areas, disruptions are considered a moderate modification in the socio-economic environment.
- Probability: high – construction activities will take place through parks and protected areas; therefore, disturbance of natural features with intrinsic value is likely.
- Confidence: moderate – particular valued built or natural features potentially disturbed will depend on right-of-way finalization.

Decrease in Quality of the Outdoor Recreational Experience of Aboriginal and Non-Aboriginal Resource Users

The outdoor recreational experiences of Aboriginal and non-Aboriginal resource users, such as canoeing, skiing, snowshoeing, wildlife viewing and fishing activities may be affected by the physical disturbance of outdoor recreation areas during pipeline construction. Nuisance air emissions, noise and visual effects may also occur during the construction of the Project and affect all land users living, working or recreating in the vicinity of the final right-of-way.

The impact balance of this residual effect is considered negative, however, mitigation measures designed to communicate construction locations and timing to the users in the vicinity of the narrowed pipeline corridor will lessen the effect, since users will have the opportunity to choose an alternate location for recreational pursuits. Given the short construction period within Finn Creek Provincial Park, use of well-maintained equipment and limiting idling of equipment, the residual effect is considered to be of low magnitude and reversible in the short-term (Table A7.2.1-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – sensory disturbances caused by construction can extend into the HORU LSA and HORU RSA.
- Duration: short-term – the event causing the effect is construction activity.
- Frequency: isolated – the event causing the effect is confined to a specific period (*i.e.*, construction).
- Reversibility: short-term - the residual effect is limited to the construction phase.
- Magnitude: low – change may be detectable, but will primarily be that of an inconvenience or nuisance.
- Probability: high – Project construction activity will occur in areas used for outdoor recreation within Finn Creek Provincial Park.
- Confidence: high – based feedback from stakeholders, location of the Project, and the professional experience of the assessment team.

Change in Land Use Patterns During Construction and Site-Specific Maintenance

Change in land use patterns in the HORU RSA during construction is anticipated to result from short-term physical disturbance of land, access roads and/or from alteration of traffic patterns, movements and volumes along highways and roads. A short-term disruption to access and use patterns could affect recreational users who are deterred from visiting Finn Creek Provincial Park. Similar effects regarding reduced access to land due to disturbances for all use types would occur during periods of site-specific maintenance (*i.e.*, integrity digs). Changes to land use patterns in the HORU RSA during operations are not anticipated since the pipeline corridor does not deviate from the existing TMPL right-of-way within the park.

Trans Mountain will employ mitigation measures that will assist in minimizing the above effects. Mitigation measures to reduce Project-related traffic (such as using multi-passenger vehicles and obeying traffic, road-use and safety laws) as well as low-impact road crossing construction methods will be implemented during Project construction activities, and will also minimize access and use disruptions. However, residual effects are still anticipated, as land disturbance within the park and increased traffic on select access routes are unavoidable during specific times of the Project.

The impact balance of this residual effect is considered negative, but these residual effects of disruption to access and use patterns within the park is considered to be reversible in the short-term (*i.e.*, limited to the construction phase or periods of site-specific maintenance that would occur within any one year during operations). Even after the implementation of proposed mitigation measures, users may still be unable to use, or be deterred from using, certain areas at certain times. Recreationalists within Finn Creek Provincial Park may alter their use destinations away from areas that interface with Project construction. Magnitude is considered low because change may be detectable, but will primarily be that of an inconvenience or nuisance (Table A7.1.1-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – access roads to use areas in the HORU RSA may be physically disturbed by construction activity and disrupted by construction-related traffic.
- Duration: short-term – the event causing the disruption to access and use is the construction phase and site-specific maintenance during operations.
- Frequency: periodic – the event causing the disruption to access and use would occur intermittently but repeatedly (*i.e.*, specific months of construction and during site-specific maintenance that would occur during any one year of operations).
- Reversibility: short-term – the residual effect is limited to the construction phase or periods of site-specific maintenance occurring within any one year during operations.
- Magnitude: low – change may be detectable, but will primarily be that of an inconvenience or nuisance.
- Probability: high – Project activities will disturb land use areas and may impede access to specific areas at select times.
- Confidence: high – based on Project information, regional land use and access patterns, and the professional experience of the assessment team.

Sensory Disturbance for Aboriginal and Non-Aboriginal Local Residents and Land Users (From Nuisance Air Emissions, Noise and Construction-related Visual Effects) During Construction and Site-Specific Maintenance

Nuisance air emissions and noise will occur during the construction of the Project and may at times affect land users living, working or recreating in the vicinity of Project components. Possible effects may include air emissions and noise from construction equipment and vehicles, and dust from vehicles (related to activities during non-frozen conditions such as reclamation). Also, equipment, areas of land disturbance, and the activity of construction workers will be visible to nearby land and resource users during periods of construction and site-specific maintenance. There may also be periods of night lighting around construction sites. Consequently, the visual quality of the landscape adjacent to the right-of-way or other construction areas may be adversely affected by the Project over the short-term related to construction or maintenance activity.

The implementation of the proposed mitigation measures will reduce the effects of noise and air emissions on land users. Nuisance air and noise emissions will also occur for isolated periods of time at specific locations during periodic site-specific maintenance activities (*e.g.*, aerial patrols, vegetation management, integrity digs) during the operations phase of the Project. Potential effects on the acoustic environment and air emissions are assessed in Sections 7.1.4 and 7.1.5.

A wide range of mitigation measures will be in place to manage air and noise effects. These include consideration of noise abatement and construction scheduling at noise sensitive locations and during noise-sensitive times, to limit disruption to sensitive receptors; and by limiting the idling of equipment.

However, even with Trans Mountain's commitment to mitigation measures, some residual sensory disturbance is anticipated. The impact balance of this residual effect is considered negative, as it will likely be undesirable for nearby residents or land/resource users. Given the successful implementation of the mitigation measures, the residual effect of nuisance air emissions, noise and visual disruption is deemed low in magnitude, as it would be limited primarily to that of a nuisance of inconvenience. The effect would be short-term in duration and periodic in frequency, as sensory disturbance would be primarily caused by construction and intermittent but repeated periods of site-specific maintenance. The potential effect is considered reversible in the short-term (Table A7.1.2-2, point 1[d]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – noise and air emissions emanating from the construction can extend into the HORU LSA and HORU RSA.
- Duration: short-term – the event causing the sensory disturbance is construction activity or site-specific maintenance that would occur within any one year during operations.
- Frequency: periodic – the event causing the sensory disturbance would be focused during construction, but would occur intermittently but repeatedly due to site-specific maintenance.
- Reversibility: short-term – the residual effect is limited to the construction phase or site-specific maintenance activities that would occur within any one year during operations.
- Magnitude: low – the implementation of the proposed mitigation measures would effectively reduce the effects of noise and air emissions to that of a nuisance or inconvenience.
- Probability: high – construction and site-specific maintenance activities will involve the use of heavy equipment and vehicles.
- Confidence: high – based on a good understanding of cause-effect relationships and the professional experience of the assessment team.

Visitor Enjoyment and Safety Indicator – Visitor Safety

Increase in Traffic on Highways and Access Roads During Construction

During construction, there will be an increase in traffic on highways and access roads due to Project-related vehicles. Construction-related traffic will include vehicles used for the transportation of equipment, supplies and workers to various locations along the narrowed pipeline corridor. Highway 5 will be the major highway most likely to be used during construction within Finn Creek Provincial Park.

Ground transport to the Finn Creek Provincial Park construction spread and accommodation hub (Village of Valemount) would be primarily via Highway 5. It is anticipated that most regionally-based personnel would use ground transport from their home community to work locations. Pipeline staging areas will have a combination of work vehicles and crew buses. Existing Annual Average Daily Traffic (AADT) varies in the Project regions. Overall Monthly Average Daily Traffic (MADT) volumes have slightly increased from 2010 to 2012 and throughout the Fraser-Fort George/Thompson-Nicola Region, MADT volumes are highest during the summer months. The addition of several hundred Project-related vehicles will more likely be perceptible on highways or highway sections with lower AADT values.

At the time of writing, detailed traffic estimates and logistics plans were not available for the proposed movement of Project workers, equipment and materials. Project effects on regional highway traffic, and how Project traffic compares to overall daily traffic volumes, will ultimately depend on the source of construction equipment, construction camp modules and other supplies and materials (especially pipe), as well as the methods used to transport these items to construction sites. Pipe and other materials obtained from Canadian or North American suppliers can be transported by rail, offloaded at rail sidings at key points within the Socio-economic RSA and transported relatively short distances by truck to construction sites.

Trans Mountain will develop detailed traffic estimates as construction and Project planning related to the movement of people, materials and equipment continues. Trans Mountain will also develop further logistics information on transportation modes and routes to be used during the construction phase, as well as timing transportation movements to each construction spread and/or facility location. This information will be further evaluated in the context of existing regional traffic volumes, and will become part of the overall information that is shared with local governments, Aboriginal communities, resource users, BC Parks and other stakeholders. This information will also be discussed with provincial transportation authorities during the course of the ongoing consultation planning and construction.

Trans Mountain will employ a number of measures to reduce Project-related vehicles and limit the effects associated with construction-related traffic, including providing daily shuttle bus services from staging areas to work sites and for local workers from pre-determined regional staging areas. It is anticipated that many major equipment deliveries will come to the region via rail to temporary stockpile sites along the narrowed pipeline corridor which will limit the distances travelled by heavy loads on regional highways. The increase in traffic will occur during the construction phase and the residual effect is considered to be reversible in the short-term (*i.e.*, limited to the construction phase). An increase in traffic over current operational movements related to workers and maintenance is not anticipated during the operations phase.

The impact balance of an increase in traffic during construction is considered to be negative, as it may contribute to disruption of existing traffic movement patterns and highway/road users. Highway 5 is one of the main access routes for Finn Creek Provincial Park. An increase in traffic on this Highway 5, particularly during summer months when there is a noticeable increase in traffic in some communities due to the tourist season, would be more than a nuisance or inconvenience to residents, travelers and other road users. It was noted during the Valemount Community Workshop that traffic congestion during construction was a concern, as Highway 5 is the only road in and out of the community. Highway 5 is also heavily used by several river rafting companies in the summer, which already creates some traffic congestion in Valemount. Concerns about traffic congestion were also raised in the Blue River Community Workshop, where it was noted that traffic is already congested at times around a scenic lookout point on the highway. Trans Mountain will employ mitigation measures to ensure the effects are reduced. The magnitude of the residual effect is anticipated to be moderate since construction in Finn Creek Provincial Park will occur during the summer/fall months and may coincide with an increase in traffic related to summer tourists. Traffic disruptions could be more than a nuisance or inconvenience to residents, travelers and other road users in some areas. The disruption could result in the need for detours or the inability to access particular locations. Therefore, the magnitude of the residual effect is anticipated to be medium. Disruption to existing traffic movement on single-lane sections of highways, could also result in a disruption to residents, travelers and other road users such as delays due to the presence of larger, slower vehicles and temporary road closures resulting in single-lane traffic movement.

The probability of occurrence of the residual effect is high, since daily travel will be required to and from the work sites and materials, equipment and workers must be brought to work sites at key points during construction. The level of confidence in the prediction is also high based on the limited number of alternative transportation routes in the Socio-economic RSA and since daily travel will be required to and from work sites. (Table A7.1.1-2, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Socio-economic RSA – highways and access roads anticipated to be used by Project vehicles are located in various locations across the Socio-economic RSA.
- Duration: short-term – the movement of Project-related equipment, materials and workers during construction will cause the effect; no perceptible increases in traffic are anticipated during the operations phase.

- Frequency: isolated – the movement of equipment, materials and workers on regional highways resulting in increases in traffic is confined to a specific phase of the assessment period (*i.e.*, construction phase).
- Reversibility: short-term – the Project-related increase in traffic is limited to the construction phase.
- Magnitude: moderate– construction within Finn Creek Provincial Park is planned for summer/fall, therefore, construction traffic may coincide with summer tourist months.
- Probability: high – Project-related traffic on highways and access roads will be present during construction.
- Confidence: high – transporting equipment and supplies will result in an increase in traffic, assuming that non-Project related traffic will remain constant.

Increase in Traffic-Related Injury and Mortality

Since the number of traffic collisions in a given area is associated with traffic volumes, an increase in Project-related traffic could be expected to result in a higher number of collisions, and with it an increase in the risk of traffic-related injuries or fatalities. It is not possible to quantify the extent of a potential increase or whether there would be a measureable increase because the numbers of proposed Project-related vehicles in the area of Finn Creek Provincial Park are not currently known. However, there are several factors that may modify the frequency or severity of those collisions and injuries and that suggest approaches for Trans Mountain to use in minimizing the potential impacts on public safety. These factors are: numbers of vehicles; location of vehicles; and driver behaviour.

Number of Vehicles

Safety performance functions that have been developed for different roadway types confirm that the number of collisions expected in a given area relates directly to the volume of traffic on that roadway segment. In other words, more traffic equates with more collisions (Parisien 2012). By limiting or minimizing the additional traffic put onto a road, the risk of collisions and traffic injuries is also reduced.

Project traffic will comprise both vehicles used to transport equipment and supplies, and also vehicles used to transport workers. Of these, worker transport is more amenable to being reduced, through the use of buses or vans to transport workers rather than private vehicles.

Driver Behaviour

A number of driver behaviours can contribute to the risk and severity of collisions. Driver inattention was the number one contributing factor to collisions in BC in 2007 according to the BC Motor Vehicle Branch (Motor Vehicle Branch 2007); excessive speed was the second most frequent contributing factor.

The development and strict enforcement of policies on driver behaviour, among both employees and contractors, is essential for minimizing potential effects on traffic safety. These policies will include screening of driver abstracts, provisions on observance of posted speed limits, a ban on cell-phone or tablet use, mandatory seatbelt use, fatigue management, no driving while impaired and other behaviours that can influence safety.

Concerns around traffic volume, congestion and safety have been raised as an issue in the context of the Project by a number of key informants (Hanlan, Hannah, Humphreys, Kreiner pers. comm.). The Project will increase the amount of traffic on public roads because of the need for transportation of equipment, supplies and workers to various locations along the narrowed pipeline corridor. Trans Mountain will develop detailed traffic estimates as construction and project planning continues; these detailed traffic estimates are not currently available. The increase in traffic is projected to occur mainly during the construction phase; little Project-related traffic is anticipated for the operations phase.

Mitigation measures include the development of site-specific Traffic Access and Control Plans; the use of shuttle buses, where feasible, to reduce the volume of traffic on the road; communication with local police and emergency services; the development and enforcement of mandatory minimum driving standards; and development of a driving complaint mechanism.

In summary, the Project will increase the number of vehicles in the Socio-economic RSA including Finn Creek Provincial Park, both in terms of Project-related construction vehicles and vehicles used to transport workers. Evidence from the literature shows that an increase in traffic volumes results in an increased risk of traffic collisions. This in turn increases the risk of collision-related injuries and fatalities. The impact balance of this effect is characterized as negative since vehicle collisions pose a detriment to community health. The effects would extend throughout the Socio-economic RSA, and would manifest in those locations in which the Project uses vehicles on public roadways. Risk will be particularly high in collision “hot-spots” – locations (usually intersections) which have pre-existing high rates of traffic collisions. The duration is characterized as short-term and the frequency as isolated since the effect is primarily linked to the construction phase when the Project workforce will be large and when the movement of heavy machinery and vehicles is required. An increase in traffic-related injury and mortality is unlikely for the operations phase since there will be fewer workers and equipment requiring transport. The reversibility is similarly characterized as short-term since any effect would mainly be observed during the construction phase. The increase in risk of traffic-related injury and mortality is highly dependent upon the number and types of additional vehicles, the current road conditions and capacity of the roadways, driver behaviour, and the characteristics of the areas through which traffic will travel. While the addition of Project-related traffic creates an increase in collision risk, traffic-related collisions, injuries and fatalities are rare events; therefore, even though the risk increases, there is no certainty that any traffic-related injuries or fatalities will result from the increase in traffic. In addition, no regulatory standards exist for this area. The magnitude of effect is characterized as negligible to medium (Table A7.2.1-2, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Socio-economic RSA – effects extend throughout the Socio-economic RSA wherever worker and Project-related traffic exists and would be a primary concern in current traffic accident hot-spots.
- Duration: short-term – the event causing the potential increase in traffic-related injury and mortality is the construction phase, when the Project workforce will be large and when heavy machinery and vehicles are required.
- Frequency: isolated – the event causing the potential increase in traffic-related injury and mortality is confined to the construction phase.
- Reversibility: short-term – residual increases in traffic related injury and mortality are considered to be limited to the construction phase.
- Magnitude: negligible to medium – no regulatory standards exist for this area. While the addition of Project-related traffic creates an increase in risk, traffic-related collisions, injuries and fatalities are rare events.
- Probability: low – the probability of occurrence is rated as low since traffic collisions, injuries and fatalities are rare events.
- Confidence: high – the literature showing this cause-effect relationship relates to other areas in BC and internationally, and some stakeholders are concerned about traffic accidents.

7.2.1.3 Summary

As identified in Table A7.2.1-2, there are no situations for visitor enjoyment and safety indicators that would result in a significant residual socio-economic effect. Consequently, it is concluded that the residual socio-economic effects of pipeline construction and operations on recreational values of Finn Creek Provincial Park related to visitor enjoyment and safety will be not significant.

7.3 Synopsis

The impacts of TMEP's construction and operation on the social and environmental values of Finn Creek Provincial Park will be minimized through mitigation and reclamation. Based on the Stage 2 Detailed Proposal prepared for BC Parks, Trans Mountain has concluded that the TMEP:

- is consistent with the 1999 Finn Creek Provincial Park Management Direction;
- allows for operational efficiencies of an existing pipeline system that has been operating for over 60 years in what is now Finn Creek Provincial Park;
- will result in no significant adverse residual environmental and socio-economic effects;
- will conserve the biological diversity of natural ecosystems and maintains the recreational values within Finn Creek Provincial Park;
- compensation offsets will maintain, and in some instances enhance, the objectives of the park management plans; and
- will provide positive overall economic benefit to BC.

8.0 RECLAMATION IN FINN CREEK PROVINCIAL PARK

The Reclamation Plan is built upon the Pipeline EPP and environmental surveys and identifies additional measures and activities to re-establish the ecological integrity of Finn Creek Provincial Park during Project construction. The measures and other work described in the Reclamation Plan will generally apply to the Project Footprint within Finn Creek Provincial Park. Ongoing consultation with BC Parks may entail further mitigation measures and revisions to the Reclamation Plan and as such, the final Reclamation Plan will be completed prior to construction. Additional site-specific reclamation plans (*i.e.,* riparian reclamation plans) may be required and involve further consultation with BC Parks, Aboriginal groups, stakeholders and the general public. Implementation of the measures included in the Reclamation Plan will commence during the construction phase and continue into the operations phase. Where warranted, follow-up plans will be developed to ensure that the mitigation measures, activities and other works identified in the Reclamation Plan are effective.

8.1 Reclamation Consultation

The development of the Reclamation Plan has been a collaborative effort between Trans Mountain, government agencies and interested stakeholders. In particular, input regarding reclamation measures was solicited and received from the Project environmental team (including fish, wetland, vegetation and wildlife experts) and BC Parks. Additional comments have been solicited from ENGOs and will continue throughout the preparation of the Reclamation Plan (Table 8.1-1).

TABLE A8.1-1

CONSULTATION CONTACTS

Stakeholder Group	Date of Contact	Method of Contact	Items Discussed
BC Parks	May 26, 2014	Phone conversation	Finn Creek, re-vegetation, old growth forest, seed mixes, weed and problem vegetation control and erosion.

8.2 General Reclamation Measures

Reclamation activities will be in keeping with the *Finn Creek Provincial Park Management Direction Statement, 1999* and particular consideration will be given to the ecological integrity of the riparian area of Finn Creek and associated upland environments.

8.2.1 Natural Regeneration

Where the potential for soil erosion and non-native invasive species infestation is low, and where it is anticipated that the topsoil or root zone material contains a propagule bank (*e.g.,* seed, stem or root pieces) of suitable species, it may in some instances be preferable to not reseed the disturbed area. This revegetation method will facilitate the establishment of pre-disturbance vegetation through native propagules establishment on the disturbed area following clean-up and topsoil/root zone material replacement. In areas with potential erosion and weed concerns, a native perennial or non-native annual grass cover crop species will be applied. The grass cover crop species will establish rapidly to control erosion and limit weed growth while pre-disturbance vegetation establishes.

Natural regeneration is preferred over seeding with commercially available native seed where practical and where it is anticipated that the pre-disturbance vegetation will re-establish on the disturbed area. However, care must be taken when using natural regeneration techniques to avoid invasion of non-native invasive species, as is often the case when paralleling other linear disturbances. Moist riparian and wetland environments that will regenerate easily in a short time frame are prime candidates for natural regeneration.

8.2.2 Woody Species Revegetation

Revegetation using native tree and shrub species will occur in select areas (*e.g.,* TWS and riparian zones) in accordance with Trans Mountains operations and maintenance procedures (*i.e.,* revegetation is allowed as long as the trench line is not obscured from aerial monitoring or access to the pipeline right-of-way for maintenance and regular inspections is not compromised).

Installation of Nursery-Grown Plant Plugs

TWS, riparian and special reclamation areas will be surveyed for evidence of naturally regenerating trees, specifically sites that are cleared of coniferous vegetation. If suitable levels of naturally regenerating (from seed or vegetative propagules) deciduous or coniferous trees are not observed, then these and other areas will be considered for the installation of nursery-grown plant plugs (*e.g.,* rooted stock plugs). Native seed will be secured and dormant woody species cuttings will be collected, as warranted. Deciduous and coniferous rooted plugs will be installed at pre-selected sites (*e.g.,* TWS, riparian areas or for line-of-sight breaks) as determined in consultation with BC Parks Conservation Specialists. Under the guidance of a Reclamation Specialist (or other qualified professional), planting crews will install the rooted stock plugs using standardized silviculture planting equipment and techniques. The rooted stock plugs will be installed at a specified density/distribution with the purpose of initiating an early ecological recovery trajectory that will, in time, emulate the adjacent undisturbed vegetation in form and function where not influenced by Trans Mountains operation and maintenance procedures.

Where it is determined that ungulate species may damage (browse or up-root) newly installed deciduous plants within riparian zones, protection of the trees via chemical (*e.g.,* animal repellent [DeerGuard]) or mechanical (*e.g.,* tree shields) methods may be warranted at the time of installation.

Installation of Locally Sourced Dormant Woody Species Transplants

At pre-determined locations where vegetation is disturbed by construction, the use of plant transplants may be considered. The use of dormant woody transfers is a cost effective and efficient method of re-establishing vegetation to disturbed locations. Unlike salvaging and storing dormant woody material during construction, transfers are dug when dormant, where warranted, from a location adjacent to the reclamation site that contains select plant species of a suitable size (conifers < 45 cm in height, deciduous trees < 2 cm stem calliper at ground level or 90 cm in height). Where a donor plant community is located adjacent to a potential reclamation site outside of park boundaries, a survey of the donor plant community will be completed to determine the level of plant extraction that could be achieved without affecting the form and/or function of the donor plant community.

A permit for harvesting transplants from the adjacent plant community will be discussed with the appropriate personnel.

8.2.3 Nutrient Management on Disturbed Forested Areas

A slow-release nitrogen fertilizer is proposed for application on lands that contain woody debris and/or wood chips mixed into the salvaged and replaced root zone material or that have been placed on cleared and ungrubbed portions of the construction right-of-way. The nitrogen fertilizer will serve to adjust the carbon-nitrogen ratio in these carbon rich environments to a level that will be conducive to the establishment of seeded grass species and naturally regenerating vegetation.

To avoid deposition or leaching of applied nutrient into Finn Creek, nitrogen fertilizer will not be applied within a 30 m buffer to the riparian swamp and Finn Creek. In addition, the fertilizer application rate will vary based on the level of woody debris and/or wood chips encountered within or on the surface of the root zone material, the soil texture and the slope of the land adjacent to Finn Creek to ensure nutrient movement is minimized.

8.2.4 Seeding of Native Grass Species

Seed mixes were developed in consultation with BC Parks and consist of species native to the park or within the vicinity of the park (Dwg. A-1 of the Stage 2 Detailed Proposal). Seeding will be conducted as soon as practical following topsoil/root zone material replacement. Drill or broadcast seeding of native seed mixes or a grass cover crop species will be conducted on most of the construction right-of-way. Seed mixes will be installed at locations indicated on the Environmental Alignment Sheets, unless otherwise requested by BC Parks Area Supervisor or Conservation Specialist.

8.2.5 Erosion and Sediment Control

Erosion and sediment control (ESC) measures will be implemented to: maintain soil conservation along the proposed right-of-way, preserve existing vegetation on the adjacent land use, reduce the risk of sedimentation of Finn Creek during and following construction activities, and facilitate the establishment of permanent vegetation along the proposed disturbance.

General ESC Measures

- Woody vegetation located on TWS areas will be cleared and not grubbed where root zone material salvage is not anticipated.
- Root zone material will be stored on cleared/ungrubbed TWS areas adjacent to the proposed right-of-way.
- Subsoil will be stored on geotextile when placed over ungrubbed TWS areas.
- Root zone material and grading material (subsoil) will be stored in separate piles so as not to admix.
- Following the replacement of trench and grade subsoil, recontour the area to match the adjacent landscape profile prior to root zone material replacement. Avoid, to the extent feasible, mixing of subsoil and root zone material during materials replacement.
- Install/re-establish coir logs, erosion control blanket or sediment fencing within the riparian area of Finn Creek.
- Install a non-native annual or native perennial grass cover crop species in the riparian zone to minimize competition to regenerating and installed woody vegetation and a prescribed grass seed mix through broadcast or drill seeding methods on all other exposed soils. Ensure any seed mixes or cover crop species used are approved by BC Parks.

Specific ESC Measures

ESC measures that will be considered for use on the proposed construction right-of-way are described in the following subsections:

Coir Log, Erosion Control Blanket and Sediment Fence Installation

Coir logs composed of natural fibers are designed to reduce slope length and surface water velocities (Dwg. A-02 of the Stage 2 Detailed Proposal). Erosion control blankets prevent scour of surface soils, conserves soil moisture and promotes vegetation establishment (Dwg. A-03 of the Stage 2 Detailed Proposal). Sediment fencing filters sediment from surface water that has the potential to discharge into Finn Creek (Dwg. A-04 of the Stage 2 Detailed Proposal). These measures should be installed following clearing and monitored and maintained following construction until vegetation establishment occurs.

Diversion Berms

Diversion berms are intended to reduce slope length and runoff velocities, and divert runoff into well-vegetated areas. Diversion berms will be designed with a suitable spacing, slope gradient and berm height to effectively convey overland water flow, originating on the construction disturbance, away from Finn Creek and other waterbodies (Dwg. A-05 of the Stage 2 Detailed Proposal).

Rollback

Trans Mountain will avoid the use of Douglas-fir, grand fir and spruce for rollback within Finn Creek Provincial Park. Select tree species (*e.g.,* pine) felled during construction will be used for rollback within riparian zones and TWS areas to provide erosion control and habitat enhancement. The woody material felled during construction will be used as rollback within the Finn Creek riparian zone and TWS area to provide erosion control and habitat enhancement. The woody rollback will provide microsites to aid in the re-establishment of woody vegetation and assist in the control of soil erosion along the proposed right-of-way where woody vegetation was cleared. To obtain material required for rollback, woody slash will be salvaged during construction clearing activities in suitable quantities to allow for the placement of rollback at select locations onto the construction right-of-way following root zone material replacement (Dwg. A-06 of the Stage 2 Detailed Proposal).

Grass Seeding

Native seed mixes have been developed and native perennial and non-native annual cover crop species selected for use on construction disturbances within Finn Creek Provincial Park. An appropriate native grass seed mix, native perennial or annual non-native cover crop will be sown (drill or broadcast seeded) along the disturbed areas following root zone material replacement at an appropriate prescribed rate. Disturbed areas containing wetland vegetation will be left to natural regeneration (Dwg. A-01 of the Stage 2 Detailed Proposal).

8.3 Specific Reclamation Issues

The biophysical features listed below warrant special consideration due to the difficulty in reclaiming and/or managing them. Specific reclamation and/or management plans will be developed from ongoing consultation with BC Parks personnel as well as field surveys.

8.3.1 Watercourses

Stabilization of the banks and slopes of Finn Creek and riparian areas prior to and immediately following construction is critical to the restoration of the habitat at watercourses. Mitigation measures have been developed to enhance the reclamation of Finn Creek. These measures involve the installation of numerous bank and slope protecting structures including:

- log crib structures (Dwg. A-07 of the Stage 2 Detailed Proposal);
- erosion control matting (Dwg. A-03 of the Stage 2 Detailed Proposal);
- revegetation grass rolls (Dwg. A-08 of the Stage 2 Detailed Proposal);
- sediment fences (Dwg. A-04 of the Stage 2 Detailed Proposal);
- biodegradable coir geotextile wraps (Dwg. A-09 of the Stage 2 Detailed Proposal);
- coniferous tree revetments (Dwg. A-10 of the Stage 2 Detailed Proposal); and
- cobble or riprap armouring (Dwg. A-11 of the Stage 2 Detailed Proposal).

In recognition of the fish-bearing status of Finn Creek and the disturbance to watercourse bed, bank and riparian area that will be created during the crossing of this watercourse, reclamation of watercourse features will be completed as per the guidelines identified in the DFO Measures to Avoid Causing Harm to Fish and Fish Habitat.

A detailed riparian reclamation plan will be developed for Finn Creek within Finn Creek Provincial Park prior to construction, and will provide measures that contribute to the reclamation of the watercourse banks and riparian areas disturbed by construction of the proposed Project (*i.e.,* erosion and sediment control measures and the planting of trees and shrubs).

8.3.2 Weed and Vegetation Management Plan

Management of weeds and problem vegetation is essential to maintaining the ecological integrity of Finn Creek Provincial Park during and after Project construction. Trans Mountain will use an integrated vegetation management (IVM) approach that includes non-chemical, cultural and chemical methods to control and reduce the spread of weeds and problem vegetation. The non-chemical, cultural or chemical treatment methods used will vary with life-form and mode of reproduction of the species targeted and the location and extent of the infestation. Non-chemical and cultural treatments include hand-pulling, cultivation, mowing, burning, mulching and active restoration of native plant communities. Chemical treatments include either selective herbicides (*i.e.*, target specific plant species) or non-selective herbicides (*i.e.*, target all vegetation).

Trans Mountain will work with BC Parks and other stakeholders to implement an IVM approach to weed and problem vegetation management as outlined in KMC's Integrated Vegetation Management Plan and the Weed and Vegetation Management Plan provided in Section 14.0 in Appendix C of the Pipeline EPP. Accurate records of weed infestations, management measures conducted and the success of these measures will be maintained so that weed and vegetation management plans can be modified as necessary from year to year.

Specific weed and problem vegetation management measures for pre-construction, construction and post-construction are provided in the aforementioned Weed and Vegetation Management Plan. Further measures involving monitoring and control measures following construction are provided in Dwg. A-12 of the Stage 2 Detailed Proposal.

Detailed weed and problem vegetation reports will be developed for site-specific locations, as required, following a pre-construction weed survey (scheduled for spring 2015) and consultation with BC Parks Conservation Specialists. Weed and problem vegetation infestations and recommended mitigation measures will be incorporated into the Environmental Alignment Sheets.

DRAWINGS

LIST OF DRAWINGS

Drawing A-01	Seed Mix Detail – Finn Creek Provincial Park
Drawing A-02	Coir/Straw Log Installation
Drawing A-03	Erosion Control Matting/Blanket
Drawing A-04	Sediment Fence
Drawing A-05	Cross Ditches and Diversion Berms
Drawing A-06	Rollback
Drawing A-07	Cribwall Staked Logs
Drawing A-08	Streambank Protection - Grass Roll
Drawing A-09	Streambank Protection - Hedge/Brush Layering
Drawing A-10	Streambank Protection – Coniferous Tree Revetment
Drawing A-11	Streambank Protection - Cobble or Riprap Armouring
Drawing A-12	Weed Control
Drawing A-13	Live Plant Salvage
Drawing A-14	Vegetation and Soil Berm - Line of Sight
Drawing A-15	Typical Wildlife Tree Enhancement Feature

CRITERIA FOR IMPLEMENTATION

Seed mixes (see tables below) will be installed at locations indicated on the Environmental Alignment Sheets, unless otherwise requested by BC Parks Area Supervisors or Conservation Specialists.

Notes:

1. Species cultivars, where applicable, will be determined at the time of procurement based on availability and suitability as determined by Trans Mountain.
2. Native seed species will be obtained from local genomes to the extent feasible.
3. All seed mix species must have Certificates of Analysis to allow for the determination of weed and undesirable species content, and germination for each species seed lot in the mix.
4. Certificates of Analysis for each seed mix species will be reviewed by Trans Mountain prior to purchase. Any lot with unacceptable weed contamination or viability will be rejected.
5. Seed mix species that are unavailable in sufficient quantity or quality at a reasonable cost as determined by Trans Mountain at the time of procurement will be eliminated from the mix and the proportions of other species in the mix increased.
6. Drill seeding will be used on all segments to be seeded with the exception of slopes which are too steep to safely operate the tractor and seed drill, areas too wet to access with a tractor and seed drill without causing rutting and poor seed placement, stony areas which could cause damage to the equipment or impede the ability of the drill to properly place the seed, and any other areas which cannot be feasibly reached with the seed drill.
7. Broadcast seeding will be used on lands where drill seeding cannot be conducted.
8. All seed drills and broadcast seeders will be calibrated for each seed mix using the manufacturer's recommended procedures; alternate calibration procedures may be used if approved by the Environmental Inspectors.
9. The seeding contractor will develop appropriate seeding procedures to ensure even distribution of all species in each seed mix and have these procedures approved by the Environmental Inspector. This may involve, but not be limited to:
    - using seed box agitators to prevent stratification of large and small seeds;
    - seeding large and small seed species from separate seed boxes, or in separate passes with the seeder; or
    - using an inert filler agent with the seed mix.
10. Seeding depth with seed drills will be 1-2 cm in fine textured soils and 1-3 cm in sandy soils.
11. Where site and safety conditions allow, broadcast seed will be harrowed into a depth of 1-3 cm, using standard agricultural harrows or other approved equipment. Harrowing will be conducted immediately following broadcasting. Steep slopes that cannot be safely harrowed will be hand raked, if feasible, to incorporate seed.
12. Only the salvaged or cultivated width of the construction right-of-way will be seeded with minimal overlap onto undisturbed areas. Swing-out passes will be made to seed scalped areas adjacent to the cultivated portion as needed.
13. Complete coverage of the stripped area will be ensured by using a sufficient number of passes. Damage to the native sod adjacent to the disturbed portion of the construction right-of-way will be avoided.
14. Broadcast seeding will be delayed during high wind conditions, as directed by the Environmental Inspector.

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TRANSMOUNTAIN

SEED MIXES – BC PARKS

7894	August 2014	Drawing A-01

SEED MIXES

Cover Crop
A cover crop is a fast-germinating and establishing annual/biennial or short-lived perennial grass species that is seeded to quickly stabilise topsoil, control erosion and limit weed growth while pre-disturbance vegetation is restored. Short-lived perennial grass cover crop species include slender/awned wheatgrass or Canada wild rye. Short-lived annual/biennial cover crop specie includes annual ryegrass. Broadcast short-lived perennial grass species seed at 10 kg/ha or 100 grams/100 m^2 and annual/biennial cover crop species at 8 kg/ha or 80 grams/100 m^2.

Non-attractant Seed Mix for Highways/Railways	
Mix #1	%WT
Rocky Mountain fescue	30
rough hair grass	40
spike trisetum	15
June grass	15
<u>seeding rate</u> broadcast seed at 18 kg/ha drill seed at 12 kg/ha	

Seed Mixes - Finn Creek Provincial Park						
	Closed Coniferous - Upland		Closed Coniferous – Moist		Riparian	
Biogeoclimatic Zone	Mix #2	%WT	Mix #3	%WT	Mix #4	%WT
interior cedar hemlock/ engelmann spruce-subalpine fir	smooth wild rye	35	smooth wild rye	30	slender wheatgrass	75
	Rocky Mountain fescue	25	slender wheatgrass	25	rough hair grass	25
	slender wheatgrass	20	tufted hair grass	15		
	rough hair grass	10	rough hair grass	15	<u>seeding rate</u> broadcast seed at 5 kg/ha	
	alpine bluegrass	10	alpine bluegrass	15		
	<u>seeding rate</u> broadcast seed at 18 kg/ha drill seed at 12 kg/ha		<u>seeding rate</u> broadcast seed at 18 kg/ha drill seed at 12 kg/ha			

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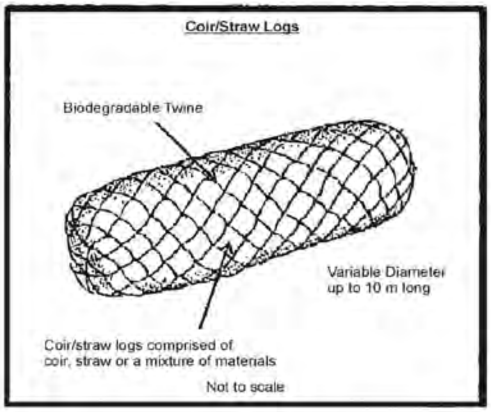
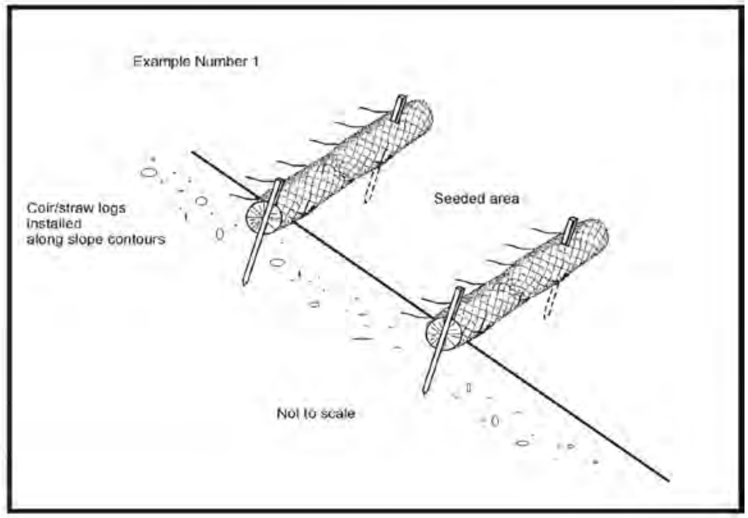
TRANS MOUNTAIN EXPANSION PROJECT

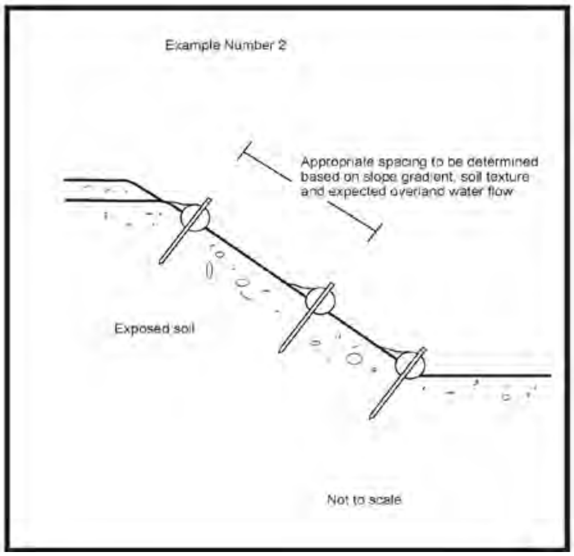
TRANSMOUNTAIN

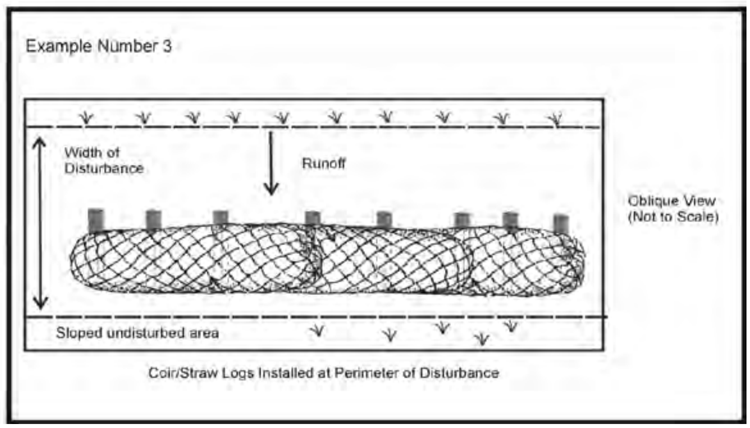
SEED MIXES

7894	August 2014	Drawing A-01









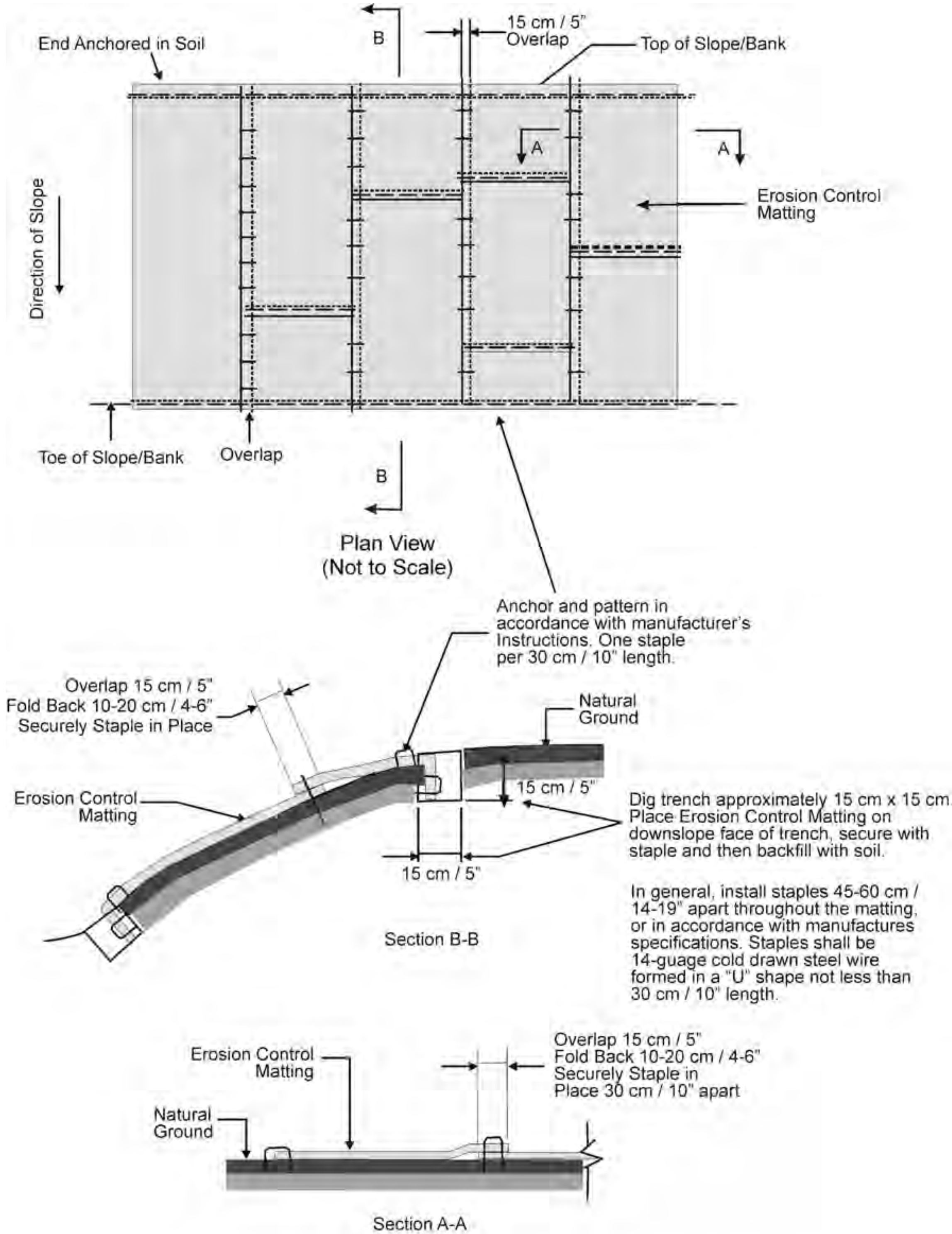
Notes:

1. Proper placement and design is critical and qualified specialists should be involved.
2. Install coir/straw logs in a shallow trench (~5-7.5 cm (2"-3") deep), perpendicular to the direction of flow and across the entire width of the disturbance. Each end of the coir/staw log should be turned slightly up slope to help retain water and prevent flow along the outside of the coir/straw log.
3. Each coir/straw log should be secured into the ground by wooded stakes spaced every 0.9-1.2 m (3'-4') across the length of the log. Stakes should be approximately 45 – 60 cm (18"-24") in length and should be driven through the centre of the coir/straw log and into the ground with approximately 5 cm (2") remaining above the coir/straw log. Stakes installed at each end of the coir/straw log should be placed approximately 5-15 cm (2"-6") from the outer edge of the log.
4. When joining two coir/straw logs together, either tightly abut both ends or overlap each log approximately 15 cm (6").
5. Store, move and install when dry.
6. Coir/straw logs may be seeded or dormant cuttings may be inserted.
7. Typical spacing is indicated below.

Slope Gradient (o)	Typical Spacing (approximate m (ft))
≥1:1	1.5 m (5')
2:1<1:1	3.0 m (10')
>4:1<2:1	5.2 m (17')
6:1-4:1	7.6 m (25')
<6:1	15.0 m (50')

Adapted from CAPP *et al.* (2005)

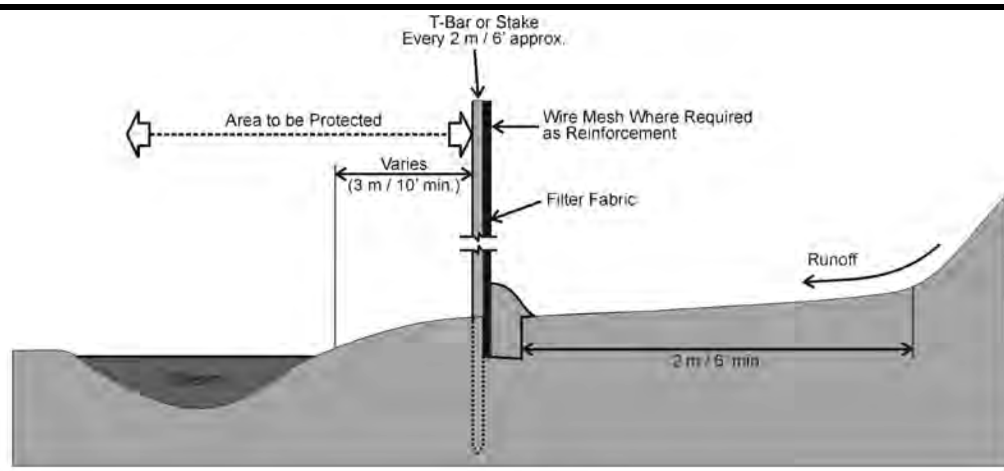
tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	COIR/STRAW LOG INSTALLATION		
	7894	August 2014	Drawing A-02



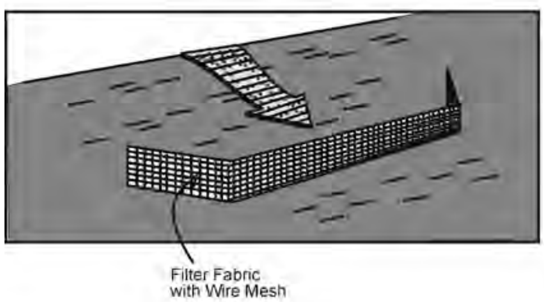
Note: When used at streambanks, erosion control matting should be secured to the bank using willow cuttings rather than staples.

Representation Only

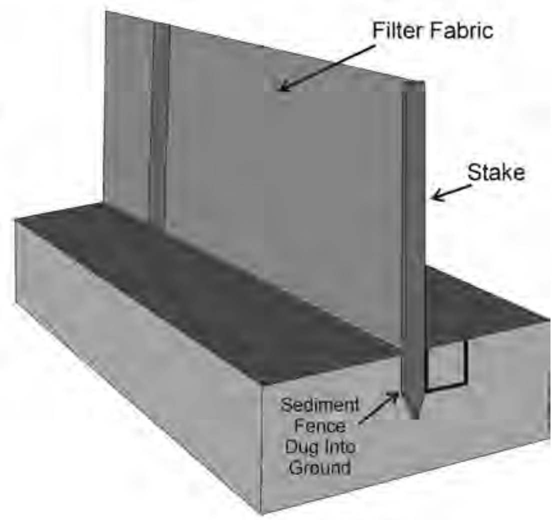
tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN	
	EROSION CONTROL MATTING/BLANKET	
7894	August 2014	Drawing A-03



Profile View
(Not to Scale)



Oblique View
(Not to Scale)



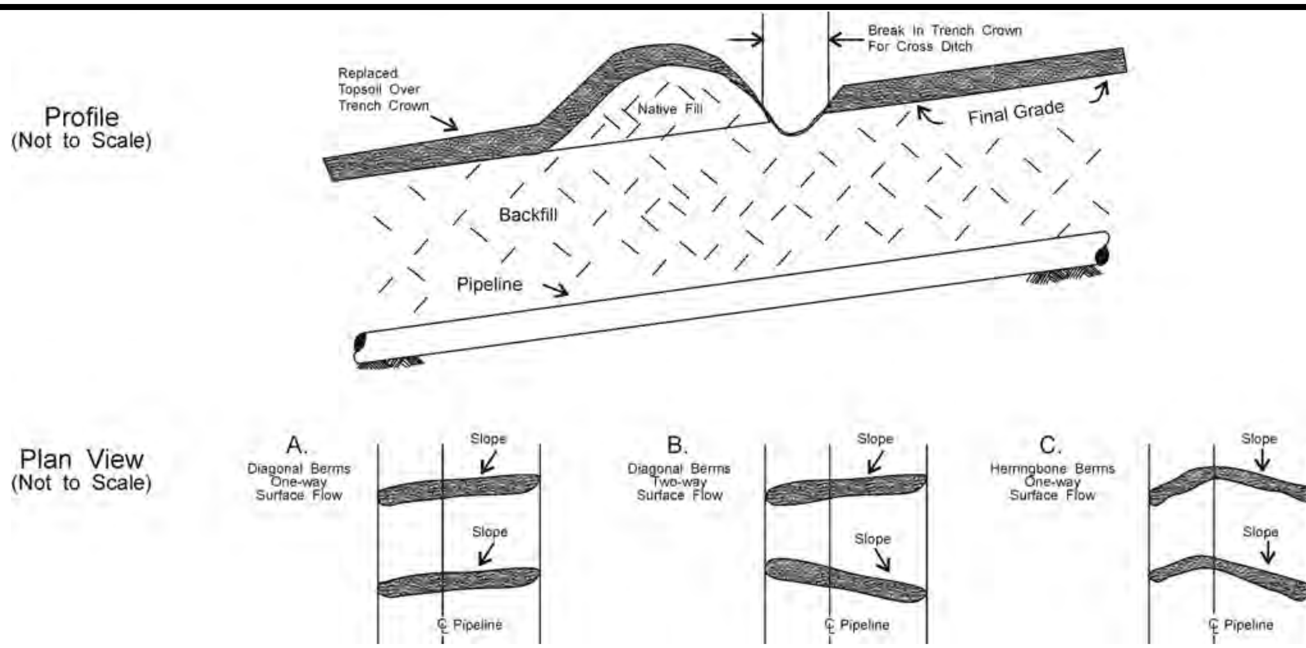
Oblique View
(Not to Scale)

Representation Only

Notes:

1. Watercourses that have moderate to high sensitivity of fish habitat and/or have steep approach slopes at the proposed crossings may need sediment fences during construction, as determined by Trans Mountain's Environmental Inspector(s).
2. Install sediment fences at the base of approach slopes to watercourses prior to clearing and grading using the method and materials above or other approved designs.
3. Ensure sediment fence is keyed into the substrate. Excavate a narrow trench, place the base of the sediment fence in the trench and place the fill back into the trench, securing the sediment fence in place.
4. Place sediment fences a minimum 2 m (6 feet), if feasible, from the toe of the slope in order to increase ponding volume.
5. Maintain sediment fences in place at the base of the approach slopes until revegetation of the construction right-of-way is complete.
6. In areas with frequent traffic, install two or more sediment fences in a staggered and overlapped configuration to allow vehicle passage without removal or opening of the sediment fence.
7. Ensure that sediment fences, if removed or damaged, are reinstalled or repaired prior to the end of the work day.
8. Install sediment fences, where warranted, to eliminate the flow of sediment from clean subsoil piles and disturbed areas into nearby wetlands.
9. Remove any sediment fences around wetlands that remain after the disturbed area is revegetated and the area is stable.

tera ENVIRONMENTAL CONSULTANTS	**TRANS MOUNTAIN EXPANSION PROJECT** TRANSMOUNTAIN		
	SEDIMENT FENCE		
	7894	August 2014	Drawing A-04



Notes:

Representation Only

1. Install diversion berm and cross ditch on moderate and steep slopes on non-cultivated lands to divert surface water off the construction right-of-way. Install berms immediately downslope of trench breakers to collect seepage forced to the surface.
2. Skew berm across the construction right-of-way at downhill gradient of 5-10%.
3. Construct diversion berm of compacted native subsoils where extensive disturbance of the sod layer has occurred. Diversion berms should be constructed of timbers, imported logs or sandbags if disturbance of the sod layer is limited. Avoid use of organic material. Where native material is highly erodible, protect upslope of berm and base of cross ditch by burying a geotextile liner approximately 20 cm below the surface or armour upslope face of berm with earth-filled sand bags.
4. Typical diversion berm height and widths are approximately 0.75 m for summer construction and 1.0 m for winter construction. Trans Mountain shall inspect berms after heavy rains and the first spring following construction; replace or restore berms, if warranted.
5. Tie berms into existing berms on adjacent rights-of-way, where applicable.
6. Leave a break in trench crown immediately upslope of diagonal berm and cross ditch to allow passage of water across the construction right-of-way.
7. Use diagonal berms where direction of slope and surface water movement is oblique to construction right-of-way.
8. Use herringbone berm and cross ditch where direction of slope and surface water movement is parallel to construction right-of-way so runoff does not cross ditchline.
9. Determine location and direction of berm based on local topography and drainage patterns. Typical diversion berm spacing is indicated below.

Slope Gradient (º ;%)	Typical Spacing (m) Erosion Hazard*		
	High	Medium	Low
<7; <12	30-45	45-60	60 or more
7; 12	25	38	51
8; 14	22	33	44
9; 16	19	29	38
11; 19	16	24	32
14; 25	12	18	24
18; 33	9	14	18
27; 50	6	9	12

* High = fine sand and silts; medium = clays and coarse sands; low = rock or gravel.

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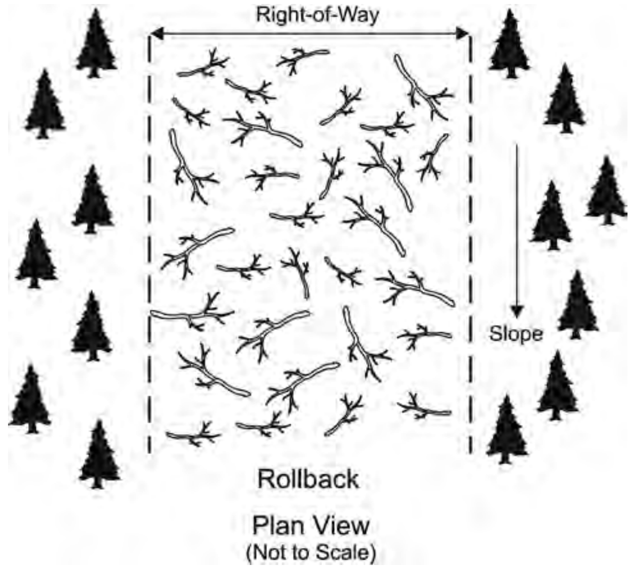
TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
CROSS DITCHES AND DIVERSION BERMS		
7894	August 2014	Drawing A-05



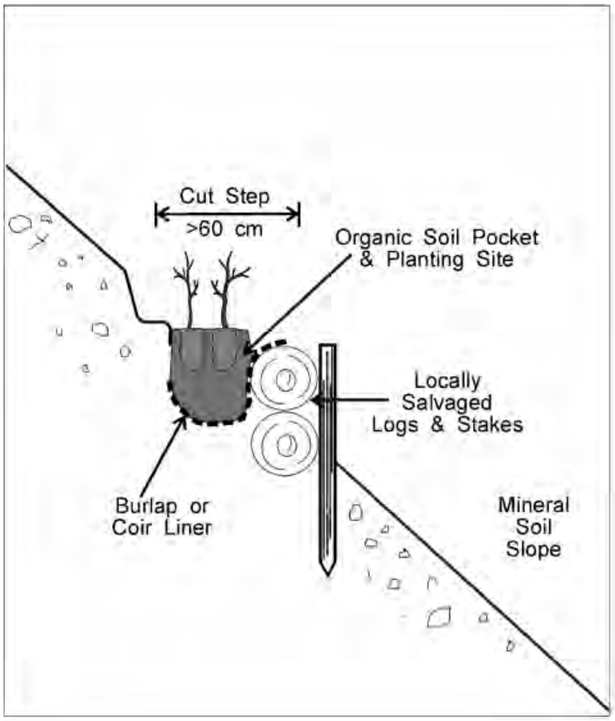
CRITERIA FOR IMPLEMENTATION

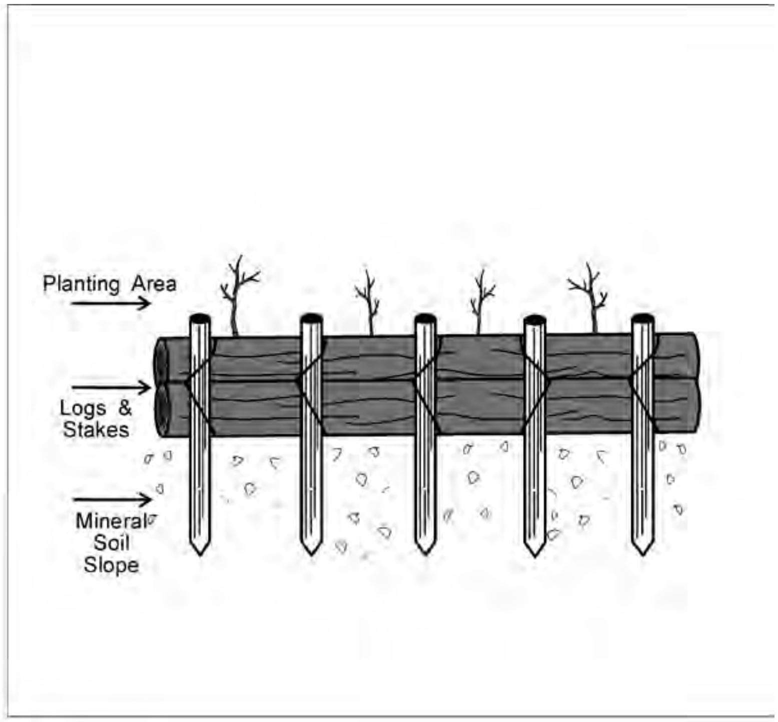
Slash and nonsalvageable timber may be used as rollback for erosion control where available and acceptable to the appropriate authority, as well as at strategic locations along the right-of-way for access control. Specific locations will be determined by Trans Mountain's Environmental Inspector(s) at the time of clearing. Do not use Douglas-fir, grand fir and spruce for rollback.

Notes:

1. Retain slash and nonsalvageable timber, where required, for use as rollback.
2. Larger diameter slash (*e.g.,* 10 cm in diameter or larger) should be used for rollback intended for riparian area access control, plant micro-sites establishment or as soil erosion control.
3. The amount of timber retained for use as rollback will be determined by Trans Mountain's Construction Supervisor(s) in consultation with Trans Mountain's Environmental Inspector(s) and the appropriate authority. Store material for rollback along the edges of the right-of-way.
4. Walk down rollback with a dozer on steep slopes, if safe to do so.
5. Spread slash and nonsalvageable timber evenly over the right-of-way where access is a concern. Do not walk down rollback.
6. Leave gaps in the rollback at obvious wildlife trails.

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN	
	ROLLBACK	
7894	August 2014	Drawing A-06



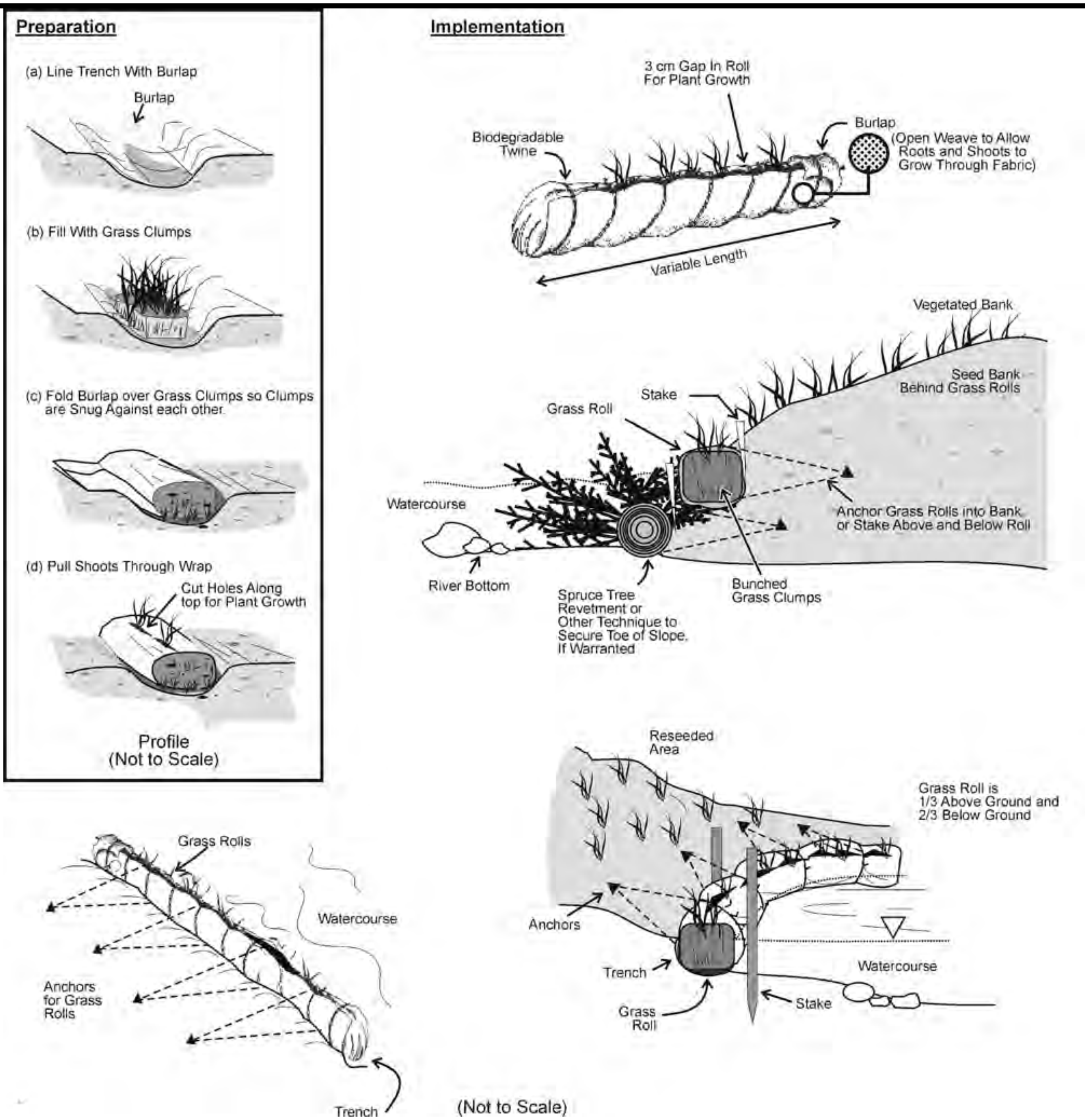


(Not to Scale)

At sites where erosion is a concern and where shrub plantings are required for reclamation, locally salvaged logs may be used to secure slopes and provide planting sites.

1. Sites where staked logs are to be installed will be selected by Trans Mountain's Environmental Inspector(s). When possible, sites will be selected prior to clearing and suitable local logs will be salvaged and stockpiled for later use.
2. Install staked logs during clean-up or reclamation phase. Where possible, use a backhoe to cut a step into the slope and push in a line of wood stakes. Note: take all necessary safety measures when working in proximity to pipeline.
3. With a qualified chainsaw operator, select and cut to fit suitable logs for horizontals. If necessary, the logs may be secured to the stakes using biodegradable rope.
4. Create a pocket behind the horizontally staked logs. The pocket can be used to install live shrub stakes and backfilled with topsoil/root zone material.
5. Where the planting pocket is required for rooted plugs or salvaged plantings, line the pocket with biodegradable fabric (burlap or coir). Bring the fabric over the top log. Fill the lined pocket with topsoil/root zone material or duff and tamp down. Install plants in pockets as directed by Trans Mountain's Environmental Inspector(s).

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	STAKED LOGS/LOG CRIBWALL FOR EROSION CONTROL		
	7894	August 2014	Drawing A-07

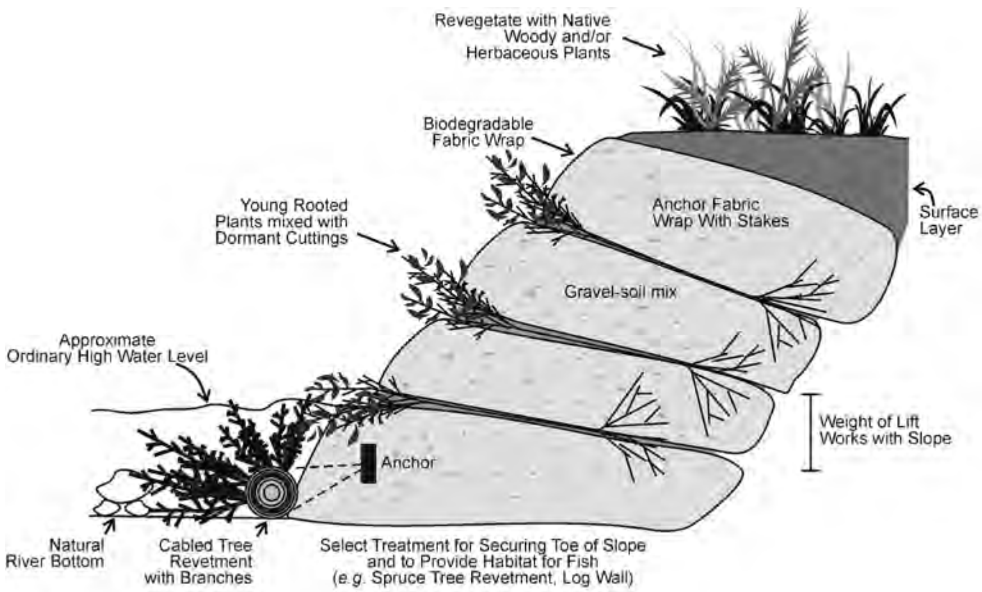


Notes:

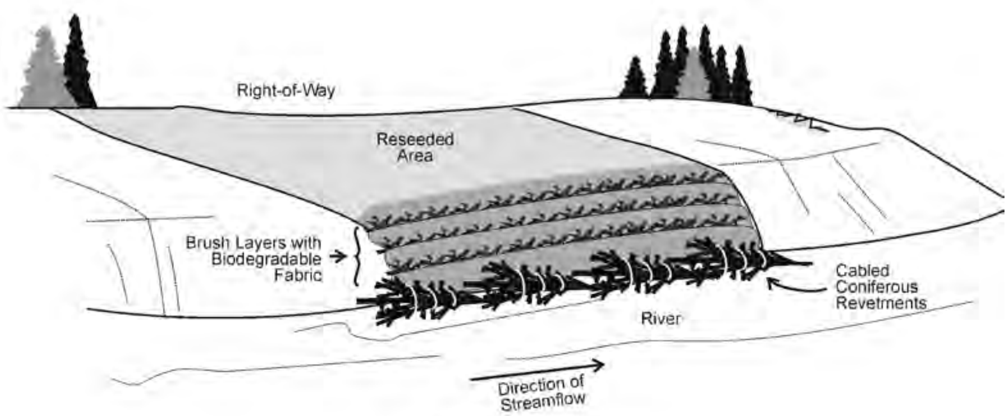
1. Proper placement and design is critical and qualified aquatics or reclamation resource specialists should be involved.
2. Excavate a shallow trench along the ordinary high level watermark parallel to the toe of the bank and line with burlap.
3. Install sod in the middle of the roll and wrap with burlap covers. Tie with twine and cut slits to expose sections of sod.
4. Stake or anchor firmly, ensuring up and downstream ends are secured to prevent washing out.

Adapted from CAPP *et al.* (2005)

tera ENVIRONMENTAL CONSULTANTS	**TRANS MOUNTAIN EXPANSION PROJECT** TRANSMOUNTAIN		
	STREAMBANK PROTECTION – GRASS ROLL		
	7894	August 2014	Drawing A-08



Profile
(Not to Scale)



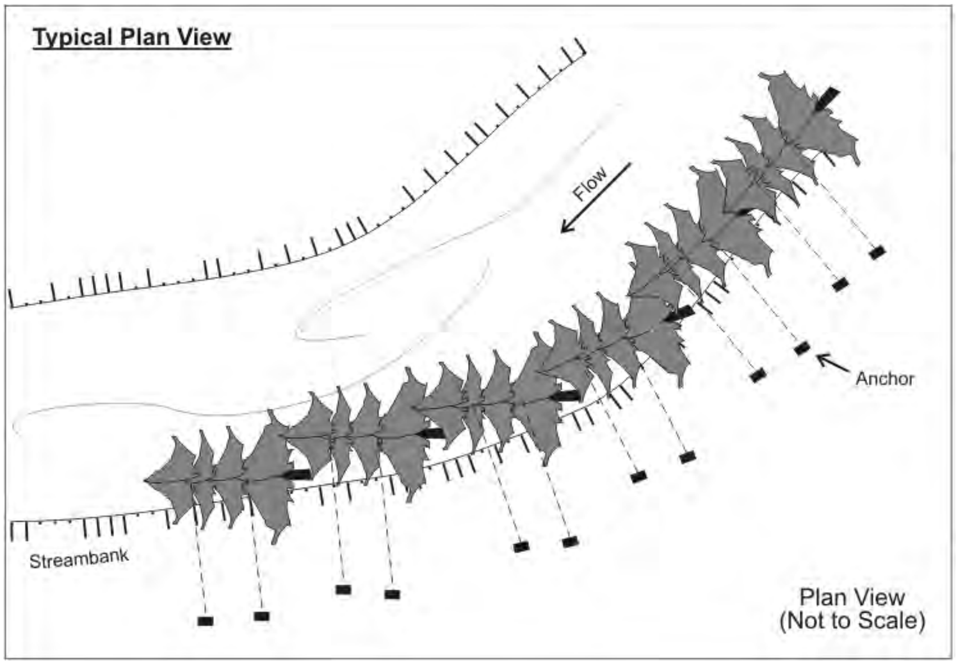
Oblique View
(Not to Scale)

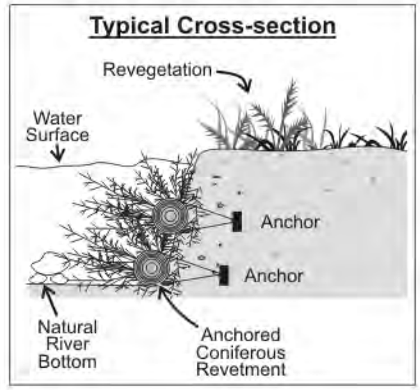
Notes:

1. Proper placement and design is critical and qualified specialists should be involved.
2. Secure the toe of the slope with appropriate technique (coniferous tree revetments, log wall, riprap, etc.).
3. Begin layering at the bottom of slope with first hedge/brush layer situated at the approximate ordinary high water level or lower. Select plant species suitable for site conditions.
4. To establish banks, install layers of soil filled biodegradable fabric (coir or equivalent) wraps. To make each layer, roll out the fabric parallel with the bank with one-third into the bank and two-thirds out (streamside). Form a step of soil approximately 30-40 cm (1-1.3 feet) high over the bank side fabric. Fold the stream side fabric over the soil step and firm into place.
5. Arrange locally salvaged live shrubs with roots (alder, rose ssp., etc.) with live stake material (willow, poplar, red osier dogwood) over the fabric wrap at 20 stems per metre, incorporate topsoil and firm into place.
6. Continue building layers of fabric soil wraps and live shrubs until original bank height is reached.
7. Use only dormant live shrub material. Keep transplants moist and install as soon as feasible following salvage. A mixture of plant species can mimic adjacent undisturbed vegetation.

Adapted from CAPP *et al.* (2005)

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT	
	STREAMBANK PROTECTION – HEDGE/BRUSH LAYERING	
7894	August 2014	Drawing A-09



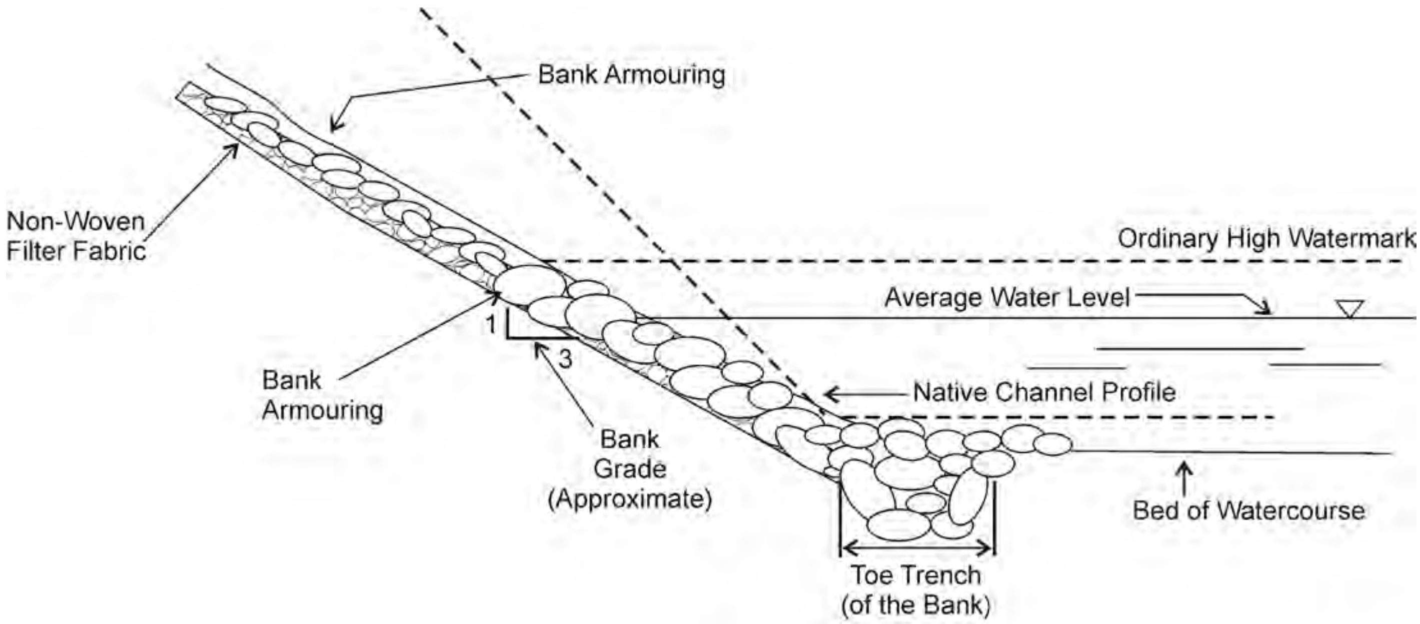


Notes:

1. Proper placement and design is critical and qualified specialists should be involved.
2. Select only good, sound, straight coniferous trees with adequate branches and a minimum length of 10 m.
3. Do not trim any branches and handle with care. Leave root ball intact if possible and transport the trees to the site with a minimum of handling to reduce damage to the branches. To the extent practical, remove soil material from the rootball before placing the tree instream. Place the trees lengthwise along or across the eroding bank to be protected beginning at the downstream end with the tips of the trees pointed in the downstream direction.
4. Begin assembly of the tree revetment at the downstream end and place tie back cable on the tree butt (largest end). Attach the cable to a suitable deadman or large armour rock with a drilled hole. Bury the anchor securely in the adjacent bank.
5. Place the butt of the next tree one-half the length of the previous tree or less upstream along the bank, so there is an overlap of the trees. If possible, cable the trees together in addition to cabling to an anchor buried in the bank.
6. Rock armour may be added along the toe of the slope, beneath the trees to reinforce the level of protection provided.
7. Maintenance, consisting of replacing severely damaged trees, will extend the life span.
8. Coniferous tree revetments also may be used as instream cover.

Adapted from CAPP *et al.* (2005)

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	STREAMBANK PROTECTION – CONIFEROUS TREE REVETMENT		
	7894	August 2014	Drawing A-10



Profile
(Not to Scale)

Notes:

1. Proper placement and design is critical and qualified specialists (*i.e.*, hydrotechnical engineers) should be involved.
2. Remove all stumps, organic matter and work material, and grade/prepare banks to a maximum slope as directed by a geotechnical engineer (≥ 45º).
3. Construct toe trench to key in bottom of armour protection into the bed and bank of the watercourse bank or adopt thickened toe option.
4. Install non-woven filter fabric or gravel filter layer at the ordinary high water level and above where cobble or riprap bank armouring will be implemented.
5. Place cleaned cobble or riprap on slope to be protected such that a well-interlocked, smooth layer is produced.
6. Key in up and downstream ends of the armoured bank in a manner such that it will not be outflanked.
7. Cobble/riprap should extend 0.5 m (min) above design flood level. If design flood level is above the top of the bank, cobble/riprap should be placed to the top of the bank.
8. Cobble/riprap should be flush with bank adjacent to the right-of-way.
9. Cobble/riprap placement should not compromise bed elevation.

Adapted from CAPP *et al.* (2005).

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN	
	STREAMBANK PROTECTION – COBBLE OR RIPRAP ARMOURING	
	7894	August 2014	Drawing A-11

CRITERIA FOR IMPLEMENTATION:

Management of weeds and non-native plant species is of paramount concern to Trans Mountain. The goal of non-native species management for the Trans Mountain Expansion Project is to prevent the introduction and spread of non-native plants to control them, to the extent feasible, along the existing TMPL system. Accurate records of weed infestations, control measures undertaken and the success of control measures will be maintained so that weed management and control plans can be modified as necessary to ensure an effective program of ongoing weed monitoring and control.

Following are measures to be implemented during the reclamation and post construction monitoring of the Trans Mountain Expansion Project.

1. All reclamation equipment shall arrive for project work in a clean condition to minimize the risk of weed introduction. Any equipment which arrives in a dirty condition will not be allowed to work until it has been cleaned off at a suitable location.
2. Equipment passing through areas identified as having a weed problem will be cleaned prior to continuing work on the right-of-way.
3. Equipment clean-off stations will be established by the main pipeline contractor under the direction of the Trans Mountain's Environmental Inspector(s). The preferred method of clean-off will be pressurized water, weather permitting.
4. Weed growth will be specifically monitored by personnel trained in weed identification walking the right-of-way and recording the density and species of all weeds observed. Weed monitoring will be conducted by teams in a timely manner so that weed control plans can be developed.
5. Monitoring will be conducted prior to, during and as per PCEM requirements.
6. Frequency of monitoring may be increased where: high potential for weeds of management concern was identified prior to, during or following construction. Weeds will generally be monitored in the spring when weed seedlings can be identified and subsequently controlled, if warranted. Additional weed monitoring in the late summer prior to setting seed will be conducted where high weed concerns exist or where spring surveys identify the need for follow-up.
7. Areas of poor plant cover will be reseeded and weed control measures applied as required.
8. The equipment cleaning station will be assessed in fall, late spring and mid-summer for at least three growing seasons following construction. Subsequent monitoring will be at least once per season, depending on weed issues identified during previous years. Weed species of concern that are identified at the sites will be treated. Manual removal of plants or chemical treatment will occur. If weeds are manually removed when in flower, the weed material will be disposed of in an approved land-fill facility.

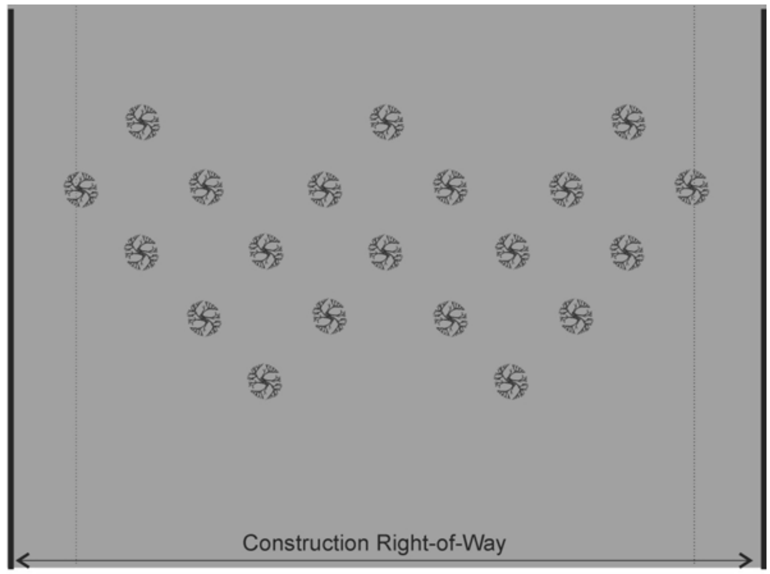
CRITERIA FOR IMPLEMENTATION

Live plant material salvage will generally be used for one of two reasons:

- salvage of shrubs with rootball; and
- salvage and transplant of rare plants.

All collection, salvage and transportation of live plant material will be conducted following approval by the appropriate regulatory authority.

Profile View
(Not to Scale)



Plan View
(Not to Scale)

Representation Only

SALVAGE OF SHRUBS WITH ROOTBALL

Shrubs for salvage will be selected by a qualified botanist/biologist and flagged prior to construction activities in that area.

1. To the extent possible, shrub salvage will be conducted during dormancy (senescence to bud break).
2. Shrub salvage will be timed to minimize period between salvage and restoration planting.
3. Prior to salvage, prune back shrub top growth as instructed by a qualified botanist/biologist. Salvage shrubs using a backhoe. Remove as large a rootball as feasible.
4. Cover the rootball of the salvaged plants with burlap or geotextile. Keep the covered rootball slightly moist (but not saturated) until the plants are replanted.

RARE PLANTS

1. Rare plants located along the construction right-of-way that require transplanting will be identified by a qualified botanist/biologist and will be flagged prior to clearing.
2. A qualified botanist/biologist will select a suitable receiving site for the plant(s). Ideally, the receiving site should be adjacent to the construction right-of-way, in an area having a similar microsite to where the rare plant(s) had been growing.
3. Delay salvaging activities until immediately prior to construction. Cut back or prune plants to be salvaged as recommended by Trans Mountain's Environmental Inspector(s) in consultation with a qualified botanist/biologist. Salvage designated plants using a shovel or backhoe. Remove as large a rootball as feasible. Cover the rootball of the salvaged plants with burlap or geotextile. Keep the covered rootball slightly moist (but not saturated) until the plants are replanted.
4. Replant the salvaged plant(s) in the receiving site as soon as feasible following salvage.

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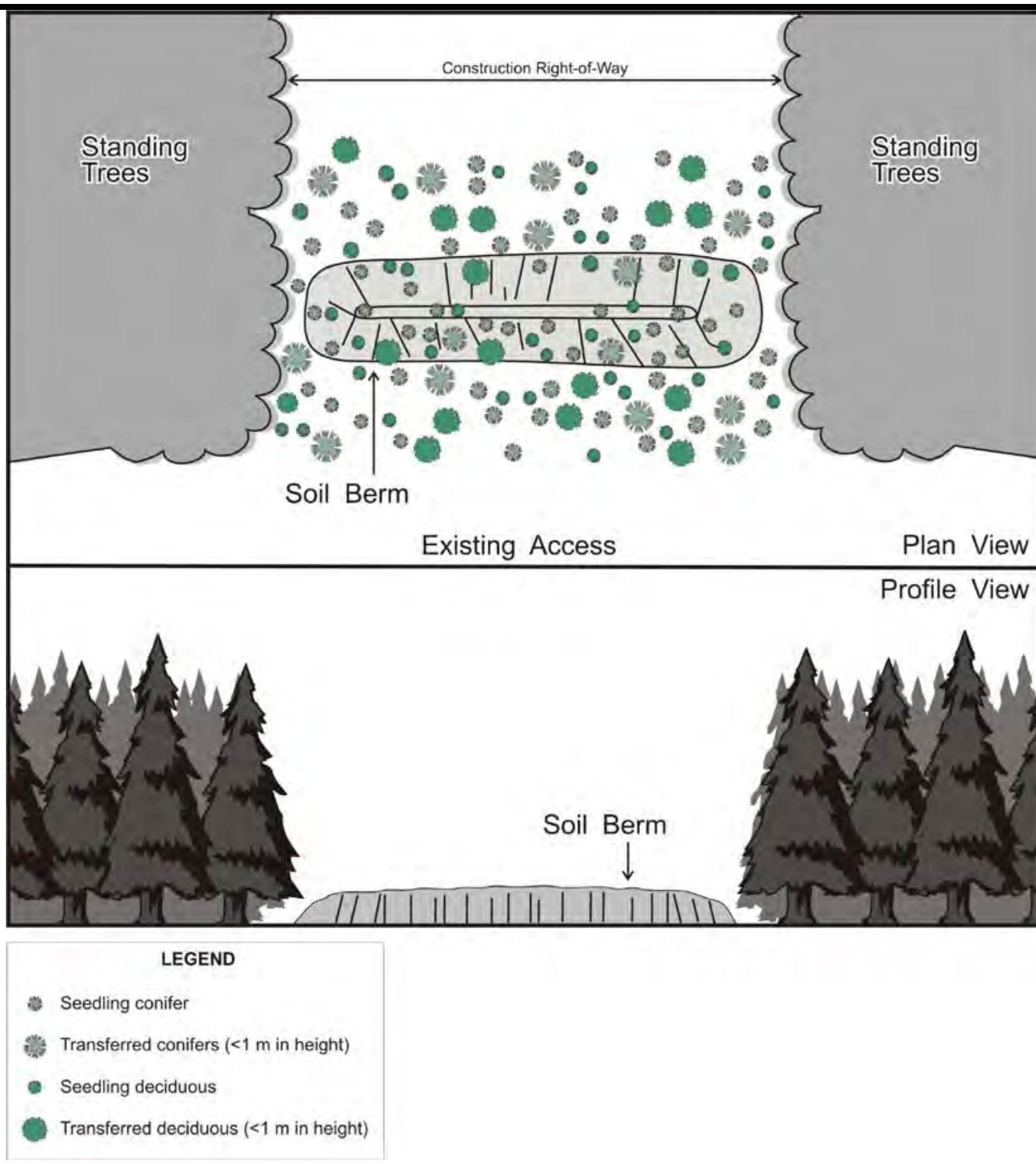
TRANS MOUNTAIN EXPANSION PROJECT

TRANSMOUNTAIN

LIVE PLANT SALVAGE AND TRANSPLANT

7894	August 2014	Drawing A-13

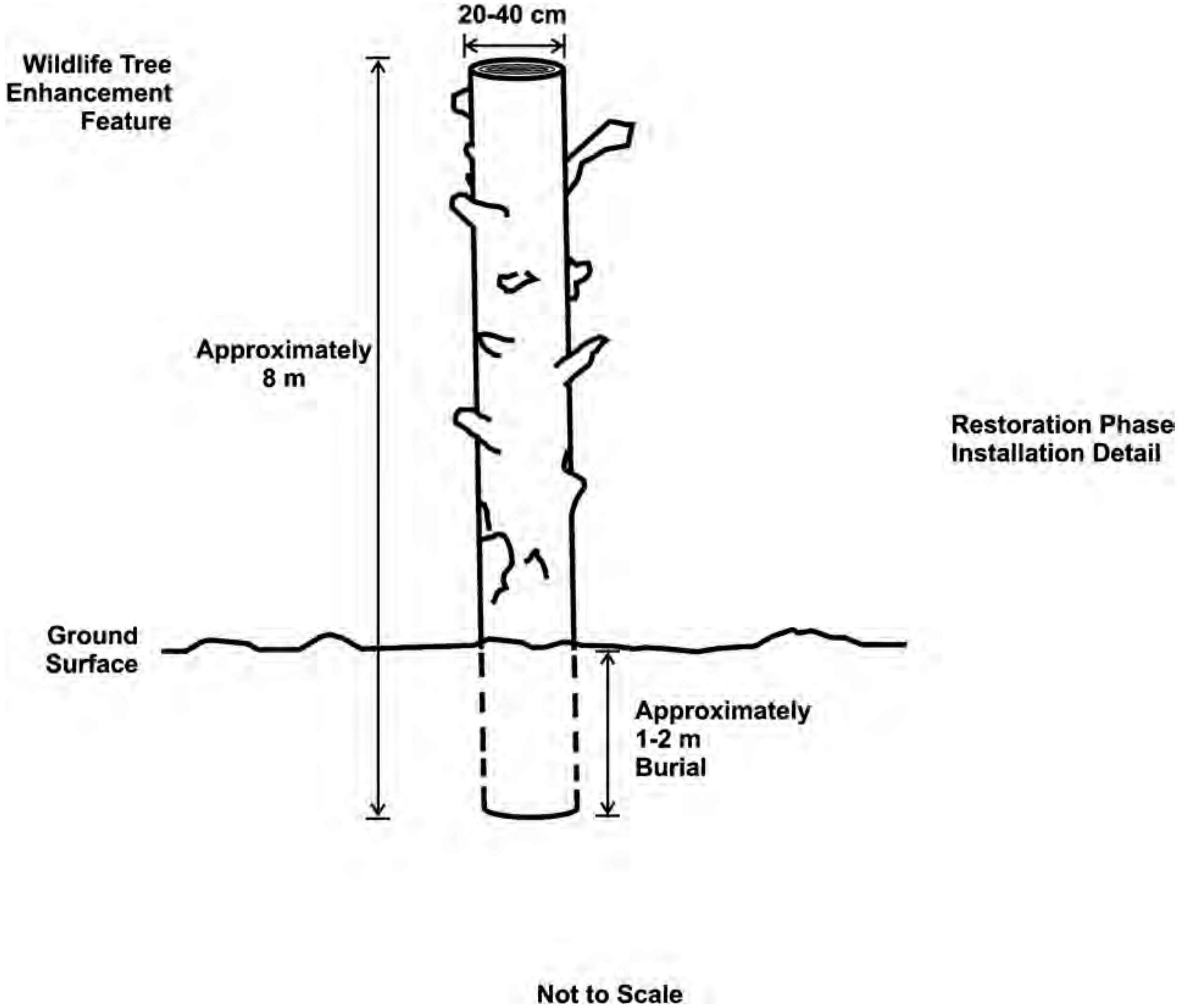


Representation Only

Notes:

1. Use subsoil to construct berm.
2. Locate berm across the entire width of the construction right-of-way.
3. Cover constructed berm with topsoil/root zone material.
4. Do not locate berm in drainages or depressions.
5. Ensure soil berm is of sufficient height to restrict line of sight down the construction right-of-way from existing access.
6. Plantings adjacent the berm on each side will be established no less than the width of the berm.
7. Plant suitable early and late seral plants together, adjacent, on the sides and top of the berm.
8. Transfer dormant, woody plant s <1 m in height from adjacent vegetated areas onto sides and adjacent areas of the berm.
9. Transfer dormant, woody plants at a density of 0.35 plant / m^2.
10. Plant seedling woody plants at a density of 1 plant / m^2.

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	VEGETATION AND SOIL BERM - LINE-OF-SIGHT BREAK		
	7894	August 2014	Drawing A-14



Notes:

1. Salvage and store sound deciduous or coniferous tree trunks at the edge of the cleared right-of-way for use as wildlife tree enhancement features.

2. Tree trunks should be delimbed, but can have 10-30 cm long branch remnants protruding from the trunk.

3. Approximate tree size: 20-40 cm diameter and 8 m long.

4. During restoration phase, the trunk will be “planted” to a depth of approximately 1-2 m in temporary workspace to serve as an artificial snag (wildlife tree).

5. Location of enhancement feature to be determined by Environmental Inspector.

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	TYPICAL WILDLIFE TREE ENHANCEMENT FEATURE		
	7894	August 2014	Drawing A-15

BC Parks - NTRDPP



TAB B – NORTH THOMPSON RIVER PROVINCIAL PARK

August 2014
Rev. 0

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Prepared for:

TRANSMOUNTAIN

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1.0 NORTH THOMPSON RIVER PROVINCIAL PARK

North Thompson River Provincial Park is a 126 ha park, established in 1967 and situated at the confluence of the Clearwater and North Thompson rivers in BC. The park is located 5 km south of Clearwater and is popular with travellers on Highway 5. The park contains a campground, riverside picnic area, playground and hiking trails. The park also provides access to the Clearwater and North Thompson rivers for fishing and canoeing. The park protects locally significant archaeological values such as the remnant of kekuli (pit houses) and food cache pits along the riverbanks.

The park conserves river riparian habitats and an important example of the IDFmw2 (Thompson Moist Warm Interior Douglas Fir) bioclimatic subzone/variant (1.8% of the provincial protected representation of this subzone/variant) in the upper north portion of the park and on an island on the river.

The management objectives of North Thompson Provincial Park include conservation of the Northern Thompson Uplands Ecosection as well as the Clearwater River.

This environmental and socio-economic assessment (ESA) took into consideration these management objectives of North Thompson River Provincial Park.

2.0 CORRIDOR SELECTION AND PROJECT ACTIVITIES

Early in 2012, Trans Mountain Pipeline ULC (Trans Mountain) conducted a preliminary route assessment of the existing Trans Mountain pipeline alignment to identify potential routing options for the Trans Mountain Expansion Project (TMEP or the Project) in North Thompson River Provincial Park. As one of the core routing criteria, Trans Mountain sought to follow the existing Trans Mountain Pipeline System (TMPL) right-of-way to the maximum extent practical, deviating from the TMPL right-of-way only where necessary to reduce environmental and socio-economic impacts or to address technical or safety issues.

2.1 Existing Trans Mountain Pipeline Route

The existing TMPL right-of-way crosses the northern portion North Thompson River Provincial Park for 0.1 km, and then crosses the Clearwater River and proceeds to traverse the park for approximately 1.6 km. Order in Council 2925 was obtained by Trans Mountain to exempt the right-of-way from the park. This right-of-way is used as a trail by Clearwater residents and park visitors, primarily during summer.

2.2 Alternatives Considered

Trans Mountain assessed an option to avoid North Thompson Provincial River Park while using the existing TMPL right-of-way and North Thompson River as the primary control points. The option to conduct a trenchless crossing of the Clearwater River would see the pipeline placed beneath the park, however, a Boundary Adjustment would still be required. The alternative to avoid the park would still require an exit point for the trenchless crossing and then a new right-of-way that would cross and by-pass the existing TMPL right-of-way to get to the west boundary of the park before paralleling the west boundary for its entire length to avoid the park. This option would require new clearing of mature forest and increase the overall length of the pipeline. For these reasons, the option to avoid the park was not considered environmentally preferable given the presence of the existing TMPL right-of-way within the park and an existing linear disturbance that could be paralleled. During consultation with BC Parks officials, it was recommended that the contingency watercourse crossing method (*i.e.*, open cut) also be considered in the route selection in the event that a trenchless crossing was not successful. The three proposed Alternatives considered in the vicinity of North Thompson River Provincial Park included:

- the Previously Proposed Pipeline Corridor to minimize the surface disturbance in North Thompson Provincial Park and avoid the park to the extent practical;
- a Proposed Pipeline Corridor (HDD) Alternative that parallels the existing TMPL right-of-way and involves a trenchless crossing of the Clearwater River and then continues to parallel the existing TMPL right-of-way through the park; and
- a Proposed Pipeline Corridor (Contingency) Alternative that crosses the Clearwater River using an open cut method and then continues to parallel the existing TMPL right-of-way through the park.

No alternative corridor has been identified that does not impact the North Thompson River Provincial Park as routing is controlled by the need to cross the Clearwater River at a feasible location.

An evaluation of the alternative corridors in North Thompson River Provincial Park is provided in Table B2.2-1 and on Figure B2.2-1. Figure B2.2.-1 also shows the narrowed pipeline corridor, which identifies the land that would be required for the purposes of constructing the Project within the North Thompson River Provincial Park.

TABLE B2.2-1

EVALUATION OF ALTERNATIVE CORRIDORS – NORTH THOMPSON RIVER PROVINCIAL PARK AND SURROUNDING AREAS (AK 725.1 TO AK 728.1)[1]

Factors	Previously Proposed Pipeline Corridor	Proposed Revised Pipeline Corridor (HDD)	Proposed Revised Pipeline Corridor (Contingency)
LENGTHS			
Parks and protected areas (km)(name)	0.3 (North Thompson River Provincial Park)	1.9 (North Thompson River Provincial Park)	1.9 (North Thompson River Provincial Park)
Length of pipeline corridor (km)	2.7	2.7	2.6
Length following existing TMPL right-of-way (km)	0.5	2.0	2.6
Length following other linear features (other pipelines, power lines, highways, roads, fibre-optic lines, railways, etc.) (km)	0.5	0.1	0
Length of “new” corridor (km)	1.8	0.6	0
Total parallels (km)	0.9	2.1	2.6
CROSSINGS			
No. of highway crossings	2	0	0
No. of road (arterial, collector, local) crossings	3	5	6
No. of TMPL crossings	2	2	0
No. of foreign line crossings	0	0	0
No. of fibre-optic/other cable crossings	3	8	8
No. of main power line crossings	0	0	0
No. of distribution power line crossings	0	0	0
No. of railway crossings	0	0	0
Crossings of named rivers (No.)	1 (Clearwater River)	1 (Clearwater River)	1 (Clearwater River)
Crossings of named creeks (No.)	0	0	0
Crossings of other watercourses (No.)	0	0	0
Total watercourses (No.)	1	1	1
GEOTECHNICAL			
Length crossing slopes > 50% on the fall line (km)	0	0	0
Length crossing slopes > 50% on side hill (km)	0	0	0
Natural hazard potential (km)	High: 0.1 Medium: 0 Low: 2.6	High: 0.1 Medium: 0 Low: 2.6	High: 0.1 Medium: 0 Low: 2.5
Length of thin veneer of overburden or exposed bedrock (km)	0	0	0
HYDRAULICS			
Minimum elevation (m)	404	404	404
Maximum elevation (m)	445	445	445
Acceptability	Yes	Yes	Yes
LAND			
Indian Reserve (km) (name)	0	0	0
Provincial Crown (km)	0.6	1.5	1.7
Private (km)	1.8	1.1	0.9
Unknown Parcels (km)	0.3	0.1	0.2
No. of private parcels	5	4	4
ENVIRONMENT			
Old Growth Management Area (non-legal)(km)	0	0.2	0.2
Wetlands crossed (km)	0	0	0
Community forests crossed (km), woodlots crossed (km), Wildlife Habitat Areas (km) (species), designated Ungulate Winter Range (km), late winter or early winter habitat for mountain caribou (km) (Wells Gray or Groundhog), and Old Growth Management Area (legal) (km)	0	0	0
Length within Riparian Reserve Zone (km)	0	0	0

TABLE B2.2-1 Cont'd

Factors	Previously Proposed Pipeline Corridor	Proposed Revised Pipeline Corridor (HDD)	Proposed Revised Pipeline Corridor (Contingency)
SOCIO-ECONOMIC			
Agricultural Land Reserve (km)	0	0	0
Community watersheds (No.)	0	0	0
Municipalities crossed (km)(name)	1.4 (Clearwater)	1.3 (Clearwater)	1.2 (Clearwater)
Land and Resource Management Plan area (km) (name)	2.7 (Kamloops Land and Resource Management Plan)	2.7 (Kamloops Land and Resource Management Plan)	2.6 (Kamloops Land and Resource Management Plan)
CONSTRUCTABILITY AND COST			
Constructability	Trenchless crossing across Clearwater River. Greenfield route across Highway 5 and south along the west side of the Highway. Cross back to east side and follow the edge of the North Thompson River Provincial Park through treed land to rejoin TMPL right-of-way.	Trenchless crossing across Clearwater River. Short section to rejoin TMPL right-of-way. Proposed TMEP pipeline located between TMPL and a fibre-optic cable in restricted clearing width through North Thompson River Provincial Park.	TMEP parallels TMPL right-of-way for the entire length as a contingency to the trenchless crossing of the Clearwater River. Open cut the Clearwater River and follow TMPL right-of-way and a fibre-optic cable in restricted clearing width through the North Thompson River Provincial Park.
Estimated Cost ($ millions)	8.7	8.6	7.9

Notes: 1 The total length of the pipeline corridor denotes a point along the corridor where it would be necessary to deviate to avoid North Thompson River Provincial Park and then rejoin the existing Trans Mountain pipeline alignment. It does not represent the total length through North Thompson River Provincial Park. This length is needed to compare the full extent of the route alternatives for comparison purposes.

Orthomosaic maps that identify the land that would be required in North Thompson River Provincial Park (*i.e.,* the narrowed pipeline corridor) for the purposes of constructing the Project are provided in Figure B2.2-2.

2.2.1 Previously Proposed Pipeline Corridor

In order to avoid the park to the extent practical, it would require approximately 1.8 km of new right-of-way that would be opened up along the west boundary of North Thompson Provincial Park within a mature forest that had not been previously disturbed. While this corridor alternative would minimize the aboveground surface disturbance within the park, it would create unnecessary environmental impacts to adjacent lands surrounding the park. Furthermore, this alternative would cross the existing TMPL right-of-way that has been operating in the park for over 60 years in order to create a new linear disturbance elsewhere. For these reasons, this alternative is not recommended.

2.2.2 Proposed Pipeline Corridor (HDD)

Geotechnical studies indicated that a trenched crossing of the Clearwater River is geotechnically feasible, and if successful, this would result in no surface disturbance in the park as the entry, exit, and staging areas will be located outside of the park boundaries. This alternative would still parallel the existing TMPL right-of-way through most of the park.

2.2.3 Proposed Pipeline Corridor (Contingency)

In the event that the trenchless method is not successful, an open cut of the Clearwater River would be conducted and this alternative would follow the TMPL right-of-way through most of the park.

2.3 Preferred Alternative

The Proposed Pipeline Corridor (HDD) is the preferred alternative based on the reasons described above. However, in the event the construction of the Proposed Pipeline Corridor (HDD) is not successful, the Proposed Pipeline Corridor (Contingency) will be constructed. Trans Mountain made efforts to further minimize the proposed pipeline corridor in North Thompson River Provincial Park (*i.e.,* the narrowed corridor) to reduce the impacts to the park. Based on selected crossing method, either the trenchless or contingency options would be constructed within the narrowed pipeline corridor.

TRANS MOUNTAIN

FIGURE B2.2-1

NORTH THOMPSON RIVER PROVINCIAL PARK ALTERNATIVE CORRIDORS

TRANS MOUNTAIN EXPANSION PROJECT

Alternative Corridors

- Proposed Pipeline Corridor (Contingency)
- Proposed Pipeline Corridor (HDD)
- Previously Proposed Pipeline Corridor

- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- TMPL Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Highway
- Paved Road
- Resource Road
- Railway
- Transmission Line
- Fiber-Optic Transmission System
- Narrowed Pipeline Corridor within North Thompson Provincial Park
- Park / Protected Area

Projection: NAD 1983 UTM Zone 10N. Routing: Baseline TMPL & Facilities: provided by KMC, 2012; Proposed Corridors V6 and V9.2 provided by UPI, August 23, 2013 and June 5, 2014. Reference Line & RK/AK VF provided by UPI, March 25 & 28, 2014; Additional Routing Alternatives provided by UPI 2013-2014; Transportation: IHS Inc., 2013, Natural Resources Canada, 2012; Geopolitical Boundaries: Natural Resources Canada, 2003, AltaLIS, 2013, IHS Inc., 2011, BC FLNRO, 2007 & ESRI, 2005; First Nation Lands: Government of Canada, 2014, AltaLIS, 2010 & IHS Inc., 2011; Hydrology: Natural Resources Canada, 2007-11 & BC FLNRO, 2008; Parks and Protected Areas: Natural Resources Canada, 2014, AltaLIS, 2012 & BC FLNRO, 2008; B/W & Colour Imagery: 2008-2011: Provided by KMC, 2012; NASA Geospatial Interoperability Program, 2005; ESRI, 2005 (Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community).

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TRANS MOUNTAIN

FIGURE B.2.2-2
ORTHOMOSAIC MAPPING OF NORTH THOMPSON RIVER PROVINCIAL PARK
SHEET 1 OF 2
TRANS MOUNTAIN EXPANSION PROJECT

- Start/End UTM Coordinate
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- TMPL Kilometre Post (KP)
- Existing Major Access
- Existing Secondary Access
- New Permanent Access
- New Temporary Access
- Deactivated Overgrown Access
- Narrowed Pipeline Corridor within North Thompson River Provincial Park
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Revised Pipeline Corridor
- Trans Mountain Expansion Project Proposed Alternative Pipeline Corridor
- Facility Property Boundary
- Highway
- Paved Road
- Resource Road
- Railway
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- Park / Protected Area

Projection: NAD 1983 UTM Zone 10N. Routing: Baseline TMPL & Facilities provided by KMC, 2012; Proposed Corridor V9.2 provided by UPI, June 5, 2014; RK/AK VF provided by UPI, March 28, 2014; Narrowed Pipeline Corridor provided by UPI, July 24, 2014; Access Roads: UPI, Jan. 24, 2014; Transportation: IHS Inc., 2013, Natural Resources Canada, 2012; Geopolitical Boundaries: IHS Inc., 2013; First Nation Lands: Government of Canada, 2014; Hydrology: Natural Resources Canada, 2007-2011 & BC FLNRO, 2008; Parks and Protected Areas: Natural Resources Canada, 2014, FLNRO, 2008; B/W & Colour Imagery: 2008-2011: Provided by KMC, 2012; NASA Geospatial Interoperability Program, 2005.

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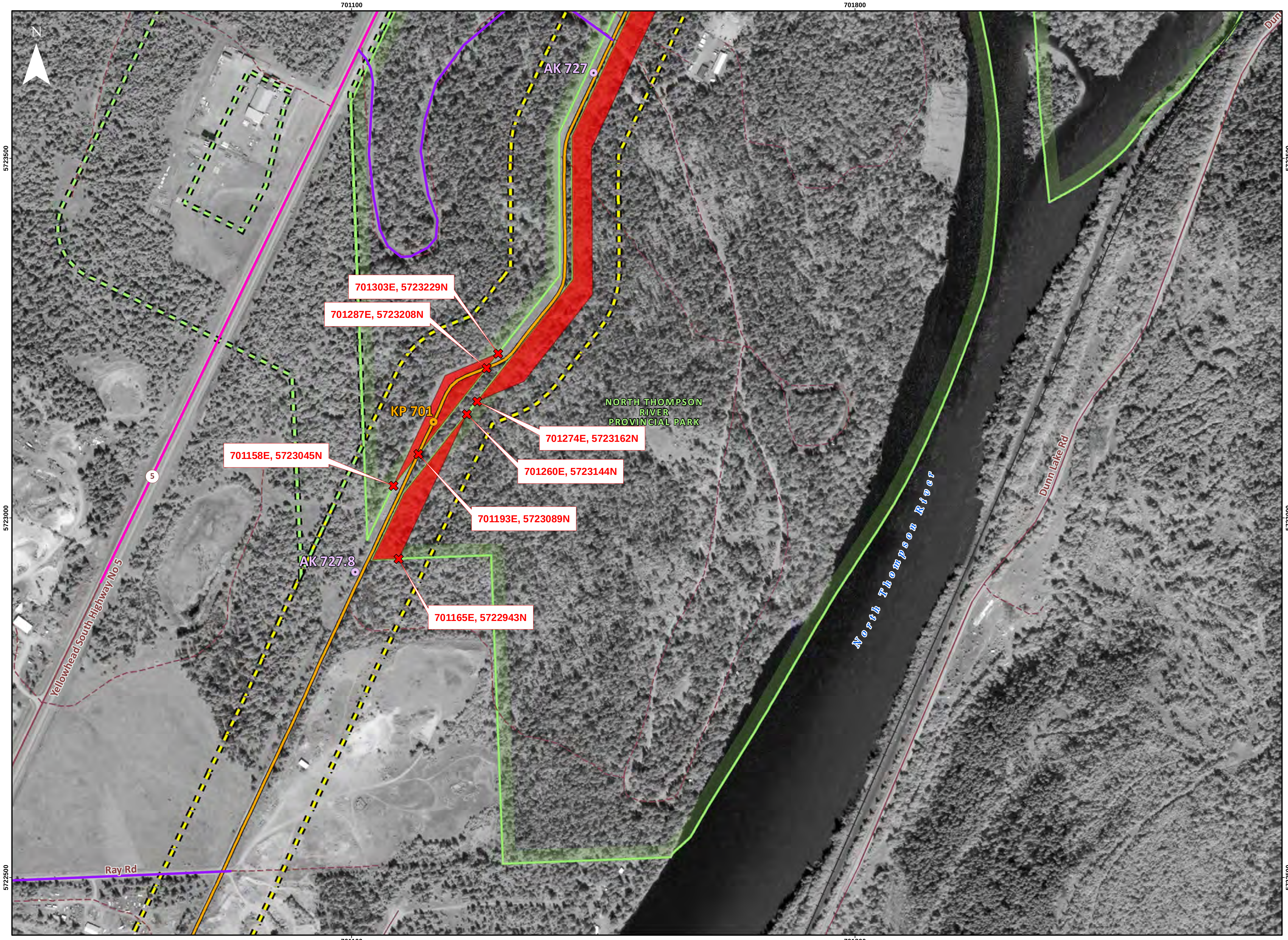

TRANS MOUNTAIN

FIGURE B.2.2-2
ORTHOMOSAIC MAPPING OF NORTH THOMPSON RIVER PROVINCIAL PARK
SHEET 2 OF 2
TRANS MOUNTAIN EXPANSION PROJECT

- Start/End UTM Coordinate
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- TMPL Kilometre Post (KP)
- Existing Major Access
- Existing Secondary Access
- New Permanent Access
- New Temporary Access
- Deactivated Overgrown Access
- Narrowed Pipeline Corridor within North Thompson River Provincial Park
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Revised Pipeline Corridor
- Trans Mountain Expansion Project Proposed Alternative Pipeline Corridor
- Facility Property Boundary
- Highway
- Paved Road
- Resource Road
- Railway
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- Park / Protected Area

Projection: NAD 1983 UTM Zone 10N. Routing: Baseline TMPL & Facilities provided by KMC, 2012; Proposed Corridor V9.2 provided by UPI, June 5, 2014; RK/AK VF provided by UPI, March 28, 2014; Narrowed Pipeline Corridor provided by UPI, July 24, 2014; Access Roads: UPI, Jan. 24, 2014; Transportation: IHS Inc., 2013, Natural Resources Canada, 2012; Geopolitical Boundaries: IHS Inc., 2013; First Nation Lands: Government of Canada, 2014; Hydrology: Natural Resources Canada, 2007-2011 & BC FLNRO, 2008; Parks and Protected Areas: Natural Resources Canada, 2014, FLNRO, 2008; B/W & Colour Imagery: 2008-2011: Provided by KMC, 2012; NASA Geospatial Interoperability Program, 2005.

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2.4 Project Components

The technical details of the components of the Project are summarized in Section 2.2.1 of the Introduction to the Draft Stage 2 Detailed Proposal.

The total land required to construct the proposed Project within North Thompson River Provincial Park is approximately 6.03 ha, which includes temporary workspace needed to support the trenchless and/or contingency open-cut method of the Clearwater River crossing. Pipeline construction in this areas will occur on a reduced right-of-way (*i.e.,* reduced from typical 40 m to 30 m, incorporating an 18 m permanent right-of-way and 12 m temporary workspace) to minimize disturbance (see Figure B2.2-1).

Construction equipment will access the proposed construction right-of-way via existing access roads and will travel along the construction right-of-way to the site. No new access will be needed; however, snow may be ploughed along the existing access road and right-of-way to allow safe passage to the work site. Design, construction and operation of the pipeline will be in compliance with all applicable codes, standards and regulations.

2.5 Construction Schedule in North Thompson River Provincial Park

Pending regulatory approval of the Project and approval of the Draft Stage 2 Detailed Proposal, mainline construction in North Thompson River Provincial Park is tentatively scheduled to commence in Q3 2016 and extend through Q4 2017, with clearing activities scheduled to commence prior to the start of construction in Q3 2016, outside of the migratory birds breeding and nesting period. Intensive construction activities including trenching, lowering-in and backfilling, will be conducted as quickly as possible in order to reduce the amount of time the trench is open. Proposed construction and clearing activities in North Thompson River Provincial Park are expected to take place over a 14 day period (see Table B2.5-1). However, within that period, the various phases of construction will occur consecutively. A description of the construction activities is found in Section 2.2.1 of the Introduction of the Draft Stage 2 Detailed Proposal.

TABLE B2.5-1

ESTIMATED PROJECT CONSTRUCTION AND OPERATIONS SCHEDULE

Major Activity	Anticipated Commencement of Major Activity	Estimated Duration of Major Activity
Pipeline Construction	Pending regulatory approval	14 days
Construction Survey	Q3 2016 prior to clearing	1 day
Clearing	Q3 2016	1 day
Topsoil or Root Zone Material Salvage	Q3 / Q4 2016	1 day
Grading (if required)	Q3 / Q4 2016	1 day
Stringing, Bending and Welding	Q3 / Q4 2016	2 days
Trenching	Q3 / Q4 2016	1 day
Lowering-in	Q3 / Q4 2016	1 day
Backfilling	Q3 / Q4 2016	1 day
Testing	Q4 2017	2 days
Clean-up and Reclamation	Spring 2017	2 days
Operations	In-Service: Q4 2018	Over the first and second complete growing seasons following construction
Post-Construction Monitoring	--	5 years (growing seasons)
Line Patrols	--	Regular intervals
In-Line Inspections	--	As required
Vegetation/Weed Management	--	As required during lifespan
Maintenance Digs	Pending regulatory approval	As required during lifespan

3.0 ABORIGINAL ENGAGEMENT IN NORTH THOMPSON RIVER PROVINCIAL PARK

As described in Section 3.0 of the Introduction of the Draft Stage 2 Detailed Proposal, the Aboriginal Engagement Program in North Thompson River Provincial Park included four First Nations groups that are potentially affected by Project activities in the park. Section 3.3 of the Introduction to the Draft Stage 2 Detailed Proposal documents Trans Mountain's engagement efforts with the following Aboriginal communities who have Aboriginal interests potentially affected by the proposed pipeline corridor in North Thompson River Provincial Park:

- Simpcw First Nation;
- Canim Lake Indian Band;
- Adams Lake Indian Band; and
- Neskonlith Indian Band.

4.0 PUBLIC CONSULTATION IN NORTH THOMPSON RIVER PROVINCIAL PARK

As described in Section 4.2.3 of the Introduction of the Draft Stage 2 Detailed Proposal, the public consultation program in North Thompson River consisted of a Community workshop and Parks workshops. The following subsections describe a summary of the attendees invited and interests and concerns raised at these workshops relating to North Thompson River Provincial Park.

4.1 Community Workshop

On June 5, 2013, Trans Mountain held a Community Workshop in Clearwater, BC for identified stakeholders to provide an opportunity for local stakeholders to receive updated information and provide feedback on issues and concerns relative to their community especially as it related to routing and environmental studies. Some concerns raised were specific to provincial parks which provided a reference point for those attending Parks Workshops in 2014.

Stakeholders were contacted by phone and email and invited to participate. A number of follow up phone calls were made to encourage invitees to participate. Of the 40 representatives that were invited, 16 attended. In some cases, organizations were represented by more than one attendee.

Table B4.1-1 provides information on the attendees at the Clearwater Community Workshop.

TABLE B4.1-1

PARTICIPANTS IN THE COMMUNITY WORKSHOP – NORTH THOMPSON RIVER PROVINCIAL PARK

Group Type	Group
Community	Chamber of Commerce
	Clearwater ATV Club
	Eight Landowners and Concerned Citizens
	Little Fort Recreation
	Snowdrifters Snowmobile Club
	Upper North Thompson Livestock Association
Local Government	Thompson-Nicola Regional District
	Tourism Wells Gray
	Wells Gray Services Committee

Interested stakeholders who were invited but did not attend the event include:

- Central North Thompson Rod & Gun Club;
- Clearwater Yellowhead Ecological Society;
- Concerned Citizen;
- Cubs and Scouts;
- District of Clearwater;
- Elks;
- Evergreen Acres (Seniors);
- Grizzly Anglers Society;
- Royal Canadian Legion;
- Thompson Nicola Regional District;

- Vavenby Trail Rides; and
- Wells Gray Outdoor Club.

4.1.1 Summary of Consultation Outcomes at Community Workshop

Table B4.1-2 provides information on key topics, interests and concerns raised relating to North Thompson River Provincial Park at the Clearwater Community Workshop.

TABLE B4.1-2

COMMUNITY WORKSHOP – NORTH THOMPSON RIVER PROVINCIAL PARK

Topic	Summary of Concern	North Thompson River Detailed Proposal Section
Noise	Concern about construction noise and vibration impacts on local businesses, residential areas in North Thompson River Provincial Park.	Section 7.1 4 of this tab. Vibration impacts are not expected to be a concern (no blasting is proposed in the park).
Land	None.	N/A
Human Activity and Land Use	Residents commonly use the existing TMPL right-of-way in North Thompson River Provincial Park for recreation (dog walking, cross country skiing and horseback riding) and are concerned that construction will limit those activities. Residents are also concerned about the preservation of the park.	Section 7.2.1 of this tab.
Water	Construction impact on access to fishing creeks in North Thompson region.	Section 7.2.1 of this tab.

4.2 Parks Workshop

On April 1, 2014, Trans Mountain held a Parks Workshop for selected participants in Clearwater, BC to discuss the proposed routing through both Finn Creek Provincial Park and North Thompson River Provincial Park. Stakeholders were contacted by phone and email and invited to participate. An introductory email was sent to all selected participants on March 17, 2014, and a reminder to RSVP email was sent on March 24, 2014. Interested stakeholders who were unable to attend the event were invited to provide feedback through the online posting of workshop information. An agenda was distributed to all attendees on March 31, 2014.

Attendees consisted of representatives from regional and municipal regulatory agencies, key community and local recreation groups and park users. Of the 20 stakeholder groups that were invited, 10 attended, with some groups having more than one attendee. A total of 26 attendees were present for the event. Local First Nations (Simpcw First Nation, Adams Lake Indian Band and Neskonlith Indian Band) were provided an opportunity to review and comment on proposed parks routing, impacts and benefits through a parallel process described in Section 3.2.3 of the Introduction to the Draft Stage 2. The list of attendees is provided in Table B4.2-1.

TABLE B4.2-1

PARTICIPANTS IN THE PARKS WORKSHOP – NORTH THOMPSON RIVER PROVINCIAL PARK

Group Type	Group
Business	Blue River Powder Packers
	Naklin Ltd.
Community	Blue River Community Association
	Little Fort Recreation
	Wells Grey Outdoor Club
Local Government	District of Clearwater
	Thompson Headwaters Services Committee
	Thompson Nicola Regional District
Provincial Government	Ministry of Environment, BC Parks, Thompson Region
	Ministry of Transportation and Infrastructure

Interested stakeholders and Aboriginal communities who were invited but did not attend the event include:

- Adams Lake Indian Band;
- Avola Recreation Society;
- Central North Thompson Rod & Gun Club;
- Clearwater ATV Club;
- Clearwater Yellowhead Ecological Society;
- Department of Fisheries and Oceans Canada;
- Neskonlith Indian Band;
- Simpcw First Nation;
- Tourism Wells Grey; and
- Vavenby Trails Rides.

4.2.1 Summary of Outcomes of Consultation at Parks Workshops

4.2.1.1 Concerns Raised

Table B4.2-2 provides information on the key topics, interests and concerns for North Thompson River Provincial Park at the Parks Workshop.

TABLE B4.2-2

CLEARWATER PARKS WORKSHOP – NORTH THOMPSON RIVER PROVINCIAL PARK

Topic	Summary of Concern	North Thompson River Detailed Proposal Section
Air	None.	N/A
Land	Very high squirrel population nesting near the right-of-way of North Thompson River Provincial Park.	Section 7.1.9 of this tab
	High incident of root disease natural to this ecosystem. Extra care is needed with tree hazard assessment during construction.	Section 7.1.8 of this tab
	Wildlife and vegetation in North Thompson River Provincial Park – moose, deer and black bear north to south migration. Salamander, frogs and toads. Five to six species of berries.	Section 7.1.9 of this tab
	Caution about increasing dust during construction (soil is silty) and potential impact on highway visibility.	Section 7.1.4 of this tab
	Do not increase drainage into Ministry of Transportation and Infrastructure right-of-way during construction	Section 7.1.3 of this tab
Human Activity and Land Use	Summer tourism in North Thompson River Provincial Park. Suggestion to plan construction during early March to April to avoid disruptions during busiest operating season April 1 to October 21. Winter construction would conflict with winter recreationalists of near 25 cars per day as opposed to 200/day and 60-80 cars overnight during the summer. Could manage impacts by limiting groomed trails near construction to promote canine trails December to March. Right-of-way is usually blocked by a snow fence. Ensure access is maintained and advertise delays on Drive BC.	Section 2.0 of this tab
	More archaeological sites than originally thought in North Thompson River Provincial Park have been studied by Simpcw First Nation.	Section 7.1.11 of this tab
	Equestrian use north to south through North Thompson River Provincial Park is permitted during summer and fall.	Section 7.2.1 of this tab
	Potential for vandalism during construction in North Thompson River Provincial Park due to easy access from highway.	Section 7.9 of Volume 5A of the Facilities Application
	Increasing unauthorized ATV and snowmobile access in North Thompson River Provincial Park.	Section 7.2.1 of this tab. Appendix A of this Proposal
Water	None.	N/A

Trans Mountain will consider all feedback raised to date and will work under the guidance of BC Parks to address concerns through construction, mitigation and reclamation techniques.

4.2.1.2 Parks Benefits

Table B4.2-3 provides information on key ideas raised by stakeholders for benefits to North Thompson River Provincial Park. Trans Mountain has submitted this list of possible benefits to BC Parks for consideration against Park management and benefit priorities. Participants were asked to prioritize the benefits that they believed were the most important to the park using a series of criteria which included:

- groups which would benefit (Community, Parks and Trans Mountain);
- impact to ecological value;
- ease of implementation;
- cost effectiveness; and
- ability to partner with existing initiatives.

Based on the number of criteria items the idea applied to, ideas that benefited the greatest number of groups and were easy to implement were determined and are outlined in Table B4.2-3.

TABLE B4.2-3

POTENTIAL PARKS BENEFITS – NORTH THOMPSON RIVER PROVINCIAL PARK

Summary of Potential Park Benefits	Priority
Invasive species in North Thompson River Provincial Park are especially bad, perhaps there is a potential to share costs on invasive species management programs.	High
Trail development for hiking and skiing to connect North Thompson River Provincial Park to Clearwater town centre. This trail would not be for vehicles, and could be either paved or gravel.	High
First Nations Road Show with interpretative info. This is the number one request from tourists to North Thompson River Provincial Park.	High
Exercise equipment on trails in North Thompson River Provincial Park.	High
Repaving of the existing road as far as Merlin's compound to right-of-way (1 km) in North Thompson River Provincial Park.	Medium

4.3 Other Consultation Activities

4.3.1 Local Government

Trans Mountain shared proposed routing with Directors for Thompson Nicola Regional District Areas A who is responsible for North Thompson River Provinical Park during project and routing briefings. The Area A Director attended, and provided input to Parks Workshop. Project briefing and proposed routing was provided to Thompson Nicola Regional District staff including the Chief Administrative Officer (CAO) and representatives fromRegional Planning, Finance and Emergency Response departments. Through these consultation activities the Thompson Nicola Regional District provided feedback about preferred construction schedules and recreational activity within the park.

While Thompson Nicola Regional District representatives and District of Clearwater did not take a position in relation to the proposed pipeline route through North Thompson River Provincial Park, no concerns were raised.

Table B4.3.1-1 outlines the Trans Mountain's public consultation activities with the Thompson Nicola Regional District and District of Clearwater.

TABLE B4.3.1-1

KEY CONSULTATION ACTIVITES WITH LOCAL GOVERNMENT STAKEHOLDERS FROM THOMPSON NICOLA REGIONAL DISTRICT AND DISTRICT OF CLEARWATER

Stakeholder Group / Agency Name	Title of Contact	Method of Engagement Activity	Date of Consultation Activity	Reason for Engagement
Thompson Nicola Regional District	Chief Administrative Officer	Letter	June 14, 2012	Provide information about the Project
Thompson Nicola Regional District	Chief Administrative Officer	Email	October 22, 2012	Invitation to upcoming public information session in Valemount.
Thompson Nicola Regional District	Chief Administrative Officer	In-person	April 29, 2013	Discuss routing within the Thompson Nicola Regional District
Thompson Nicola Regional District	Chief Administrative Officer	In-person	May 29, 2013	Community Workshop (Refer to Table B4.1-2 for comments provided from stakeholders during this event).
Thompson Nicola Regional District District of Clearwater	Chief Administrative Officer	In-person	April 1, 2014	Parks Workshop (Refer to Table B4.2-1 for comments provided from stakeholders during this event).

5.0 ECONOMIC BENEFIT TO NORTH THOMPSON RIVER PROVINCIAL PARK

A description of economic benefits to the province of BC resulting from the Project is provided in Section 5.0 of the Introduction of the Draft Stage 2 Detailed Proposal.

5.1 Estimated Workforce Requirements

The construction of the Project will involve a workforce of approximately 550 workers onsite at any given time for the duration of construction from North Thompson #6 to Darfield Pump Station, which includes North Thompson River Provincial Park. The skills of the anticipated workforce will include heavy equipment operators, welders, labourers, mechanics, foremen, surveyors, inspectors and field office support personnel. Generally, during pipeline construction, pipeline crews and workers will use a combination of accommodation resources, including local commercial motels and hotels, private boarding arrangement, temporary work camps, and temporary or permanent RVs. While a worker accommodation strategy will be developed closer to construction, for workers involved in pipeline construction in North Thompson River Provincial Park, it is anticipated they may stay in a work camp established in the Clearwater/Vavenby area.

6.0 SETTING OF NORTH THOMPSON RIVER PROVINCIAL PARK

The environmental and socio-economic setting along the proposed or narrowed pipeline corridor within North Thompson River Provincial Park is described in Table B6.0-1. Information collected for the setting was obtained both from desktop overviews and field assessments.

TABLE B6.0-1

SUMMARY OF BIOPHYSICAL AND SOCIO-ECONOMIC ELEMENTS AND CONSIDERATIONS IN NORTH THOMPSON RIVER PROVINCIAL PARK

Biophysical and Socio-Economic Element	Summary of Considerations
Physical and Meteorological Environment	• The North Thompson River Provincial Park is located within the Interior Plateau Physiographic Region, which is characterized by gentle to moderately sloping rolling uplands with rounded ridges and summits, valleys deeply dissecting the plateau, terraces, fluvial plains, fans, and cones (Demarchi 2011, Holland 1976). • The North Thompson River Provincial Park is predominantly underlain by gneisses and other metamorphic rocks (Journeay *et al.* 2000b). • The surficial geology beneath the site is mapped as predominantly fluvial (Tipper 1971). • There are no areas of permafrost within the area of the North Thompson River Provincial Park. • No areas of potential terrain instability are known to occur in the vicinity of the North Thompson River Provincial Park. • The park is located in a zone of low seismic activity (NRCan 2010a). Peak ground acceleration with a 1:2475 annual probability of exceedance is between 0.1 and 0.2 g (NRCan 2013a). No earthquakes have been recorded in the area (NRCan 2013b). • The topography in the area of North Thompson River Provincial Park is relatively flat and the elevation is approximately 390 m above sea level. • A description of the climate for the Interior Douglas-Fir (IDF) Biogeoclimatic Zone (BGC) Zone is provided in the Vegetation Section of this table. • No major tornadoes or hailstorms have been recorded in the vicinity of the North Thompson River Provincial Park (NRCan 2010b,c).
Soil and Soil Productivity	• A soils survey was conducted in March 2014, along the narrowed pipeline corridor within North Thompson River Provincial Park. The soils along the narrowed pipeline corridor in North Thompson River Provincial Park are classified as Eluviated and Orthic Eutric Brunisols (Struthers 1 and Struthers 2). Locations of these soils series along the narrowed pipeline corridor are presented on the accompanying Environmental Alignment Sheets. • Eluviated and Orthtic Eutric Brunisols generally occur where dryer climatic conditions exist. There is no topsoil in North Thompson River Provincial Park, instead there is a thin duff layer overlying a Bm horizon. • These soils are coarse-textured and lack cohesion properties. • These soils contain moderate to high wind erosion hazards and slight to high water erosion hazards. • Struthers 1 soils have gravel at the surface or within 25-30 cm of the surface. • Both soils will result in unstable trench walls when vertically ditched.
Water Quality and Quantity	• The narrowed pipeline corridor through the park is located in the Upper North Thompson River Watershed of the Fraser River Basin. • The narrowed pipeline corridor crosses the Clearwater River, provincially rated as an S1A perennial watercourse. • During fisheries field studies conducted in November 2012, streamflow at Clearwater River was measured at 71.8 m^3/s and mean channel width and mean bank height was measured at 105.2 m and 1.7 m, respectively. • The narrowed pipeline will be installed using a trenchless (*i.e.,* HDD) crossing method. In the event a trenchless method is unsuccessful, a contingency open cut crossing will be conducted within the provincial least risk biological window of August 7 to August 15. • No provincial or federal surficial geology mapping is available within the North Thompson River Provincial Park. However, mapping completed by BGC Engineering (2013) indicates that the materials along the narrowed pipeline corridor through the park consists of fluvial sediments. • The bedrock beneath the park consists of marine sedimentary and volcanic rocks of the Fennell Assemblage. There are no bedrock exposures within the park. • North Thompson River Provincial Park is entirely underlain by Aquifer #769; sand and gravel alluvial fan deposits; high vulnerability, moderate productivity and moderate demand. • Groundwater flows generally follow local topography with recharge occurring either directly over the unmapped aquifers or from the valley walls (mountain sides) and with groundwater discharge feeding the local Clearwater and North Thompson River system or flowing within fluvial sediments, down gradient, subparallel to the valley axis. • There is a major water course crossing at AK 725.6 to AK 725.7 of the Clearwater River within the park. The North Thompson River is located on the east side of the provincial park along its eastern boundary.

TABLE B6.0-1 Cont'd

Biophysical and Socio-Economic Element	Summary of Considerations
Water Quality and Quantity (cont'd)	• Numerous wells exist outside the park boundaries within the hamlet of Blackpool. There are no community-owned wells within Blackpool. Two water wells are noted in the BC WELLs database within the park boundaries (BC Ministry of Environment [MOE] #25693 and #25692). Well #25693 is listed as drinking water supply and is owned by the park. Water levels in both wells range from 7.9 to 12.5 m below ground (mbg). Two additional wells (#59441 and #76431), outside the park boundary but within the narrowed pipeline corridor have water levels of 18.9 and 22.9 mbg, respectively. Wells vulnerable to influences of surface activity by the unconfined nature of the sand and gravel deposit. • The area is susceptible to changes in groundwater flow patterns (*i.e.,* areas where the pipeline cuts across a slope).
Air Emissions and Greenhouse Gas Emissions (GHG)	• The nearest permanent residence to the Project is located approximately 350 m from the narrowed pipeline corridor in North Thompson River Provincial Park. • Existing factors affecting air quality in North Thompson River Provincial Park include emissions from intermittent vehicle traffic exhaust from Highway 5, nearby residences in the District of Clearwater. • The primary source of air emissions (criteria air contaminants [CACs]) during construction will be from fuel combustion related to the use of transportation vehicles and heavy-duty equipment. During operations, emissions will be limited to transportation and equipment use during maintenance activities. CACs expected to be emitted from Project-related activities include sulphur oxides, volatile compounds, carbon monoxide and particulate matter. • A temporary increase in airborne emissions is anticipated during pipeline construction but will not result in an increase in airborne emissions during operations and maintenance. Therefore, a detailed assessment of air and GHG emissions is not warranted.
Acoustic Environment	• Current sources of noise emissions in North Thompson River Provincial Park are from intermittent sources such as vehicle traffic on Highway 5, nearby permanent residences in the District of Clearwater. • District of Clearwater's Noise Bylaw No. 14, 2008, applies outside the hours of 8:00 AM and 5:00 PM from Monday to Friday. • Construction and clearing are scheduled for Q3 and Q4 of 2016, when there are fewer recreational users within the park and the campground is closed. • A temporary increase in noise levels is anticipated during pipeline construction. Noise from construction activities will be in compliance with the BC Oil and Gas Commission (BC OGC) *British Columbia Noise Control Best Practices Guideline* (BC OGC 2009). • Noise arising from construction activities and the potential effect on wildlife are discussed in Section 7.1.9. • Noise generated during operations is expected to be undetectable and will not contribute to ambient noise levels. A quantitative assessment of the acoustic environment is, therefore, not warranted.
Fish and Fish Habitat	• The narrowed pipeline corridor crosses one fish-bearing watercourse (Clearwater River) in North Thompson River Provincial Park. The Clearwater River has been rated as having high levels of fish habitat potential for rearing, overwintering and migration, and moderate levels of spawning habitat for salmonids at the crossing location. Previously documented fish species within the Clearwater River include: coho salmon, Chinook salmon, sockeye salmon; bull trout/Dolly Varden; rainbow trout/steelhead; mountain whitefish; slimy sculpin; northern pikeminnow; and longnose dace. • The primary management objective of North Thompson River Provincial Park is to provide an overnight and stay use stopover site for the public (*i.e.,* travellers on Highway 5) (BC MOE 2013a). Other management objectives for the park include conservation of river riparian habitats and a small, but relatively important example of the IDFmw2 subzone/variant (BC MOE 2013a).
Wetlands Loss or Alteration	• The North Thompson River Provincial Park is situated within the boundaries of the Columbia Mountains and Highlands Ecoregion of the Montane Cordillera Ecozone. Wetlands in this ecoregion tend to be restricted to mountain slopes where non-forested bogs, marshes and swamps occur (Ecological Stratification Working Group 1995). • The North Thompson River Provincial Park is located within the South Interior Mountain Wetland Region. Wetlands characteristic of this region include flat bogs, basin bogs and shallow basin marshes. Within alpine areas, small basin fens and basin bogs can be found (Government of Canada 1986). • The North Thompson River Provincial Park is located within the Interior Douglas-Fir (IDF) Biogeoclimatic (BGC) Zone of BC. In this BGC Zone, wetlands are often found in depressions, around open water, small streams and drainage channels. Wetlands types include fens, marshes as well as shrubby swamps (BC Ministry of Forests 1996, Meidinger and Pojar 1991). • Wetlands provide habitat for native plants and wildlife species, including nesting and foraging habitat for a variety of bird species, forage and cover for ungulates and fur-bearers and breeding habitat for amphibians. Wetlands provide water storage, groundwater recharge and natural filtering of sediments. • There are no Ramsar Wetlands of International Importance (Bureau of the Convention on Wetlands 2014), Important Bird Areas (IBAs) (Bird Studies Canada and Nature Canada 2012), Western Hemisphere Shorebird Reserves (WHSRN 2014), Migratory Bird Sanctuaries (Environment Canada 2013) or Ducks Unlimited Canada (DUC) Priority Areas (DUC 2014) located within the North Thompson River Provincial Park. The narrowed pipeline corridor does not cross any DUC projects within the North Thompson River Provincial Park (Harrison pers. comm.); therefore, no additional mitigation or consultation is required. • No wetlands were identified as being crossed by the narrowed pipeline corridor within the North Thompson River Provincial Park during helicopter reconnaissance (September 2012 and May 2013) and satellite imagery review (1:10,000).

TABLE B6.0-1 Cont'd

Biophysical and Socio-Economic Element	Summary of Considerations
Vegetation	• The Project crosses North Thompson River Provincial Park, located at the confluence of the North Thompson River and the Clearwater River. The park serves to conserve river riparian habitats, as well as an example of IDFmw2 subzone/variant, which is an underrepresented subzone/variant within the protected area system. The North Thompson River Provincial Park represents 1.8% of the IDFmw2 variant protected in the province, while only 4% of the IDFmw2 is captured in the protected area system in BC (BC MOE 2003). • North Thompson River Provincial Park is located in the IDF BGC Zone. The landscape of the IDF BGC zone consists largely of open to closed, mature forests of Douglas-fir. Pure Douglas-fir climax stands are common. Mixed stands of Douglas-fir and lodgepole pine are often present in areas frequently affected by fire. Extensive grassland communities also occur in parts of the zone due to a combination of edaphic and topographic conditions and fire history. Non-forested wetlands are common in this zone and include marshes, sedge and shrub fens, shrub-carrs and saline meadows. Willow swamps often occur along small streams and drainages (Meidinger and Pojar 1991). • The narrowed pipeline corridor within North Thompson River Provincial Park crosses forested land in the Thompson Moist Warm (mw2) variant for its entire length and includes a trenchless crossing of Clearwater River, with entry and exit points outside the park boundaries. If the trenchless crossing method is not successful, a 338 m long right-of-way will be required on land through the forested north extension of North Thompson River Provincial Park. • There are no species designated under the BC *Wildlife Act* in the IDF BGC zone. There are 11 vascular plant species and 2 non-vascular species listed under Schedule 1 of the *Species at Risk Act (SARA)* that have the potential to occur in the IDF zone (BC CDC 2014). No previously recorded Element Occurrences of plant species listed pursuant to the British Columbia *Wildlife Act* or *SARA* are known to occur within the Vegetation RSA (BC Conservation Data Centre [CDC] 2012) within the park boundaries. • The IDFmw2 variant has the potential to host two Blue-listed rare ecological communities: western red cedar – paper birch / oak fern (S2S3); and common cattail marsh (S3). No rare plant species or rare ecological communities in the IDF zone have been listed on the BC *Identified Wildlife Management Strategy*. • A search of the BC CDC database identified one previous observation of a Red-listed rare plant species, bearded sedge, within 5 km of the narrowed pipeline corridor through North Thompson River Provincial Park. The occurrence of bearded sedge was identified approximately 1.5 km from the narrowed pipeline corridor. There are no known rare ecological communities within 5 km of the narrowed pipeline corridor within North Thompson River Provincial Park (BC CDC 2012). • Vegetation surveys were conducted in the northern portion of the Park on June 19 and 20, 2013, as well as August 3, 2013. No rare plant species or rare ecological communities were identified during these surveys. Additional surveys are planned in July and August 2014 to survey areas of the park that were not surveyed in 2013. • The Project is located in Emergency Bark Beetle Management Area (EBBMA) designated as Salvage/Limited Action for Mountain Pine Beetle and Aggressive management areas for the Douglas Fir and Spruce Beetles (BC Ministry of Forests, Lands and Natural Resource Operations [MFLNRO] 2010). • One Non-legal Old Growth Management Area (OGMA) is crossed for 0.2 km along the narrowed pipeline corridor within North Thompson River Provincial Park. • Weed species identified within the park boundaries in 2013 include: one provincially noxious species - spotted knapweed [*Centaurea stoebe* spp. *micranthos* (C. maculosa)]; two regionally noxious species - oxeye daisy [*Leucanthemum vulgare* (*Chrysanthemum leucanthemum*)] and sulphur cinquefoil (*Potentilla recta*); and one species designated as noxious in other regions - hoary alyssum (*Berteroa incana*). Eight species of nuisance weeds were recorded: pineapple weed (*Matricaria discoidea*); great mullein (*Verbascum thapsus*); common plantain; lamb's-quarters; sheep sorrel (*Rumex acetosella*); chicory (*Cichorium intybus*); yellow salsify; and St. John's wort (*Hypericum perforatum*). • A management objective for the park includes conservation of river riparian habitats and a small, but relatively important example of the IDFmw2 subzone/variant (BC MOE 2013a).
Wildlife and Wildlife Habitat	• The North Thompson River Provincial Park website identifies squirrels, deer mice, shrews, marten, coyote, deer, moose, black bears, chickadees, varied thrush, woodpeckers, flickers, swallows, jays, bald eagles and ospreys as wildlife species that occur in the park (BC MOE 2013a). Public consultation reported a large squirrel population that nests near the existing TMPL right-of-way, and moose, deer and black bear are known to move from north to south through the park. • Early candidate critical habitat for American badger, *jeffersonii* ssp. is identified along the narrowed pipeline corridor in North Thompson River Provincial Park (Environment Canada 2014a). Badgers use a wide variety of natural and human-modified open habitat types, including deserts, grasslands, forest clearings, alpine areas, agricultural fields, road rights-of-way and linear disturbances (Apps *et al.* 2001). Predominant threats for badger populations in BC are attributed to urban, rural and road development, road mortality and trapping (*Jeffersonii* Badger Recovery Team 2008). • The primary management objective of North Thompson River Provincial Park is to provide an overnight and stay use stopover site for the public (*i.e.,* travellers on Highway 5) (BC MOE 2013a). A management objective for the park includes conservation of river riparian habitats and a small, but relatively important example of the IDFmw2 subzone/variant (BC MOE 2013a).

TABLE B6.0-1 Cont'd

Biophysical and Socio-Economic Element	Summary of Considerations

Species at Risk	• The following fish species at risk have the potential to occur in North Thompson River Provincial Park based on historical and/or known occurrences of the species (BC CDC 2014, COSEWIC 2014). Species at risk are defined here to include those species listed federally under Schedule 1 of *SARA* or by COSEWIC. Species of concern that are listed provincially are provided at the end of the list.
	  ◦ coho salmon: Endangered by COSEWIC; and
	  ◦ bull trout: Special Concern by COSEWIC (South Coast British Columbia populations) (Blue-listed).
	• There are two vascular plant species and two non-vascular species listed under Schedule 1 of the *Species at Risk Act (SARA)* that have the potential to occur in the IDF zone within the Kamloops Forest District (BC CDC 2014). Of these species, whitebark pine (*Pinus albicaulis*) and Mexican mosquito fern (*Azolla mexicana*) have the potential to occur within the Vegetation RSA in the North Thompson River Provincial Park.
	• No previously recorded Element Occurrences of plant species listed pursuant to the British Columbia *Wildlife Act* or *SARA* are known to occur within the Vegetation RSA (BC CDC 2012) within the park boundaries.
	• Potential habitat for whitebark pine habitat is generally in upper subalpine forest, which does not occur along the narrowed pipeline corridor within the park boundaries. There is low potential habitat for Mexican mosquito fern along the narrowed pipeline corridor within the park boundaries.
	• Vegetation surveys were conducted in the northern portion of the park on June 19 and 20, 2013, as well as August 3, 2013. No *SARA* listed or BC *Wildlife Act* rare plant species were identified during these surveys. Additional surveys are planned in July and August 2014 to address areas of the park that were not surveyed in 2013.
	• Candidate Critical Habitat for Species at Risk have been developed by Environment Canada, through recovery strategies for toothcup meadow-foam and whitebark pine. Candidate critical habitat for toothcup meadow-foam overlaps with the narrowed pipeline corridor and early candidate critical habitat for whitebark pine occurs within 1 km of the narrowed pipeline corridor in North Thompson River Provincial Park in two locations (Environment Canada 2014a).
	• The following wildlife species at risk have the potential to occur in North Thompson River Provincial Park based on range and habitat availability (BC CDC 2014, Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2014, Environment Canada 2014b). Species at risk is defined here to include those species listed federally under Schedule 1 of *SARA* and/or by COSEWIC. Species of concern that are listed provincially are provided at the end of the list.
	  ◦ Bank swallow: Threatened by COSEWIC;
	  ◦ Barn swallow: Threatened by COSEWIC, Blue-listed;
	  ◦ Common nighthawk: Threatened by *SARA* and COSEWIC;
	  ◦ Lewis's woodpecker: Threatened by *SARA* and COSEWIC, Red-listed;
	  ◦ Olive-sided flycatcher: Threatened by *SARA* and COSEWIC, Blue-listed;
	  ◦ Grizzly bear, western population: Special Concern by COSEWIC, Blue-listed;
	  ◦ Little brown myotis: Endangered by COSEWIC; and
	  ◦ Magnum mantleslug: Special Concern by COSEWIC, Blue-listed.
	  ◦ Provincially listed species: California gull (Blue-listed); fisher (Blue-listed); and Townsend's big-eared bat (Blue-listed).

Heritage Resources	• There is archaeological potential throughout the narrowed pipeline corridor in North Thompson River Provincial Park due to known site presence and proximity, and the associated Clearwater and North Thompson confluence. • There are no previously recorded archaeological sites in North Thompson River Provincial Park. • In accordance with provincial legislation, in the event that any historical, archaeological or palaeontological resources are discovered during construction, construction activity in the vicinity of the discovery will be suspended until provincial authorities allow work to resume. • Approval under the BC *Heritage Act* will be acquired prior to commencement of construction.
Traditional Land Use	• Old pithouses and cache pits were identified in the North Thompson River Provincial Park between the North Thompson and Clearwater rivers by the Canim Lake Indian Band. • These pithouses are not found within the narrowed pipeline corridor and Canim Lake Indian Band did not request any mitigation for these sites.
Visitor Enjoyment and Safety	• The park contains a campground, riverside picnic area, playground and hiking trails. The park also provides access to the Clearwater and North Thompson rivers for fishing and canoeing. • Access to the park is via a road off Highway 5. In the summer, approximately 200 cars per day visit the park, with 60 to 80 staying overnight; during the winter, approximately 25 cars per day visit the park (Clearwater Parks Workshop). • The park serves as regional day use as well as destination use (BC MOE 2003).

7.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS AND MITIGATION

Using the assessment methodology described in Section 6.1 of the Introduction of the Draft Stage 2 Detailed Proposal of this report, the following subsections evaluate the potential environmental and socio-economic effects associated with construction and operations of the pipeline within North Thompson River Provincial Park.

Environmental and socio-economic elements potentially interacting with the construction and operations of the pipeline in North Thompson River Provincial Park are identified in Table B7.0-1.

TABLE B7.0-1

ELEMENT INTERACTION WITH PROPOSED PIPELINE COMPONENT IN NORTH THOMPSON RIVER PROVINCIAL PARK

Element	Interaction with Pipeline Component	
	Construction	Operations
Conservational Values of North Thompson River Provincial Park		
Physical and Meteorological Environment	Yes	Yes
Soil and Soil Productivity	Yes	Yes
Water Quality and Quantity	Yes	Yes
Air Emissions	Yes	Yes
Acoustic Environment	Yes	Yes
Fish and Fish Habitat	Yes	Yes
Wetlands	No – wetlands are not anticipated to be disturbed during Project construction within North Thompson River Provincial Park.	No – wetlands are not anticipated to be disturbed during Project operations within North Thompson River Provincial Park.
Vegetation	Yes	Yes
Wildlife and Wildlife Habitat	Yes	Yes
Species at Risk	Yes	Yes
Heritage Resources	Yes	No – since surface or buried heritage resource sites, if present, would have been disturbed as a result of construction activities, no interaction is anticipated during operations of the pipeline in North Thompson River Provincial Park.
Traditional Land and Resource Use	Yes	Yes
Recreational Values of North Thompson River Provincial Park		
Visitor Enjoyment and Safety	Yes	Yes

The potential environmental and socio-economic effects associated with the pipeline, as well as the accompanying proposed mitigation measures and resulting residual effects are presented for each environmental and socio-economic element. In addition, using the criteria presented in Table 6.2.6-1 of the Introduction of the Draft Stage 2 Detailed Proposal of this report, the evaluation of significance is provided for each potential residual effect associated with the applicable environmental and socio-economic element in the subsections below.

Many of the recommended mitigation measures are considered industry accepted best practices in pipeline construction, reclamation and operations. However, a number of enhanced measures are also recommended specific for North Thompson River Provincial Park. The measures are discussed further in Section 8.0 and are summarized in Table B7.0-2. The entirety of the wildlife mitigation presented in Table B7.1.9-2 is intended to be specific to North Thompson River Provincial Park and, therefore, has not been repeated in Table B7.0-2.

TABLE B7.0-2

ENHANCED MITIGATION MEASURES RECOMMENDED IN NORTH THOMPSON RIVER PROVINCIAL PARK

Element/Topic	Recommendations	Section Discussed
Reclamation	<u>Park Trails</u> • Re-establish park trails following the replacement of soil and/or aggregate surface material as well as the replacement of park/trail signage removed during construction. <u>Natural Regeneration</u> • Allow for natural regeneration in areas where potential soil erosion and non-native invasive species infestation is low, and where it is anticipated that the topsoil or root zone material contains a propagule bank (*e.g.,* seed, stem or root pieces) of suitable species. • Apply a native perennial or non-native annual grass cover crop species in areas with potential erosion and weed concerns. <u>Woody Species Revegetation</u> *Installation of Nursery-Grown Plant Plugs* • Install nursery-grown plant plugs (*e.g.,* rooted stock plugs) in TWS, riparian and special reclamation areas, where suitable levels of naturally regenerating (from seed or vegetative propagules) deciduous or coniferous trees are not observed. • Secure native seed and collect dormant woody species cuttings, as warranted. • Install deciduous and coniferous rooted plugs at pre-selected sites (*e.g.,* TWS, riparian areas or for line-of-sight breaks) as determined in consultation with BC Parks Conservation Specialists. *Installation of Locally Sourced Dormant Woody Species Transplants* • Use plant transplants at pre-determined locations where vegetation is disturbed by construction. <u>Nutrient Management on Disturbed Forested Areas</u> • Apply a slow-release nitrogen fertilizer on lands that contain woody debris and/or wood chips mixed into the salvaged and replaced root zone material or that have been placed on cleared and ungrubbed portions of the construction right-of-way. <u>Seeding of Native Grass Species</u> • Develop seed mixes in consultation with BC Parks and consist of species native to the park or within the vicinity of the park. • Drill or broadcast seed native seed mixes or grass cover crop species on most of the construction right-of-way or at locations indicated on the Environmental Alignment Sheets, unless otherwise requested by BC Parks Area Supervisor or Conservation Specialist. <u>Specific Erosion and Sediment Control</u> • Install coir logs, erosion control blankets and sediment fences following clearing. Monitor and maintain following construction until vegetation establishment occurs. • Install diversion berms to reduce slope length and runoff velocities, and divert runoff away from watercourses/waterbodies and into well-vegetated areas. • Implement rollback using select tree species (*e.g.,* pine) felled during construction (avoid the use of Douglas-fir, grand fir and spruce) within riparian zones and TWS areas to provide erosion control and habitat enhancement. • Seed (drill or broadcast seeded) using an appropriate native grass seed mix, native perennial or annual non-native cover crop, along the disturbed areas following root zone material replacement at an appropriate prescribed rate. <u>Protect Rare Plants and Communities</u> • Leave gaps in the root zone material piles or subsoil piles to avoid the site • Use protective matting and/or snow during the winter (mark the area in case snow melts) to mat over the population or community where it occurs on the Project area, and other areas where root zone material removal is not required, to protect vegetation from scraping and compacting. • Monitor the effectiveness of implemented mitigation measures during rare plant PCEM. • Avoid blanket use of herbicides within 30 m of, or between the range of, the provided UTM coordinates. <u>Weed Management</u> • Utilize Trans Mountain's integrated vegetation management (IVM) approach to manage weeds and problem vegetation. • Develop detailed weed and problem vegetation reports for site-specific locations, as required, following a pre-construction weed survey (scheduled for spring 2015) and consultation with BC Parks Conservation Specialists. Weed and problem vegetation infestations and recommended mitigation measures will be incorporated into the Environmental Alignment Sheets. <u>Watercourses</u> • Stabilize banks and slopes of watercourse and riparian areas prior to and immediately following construction (crib structures, erosion control matting, revegetation grass rolls, sediment fences, biodegradable coir geotextile wraps, coniferous tree revetments, cobble or riprap armouring).	Section 8.0

TABLE B7.0-2 Cont'd

Element/Topic	Recommendations	Section Discussed
Reclamation (cont'd)	Wildlife Movement, Mortality and Human Encounters • Seed using native grass species with reduced palatability in areas where potential wildlife vehicle collisions and human encounters may be higher. • Install visual barriers along the right-of-way and salvaged wildlife habitat trees to restore the effectiveness of wildlife movement corridors.	See above

7.1 Conservational Values of North Thompson River Provincial Park

7.1.1 Physical and Meteorological Environment

This subsection describes the potential Project effects on the physical environment in North Thompson River Provincial Park. The Physical Environment LSA consists of a 1 km wide band generally extending from the centre of the proposed pipeline corridor and facilities (*i.e.*, 500 m on both sides of the proposed pipeline corridor centre); shown in Figure 6.2.2-4 of the Introduction to the Draft Stage 2 Detailed Proposal.

All physical environment indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; however, only terrain instability was determined to interact with pipeline construction in North Thompson River Provincial Park. There are no sites in North Thompson River Provincial Park with the potential for acid rock drainage. The topography within North Thompson River Provincial Park is level to undulating with steep slopes at the Clearwater River.

7.1.1.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on physical environment indicators are listed in Table B7.1.1-1.

A summary of mitigation measures provided in Table B7.1.1-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines including BC OGC (2013) and BC Ministry of Energy and Mines (Price and Errington 1998).

TABLE B7.1.1-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON PHYSICAL ENVIRONMENT FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Physical Environment Indicator – Terrain Instability			
1.1 General Measures	LSA	• Assess the need for special trench compaction measures or equipment prior to commencement of backfilling [Section 8.4] See additional backfilling measures in Section 8.4 of the Pipeline EPP. • Install subsoil cross berms moderate to steep slopes (*i.e.,* of the Clearwater River), and treed lands in order to prevent runoff along the construction right-of–way [Section 8.6]. • Revegetate as soon as feasible to reduce or avoid soil erosion and establish long-term cover. Seed immediately following root zone material replacement [Section 8.6]. See additional erosion control and revegetation measures in Section 8.6 in the Pipeline EPP.	• Areas of instability may occur as a result of construction activities.
1.2 Terrain instability due to slumping at the Clearwater River crossing	LSA	<u>Contingency Open Cut Crossing</u> • Take extra care to compact the trench at banks of the Clearwater River crossing [Section 8.4]. Stabilize and revegetate areas disturbed during installation and removal of a bridge; install erosion control measures, where warranted, to control surface erosion until vegetation is established [Section 8.7]. • Return the bed and banks of the Clearwater River crossing as close as feasible to their pre-construction contours (slope and height). Take appropriate measures to reduce the risk of sloughing of the streambank following construction [Section 8.7]. • Install riprap bank armouring along unstable banks with high erosion potential [Section 8.7]. • Seed riparian areas with an approved annual or perennial grass cover crop or native grass mix as soon as feasible after construction [Section 8.6]. See additional measures in Section 8.6 of the Pipeline EPP.	• Areas of slope instability may occur if trenched crossing methods are required at the Clearwater River crossing.

Notes: 1 LSA = Physical Environment LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.1.2 Significance Evaluation of Potential Residual Effects

Table B7.1.1-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in North Thompson River Provincial Park on the physical environment. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE B7.1.1-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON PHYSICAL ENVIRONMENT FOR NORTH THOMPSON RIVER PROVINCIAL PARK

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
				Duration	Frequency	Reversibility				
1	Physical Environment Indicator – Terrain Instability									
1(a)	Areas of terrain instability may occur as a result of construction activities.	Negative	LSA	Short-term	Isolated	Short to medium-term	Low	High	High	Not Significant
1(b)	Areas of slope instability mat occur if trenched crossing methods are required at the Clearwater River crossing.	Negative	LSA	Short-term	Isolated	Short to medium-term	Low	Low	High	Not significant

Notes: 1 LSA = Physical Environment LSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Physical Environment Indicator – Terrain Instability

Terrain Instability

Minor areas of terrain instability may occur along areas of the narrowed pipeline corridor as a result of the proposed construction activities (*e.g.,* grading, trenching and backfilling). The impact balance of this residual effect is considered negative since terrain instability could affect the safety of the pipe and result in surface erosion. Terrain along most of the narrowed pipeline corridor in North Thompson River Provincial Park is considered to be stable (level to undulating, with steep slopes at the Clearwater River), based on observations and operating experience of the existing TMPL system to date, as well as the results of the Terrain Mapping and Geohazard Inventory (Volume 4A of the Facilities Application) and the soil survey.

During construction of the pipeline, removal of vegetation and root mass, grading, cut and fills and runoff controls could lead to localized areas of potential instability. Monitoring during construction will ensure any observed instability issues will be resolved early before potentially severe instability problems arise. Grade material will be replaced to a stable contour that will approximate the pre-construction contour, except where it is not practical or safe from a pipe integrity perspective or for public safety.

Regular aerial and ground patrols will be conducted to examine vegetation establishment and confirm mitigation measures are functioning as intended, as well as identify any new areas of potential instability. At any areas where erosion is observed, appropriate measures will be implemented to clean-up and stabilize the site. Monitoring of the reclaimed sites will continue until the site is determined to be in a stable condition.

The residual effect of terrain instability occurring as a result of planned construction activity is reversible in the short to medium-term and of low magnitude (Table B7.1.1-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Physical Environment LSA - terrain instability as a result of construction activities may extend beyond the construction workspace.
- Duration: short-term – the event causing potential terrain instability is construction of the pipeline (*e.g.,* grading, and rough clean-up).
- Frequency: isolated – the event causing potential terrain instability (*i.e.*, construction of the pipeline) is confined to a specific period.

- Reversibility: short to medium-term – most areas of terrain instability will be remediated within a year, however, some areas may require a second or third year of remedial effort to fully stabilize.
- Magnitude: low – the implementation of the proposed mitigation measures in addition to detailed engineering design is expected to effectively reduce the severity and extent of potential effects on terrain instability.
- Probability: high – terrain instability is likely to result from pipeline construction at localized areas.
- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

Slope Instability at Watercourses

Areas of slope instability may occur should a trenched crossing method be used at the Clearwater River crossing. The impact balance of this residual effect is considered negative since slope instability could affect the safety of the pipe and water quality of the watercourse. Terrain along the narrowed pipeline corridor within the North Thompson River Provincial Park ranges from level to undulating with steep slopes at the crossing of the Clearwater River. The placement of trenchless crossing entry and exit locations well back from the potentially unstable areas and the depth of the drill path are expected to avoid the effect of terrain instability issues on the pipeline. However, should a trenchless crossing of the Clearwater River be unsuccessful and a trenched (*i.e.*, open-cut) installation is necessary, Trans Mountain will engage a geotechnical engineer regarding additional mitigation measures to prevent and control terrain instability, as needed, during construction. The installation of erosion protection measures will reduce the potential for slumping. Specific mitigation measures will be embedded in detailed crossing drawings that will be developed during detailed engineering design to address site-specific slope stability issues at the Clearwater River crossing. The residual effect of slope instability during a trenched crossing of the Clearwater River in North Thompson River Provincial Park is of low magnitude and is reversible in the short to medium-term depending on the length of time required to restabilize the affected area (Table B7.1.1-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Physical Environment LSA – slope instability as a result of trenching at the Clearwater River may extend beyond the construction workspace.
- Duration: short-term – the event causing potential slope instability is construction of the pipeline (*e.g.,* grading, trenching and backfilling during trenched crossing).
- Frequency: isolated – the event causing potential slope instability (*i.e.*, construction of the pipeline) is confined to a specific period.
- Reversibility: short to medium-term – depending upon the length of time required to restabilize the affected area.
- Magnitude: low – the implementation of the proposed mitigation measures is expected to effectively reduce the potential effects on slope instability within North Thompson River Provincial Park.
- Probability: low – slope instability will likely be avoided by the installation of erosion protection measures and proper trenched crossing procedures.
- Confidence: high – based on the professional experience of the assessment team on previous pipeline projects with similar conditions.

7.1.1.3 Summary

As identified in Table B7.1.1-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on the physical environment indicator of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of North Thompson River Provincial Park related to physical environment will be not significant.

7.1.2 Soil and Soil Productivity

This subsection describes the potential Project effects on the soil and soil productivity in North Thompson River Provincial Park. The Soil LSA consists of a 1 km wide band from the centre of the proposed pipeline corridor and facilities (*i.e.,* 500 m on both sides of the proposed pipeline corridor centre); shown in Figure 6.2.2-4 of the Introduction to the Draft Stage 2 Detailed Proposal.

All soil and soil productivity indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; however, only soil productivity, soil degradation and soil contamination indicators were determined to interact with pipeline construction and operations in North Thompson River Provincial Park. Soils in North Thompson River Provincial Park are not stony and, therefore, pipeline construction and operations does not interact with the bedrock and stone disposal indicator.

7.1.2.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on soil and soil productivity indicators are listed in Table B7.1.2-1.

A summary of mitigation measures provided in Table B7.1.2-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines including BC OGC (2010) and Canadian Association of Petroleum Producers (CAPP) (1996, 1999, 2008).

TABLE B7.1.2-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON SOIL AND SOIL PRODUCTIVITY FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Soil Indicator – Soil Productivity				
1.1 Decreased root zone material productivity during root zone material salvaging	Soil series: Struthers 1, Struthers 2	Footprint	Root Zone Material Depth • Soils in North Thompson River Provincial Park crossed by the narrowed pipeline corridor lack topsoil, therefore, root zone material (15-20 cm) should be salvaged for replacement, using the Environmental Alignment Sheets as a guide [Section 8.2]. Root Zone Material Salvage (General) • Implement the Wet/Thawed Soils Contingency Plan (See Appendix B of the Pipeline EPP) during wet/thawed soils conditions in the event wet or thawed soils are encountered during construction [Section 8.2]. • Accommodate BC Parks root zone material salvage requests. Record any locations where BC Parks has requested soils handling which differs from the planned method [Section 8.2]. • Salvage root zone material from areas to be graded and windrow to the closest edge of the construction right-of-way. Avoid overstripping. The area salvaged is to correspond to the area to the b graded [Section 8.2]. See additional grading measures in Section 8.2 of the Pipeline EPP. • Store root zone material prior to grading along the nearest pipeline construction right-of-way boundary taking into consideration space requirements for grade and trench spoil, local topography and drainage [Section 8.2]. • Keep the trench spoil pile separate from the root zone material pile [Section 8.3].	• Mixing of root zone material and subsoil.

TABLE B7.1.2-1 Cont'd

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.1 Decreased root zone material productivity during root zone material salvaging (cont'd)	See above	See above	Root Zone Material Salvage (Non-frozen) • Salvage root zone material from the entire construction right-of-way (see Drawing [Topsoil or Root Zone Material Salvage in Forest – Full Right-of-Way] provided in Appendix R of the Pipeline EPP) where grading is necessary and at locations indicated on the accompanying Environmental Alignment Sheets [Section 8.2]. • Salvage a blade width of root zone material centered over the trench (see Drawing [Topsoil or Root Zone Material Salvage – Blade Width/Frozen] provided in Appendix R of the Pipeline EPP) at locations indicated on the accompanying Environmental Alignment Sheets. Disc well-sodded lands prior to root zone material salvage in order to facilitate root zone material salvage operations [Section 8.2]. • See additional root zone material salvage measures in Section 8.2 of the Pipeline EPP. Root Zone Material Salvage (Frozen) • Pre-salvage root zone material prior to freeze-up if feasible. Attempt to have all root zone material salvage completed prior to October 31 [Section 8.2]. • Salvage root zone material from an area approximately 1 m wider than the trench and centred over the trench (see Drawing [Topsoil or Root Zone Material Salvage – Trench Width] provided in Appendix R of Pipeline EPP). • Avoid mixing snow with spoil material during backfill. Have trench spoil backfilled by the end of the working day to minimize hazards to wildlife, as well as reduce frost penetration. Ensure that all segments trenched during frozen soil conditions are backfilled prior to spring breakup [Section 8.4]. • Postpone compaction of frozen trench spoil until final clean-up in mid to late spring [Section 8.4]. Root Zone Materials Replacement • Follow mitigation measures for backfilling as outlined in Section 8.4 of the Pipeline EPP. Postpone replacement during wet conditions or high winds to prevent damage to soil structure or erosion of root zone material [Section 8.6]. • Replace root zone material evenly over all portions of the construction right-of-way that have been stripped. • Revegetate as soon as feasible to reduce or avoid soil erosion and establish long-term cover. Seed immediately following root zone material replacement [Section 8.6]. • See additional root zone material replacement mitigation measures in Section 8.6 of the Pipeline EPP.	• See above
1.2 Decreased root zone material productivity through trench instability during trenching	Soil series: Struthers 1, Struthers 2	Footprint	• Suspend trenching and salvage a wider area of root zone material if the trench walls slough into the trench and the potential for root zone material/subsoil mixing exists. Backslope the trench walls until stable. Equip backhoe with a swamp bucket, if practical, to avoid or reduce trench sloughing [Section 8.3]. • Weld up pipe prior to trenching at locations with soils prone to sloughing in order to reduce the time the trench is left open [Section 8.3]. • Limit the length of open trench and the time the trench will be left open to reduce the amount of trench sloughing, frost penetration and interference with wildlife and Park visitors [Section 8.3]. • Store salvaged root zone material at a sufficient distance from the trench so that root zone material is not lost in the trench. [Section 8.3].	• Mixing of root zone material and subsoil due to trench instability.

TABLE B7.1.2-1 Cont'd

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.3 Decreased soil productivity from trench subsidence	Soil series: Struthers 1, Struthers 2	Footprint	• Compact the backfill to reduce trench settlement by running a grader wheel over the backfill when the trench has been backfilled to the level of the surrounding ground. Take extra care to compact the trench at banks of the Clearwater River if the contingency trenched method is used. [Section 8.4]. • Crown the trench with remaining spoil to allow for settlement. A larger crown will be needed to compensate for settlement after thawing [Section 8.4]. • Postpone feathering-out of excess spoil along segments of the route constructed during frozen soil conditions until after the spring breakup and the trench has settled [Section 8.4]. • See additional measures in Section 8.4 of the Pipeline EPP. • Feather-out excess trench spoil over the salvaged portion of the construction right-of-way during non-frozen soil conditions to avoid the creation of a permanent trench crown. Excess spoil will not be feathered-out over the salvaged area to an extent that may cause excessive subsidence of the trench [Section 8.4].	• Excessive trench subsidence or known remnant crown.
1.4 Decreased soil productivity from disturbance (*e.g.,* maintenance dig activities) during operations	Soil series: Struthers 1, Struthers 2	Footprint	• Implement the recommended soil handling procedures outlined in the Pipeline EPP to reduce the potential for a reduction in soil productivity when construction activities involving soil disturbance are necessary during operations of the pipeline. • Monitor areas along the construction right-of-way that are disturbed during operations and maintenance activities. Implement remedial measures, where warranted.	• Mixing of root zone material and subsoil.
2. Soil Indicator – Soil Degradation				
2.1 Loss of root zone material through wind erosion	Soil series: Struthers 1, Struthers 2	Footprint	General • Tackify or apply water/snow or pack the root zone material windrow with a sheep foot packer or other approved equipment, if the assessment by the Environmental Inspector(s) indicates that soils are likely to be prone to erosion by wind. • Apply water or approved tackifier to exposed soil piles if wind erosion occurs [Section 8.2]. • Monitor soil windrows during the growing season for wind and water erosion, and weed growth until the soils are replaced. Implement additional mitigation measures to control erosion (see Soil Erosion and Sediment Control Contingency Plan in Appendix B of the Pipeline EPP) and weed growth when warranted (see Weed and Vegetation Management Plan in Appendix C of Pipeline EPP) [Section 8.2]. • Avoid removing excess small diameter slash in wooded areas with erodible soils [Section 8.6]. • Seed disturbed erodible soils with a mixture of native seed and cover crop such as fall rye if seeding in late summer or annual oats if seeding in the winter, spring or early summer [Section 8.6]. • See additional measures in the Soil Erosion and Sediment Control Contingency Plan and Soil/Sod Pulverization Contingency Plan in Appendix B of the Pipeline EPP. • Apply hydromulch/hydroseed at a rate recommended by the supplier on steep recontoured slopes and/or where soil wind erosion may be problematic (see accompanying Environmental Alignment Sheets) [Section 8.6]. • Install erosion control blanket, coir/straw logs or rollback on exposed moderately to highly erodible soils where there is potential for water or wind erosion prior to re-establishment of vegetation (see Drawings [Rollback] and [Erosion Control – Rollback in Riparian Areas] and [Coir/Straw Log Installation] and [Erosion Control Matting/Blanket] provided in Appendix R of Pipeline EPP) [Section 8.6].	• Surface erosion of root zone material can be expected until a vegetative cover is established.

TABLE B7.1.2-1 Cont'd

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2.2 Loss of root zone material through water erosion	Soil series: Struthers 1	Footprint	• Postpone root grubbing until immediately prior to grading along segments of the construction right-of-way where pre-clearing occurred and where there is a potential for soil erosion to occur, due to sloping terrain and erodible soils [Section 8.1]. See additional grubbing measures in Section 8.1 of the Pipeline EPP. • Leave breaks in the trench crown at obvious drainages and wherever seepage occurs to reduce or avoid interference with natural drainage. Leave breaks in the crown at frequent intervals where sidehill is encountered. Compact backfill where breaks have been left [Section 8.4]. • Install temporary sediment fences, where warranted, to control sedimentation prior to final clean-up and the establishment of permanent erosion and sediment control measures (see Drawing [Sediment Fence] provided in Appendix R of Pipeline EPP) [Section 8.6.2]. • Implement the Soil Erosion and Sediment Control Contingency Plan [Section 8.0 of Appendix B of the Pipeline EPP]. • Replace grade material to a stable contour that will approximate the pre-construction contour, except where it is not practical or safe to do so. When replacing sidehill or other graded areas is not practical due to the risk of slope failure, the Lead Activity Inspector, the Lead Environmental Inspector, the Inspector(s), the Construction Manager and a Geotechnical Engineer will discuss to determine an appropriate grade [Section 8.4]. • Recontour the construction right-of-way and re-establish the pre-construction grades and drainage channels if frozen soil conditions prevented completion of this task during backfilling [Section 8.6]. • Regrade areas with vehicle ruts, erosion gullies or where the trench has settled [Section 8.6]. • See additional measures to reduce water erosion at watercourses in Sections 8.6 of the Pipeline EPP.	• Surface erosion of root zone material can be expected until a vegetative cover is established.
2.3 Loss of root zone material through surface water erosion on moderately steep slopes	Soil series: Struthers 1, Struthers 2	LSA	• Install temporary berms on approach slopes of the Clearwater River crossing and erect sediment fence(s) near the base of approach slopes following grading (see Drawings [Cross Ditches and Diversion Berms] and [Sediment Fence] provided in Appendix R of the Pipeline EPP). Inspect the temporary sediment control structures on a daily basis and repair before the end of each working day [Section 8.2]. • Install trench breakers (sack, foam or bentonite), where warranted, on moderate and steep slopes with high soil water erosion potential to control subsurface flow (see Drawing [Trench Breakers/Ditch Plugs] provided in Appendix R of the Pipeline EPP) [Section 8.4]. • Install subdrains in association with trench breakers as directed by the Hydrogeological Resource Specialist where there is evidence of seepage or a flowing spring on a slope once the trench is excavated (see Drawing [Subdrains] provided in Appendix R of the Pipeline EPP) [Section 8.4]. • Install cross ditches and berms on the slopes of the Clearwater River in order to prevent runoff along the construction right-of-way and subsequent erosion (see Drawing [Cross Ditches and Diversion Berms] provided in Appendix R of the Pipeline EPP) [Section 8.6]. • Recontour the construction right-of-way and stabilize approach slopes at the Clearwater River crossing. [Section 8.6]. • Seed riparian areas with an approved annual or perennial grass cover crop or native grass mix as soon as feasible after construction. See additional measures outlined in the Reclamation Management Plan [Appendix C].	• Surface erosion of root zone material can be expected until a vegetative cover is established.

TABLE B7.1.2-1 Cont'd

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2.3 Loss of root zone material through surface water erosion on moderately steep slopes (cont'd)	See above	See above	• Install temporary erosion control measures such as temporary berms, sediment fences or cross ditches within 24 hours of backfilling banks and approach slopes of the Clearwater River at any location where runoff from the construction right-of-way may flow into the river. See additional measures outlined in the Reclamation Management Plan (see Appendix C of the Pipeline EPP) and aquatic resources (see Appendix J) [Section 8.6]. • Rollback slash and small diameter, salvageable timber on steep slopes and approach slopes of the Clearwater River crossing. Do not bury rollback when walking down with bulldozer. Leave gaps in rollback at all obvious wildlife trails [Section 8.6].	• See above
2.4 Loss of root zone material from disturbance (*e.g.*, maintenance dig activities) during operations	Soil series: Struthers 1, Struthers 2	Footprint	• Implement the recommended soil handling procedures outlined in the Pipeline EPP to reduce the potential for soil degradation when maintenance activities involving soil disturbance are necessary during operations of the pipeline. • Monitor areas along the right-of-way that are disturbed during operations and maintenance activities. Implement remedial measures, where warranted.	• Surface erosion of root zone material can be expected until a vegetative cover is established.
3. Soil Indicator – Soil Contamination				
3.1 Soil contamination due to spot spills during construction	Soil series: Struthers 1, Struthers 2	LSA	• Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into watercourses/wetlands/lakes. In the event of a spill, implement the Spill Contingency Plan (see Appendix B of the Pipeline EPP) [Section 7.0]. • Place tarps or other impermeable material on the ground to catch drippings from coating application at weld joints and areas where repairs to the coating are made. Dispose of spilled coating at approved locations [Section 8.3]. • Isolate test pumps, generators and fuel storage tanks with an impermeable lined dike or depression to capture and retain any spills of fuels or lubricants [Section 8.5].	• No residual effect identified.

Notes: 1 LSA = Soil LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.2.2 Significance Evaluation of Potential Residual Effects

Table B7.1.2-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in North Thompson River Provincial Park on the soil and soil productivity indicators. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE B7.1.2-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON SOIL AND SOIL PRODUCTIVITY FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1. Soil Indicator – Soil Productivity									
1(a) Mixing of root zone material and subsoil.	Negative	Footprint	Short-term	Periodic	Medium-term	Low	High	High	Not significant
1(b) Excessive trench subsidence or a remnant crown.	Negative	Footprint	Short-term	Isolated	Short to medium-term	Low	High	High	Not significant
2. Soil Indicator – Soil Degradation									
2(a) Surface erosion of root zone material can be expected until a vegetation cover is established.	Negative	Footprint	Short-term	Periodic	Medium-term	Low	High	High	Not significant
3. Soil Indicator – Soil Contamination									
No residual effects identified.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes: 1 LSA = Soil LSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Soil Indicator – Soil Productivity

Root Zone Material and Subsoil Mixing

During the construction of the pipeline and, to a lesser extent, during maintenance activities, it is likely that a minor amount of root zone material and subsoil mixing will occur along the proposed construction right-of-way. The impact balance of this residual effect is considered negative since admixing could decrease soil productivity. A summary of the rationale for all of the significance criteria is provided in Table B7.1.2-2 (point 1[a]) and below.

- Spatial Boundary: Footprint – admixing is confined to the area of disturbance along the construction right-of-way.
- Duration: short-term – the events causing potential admixing are construction of the pipeline and maintenance-related activities, the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events causing potential admixing (*i.e.*, construction and maintenance-related activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: medium-term – loss of soil productivity due to minor root zone material and subsoil mixing is expected to be reversed within 10 years given the implementation of mitigation measures during construction and, if necessary, the application of soil amendments post-construction. The results of recent post-construction environmental monitoring programs in forested areas demonstrate that root zone material mixing with subsoil is alleviated within a few years post-construction.
- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table B7.1.2-2 and, if necessary, soil amendments applied post-construction. The results of recent post-construction environmental monitoring programs in forested areas demonstrate that root zone material mixing with subsoil is generally minor in severity and limited in extent.
- Probability: high – admixing is a common residual effect of pipeline construction and may also occur during maintenance activities.

- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and soil productivity.

Trench Subsidence or Remnant Crown

Soils crossed by the narrowed pipeline corridor in North Thompson River Provincial Park are prone to wind and water erosion as well as lack cohesion properties and therefore, construction activities may result in localized areas of excessive trench subsidence and/or a remnant crown over the trench. The impact balance of this residual effect is considered negative since excessive trench subsidence or a remnant crown may reduce soil productivity through erosion and drainage issues. Trench subsidence and a remnant crown do not always occur during the year following construction and reclamation, and will be greatly influenced by the amount of precipitation. The reversibility of trench subsidence and/or a remnant crown is considered to be short to medium-term since remedial work associated with trench subsidence and/or a remnant crown typically occurs within a year of construction; however, localized trench subsidence may arise 2 to 3 years following construction (TERA 2009a,b, 2011a,b,c, 2012a, 2013a,b). With effective compaction of the backfilled trench and feathering out any remaining material over the trench, the magnitude of the effect of trench subsidence on soil and soil productivity is considered to be low (Table B7.1.2-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – trench subsidence or a remnant crown is confined to the trench line within the construction right-of-way.
- Duration: short-term – the event causing potential trench subsidence or a remnant crown is construction of the pipeline which is limited to the construction phase.
- Frequency: isolated – the event causing potential trench subsidence or a remnant crown (*i.e.*, construction activities) is confined to a specified phase of the assessment period.
- Reversibility: short to medium-term – remedial work associated with a remnant crown and trench subsidence typically is conducted within a year of construction, however, localized trench subsidence may also arise 2 to 3 years after construction.
- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table B7.1.2-1 and, if necessary, soil amendments applied post-construction. The results of recent post-construction environmental monitoring programs in forested areas demonstrate that trench subsidence or a remnant crown is generally minor in severity and limited in extent.
- Probability: high – trench subsidence or a remnant crown is a common residual effect of pipeline construction.
- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and trench subsidence/remnant crowns.

<u>Soil Indicator – Soil Degradation</u>

Surface Erosion of Root Zone Material

Construction and maintenance activities which disturb the soil will likely result in some surface erosion of root zone material until a stable vegetative cover can be established, particularly on the slopes of the Clearwater River crossing, given the trenched contingency method is used. The impact balance of this residual effect is considered negative since erosion could decrease soil productivity. Minor surface erosion of root zone material is considered to be reversible in the medium-term (Table B7.1.2-2, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – surface erosion is confined to the area of disturbance along the construction right-of-way.
- Duration: short-term – the events causing surface erosion are construction of the pipeline and maintenance-related activities, the latter of which are limited to any one year during the operations phase.

- Frequency: periodic – the events causing surface erosion (*i.e.*, construction and maintenance-related activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: medium-term – surface erosion is generally expected to be reversed within 2 to 3 years given the implementation of mitigation measures during construction and, if necessary, the application of soil amendments post-construction.
- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table B7.1.2-1 and, if necessary, soil amendments applied post-construction.
- Probability: high – surface erosion is a common residual effect of pipeline construction which can be addressed during post-construction environmental monitoring and may also occur during maintenance activities.
- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and soil degradation.

Soil Indicator – Soil Contamination

No residual effects of the construction and operations of the proposed pipeline were identified for the soil contamination indicator (Table B7.1.2-2). Consequently, no further assessment is warranted.

7.1.2.3 Summary

As identified in Table B7.1.2-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on soil and soil productivity indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on the conservational values of North Thompson River Provincial Park related to soil and soil productivity will be not significant.

7.1.3 Water Quality and Quantity

This subsection describes the potential Project effects on water quality and quantity in North Thompson River Provincial Park. The Water Quality and Quantity LSA is the area generally extending 100 m upstream of the centre of the proposed pipeline corridor to a minimum of 300 m downstream of the centre of the proposed pipeline corridor, as well as within 300 m of the proposed pipeline corridor, in potentially vulnerable aquifer areas in hydraulic connection with the Footprint and in consideration of surface water drainage patterns along the pipeline corridor; shown in Figure 6.2.2-4 of the Introduction to the Draft Stage 2 Detailed Proposal. The Aquatics RSA includes all watersheds directly affected by the proposed pipeline corridor and applies to surface water; shown in Figure 6.2.2-1 of the Introduction to the Draft Stage 2 Detailed Proposal.

All water quality and quantity indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; and all of them were determined to interact with pipeline construction and operations in North Thompson River Provincial Park.

7.1.3.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on water quality and quantity indicators are listed in Table B7.1.3-1.

A summary of mitigation measures provided in Table B7.1.3-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial and federal regulatory guidelines including BC MOE (2010b), BC Ministry of Forests (MOF) (1995), BC Ministry of Water, Land and Air Protection (MWLAP) (2004), BC OGC (2013), CAPP *et al*. (2012) and Fisheries and Oceans Canada (DFO) (1995, 1999, 2013a), as well as groundwater legislation under the *Oil and Gas Activities Act* (*Environmental Protection and Management Regulation*) and the *BC Environmental Assessment Act.* Table B7.1.3-2 provides the pipeline and vehicle crossing methods for the Clearwater River encountered within North Thompson River Provincial Park.

TABLE B7.1.3-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WATER QUALITY AND QUANTITY FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Water Quality and Quantity Indicator – Surface Water Quality			
1.1 Inadvertent instream drilling mud release	LSA	<u>Trenchless Crossing Method</u> • Plan for and use the procedures for a trenchless crossing at the Clearwater River in accordance with those provided in the Horizontal Directional Drilling/Trenchless Planning and Procedures Management Plan of the Pipeline EPP [Appendix C and Section 8.7]. • Cease trenchless crossing work immediately and refer to the Drilling Mud Release Contingency Plan of the Appendix B of the Pipeline EPP in the event that an inadvertent release of drilling mud has occurred and the material is or may enter the Clearwater River or affect other sensitive environmental or land use features [Section 8.7]. • Assign Inspector(s) or Qualified Environmental Professional (QEP) with expertise in the containment of inadvertent release of drilling mud and clean up to HDDs under a watercourse (see Drilling Mud Release Contingency Plan in Appendix B in the Pipeline EPP) [Section 8.7]. • Follow the drilling mud frac-out monitoring and other measures outlined in the Drilling Mud Release Contingency Plan in Appendix B of the Pipeline EPP during horizontal directional drilling [Section 8.7]. • Monitor to assess the immediate effects of crossing construction. Also monitor sediment release (i.e., turbidity and TSS) throughout the crossing construction period, if required [Section 8.7].	• Reduction in surface water quality due to an inadvertent drilling mud release during the trenchless crossing.
1.2 Suspended sediment concentrations in the water column during instream activities	LSA	<u>Open-Cut Contingency Crossing</u> • The open-cut contingency crossing method has been selected in consideration of the size, environmental sensitivities of Clearwater River and the period of construction [Section 8.7]. • Confirm with the Inspector(s) that all notifications and approvals are in place prior to commencing instream construction at Clearwater River. • Grade away from Clearwater River to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in the Clearwater River during grading [Section 8.7]. • Install a temporary sediment barrier (*e.g.,* sediment fences), where warranted, to eliminate the flow of sediment from spoil piles and disturbed areas into the Clearwater River [Section 8.7]. • Inspect temporary sediment control structures (*e.g.,* sediment fences, subsoil berms) installed on approach slopes, on a daily basis throughout crossing construction. Repair the structures before the end of the working day [Section 8.7]. • Develop a water quality monitoring plan to monitor for sediment events during the open-cut contingency crossing of Clearwater River. If monitoring reveals that sediment values are approaching threshold values, the water quality monitors will notify the Lead Environmental Inspector and Inspector(s) who, with the Construction Manager and contractor, will develop corrective actions [Section 8.7]. • Construct the Clearwater River crossing in accordance with applicable existing provincial and federal guidelines (*e.g.*, mitigation measures recommended in the *Fisheries Act* self-assessment) as well as the conditions of the *Fisheries Act* authorization, if applicable [Section 8.7].	• Reduction in surface water quality due to suspended sediment during instream activities in the event a contingency open cut crossing is required.

TABLE B7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.3 Erosion from approach slopes	LSA	<u>Open-Cut Contingency Crossing</u> • Prohibit clearing of extra temporary workspace within the riparian buffer, only the trench and temporary workspace areas will be cleared. • Ensure staging areas for the Clearwater River crossing construction and spoil storage areas are located a minimum of 10 m from the banks of the watercourse boundaries. This distance may be reduced by the Lead Environmental Inspector and the Inspector(s) where appropriate controls are in place [Section 8.1]. • Restrict root grubbing to the area outside of the vegetated riparian buffer adjacent to the Clearwater River [Section 8.1]. • Install erosion control measures, where warranted, prior to commencing grading in the vicinity of the Clearwater River crossing [Section 8.2]. • Grade away from the Clearwater River to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in the Clearwater River during grading [Section 8.2]. • Install temporary berms on approach slopes to the Clearwater River and erect sediment fence(s) near the base of approach slopes following grading. Inspect the temporary sediment control structures on a daily basis and repair before the end of each working day [Section 8.2]. • Install sack trench breakers back from the edge of the Clearwater River where the banks consist of organic material to prevent sloughing of backfill into the channel (see Trench Breaker – Watercourse / Wetland Drawing in Appendix R of the Pipeline EPP] [Section 8.4]. • Install temporary erosion and sediment control structures (e.g., sediment fences, coir logs) immediately following the completion of backfilling lands adjacent to the Clearwater River crossing where the potential for sedimentation exists (see Sediment Fence and Coir/Straw Log Installation Drawings provided in Appendix R of the Pipeline EPP) [Section 8.4]. • Seed riparian areas with an approved annual or perennial grass cover crop or native grass mix as soon as is feasible after construction. See additional measures outlined in the Reclamation Management Plan of the Pipeline EPP [Appendix R of the Pipeline EPP]. • Transplant dormant shrubs, or install dormant willow stakes or commercially grown rooted stock plants (plugs), where warranted, during reclamation of streambanks where riparian vegetation is present prior to construction. See additional measures outlined in the Reclamation Management Plan [Appendix C] and aquatic resources tables [Appendix I and Section 8.6]. • Install permanent erosion control measures, as outlined in the Reclamation Management Plan [Appendix C] unless otherwise approved by Trans Mountain to adjust for site conditions and suitability [Section 8.6]. • Install temporary fencing to allow the revegetation treatments to become established and avoid damage to the banks and riparian area by wildlife [Section 8.7]. • Monitor the Clearwater River crossing after construction as outlined in Section 9.0 of Volume 6A to assess the success of construction and reclamation mitigation measures following the temporary disturbance. <u>Operations</u> • Implement measures similar to construction under direction of Trans Mountain's Environmental, Health and Safety Management System for controlling erosion from banks and approach slopes during integrity digs conducted in vicinity to the Clearwater River.	• Reduction in surface water quality due to erosion from banks and approach slopes in the event an open-cut contingency crossing is required.

TABLE B7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)

1.4 Reduction of surface water quality due to small spill during construction or site-specific maintenance activities	LSA	• Use non-toxic, biodegradable hydraulic fluids in all equipment that will work instream when flowing water will be encountered during construction.
		• Ensure the following separation distances are maintained between the Clearwater River when planning and constructing the pipeline, unless otherwise approved:
		  • fuel or hazardous material storage site - 300 m;
		  • burning site - 100 m; and
		  • oil change area - 100 m [Section 7.0].
		• Refer to the Pipeline EPP for additional measures for hazardous materials storage, servicing vehicles and spill equipment needs as well as cleaning of equipment.
		• Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into the Clearwater River. In the event of a spill, implement the Spill Contingency Plan [Appendix B] [Section 7.0].
		• Conduct refuelling a minimum of 100 m from any watercourse unless otherwise approved by the appropriate regulatory authority [Section 7.0]. See additional measures for refuelling near waterbodies in Section 7.0 of the Pipeline EPP.
			• Contamination of surface water due to a small spill during construction or site-specific maintenance activities.

2. Water Quality and Quantity Indicator – Surface Water Quantity			
2.1 Alteration of natural surface drainage patterns	LSA	• Maintain drainage across the construction right-of-way during all phases of construction [Section 7.0]. • Ensure the potential for soil erosion by water is reduced during construction activities by avoiding ponding of water or the unintentional channelization of surface water flow [Section 7.0]. • Provide surface drainage of adequate capacity across the construction right-of-way [Section 7.0]. • Reduce grading along the construction right-of-way, especially within the Clearwater River vegetated buffers [Section 8.2]. • Leave hard plugs or install soft plugs at locations where the open trench could flood other areas [Section 8.3]. • Leave breaks in the trench crown at obvious drainages and wherever seepage occurs to reduce or avoid interference with natural drainage [Section 8.4]. • Recontour the construction right-of-way and stabilize approach slopes at the Clearwater River crossing. Where reclamation of the pre-construction grade is not feasible due to risk of failure of fill on slopes or maintenance of an access trail, recontour to grades as directed by the Geotechnical Engineer [Section 8.6]. • Regrade areas with vehicle ruts, erosion gullies or where the trench has settled [Section 8.6]. • Implement similar mitigation measures during site-specific maintenance activities during operations.	• Localized alteration of natural surface drainage patterns until trench settlement is complete.
2.2 Disruption or alteration of streamflow	LSA	<u>Open-Cut Contingency Crossing</u> • Adhere to clearing guidelines for protection of streams provided the Riparian Management Area Guidebook [Section 8.1]. • Fell trees away from the Clearwater River and away from limits of the construction right-of-way to reduce damage to the streambanks, bed and adjacent trees. Hand clear the area, if necessary, to reduce disturbance. Any trees, debris and soil inadvertently deposited within the ordinary high watermark will be promptly removed in a manner that avoids or reduces disturbance of the bed and banks. Trees will not be stood or hauled across the watercourse [Section 8.1]. • Do not place windrowed or fill material in the watercourse during grading [Section 8.2]. • Ensure streamflow, if present, is maintained at all times when trenching through the Clearwater River [Section 8.7].	• Disruption and alteration of natural streamflow from instream activities in the event a contingency open cut crossing is required.

TABLE B7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2.2 Disruption or alteration of streamflow (cont'd)	See above	• Ensure that new vehicle crossing structures (*i.e.,* access both banks) are appropriate for the Clearwater River approaches, channel width and configuration, anticipated streamflow during the period of use, planned vehicle loads, and overall period/duration of use [Section 8.7]. • Re-establish streambanks and approaches immediately following construction of the Clearwater River crossing as outlined in the Reclamation Management Plan of the Pipeline EPP. Develop site-specific mitigation and/or reclamation plan for Clearwater River in the event an open cut contingency crossing method is required.	• See above
3. Water Quality and Quantity Indicator – Groundwater Quality			
3.1 Shallow groundwater with existing contamination encountered during trench construction	LSA	• Ensure contaminated soil and water are not transported off-site or disposed until analytical results have been received as per federal and provincial regulations. The Construction Manager and Environmental Inspector will provide notification as to when excavations can be backfilled [Section 8.3]. • Notify and adhere to the advice of the Trans Mountain Environment, Health and Safety Department or Trans Mountain's Lead Environmental Inspector and Environmental Inspector(s) at locations where water potentially contaminated with hydrocarbons or other materials is to be discharged from the trench. Measures may include the use of tank trucks to haul discharged water to an appropriate disposal facility/site, ensuring the intake is submerged below the surface sheen, lab testing and use of sorbent booms to hold the sheen away from the pump intake [Section 8.3].	• No residual effect identified.
3.2 Areas susceptible to drilling mud release during trenchless crossing construction	LSA	• Conduct investigations prior to the commencement of drilling activities to assess groundwater conditions and risks (water supply wells within LSA) in highly vulnerable aquifers. Modify the drill path of the horizontal directional drill, if feasible, to reduce the potential effects on groundwater quality and monitor water supply wells in the immediate area before, during and after the horizontal directional drill. Have plans in place for the supply of alternate water in the event that water quality in the wells is affected. [Section 8.7] • Plan for and use the procedures for a HDD or other trenchless crossing in accordance with those provided in the Horizontal Directional Drilling/Trenchless Planning and Procedures Management Plan (see Appendix C of Pipeline EPP) [Section 8.7]. • Ensure that drilling mud composition is limited to bentonite mud drilling systems, fresh water and other inert additives [Appendix B]. • Cease trenchless crossing work immediately and refer to the Drilling Mud Release Contingency Plan (see Appendix B of the Pipeline EPP) in the event that an inadvertent release of drilling mud has occurred and the material is entering or may enter the watercourse or affect other sensitive environmental or land use features [Section 8.7]. • Follow the drilling mud frac-out monitoring and other measures outlined in the Drilling Mud Release Contingency Plan (see Appendix B of Pipeline EPP) during horizontal directional drilling [Section 8.7].	• Elevated turbidity in groundwater as a result of accidental drilling mud release.
3.3 Areas susceptible to sedimentation in the aquifer	LSA	• Assess the grain size; if it is poorly graded and coarse material, the installation of filter fabric at the base of the trench to prevent migration of fine sediment into the aquifer during trenching over highly vulnerable aquifers.	• Elevated turbidity in groundwater as a result of sedimentation.
3.4 Areas with potential artesian conditions	LSA	• Ensure that surficial materials are hydraulically isolated before drilling to deeper depths. • Use current drilling technology to ensure mud or casing seal is effective. • Depressurize the aquifer in the vicinity of the HDD area during the subsurface crossing and casing installation operations. • Seal/cement annular space around pipeline [Section 8.3]. • Abandon boreholes upon completion of the HDD.	• Groundwater from different aquifers may be mixed.

TABLE B7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
3.5 Aquifers (including unconfined aquifers) or wells vulnerable to possible future contamination from a spill during construction	LSA	• Utilize Best Management Practices for spill prevention outlined in the Pipeline EPP including in areas where higher vulnerability wells and aquifers are identified. • Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into waterbodies. In the event of a spill, implement the Spill Contingency Plan (see Appendix B of Pipeline EPP) [Section 7.0]. • Re-establish or replace a potable water supply as required should a registered or known water well located within 30 m of the construction right-of-way be damaged (*i.e.,* diminishment in quantity and/or quality) during pipeline installation [Section 7.0].	• Contamination of aquifer a result of a spill during construction.
4. Water Quality and Quantity Indicator – Groundwater Quantity			
4.1 Areas susceptible to changes in groundwater flow patterns	LSA	• Monitor water encountered in the trench during trenching to determine if groundwater flow is being intercepted. If spring flow has been disrupted, seek and follow the advice of the Hydrogeological or Geotechnical Resource Specialist to maintain cross drainage within the trench (*e.g.,* installation of subdrains, trench breakers, etc.) [Section 8.3]. • Assess the need for well points or other dewatering methods, prior to commencing trenching, to intercept groundwater at site-specific locations before it enters the trench [Section 8.3]. • Prevent the pipeline trench and bedding from becoming a conduit for increased groundwater flow. • Install trench breakers to force groundwater seepage along the pipeline trench to the surface, if springs are encountered along the route. Install subdrains to divert shallow groundwater flow from the right-of-way [Section 8.4]. • Install subdrains in association with trench breakers as directed by Trans Mountain's Engineer where there is evidence of seepage or a flowing spring on a slope once the trench is excavated (see Subdrains Drawing in Appendix R of the Pipeline EPP) [Section 8.4]. • Backfill clay/mineral soil first, if salvaged separately from organic material in shallow peatland areas, to ensure that cross drainage is maintained [Section 8.4].	• Natural groundwater pathways may be bisected and create a sink (drain) for shallow groundwater. • Flooding on the up-gradient side of the pipeline may result in creation of wet zones on ground surface. • Reduction of baseflow to local streams.
4.2 Areas where dewatering may be necessary during pipeline construction activities	LSA	• Dewater the trench when laying pipe in areas with high water tables. Place pumps on a tray or within an excavated sump lined with polyethylene sheeting above the ordinary high water level of the watercourse. Pump water onto stable and well vegetated areas, tarpaulins or sheeting at least 50 m from the nearest waterbody in a manner that does not cause erosion or any unfiltered or silted water to re-enter a watercourse [Section 8.3]. See additional dewatering measures in Section 8.3 of the Pipeline EPP. • Use floating suction hose and elevated intake, or other measures approved by Trans Mountain's Environmental Inspector(s), to prevent sediment from being sucked from the bottom of the trench. Secure the pump intake a minimum of 30 cm above the bottom of the trench [Section 8.3].	• Change in natural groundwater levels and stream recharge due to the discharge of groundwater to surface water systems if not practical to discharge trench water to ground.

Notes: 1 LSA = Water Quality and Quantity LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

TABLE B7.1-3-2

PROPOSED PIPELINE AND VEHICLE WATERCROSSING METHODS ALONG THE NARROWED PIPELINE CORRIDOR THROUGH NORTH THOMPSON RIVER PROVINCIAL PARK

Watercourse Name	RK	Fish Presence Captured or Observed (Previously Documented)	Sensitivity Rating	Provincial Instream Work Window	Least Risk Biological Window Proposed	Pipeline Crossing Method		Vehicle Crossing Method		Reclamation
						Recommended Primary	Recommended Contingency	Recommended Crossing Method (Flowing)	Recommended Crossing Method (Dry/Frozen)	
Clearwater River	725.5	None (CCG, CH, CO, BT, LNC, MW, RB, RSC, SK)	High	August 7 – August 15	August 7 – August 15	Trenchless with water quality monitoring	Open-cut with water quality monitoring inside timing window	Access both banks	Access both banks	*Prior to Instream Work* • Identify any instream site-specific features at the crossing proposed and record their location *(e.g.,* root wad, large woody debris, large boulders). Salvage these for use later. *During Instream Work* • Salvage upper coarse-textured substrate material from the channel and banks, and stockpile separately from lower substrate. *At the Completion of Instream Work* • Return the watercourse (or wetland) bed and banks to their preconstruction configuration and alignment. • Cap disturbed area of the channel and banks with salvaged substrate; extend replacement of cobbles and boulders to the ordinary high water level (OHWL) if adequate material is available. • Replace any site-specific features that are important for fishes or other aquatic organisms (*i.e.,* as initially salvaged or as directed by Trans Mountain's Environmental Inspector). • Install the appropriate temporary erosion and sediment control measures, where warranted (*e.g.,* sediment fence, erosion control blanket, coir logs, etc.). • Seed with an appropriate grass mix and/or cover crop species as directed in the Reclamation Management Plan for the Project.

Note: 1 CCG = Slimy sculpin; CH = Chinook salmon; CO = coho salmon; BT = Bull trout; LNC = Longnose dace; MW = Mountain whitefish; RB = Rainbow trout; RSC = Redside shiner; SK = Sockeye salmon.

7.1.3.2 Significance Evaluation of Potential Residual Effects

Table B7.1.3-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in North Thompson River Provincial Park on water quality and quantity indicators. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE B7.1.3-3

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WATER QUALITY AND QUANTITY FOR NORTH THOMPSON RIVER PROVINCIAL PARK

				Temporal Context						
	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance[2]
1	Water Quality and Quantity Indicator – Surface Water Quality									
1(a)	Reduction in surface water quality due to an inadvertent drilling mud release during the HDD crossing.	Negative	LSA	Immediate to short-term	Accidental	Immediate to short-term	Low to medium	Low	Moderate	Not significant
1(b)	Reduction in surface water quality due to suspended sediment during instream activities in the event a contingency open cut crossing is required.	Negative	LSA	Immediate to short-term	Isolated	Immediate	Low to medium	High	High	Not significant
1(c)	Reduction in surface water quality due to erosion from banks and approach slopes in the event a contingency open cut crossing is required.	Negative	LSA	Immediate to short-term	Isolated to occasional	Short to medium-term	Low to medium	Low	High	Not significant
1(d)	Contamination of surface water due to a small spill during construction or site-specific maintenance activities.	Negative	LSA	Immediate	Accidental	Short to medium-term	Low to high	Low	Moderate	Not significant
2	Water Quality and Quantity Indicator – Surface Water Quantity									
2(a)	Localized alteration of natural surface drainage patterns until trench settlement is complete.	Negative	LSA	Short-term	Isolated to occasional	Short to medium-term	Low	High	High	Not significant
2(b)	Disruption and alteration of natural streamflow from instream activities in the event a contingency open cut crossing is required.	Negative	LSA	Immediate to short-term	Isolated	Short to medium-term	Low to medium	High	High	Not significant
3	Water Quality and Quantity Indicator – Groundwater Quality									
3(a)	Elevated turbidity in groundwater as a result of accidental drilling mud release.	Negative	LSA	Short-term	Accidental	Short-term	Medium	Low	Moderate	Not significant
3(b)	Elevated turbidity in groundwater as a result of sedimentation.	Negative	LSA	Short-term	Accidental	Short-term	Medium	Low	Moderate	Not significant
3(c)	Groundwater from different aquifers may be mixed.	Negative	LSA	Short-term	Accidental	Medium-term	Low to high	Low	Moderate	Not significant
3(d)	Contamination of aquifer as a result of a spill.	Negative	LSA	Immediate	Accidental	Short to medium-term	Low to high	Low	Moderate	Not significant
4	Water Quality and Quantity Indicator – Groundwater Quantity									
4(a)	Natural groundwater pathways may be bisected and create a sink (drain) for shallow groundwater.	Negative	LSA	Short-term	Periodic	Short to medium-term	Low	Low	Moderate	Not significant
4(b)	Flooding on the up-gradient side of the pipeline may result in the creation of wet zones on ground surface.	Negative	LSA	Short-term	Periodic	Short-term	Low	Low	Moderate	Not significant
4(c)	Reduction of base flow to local streams.	Negative	LSA	Short-term	Periodic	Short-term	Low	Low	Moderate	Not significant
4(d)	Change in natural groundwater levels and stream recharge due to the discharge of groundwater to surface water systems if not practical to discharge trench water to ground.	Negative	LSA	Short-term	Isolated	Short-term	Low	Low	Moderate	Not significant

Notes: 1 LSA = Water Quality and Quantity LSA.
2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Water Quality and Quantity Indicator – Surface Water Quality

Inadvertent Drilling Mud Release

Although unlikely, it is possible for a drilling mud release to occur during the HDD crossing of Clearwater River that could introduce sediment to the watercourse. The impact balance of this potential residual effect is considered negative since the release could decrease surface water quality.

The HDD method of trenchless pipeline installation is one of the lowest impact watercourse construction techniques (CAPP 2004). Successful implementation of the HDD method is, however, dependent upon many factors. Geotechnical studies indicated that a HDD of Clearwater River is feasible, and Trans Mountain will endeavour to reduce risks of drilling mud release through proper planning, suitable and well-maintained equipment, experienced personnel and adequate contingency planning.

In 2003, Trans Mountain replaced a segment of its existing Trans Mountain Pipeline system across the Fraser River to minimize exposure of the pipeline to seismically triggered lateral spreading. The 2.3 km crossing was conducted by horizontal directional drilling. Despite the engineering and geotechnical complexities of such a long HDD, the crossing was considered a success and no drilling mud was released into the watercourse. Other recent pipeline projects have conducted successful HDD crossings of major watercourses, for example, an HDD method was successfully implemented at the South Saskatchewan River (TERA Environmental Consultants [TERA] 2011a) as well as at the Pouce Coupe and the Kiskatinaw rivers (TERA 2013a).

To avoid or reduce effects of a drilling mud release on surface water quality, Trans Mountain will continually monitor for sediment release (*i.e.*, turbidity and TSS) throughout the crossing construction period. In the event of a release into the watercourse, Trans Mountain will immediately suspend drilling activities and implement measures outlined in the Drilling Mud Release Contingency Plan to reduce effects of drilling mud release into the watercourse. Any releases would be reported to DFO and BC MOE and clean up and monitoring will be carried out until water quality is returned to existing (background) conditions.

The mud used for the HDD crossing will be suitable for use in waterbodies. Appropriate drill paths will be established and drilling mud pressures and returns monitored to reduce the risk of inadvertent releases of drilling mud during the HDD. Although sediment input could occur, the proposed mitigation measures are expected to reduce the magnitude of a drilling mud release on the surface water quality indicator to low to medium levels. This residual effect is reversible in the immediate to short-term (Table B7.1.3-3, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – any drilling mud released during construction activities will be carried downstream until it disperses and/or naturally settles out.
- Duration: immediate to short-term – the event causing a decrease in surface water quality is the release of drilling mud, the period of which may be less than or equal to two days for small releases or could extend for longer, but less than one year.
- Frequency: accidental – the release of drilling mud into surface water occurs rarely over the assessment period.
- Reversibility: immediate to short-term – suspended sediments resulting from a drilling mud release would settle out of suspension within 24 hours after the release, however, any sediments that result in deposition on the substrate of a watercourse are expected to be flushed from the system during the first annual natural flushing event following construction.
- Magnitude: low to medium – depending upon the volume of the drilling mud release and the sensitivity of the receiving watercourse.
- Probability: low – it is unlikely that an accidental release of drilling mud would occur; however, in the event of an accidental release of instream drilling mud during the HDD crossing, the probability of a temporary reduction in surface water quality is high.

- Confidence: moderate – based on results of geotechnical studies at Clearwater River, Trans Mountain's previous experience crossing the lower Fraser River in 2003, success of HDD crossings from similar projects and the professional experience of the assessment team.

Instream Construction During a Contingency Open Cut Crossing

Due to the size of Clearwater River, an isolated crossing technique would not be feasible and an open cut crossing during flowing conditions would be required in the event an HDD is unsuccessful. The open cut crossing technique will be designed to meet federal and provincial regulatory requirements and will be conducted within the instream least risk biological window. Monitoring will be conducted under flowing conditions to document downstream turbidity and any exceedances of the relevant guidelines will be reported to the appropriate regulatory authorities.

Measures in Table B7.1.3-1 and the Pipeline EPP, including continual monitoring of sediment release (*i.e.*, turbidity and TSS), will be implemented during crossing design and construction to reduce the magnitude and duration of the sediment pulse.

Given that suspended sediments are expected to settle out of the water column within the ZOI in a timeframe measuring from minutes to a few hours (*i.e.*, less than CCME's short-term guideline of 24 hours), residual effects on the surface water quality indicator during a contingency trenched crossing of the Clearwater River would be reversible in the immediate-term and of low to medium magnitude (Table B7.1.3-3, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – suspended sediments released during construction activities will be carried downstream until they disperse and/or naturally settle out within the predicted ZOI.
- Duration: immediate to short-term – the events causing the release of suspended sediments into surface water are instream construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.
- Frequency: isolated to occasional – the events causing the release of suspended sediments into the Clearwater River (*i.e.,* pipeline construction and maintenance activities) occur during construction and, for operations activities, intermittently and sporadically over the assessment period.
- Reversibility: immediate – an increase in suspended sediments is confined to a specific period not exceeding 24 hours after instream construction.
- Magnitude: low – an increase in suspended sediments is anticipated for a short timeframe and anticipated to be within CCME guidelines given the implementation of mitigation measures to reduce sedimentation.
- Probability: high – a trenched crossing method is recommended during potentially flowing conditions at the time of pipeline construction through the Clearwater River.
- Confidence: high – based on available research literature, data pertinent to previous crossings along the existing TMPL right-of-way and the professional experience of the assessment team.

Erosion from Approach Slopes and Banks During a Contingency Open Cut Crossing

In the event a contingency open cut crossing is required, it is possible for some erosion to occur on approach slopes and banks following grading, causing sediment to enter the Clearwater River. The impact balance of this potential residual effect is considered negative since sediment input could decrease surface water quality.

The secondary role of the park of protecting riparian habitat will be supported through proper reclamation and post-construction monitoring. Mitigation measures will be identified on a site-specific basis and may include, for example: installation of temporary erosion control structures (*e.g.,* sediment fences); reclamation to stabilise the banks (*e.g.,* soil wraps, brush layers, willow plantings and matting); seeding the disturbed banks and approaches with the appropriate cover crop species and native grass mix; installation of coir or other biodegradable erosion control fabric on the banks of the watercourse; installation of live dormant willow stakes or salvaged willow/shrub transplants or commercially grown rooted stock plugs in the banks of the watercourse; and monitoring to assess the success of construction and reclamation mitigation measures and implementation remedial measures, where warranted.

Proposed mitigation measures are expected to reduce the magnitude of erosion from approach slopes and banks on the surface water quality indicator to low to medium levels. This residual effect is reversible in the short to medium-term (Table B7.1.3-3, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – any sedimentation caused by erosion will be carried downstream until it disperses and/or naturally settles out within the predicted ZOI.
- Duration: immediate to short-term – the events causing the erosion and sedimentation of surface water are instream construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited any one year during the operations phase.
- Frequency: isolated to occasional – the events resulting in sedimentation caused by erosion of approach slopes and banks (*i.e.*, pipeline construction and operations activities [*e.g.*, integrity digs]) occur intermittently and sporadically in the event the crossing is unstable until mitigated.
- Reversibility: short to medium-term – vegetation may be re-established within one year of construction on gentle banks and approach slopes while revegetation of steeper approach slopes and banks may take longer than one growing season.
- Magnitude: low to medium – depending upon the amount of erosion that occurs.
- Probability: low – proven and effective industry standard mitigation measures are expected to control erosion on slopes and banks and prevent sediment from entering the Clearwater River.
- Confidence: high – based on data pertinent to the proposed crossing location at the Clearwater River and the professional experience of the assessment team.

Contamination of Surface Water Due to Small Spills

A spill during construction or site-specific maintenance activities could cause contamination of the surface water and would be considered to have a negative impact balance; however, with proper implementation of industry and government recommended mitigation measures, the effects can be limited. For example, during the construction of the TMX Anchor Loop Project, all fuel trucks, service trucks and pick-ups with box-mounted fuel tanks were required to carry spill prevention, containment and clean up materials. Furthermore, all hazardous material storage and oil changes, refuelling, and lubrication of industrial equipment were required to occur more than 100 m from a waterbody or watercourse except where secondary containment was provided. Spills or accidental release of potentially harmful materials (*i.e.*, oil or diesel fuel) were recorded. The Spill Contingency Plan was implemented on each spot spill and all spills were cleaned up as soon as they were discovered. During the TMX Anchor Loop Project, all spills were terrestrial, and no spills or leaks occurred in, or reached, a waterbody or watercourse (TERA 2009a).

Similar spill prevention mitigation is planned for the Project and spill prevention measures outlined in Table B7.1.3-1 and the Pipeline EPP will be followed. Fuel storage and handling practices will be monitored throughout construction of the Project to reduce spill risk. Should a leak be spotted or detected during construction of the pipeline, Trans Mountain will implement the Spill Contingency Plan. Depending on the nature and volume of a spill, the magnitude of change to water quality could vary from low to high. This residual effect is reversible in the short to medium-term and is of low probability (Table B7.1.3-3, point 1[d]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – a spill during construction or site-specific maintenance activities may extend beyond the Footprint and evidence suggests that effect of most minor spills is localized.).

- Duration: immediate – the event causing a potential reduction in surface water quality is a spill, the period of which is less than or equal to two days.
- Frequency: accidental – a spill into surface water occurs rarely over the assessment period.
- Reversibility: short to medium-term – the effects of a spill are not expected to last beyond one year, but may last longer depending on seasonal conditions and the extent and source of the spill.
- Magnitude: low to high – depending upon the volume, location and contaminant released.
- Probability: low – due to mitigation measures in place to reduce the potential for spills reaching the Clearwater River and affecting surface water quality.
- Confidence: moderate – spill location and effects of accidental spills cannot be accurately predicted.

Water Quality and Quantity Indicator – Surface Water Quantity

Alteration of Natural Drainage Patterns

With proper implementation of the industry-accepted standard mitigation practices that are proposed, disruption of surface flow patterns following construction or maintenance activities is expected to be minor through North Thompson River Provincial Park. By paralleling the existing TMPL right-of-way and narrowing the construction right-of-way to the extent feasible through the park, effects to natural drainage patterns will be further reduced in support of the management objective to maintain the natural qualities and conditions of the park. Nevertheless, construction activities may contribute to some localized alteration of natural surface drainage patterns until trench settlement is complete. The impact balance of this potential residual effect is considered negative since it could alter or disrupt natural above ground hydrologic conditions within the park.

In the event that construction or maintenance activities result in changes in surface water regimes, corrective action, in consultation with the appropriate regulatory authorities, will be implemented to resolve the issue. The post-construction environmental monitoring program will identify any locations in the park with altered drainage patterns (*e.g.,* ponded water) and remedial work will be conducted, where warranted. Consequently, the residual effect is reversible in the short to medium-term. Some minor incidents (*e.g.*, ponding, minor flooding, erosion) are expected following construction and are considered to be within environmental standards, and therefore, of low magnitude (Table B7.1.3-3, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – although alteration of natural drainage patterns is generally confined to the disturbed portion of the construction right-of-way, potential changes in hydrology may extend beyond the pipeline right-of-way.
- Duration: short-term – the events causing alteration of natural drainage are pipeline construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year of the operations phase.
- Frequency: isolated to occasional – the events causing alteration of natural drainage (*i.e.*, pipeline construction and maintenance activities) occur during construction and, for operations activities, intermittently and sporadically over the assessment period.
- Reversibility: short to medium-term – it may take more than one year plus adequate precipitation levels in order for the trench crown to settle and natural drainage patterns to be restored.
- Magnitude: low – the potential for minor ponding, flooding or erosion exists until the natural drainage patterns are restored.
- Probability: high – minor trench settlement or a remnant crown are likely to occur as a result of pipeline construction or site-specific maintenance activities and, consequently, are likely to affect natural drainage patterns in localized areas.

- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

Alteration of Streamflow

Trenched pipeline crossing methods (*i.e.*, isolated or open cut) have the potential to result in alterations of natural streamflow. Crossing activities may contribute to some localized alteration of watercourse bed and banks until complete and stable reclamation is achieved following construction. The impact balance of this potential residual effect is considered negative since it could alter or disrupt hydrologic conditions of the watercourse. However, with proper implementation of the industry-accepted standard mitigation practices that are proposed, alteration of natural streamflow resulting from an isolated or open cut pipeline crossing of the Clearwater River is expected to be minor.

In the event that construction or maintenance activities result in alterations to watercourse hydrology, corrective action, in consultation with the appropriate regulatory authorities, will be conducted to resolve the issue. The post-construction environmental monitoring program will identify locations of altered streamflow (*e.g.,* damaged bed and banks) and remedial work will be conducted. Consequently, the residual effect is reversible in the short to medium-term. Generally, the residual effect of altered bed and banks is considered to be within environmental standards for pipeline construction and, therefore, is of low to medium magnitude (Table B7.1.3-3, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – although alteration of natural streamflow is generally confined to the disturbed portion of watercourse bed and banks, potential changes in watercourse hydrology may extend beyond the pipeline right-of-way.
- Duration: immediate to short-term – the events causing alteration of natural streamflow are pipeline construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year of the operations phase.
- Frequency: isolated to occasional – the events causing alteration of natural streamflow (*i.e.*, pipeline construction and maintenance activities) occur during construction and, for operations activities, intermittently and sporadically over the assessment period.
- Reversibility: short to medium-term – it may take more than one year to fully restore and stabilize watercourse channel and associated flow conditions.
- Magnitude: low to medium – the potential for changes to streamflow exists but experience with past projects demonstrates that proper design and remedial work will reduce effect magnitude.
- Probability: high – alteration of bed and banks from an isolated or open cut crossing of the Clearwater River crossing will result from pipeline construction or site-specific maintenance activities and, consequently, alteration of natural streamflow is likely to occur.
- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

Water Quality and Quantity Indicator – Groundwater Quality

Elevated Turbidity in Groundwater as a Result of Accidental Mud Release and Sedimentation

Increased turbidity in groundwater may be the result of the effects from accidental drilling mud release and sedimentation. In the case of an accidental drilling mud release, the turbidity originates with the drilling mud. In the case of sedimentation, the turbidity results from a release of sediment particles in the formation where the pipeline is installed below the water table which will decrease as the groundwater flows through the formation. The turbidity in both cases will decrease as the groundwater flows through the formation. Interconnected pores through which the groundwater flows are generally smaller than silt size particles causing the silt particles to be retained in the formation close to their source (*i.e.*, the location of the potential drilling mud release). This residual effect is considered to have a negative impact balance since elevated turbidity can affect groundwater quality. The residual effect of an elevated turbidity on groundwater quality is considered to be reversible in the short-term based on previous experience; particles either settle out or cannot pass through the pore space of the sediment (Table B7.1.3-3, points 3[a] and 3[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – particles in the groundwater naturally settle out within the LSA.
- Duration: short-term – the event causing the potential increase in turbidity of groundwater is a drilling mud release or construction activities where the pipeline is installed below the water table.
- Frequency: accidental – the event causing the potential increase in turbidity occurs rarely over the assessment period.
- Reversibility: short-term – turbidity of groundwater is expected to decrease in the vicinity of the accidental drilling mud release or in the area where the pipeline is below the water table.
- Magnitude: medium – depending upon the volume of accidental drilling mud released or sediment / silt introduced and the permeability of the formation.
- Probability: low – it is unlikely that an accidental release of drilling mud would occur or that construction activities where the pipeline is installed below the water table will release sediment or silt.
- Confidence: moderate – based on previous experience of the assessment team.

Groundwater from Different Aquifers May Be Mixed

Drilling a borehole through multiple aquifers at different depths can result in cross-formational flow between two or more water bearing units resulting in mixing of those waters. This would be the case if drilling were to proceed through unconsolidated water-bearing surficial materials into deeper unconsolidated or bedrock aquifers. The proposed pipeline trench depth will typically be 2.1 m and, consequently, no residual effects resulting in aquifer mixing are anticipated during trenching activities and the potential effect is limited to drilling activities. In addition to horizontal directional drilling, drilling may also occur as part of the investigation prior to trenchless crossing activities.

In general, this effect would apply to shallow bedrock aquifers underlying unconsolidated water-bearing surficial materials. Drilling practice in this case would be to isolate the surficial materials before drilling proceeded to deeper depths. Proper abandonment of boreholes is necessary to prevent this effect from occurring. The impact balance of this residual effect is considered negative since this could adversely affect groundwater quality in an aquifer.

This residual effect on the natural groundwater and surface water systems in terms of water quality is considered to be reversible in the medium-term. Drilling activities that advance through more than one aquifer within the Water Quality and Quantity LSA are expected to be limited over the construction phase of the Project (Table B7.1.3-3, point 3[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, potential affects could extend beyond the Footprint and into the LSA.
- Duration: short-term – the event causing the potential mixing of groundwater from different aquifers is construction of the pipeline.
- Frequency: accidental – this effect is expected to occur rarely over the assessment period and only during the construction phase.
- Reversibility: medium-term – with the implementation of mitigation measures in Table B7.1.3-1 and the Pipeline EPP, the residual effect is likely to be reversible over a period of less than 10 years.
- Magnitude: low to high – depending on the difference in water quality between the two aquifers.

- Probability: low – this effect is unlikely to occur if the local groundwater conditions are understood and proper practices are observed during drilling and trenching.
- Confidence: moderate – based on professional experience of the assessment team.

Contamination of an Aquifer as a Result of a Spill During Construction

Contamination of an aquifer may result if the spilled material migrates through the developed soil near the surface through the surficial materials into the first water-bearing unit. The rate of migration is dependent upon the permeability of the materials, presence or absence of fractures, the properties of the spilled contaminant (density, viscosity) and the vertical hydraulic gradients. A spill during the construction phase of the Project is likely to be noted quickly and be of small volume, and evidence suggests that the effects of most minor spills are localized.

The impact balance of this residual effect is considered negative since this could potentially affect water quality in the aquifer. This residual effect is unlikely to extend beyond the Water Quality and Quantity LSA; it is considered to represent a short to long-term influence on the natural groundwater and surface water systems depending upon the volume of the spill, and the properties of the aquifer and overlying material. Spills where the spilled material contaminates an aquifer within the Water Quality and Quantity LSA may occur accidentally over the construction phase of the Project (Table B7.1.3-3, point 3[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – a spill during construction activities may extend beyond the Footprint but based on professional experience the effects of most minor spills are localized.
- Duration: immediate – the event causing potential contamination of the aquifer is a spill, the period of which is less than one day.
- Frequency: accidental – a spill into groundwater during construction is rare.
- Reversibility: short to medium-term – the effects of a spill are not expected to last beyond one year, but may last longer depending upon the extent and source of the spill.
- Magnitude: low to high – depending upon the volume, location and contaminant released.
- Probability: low – due to mitigation measures in place to reduce the potential for spills migrating into the subsurface and affecting groundwater quality.
- Confidence: moderate – spill location and effects of accidental spills cannot be accurately predicted.

Water Quality and Quantity Indicator – Groundwater Quantity

Natural Groundwater Pathways May Be Bisected and Create a Sink (Drain) for Shallow Groundwater

Excavation of the trench in areas of shallow groundwater or springs, during pipeline construction, can alter groundwater and surface water flow patterns. This may result in the trench becoming a sink. That is, both groundwater and surface water intersecting the trench will flow into the trench resulting in changed flow patterns.

The backfill of the trench around the pipeline will consist of native backfill as much as practical in order to maintain the soil/formation permeability similar to the pre-construction permeability. For example, if the trench was backfilled with a higher permeability material, the filled trench could become a preferred pathway for groundwater flow and, consequently, permanently change the natural flow pattern. Where there is concern for increased permeability, a trench breaker would be installed.

Upon backfilling the trench with native backfill, groundwater flow patterns will typically revert to their pre-construction state. Where springs are encountered, advice will be sought for the Hydrogeological or Geotechnical Resource Specialist so that cross drainage within the trench can be maintained. The impact balance of this residual effect is considered negative since groundwater flow down-gradient could temporarily decrease because flow is directed along the pipeline (Table B7.1.3-3, point 4[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge could extend beyond the Footprint and into the LSA.
- Duration: short-term – the events causing the potential alteration of groundwater flow are construction of the pipeline and maintenance activities, the latter of which are limited to any one year during operations.
- Frequency: periodic – the events causing alteration of natural groundwater flow (*i.e.,* pipeline construction and maintenance activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: short to medium-term – residual effects are expected to reverse within one year.
- Magnitude: low – the potential for changes to groundwater flow exists but experience with past projects demonstrates that proper design and remedial work will reduce the severity of the effects.

  Probability: low – although the narrowed pipeline corridor crosses areas with highly permeable materials, with the implementation of the mitigation measures outlined in Table B7.1.3-1, alteration of groundwater flow as a result of pipeline construction is unlikely.
- Confidence: moderate – based on previous experience of the assessment team and shallow groundwater mapping has been completed using available provincial mapping and existing well log reports.

Flooding on the Up-Gradient Side of the Pipeline May Result in Creation of Wet Zones on Ground Surface

A reduction in the permeability of materials along the groundwater flow path may result in a rise in the groundwater table to the extent that ground to surface flooding occurs. This may occur if the trench spoil is not backfilled in the correct order or soils are not properly salvaged resulting in a change in permeability of the upper trench materials and blocking of near surface groundwater flows. The impact balance of this residual effect is considered negative since this could potentially affect recharge to shallow aquifers or local streams and create permanently wet areas. This residual effect is considered to have a short-term influence on the natural groundwater and surface water systems as long as mitigation measures are applied (Table B7.1.3-3, point 4[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge away from the Footprint could affect an area within the LSA.
- Duration: short-term – the events causing the potential alteration of groundwater flow are construction of the pipeline and maintenance activities, the latter of which are limited to any one year during operations.
- Frequency: periodic – the events causing alteration of natural groundwater flow (*i.e.,* pipeline construction and maintenance activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: short-term – the effects of pipeline trench construction are not expected to last beyond one year once the trench has been backfilled as long as mitigation measures are applied.
- Magnitude: low – the potential for changes to groundwater flow exists but professional experience demonstrates that proper design and remedial work will reduce the effect.
- Probability: low – the proper construction of the pipeline trench and native backfill will reduce the occurrence of this effect.

- Confidence: moderate – based on previous experience and on data pertinent to the Project area.

Reduction of Base Flow to Local Streams

Dewatering of the pipeline trench during construction may result in lowering of the local water table which in the case of local streams may reduce the groundwater inflow (base flow) to streams. As indicated in Table B7.1.3-3 (point 4[b]), the extracted groundwater may be released to the ground or directly into a nearby stream in which case there would be minimal disruption of flow in the stream. The impact balance of this residual effect is considered negative due to the potential decrease of groundwater flow into local streams. This residual effect likely will not extend beyond the Water Quality and Quantity LSA to the watershed level, and, it is considered to represent a short-term influence on the natural groundwater and surface water systems (Table B7.1.3-3, point 4[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge away from the Footprint could affect an area within the LSA.
- Duration: short-term – the events causing the reduction in baseflow are the result of discharge during dewatering and occur while the trench is being constructed (either for pipeline installation or for pipeline daylighting during integrity digs).
- Frequency: periodic – the events causing alteration of natural groundwater flow (*i.e.,* pipeline construction and maintenance activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: short-term – the effects of pipeline trench construction are not expected to last beyond one year once the trench has been backfilled.
- Magnitude: low – the potential for changes to groundwater flow exists but professional experience demonstrates that proper design and remedial work will reduce effect magnitude.
- Probability: low – the proper construction of the pipeline trench and the use of native backfill will reduce the occurrence of this effect.
- Confidence: moderate – based on previous experience and on data pertinent to the Project area.

Change in Natural Groundwater Levels and Stream Recharge Due to the Discharge of Groundwater to Surface Water Systems if Not Practical to Discharge Trench Water to Ground

Shallow groundwater will be present in the subsurface in many areas along the narrowed pipeline corridor; at North Thompson River Provincial Park, this is likely to occur within the alluvial materials on either side of the Clearwater River crossing. During pipeline construction, it is common practice to dewater the trench to allow the pipe to be laid down in a dry environment. Extracted groundwater from the dewatering operations will be disposed to ground where possible, but in areas where this is not practical, the water may be discharged away from the area, directly into a water body (post-treatment), or stormwater discharge system causing local groundwater levels and flow patterns to be temporarily disrupted. The impact balance of this residual effect is considered negative since this could potentially affect recharge to local streams or shallow aquifers. This residual effect is confined to the Water Quality and Quantity LSA and is considered to represent a short-term influence on the natural groundwater and surface water systems. Dewatering activities where the extracted groundwater cannot be returned to ground are unlikely to occur given the proposed mitigation measures in Table B7.1.3-1 and in the Pipeline EPP. The residual effects in areas of discharge of collected groundwater are expected to reverse within one year when seasonal precipitation replenishes the aquifer (Table B7.1.3-3, point 4[d]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge away from the Footprint could extend to the LSA.

- Duration: short-term – the event causing the discharge of groundwater from the trench is the construction of the pipeline.
- Frequency: isolated – dewatering activities are expected to occur at specific locations/times over the construction phase of the Project.
- Reversibility: short-term – residual effects are expected to reverse within one year once seasonal precipitation recharges the aquifer.
- Magnitude: low – it is not expected that dewatering activities will noticeably affect groundwater flow patterns given the implementation of mitigation measures.
- Probability: low – it is unlikely that groundwater flow patterns will be affected by dewatering activities given the implementation of proposed mitigation measures.
- Confidence: moderate – shallow groundwater mapping has been completed using available provincial mapping and existing well log reports.

7.1.3.3 Summary

As identified in Table B7.1.3-3, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on water quality and quantity indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of North Thompson River Provincial Park related to water quality and water quantity will be not significant.

7.1.4 Air Emissions

This subsection describes the potential Project effects on the air emissions in North Thompson River Provincial Park. The Air Quality RSA consists of a 5 km wide band generally extending from the Footprint (*i.e.*, 2.5 km on both sides of the Footprint); shown in Figure 6.2.2-1 of the Introduction to the Draft Stage 2 Detailed Proposal.

All air quality indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; however, only primary emissions of CACs was determined to interact with pipeline construction and operations in North Thompson River Provincial Park. Formation of secondary ozone and emissions which have the potential to cause nuisance odours are associated with facilities, and since there are no Project facilities in North Thompson River Provincial Park, these indicators do not interact with pipeline construction and operations.

7.1.4.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on air emissions indicators are listed in Table B7.1.4-1.

A summary of mitigation measures provided in Table B7.1.4-1 was principally developed in accordance with Trans Mountain Standards and accepted pipeline construction methods for construction-related activities.

TABLE B7.1.4-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON AIR EMISSIONS FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Air Emissions Indicator – Primary Emissions of Criteria Air Contaminants and Volatile Organic Compounds			
1.1 Project contribution to emissions	RSA	• Restrict the duration that vehicles and equipment are allowed to sit and idle to less than one hour, unless air temperatures are less than 0°C [Section 7.0]. • Ensure equipment is well-maintained during construction to minimize air emissions [Section 7.0]. • Use multi-passenger vehicles for the transportation of crews to and from the job sites, where feasible [Section 7.0].	• Increase in air emissions during construction. • Increase in air emissions during site-specific maintenance and inspection activities.
1.2 Smoke during construction	RSA	• Conduct burning in accordance with burning permit requirements and A Smoke Management Framework for British Columbia, as applicable. Comply with local government bylaws, the *Forest*, *Open Burning Smoke Control Regulation* (BC) and the *Forest Fire Prevention and Suppression Regulation* (BC) when burning slash [Section 7.0]. • Limit smoke production during slash disposal by limiting pile size, reducing fuel moisture content, maintenance of loose burning piles free of soil and by using burning sloops or large capacity shredders [Section 7.1]. • Permit burning only when conditions exist that allow for adequate dispersion of smoke so that high concentrations of smoke do not locally affect human health or wildlife. Avoid burning when temperature inversions are present or predicted [Section 8.1].	• Increase in smoke during construction.

Notes: 1 RSA = Air Quality RSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.4.2 Significance Evaluation of Potential Residual Effects

Table B7.1.4-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in North Thompson River Provincial Park on the air emissions indicator. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE B7.1.4-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON AIR EMISSIONS FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Air Emissions Indicator – Primary Emissions of Criteria Air Contaminants and Volatile Organic Compounds									
1(a) Increase in air emissions during construction.	Negative	RSA	Short-term	Isolated	Short-term	Medium	High	Moderate	Not significant
1(b) Increase in air emissions during site-specific inspection and maintenance activities.	Negative	RSA	Short-term	Periodic	Short-term	Low	High	Moderate	Not significant
1(c) Increase in smoke during construction.	Negative	RSA	Short-term	Isolated	Short-term	Low	High	Moderate	Not significant

Notes: 1 RSA = Air Quality RSA.
2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Air Emissions Indicator – Primary Emissions of Criteria Air Contaminants (CACs) and Volatile Organic Compounds (VOCs)

Increase in Air Emissions During Construction

The primary sources of air emissions during construction will be from fuel combustion while transporting crews to and from the work site and along the narrowed pipeline corridor, as well as from the operation of heavy equipment required for construction. Implementation of accepted pipeline construction methods as outlined in Table B7.1.4-1 is the preferred approach to reducing air emissions from pipeline construction.

The amount of CAC and VOC emissions associated with construction activities will be reduced by using multi-passenger vehicles for the transportation of crews to and from the job sites, to the extent feasible, as well as using well-maintained equipment. The residual effects of increased air emissions during construction are considered to have a negative impact balance, but they are expected to dissipate within the Air Quality RSA. Ambient concentrations of CAC and VOC are expected to be within provincial objectives and standards (BC MOE 2013b) and, therefore, of medium magnitude. Air emissions resulting from construction activities are considered to be reversible in the short-term (Table B7.1.4-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Air Quality RSA – potential increases in air emissions resulting from construction activities will dissipate within the Air Quality RSA.
- Duration: short-term – the event resulting in increased air emissions is construction of the pipeline.
- Frequency: isolated – the event resulting in increases in air emissions (*i.e.*, construction of the pipeline) is confined to a specific period.
- Reversibility: short-term – the residual effects are expected to reverse within less than one year for all contaminants after completion of construction.
- Magnitude: medium – an increase in air emissions will occur and may approach but are not expected to exceed environmental or regulatory standards; the increase will be short-lived and localized to the construction area.
- Probability: high – the equipment and vehicles used for construction will emit air contaminants.
- Confidence: moderate – based on a good understanding of the cause-effect relationship but reliant on vehicle and equipment estimates from previous projects.

Increase in Air Emissions During Site-Specific Inspection and Maintenance Activities

The primary sources of air emissions during operations will be from fuel combustion while transporting crews to and from the narrowed pipeline corridor during site-specific maintenance activities. Aerial patrols along the pipeline segments are unlikely to cause measurable increases of near-surface ambient CAC concentrations above background levels. Furthermore, in the absence of more detailed information, it was assumed that the current frequency and duration of aerial patrols will be sufficient to serve the pipeline expansion associated with the Project.

The amount of air emissions associated with site-specific maintenance activities will be reduced by using multi-passenger vehicles for the transportation of crews to and from the job sites, to the extent feasible, as well as using well-maintained equipment. The residual effects of increased air emissions during site-specific maintenance activities are considered to have a negative impact balance. However, they are expected to dissipate within the Air Quality RSA and be well within provincial objectives and standards (BC MOE 2013b) and, therefore, will be of low magnitude. Air emissions resulting from site-specific inspections and maintenance activities are considered to be reversible in the short-term (Table B7.1.4-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Air Quality RSA – potential increases in air emissions resulting from site-specific maintenance activities (*e.g.*, vegetation management, integrity digs) will dissipate within the Air Quality RSA.

- Duration: short-term – the events resulting in increases in air emissions, are individual maintenance activities (*e.g.*, vegetation management, integrity digs) and each maintenance event will be completed within one year.

- Frequency: periodic – maintenance and operations-related activities (*e.g.*, vegetation management, integrity digs) will occur intermittently but repeatedly over the assessment period.

- Reversibility: short-term – the residual effects are expected to reverse within less than one year for all contaminants after completion of individual maintenance activities.

- Magnitude: low – periodic increases in air emissions during site-specific maintenance will be detectable but within normal variability of existing conditions with the implementation of proposed mitigation measures.

- Probability: high – the equipment and vehicles used for site-specific activities (*e.g.*, vegetation management, integrity digs) will emit air contaminants.

- Confidence: moderate – based on a good understanding of the cause-effect relationship and from current pipeline operations in the same regions; however, detailed information on equipment and vehicle usage for site-specific activities and the duration and frequency of future aerial patrol are not available.

Increase in Smoke During Construction

Smoke will be associated with the burning of slash along discrete segments of the narrowed pipeline corridor in North Thompson River Provincial Park. In accordance with applicable provincial legislation pertaining to mulching depth requirements, not all non-merchantable timber can be disposed of by mechanical means; therefore, slash burning is required. As requested by BC Parks, some timber will be left on the right-of-way as rollback. Since the maximum depth of mulch will not exceed 5 cm or will be in accordance with the applicable provincial legislation, whichever is less, any remaining vegetation and non-salvageable timber not retained for rollback will be burned. The impact balance of this potential residual effect is considered to be negative since smoke could reduce local air quality.

Larger particles of smoke will settle out via gravitational settling within a relatively short timeframe at any given location, while finer particles might remain suspended for more than 2 days. Therefore, this residual effect is reversible in the short-term. With the implementation of the recommended mitigation measures provided in Table B7.1.4-1, smoke during construction will be reduced; therefore, the magnitude is rated as low (Table B7.1.4-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Air Quality RSA – potential increases in smoke resulting from construction may extend beyond the Footprint and into the Air Quality RSA.

- Duration: short-term – the event resulting in increases in smoke is construction of the pipeline.

- Frequency: isolated – the event resulting in increases in smoke (*i.e.*, construction of the pipeline) is confined to a specific period.

- Reversibility: short-term – the effects are expected to reverse within several days once construction or the maintenance activity is complete.

- Magnitude: low – a small volume of slash along the narrowed pipeline corridor within North Thompson River is expected, and the mitigation measures provided in Table B7.1.4-1 will reduce smoke during construction.

- Probability: high – disposal of slash by burning is planned.

- Confidence: moderate – based on the professional experience of the assessment team.

7.1.4.3 Summary

As identified in Table B7.1.4-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on the air emissions indicator of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on the conservational values of North Thompson River Provincial Park related to air emissions will be not significant.

7.1.5 Acoustic Environment

This subsection describes the potential Project effects on the acoustic environment in North Thompson River Provincial Park. The Acoustic Environment LSA consists of a 1.5 km band on both sides of the proposed pipeline corridor (*i.e.*, a total width of 3.15 km).

All acoustic environment indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; only sound levels was determined to interact with pipeline construction and operations in North Thompson River Provincial Park. There is no blasting proposed for North Thompson River Provincial Park and therefore the vibrations indicator is not anticipated to interact with pipeline construction.

7.1.5.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on the acoustic environment indicator are listed in Table B7.1.5-1.

A summary of mitigation measures provided in Table B7.1.5-1 was principally developed in accordance with industry accepted best practices and accepted pipeline construction methods for construction-related activities.

TABLE B7.1.5-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON ACOUSTIC ENVIRONMENT FOR NORTH THOMPSON RIVER PROVINICAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Acoustic Environment Indicator – Sound levels			
1.1 Changes in sound levels during construction	LSA	• District of Clearwater's Noise Bylaw No. 14, 2008, applies outside the hours of 8:00 AM and 5:00 PM from Monday to Friday. • Unless otherwise noted in municipal by-laws (*i.e.*, District of Clearwater Noise Bylaw No. 14, 2008), generally conduct construction activity between the hours of 8:00 AM and 5:00 PM. Note: some construction activities, once started, must continue on a 24 hour basis (*e.g.*, an HDD may be continuous until completion). • Adhere to all federal (*i.e.*, Environment Canada, Motor Vehicle Safety Act, Oil and Gas Occupational Safety and Health Regulations, Health Canada) and provincial (*i.e.*, BC Noise Control Guideline Best Practices Guideline, Worker's Compensation Act, section 7.2 of the Occupational Health and Safety Regulations [BC Reg 296/97 as amended] Section 7.2 [BC Reg. 382/2004, s.1]) guidelines and regulations and legislation for noise management [Section 7.0]. • Schedule intermittent noise producing events to avoid, where feasible, important habitat of wildlife species at risk/sensitive species/livestock during sensitive periods, where feasible [Section 7.0]. • Enforce vehicle speed limits and inform contractor truck drivers and equipment operators that engine retarder braking in urban areas is prohibited [Section 7.0]. • Maintain equipment in good working condition and in accordance with manufacturer guidelines [Section 7.0]. • Maintain noise suppression equipment on all construction machinery and vehicles in good order [Section 7.0]. • Enclose noisy equipment and use baffles, where and when feasible, to limit the transmission of noise beyond the construction site [Section 7.0]. • Use only the size and power of tools necessary limit noise from power tool operations. Locate stationary equipment, such as compressors and generators located away from noise receptors, to the extent feasible, and follow applicable municipal, provincial and federal guidelines [Section 7.0].	• Increase in sound levels during construction period.
1.2 Changes in sound level during operations	LSA	• Unless otherwise noted in municipal by-laws (*i.e.,* District of Clearwater Noise Bylaw No. 14, 2008), generally conduct construction activity between the hours of 8:00 AM and 5:00 PM. • Limit helicopter inspections to weekdays only to the extent practical. • Use of off-road vehicles for inspection should be limited to weekdays if feasible. • Maintain equipment in good working condition and in accordance with manufacturer guidelines. • Maintain noise suppression equipment on all construction machinery and vehicles in good order.	• Periodic noise events due to maintenance and inspections.

Notes: 1 LSA = Acoustic Environment LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.5.2 Significance Evaluation of Potential Residual Effects

Table B7.1.5-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in North Thompson River Provincial Park on the acoustic environment indicator. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE B7.1.5-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON ACOUSTIC ENVIRONMENT FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Acoustic Environment Indicator – Sound Levels									
1(a) Increase in sound levels during construction period.	Negative	LSA	Short-term	Isolated	Short-term	Low to medium	High	Moderate	Not significant
1(b) Periodic noise events due to maintenance and inspections.	Negative	LSA	Short-term	Periodic	Immediate to short-term	Negligible to medium	High	Moderate	Not significant

Notes: 1 LSA = Acoustic Environment LSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Acoustic Environment Indicator – Sound levels

Increase in Sound levels During Construction

Noise arising from construction and clearing activities will occur along the narrowed pipeline corridor in North Thompson River Provincial Park and this residual effect is considered to have a negative impact balance. Clearing and construction activities are scheduled for Q3 / Q4 of 2016.

Participants in the Clearwater Community Workshop noted that construction was a local concern for residents of Clearwater and could potentially affect other users in the area (*e.g.,* recreational users in North Thompson River Provincial Park). One of the suggestions from the participants of the Clearwater Parks Workshop included scheduling construction during the early March – April to avoid disruption to recreation users. Concerns raised by participants in the Clearwater Parks Workshop were taken into account, however, construction is scheduled to occur in Q3 and Q4 of 2016 as the breeding and nesting periods of migratory birds (*i.e*., migratory birds timing window) occurs from late-March to mid-August in this area. Clearing activities scheduled for Q3 2016 will also avoid the migratory bird breeding and nesting period. According to the *Migratory Birds Convention Act*, no disturbance to nests or nesting birds is allowed during breeding and nesting periods.

The duration of the sounds experienced is dependent on the activity; each type of sound will last only for the particular phase of construction (*e.g.,* clearing, trenching, welding, and reclamation). As described in Section 2.0, construction is expected occur within Q3 / Q4 of 2016 and last for approximately two weeks within the North Thompson River Provincial Park. However, within that period, the various phases of construction will occur consecutively. Given the need to transition each phase, the time for maximum activity during each phase is limited.

In addition, construction equipment and vehicles will be equipped with noise abatement equipment (*e.g.*, mufflers). There may be some situations where after hours noise such as generators or pumps may be used and may cause disturbance to nearby residents. A summary of the rationale for all of the significance criteria is provided below (Table B7.1.5-2, point 1[a]).

- Spatial Boundary: Acoustic Environment LSA – noise resulting from construction activities may transmit beyond the construction right-of-way.
- Duration: short-term – the events causing changes in sound levels will occur only during the construction phase.

- Frequency: isolated – the event causing changes in sound levels will occur only during the construction phase.
- Reversibility: short-term - the period over which the change in sound level extends is the construction period. However, at any specific location along the narrowed pipeline corridor, all sound level changes will cease when construction activities have finished.
- Magnitude: low – the increased nuisance noise may affect recreational users.
- Probability: high – heavy machinery and other construction equipment required for construction will produce noise above baseline conditions while in use.
- Confidence: high – based on the professional experience of the assessment team.

Periodic Noise Events Due to Maintenance and Inspection

Noise from pipeline operations is limited to regular aerial and ground patrols, vegetation management and integrity digs. Sounds would be similar to those already heard in areas where the narrowed pipeline corridor is adjacent to the existing TMPL right-of-way. Similar to noise during construction, noise resulting from periodic site-specific maintenance will be limited.

The spatial extent of the change in sound levels is limited to the Acoustic Environment LSA. Since maintenance activities are typically completed at any given location within a few minutes to hours (aerial patrols, vegetation management) or within several weeks (*e.g.*, integrity digs), the duration of the maintenance and inspection activities is short-term. The frequency of maintenance activities occur intermittently but repeatedly over the assessment period and, therefore, are considered to be periodic. The effect is reversible in the immediate to short-term as sound level changes due to maintenance activity will cease as soon as the maintenance activity stops.

While aerial patrols or vegetation management during operations may cause momentary sound levels to increase, the day and night average levels are not expected to change due to such short duration events. Although integrity digs may extend over several weeks, the amount and size of the equipment used during this activity is generally smaller than that used during pipeline construction. Nevertheless, the magnitude of the change in sound level during operations of the pipeline is considered to be of negligible magnitude for most operational activities. Sounds would be noticeable to park users near the activities, however, there would be transient sounds and annoyance is expected to be minimal for maintenance inspections. Some disturbance may occur if park users were near an integrity dig and the degree of annoyance would depend on the location and duration of the dig.

The inspections and maintenance are essential to safe pipeline operations so the probability of occurrence is rated as high (Table B7.1.5-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Acoustic Environment LSA – the change in sound level during operations is confined to the Acoustic Environment LSA.
- Duration: short-term – the events causing changes in sound levels during operations (*i.e.*, maintenance activities) are completed within any one year during operations.
- Frequency: periodic – the events causing changes in sound levels during operations (*i.e.*, aerial patrols, vegetation management, integrity digs) occur intermittently but repeatedly over the assessment period.
- Reversibility: immediate to short-term – the changes in sound level associated with maintenance activities at any given location range from a few minutes to hours for aerial patrols and vegetation management (immediate) to a few weeks for integrity digs (short-term). All sound level changes are reversible as the sound will cease when the inspection/maintenance is finished.
- Magnitude: negligible to medium – the sound level events associated with aerial patrols and vegetation management will have a short timeline, so changes to the day or night average levels are not expected.

However, integrity digs that occur near residents may result in sound level changes that could affect day or night average levels.

- Probability: high – changes to sound levels will occur since inspections and maintenance are essential to safe pipeline operation.
- Confidence: high – based on the professional experience of the assessment team.

7.1.5.3 Summary

As identified in Table B7.1.5-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on the acoustic environment indicator of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on the conservational values of North Thompson River Provincial Park related to acoustic environment will be not significant.

7.1.6 Fish and Fish Habitat

This subsection describes the potential Project effects on the fish and fish habitat in North Thompson River Provincial Park. The Fish and Fish Habitat LSA consists of the area extending 100 m upstream from the centre of the proposed pipeline corridor to a minimum of 300 m downstream from the centre of the proposed pipeline corridor at defined watercourses. The Fish and Fish Habitat LSA also includes the area of riparian vegetation to a width of 30 m back from each bank edge within the width of the construction right-of-way. The Aquatics RSA includes all watersheds directly affected by the Project; shown in Figure 6.2.2.1 of the Introduction to the Draft Stage 2 Detailed Proposal.

Fish and fish habitat indicators (*i.e.,* riparian habitat, instream habitat and fish mortality or injury) (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; each of which were determined to interact with pipeline construction and operations in North Thompson River Provincial Park. Fish and fish habitat species indicators (*i.e.,* bull trout, coho salmon, Chinook salmon and rainbow trout) with an observed/captured or historical presence within North Thompson Provincial Park were also considered in this evaluation and are discussed in Section 7.1.6.2 Effects to Fish Species of Concern due to a Trenchless Crossing.

7.1.6.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on fish and fish habitat indicators are listed in Table B7.1.6-1.

In the event an open cut method is required for the crossing of the Clearwater River, the DFO Self-Assessment Process and the Measures to Avoid Causing Harm to Fish and Fish Habitat cannot be met (DFO 2013a, 2014) and, therefore, a review by DFO will be required. In the case that it is determined that the works will cause serious harm to fish and fish habitat, an Authorization will also be required, including a suitable offsetting plan. A summary of mitigation measures is provided in Table B7.1.6-1 which was principally developed in accordance with Trans Mountain Standards as well as industry and provincial regulatory guidelines including BC Ministry of Water, Land and Air Protection (MWLAP) (2004a), CAPP (2004), CAPP *et al.* (2012), and DFO (1995, 2013a, 2014).

TABLE B7.1.6-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON FISH AND FISH HABITAT FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Fish and Fish Habitat Indicator – Riparian Habitat			
1.1 Riparian habitat loss or alteration during construction in the event of an open cut contingency crossing.	Footprint	<u>Open Cut Contingency Crossing Method</u> <u>Clearing and Grading</u> • Prohibit clearing of extra temporary workspace (TWS) within the riparian buffer, only the trench and TWS areas will be cleared [Section 8.1]. • Clear vegetation located within the Clearwater River vegetation buffer area crossed by the pipeline right-of-way and TWS only if absolutely necessary [Section 8.1]. • Fell trees away from the Clearwater River and away from limits of the construction right-of-way to reduce damage to streambanks, beds and adjacent trees. Hand clear the area, if necessary, to reduce disturbance [Section 8.1]. • Adhere to clearing guidelines for protection of streams provided in the Forest Practices Code, and the Riparian Management Area Guidebook in BC, where riparian management zones (widths) are identified based on stream class [Section 8.1]. <u>Bank and Riparian Restoration</u> • Identify any instream site-specific features at the crossing proposed and record their location *(e.g.,* root wad, large woody debris, large boulders). Salvage these for use later. • Salvage upper coarse-textured substrate material from the channel and banks, and stockpile separately from lower substrate. • Install the appropriate temporary erosion and sediment control measures, where warranted (*e.g.,* sediment fence, erosion control blanket, coir logs, etc.). • Seed with an appropriate grass mix and/or cover crop species as directed in the Reclamation Management Plan for the Project. • See Table B7.1.3-2 for additional reclamation mitigation measures.	• Riparian habitat loss or alteration due to construction activities in the event of an open cut contingency crossing.
1.2 Riparian habitat alteration during maintenance and operations	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• Clearing or disturbance of riparian habitat during maintenance and operations in the event of an open cut contingency crossing.
1.3 Riparian habitat loss and alteration from accidental drilling mud release	RSA	<u>Trenchless Crossing Method</u> • Excavate the entry and expected exit sites to provide for the containment of drilling mud and cuttings during a trenchless crossing. Ensure the excavations are located far enough from the Clearwater River and in containment berms or tanks that are large enough to contain the anticipated maximum volume of drilling mud above the high watermark of the river [Section 8.7]. • Follow the drilling mud frac-out monitoring and other measures outlined in the Drilling Mud Release Contingency Plan (see Appendix B of the Pipeline EPP) during horizontal directional drilling [Section 8.7].	• Alteration of riparian habitat from accidental drilling mud release and associated clean-up activities.
1.4 Contamination from spills during construction and maintenance	See above	• Review and adhere to the general mitigation measures provided in Section 7.0 of the Pipeline EPP related to equipment washing, inspection of hydraulic, fuel and lubrication systems of equipment, equipment servicing and refuelling as well as fuel storage in proximity to watercourses during water crossing construction [Section 8.7]. • Use non-toxic, biodegradable hydraulic fluids in all equipment that will work instream if/when flowing water will be encountered during construction [Section 8.7]. • Do not store fuel, oil or hazardous material within 300 m of a watercourse/wetland [Section 7.0].	• Contamination of riparian habitat from spills during construction and maintenance.

TABLE B7.1.6-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2. Fish and Fish Habitat Indicator – Instream Habitat			
2.1 Instream habitat alteration	RSA	<u>General</u> • Site-specific mitigation and reclamation procedures will be implemented if an open cut contingency crossing is required at Clearwater River. • In the event that the least risk biological window proposed (August 7 – August 15) cannot be adhered to for the Clearwater River open cut contingency crossing, applicable approvals will be required and additional mitigation will be applied in consultation with provincial and federal regulatory authorities. • Trans Mountain will work with regulatory authorities to determine the necessary approvals, licenses and permits needed for construction of the pipeline or associated components prior to the commencement of the permitted activity in North Thompson River Provincial Park. The contractor(s), subcontractors and the Inspector(s) will be provided with copies of all approvals/licenses and permits including the most recent updates and revisions, and will comply with all conditions presented to Trans Mountain. Trans Mountain will resolve any inconsistencies between approval/permit conditions and contract documents prior to commencement of the construction activity [Section 3.0]. • Follow applicable Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2014) outlining conditions and measures to avoid serious harm to fish or any permanent alteration to, or destruction of, fish habitat when working in or near a watercourse/wetland that has been identified as providing fish habitat [Section 8.7]. • Ensure all necessary equipment, personnel and materials are on-site and ready for installation prior to commencing instream work. Complete all work as quickly as practical to limit the duration of disturbance [Section 8.7]. • Re-establish streambanks and approaches immediately following construction of the Clearwater River as outlined in the Reclamation Management Plan (see Appendix C of the Pipeline EPP) [Section 8.6].	• Alteration of instream habitat within the ZOI in the event of an open cut contingency crossing.
2.2 Instream habitat alteration from accidental drilling mud release	LSA	<u>Trenchless Crossing Method</u> • Construct trenchless crossings in accordance with the conditions of the DFO Self-Assessment Process and Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a, 2014) [Section 8.7]. • Monitor to assess the immediate effects of crossing construction. Also monitor sediment release (*i.e.,* turbidity and total suspended solids) throughout the crossing construction period, if required [Section 8.7]. • Cease trenchless crossing work immediately and refer to the Drilling Mud Release Contingency Plan (see Appendix B of Pipeline EPP) in the event that an inadvertent release of drilling mud has occurred and the material is or may enter the watercourse or affect other sensitive environmental or land use features [Section 8.7]. • Assign the Inspector(s), Qualified Environmental Professional (QEP) with expertise in the containment of inadvertent release of drilling mud and clean up to HDDs under a watercourse (see Drilling Mud Release Contingency Plan in Appendix B of Pipeline EPP) [Section 8.7].	• Alteration of instream habitat from drilling mud release.
2.3 Contamination from spills during construction	RSA	• Review and adhere to the general mitigation measures in Section 7.0 of the Pipeline EPP related to equipment washing, inspection of hydraulic, fuel and lubrication systems of equipment, equipment servicing and refuelling as well as fuel storage in proximity to watercourses during water crossing construction [Section 8.7]. • Do not store fuel, oil, or hazardous material within 300 m of a watercourse/wetland/lake [Section 7.0]. • Use non-toxic, biodegradable hydraulic fluids in all equipment that will work instream if/when flowing water will be encountered during construction or in wetland and/or lakes if requested by the Inspector(s) [Section 8.7]. • See recommended mitigation measures for potential effect 1.4 of this table.	• Contamination of instream habitat from spills during construction.

TABLE B7.1.6-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2.4 Increased access to instream habitat during operations (*e.g.*, horse, unauthorized ATVs)	LSA	• Follow the measures in the Traffic and Access Control Management Plan (see Appendix C of Pipeline EPP) [Section 8.7]. • Install tree/shrub plantings at potential access points to the construction right-of-way to visually screen the construction right-of-way (see Drawing [Vegetation Screen] provided in Appendix R) [Section 8.6]. • Rollback slash and salvageable timber to prevent access along the construction right-of-way. Spread evenly over the construction right-of-way. Rollback will not be walked on [Section 8.6].	• Disturbance to instream habitat due to a potential increase in access during operations.
3. Fish and Fish Habitat Indicator – Fish Mortality or Injury			
3.1 Fish mortality or injury during construction	LSA	Open Cut Contingency Crossing Method • In the event that the least risk biological window proposed cannot be adhered to for the Clearwater River open cut contingency crossing, applicable approvals will be required and additional mitigation will be applied in consultation with provincial and federal regulatory authorities. • If it is determined that serious harm to fish, or any permanent alteration to, or destruction of, fish habitat will occur, an offsetting plan and site-specific mitigation and/or reclamation plans will be implemented in conjunction with DFO Authorization. • Determine the presence of any aquatic or riparian plants and pests prior to the commencement of construction activities within the riparian buffer. Notify the contractor of any special measures to be implemented to prevent the transfer of these organisms from one watercourse to another [Section 8.7]. • Follow applicable DFO Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2014) and measures outlined Section 8.7 of Pipeline EPP, when working in or near a watercourse or wetland that has been identified as provided fish habitat (*i.e.*, Clearwater River). • Prohibit recreational fishing by Project personnel on or in the vicinity of the construction right-of-way. The use of the construction right-of-way to access fishing sites is prohibited [Section 7.0]. • Ensure all water intakes are screened in accordance with the DFO's *Freshwater End-of-Pipe Fish Screen Guideline*. Ensure the screens are free of debris during pumping [Section 8.7]. • Monitor to assess the immediate effects of crossing construction. Also monitor sediment release (*i.e.,* turbidity and total suspended solids) throughout the crossing construction period, if required [Section 8.7]. • Clean fish salvage equipment (*e.g.,* waders, boots, nets) of soil, and disinfect with 100 mg/L chlorine bleach before using in any watercourse to prevent the spread of pathogens (*e.g.,* whirling disease) and/or invasive plant species. Ensure that washed off soil is disposed of at a location that will prevent the reintroduction of these untreated materials into a watercourse [Section 8.7]. • See recommended mitigation measures outlined in potential effects 1.4 and 2.1 of this table.	• Increased fish mortality or injury due to construction activities in the event of an open cut contingency crossing.
3.2 Fish mortality or injury from spills during construction	RSA	• See recommended mitigation measures outlined in potential effect 3.1 of this table.	• Increased fish mortality or injury from spills during construction activities.

TABLE B7.1.6-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
3.3 Increased suspended sediment concentrations within the ZOI during instream construction	RSA	<u>General</u> • Develop water quality monitoring plans, where required for watercourses with high sensitivity fish habitat. If monitoring reveals that sediment values are approaching threshold values, the water quality monitors will notify the Lead Environmental Inspector and Inspector(s) who, with the Construction Manager and contractor, will develop corrective actions [Section 8.7]. • Grade away from the Clearwater River to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in watercourses during grading [Section 8.2]. • Ensure temporary berms and/or sediment fence installed following grading (see Section 8.2 of the Pipeline EPP) will adequately control runoff from entering the open trench in the vicinity of water crossings [Section 8.3]. • Install a temporary sediment barrier (*e.g.,* sediment fences), where warranted, to eliminate the flow of sediment from spoil piles and disturbed areas into the Clearwater River (see Drawing [Sediment Fence] provided in Appendix R) [Section 8.7]. • Inspect temporary sediment control structures (*e.g.,* sediment fences, subsoil berms) installed on approach slopes, on a daily basis throughout crossing construction. Repair the structures before the end of the working day [Section 8.7]. • Ensure all necessary equipment, personnel and materials are on-site and ready for installation prior to commencing instream work. Complete all work as quickly as practical to limit the duration of disturbance [Section 8.7]. • See additional monitoring measures in Section 8.7 of the Pipeline EPP. • See additional monitoring measures in Section 8.7 of the Pipeline EPP. <u>Open Cut Contingency Crossing</u> • Site-specific mitigation and reclamation procedures will be implemented if an open cut contingency crossing is required for Clearwater River crossing.	• Increased fish mortality or injury due to increased suspended sediment concentrations within the ZOI during instream construction in the event of an open cut contingency crossing.
3.4 Increased suspended sediment concentrations in the water column from accidental drilling mud release	LSA	• See recommended mitigation measures outlined in potential effect 2.2 of this table.	• Increased fish mortality or injury due to suspended sediment from drilling mud release.
3.5 Increased access to fish and fish habitat during operations (*e.g.,* horse, unauthorized ATVs)	LSA	• See recommended mitigation measures outlined in potential effect 2.4 of this table.	• Increased fish mortality or injury due to a potential increase in access during operations.
3.6 Interbasin transfer of aquatic organisms	RSA	• Determine the presence of any aquatic or riparian plants and pests prior to the commencement of construction activities within the riparian buffer. Notify the contractor of any special measures to be implemented to prevent the transfer of these organisms from one watercourse to another [Section 8.7]. • Ensure that test water withdrawn from one drainage basin is not allowed to enter natural waters of another drainage basin [Section 8.5].	• No residual effect identified.

TABLE B7.1.6-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
3.7 Effects on fish species of concern	RSA	• Implement applicable measures from the Fish Species of Concern Contingency Plan (see Appendix B of the Pipeline EPP) should fish species of concern be discovered during construction [Section 8.7]. • See recommended mitigation measures outlined in potential effects 3.1 to 3.5 of this table. • See recommended mitigation measures outlined in potential effect 2.3 of this table.	• Fish species of concern may be affected by an increase in suspended sediment concentration, habitat alteration within the ZOI and increased potential for mortality or injury due to a trenchless crossing. • Fish species of concern may be affected by an increase in suspended sediment concentration, habitat alteration within the ZOI and increased potential for mortality or injury in the event of an open cut contingency crossing.

Notes: 1 LSA = Fish and Fish Habitat LSA; RSA = Aquatics RSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.6.2 Significance Evaluation of Potential Residual Effects

Table B7.1.6-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the pipeline on fish and fish habitat indicators, for both the primary (*i.e.,* trenchless) and contingency (*i.e.*, open cut) crossing methods proposed. The rationale used in the evaluation of significance of each of the potential residual environmental effects is provided below.

TABLE B7.1.6-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON FISH AND FISH HABITAT FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1 Fish and Fish Habitat Indicator – Riparian Habitat									
1(a) Riparian habitat loss or alteration due to construction activities in the event of an open cut contingency crossing.	Negative	Footprint	Short-term	Isolated	Medium to long-term	Low	High	High	Not significant
1(b) Clearing or disturbance of riparian habitat during maintenance and operations.	Negative	Footprint	Immediate to short-term	Occasional	Medium to long-term	Low	Low	High	Not significant
1(c) Alteration of riparian habitat from accidental drilling mud release and associated clean-up activities.	Negative	RSA	Immediate to short-term	Accidental	Short to long-term	Low to high	Low	High	Not significant
1(d) Contamination of riparian habitat from spills during construction and maintenance.	Negative	RSA	Immediate	Accidental	Short to long-term	Low to high	Low	Moderate	Not significant
2. Fish and Fish Habitat Indicator – Instream Habitat									
2(a) Alteration of instream habitat within the ZOI in the event of an open cut contingency crossing.	Negative	RSA	Short-term	Isolated	Short term	Low	High	High	Not significant
2(b) Alteration of instream habitat from drilling mud release.	Negative	RSA	Immediate to short-term	Accidental	Immediate to medium-term	Low to high	Low	High	Not significant

TABLE B7.1.6-2 Cont'd

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
2(c)	Contamination of instream habitat from spills during construction.	Negative	RSA	Immediate	Accidental	Short to medium-term	Low to high	Low	High	Not significant
2(d)	Disturbance to instream habitat due to a potential increase in access during operations.	Negative	LSA	Long-term	Occasional	Immediate to long-term	Low	Low	Moderate	Not significant
3.	Fish and Fish Habitat Indicator – Fish Mortality and Injury									
3(a)	Increased fish mortality or injury due to construction activities in the event of an open cut contingency crossing.	Negative	LSA	Short-term	Isolated	Medium-term	Low	Low	High	Not significant
3(b)	Increased fish mortality or injury from spills during construction activities.	Negative	RSA	Immediate	Accidental	Short to long-term	Low to high	Low	High	Not significant
3(c)	Increased fish mortality or injury due to increased suspended sediment concentrations within the ZOI during instream construction in the event of an open cut contingency crossing.	Negative	LSA	Short-term	Isolated	Medium-term	Low to medium	Low	High	Not significant
3(d)	Increased fish mortality or injury due to suspended sediment from drilling mud release.	Negative	RSA	Immediate	Accidental	Immediate to medium-term	Low to high	Low	High	Not significant
3(e)	Increased fish mortality or injury due to a potential increase in access during operations.	Negative	LSA	Long-term	Occasional	Short to long-term	Low	Low	Moderate	Not significant
3(f)	Fish species of concern may be affected by an increase in suspended sediment concentration, habitat alteration within the ZOI and increased potential for mortality or injury due to a trenchless crossing.	Negative	RSA	Immediate to short-term	Accidental	Short-term	Low	Low	Moderate	Not significant
3(g)	Fish species of concern may be affected by an increase in suspended sediment concentration, habitat alteration within the ZOI and increased potential for mortality or injury in the event of an open cut contingency crossing.	Negative	RSA	Short-term	Isolated	Short-term	Low to medium	High	Moderate	Not significant

Notes: 1 LSA = Fish and Fish Habitat LSA; RSA = Aquatics RSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Fish and Fish Habitat Indicator – Riparian Habitat

Riparian Habitat Loss or Alteration Due to Construction Activities in the Event of an Open Cut Contingency Crossing

Riparian vegetation within the construction right-of-way and temporary workspace will be disturbed at the Clearwater River in the event of an open cut contingency crossing only, and will be considered in the site-specific mitigation and reclamation plan.

The maximum potential riparian disturbance would be 2,700 m^2 as a result of pipeline construction if the entire riparian area, to the width of the construction right-of-way and 30 m from the top of the bank was removed at the North Thompson River crossing as a result of an open cut contingency crossing; however, the actual disturbance to riparian habitat is expected to be less. In the event that the open cut contingency crossing method is required, clearing of riparian vegetation would only occur within the pipeline easement and temporary workspace would not be cleared within the riparian buffer.

The North Thompson River Provincial Park has developed management objectives for the park which includes a park goal of conserving river riparian habitats. With the successful implementation of the recommended mitigation measures, it is anticipated that the pipeline crossing at Clearwater River will meet the objectives of the North Thompson River Provincial Park Purpose Statement and Zoning Plan.

The potential residual effect of pipeline construction from clearing riparian vegetation, although negative, is considered to be of low magnitude given the implementation of industry standard and provincially and federally recommended mitigation measures and monitoring of revegetation success at water crossings post-construction. The potential residual effect is also considered to be reversible in the medium to long-term, depending on the pre-existing vegetation community (*e.g.,* shrubs regenerate within several years, however, tree regrowth is expected to extend into the long-term) (Table B7.1.6-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – clearing or disturbance of riparian vegetation is confined to the Footprint.
- Duration: short-term – the event causing the alteration of riparian vegetation is construction of the various components of the Project (*e.g.*, pipeline crossing).
- Frequency: isolated – the event causing clearing or disturbance of riparian vegetation (*i.e.,* construction of the pipeline crossing) is confined to a specific period.
- Reversibility: medium to long-term – depending upon the pre-existing vegetation community (*e.g.,* grasses, shrubs and/or trees).
- Magnitude: low – based on implementation of mitigation measures, including revegetation, and the results of post-construction environmental monitoring programs which demonstrate the effectiveness of the measures proposed.
- Probability: high – alteration of riparian vegetation is expected to occur at the Clearwater River crossing.
- Confidence: high – based on a good understanding by the assessment team of trenched (open cut) crossing methods and associated effects on riparian vegetation.

Clearing or Disturbance of Riparian Habitat During Maintenance and Operations

Routine vegetation control at the proposed crossing along the proposed pipeline right-of-way and during operations will exclude riparian areas. However, a situation may occur during the life of the operating pipeline where riparian vegetation disturbance may be necessary to accommodate maintenance activities (*e.g.,* in the event of a flood event that causes scouring over the pipeline trench that would require measures to restore depth of cover and pipe integrity). The residual effect of clearing riparian habitat during pipeline operations is of low magnitude and reversible in the medium to long-term (Table B7.1.6-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – clearing or disturbance of riparian vegetation is confined to the Footprint.
- Duration: immediate to short-term – the event causing alteration of riparian vegetation during operations is maintenance activities which may take less than two days (*i.e.,* immediate) or may take more than two days but less than one year (*i.e.,* short-term).
- Frequency: occasional – any maintenance activities required at the watercourse crossing will occur intermittently and sporadically over the assessment period.
- Reversibility: medium to long-term – depending upon the pre-existing vegetation community (*e.g.,* shrubs or trees) and the extent of clearing or alteration of riparian vegetation required for maintenance activities to take place.
- Magnitude: low – based on the implementation of industry standard and provincially and federally recommended mitigation measures during operations phases of the Project and the results of post-construction environmental monitoring programs which demonstrate the effectiveness of the measures proposed.

- Probability: low – clearing within the riparian area is not expected to occur during operations.
- Confidence: high – based on the professional experience of the assessment team.

Alteration of Riparian Habitat from Accidental Drilling Mud Release and Associated Clean-up Activities

During the trenchless crossing of the Clearwater River, monitoring of drilling fluid volumes and pressure, as well as monitoring of sediment concentrations in the watercourse and for terrestrial frac-outs is expected to reduce the potential for a drilling mud release to affect a watercourse. If a release on-land (*i.e.*, terrestrial) were to occur clean up and reclamation measures may result in some riparian habitat alteration. To avoid or reduce effects of drilling mud release on riparian habitat, Trans Mountain will continually monitor for sediment release (*i.e.,* turbidity and TSS) throughout the crossing construction period. In the event of a release into the Clearwater River, Trans Mountain will immediately suspend drilling activities and implement measures outlined in the Drilling Mud Release Contingency Plan to reduce effects of drilling mud release into the watercourse. Any releases would be reported to DFO and BC MOE and clean up and monitoring will be carried out until water quality is returned to existing (background) conditions. Appropriate drill paths will be established and drilling mud pressures and returns monitored to reduce the risk of inadvertent releases of drilling mud during an HDD. The post-construction environmental monitoring program will identify any locations with altered drainage patterns (*e.g.,* ponded water) and remedial work will be conducted, where warranted. Results of the post-construction environmental monitoring from previous pipeline projects also indicated the effectiveness of several mitigation measures recommended for the construction and operations of the pipeline in Table B7.1.6-1.

With the implementation of mitigation and reclamation measures, the potential residual effects of a drilling mud release on riparian habitat are low to high in magnitude (depending on the volume of the release and area affected) and reversible in the short to long-term (depending on the pre-existing vegetation community) (Table B7.1.6-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – a drilling mud release on land may flow beyond the construction right-of-way.
- Duration: immediate to short-term – the event causing an alteration of riparian habitat is the accidental release of drilling mud, the period of which may be less than or equal to two days for small releases or could extend longer.
- Frequency: accidental – the release of drilling mud occurs rarely over the assessment period.
- Reversibility: short to long-term – depending upon the length of time it takes for vegetation to recolonize the area disturbed by mud (*e.g.,* if the release occurs over a small area and if only grasses are affected, they could recover within one growing season; however, if shrubs or trees are affected recovery may extend into the long-term).
- Magnitude: low to high – depending upon the location and sensitivity of the receiving environment and the volume of drilling mud released.
- Probability: low – mitigation measures will be implemented during HDD operations to prevent drilling mud release.
- Confidence: high – based on the professional experience of the assessment team.

Contamination of Riparian Habitat from Spills During Construction and Maintenance

In the event of spot spills, or a more serious fuel truck release, the adverse residual effects would, depending on the volume of the spill and the sensitivity of the receiving environment, range from low to high magnitude with potentially long lasting ramifications to riparian vegetation. However, spill contingency and clean up measures would reduce the magnitude and reversibility of the residual effects.

Spills are cleaned up immediately within the construction right-of-way during construction activities, the probability of a significant adverse residual effect is low (Table B7.1.6-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – spills resulting in the contamination of riparian habitat may extend beyond the construction right-of-way and, consequently, beyond the Fish and Fish Habitat LSA.
- Duration: immediate – the event causing contamination is a spill, the period of which is less than or equal to two days.
- Frequency: accidental – contamination from spills occurs rarely over the assessment period.
- Reversibility: short to long-term – depending upon the nature and volume of the spill as well as the level of sensitivity of the receiving environment and the pre-existing vegetation community (*e.g.,* shrubs or tress).
- Magnitude: low to high – depending on the sensitivity of the receiving environment and volume of the spill.
- Probability: low – based on established mitigation measures to prevent a spill.
- Confidence: moderate – based on the professional experience of the assessment team.

Fish and Fish Habitat Indicator – Instream Habitat

Alteration of Instream Habitat within the ZOI in the event of an Open Cut Contingency Crossing

Instream habitat at the Clearwater River may be disturbed in the event of an open cut contingency crossing. The maximum area of instream habitat that may be disturbed by construction of the proposed pipeline at the Clearwater River crossing in the event of an open cut contingency is 0.46 ha; however, the actual disturbance to instream habitat is expected to be less.

The residual effects of the Project on instream habitat are expected to be of low magnitude and reversible in the short-term for the Clearwater River crossing in North Thompson River Provincial Park. In addition, with the successful implementation of mitigation proposed the effects will be reduced to low magnitude (Table B7.1.6-2, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – alteration of instream habitat may extend beyond the Fish and Fish Habitat LSA for some activities (*e.g.,* for hydrostatic testing).
- Duration: short-term– the event causing alteration of instream habitat to the watercourse is expected to take more than two days due to the assumption that flowing water may be present at the time of construction.
- Frequency: isolated – the event causing alteration of instream habitat is confined to the construction phase.
- Reversibility: short-term – any sediments that result in deposition on the substrate of a watercourse are expected to be flushed from the system following the first annual flushing event after construction and, if any fish habitat compensation/offset measures are implemented, they should be implemented during construction and/or within the first year following construction of the watercourse crossing.
- Magnitude: low – based on the effectiveness of the proposed mitigation, the anticipated level of effects of the alteration of instream habitat and the implementation of a compensation/offset plan if serious harm to fish or any permanent alteration to, or destruction of, fish habitat is anticipated.
- Probability: high – watercourses (*i.e.,* Clearwater River) with documented fish presence will be crossed using open cut crossing methods.

- Confidence: high – based on a good understanding by the assessment team of open cut crossing methods and associated effects on instream habitat.

Alteration of Instream Habitat from Drilling Mud Release

During trenchless crossings, monitoring of drilling fluid volumes and pressure, as well as monitoring of sediment concentrations in the watercourse and on-land frac-outs are expected to help reduce the potential for a drilling mud release to affect instream habitat.

A release of drilling mud into a watercourse could affect instream habitat by increasing suspended sediments and subsequent sediment deposition; however, with the implementation of the Horizontal Directional Drilling/Trenchless Planning and Procedures Management Plan (Appendix C of the Pipeline EPP), the potential residual effects of a drilling mud release on instream habitat are considered low to high magnitude, but of low probability.

Information acquired during a trenchless feasibility assessment will be used to establish appropriate drill paths, and monitoring of drilling mud pressures and returns will be conducted to reduce the risk of an inadvertent release of drilling mud. This potential residual effect is considered reversible in the immediate to medium-term, depending on the volume of the release and flow rates of the watercourse (Table B7.1.6-2, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – drilling mud released during construction activities will be carried downstream until they disperse and/or naturally settle out within the ZOI; however, fine sediments from HDD drilling mud releases, should they occur, may carry beyond the Fish and Fish Habitat LSA.
- Duration: immediate to short-term – the event causing the alteration of instream habitat is the accidental release of drilling mud, the period of which may be less than or equal to two days (immediate) or could extend longer (short-term).
- Frequency: accidental – the release of drilling mud occurs rarely over the assessment period.
- Reversibility: immediate to medium-term – depending on the volume of release and flow rates of the watercourse.
- Magnitude: low to high – depending on the location of the release and quantity of drilling mud released.
- Probability: low – mitigation measures will be implemented during HDD operations to prevent drilling mud release.
- Confidence: high – based on the professional experience of the assessment team.

Contamination of Instream Habitat from Spills During Construction

In the event of spot spills, or a more serious fuel truck release in or near a stream, the adverse residual effects could, depending on the volume of the spill and the sensitivity of the receiving environment, be of high magnitude with potentially long lasting ramifications to the health of the watercourse. Such an event has the potential to occur during any activities in or near a watercourse. Although spill contingency and clean up measures would reduce the magnitude and reversibility of the residual effects, such an incident could be considered of high magnitude due to adverse residual effects if it were to occur in a highly sensitive environment, such as the Clearwater River.

Spills are cleaned up immediately within the construction right-of-way during construction activities, and occur even more rarely instream, the probability of a significant adverse residual effect is low (Table B7.1.6-2 point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatic RSA – spills resulting in the contamination of instream habitat may extend beyond the Footprint and the Fish and Fish Habitat LSA.
- Duration: immediate – the event causing contamination is an accidental spill during construction, the period of which is less than or equal to two days.

- Frequency: accidental – contamination from spills occurs rarely, if at all, during the assessment period.
- Reversibility: short to medium-term – depending on the nature and volume of the spill as well as the level of sensitivity of the Clearwater River to adverse residual effects resulting from contamination.
- Magnitude: low to high – depending on the sensitivity of the receiving environment and the volume of the spill.
- Probability: low – based on established mitigation measures to prevent a spill.
- Confidence: high – based on the professional experience of the assessment team.

Disturbance to Instream Habitat Due to a Potential Increase in Access During Operations

If the Traffic and Access Control Management Plan (Appendix C of the Pipeline EPP) does not completely prevent access to pipeline right-of-way during operations, increased access has the potential to alter instream habitat and this potential residual effect is considered to have a negative impact balance.

Increased foot access and off-road vehicle access (*e.g.*, recreational ATVs), as a result of pipeline development, could result in disturbances to instream habitat during the operations phase of the pipeline through increased suspended sediment or damage to the watercourse substrate.

With the application of measures outlined in the Traffic and Access Control Management Plan (Appendix C of the Pipeline EPP), the magnitude of the potential residual effect of increased access will be reduced to low (Table B7.1.6-2, point 2[d]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics LSA – the pipeline construction right-of-way may allow increased access to instream habitat.
- Duration: long-term – the event causing fish mortality or injury is increased access to watercourses which is initiated during construction and extends beyond the first year of the operations phase.
- Frequency: occasional – the events contributing to potential habitat alteration *(e.g.,* recreational off-road vehicles causing sediment events) may occur intermittently and sporadically during the operations phase.
- Reversibility: immediate to long-term – although grasses in disturbed areas can be re-established relatively quickly, the regrowth of some plants that are planted as part of the mitigation measures identified in the Traffic and Access Control Management Plan could take more than 10 years to reach their desired size.
- Magnitude: low – with the narrowed pipeline corridor running adjacent to the existing TMPL right-of-way, and the implementation of mitigation measures, the potential residual effect is considered to be low.
- Probability: low – paralleling the existing TMPL right-of-way and conditions within the Fish and Fish Habitat LSA will limit new opportunities for recreational off-road vehicle use.
- Confidence: moderate – based on the professional experience of the assessment team.

<u>Fish and Fish Habitat Indicator – Fish Mortality and Injury (Contingency Open Cut Crossing Only)</u>

Increased Fish Mortality or Injury Due to Construction Activities in the event of an Open Cut Contingency Crossing

Some construction activities may lead to an increase in fish mortality or injury (*e.g.,* trenching activities). The magnitude of this potential residual effect is considered to be low with the successful implementation of the recommended mitigation measures (Table B7.1.6-2, point 3[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Fish and Fish Habitat LSA – fish mortality or injury may result from watercourse crossing construction activities at the Clearwater River in the event of a contingency open cut.
- Duration: short-term – the event causing fish mortality or injury is construction of the contingency open cut crossing which will take more than two days but less than one year.
- Frequency: isolated – the event causing fish mortality or injury (*i.e.,* construction of the pipeline) is confined to a specific period.
- Reversibility: medium-term – loss of one or more individuals could affect population scale for several years, or until those individuals can be replaced.
- Magnitude: low – based on the implementation of mitigation measures proven to be effective.
- Probability: low– mitigation measures will be implemented to prevent fish mortality or injury.
- Confidence: high – based on the professional experience of the assessment team.

Increased Fish Mortality or Injury from Spills During Construction Activities

Spills accidentally released at watercourse crossings with fish habitat potential during construction and maintenance activities could cause behavioural or sub-lethal/lethal effects on fish within the ZOI. A spill, such as a fuel truck rollover in or near a stream, during construction could cause increased fish mortality or injury and would be considered to have a negative impact balance; however, proper spill contingency and clean up measures would reduce the magnitude and increase the reversibility of the residual effects. Depending on the volume of the spill and the sensitivity of the receiving environment, the adverse residual effects could range from low to high magnitude with potentially increased fish mortality or injury.

Since spills rarely occur within the construction right-of-way during construction activities that effect watercourses, and occur even more rarely instream, the probability of a significant adverse residual effect is low (Table B7.1.6-2 point 3[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – fish mortality or injury may result from watercourse crossing construction activities which are generally confined to the Fish and Fish Habitat LSA.
- Duration: immediate – the event causing increased fish mortality or injury is a spill, the period of which is less than or equal to two days.
- Frequency: accidental – fish mortality of injury from spills occurs rarely over the assessment period.
- Reversibility: short to long-term – depending upon the nature and volume of the spill as well as the level of sensitivity of the receiving population.
- Magnitude: low to high – depending on the sensitivity of the receiving indicators and volume of the spill.
- Probability: low – mitigation measures will be implemented to prevent fish mortality or injury.
- Confidence: high – based on the professional experience of the assessment team.

Increased Fish Mortality or Injury Due to Increased Suspended Sediment Concentrations Within the ZOI During Instream Construction in the event of an Open Cut Contingency Crossing

In the event that an open cut contingency crossing is required for the Clearwater River, an increase in fish mortality or injury due to suspended sediment during instream construction may occur. With the implementation of site-specific mitigation strategies in addition to the mitigation measures outlined in Table B7.1.6-1 and the Pipeline EPP, the likelihood of fish mortality or injury in the Clearwater River arising from suspended sediment during an open cut contingency instream construction, can be substantially reduced (Table B7.1.6-2, point 3[c]).

Suspended sediment released at watercourse crossings during instream activities could cause behavioural, sublethal (*e.g.*, irritation of gill tissue) or lethal (*e.g.*, suffocation of developing embryos) effects on fish within the ZOI (Anderson *et al.* 1996, Newcombe and MacDonald 1991). There is a level of risk to aquatic resources as a result of high levels of sediment discharge caused by instream construction activities. The Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2002) are often used to ensure aquatic resources are protected during instream activities. These guidelines indicate that a biologically important average increase in TSS concentration over a short-term period (*i.e.*, 24 h) is 25 mg/L above the background level (CCME 2002). DFO (2000) has identified risk levels to protect aquatic resources. The risk levels are determined based on the relationship between increasing suspended sediment concentrations and the level of risk that increasing sediment concentrations can have on fish and fish habitat. DFO (2000) indicates that concentrations < 25 mg/L, 25-100 mg/L, 100-200 mg/L, 200-400 mg/L and > 400 mg/L have very low, low, moderate, high and unacceptable risk, respectively. Additional background on these risk levels is discussed in Birtwell (1999).

Although elevated suspended sediment concentrations may result from instream construction, pulses of suspended solids are generally expected to settle out of the water column within the ZOI in a timeframe measuring from minutes to a few hours.

With the implementation of mitigation measures outlined in Table B7.1.6-1 and the Pipeline EPP, the likelihood of fish mortality or injury in the Clearwater River arising from suspended sediment during instream construction is low (Table B7.1.6-2, point 3[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Fish and Fish Habitat LSA – Project activities causing an increase in suspended sediment will be limited to the Fish and Fish Habitat LSA associated with the Clearwater River.
- Duration: short-term – the event causing fish mortality or injury due to suspended sediment is instream construction, the period of which is likely to be several days due to the assumption that flowing water will be present at time of construction.
- Frequency: isolated – the event causing fish mortality or injury is confined to a specific period.
- Reversibility: medium-term – loss of one or more individuals could affect population scale for several years, or until those individuals can be replaced.
- Magnitude: low to medium – based on the implementation of mitigation measures proven to be effective, and regulatory authorizations and, where warranted, the implementation of fish habitat compensation/offset.
- Probability: low – mitigation measures will be implemented to prevent fish mortality or injury and are anticipated to be effective.
- Confidence: high – based on available research literature and the professional experience of the assessment team.

Increased Fish Mortality or Injury Due to Suspended Sediment from Drilling Mud Release

Suspended sediment resulting from the release of drilling mud at watercourse crossings with fish habitat potential could cause behavioural or sublethal/lethal effects on fish within the ZOI. The effects of suspended sediment on fish are discussed in greater detail in the sub-section *Increased Fish Mortality or Injury Due to Suspended Sediment Concentrations Within the ZOI During Instream Construction in the event of an Open Cut Contingency Crossing.*

During trenchless crossings, monitoring of drilling fluid volumes and pressure, as well as monitoring of sediment concentrations in the watercourse and on-land frac-outs are expected to help reduce the potential for a drilling mud release to affect instream habitat.

A release of drilling mud into a watercourse could affect instream habitat by increasing suspended sediments and sediment deposition. Increased sediment in the water column can increase the probability of fish mortality; however with the implementation of the Horizontal Directional Drilling/Trenchless Planning and Procedures Management Plan (Appendix C of the Pipeline EPP), the potential residual effects of a drilling mud release on fish mortality or injury are considered low to high but of low probability.

Information acquired during an HDD feasibility assessment will be used to establish appropriate drill paths, and monitoring of drilling mud pressures and returns will be conducted to reduce the risk of an inadvertent release of drilling mud. This residual effect is considered reversible in the immediate to medium-term, depending on the volume of the release and flow rates of Clearwater River (immediate [*i.e.,* a small release with high flow resulting in no loss of individuals] to medium-term [*i.e.,* a large release with low flow resulting in loss of individuals which could affect population scale for several years]) reversibility. (Table B7.1.6-2, point [3d]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – Drilling mud released during construction activities will be carried downstream until they disperse and/or naturally settle out within the ZOI; however, fine sediments from HDD drilling mud releases, should they occur, may carry beyond the Fish and Fish Habitat LSA.
- Duration: immediate – the event causing fish mortality or injury is the accidental release of drilling mud, the period of which is less than or equal to two days.
- Frequency: accidental – the event causing fish mortality or injury is the accidental release of drilling mud which occurs rarely over the assessment period.
- Reversibility: immediate to medium-term – depending upon the volume of release and flow rates of Clearwater River, increased fish mortality or injury may be of immediate (*i.e.,* a small release with high flow resulting in no loss of individuals) to medium-term (*i.e.,* a large release with low flow resulting in loss of individuals which could affect population scale for several years) reversibility.
- Magnitude: low to high – depending on the location of the release and quantity of drilling mud released, increased fish mortality or injury may be of low (*i.e.,* behavioural effects) to high (*i.e.,* sublethal/lethal effects) magnitude.
- Probability: low – mitigation measures will be implemented during HDD operations to prevent drilling mud release.
- Confidence: high – based on the professional experience of the assessment team.

Increased Fish Mortality or Injury Due to a Potential Increase in Access During Operations

If the Traffic and Access Control Management Plan (Appendix C of the Pipeline EPP) does not prevent access to the pipeline right-of-way during the operations phase, increased access has the potential to cause increased fish mortality or injury and this potential residual effect is considered to have a negative impact balance. Trees and/or shrubs will be planted where new access is created in an attempt to control access during operations (Appendix C of the Pipeline EPP).

Increased access may contribute to angler overharvest, which has been reported as one of the primary sources of fisheries declines in western Canada (Post *et al.* 2002). Restrictive harvest legislation is implemented in BC to protect sensitive species and minimize the potential for overharvest by anglers (BC MFLNRO 2013a).

Trees and shrubs will be planted as part of the revegetation program at the Clearwater River crossing which will prevent increased access. Post-construction environmental monitoring will evaluate the effectiveness of human access control measures. With the application of measures outlined in the Traffic and Access Control Management Plan, the potential residual effect of increased access will be reduced to low magnitude (Table B7.1.6-2, point 3[e]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Fish and Fish Habitat LSA – increased access is limited to the instream habitat within the Fish and Fish Habitat LSA at the Clearwater River crossing in North Thompson River Provincial Park.

- Duration: long-term – the event causing fish mortality or injury is increased access at the Clearwater River crossing which is initiated during construction and extends beyond the first year of the operations phase. Access may be limited when riparian vegetation is re-established. The time for this may vary and depending on the pre-existing vegetative community (*e.g.,* shrubs or trees).

- Frequency: occasional – the events contributing to fish mortality or injury (*e.g.,* recreational off-road vehicles causing sediment events and increased angling) may occur intermittently and sporadically during the operations phase of the pipeline.

- Reversibility: short to long-term – the regrowth of some plants that are planted as part of the mitigation measures identified in the Traffic and Access Management Plan could take more than 10 years to reach their desired size.

- Magnitude: low – with the utilization of existing access to the extent feasible and successful implementation of mitigation measures, the potential residual effect is considered low.

- Probability: low – paralleling existing rights-of-way and conditions within the Fish and Fish Habitat LSA will limit new opportunities for recreational off-road vehicle use.

- Confidence: moderate – based on the professional experience of the assessment team.

Effects to Fish Species of Concern due to a Trenchless Crossing

Several fish species of concern (*i.e.*, federally and/or provincially listed or a fish and fish habitat indicator species) are known to occur in the Clearwater River watershed Aquatics RSA. COSEWIC and/or provincially listed species within the Aquatics RSA include, bull trout and coho salmon. Fish and fish habitat indicator species within the Aquatics RSA include, bull trout, coho salmon, Chinook salmon and rainbow trout. Bull trout are provincially Blue-listed (BC CDC 2014) as well as listed as a species of Special Concern by COSEWIC (COSEWIC 2014). Coho salmon (*i.e.,* Interior Fraser River population) have been identified by COSEWIC as Endangered (COSEWIC 2014). Chinook salmon and rainbow trout are neither provincially nor federally listed.

A trenchless crossing method has been selected at the Clearwater River crossing to reduce Project-specific effects in consideration of presence and use by fish species of concern in Clearwater River watershed Aquatics RSA.

Bull trout are piscivores, distributed in cool waters throughout the interior of BC and are absent from many shorter coastal rivers (McPhail 2007). Bull trout, in particular, are susceptible to degraded water and habitat conditions from land disturbance (*i.e.,* roads, oil and gas developments, forest harvesting, mining developments) (ASRD 2012, Brewin *et al*. 2001, Hammond 2004). Hybridization and competitive interactions with other species (*e.g.,* non-native brook) can also cause declines in bull trout populations (McPhail 2007). Contamination, loss or alteration of instream habitat is the greatest contributor of effects to this indicator.

Coho salmon have an extensive distribution within BC. Coho salmon are susceptible to natural and anthropogenic habitat degradation (COSEWIC 2002a). However, according to TEK participants, coho are more durable than other salmon varieties and are best at adapting to changing conditions. Contamination, loss or alteration of instream habitat and riparian habitat are both equal contributors of effects to this indicator.

Chinook salmon are the largest anadromous species to complete life-history events (*i.e.,* spawning and rearing) in the Fraser River mainstem and associated tributaries. Chinook may migrate as far as 600 km inland (McPhail 2007). Chinook salmon are susceptible to direct and indirect habitat loss (COSEWIC 2006) which makes contamination, loss or alteration of instream habitat and riparian habitat both equal contributors of effects to this indicator.

Rainbow trout are a cool water salmonid species with widespread distribution throughout BC. Rainbow trout have not been considered a conservation concern (McPhail 2007); however, the species is representative of overall effects to fish and fish habitat. Rainbow trout are migratory in nature and will swim to new areas should habitat conditions change (Natural Resources Conservation Service 2000); however, contamination, loss or alteration of instream habitat would still be the major contributor to effects on this species.

The potential residual effect of the construction of the pipeline on fish species of concern in the Clearwater River in North Thompson River Provincial Park is considered to be reversible in the short-term and of low magnitude (Table B7.1.6-2, point 3[f]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – fish species of concern may be affected by an increase in suspended sediment concentrations downstream of watercourse crossings or habitat alteration in the event of a drilling mud release.
- Duration: immediate to short-term – the event causing fish species of concern to be affected is an accidental drilling mud release.
- Frequency: accidental – the event causing fish species of concern to be affected (*e.g.,* drilling mud release) rarely occurs over the assessment period.
- Reversibility: short-term – the potential residual effects of pipeline construction on fish species of concern is limited to the construction phase.
- Magnitude: low – the implementation of the proposed mitigation and site-specific reclamation measures is expected to effectively reduce the potential effects on fish species of concern.
- Probability: low – the proposed trenchless crossing method at Clearwater River crossing and implementation of the mitigation outlined in Table B7.1.6-1 should reduce the probability of effects to fish species of concern.
- Confidence: moderate – based on the professional experience of the assessment team.

Effects to Fish Species of Concern in the event of an Open Cut Contingency Crossing

Several fish species of concern (*i.e.*, federally and/or provincially listed or a fish and fish habitat indicator species) are known to occur in the Clearwater River watershed See *Effects to Fish Species of Concern due to a Trenchless Crossing* for fish and fish habitat indicator species information.

In the event of an open cut contingency crossing at the Clearwater River crossing, the application of appropriate mitigation will reduce Project-specific effects in consideration of presence and use by fish species of concern in the Clearwater River watershed Aquatics RSA.

The potential residual effect of the construction of the pipeline on fish species of concern in the Clearwater River in North Thompson River Provincial Park is considered to be reversible in the short-term and of low to medium magnitude (Table B7.1.6-2, point 3[g]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – fish species of concern may be affected by an increase in suspended sediment concentrations downstream of watercourse crossings or habitat alteration from an open cut contingency crossing.
- Duration: short-term – the event causing fish species of concern to be affected is instream construction of the pipeline and associated alterations to riparian habitat.
- Frequency: isolated – the event causing fish species of concern to be affected (*e.g.,* watercourse crossing construction) is confined to a specific period.
- Reversibility: short-term – the potential residual effects of pipeline construction on fish species of concern is limited to the construction phase and a short time thereafter until habitat conditions are restored to their original state.

- Magnitude: low to medium – the implementation of the proposed mitigation, site-specific reclamation measures and regulatory authorizations is expected to effectively reduce the potential effects on fish species of concern.
- Probability: high – in the event construction timing is outside of the least risk biological window at the Clearwater River crossing.
- Confidence: moderate – based on the professional experience of the assessment team.

7.1.6.3 Summary

As identified in Table B.7.1.6-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on fish and fish habitat indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects on the conservational values of North Thompson River Provincial Park related to fish and fish habitat will be not significant.

7.1.7 Wetlands

There are no wetlands crossed by the narrowed pipeline corridor in North Thompson River Provincial Park and, consequently, an effects assessment was not conducted as there are no wetland interactions with the wetland indicator on the construction and operation of the narrowed pipeline corridor.

7.1.8 Vegetation

This subsection describes the potential Project effects on vegetation in North Thompson River Provincial Park. The Vegetation LSA generally consists of a 300 m wide band from the centre of the proposed pipeline corridor (*i.e.*, 150 m on both sides of the centre of the proposed pipeline corridor); shown in Figure 6.2.2-4 of the Introduction to the Draft Stage 2 Detailed Proposal. The Vegetation RSA consists of a 2 km wide band generally from the centre of the proposed pipeline corridor centre and facilities (*i.e.*, 1,000 m on both sides of the centre of the proposed pipeline corridor); shown in Figure 6.2.2-1 of the Introduction to the Draft Stage 2 Detailed Proposal.

All vegetation indicators were considered in this evaluation and all of them were determined to interact with pipeline construction and operations in North Thompson River Provincial Park.

7.1.8.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline in North Thompson River Provincial Park on vegetation indicators are listed in Table B7.1.8-1.

A summary of mitigation measures is provided in Table B7.1.8-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines.

TABLE B7.1.8-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VEGETATION FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP reference[2]]	Potential Residual Effect(s)
1. Vegetation Indicator – Vegetation Communities of Concern			
1.1 Loss or alteration of native vegetation	Footprint	• Confine all pre-clearing/mowing and general clearing activities within the staked/flagged construction right-of-way boundaries. Adhere to clearing/mowing restrictions associated with the Clearwater River, sensitive environmental features and buffer areas (at the Clearwater River crossing). • Maintain low vegetation or vegetated ground mat within the riparian buffer zone of the Clearwater River, to the extent practical, by clearing only trees, walking-down low vegetation so low-lying vegetation remains intact. Limit grubbing of cleared/mowed trees/shrubs only to the trench line and work side area needed for the vehicle crossing to protect riparian areas [Section 8.1]. • Use hand clearing methods where directed by Trans Mountain's Lead Environmental Inspector and Inspector(s) to avoid or reduce disturbance to the ground surface on sensitive terrain [Section 8.1]. • Restrict root grubbing to the trench line and restrict root grubbing in wet areas to avoid creation of bog holes, minimize surface disturbance and encourage re-sprouting/natural regeneration of deciduous trees and shrubs. See additional clearing and grubbing measures in Section 8.1 of the Pipeline EPP. • Within the vicinity of the construction right-of-way, collect dormant woody plant material (deciduous stakes/brush) and select suitably sized transplants (small conifer/deciduous trees/shrubs) from a suitable donor site following approval from the applicable land manager [Section 7.0 of Appendix C]. • Use a grass cover crop and/or native grass seed mix that has been developed for use at riparian areas to support the establishment of installed and naturally regenerating native woody plant material and plants and to provide erosion protection in the short-term [Section 7.0 of Appendix C]. • Seed disturbed lands with land uses that support native plant communities with native grass mixtures and rates, respectively, as identified in the Reclamation Management Plan as per results of the vegetation field surveys [Appendix C, Section 8.6]. • For native seed, the highest seed grade available will be obtained. Do not accept seed lots that contain any Prohibited Noxious or Noxious weeds as identified in the Certificate of Analysis. Retain the Certificates of Analysis obtained for native seed for future documentation. The Certificates of Analysis will be presented to BC Parks upon request [Section 8.6]. • Minimize foot traffic on newly seeded areas until grass establishment has taken place. Vehicle traffic will be avoided on seeded areas until the sod is re-established [Section 8.6, Section 10.0 of Appendix C]. • Plant native shrub/tree species, where warranted, depending on the site-specific objectives [Section 14.0 of Appendix C]. • Remove problem vegetation (*i.e.*, weeds or invasive species) when adjacent to or crossing the Clearwater River and replace it with compatible, low-growing plant species that will out-compete problem vegetation [Section 14.0 of Appendix C]. • Refer to the Problem Vegetation Management Plan [Sections 14 of Appendix C] for management of non-native or invasive species. • See potential effect 3.1 of this table for mitigation regarding non-native or invasive species during construction and operations. • Monitor the effectiveness of revegetation efforts during the PCEM of the construction right-of-way. Conduct additional remedial work, where warranted.	• Alteration of the composition of up to 5.8 ha of vegetation (of which, 34 m is the North Thompson River).

TABLE B7.1.8-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP reference[2]]	Potential Residual Effect(s)
1.2 Loss or alteration of rare ecological communities	LSA	• Additional late-season vegetation and rare plant surveys will be conducted in August 2014 within North Thompson River Provincial Park. • See potential effect 1.1 of this table for mitigation regarding alteration of native vegetation. • If previously unidentified occurrences of vegetation communities of concern are found during supplemental rare plant surveys, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan [Section 6.0 of Appendix C]. • Site-specific mitigation will include avoidance, narrowing the construction right-of-way, fencing or protecting [Section 6.0 of Appendix C, Appendix J]. • Flag or fence-off resource-specific environmental features (*e.g.,* rare plant species, rare ecological communities) prior to commencing construction in the vicinity of the resource site. See additional mitigation in Section 6.0 of the Pipeline EPP. • Implement the resource-specific mitigation measures associated with vascular and non-vascular plant species of concern as well as rare and unique plant communities on or adjacent to the staked construction boundaries as outlined in the environmental resource-specific mitigation tables for rare plant/rare ecological communities provided in Table 4 of the Index Sheets and as shown in the accompanying Environmental Alignment Sheets [Section 6.0]. • Suspend activity if previously unidentified rare ecological communities are found on or adjacent to the construction right-of-way. Implement the Rare Ecological Communities or Rare Plant or Species Discovery Contingency Plan [Section 7.0 of Appendix B]. • Fence off the area where the rare plant community is traversed [Narrow Down Fencing Drawing in Appendix R] [Section 6.0 of Appendix C]. • Water down construction sites and access roads, when warranted, to reduce or avoid the potential for dust emissions. Increase the frequency of watering roads and sites during periods of high risk (*e.g.*, high winds). Implement additional dust abatement measures (*e.g.*, covering root zone material windrows, installing sediment fences, applying a tackifier) will be implemented, when warranted, during clearing and construction activities. See additional measures to control dust in Section 8.2 of the Pipeline EPP. • Place erosion control blankets or coir matting [Erosion Control Matting Drawing in Appendix R], woody slash or log diversions [Rollback Drawing in Appendix R] along the right-of-way on erodible soils or wind exposed sites to provide micro-habitat and support plant establishment [Brush Wind Barrier Drawing and Staked Logs for Erosion Control Drawing in Appendix R] [Section 7.0 of Appendix C]. • Recontour the landscape to pre-construction conditions [Section 7.0 of Appendix C]. • Restrict the application of herbicide within 30 m of known rare plant populations or rare ecological communities. Spot spraying, wicking, mowing or hand-picking are acceptable weed control measures in proximity to rare plants, rare lichens and vegetation communities of concern [Section 7.0]. • Monitor the effectiveness of revegetation efforts during the post-construction environmental monitoring of the construction rights-of-way. Conduct additional remedial work, where warranted.	• Some disturbance or alteration of a rare ecological community, if avoidance is not practical and mitigation measures do not completely protect a site. • If rare ecological communities are located adjacent to the construction right-of-way, they may be indirectly affected by changes in hydrology or light levels.

TABLE B7.1.8-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP reference[2]]	Potential Residual Effect(s)
2. Vegetation Indicator – Plant and Lichen Species of Concern			
2.1 Loss or alteration of rare plant and/or lichen occurrences	LSA	• Additional late-season rare plant surveys will be conducted in August 2014 in North Thompson River Provincial Park. • See potential effect 1.3 of this table for mitigation applicable to the loss or alteration of rare ecological communities. • Flag or fence-off resource-specific environmental features (*e.g.*, rare plant species, rare ecological communities) prior to commencing construction in the vicinity of the resource site See additional measures in Section 6.0 of the Pipeline EPP. • Apply only water or non-toxic and non-persistent chemical products as approved to access roads for dust control at park locations or sensitive areas including agricultural crop production areas, especially berries [Section 9.0]. • Water down construction sites and access roads, when warranted, to reduce or avoid the potential for dust emissions. Increase the frequency of watering roads and sites during periods of high risk (*e.g.*, high winds). Implement additional dust abatement measures (*e.g.*, covering root zone material windrows, installing sediment fences, applying a tackifier) will be implemented, when warranted, during clearing and construction activities. See additional measures to control dust in Section 8.2 of the Pipeline EPP. • Recontour the landscape to pre-construction conditions [Section 7.0 of Appendix C]. • Restrict general application of herbicide within 30 m of rare plant populations or rare ecological communities. Spot spraying, wicking, mowing or hand-picking are acceptable measures for weed control in these areas [Section 7.0 of Appendix C]. • Monitor the effectiveness of revegetation efforts during the post-construction environmental monitoring of the construction rights-of-way. Conduct additional remedial work, where warranted.	• Some disturbance or alteration of a rare plant occurrence, if avoidance is not practical and mitigation measures do not completely protect a site. • Some disturbance or alteration of a rare lichen occurrence, if avoidance is not practical and mitigation measures do not completely protect a site. • If rare plant or lichen sub-populations are located adjacent to the construction right-of-way they may be affected by changes in dust, hydrology or light levels. • If vegetation species at risk sub-populations are located adjacent to the construction right-of-way they may be affected by changes in dust, hydrology or light levels.
3. Vegetation Indicator – Presence of Infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern			
3.1 Weed introduction and spread	RSA	• Conduct a pre-construction weed survey and record problem vegetation (designated weeds) infestations on and immediately adjacent to the construction right-of-way [Section 6.0] [Section 14.0 of Appendix C]. • Implement weed management in consultation with BC Parks (*i.e.*, using proper application of chemical, mechanical or manual measures, or a combination of all) at locations identified within the pre-construction weed survey to a level that is consistent with weed management observed adjacent to the eventual construction right-of-way to reduce the potential for weed infestations following construction [Section 6.0]. Also refer to the Weed and Vegetation Management Plan [Section 14.0 of Appendix C]. • Ensure equipment arrives at all construction sites clean and free of soil or vegetative debris. Do not allow any equipment arriving in a dirty condition on site until it has been cleaned [Section 7.0]. • Power wash and misting stations will be established, where required, to clean equipment used during clearing and root zone material handling activities [Appendix F]. In addition, shovel and compressed air cleaning stations for root zone material handling equipment will be established at selected locations to prevent the spread of weeds [Appendix J] [Section 5.2]. • Restrict all vehicular traffic to the approved and staked construction right-of-way, workspace and access roads [Section 6.0]. • Monitor the root zone material and other soil piles for weed growth frequently during the growing season. Direct the contractor when warranted to take proactive measures to control weed growth [Section 7.0]. • Consider placing mats (*i.e.*, construction mats or swamp mats) over infested areas to reduce construction equipment transporting weed or plant material. Where mats are used, ensure they are free of soil, vegetation and debris prior to removing from the site [Section 7.0]. • Consider salvaging root zone material from the full construction right-of-way during non-frozen conditions if localized weed infestations are encountered, as outlined in the Weed and Vegetation Management Plan [Section 7.0] [Section 14.0 of Appendix C].	• Weed introduction and spread.

TABLE B7.1.8-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP reference[2]]	Potential Residual Effect(s)
3.1 Weed introduction and spread (cont'd)	See above	• Clean equipment (*i.e.*, shovel and sweep, pressurized water or compressed air) involved in root zone material handling at weed-infested sites prior to leaving the location unless full right-of-way root zone material salvage has been conducted. Clean equipment involved in root zone material handling at weed-infested sites prior to leaving the location [Section 7.0]. • Use only Certified Canada No. 1 or the best available agronomic seed. For native seed, the highest seed grade available will be obtained. Do not accept seed lots that contain any Prohibited Noxious or Noxious weeds as identified in the Certificate of Analysis. Retain the Certificates of Analysis obtained for both agronomic and native seed for future documentation. The Certificates of Analysis will be presented to BC Parks upon request [Section 8.6]. • Limit vehicle travel through problem vegetation infested areas [Section 14.0 of Appendix C]. • The Weed and Vegetation Management Plan consists of vegetation management measures to be implemented in the short-term, during the pre-construction, construction and PCEM phases of Project construction and the long-term, during the regular operations and maintenance phase of the Project. Vegetation management measures to be implemented during both short-term and long-term periods in consultation with BC Parks [Section 14.0 of Appendix C]. • The use of herbicides for problem vegetation management along the construction right-of-way during construction and operations within BC will be conducted in accordance with the Integrated Pest Management Regulation of BC as part of the BC *Integrated Pest Management Act* and in consultation with BC Parks [Section 14.0 of Appendix C]. • Monitor the effectiveness of revegetation efforts during the post-construction environmental monitoring of the construction rights-of-way. Conduct additional remedial work, where warranted. • During regular maintenance and operations activities, incidental ground inspections for problem vegetation along the construction right-of-way may be conducted to determine the extent (percent cover, composition, distribution, location of infestations) of problem vegetation (*i.e.*, presence of mature brush and trees, and weeds). Areas of new infestations, recommended treatment sites and BC Parks concerns will also be identified and documented during monitoring. To assist monitoring efforts, the baseline data collected during the pre-construction weed survey and the results of the PCEM Program will assist in establishing thresholds and determining if objectives of the Weed and Vegetation Management Plan are being met [Section 14.0 of Appendix C].	• See above

Notes: 1 LSA = Vegetation LSA; RSA = Vegetation RSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of the Draft Stage 2 Detailed Proposal).

7.1.8.2 Significance Evaluation of Potential Residual Effects

Table B7.1.8-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in North Thompson River Provincial Park on vegetation. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE B7.1.8-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VEGETATION FOR NORTH THOMPSON RIVER PROVINCIAL PARK

				Temporal Context					
Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance[2]
1. Vegetation Indicator – Vegetation Communities of Concern									
1(a) Alteration of the composition of up to 5.8 ha of vegetation.	Negative	Footprint	Short-term	Periodic	Medium to long-term	Medium	High	High	Not significant
1(b) Some disturbance or alteration of a rare ecological community, if avoidance is not practical and mitigation measures do not completely protect a site.	Negative	Footprint	Short-term	Periodic	Medium to long-term	Medium	High	Moderate	Not significant
1(c) If rare ecological communities are located adjacent to the construction right-of-way they may be indirectly affected by changes in hydrology or light levels.	Negative	LSA	Short-term	Periodic	Medium to long-term	Low	High	Moderate	Not significant
2 Vegetation Indicator – Plant and Lichen Species of Concern									
2(a) Some disturbance or alteration of a rare plant occurrence, if avoidance is not practical and mitigation measures do not completely protect a site.	Negative	Footprint	Short-term	Periodic	Medium to long-term	Medium	High	High	Not significant
2(b) Some disturbance or alteration of a rare lichen occurrence, if avoidance is not practical and mitigation measures do not completely protect a site.	Negative	Footprint	Short-term	Periodic	Short to medium-term	Medium	High	High	Not significant
2(c) If rare plant or lichen sub-populations are located adjacent to the construction right-of-way, they may be affected by changes in dust, hydrology or light levels.	Negative	LSA	Short-term	Periodic	Short to long-term	Low	High	High	Not significant
2(d) If vegetation species at risk sub-populations are located adjacent to the construction right-of-way they may be affected by changes in dust, hydrology or light levels.	Negative	LSA	Short-term	Periodic	Medium to long-term	Medium	Low	High	Not significant
3. Vegetation Indicator – Presence of infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern									
3(a) Weed introduction and spread.	Negative	RSA	Short-term	Periodic	Short to medium-term	Low to medium	High	High	Not significant

Notes: 1 LSA = Vegetation LSA; RSA = Vegetation RSA.
2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Vegetation Indicator – Vegetation Communities of Concern

Alteration of Native Vegetation

The Project parallels existing disturbance for its entire length within North Thompson River Provincial Park. The park is in close proximity of the District of Clearwater, BC, but the degree of anthropogenic disturbance in the Vegetation RSA is generally low within the boundaries of North Thompson River Provincial Park.

The narrowed pipeline corridor through North Thompson River Provincial Park was routed to parallel the existing TMPL route. If an HDD is successful, native vegetation in the northern extension of the park is not expected to be disturbed or altered, as the proposed entry and exit points are outside of the park boundaries. Up to approximately 5.8 ha of native vegetation may be disturbed or altered on the Footprint within the park boundaries during construction and operations of the proposed pipeline. It is recognized that a small portion (34 m) of this total consists of the Clearwater River, however this amount is included in the total because aquatic and riparian vegetation species may occur within this segment. The alteration of native vegetation is considered to have a negative impact balance.

Disturbed areas in parks and protected areas will be seeded with the appropriate native seed mix. Cover crops will be used for initial soil stabilization and weed control. Although areas disturbed during construction and periodic maintenance activities will revegetate with the appropriate native species, species composition in the disturbed Footprint will be altered. Clearing of the right-of-way and temporary workspace and the maintenance of the right-of-way will result in the perpetuation of early seral vegetation. The extent of altered vegetation communities will be limited by the implementation of mitigation measures outlined in Table B7.1.8-1 and in the Pipeline EPP and reclamation measures will speed the recovery.

No locally or regionally adopted threshold or standard exists against which the incremental change in vegetation composition can be assessed. This residual effect is limited to the Footprint, reversible in the medium to long-term and of medium magnitude (Table B7.1.8-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – effects of pipeline construction and operations on the alteration of native vegetation is confined to the construction right-of-way within North Thompson River Provincial Park.

- Duration: short-term – the events contributing to the alteration of native vegetation are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation management), the latter of which are limited to any one year during the operations phase.

- Frequency: periodic – the events resulting alteration of native vegetation (*i.e.*, pipeline construction and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.

- Reversibility: medium to long-term – depending upon the associated land use and the growth time required for species in each affected area (*e.g.,* forb versus tree), changes to native vegetation community composition are considered reversible in the medium to long-term. The effects of the proposed pipeline on forb and graminoid species (*e.g.,* grasses, bunchberry) is expected to be reversible in the medium-term, whereas the effects on tree species (*e.g.,* Douglas-fir and lodgepole pine) are expected to be reversible in the long-term (more than 10 years) because the full right-of-way will be maintained free of higher growing vegetation until abandonment. Therefore, the overall alteration of the composition of vegetation along the Footprint will persist in the medium to long-term.

- Magnitude: medium – the narrowed pipeline corridor is located adjacent to existing disturbances for its entire length within the park boundaries and the construction of the pipeline will result in the clearing of approximately 5.8 ha of vegetation on the Footprint, which is considered to be within environmental standards given that best practices and provincial guidelines are being followed. The secondary role of the park is to conserve what BC MOE calls a relatively small but relatively important example of the IDFmw2 subzone/variant which is underrepresented in the protected area system (1.8% of the provincial protected representation of this subzone/variant [BC MOE 2003]). While permanent loss of native vegetation is not anticipated to result from either the construction or operations of the proposed pipeline, returning the Footprint to an equivalent land capability during the abandonment phase could take years, as discussed under reversibility. The indirect effects of Project construction and maintenance due to edge effects such as changes in light and moisture will be of low magnitude since they will not result in the loss of vegetation but only a localized change in vegetation community composition.

- Probability: high – the Footprint crosses native vegetation.

- Confidence: high – based on past pipeline projects and the professional experience of the assessment team.

Some Disturbance or Alteration of a Rare Ecological Community, if Avoidance is Not Practical and Mitigation Measures Do Not Completely Protect a Site

Rare plant surveys were conducted during the growing season in 2013 on small portions of Footprint in the northern portion of North Thompson River Provincial Park and in July 2014. During the 2013 and 2014 rare plant surveys, there were no occurrences of BC CDC-listed rare ecological communities observed. Supplemental ground-based rare plant surveys are planned to be conducted in August 2014. In the event that rare ecological communities are identified in the Footprint during supplemental surveys, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan (Section 5.0 of Appendix C of the Pipeline EPP).

Mitigation measures for rare ecological communities generally fall into categories of avoidance, (*e.g.,* realignment, change of work side, narrowing), reducing disturbance (*e.g.,* narrowing, adjusting workspaces, ramping/matting over) and alternative construction/reclamation techniques (*e.g.,* salvaging seed or sod, plant propagation, transplanting component species, separate root zone material salvage, delayed clearing, access management) (see Appendix C of the Pipeline EPP). These proposed mitigation measures have been used previously on other major pipeline construction projects with good success. Some examples are provided below.

Narrowing down the right-of-way for sensitive communities was successfully conducted during construction at several locations on a pipeline project in the Central Alberta area (Alliance 2000a,b). At the South Saskatchewan River, shrubby vegetation important for wildlife was temporarily covered with geotextile pads during construction (Alliance 2000c). In addition, sensitive grasslands with thorny buffaloberry, considered important for wildlife, was ramped over during construction. The thorny buffaloberry was cut low to the ground and the root mat preserved (Alliance 2000c). Covering a rare ecological community with geotextile or ramping over are measures that are expected to have higher success during construction in frozen conditions when plants are dormant and snow can be used to protect the vegetation.

Learnings from the TMX Anchor Loop Project (TERA 2013b) pertinent to rare ecological communities include the following.

- Natural regeneration is an effective means of revegetation in rare ecological communities where construction disturbance is limited to the trench area and where accurate separation and replacement of trench materials is achieved.

Mitigation is developed with a number of factors taken into account that include, however, are not limited to:

- component species;
- community size;
- rarity;
- construction timing;
- location of the community with respect to the proposed right-of-way;
- primary mode of component species reproduction;
- habitat and proximity of available habitat; and
- past mitigation success (of the community or similar communities).

Based on the assessment of the rare ecological communities that may be encountered during construction, the mitigation measures described above are considered to be appropriate and applicable to the Project. If mitigation measures do not completely protect the site, a disturbance or alteration of a portion of the community may occur and is considered to have a negative impact balance. By basing mitigation on community ranking and abundance, in addition to its location on the construction right-of-way and the community type, any alteration of the local community, particularly S1 communities, will be reduced to a level such that the local community is not placed at risk. Consequently, the residual effect of pipeline construction on rare ecological communities and unique communities are of medium magnitude (Table B7.1.8-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – the potential disturbance or alteration of a rare ecological community is confined to the construction right-of-way.

- Duration: short-term – the events resulting in potential disturbance or alteration of a rare ecological community are construction of the pipeline or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.

- Frequency: periodic – the events resulting in potential disturbance or alteration of a rare ecological community (*i.e.*, construction of the pipeline and maintenance activities) occur intermittently, however, repeatedly during the operations phase of the Project.

- Reversibility: medium to long-term – depending on the component species (*e.g.,* western redcedar and amabilis fir [amabilis fir - western redcedar/devil's club community] will take years to grow to mature trees, compared to common cattails [common cattail marsh] or beaked sedge [beaked sedge marsh] which can recolonize or re-establish in one growing season if the seed bank and habitat is available).

- Magnitude: medium – the potential disturbance or alteration of a rare ecological community is of medium magnitude since the effect is still within environmental standards given that best practices, objectives and provincial guidelines are being followed. Returning the Footprint to an equivalent land capability and regrowth of a rare ecological community could take years, as discussed under reversibility.

- Probability: high – there were no rare ecological communities identified within the narrowed pipeline corridor during the vegetation surveys in 2014 that may be traversed by the Footprint. However, there is potential for rare ecological communities to be identified within the Footprint during surveys in August 2014.

- Confidence: moderate – confidence is high based on past pipeline projects, the professional experience of the assessment team and the results of post-construction environmental monitoring. However, very few portions of the park have been surveyed. Confidence will increase following the August 2014 supplemental survey.

Indirect Effects to Rare Ecological Communities

With proper implementation of the industry-accepted standard mitigation practices that are proposed, disruption of surface flow patterns and light levels following construction or maintenance activities are expected to be minor along the narrowed pipeline corridor. However, construction and maintenance activities (*e.g.*, integrity digs) may contribute to some localized alteration of light levels and natural surface drainage patterns until trench settlement is complete and seeded and/or naturally regenerated vegetation has matured. The impact balance of this potential residual effect is considered negative since it could alter the moisture regime and light levels.

Indirect alteration of rare ecological communities adjacent to the Footprint may occur due to soil erosion. Some rare ecological communities may be more susceptible to erosion than others. Since the areas with greatest erosion risk will be seeded with native species or an annual cover crop (or otherwise stabilized with erosion control blankets, coir matting, or woody slash, [Section 6.0 of Appendix C and Section 8.6.3 of the Pipeline EPP]), the indirect alteration of native vegetation as a result of erosion will not measurably contribute to the overall effect of pipeline construction on the alteration of rare ecological communities.

Increased distance of light penetration due to clearing will result in an indirect alteration of native vegetation (*i.e.*, the native species making up the rare ecological community). For example, some forested communities are characterized by low light penetration due to dense tree canopy. If part of the community is cleared, the light penetrating to the understory will change the species composition along the edges of the community where clearing occurred. However, this effect will not substantially contribute to the alteration of native vegetation beyond the effects detailed in relation to the clearing of native vegetation. Additionally, during the course of reclamation, as revegetation progresses, light penetration will generally decrease over time.

Given that indirect effects are, in part, caused by disturbance to vegetation structure associated with clearing activities, allowing disturbed areas to naturally revegetate may not alleviate indirect effects where vegetation management is conducted or long-term persistence of the disturbance exists. Consequently, indirect effects to vegetation are expected to persist until the pre-existing vegetation composition and structure is restored for the Footprint.

During the construction and operations of the pipeline, there will be a decrease in woody species richness and abundance due to clearing within the Footprint, but due to edge effects there may be increases in woody species richness and abundance in areas adjacent to the Footprint. Forb and graminoid species richness and abundance will increase following construction as natural vegetation regenerates.

Alteration of native vegetation due to competition for light, soil nutrients and moisture may occur while the Footprint is revegetating. However, the establishment of early successional communities following construction will resemble revegetation following natural disturbance since the species composition will favor early successional/colonial species, which are adapted for greater competition pressure for light, nutrients and moisture (excepting the competition resulting from weedy non-native species).

The post-construction environmental monitoring program will identify any locations with altered drainage patterns (*e.g.,* ponded water) and remedial work will be conducted. Once pre-construction moisture regimes are returned to a site, regeneration or revegetation of rare ecological communities will be more likely.

The effect of construction on adjacent rare ecological communities is deemed to have a negative impact balance. This residual effect is limited to the Vegetation LSA, reversible in the medium to long-term and of low magnitude since the narrowed pipeline corridor parallels other pipeline rights-of-way and disturbance for its entire length within the park boundaries (Table B7.1.8-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Vegetation LSA – although alteration of rare ecological communities is generally confined to the construction right-of-way, potential changes in hydrology, light levels and species composition may extend beyond the pipeline right-of-way.

- Duration: short-term – the events resulting in alteration of adjacent rare ecological communities are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation management), the latter of which are limited to any one year during the operations phase.

- Frequency: periodic – the events resulting in alteration of adjacent rare ecological communities (*i.e.*, pipeline construction and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.

- Reversibility: medium to long-term – it may take more than one year plus adequate precipitation levels in order for the trench crown to settle and natural drainage patterns to be restored, and it will take several years for vegetation to grow back to former heights, which will prevent increased light from reaching surrounding plants in the ecological community.

- Magnitude: low – the narrowed pipeline corridor is located adjacent to existing disturbances to the extent practical and the residual effects are detectable but are still considered to be within environmental standards given that best practices, objectives and provincial guidelines are being followed.

- Probability: high – the narrowed pipeline corridor is adjacent to native vegetation with high potential to support rare ecological communities, including forested areas that will be affected by clearing vegetation during construction.

- Confidence: moderate – confidence is high based on past pipeline projects, the professional experience of the assessment team and the results of post-construction environmental monitoring. However, very few portions of the park have been surveyed. Confidence will increase following the August 2014 supplemental survey.

<u>Vegetation Indicator – Plant and Lichen Species of Concern</u>

Some Disturbance or Alteration of a Rare Plant Occurrence, if Avoidance is Not Practical and Mitigation Measures Do Not Completely Protect a Site

During the July 2014 rare plant survey within North Thompson River Provincial Park, which were a component of the vegetation surveys, one BC CDC-listed rare plant species was observed within the park boundaries, white wintergreen (*Pyrola elliptica*, S2S3, Blue). Mitigation measures for rare plant species generally fall into categories of avoidance, (*e.g.,* realignment, change of work side, narrowing), reducing disturbance (*e.g.,* narrowing, adjusting workspaces, ramping/matting over) and alternative construction/reclamation techniques (*e.g.,* salvaging seed or sod, plant propagation, transplanting, separate strippings salvage, delay clearing, access management). These proposed mitigation measures have been used previously on other major pipeline construction projects with good success.

In the event that rare plant species are identified in the Footprint during the August 2014 supplemental survey, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan (Section 7.0 of Appendix C of the Pipeline EPP). In the event that additional rare plant species are identified on or within 30 m of the construction right-of-way during construction, refer to the Rare Ecological Community and Rare Plant Population Discovery Contingency Plan (Section 7.0 of Appendix B of the Pipeline EPP).

Based on the assessment of the rare plants with potential to be encountered during construction, the mitigation measures described above are considered likely to be appropriate and applicable to the Project. However, if mitigation measures do not completely protect the site, a disturbance or alteration of a portion of the population or community may occur. Mitigation is developed with a number of factors taken into account that include, however, are not limited to:

- species;
- population size;
- rarity;
- growth form of the plant (*i.e.*, annual, biennial, perennial);
- construction timing;
- location of the population with respect to the Footprint;
- primary mode of species reproduction;
- mode and magnitude of propagule dispersal;
- habitat and proximity of available habitat; and
- past mitigation success (of the species or similar species).

By basing mitigation on these factors, any disturbance or alteration of a rare plant population, particularly those ranked S1, would be reduced to a level such that the population is not placed at risk (Table B7.1.8-2 point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – the potential disturbance or alteration of a rare plant population is confined to the construction right-of-way.
- Duration: short-term – the events resulting in potential disturbance or alteration of a rare plant population are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation maintenance), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events causing potential disturbance or alteration of a rare plant population (*i.e.*, construction of the pipeline and maintenance activities) occur intermittently but repeatedly at some locations during the operations phase of the Project.
- Reversibility: medium to long-term – depending on the species, the construction method (*e.g.,* narrowing the right-of-way or matting over, compared to transplanting) and the landscape. For example, golden saxifrage has been documented to revegetate previously disturbed rights-of-way within a few years following post-construction environmental monitoring (Alliance 2002) as long as the landscape is recontoured and the hydrology returns to pre-construction conditions (medium-term). Stalked moonwort and Michigan moonwort, were found along the proposed pipeline corridor in open,

sandy areas with lodgepole pine. The area these plants inhabit will be prone to erosion and their associated species (lodgepole pine) will take more than 10 years to grow back (long-term).

- Magnitude: medium – the potential disturbance or alteration of a rare plant population is of medium magnitude since the effect is considered to be within environmental standards given that best practices, objectives and provincial guidelines are being followed.
- Probability: high – there was one rare plant population identified within the narrowed pipeline corridor within the park boundaries in July 2014. An additional rare plant survey is planned in August 2014.
- Confidence: high – confidence is high based on field results, past pipeline projects and the experience of the assessment team.

Some Disturbance or Alteration of a Rare Lichen Occurrence, if Avoidance is Not Practical and Mitigation Measures Do Not Completely Protect a Site

During the 2013 and 2014 rare plant surveys in North Thompson River Provincial Park, which were a component of the vegetation surveys, no BC CDC-listed rare lichen populations were observed. In the event that rare lichen populations are observed during the August 2014 survey, mitigation measures for rare lichen species generally fall into categories of avoidance, (*e.g.* realignment, change of work side, narrowing), reducing disturbance (*e.g.,* narrowing, protective matting, snow cover in winter) and alternative construction/reclamation techniques (*e.g.,* relocation of substrates, transplanting of thalli or peds, inoculation using vegetative fragments). These proposed mitigation measures have been used previously on other major pipeline construction projects with good success, but in general, fencing and avoiding is the mitigation that has the greatest likelihood of success, as compared to transplanting, and is the preferred conservation strategy.

Avoidance was highly successful in protecting rare species along the TMX Anchor Loop Project. Of the sites monitored in 2010 where fence and avoid procedures were employed, 93% had retained the rare lichen species targeted for mitigation (TERA 2011a).

Based on the assessment of the rare lichens with potential to be encountered during pipeline construction, the mitigation measures described above are considered likely to be appropriate and applicable to the Project. However, if mitigation measures do not completely protect the site, a disturbance or alteration of a portion of the population may occur. Mitigation is developed with a number of factors taken into account that include, but are not limited to:

- species;
- population size;
- rarity;
- construction timing;
- location of the population with respect to the Footprint;
- preference substrate and proximity of available substrates; and
- past mitigation success (of the species or similar species).

By basing mitigation on these factors, any disturbance or alteration of a rare lichen population, particularly those ranked S1, would be reduced to a level such that the population is not placed at risk.

A supplemental ground-based rare plant survey is planned during August 2014. In the event that rare lichen species are identified within the Footprint during supplemental surveys, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan (Section 7.0 of Appendix C of the Pipeline EPP). In the event that additional rare plant species are identified on or within 30 m of the construction right-of-way during construction, refer to the Rare Ecological Community and Rare Plant Population Discovery Contingency Plan (Section 7.0 of Appendix B of the Pipeline EPP).

The effect of construction on rare lichen populations is deemed to have a negative impact balance. This residual effect is limited to the Footprint, reversible in the short to medium-term and of medium magnitude since the narrowed pipeline corridor parallels other pipeline projects and disturbance for its entire length within the park boundaries (Table B7.1.8-2, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – the potential disturbance or alteration of a rare lichen population is confined to the construction right-of-way.
- Duration: short-term – the events resulting in potential disturbance or alteration of a rare lichen population are construction of the pipeline or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in potential disturbance or alteration of a rare lichen population (*i.e.*, construction of the pipeline and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.
- Reversibility: short to medium-term – depending on the species and the mitigation measures applied. Based on post-construction environmental monitoring results from TMX Anchor Loop, effects on rare lichens were generally resolved in three to five years (*i.e.,* it was apparent in three to five years of post-construction environmental monitoring whether the population would survive or not) (TERA 2011a).
- Magnitude: medium – the potential disturbance or alteration of a rare lichen population is of medium magnitude since the effect is still within environmental standards given that best practices, objectives and provincial guidelines are being followed.
- Probability: high – there were no rare lichen populations identified within the narrowed pipeline corridor during the rare plant surveys in 2013 and 2014 within the park boundaries and it is possible that rare lichen populations will be found within the Footprint.
- Confidence: high – based on past pipeline projects, the experience of the assessment team and the results of the rare plant surveys.

Indirect Effects to Rare Plant and Lichen Sub-Populations

With proper implementation of the industry-accepted standard mitigation practices that are proposed, disruption of surface flow patterns and light levels following construction or maintenance activities is expected to be minor along the narrowed pipeline corridor. However, construction activities may contribute to some localized alteration of light levels and natural surface drainage patterns until trench settlement is complete and vegetation has matured. The impact balance of this potential residual effect is considered negative since it could alter the moisture regime and light levels. In addition, dust deposition and the chemicals used to suppress dust have the potential to impact rare plants and lichens.

Indirect alteration of rare plant and lichen populations adjacent to the Project may occur due to soil erosion. Since the areas with greatest erosion risk will be seeded with native species or an annual cover crop (or otherwise stabilized with mulch, straw, crimping), the indirect alteration of native vegetation as a result of erosion will not measurably contribute to the overall effect of the Project on the alteration of rare plant populations.

Increased distance of light penetration due to clearing will result in an indirect alteration of native vegetation (*i.e.*, the native species making up the habitat for rare plant populations). If part of a treed community is cleared, the light penetrating to the understory will change the species composition along the edges of the community where clearing occurred and the increased air flow will alter humidity within the area. However, this effect will not substantially contribute to the alteration of native vegetation beyond the effects detailed in relation to the clearing of native vegetation. Additionally, during the course of reclamation, as revegetation progresses, light penetration and air flow will generally decrease over time.

Given that indirect effects are, in part, caused by disturbance to vegetation structure associated with clearing activities, allowing disturbed areas to naturally revegetate may not alleviate indirect effects where vegetation management is conducted or long-term persistence of the disturbance exists. Consequently, indirect effects to rare plant and lichen populations are expected to persist until the pre-existing vegetation composition and structure is restored for the Footprint.

During construction and operations of the pipeline, vehicle traffic will increase dust deposition onto native vegetation adjacent to the Footprint which could include rare lichen populations. Use of dust suppressants has the potential to affect both plant and lichen species. During reclamation, dust due to Project traffic could also result in minor effects to rare lichens located adjacent to the right-of-way.

Alteration of native vegetation due to competition for light, soil nutrients and moisture may occur while the Footprint is revegetating. However, the establishment of early successional communities following construction will resemble revegetation following natural disturbance since the species composition will favor early successional/colonial species, which are adapted for greater competition pressure for light, nutrients and moisture (excepting the competition resulting from weedy non-native species).

Many rare species inhabit areas with specific hydrology and light regimes. If hydrology of an area is altered, rare plant or lichen species located adjacent to the construction right-of-way may be affected. For example, golden saxifrage requires moist but not submerged substrate to grow on. The post-construction environmental monitoring program will identify any locations with altered drainage patterns (*e.g.,* ponded water) and remedial work will be conducted. Consequently, the residual effect is reversible in the short to long-term. This residual effect is of low magnitude since the narrowed pipeline corridor parallels other pipeline projects and disturbance for its entire length within the park boundaries (Table B7.1.8-2, point 2[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Vegetation LSA – although alteration of rare plant and lichen populations is generally confined to the disturbed portion of the construction right-of-way, potential changes in hydrology, dust and light levels may extend beyond the pipeline right-of-way.
- Duration: short-term – the events resulting in alteration of rare plant and lichen populations are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation management), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in alteration of rare plant and lichen populations via disruption of drainage patterns and altered light levels (*i.e.*, construction of the pipeline and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.
- Reversibility: short to long-term – it may take more than one year plus adequate precipitation levels in order for the trench crown to settle and natural drainage patterns to be restored and along extra temporary workspace it will take years for vegetation to grow back to former heights, which is what affects the light levels reaching surrounding plants. The full right-of-way will be maintained free of higher growing vegetation until abandonment (long-term). The potential for effects from dust and dust suppressants exist until construction activities are completed.
- Magnitude: low – the narrowed pipeline corridor is located adjacent to existing disturbances to the extent practical. Residual effects are detectable, but are still considered to be within environmental standards given that best practices, objectives and provincial guidelines are being followed.
- Probability: high – the narrowed pipeline corridor crosses forested vegetation communities that provide potential habitat for rare plant and lichen species and the forested vegetation will be affected by clearing activities during construction.
- Confidence: high – based on past pipeline projects, the experience of the assessment team and the results of the rare plant surveys.

Indirect Effects to Vegetation Species at Risk

Federally-listed vegetation species at risk (*i.e.*, designated by COSEWIC or on *Species at Risk Act* Schedule 1) identified as having potential to occur along the narrowed pipeline corridor in North Thompson River Provincial Park described in Section 6.0.

While whitebark pine (*Pinus albicaulis*) and Mexican mosquito fern (*Azolla mexicana*) have the potential to occur within the Vegetation RSA, no previously recorded Element Occurrences of plant species listed pursuant to the British Columbia *Wildlife Act* or *SARA* are known to occur within the park boundaries (BC CDC 2014). Potential habitat for whitebark pine habitat is generally in upper subalpine forest, which does not occur along the narrowed pipeline corridor within the park boundaries. There is low potential habitat for Mexican mosquito fern along the narrowed pipeline corridor within the park boundaries. Candidate critical habitat for toothcup meadow-foam overlaps with the narrowed pipeline corridor and early candidate critical habitat for whitebark pine occurs within 1 km of the narrowed pipeline corridor in two locations (Environment Canada 2014a). No *SARA* listed or BC *Wildlife Act* rare plant species were identified during vegetation surveys in 2013 and 2014. Based on these findings, the key vegetation species at risk that has potential to occur in the Park is Mexican mosquito fern.

Mexican mosquito fern is known to inhabit shallow slow-moving or standing water, with fluctuating water levels, over sandy alluvium that is covered with organic debris (BC CDC 2014). This plant has been known to occur in BC along broad flat river floodplains and can be free floating or on logs and rotting vegetation (BC CDC 2014). Therefore, during additional surveys planned in 2014 any potential habitats, such as those described above, will be examined in the park for potential populations of Mexican mosquito fern.

The potential effects associated with the construction and operations of the proposed pipeline on vegetation species at risk were identified by the assessment team based on element occurrence records (within the Vegetation RSA) from BC CDC (2014), as well as candidate critical habitat mapping (Environment Canada 2014a).

The narrowed pipeline corridor has been aligned to reduce disturbance to native vegetation by paralleling existing linear disturbances to the extent practical and by utilizing workspace on adjacent existing rights-of-way. These measures were developed in accordance with industry standards and the provincial and federal regulatory guidelines listed in Table B7.1.8-1.

There were no species listed on Schedule 1 of the *Species at Risk Act* observed during the 2013 and 2014 surveys.

The *Species at Risk Act* states that no person shall destroy any part of the habitat of a species listed as Endangered or Threatened and that no species listed as Endangered or Threatened can be damaged or destroyed. Section 97 of *SARA* states that this is an indictable offense for which there are monetary penalties. For species designated as Endangered or Threatened on Schedule 1, a Recovery Strategy must be provided within one year of their designation. Critical habitat is defined in a species-specific Recovery Strategy and is based on the best available information. Mexican mosquito fern was last assessed by COSEWIC in 2008 and the recovery strategy is not yet finalized (Environment Canada 2014a). Candidate critical habitat does not yet exist for Mexican mosquito fern (Environment Canada 2014a).

Protection measures and environmental management techniques for vegetation species at risk are provided in Appendix C of the Pipeline EPP. Mitigation measures for vegetation species at risk should be those of avoidance (*e.g.* realignment, change of work side, narrowing).

Rare plant surveys were completed during the growing season in 2013 in the northern portion of the park along the pipeline corridor. Supplemental rare plant surveys are planned prior to construction in 2014 on additional areas within the park.

Based on the assessment of the vegetation species at risk with potential to be encountered during construction (*i.e.* Mexican mosquito fern), the mitigation measures described above are considered likely to be appropriate and applicable to the Project. Due to the restrictions around damaging or destroying *Species at Risk Act*-listed plant or lichen species, any populations should be avoided by construction and operations, so there should not be any disturbance or alteration of a portion of a population. A summary of the rationale for all of the significance criteria is provided below (Table B7.1.8-2, point 2[d]).

- Spatial Boundary: Vegetation LSA – the potential disturbance or alteration of a vegetation species at risk would not occur on the construction right-of-way since mitigation will avoid any impacts, but could indirectly affect portions of a population adjacent to the right-of-way in the Vegetation LSA through changes to dust, light or moisture levels.

- Duration: short-term – the events resulting in potential indirect effects to a vegetation species at risk is clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in potential indirect effects to a vegetation species at risk may occur during construction and intermittently but repeatedly (*i.e.*, maintenance activities) during the operations phase of the Project.
- Reversibility: medium to long-term – depending on the site-specific and the mitigation measures applied.
- Magnitude: medium – the potential disturbance or alteration of a vegetation species at risk would be of high magnitude since residual effects would exceed regulatory standards, but any vegetation species at risk populations will be avoided and indirect effects will be mitigated. Residual effects will not exceed regulatory standards.
- Probability: low – there were no vegetation species at risk identified within the narrowed pipeline corridor within the park boundaries during the rare plant surveys in 2013 and 2014. With mitigation from Table B7.1.8-1 and the Pipeline EPP applied, it is unlikely that vegetation species at risk will interact with the Footprint.
- Confidence: high – based on past pipeline projects, the professional experience of the assessment team and the results of the rare plant surveys.

<u>Vegetation Indicator – Presence of Infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern</u>

Weed Introduction and Spread

Non-native and invasive species tend to be pioneer species with characteristics that can exploit recently disturbed ecosystems. Non-native and invasive species that occur at high densities on the landscape can exert competitive pressure on native vegetation and result in alteration of native vegetation.

In general, invasive species are most prevalent where the ground has been disturbed by anthropogenic activity. During the 2013 and 2014 vegetation surveys, any weed species encountered were noted and their density/distribution was recorded.

One provincially noxious species, spotted knapweed, was found in two locations; one as a single patch and the other, as several patches. Two regionally noxious species were recorded. Oxeye daisy was recorded in two locations; one as a single patch and the other, as several plants. Sulphur cinquefoil was recorded in a single location as several patches.

One species designated as noxious in other regions, hoary alyssum, occurred as single patches in two locations. Eight species of nuisance weeds were recorded: pineapple weed, great mullein, common plantain, lamb's-quarters, sheep sorrel, chicory, yellow salsify, and St. John's wort. Some introduced pasture species were also present.

The information collected during the vegetation surveys allows for an understanding of baseline weed conditions and the magnitude of weed infestations encountered in areas supporting native vegetation along the narrowed pipeline corridor.

Mitigation measures outlined in Table B7.1.8-1 and in the Pipeline EPP are effective industry standard measures to reduce the potential for the introduction and spread of weeds. These measures will be implemented during both construction and maintenance of the Project. All problem vegetation along the construction right-of-way will be monitored during all pipeline construction phases (*i.e.,* pre-construction and construction) and the operations phase (*i.e.*, post-construction environmental monitoring) (Section 12.0 of Appendix C of the Pipeline EPP).

Specific learnings from the TMX Anchor Loop Project (TERA 2013b) regarding weed introduction and spread include:

- chemical and mechanical weed treatments were effective at controlling or suppressing non-native invasive broadleaf species of concern along and off the right-of-way, at temporary facilities and permanent facilities; and
- hand (manual) removal of vegetation in riparian areas (areas where chemical treatment was not allowed due to proximity to water) was effective in controlling or suppressing non-native broadleaf weeds.

In addition, the final post-construction environmental monitoring report for the TMX Anchor Loop Project indicated that after five years, the post-construction vegetation management program had effectively controlled or suppressed non-native invasive broadleaf species of concern, identified during the pre-construction survey, along the right-of-way (TERA 2013b).

The potential introduction or spread of Noxious weeds and invasive, non-native species may vary in the period required to reverse the effect depending on the land use affected and the species. Consequently, the residual effect is considered to be reversible in the short to medium-term and of low to medium magnitude (Table B7.1.8-2, point 3[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Vegetation RSA – potential weed introduction and spread resulting from pipeline construction and maintenance activities may extend beyond the Footprint and Vegetation LSA to the Vegetation RSA.
- Duration: short-term – the events resulting in potential weed introduction and spread are construction of the pipeline or site-specific maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in potential weed introduction and spread (*i.e.*, pipeline construction, operations and maintenance activities) occur during construction and intermittently, but, repeatedly over the assessment period.
- Reversibility: short to medium-term – depending on the weed species, the size/location of the weed occurrence and the associated land use.
- Magnitude: low to medium – the narrowed pipeline corridor parallels existing disturbances for its entire length within the park boundaries and the north end of the narrowed pipeline corridor is adjacent to an urban area with higher densities of weeds than native land uses. Based on consultation, weeds are a concern in populated areas. Magnitude varies from low to medium depending on the weed or invasive plant species, affected land use and density/distribution of associated weed occurrences.
- Probability: high – pipeline construction is expected to cause some weed introduction and spread.
- Confidence: high – based on past pipeline projects, the professional experience of the assessment team and post-construction environmental monitoring results.

7.1.8.3 Summary

As identified in Table B7.1.8-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on vegetation indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on the conservational values of North Thompson River Provincial Park related to vegetation will be not significant.

7.1.9 Wildlife and Wildlife Habitat

This subsection describes the potential Project effects on wildlife and wildlife habitat in North Thompson River Provincial Park. The Wildlife LSA is defined as the area within a 1 km buffer of the centre of the proposed pipeline corridor; shown in Figure 6.2.2-4 of the Introduction to the Draft Stage 2 Detailed Proposal. The Wildlife RSA is defined as the area within a 15 km buffer of the centre of the proposed pipeline corridor; shown in Figure 6.2.2-1 of the Introduction to the Draft Stage 2 Detailed Proposal.

Wildlife and wildlife habitat indicators (Table 6.2.1-1 of the Introduction to the Draft Stage 2 Detailed Proposal) were considered in this evaluation and the following indicators may occur in North Thompson River Provincial Park: grizzly bear; moose; forest furbearers; bats; mature/old forest birds; early seral forest birds; riparian and wetland birds; Lewis's woodpecker; bald eagle; common nighthawk; and olive-sided flycatcher.

7.1.9.1 Identified Potential Effects

Project construction and operational activities have the potential to affect wildlife and wildlife habitat through changes to habitat, movement and mortality risk. A summarized discussion of potential Project effects on wildlife and wildlife habitat specific to North Thompson River Provincial Park is provided below. Potential effects associated with the construction and operation of the proposed pipeline on wildlife and wildlife habitat are listed in Table B7.1.9-1.

TABLE B7.1.9-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATION ON WILDLIFE AND WILDLIFE HABITAT FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures	Potential Residual Effect(s)
1 Change in habitat	LSA	• Refer to Table B7.1.9-2 below: habitat loss/alteration, wildlife disturbance and attraction of wildlife during construction, sensory disturbance, mammal dens, species with special conservation status, mineral licks, bats, migratory birds, raptor/owl nest.	• Combined Project effects on wildlife and wildlife habitat in North Thompson River Provincial Park.
2 Change in movement	LSA	• Refer to Table B7.1.9-2 below: habitat loss/alteration, access and line-of-sight management, barriers to wildlife movement, wildlife disturbance and attraction of wildlife during construction, mineral licks, mammal dens, bats, migratory birds, raptor/owl nest.	
3 Increased mortality risk	LSA	• Refer to Table B7.1.9-2 below: habitat loss/alteration, access and line-of-sight management, disturbance and attraction of wildlife during construction, mammal dens, species with special conservation status, bats, migratory birds, raptor/owl nest.	

Notes: 1 LSA = Wildlife LSA

Mitigation measures (as shown in the Pipeline EPP) that are particularly relevant to potential Project effects onfor wildlife and wildlife habitat in North Thompson River Provincial Park are identified in Table B7.1.9-2 below. The mitigation measures were principally developed in accordance with Trans Mountain Standards, as well as industry and provincial regulatory guidelines.

TABLE B7.1.9-2

RECOMMENDED MITIGATION FOR WILDLIFE AND WILDLIFE HABITAT WITHIN THE NORTH THOMPSON RIVER PROVINCIAL PARK

Concern	Recommended Mitigation[1]
Habitat Loss/Alteration	• Avoid activity during sensitive time periods for wildlife species to the extent feasible. • Share workspace with the adjacent existing TMPL right-of-way or other existing rights-of-way to reduce the construction right-of-way-width. • Do not clear timber, stumps, brush or other vegetation beyond the marked construction right-of-way boundary. • Where grading is not required, cut/mow/walk down shrubs and small diameter deciduous trees at ground level to facilitate rapid regeneration. • Plant native tree seedlings and/or shrubs at select locations to be determined in the field by the Environmental Inspector, in consultation with the Wildlife Resource Specialist. • Avoid the use of pesticides (except for herbicides to control invasive plants or noxious weeds; only use as spot treatments and outside the migratory bird breeding season) (BC MOE 2012a). • Reduce the width of grubbing near the Clearwater River and through other wet areas to facilitate the restoration of shrub communities. • Reduce disturbance at riparian areas and extend the riparian buffer by implementing trenchless pipeline crossing techniques, or cut/mow/walk down shrubs and small diameter deciduous trees at ground level to facilitate rapid regeneration. • Limit vegetation control along the right-of-way and allow natural regeneration during the operations phase to the extent feasible. • Conduct pre-construction surveys to identify site-specific habitat features (*e.g.,* mineral licks) and implement the appropriate setbacks and/or timing windows.
Barriers to Wildlife Movement	• Conduct work as expeditiously as practical (*i.e.,* interval between front-end work activities such as grading and back-end activities such as clean-up) to reduce the length and duration of the open trench and to reduce potential barriers and hazards to wildlife. Refer to Table B2.5-1 for the length and duration of construction activities. • Locate gaps in pipe to allow wildlife movement in places that also facilitate construction such as at slope changes and bends. The locations of the gaps should coincide with gaps in spoil, slash piles and snow windrows. The locations can be determined in the field by the Environmental Inspector. • Restore habitat connectivity by redistributing large-diameter slash (rollback) over select locations on the pipeline right-of-way (*e.g.,* where high levels of coarse woody debris occur prior to construction), to provide cover and facilitate movement of wildlife. Specific locations are to be determined in the field by the Environmental Inspector and Wildlife Resource Specialist in discussion with provincial regulatory authorities. Avoid the use of Douglas-fir, grand fir and spruce for rollback within North Thompson Provincial Park.
Wildlife Disturbance and Attraction of Wildlife During Construction	• Schedule clearing and construction activities to avoid sensitive wildlife timing windows wherever feasible. • Minimize traffic and prohibit recreational use of all-terrain vehicles or snowmobiles by construction personnel on the pipeline right-of-way and at facilities. • Prohibit personnel from having pets on the pipeline right-of-way and at facilities. • Prohibit personnel from feeding or harassing wildlife. • Obey speed limits along access roads and the right-of-way. • Ensure that food waste and industrial waste are disposed of properly. • Report any issues related to wildlife encountered during construction and operations to the Environmental Inspector, who will report it to the appropriate regulatory authorities. • Implement the measures in the Wildlife Conflict Management Plan to prevent human/wildlife conflict and wildlife mortality (Appendix C of the Pipeline EPP).
Migratory Birds	• The migratory bird nesting period within the North Thompson River Provincial Park is identified as the end of March to mid-August (Environment Canada 2014). • In the event that clearing or construction activities are scheduled during the migratory bird nesting period conduct nest sweeps within 7 days of activity. Use non-intrusive methods to conduct an area search for evidence of nesting (*e.g.,* presence of singing birds, territorial males, alarm calls, distraction displays). In the event an active nest is found, it will be subject to site-specific mitigation measures (*i.e.,* clearly marked protective buffer around the nest and/or non-intrusive monitoring).

TABLE B7.1.9-2 Cont'd

Concern	Recommended Mitigation[1]
Raptor Nest	• Schedule clearing and construction activities outside of sensitive time periods for raptors (generally March to August), to the extent feasible. • In the event clearing is scheduled at a time when raptor nests will be active, in areas of suitable habitat conduct raptor nest searches prior to clearing to locate active raptor nests. In the event an active raptor nest is discovered, consult with the appropriate regulatory authorities to discuss practical options and mitigation measures. • Eagle, peregrine falcon, gyrfalcon, osprey and burrowing owl nests are protected year-round by the BC Wildlife Act and may not be cleared. The Guidelines for Raptor Conservation (BC MOE 2013e) provides information on sensitive breeding and nesting time periods and buffers for raptor nests according to their tolerance to human disturbance. These buffers range from 50 m to 500 m depending on the surrounding land use and species. During the breeding season, an additional 100 m "quiet" buffer is recommended. Clearly mark the appropriate buffers with fencing to prevent access to the nest. • If construction is unavoidable within the recommended year-round and breeding buffers, a Nest Management Plan addressing various mitigation (including nest monitoring during the breeding period) is recommended. • If construction activities require the removal of a raptor nest that is protected year-round under the BC Wildlife Act (i.e., eagle, peregrine falcon, gyrfalcon, osprey and burrowing owl), Trans Mountain will work with the appropriate regulatory authorities to develop a Nest Removal Management and Compensation Plan. Upon confirmation the nest is inactive, nest removal should occur during the least risk window of August through December. When a nest is removed the installation of a replacement structure (i.e., a platform on a pole or transplanted tree) should be erected in nearby suitable habitat (BC MOE 2013e).
Bats	• Protect bat roosts from disturbance by humans and other sensory disturbances (BC MOE 2012a). Implement a 125 m buffer from bat hibernacula (from October 1 to April 30 or maternity roost (from May 1 to August 31) (BC MWLAP 2004b). Consult with BC MFLNRO where disturbance of a hibernacula or maternity roost is unavoidable to discuss practical options and mitigation measures.
Mammal Dens	• Contact provincial regulatory authorities to discuss the appropriate mitigation in the event an active mammal den is discovered on the work site. Mitigation may include establishing protective buffers, monitoring the den and/or modifying the construction schedule to avoid activity until the den is inactive. • A setback of 50 m from active bear dens is recommended (BC OGC 2013).
Mineral Licks	• Implement a 100 m setback in the event a mineral lick is identified (BC OGC 2013). In the event that shifting/narrowing the pipeline right-of-way is not feasible to maintain the minimum setback from a mineral lick, consult with AESRD or BC MFLNRO to discuss practical options and mitigation measures. • Do no block well-used game trails to/from a mineral lick. • Avoid activities (*i.e.,* clearing, construction, helicopter overflights) near mineral licks during critical periods (May to November) (BC MWLAP 2004b), to the extent feasible. • Leave a gap in set-up pipe within the area of the mineral lick to allow wildlife to access the mineral lick. The locations of the gaps in strung pipe should coincide with gaps in strippings, spoil, snow and rollback windrows.
Species with Special Conservation Status	• In the event that a species with special conservation status is observed during construction, the appropriate regulatory authorities will be contacted to determine if additional mitigation measures are warranted. • Implement the Wildlife Species of Concern Discovery Contingency Plan in the event that wildlife species of concern are identified during construction.

Note: 1 Detailed mitigation measures are outlined in Table L-2 of Appendix L in the Pipeline EPP (Appendix A of this Proposal).

7.1.9.2 Significance Evaluation of Potential Residual Effects on Wildlife and Wildlife Habitat

The assessment of the residual combined effect on wildlife and wildlife habitat in North Thompson River Provincial Park considered all of the assessment criteria defined in Table 6.2.1-1 of the Introduction to the Draft Stage 2 Detailed Proposal. The significance determinations incorporate professional judgment, which allows integration of all of the effects criteria ratings to provide relevant significance conclusions that are sensitive to context and facilitate decision-making (Lawrence 2007).

Table B7.1.9-3 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operation of the proposed pipeline in North Thompson River Provincial Park on wildlife and wildlife habitat. The rationale used to evaluate the significance of the residual effects on wildlife and wildlife habitat in North Thompson River Provincial Park is provided below.

TABLE B7.1.9-3

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WILDLIFE AND WILDLIFE HABITAT FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1a) Combined Project effects on wildlife and wildlife habitat in North Thompson River Provincial Park.	Negative	LSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not Significant

Notes: 1 LSA = Wildlife LSA

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Change in Habitat

North Thompson River Provincial Park comprises various habitat types that support wildlife, as it borders the dry southern interior and wet interior regions (BC MOE 2013a). Habitats are characterized by a dry stands of Douglas-fir, lodgepole pine and juniper next to wetter cedar or spruce habitats (BC MOE 2013a). The Project will change the amount of available effective habitat for wildlife in North Thompson River Provincial Park. The likely mechanisms for changes in effective wildlife habitat include vegetation clearing, sensory disturbance (*e.g.,* human activity and noise) and soil handling (including trenching). The Project will increase the existing corridor width (since it parallels the existing TMPL right-of-way for most of the proposed route within North Thompson River Provincial Park) and require ongoing clearing as part of vegetation management during operations. Habitat loss and reduced habitat effectiveness can cause displacement of wildlife, and potentially result in the use of less suitable habitat, reduced foraging ability (Bird *et al.* 2004), increased energy expenditure (Jalkotzy *et al.* 1997) and lower reproductive success (Habib *et al.* 2007).

Clearing activities during construction of the Project will alter habitat structure, and result in direct habitat loss or alteration. Operations of the Project will also require ongoing vegetation management, resulting in the maintenance of forest habitat in earlier seral stages (herbaceous and shrub stages) until the pipeline is abandoned and the disturbed areas are reclaimed. Clearing of the construction right-of-way and temporary workspace will reduce cover habitat and temporarily reduce forage availability. As cleared areas regenerate with early seral vegetation, forage availability will increase for some species. Vegetation clearing for the Project will decrease available habitat for forest and shrub-reliant species over the medium to long-term. The openings created by the Project may increase habitat for species that use open areas for (*e.g.,* common nighthawk) and for habitat generalists (*e.g.,* corvids, some songbirds such as dark-eyed junco) (Jalkotzy *et al.* 1997).

Indirect habitat loss or alteration occurs when habitat is available but the quality or effectiveness of the habitat is changed such that wildlife avoid the habitat or reduce their use of it. Reduced habitat effectiveness can occur as a result of fragmentation, creation of edges, or sensory disturbance (*e.g.,* noise, artificial light, proximity to facilities and infrastructure, human activity and traffic). Habitat fragmentation can cause habitat to become unsuitable for species with large territories or home ranges, alter predator-prey dynamics and allow for increased invasive or parasitic species abundance (*e.g.,* cowbird parasitism of songbird nests near forest edges). Changes in habitat suitability may also result from changes in vegetation communities due to increased light penetration at clearing edges causing increased understory vegetation growth, or from changes in water quality (*e.g.,* sedimentation, deposition of airborne contaminants).

The proposed mitigation measures (Table B7.1.9-2 and the Pipeline EPP) are expected to reduce residual Project effects on wildlife and wildlife habitat. To minimize vegetation clearing and reduce the fragmentation and isolation of habitat patches, the narrowed pipeline corridor parallels the existing TMPL right-of-way for most of the proposed route within North Thompson River Provincial Park. Other mitigation measures such as avoiding activity during sensitive time periods for wildlife species, reducing the width of grubbing near watercourses and wet areas to facilitate the restoration of shrub communities, limiting vegetation control along the right-of-way, and allowing natural regeneration during the operations phase to the extent feasible will also help reduce residual Project effects on wildlife and wildlife habitat.

Proposed candidate critical habitat for American badger occurs within North Thompson Provincial Park (Environment Canada 2014a). American badger habitat preferences include natural grasslands, open forested sites and soil that allows for digging (Environment Canada 2014b). Supplemental field surveys will be completed for the Project, which will allow for an evaluation of the biophysical attributes of the habitat within the proposed corridor as it relates to the draft attributes of the candidate critical habitat defined by Environment Canada (2014a,b). This information will be used to inform mitigation planning.

Change in Movement

Project construction and operations can alter wildlife movement by reducing habitat connectivity and creating barriers or filters to movement. A disturbance is considered a barrier when no movement occurs across it, or a filter when the rate of movement through the disturbance is less than it would be through intact habitat (Jalkotzy *et al.* 1997). Habitat fragmentation results when barriers to movement cause functional separation of habitats into smaller, isolated habitat patches (Andrén 1994, Jalkotzy *et al.* 1997). Species that have late age of first reproduction, low population densities, low reproductive rates, large home ranges, low fecundity, and move over large distances to disperse, find food and mate, display low resilience to habitat fragmentation (Dunne and Quinn 2009).

The increased corridor width may cause an incremental barrier effect for some wildlife species. In some cases, linear developments have been shown to block, delay or deflect ungulate movements, potentially restricting or reducing access to some parts of their range (Harper *et al.* 2001). Studies on small mammal movements in the boreal forest have concluded that pipeline rights-of-way may act as barriers or filters to movement of flying squirrels, red squirrels and marten (Marklevitz 2003). Forest gaps have been shown to affect movements of forest birds (Bayne *et al.* 2005, Desrochers and Hannon 1997, Fleming and Schmiegelow 2002) and owls (COSEWIC 2008). Wider corridor widths increase barrier effects on bird movements more than narrower corridors (Desrochers and Hannon 1997), and parallel forest openings can cause a cumulative barrier effect at the landscape scale for some species (Bélisle and St. Clair 2001).

Changes in movement patterns can also occur since some species may be attracted to the rights-of-way. The Footprint will create increased forage availability for some wildlife species once vegetation communities regenerate to early seral vegetation after reclamation. This may attract some wildlife to the right-of-way and, therefore, affect their normal movement patterns. Public consultation reported that moose, deer and black bear are known to move from north to south through the park. Moose have been shown to select habitat based on forage over security, often preferring early seral, shrub-dominated habitats (Wasser *et al.* 2011) with lower densities of coniferous tree cover (Hebblewhite *et al.* 2010, Rempel *et al.* 1997, Schwartz and Franzmann 1991). Deer are also known to be attracted to recently cleared, linear disturbances (Lyons and Jensen 1980) given the increased production of forage (Wallmo *et al.* 1972). Rights-of-way may also provide travel routes for predators such as bears (McKay *et al.* 2013). Bats have also been shown to use linear landscape features for movement, which provide navigational references and flight corridors for some bat species (Hein *et al.* 2009, Verboom and Huitema 1997). Birds that use open spaces for hunting, foraging or nesting may also benefit.

Application of the proposed mitigation measures (Table B7.1.9-2 and the Pipeline EPP) is expected to reduce the magnitude of potential residual effects of Project construction and operations on wildlife movement. Limiting the length of open trench, maintaining periodic gaps in soil, slash, snow and pipe, where feasible, will limit barriers to wildlife movement during construction. Limiting the construction right-of-way by utilizing shared workspace on the existing TMPL right-of-way will reduce the Project's potential for habitat fragmentation. Redistributing large-diameter slash (coarse woody debris) over select locations on the right-of-way and promoting regeneration of native vegetation, including shrubs and trees, will contribute to maintaining habitat connectivity by reducing limitations to movement of wildlife across the right-of-way. The Project is expected to result in a filter, but not complete barrier to movement of some wildlife species.

Increased Mortality Risk

The Project has potential to increase wildlife mortality risk during construction as a result of loss or disruption of habitat (*e.g.,* nests, dens, overwintering sites), wildlife collisions with vehicles or equipment, and sensory disturbance (*e.g.,* nest abandonment). Project construction (clearing, soil handling) may affect the mortality risk of some wildlife species. Pre-construction surveys will identify any site-specific habitat features (*e.g.*, active dens) that warrant additional mitigation to avoid disruption or mortality of wildlife. Scheduling of clearing activities will consider the migratory bird breeding season. If the migratory bird breading season cannot be practically avoided, potential effects of clearing and construction on bird mortality risk during the nesting period will be mitigated by conducting non-intrusive area searches for evidence of nesting (*e.g.,* presence of singing birds, territorial males, alarm calls, distraction displays). Any active nests will be subject to site-specific mitigation measures.

Linear corridors can potentially affect wildlife mortality risk from trapping, hunting and poaching due to access development, since these activities are often associated with roads or other linear corridors that create access (Collister *et al.* 2003, Wiacek *et al.* 2002). The Project will not add a new linear corridor to the park since it parallels the existing TMPL right-of-way.

Vehicle traffic due to construction and operations of the Project may increase the risk of wildlife mortality due to vehicle collisions. With posting of low traffic speeds, signage and education of construction and operations contractors and employees, risk of wildlife injury or mortality associated with vehicle collisions is not expected to increase substantially as a result of the Project. Trans Mountain has developed a Wildlife Conflict Management Plan (see Section 15 of Appendix C of the Pipeline EPP) to avoid potential conflict between Project personnel and the wildlife species most likely to be encountered during the construction and operations of the Project.

Artificial night-time light sources attract songbirds that migrate at night and can increase bird mortality risk from collisions, excessive energy expenditure and predation (Jones and Francis 2003, Poot *et al.* 2008). The possible use of artificial night-time light sources within North Thompson River Provincial Park will be short-term in duration and occur either during construction or during site-specific operations and maintenance activities. There are no permanent facilities planned within North Thompson River Provincial Park that would require permanent artificial night-time light.

Summary of Effects Characterization Rationale for Wildlife and Wildlife Habitat

The following provides the evaluation of significance of potential residual effects on wildlife and wildlife habitat within North Thompson River Provincial Park (Table B7.1.9-3, point 1[a]).

- Spatial Boundary: Wildlife LSA – habitat changes (*e.g.,* clearing), alteration of movement (*e.g.,* barriers during construction) and mortality risk (*e.g.,* disturbance of occupied habitat feature) are primarily limited to the Wildlife LSA.

- Duration: short-term – the events causing effects are construction and operational activities (*e.g.,* monitoring, vegetation management and site-specific maintenance), the latter of which are limited to any one year during operations.

- Frequency: periodic – the events causing effects (*i.e.,* clearing of the Footprint, traffic and activity) will occur during construction and intermittently during operations for monitoring, vegetation control and maintenance.

- Reversibility: long-term – effects are reversible in the long-term following decommissioning and abandonment, once native vegetation regenerates over the Project Footprint. Herbaceous and shrub-dominant habitats are expected to regenerate to similar ecological stages and habitat function in the medium-term following completion of reclamation. However, restoration of forested habitat will take longer than 10 years (*i.e.,* long-term). Sensory disturbance and mortality risk associated with construction is reversible immediately upon completion of activities.

- Magnitude: medium – regulatory and ecological context are key considerations in the characterization of magnitude for residual effects of the Project on wildlife in the North Thompson River Provincial Park. The stated management objectives of the park relevant to wildlife include conservation of riparian habitats and the IDFmw2 subzone/variant. Residual effects of the Project on wildlife habitats in the park are reduced by paralleling the existing TMPL right-of-way, the close proximity to Highway 5, minimizing the footprint and reclamation of the footprint to native vegetation. The park provides habitat for wildlife species at risk, which, in general, often have low resilience to habitat disturbance. Mitigation will be developed to prevent Project-related mortality for American badger, which have early candidate critical habitat in the park. Through development of mitigation in consultation with regulatory authorities, and implementation of mitigation and monitoring, including adaptive measures where warranted, the residual Project effects on wildlife in North Thompson River Provincial Park are expected to remain within regulatory and ecological tolerance. Therefore, the magnitude of the residual effect is concluded to be medium.

- Probability: high – the Project will affect wildlife in the park through changes in habitat, movement and mortality risk.
- Confidence: moderate – the assessment is based on a good understanding of cause-effect relationships and relevant data. Limitations and uncertainty associated with available data pertinent to the Project area reduce the confidence level to moderate.

7.1.9.3 Summary

As identified in Table B7.1.9-3, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on wildlife and wildlife habitat of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operation on conservation values of North Thompson River Provincial Park related to wildlife and wildlife habitat will be not significant.

7.1.10 Species at Risk

For the purpose of the assessment, species at risk are considered to include all federally-listed species of conservation concern (*i.e.*, COSEWIC or *SARA* Schedule 1 designation) (COSEWIC 2013, Environment Canada 2014a). Species identified as having the potential to occur along the narrowed pipeline corridor and in the element-specific RSAs are based on previous field assessments and existing data.

This subsection discusses the species at risk that have been identified as likely to occur within each element-specific RSA. The list of federal species at risk in the vicinity of North Thompson River Provincial Park includes 2 fish species within the Aquatics RSA and 8 wildlife species within the Wildlife RSA.

The two fish species include:

- coho salmon: Endangered by COSEWIC; and
- bull trout: Special Concern by COSEWIC (South Coast BC populations) (Blue-listed).

The eight wildlife species include:

- Bank swallow: Threatened by COSEWIC;
- Barn swallow: Threatened by COSEWIC, Blue-listed;
- Common nighthawk: Threatened by *SARA* and COSEWIC;
- Lewis’s woodpecker: Threatened by *SARA* and COSEWIC, Red-listed;
- Olive-sided flycatcher: Threatened by *SARA* and COSEWIC, Blue-listed;
- Grizzly bear, western population: Special Concern by COSEWIC, Blue-listed;
- Little brown myotis: Endangered by COSEWIC; and
- Magnum mantleslug: Special Concern by COSEWIC, Blue-listed.

Potential effects of the Project on these species are assessed through the use of indicators in Sections 7.1.6 and 7.1.9, respectively.

7.1.11 Heritage Resources

This subsection describes the potential Project effects on heritage resources in North Thompson River Provincial Park. The Heritage Resources RSA consists of the broader landscape context extending beyond the Project Footprint, defined as an area of intersecting Borden Blocks (Borden and Duff 1952); shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal. A Borden Block measures 10 minutes of latitude by 10 minutes of longitude

The potential for encountering heritage resources in North Thompson River Provincial Park has been reduced by aligning the narrowed pipeline corridor to parallel the existing TMPL right-of-way. Qualified archaeologists commenced an Archaeological Impact Assessment (AIA) for the BC portion of the narrowed pipeline corridor in July of 2013 under Heritage Inspection Permit 2013-0165; the assessment of which is ongoing and will need to continue into the 2014 field season (including North Thompson River Provincial Park). For the AIA, background data was reviewed and complemented with ground reconnaissance, in order to identify targeted areas for more intensive visual inspection, and where warranted, shovel testing. The ground reconnaissance and shovel testing programs focused on areas along the narrowed pipeline corridor that are of moderate to high potential for archaeological sites, following the standards and methodologies outline under Permit 2013-0165. The application of these standards and methodologies will continue into the 2014 field season.

7.1.11.1 Identified Potential Effects

The potential effects associated with the construction and operations on heritage resources indicators are listed in Table B7.1.11-1.

A summary of mitigation measures is provided in Table B7.1.11-1 was principally developed in accordance with Trans Mountain Standards as well as industry and provincial regulatory guidelines including BC OGC (2010) and CAPP (1999, 2001).

TABLE B7.1.11-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON HERITAGE RESOURCES FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures[EPP Reference][1]	Potential Residual Effect(s)
1. Heritage Resources Indicator – Archaeological Sites			
1.1 Disruption to previously unidentified archaeological sites during AIA	Footprint	• Follow any conditions or recommendations identified in the permits for the AIA for BC. • Suspend work in proximity (*i.e.*, within 30 m) to archaeological, palaeontological or historical sites (*e.g.,* modified bone, pottery fragments, fossils) discovered during construction. No work at that particular location shall continue until permission is granted by the appropriate regulatory authority. Follow the contingency measures identified in the Heritage Discovery Contingency Plan [Appendix B of the Pipeline EPP]. • Arrange for emergency archaeological excavation of previously unidentified sites endangered by pipeline construction wherever such sites warrant attention and can be excavated without interfering with the construction schedule. When for practical reasons, the sites cannot be investigated, map and suitably flag these sites for later investigation [Section 7.0]. • Prohibit the collection of any historical, archaeological or palaeontological resources by Project personnel [Section 7.0].	• No residual effect identified.

TABLE B7.1.11-1 Cont'd

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures[EPP Reference][1]	Potential Residual Effect(s)
1.1 Disruption to previously unidentified archaeological sites during AIA (cont'd)	See above	• Avoid, where possible, disturbance of geodetic or legal survey monuments, to the extent feasible during construction of the pipeline, Trans Mountain's Construction Manager will immediately report such disturbance to the appropriate regulatory authority. The contractor will restore or re-establish the monument, where feasible, in accordance with the instructions of the Dominion Geodesist [Section 7.0].	• See above
1.2 Disturbance to known archaeological sites during AIA	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
1.3 Disturbance of previously unidentified archaeological sites during construction	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
2. Heritage Resources Indicator – Historic Sites			
2.1 Disturbance to previously unidentified historic sites during AIA	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
2.2 Disturbance of previously unidentified historic sites during AIA	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
3. Heritage Resources Indicator – Palaeontological Sites			
3.1 Disturbance of previously unidentified palaeontological sites during construction	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.

Note: 1 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.11.2 Potential Residual Effects

Heritage resources provide a window into past human experiences and the geological record, and by their very nature, are non-renewable. Once disturbed, the resource may be altered or even lost. Consequently, the primary mitigation measure in protecting heritage resources is avoidance, and secondarily, site specific mitigation developed in consultation with appropriate provincial regulatory authorities and approved by these authorities in fulfillment of Permit obligations may also be used. In order to better understand heritage resources and the historical information associated with these resources, disturbing the resource through excavations is an acceptable practice and, in many cases, the only method to collect in situ information to add to the archaeological record. Regardless of whether the excavation of the site is for academic or development purposes, the loss of heritage resource sites is generally offset by the recovery of knowledge about the site gained through meticulous identifying, cataloguing and preserving of artifacts and features in compliance with provincial guidelines.

7.1.11.3 Summary

Given that disturbances to heritage resources by the Project in North Thompson River Provincial Park are effectively offset by knowledge gained through the mitigation approved by the provincial regulatory authorities, no residual effects on heritage resource indicators have been identified and, consequently, no further evaluation of the effects of the Project on heritage resources is warranted.

7.1.12 Traditional Land and Resource Use

This subsection describes the potential Project effects on the potential traditional land and resource use (TLRU) sites in North Thompson River Provincial Park. The TLRU LSA includes the zones of influence of water quality and quantity, air emissions, acoustic environment, fish and fish habitat, vegetation, wildlife and wildlife habitat and heritage resources since TLRU is dependent on these resources; shown in Figure 6.2.2.4 of the Introduction to the Draft Stage 2 Detailed Proposal. The TLRU RSA includes the RSA boundaries of water quality and quantity, air emissions, acoustic environment, fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat and heritage resources; shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal.

To date no TLRU sites have been identified along the narrowed pipeline corridor in North Thompson River Provincial Park. However, Trans Mountain will continue to engage Aboriginal communities through all phases of the Project. Traditional land and resource use information received from participating communities will be reviewed in order to confirm literature results and mitigation measures including those provided in the Pipeline EPP. Any additional site-specific mitigation measures resulting from these studies will be provided in the updated Pipeline EPP prior to construction.

The construction of the Project has the potential to directly and indirectly disrupt subsistence sites and activities, as well as the broader ecological system, through the temporary physical disturbance of land or resources. Subsistence sites and activities may also be affected by Project activities resulting from limited access and/or increased public access to traditional harvesting areas and increased pressure on environmental resources.

The operations phase of the Project will affect TLRU primarily through temporary disturbances related to site-specific maintenance.

A summary of mitigation measures provided in Table B7.1.12-1 was principally developed in accordance with Trans Mountain standards as well as industry accepted best practices and procedures and provincial regulatory authority guidelines related to specific elements such as fish and fish habitat, vegetation, wildlife and wildlife habitat, and heritage resources.

TABLE B7.1.12-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON TRADITIONAL LAND AND RESOURCE USE FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Traditional Land and Resource Use Indicator – Subsistence Activities and Sites			
1.1 Disruption of use of trails and travelways	Footprint	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Upon Footprint finalization, applicable mitigation options listed below for previously identified trails and travelways within the narrowed pipeline corridor will be confirmed based on the following criteria: the location of the site with respect to the proposed area of development, the relative importance of the site to the community, and the potential for an alternative mitigation strategy to reduce or avoid sensory disturbance. • Should additional trails and travelways be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: • detailed recording and mapping to within 100 m on both sides of the pipeline right-of-way; in partnership with community representatives, a decision is then made about the relative importance of the trail and how best to maintain and control access;	• Disturbance of trails and travelways during construction and site-specific maintenance.

TABLE B.7.1.12-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.1 Disruption of use of trails and travelways (cont'd)	See above	• signage or scheduling construction during periods of least impact; and/or • alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • Implement appropriate measures identified in the Heritage Resources Discovery Contingency Plan [Appendix B]. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• See above.
	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during the construction and site-specific maintenance activities (refer to Section 7.2.1).
1.2 Alteration of plant harvesting sites	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Ensure equipment arrives at all construction sites clean and free of soil or vegetative debris. Inspect and identify equipment deemed to be acceptable with a suitable marker, such as a sticker. Do not allow any equipment arriving in a dirty condition onsite until it has been cleaned [Section 7.0]. • Should additional plant harvesting sites be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: • limiting the use of chemical applications; • replacement of plant species during reclamation; • avoidance of the site; and/or • alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • See Section 7.1.8 Vegetation for additional mitigation measures. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.
1.3 Disruption of subsistence hunting activities	LSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • See Section 7.1.9 Wildlife and Wildlife Habitat for mitigation relevant to sensory disturbance, loss or alteration of wildlife habitat, injury and mortality.	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.

TABLE B.7.1.12-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)

1.3 Disruption of subsistence hunting activities (cont'd)	See above	• Should additional hunting sites be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures:
		  • adhering to species specific timing constraints to the extent feasible;
		  • leaving breaks in the pipeline trench to allow animals to cross;
		  • limiting the use of chemical applications; and/or
		  • alternative site-specific mitigation strategies recommended by participating Aboriginal communities.
		• See Section 7.1.5 Acoustic Environment for additional mitigation measures.
		• Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).
			• See above.

1.4 Disruption of subsistence trapping activities	LSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0].
		• Install signage notifying of construction activities in the area [Section 4.0].
		• Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0].
		• Prohibit the vandalism or theft of trapper equipment or trapped animals if they are observed on the construction right of way or the construction site prior to clearing [Section 7.0].
		• Should additional trapping sites or trap line equipment be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures:
		  • maintaining access to the trap line;
		  • moving of trap line equipment by the trapper prior to construction; and/or
		  • alternative site-specific mitigation strategies recommended by participating Aboriginal communities.
		• See Section 7.1.5 Acoustic Environment for additional mitigation measures.
		• See Section 7.1.9 Wildlife and Wildlife for mitigation relevant to sensory disturbance, loss or alteration of wildlife habitat, and wildlife mortality.
		• Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).
			• Alteration of subsistence resources.
			• Disruption of subsistence activities during construction and site-specific maintenance.

1.5 Disruption of subsistence fishing activities	LSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Prohibit recreational fishing by Project personnel on or in the vicinity of the construction right of way. The use of the construction right of way to access fishing sites is prohibited [Section 7.0].	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.

TABLE B.7.1.12-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)

1.5 Disruption of subsistence fishing activities (cont'd)	See above	• Should additional fishing sites be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures:
		  • recording and mapping of fishing locales;
		  • strict adherence to the legislation, standards and guidelines set by provincial and federal regulatory authorities for watercourse crossings; and/or
		  • alternative site-specific mitigation strategies recommended by participating Aboriginal communities.
		• See Section 7.1.3 Water Quality and Quantity for mitigation measures relevant to potential effects on water quality and quantity.
		• See Section 7.1.6 Fish and Fish Habitat for mitigation measures relevant to potential effects on fish and fish habitat.
		• Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).
			• See above.

2. Traditional Land and Resource Use Indicator – Cultural Sites			
2.1 Disturbance of gathering places	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • See Section 7.1.4 Air Emissions and Section 7.1.5 Acoustic Environment for measures pertaining to nuisance air and noise emissions, respectively. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site specific maintenance activities (refer to Section 7.2.1).
2.2 Disturbance of sacred sites	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • See Section 7.1.4 Air Emissions and Section 7.1.5 Acoustic Environment for measures pertaining to nuisance air and noise emissions, respectively. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site specific maintenance activities (refer to Section 7.2.1).

Notes: 1 LSA = TLRU LSA; RSA = TLRU RSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.12.1 Significance Evaluation of Potential Residual Effects

To date, Trans Mountain has not been made aware of any use of the lands within the narrowed pipeline corridor in North Thompson River Provincial Park for traditional activities. Nevertheless, Trans Mountain assumes that TLRU activities could be potentially practiced within the park.

Table B7.1.12-2 provides a summary of the significance evaluation of the potential residual socio-economic effects of the construction and operations of the proposed pipeline on TLRU indicators in North Thompson

River Provincial Park. The rationale used to evaluate the significance of each of the residual socio-economic effects is provided below.

TABLE B7.1.12-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON TRADITIONAL LAND AND RESOURCE USE FOR NORTH THOMPSON RIVER PROVINCIAL PARK

				Temporal Context						
	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance[2]
1	Traditional Land and Resource Use Indicator – Subsistence Activities and Sites									
1(a)	Disturbance of trails and travelways during site-specific maintenance.	Negative	Footprint	Short-term	Periodic	Short-term	Medium	Low	Moderate	Not significant
1(b)	Alteration of subsistence resources.	Negative	RSA	Short-term	Periodic	Long-term	Medium	Low	Moderate	Not significant
1(c)	Disruption of subsistence activities during construction and site-specific maintenance.	Negative	RSA	Short-term	Periodic	Long-term	Medium	Low	Moderate	Not significant
1(d)	Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site-specific maintenance activities.	Negative	RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant
2	Traditional Land and Resource Use Indicator – Cultural Sites									
2(a)	Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site-specific maintenance activities.	Negative	RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant

Notes: 1 LSA = TLRU LSA; RSA = TLRU RSA.

2 Significant Residual Socio-economic Effect: A residual socio-economic effect is considered significant if the effect is predicted to be:

- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or

- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

TLRU Indicator – Subsistence Activities and Sites

Disturbance of Trails and Travelways During Construction and Site-Specific Maintenance

Disturbance of trails and travelways during construction is anticipated to result from short-term physical disturbance of land and access limitations that may affect the practice of traditional activities by Aboriginal communities. Similar effects of reduced access may occur during periods of site-specific maintenance.

To date, no trails and travelways have been identified along the narrowed pipeline corridor within North Thompson River Provincial Park. If trails and travelways are identified in North Thompson River Provincial Park during ongoing engagement with Aboriginal communities, the proposed mitigation measures described in Table B7.1.12-1 will be implemented to mitigate the potential adverse effects of the Project on these site types and will be dependent upon the type of site identified.

Additional measures to reduce the disruption of trails and travelways include notification regarding construction schedules and pipeline route maps, installing signage notifying of construction activities in the area and working with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members.

Despite the implementation of the proposed mitigation measures, traditional land and resource users may still be unable to use, or be deterred from using, certain areas at times during construction and periods of site-specific maintenance and consequently, the magnitude of the residual effect is considered to be medium (Table B7.1.12-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – trails, and travelways may be physically disturbed if occurring within the construction right-of-way and temporary workspace.
- Duration: short-term – events causing the effects will be construction activity or site-specific maintenance that would occur within any one year period during operations.
- Frequency: periodic – construction and site-specific maintenance activities will occur intermittently but repeatedly throughout the assessment period.
- Reversibility: short-term – effects will be focused on the construction phase or site-specific maintenance that would occur within any one year period during operations.
- Magnitude: medium – it is expected that Project-related disturbances would be temporary through the implementation of the proposed mitigation measures during construction and operations to reduce, but not eliminate, potential effects on disturbance of trails and travelways. Mitigation strategies are also in place in the event any unidentified subsistence sites are discovered.
- Probability: low - to date no trails and travelways have been identified within the narrowed pipeline corridor in North Thompson River Provincial Park.
- Confidence: moderate – based on Project information and the professional experience of the assessment team.

Alteration of Subsistence Resources

Subsistence resources may be disturbed or altered during construction and operations of the Project. The alteration of subsistence activities could manifest itself through changes to local harvesting locales, behavioural alteration or sensory disturbance of environmental resources or increased public access to traditional harvesting areas and increased pressure on environmental resources. The operations of the proposed pipeline will affect subsistence resources primarily due to temporary disturbances related to maintenance activities.

To date, no subsistence harvesting sites have been identified along the narrowed pipeline corridor within North Thompson River Provincial Park. If subsistence harvesting sites are identified in North Thompson River Provincial Park during ongoing engagement with Aboriginal communities, the proposed mitigation measures described in Table B7.1.12-1 will be implemented to mitigate the potential adverse effects of the Project on these site types and include measures outlined under the assessment of relevant environmental resources (*e.g.,* air emissions, acoustic environment, fish and fish habitat, wildlife and wildlife habitat, vegetation, wetlands).

Despite the implementation of the proposed mitigation measures, traditional land and resource users may still be unable to use, or be deterred from using, certain areas at times during construction and periods of site-specific maintenance. Changes to the distribution and abundance of resources could in turn result in loss or alteration of harvesting areas, which could result in indirect effects such as harvesters having to spend more time and money to travel further for subsistence activities. Therefore the magnitude of the residual effect is considered to be medium (Table B7.1.12-2, point 1[b]).A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: TLRU RSA – potential effects may extend beyond the Footprint into ZOI of target environmental resources.
- Duration: short-term – events causing the effects will be construction activity or site-specific maintenance that would occur within any one year period during operations.
- Frequency: periodic – construction and site-specific maintenance activities will occur intermittently but repeatedly throughout the assessment period.

- Reversibility: long-term – the effects of disturbance to traditionally harvested resources will be dependent on each target species' sensitivities and could extend greater than 10 years following decommissioning and abandonment, once native vegetation regenerates over the Footprint.

- Magnitude: medium – the effects assessment results for fish and fish habitat, wildlife and wildlife habitat and vegetation indicates that effects to traditionally harvested resources may be detectable and is dependent on each target species' sensitivities.

- Probability: low – to date no subsistence resources have been identified by Aboriginal communities within the narrowed pipeline corridor in North Thompson River Provincial Park.

- Confidence: moderate – based on Project information and the professional experience of the assessment team.

Disruption of Subsistence Activities During Construction and Site-Specific Maintenance

The disruption of subsistence hunting, fishing, trapping and plant gathering activities is a potential residual effect of interactions between traditional resource users and construction and operations activities of the Project. In the event that subsistence activities are disrupted by the construction or operations of the Project, the interruption could mean that the traditional resource user misses the harvest opportunity or that their participation is curtailed. The disruption of subsistence activities also refers to the possibility that traditional resource users could be prevented from accessing key harvesting areas resulting from limited access or increased public access to traditional harvesting areas. The operations of the proposed Project will affect subsistence activities primarily due to temporary disturbances related to site-specific maintenance.

To date, Trans Mountain has not been made aware of any subsistence activities along the narrowed pipeline corridor within North Thompson River Provincial Park. Nevertheless, Trans Mountain assumes that subsistence activities could be potentially practiced within the park, although of low probability (Table B7.1.12-2, point 1[c]).

Aboriginal communities will be provided with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities. Signage will be installed, notifying of construction activities in the area. Trans Mountain will work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members. A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: TLRU RSA – the proposed Project may affect subsistence activities beyond the construction footprint and may also indirectly affect the distribution of traditional resource users in other areas of the TLRU RSA.

- Duration: short-term – events causing the effects will be construction activity or site-specific maintenance that would occur within any one year period during operations.

- Frequency: periodic – construction and site-specific maintenance activities will occur intermittently but repeatedly throughout the assessment period.

- Reversibility: long-term – the disruption of subsistence hunting, trapping, fishing and plant gathering activities during construction is limited to the construction phase of the Project; however, changes to preferred harvesting locales could result in indirect effects such as harvesters having to spend more time and money to travel further for subsistence activities, and could extend greater than 10 years following decommissioning and abandonment, once native vegetation regenerates over the Footprint.

- Magnitude: medium – mitigation measures are in place in the event any unidentified subsistence activities and land users are discovered and given that the effects assessment results for fish and fish habitat, vegetation, wetlands, and wildlife and wildlife habitat demonstrate that equivalent land use capability will be maintained by the application of the mitigation strategies described in this Draft Stage 2 Detailed Proposal and in the Pipeline EPP. It is expected that Project-related disruptions would be temporary through the implementation of the proposed mitigation measures during the construction and operations phases to reduce, but not eliminate, the potential effects on subsistence activities.

- Probability: low – to date no subsistence activities and land users have been identified within the TLRU RSA.
- Confidence: moderate – based on Project information and the professional experience of the assessment team.

Sensory Disturbance for Aboriginal and Non-Aboriginal Local Residents and Land Users (from Nuisance Air Emissions and Noise)

The construction and site-specific maintenance of the Project may result in the sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (Table B7.1.12-2, point 1[d]). This potential residual effect is assessed under the Visitor Enjoyment indicator of Recreational Values in Section 7.2.1. The significance evaluation of this residual effect is provided in Section 7.2.1 which includes all land and resource users, provides an explanation of the rationale and significance criteria.

TLRU Indicator – Cultural Sites

Sensory Disturbance for Aboriginal and Non-Aboriginal Local Residents and Land Users (from Nuisance Air Emissions and Noise)

The construction and site-specific maintenance of the Project may result in the sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (Table B7.1.12-2, point 2[a]). This potential residual effect is assessed under the Visitor Enjoyment indicator of Recreational Values in Section 7.2.1. The significance evaluation of this residual effect is provided in Section 7.2.1 which includes all land and resource users, provides an explanation of the rationale and significance criteria.

7.1.12.2 Summary

As identified in Table B7.1.12-2, there are no situations for TLRU indicators that would result in a significant residual socio-economic effect. Consequently, it is concluded that the residual socio-economic effects of Project construction and operations on conservational values of North Thompson River Provincial Park related to TLRU will be not significant.

7.2 Recreational Values of North Thompson River Provincial Park

North Thompson River Provincial Park is a popular campground as well as has a beautiful viewpoint looking over the confluence of the Clearwater and North Thompson rivers. Hiking, cycling and camping are some of the recreational opportunities that are offered by the park.

7.2.1 Visitor Enjoyment and Safety

This subsection describes the potential Project effects on visitor enjoyment and safety values within North Thompson River Provincial Park. This refers to the use of the land and resources by people, in both a consumptive and non-consumptive manner. Aesthetic attributes of human use areas are also considered in this discussion *(e.g.,* sensory disturbance, changes in viewshed*).*

Visitor enjoyment and safety amalgamates relevant components from the human occupancy and resource use (HORU) and infrastructure and services elements in Volume 5B of the Facilities Application, particularly indicators related to parks and protected areas, outdoor recreation use and transportation infrastructure. Spatial boundaries for visitor enjoyment follow the spatial boundaries outlined for the human occupancy and resource use element. Spatial boundaries for visitor safety follow the spatial boundaries outlined for the infrastructure and services element; shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal.

7.2.1.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline in North Thompson River Provincial Park on visitor enjoyment and safety indicators are listed in Table B7.2.1-1.

A summary of mitigation measures provided in Table B7.2.1-1 was principally developed in accordance with Trans Mountain standards and industry best practices. A full list of socio-economic mitigation measures is found in the Socio-economic Management Plan (SEMP) (Section 8.0) of the Pipeline EPP.

TABLE B7.2.1-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VISITOR ENJOYMENT AND SAFETY FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Visitor Enjoyment and Safety Indicator – Visitor Enjoyment			
1.1 Physical disturbance to North Thompson River Provincial Park	Footprint	• Minimize disturbance of valued natural features with a non-traditional human use (e.g., recreational trails, recreational use areas, key use areas within North Thompson River Provincial Park) during final route refinement to the extent practical [SEMP Section 8.4.6]. • Provide provincial and federal regulatory authorities, municipal / regional governments; Aboriginal communities; BC Parks and recreational organizations with final routing information, including maps, as well as construction schedule information [SEMP Section 8.4.6]. • Install signs in North Thompson River Provincial Park and known recreational use areas in the vicinity notifying users of construction activities and timing [SEMP Section 8.4.6]. • Develop and implement a communication plan for sharing information about key Project construction milestones and information with the general public in affected areas [SEMP Section 8.4.6]. • Ensure any changes in planned timing or location of construction activities is communicated to the public, relevant municipal and regional governments, Aboriginal communities, BC Parks and formal recreation organizations in affected areas [SEMP Section 8.4.6]. • Apply all measures pertaining to HORU in the SEMP and all measures pertaining to notification and vegetation in the Pipeline EPP.	• Physical disturbance to natural and built features in protected areas during construction and site-specific maintenance.
1.2 Physical disturbance to facilities, including trails and trailheads, within North Thompson River Provincial Park	HORU RSA	• Avoid disturbance of built features during final route refinement, to the extent practical [SEMP Section 8.4.6]. • Narrow the construction right-of-way at key locations to avoid valued built or natural features, to the extent practical [SEMP Section 8.4.6]. • Ensure closure signage is placed on affected established trails or trailheads. • Contact appropriate regulatory authorities and municipal tourism offices prior to construction activities and provide maps and schedules of the proposed construction activities to enable them relay information about possible trail and recreational use area closures [SEMP Section 8.4.6]. • Develop and implement a communication plan for sharing information about key Project construction milestones and information with the general public in affected areas [SEMP Section 8.4.6]. • Apply all measures pertaining to HORU in the SEMP and all measures pertaining to notification and vegetation in the Pipeline EPP.	• Decrease in quality of the outdoor recreational experience of Aboriginal and non-Aboriginal resource users during construction.
1.3 Change to access of protected area	HORU RSA	• Maintain access to established recreation features, through the clearing, construction and reclamation period [SEMP Section 8.4.6]. • Deactivate and reclaim temporary access routes and sites where required to construct the Project once Project construction is complete [SEMP Section 8.4.6]. • Place signage on access roads in the vicinity of construction activities to ensure users are aware that construction activities are taking place [SEMP Section 8.4.6]. • Bore under paved and high use roads [SEMP Section 8.4.6]. • Where minor roads are crossed that may affect established community use/access routes, complete an open cut crossing within one day, to the extent practical [SEMP Section 8.4.6]. • Provide provincial and federal regulatory authorities, municipal / regional governments; Aboriginal communities; BC Parks; and recreational organizations with final routing information, including maps, as well as construction schedule information [SEMP Section 8.4.3]. • Develop Traffic Control Plans for site specific sections of roads affected by the Project [SEMP Section 8.4.3]. • Develop a communication plan for activities that impact normal traffic flow, such as road closures, detours [SEMP Section 8.4.3]. • Develop and implement a communication plan for sharing information about key Project construction milestones and information with the general public in affected areas [SEMP Section 8.4.6].	• Change in land use patterns during construction and site-specific maintenance.

TABLE B7.2.1-1 Cont'd

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.3 Change to access of protected area (cont'd)	See above	• Ensure any changes in planned timing or location of construction activities is communicated to the public, relevant municipal and regional governments, Aboriginal communities, BC Parks and formal recreation organizations in affected areas. • Apply all other measures pertaining to notification and access in the SEMP.	• See above
1.4 Sensory disturbance of land and resource users	HORU RSA	• Adhere to all federal and provincial guidelines and legislation for noise management. • Use only the size and power of tools necessary to limit noise from power tool operations. Ensure stationary equipment, such as compressors and generators, will be located away from noise receptors, to the extent feasible. • Maintain noise suppression equipment (e.g., silencers) on all construction machinery and vehicles. • Enclose noisy equipment and use baffles such as material storage and subsoil piles, where and when feasible, to limit the transmission of noise beyond the construction site. • Restrict the duration that vehicles and equipment are allowed to site and idle to less than one hour, unless air temperature is less than 0°C. • To reduce air and noise emissions from Project-related vehicles, use multi-passenger vehicles for the transportation of crews to and from the job sites, where feasible. Actively encourage car-pooling when shuttle bus services are not practical.	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions, noise and visual effects) during construction and site-specific maintenance activities.
1.5 Alteration of viewsheds	HORU LSA	• To limit the effects of clearing in areas of new pipeline right-of-way, during reclamation use seeds that ensure vegetation regrowth blends with adjacent vegetation [SEMP Section 8.4.7). • Use seedlings and/or larger trees for vegetation screens that have been salvaged from the construction right-of-way or sourced from acceptable donor sites or commercially propagated rooted stock seedlings and container trees grown from a seed sources obtained from the same natural subregion/Biogeoclimatic Zone, as well as the same general latitude and elevation [EPP Section 8.0]. • Maintain an undisturbed vegetation screen between a new borrow site and an adjacent road [EPP Section 11.0]. • Develop and implement an issues tracking process to monitor and respond to Project-related socio-economic issues and opportunities that emerge during construction and reclamation [SEMP 8.4.11]. • Continue communication and engagement with stakeholders as the Project progresses [SEMP 8.4.11].	• Alteration of viewsheds.
2. Visitor Enjoyment and Safety Indicator – Visitor Safety			
2.1 Increased traffic due to transportation of workers and supplies	Socio-economic RSA	• Develop estimates of Project-related traffic volumes associated with all Project components, related to both the movement of workers and the movement of equipment and materials. • Continue to consult with the BC Ministry of Transportation and relevant municipalities regarding traffic volumes anticipated and the traffic management protocols. • Develop a traffic and Access Control Management Plan for the Project and Traffic Control Plans for particular contracts. • Where possible, provide daily shuttle bus service from designated staging areas to work sites. • Actively encourage carpooling for times when shuttles/buses is not practical or available. • Communicate with local police and emergency services personnel to keep these organizations informed of traffic schedules. • Develop a communication plan for activities that impact normal traffic flow, such as road closures, detours. • Apply all other transportation and traffic related measures outlined in the Pipeline EPP.	• Increase in traffic on highways and access roads during construction. • Sensory disturbances for Aboriginal local residents and land use (refer to potential effect 1.4 of this table). • Increase in traffic related injury and mortality.

Note: 1 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.2.1.2 Significance Evaluation of Potential Residual Effects

Table B7.2.1-2 provides a summary of the significance evaluation of the potential residual effects of the construction and operations of the Project on visitor enjoyment and safety indicators. The rationale used to value the significance of each of the residual socio-economic effects is provided below.

TABLE B7.2.1-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VISITOR ENJOYMENT AND SAFETY FOR NORTH THOMPSON RIVER PROVINCIAL PARK

Potential Residual Effects		Impact Balance	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
				Duration	Frequency	Reversibility				
1.	Visitor Enjoyment and Safety Indicator - Visitor Enjoyment									
1(a)	Physical disturbance to natural and built features in protected areas during construction and site-specific maintenance.	Negative	Footprint	Short-term	Periodic	Short to medium-term	Medium	High	Moderate	Not significant
1(b)	Decrease in quality of the outdoor recreational experience of Aboriginal and non-Aboriginal resource users during construction.	Negative	HORU RSA	Short-term	Isolated	Short-term	Low	High	High	Not significant
1(c)	Decrease in quality of the outdoor recreational experience of Aboriginal and non-Aboriginal resource users during site-specific maintenance.	Neutral to negative	HORU RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant
1(d)	Change in land use patterns during construction and site-specific maintenance.	Negative	HORU RSA	Short-term	Periodic	Short-term	Medium	High	High	Not significant
1(e)	Change in land use patterns during operations.	Negative to positive	HORU RSA	Short-term	Isolated	Long-term	Low	High	High	Not significant
1(f)	Sensory disturbances for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions, noise and visual effects) during construction and site-specific maintenance.	Negative	HORU RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant
1(g)	Alteration of viewsheds.	Negative	HORU LSA	Short-term	Isolated	Long-term	Low	High	High	Not significant
2.	Visitor Enjoyment and Safety Indicator – Visitor Safety									
2(a)	Increase in traffic on highways and access roads during construction.	Negative	Socio-economic RSA	Short-term	Isolated	Short-term	Low	High	High	Not significant
2(b)	Increase in traffic related injury and mortality.	Negative	Socio-economic RSA	Short-term	Isolated	Short-term	Negligible to medium	Low	High	Not significant

Note: 1 Significant Residual Socio-economic Effect: A residual socio-economic effect is considered significant if the effect is predicted to be:
- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

Visitor Enjoyment and Safety Indicator – Visitor Enjoyment

Physical Disturbance to Natural and Built Features in Protected Areas During Construction and Site-Specific Maintenance

North Thompson River Provincial Park will be crossed by the narrowed pipeline corridor during construction activities, as well as during periods of site-specific maintenance (*i.e.*, integrity digs).

Natural and built features within North Thompson River Provincial Park - such as interpretive signs, parking lots, picnic areas, trees, rocks, watercourses and trails - may have intrinsic, interpretive and recreational value, which may be disturbed as a result of pipeline construction and site-specific maintenance. The narrowed pipeline corridor crosses a sani-station at approximately AK 727 and the Northside and Southside Trail from approximately AK 726.6 to AK 727.3. The narrowed pipeline corridor also crosses the access road to the recreational use area of the park at approximately AK 726.9 and Swanson Road at approximately AK 725.5 which provides access to the area of the park east of the Clearwater River. The existing TMPL right-of-way in the park is commonly used for recreation purposes such as dog walking, cross country skiing and horseback riding, as identified at the Clearwater Parks Workshop and Clearwater Community Workshop.

Mitigation measures related to vegetation, wetlands, wildlife and wildlife habitat and fish and fish habitat have been designed to reduce the amount of land disturbed in any park or protected area. Other key mitigation measures includes avoiding key valued natural or built features during right-of-way finalization, narrowing the right-of-way in certain areas, and restoring any trails or other valued features that may be disturbed. Even with the implementation of mitigation measures to reduce land disturbance, certain natural features with intrinsic value may be disrupted depending on the final right-of-way selection, resulting in a residual adverse effect. Assuming the implementation of all mitigation measures, the residual effect of the Project on natural and built features in protected areas is considered to be reversible in the short to medium-term (*i.e.*, residual effects will primarily occur during construction, but reclamation of valued features or areas may extend into the first several years of operations). The magnitude of the effect is considered medium; though the effect may be primarily that of an inconvenience or nuisance, parks and protected areas have an intrinsic value to many users (Table B7.2.1-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – natural and built features within parks and protected areas will be directly affected by construction of the pipeline.
- Duration: short-term – the residual effect will be caused by construction and site-specific maintenance that may occur within any one year during operations.
- Frequency: periodic – the disturbance to natural and built features in parks and protected areas will be caused by construction and periods of site-specific maintenance that would occur intermittently but repeatedly during the assessment period.
- Reversibility: short to medium-term – disturbance to natural and built features will be primarily limited to the construction phase and periods of site-specific maintenance; but post-construction reclamation of natural areas and features may extend into the first several years of operations.
- Magnitude: medium – given the intrinsic value of parks and protected areas, disruptions are considered a moderate modification in the socio-economic environment.
- Probability: high – construction activities will take place through parks and protected areas; therefore, disturbance of natural features with intrinsic value is likely.
- Confidence: moderate – particular valued built or natural features potentially disturbed will depend on right-of-way finalization.

Decrease in Quality of the Outdoor Recreational Experience of Aboriginal and Non-Aboriginal Resource Users

Construction

The outdoor recreational experiences of Aboriginal and non-Aboriginal resource users, such as hiking, cycling and fishing activities may be affected by the physical disturbance of outdoor recreation areas during pipeline construction. Nuisance air emissions, noise and visual effects may also occur during the construction of the Project and affect all land users living, working or recreating in the vicinity of the final right-of-way.

The impact balance of this residual effect is considered negative; however, mitigation measures designed to communicate construction locations and timing to the users in the vicinity of the narrowed pipeline corridor will lessen the effect, since users will have the opportunity to choose an alternate location for recreational pursuits. Given the relatively short construction period at any given location, use of well-maintained equipment and limiting idling of equipment, the residual effect is considered to be of low magnitude and reversible in the short-term (Table B7.2.1-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – sensory disturbances caused by construction can extend into the HORU LSA and HORU RSA.
- Duration: short-term – the event causing the effect is construction activity.
- Frequency: isolated – the event causing the effect is confined to a specific period (*i.e.,* construction).
- Reversibility: short-term - the residual effect is limited to the construction phase.
- Magnitude: low – change may be detectable, but will primarily be that of an inconvenience or nuisance.
- Probability: high – Project construction activity will occur in areas used for outdoor recreation.A summary of the rationale for all of the significance criteria is provided below.
- Confidence: high – based feedback from stakeholders, location of the Project, and the professional experience of the assessment team.

Site-Specific Maintenance Activities

The outdoor recreational experience of Aboriginal and non-Aboriginal resource users, such as camping, quadding, canoeing, trail rides, hunting, wildlife viewing and fishing activities may be affected by site-specific maintenance. Use of outdoor water and land based recreation areas, such as trails and trailheads and waterways, may be disturbed or disrupted by site-specific maintenance. Site-specific maintenance (*e.g.*, aerial patrols, vegetation management, integrity digs) will occur periodically throughout the operations phase of the Project. These activities will involve workers and equipment that could result in nuisance air and noise emissions.

The impact balance of this residual effect is considered neutral to negative. From approximately AK 726.2 to AK 727.8, where the narrowed pipeline corridor is along the existing TMPL right-of-way, these activities will be comparable to existing TMPL operations and not considered to be a change. The portion park where the narrowed pipeline corridor parallels the existing TMPL right-of-way is predominantly used for recreational purposes. The impact balance of this potential residual effect is considered negative, as it may cause disruption to park users. From approximately AK 725.4 to AK 725.8, the narrowed pipeline corridor deviates slightly from the existing TMPL right-of-way within the park boundaries. The magnitude of this effect will be reduced through the use of well-maintained equipment, by limiting the idling of equipment and by scheduling activities to avoid peak recreational use times where practical. The residual effect is reversible in the short-term since site-specific maintenance activities will be completed within any one year of operations (Table B7.2.1-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – noise and air emissions caused by from site-specific maintenance activities can extend into the HORU LSA and HORU RSA.
- Duration: short-term – site-specific maintenance will be completed within any one year during operations.
- Frequency: periodic – the event causing the effect (*i.e.,* site-specific maintenance activities) occurs intermittently but repeatedly over the assessment period.
- Reversibility: short-term – site-specific maintenance will be completed in any one year during operations.
- Magnitude: low – change may be detectable, but will primarily be that of an inconvenience or nuisance.
- Probability: high – site-specific maintenance activities will be required as part of regular operations and will involve the use of heavy and light equipment and vehicles.
- Confidence: high – based on Project information and the professional experience of the assessment team.

Change in Land Use Patterns

Construction and Site-Specific Maintenance

Change in land use patterns in the HORU RSA during construction is anticipated to result from short-term physical disturbance of land, access roads and/or from alteration of traffic patterns, movements and volumes along highways and roads. A short-term disruption to access and use patterns could affect recreational (both in and outside of park and protected areas) users who are deterred from visiting a particular location. The narrowed pipeline corridor crosses the only access road to the campground, picnic area, playground and hiking trails in the park the park at approximately AK 726.9. Paved, high grade roads such as this access road will likely be bored. The park is a popular campground and day use site and the only provincial park facility on Highway 5 between Kamloops and Mount Robson. It primarily serves transient users travelling on Highway 5 (BC Ministry of Environment 2003). Restriction of access to fishing creeks was identified as a concern at the Clearwater Community Workshop.

The North Thompson River Provincial Park has a service yard located approximately 60 m from the narrowed pipeline corridor at approximately AK 726.9 that is used by Conservation Officer Services, Forest Service Protection and the Park Facility Operator (BC Ministry of Environment 2003). Access to the service yard is via the access road to the recreational use area of the park.

Trans Mountain will employ mitigation measures that will assist in minimizing the above effects. Mitigation measures to reduce Project-related traffic (such as using multi-passenger vehicles and obeying traffic, road-use and safety laws) as well as low-impact road crossing construction methods will be implemented during Project construction activities, and will also minimize access and use disruptions. However, residual effects are still anticipated, as land disturbance through a range of land use areas and increased traffic on select access routes are unavoidable during specific times of the Project.

The impact balance of this residual effect is considered negative, but these residual effects of disruption to access and use patterns of land is considered to be reversible in the short-term (*i.e.,* limited to the construction phase or periods of site-specific maintenance that would occur within any one year during operations). Even after the implementation of proposed mitigation measures, users may still be unable to use, or be deterred from using, certain areas at certain times. Recreationalists may alter their use destinations away from areas that interface with Project construction. Disruption of access may result in certain Aboriginal land and resource users being deterred from practicing traditional activities and could affect the livelihoods of certain users. Construction activity could affect resource based business practices (*e.g.,* commercial recreation), which could result in a loss of income for those reliant on natural resources or commercial locations for their livelihood. Given the potential implications for livelihood practices associated with a disruption to access and use patterns of some land use areas, the magnitude of this residual effect is considered to be medium (*i.e.,* more than an inconvenience or nuisance) (Table B7.2.1-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – access roads to use areas in the HORU RSA may be physically disturbed by construction activity and disrupted by construction-related traffic.
- Duration: short-term – the event causing the disruption to access and use is the construction phase and site-specific maintenance during operations.
- Frequency: periodic – the event causing the disruption to access and use would occur intermittently but repeatedly (*i.e.,* specific months of construction and during site-specific maintenance that would occur during any one year of operations).
- Reversibility: short-term – the residual effect is limited to the construction phase or periods of site-specific maintenance occurring within any one year during operations.
- Magnitude: low – change may be detectable, but will primarily be that of an inconvenience or nuisance.
- Probability: high – Project activities will disturb land use areas and may impede access to specific areas at select times.

- Confidence: high – based on Project information, regional land use and access patterns, and the professional experience of the assessment team.

Operations

Changes to land use patterns during operations (*i.e.,* during periods not associated with site-specific maintenance) may result from vegetation management on the pipeline right-of-way in areas where the narrowed pipeline corridor deviates from the existing TMPL right-of-way or other linear disturbances. In North Thompson River Provincial Park, the narrowed pipeline corridor deviates slightly from the existing TMPL right-of-way from approximately AK 725.4 to AK 725.8. This portion of the park is zoned as Natural Environment (BC Ministry of Environment 2003).

In the areas of new right-of-way, vegetation management during operations will involve the removal of trees or any vegetation that might restrict service and maintenance equipment along the pipeline right-of-way (though some low growth vegetation will be re-established). Areas of new cleared right-of-way could improve access for some users, including fishing/trapping/hunting users, recreationalists, and traditional Aboriginal resource users. The use of the right-of-way as a recreational trail route was mentioned as a benefit in many communities during stakeholder consultation.

Any new cleared right-of-way could also contribute to fragmentation of certain land use areas over the longer term, resulting in a disruption to recreational use activities. For example, new right-of-way in areas used for hiking or mountain biking could result in land users not using the area; however, it could also result in improved recreational access.

A range of mitigation measures will be implemented to manage issues related to any long-term changes in access and land use patterns that emerge based on right-of-way finalization. These mitigation measures include: communications measures with governments, residents and recreational users about site-specific maintenance activities; and measures to ensure minimization of vegetation disturbance and optimize reclamation. The impact balance of this residual effect is considered negative or positive, depending on the user. The reversibility of the effect is considered long-term, since changes to access and use patterns in areas where the narrowed pipeline corridor deviates from the existing TMPL right-of-way or other linear disturbances will extend throughout the operations phase. The magnitude of this residual effect is medium. The residual effect will be a nuisance for some land users (*i.e.,* recreationalists) (Table B7.2.1-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – clearing of the new pipeline right-of-way may result in fragmentation of land use areas beyond the Footprint and HORU LSA throughout operations. However, it will occur only in the limited areas where new corridor is required (new corridor is proposed for only 10% of the proposed route).
- Duration: short-term – the event causing the change to land use and access is the construction of the pipeline.
- Frequency: isolated – the event causing the change in land use and access is the construction of the pipeline which is limited to a specific phase of the assessment period.
- Reversibility: long-term – the residual effect extends throughout operations.
- Magnitude: low – change may be detectable, but will primarily be that of an inconvenience or nuisance.
- Probability: high – new right-of-way will be cleared in select areas.
- Confidence: high – based on Project information, current land uses in the HORU RSA and the professional experience of the assessment team.

Sensory Disturbance for Aboriginal and Non-Aboriginal Local Residents and Land Users (From Nuisance Air Emissions, Noise and Construction-related Visual Effects) During Construction and Site-Specific Maintenance

Nuisance air emissions and noise will occur during the construction of the Project and may at times affect land users living, working or recreating in the vicinity of Project components. Concern regarding construction noise and vibrations was identified at the Clearwater Community Workshop and increased dust due to silty soil was identified as a concern at the Clearwater Parks Workshop. Possible effects may include air emissions and noise from construction equipment and vehicles. Also, equipment, areas of land disturbance, and the activity of construction workers will be visible to nearby land and resource users during periods of construction and site-specific maintenance. There may also be periods of night lighting around construction sites. Consequently, the visual quality of the landscape adjacent to the right-of-way or other construction areas may be adversely affected by the Project over the short-term related to construction or maintenance activity.

The implementation of the proposed mitigation measures will reduce the effects of noise and air emissions on land users. Noise and air emissions levels will adhere to municipal by-laws. Nuisance air and noise emissions will also occur for isolated periods of time at specific locations during periodic site-specific maintenance activities (*e.g.*, aerial patrols, vegetation management, integrity digs) during the operations phase of the Project. Potential effects on the acoustic environment and air emissions are assessed in Sections 7.1.4 and 7.1.5.

A wide range of mitigation measures will be in place to manage air and noise effects. These include complying with local noise legislation; using only the size and power of tools necessary to limit noise from power tool operations; ensuring stationary equipment, such as compressors and generators, will be located away from noise receptors, to the extent feasible; maintaining noise suppression equipment (*e.g.,* silencers) on all construction machinery and vehicles; enclosing noisy equipment and use baffles such as material storage and subsoil piles, where and when feasible, to limit the transmission of noise beyond the construction site; and by limiting the idling of equipment. In addition to the mitigation measures identified, the timing of construction is scheduled to occur during the winter, outside of peak visitor use of the park.

However, even with Trans Mountain's commitment to mitigation measures, some residual sensory disturbance is anticipated. The impact balance of this residual effect is considered negative, as it will likely be undesirable for recreationalists and other park users. Given the successful implementation of the mitigation measures, the residual effect of nuisance air emissions, noise and visual disruption is deemed low in magnitude, as it would be limited primarily to that of a nuisance of inconvenience. The effect would be short-term in duration and periodic in frequency, as sensory disturbance would be primarily caused by construction and intermittent but repeated periods of site-specific maintenance. The potential effect is considered reversible in the short-term (Table B7.2.1-2, point 1[d]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – noise and air emissions emanating from construction can extend into the HORU LSA and HORU RSA.
- Duration: short-term – the event causing the sensory disturbance is construction activity or site-specific maintenance that would occur within any one year during operations.
- Frequency: periodic – the event causing the sensory disturbance would be focused during construction, but would occur intermittently but repeatedly due to site-specific maintenance.
- Reversibility: short-term – the residual effect is limited to the construction phase or site-specific maintenance activities that would occur within any one year during operations.
- Magnitude: low – the implementation of the proposed mitigation measures would effectively reduce the effects of noise and air emissions to that of a nuisance or inconvenience.
- Probability: high – construction and site-specific maintenance activities will involve the use of heavy equipment and vehicles.

- Confidence: high – based on a good understanding of cause-effect relationships and the professional experience of the assessment team.

Alteration of Viewsheds

The Project is anticipated to have longer term visual effects related the presence of the new pipeline right-of-way in select areas. This may affect the quality or experience of certain viewsheds for some land and resource users. The impact balance of this residual effects is considered negative, but low in magnitude as it is considered primarily that of a nuisance or inconvenience.

Potential long-term visual effects of new pipeline right-of-way will be reduced by paralleling an existing linear disturbance (*i.e.,* the existing TMPL right-of-way or other existing rights-of-way) for a majority (approximately 71%) of the route through the park, as well as sharing workspace. The narrowed pipeline corridor parallels the existing TMPL right-of-way near the designated recreational use area of the North Thompson River Provincial Park. Maintenance of existing vegetation buffers and reseeding of the right-of-way and temporary workspaces will also reduce the visual intrusion of new areas of right-of-way. A viewpoint exists in the park overlooking the confluence of the Clearwater and North Thompson rivers (BC Parks 2014).

Re-seeding of disturbed land during reclamation with native and non-native grass mixtures and at rates identified in the Reclamation Management Plan in the Pipeline EPP will ensure the right-of-way vegetation is visually compatible with adjacent areas over the long term. Installing tree/shrub plantings at potential new access points and viewsheds along the right-of-way will minimize the effect in areas of new right-of-way.

The overall residual visual effect of the new pipeline corridor is considered to be reversible in the long-term, as any new cleared right-of-way will be present throughout operations and until the Project is decommissioned and abandoned. However, the magnitude of residual visual effects is considered low. The effect is considered to be that of a nuisance or inconvenience. The duration of the potential residual effect is considered short-term, and the frequency is considered isolated, as the event causing the alterations in viewshed (*i.e.,* clearing of right-of-way) occurs during the construction phase (Table B7.2.1-2, point 1[f]). Trans Mountain will continue to consult with stakeholders regarding visual effects and potential additional site-specific mitigation during the route finalization. A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU LSA – visual effects related to the pipeline extend beyond the pipeline right-of-way into the HORU LSA.
- Duration: short-term – the event causing the alteration of viewsheds (*i.e.*, clearing of the pipeline right-of-way) occurs during the construction phase.
- Frequency: isolated – the event causing the alteration of viewsheds is confined to a specific period (*i.e.*, construction of the pipeline).
- Reversibility: long-term – the alteration of select viewsheds within North Thompson River Provincial Park due to areas of new right-of-way clearing will last throughout the operations phase.
- Magnitude: low – while changes in certain viewsheds will be detectable, the potential effect is considered to be that of an inconvenience or nuisance. The alteration of the local viewsheds is expected to be reduced within North Thompson River Provincial Park by the alignment of the pipeline right-of-way adjacent to existing linear features.
- Probability: high – the Project will involve clearing and construction activities within North Thompson River Provincial Park.
- Confidence: high – based on the professional experience of the assessment team.

Visitor Enjoyment and Safety Indicator – Visitor Safety

Increase in Traffic on Highways and Access Roads During Construction

During construction, there will be an increase in traffic on highways and access roads due to Project-related vehicles. Construction-related traffic will include vehicles used for the transportation of equipment, supplies and workers to various locations along the narrowed pipeline corridor. Major highways that are likely to be used for construction of the Project within North Thompson River Provincial Park include Highway 5.

Ground transportation to the North Thompson River Provincial Park construction spread would be primarily via Highway 5. It is anticipated that most regionally-based personnel would use ground transport from their home community to work locations. Pipeline staging areas will have a combination of work vehicles and crew buses. Existing Annual Average Daily Traffic (AADT) varies in the Project regions. Overall Monthly Average Daily Traffic (MADT) volumes have slightly increased from 2010 to 2012 and throughout the Fraser-Fort George / Thompson-Nicola Region, MADT volumes are highest during the summer months. The addition of several hundred Project-related vehicles will more likely be perceptible on highways or highway sections with lower AADT values.

At the time of writing, detailed traffic estimates and logistics plans were not available for the proposed movement of Project workers, equipment and materials. Project effects on regional highway traffic, and how Project traffic compares to overall daily traffic volumes, will ultimately depend on the source of construction equipment, construction camp modules and other supplies and materials (especially pipe), as well as the methods used to transport these items to construction sites. Pipe and other materials obtained from Canadian or North American suppliers can be transported by rail, offloaded at rail sidings at key points within the Socio-economic RSA and transported relatively short distances by truck to construction sites.

Trans Mountain will develop detailed traffic estimates as construction and Project planning related to the movement of people, materials and equipment continues. Trans Mountain will also develop further logistics information on transportation modes and routes to be used during the construction phase, as well as timing transportation movements to each construction spread and/or facility location. This information will be further evaluated in the context of existing regional traffic volumes, and will become part of the overall information that is shared with local governments, Aboriginal communities, resource users, BC Parks and other stakeholders. This information will also be discussed with provincial transportation authorities during the course of the ongoing consultation planning and construction.

Trans Mountain will employ a number of measures to reduce Project-related vehicles and limit the effects associated with construction-related traffic near and within North Thompson River Provincial Park, including providing daily shuttle bus services from staging areas to work sites and for local workers from pre-determined regional staging areas. It is anticipated that many major equipment deliveries will come to the region via rail or ship to temporary stockpile sites along the narrowed pipeline corridor which will limit the distances travelled by heavy loads on regional highways. The increase in traffic will occur during the construction phase and the residual effect is considered to be reversible in the short-term (*i.e.*, limited to the construction phase). An increase in traffic over current operational movements related to workers and maintenance is not anticipated during the operations phase.

The impact balance of an increase in traffic during construction is considered to be negative, as it may contribute to disruption of existing traffic movement patterns and highway/road users. Highway 5 is the main access route for North Thompson River Provincial Park. Access to the recreational use area of North Thompson River Provincial Park is by a single road off Highway 5, just south of the District of Clearwater. Plans are to pave, high grade roads such as this access road The area of the park east of the Clearwater River can be accessed by Swanson Road from Highway 5 east of the Clearwater River Bridge or from within the District of Clearwater. An increase in traffic on these roads and highways, particularly during summer months when there is a noticeable increase in traffic in some communities due to the tourist season, would be more than a nuisance or inconvenience to residents, travellers and other road users. Trans Mountain will employ mitigation measures to ensure the effects are reduced. The magnitude of the residual effect is anticipated to be low since construction in North Thompson River Provincial Park will occur during the late fall/winter months and will not coincide with an increase in traffic brought on by summer tourists.

The probability of occurrence of the residual effect is high, since daily travel will be required to and from the work sites and materials, equipment and workers must be brought to work sites at key points during construction. The level of confidence in the prediction is also high based on the limited number of alternative transportation routes in the Socio-economic RSA and since daily travel will be required to and from work sites. (Table B7.2.1-2, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Socio-economic RSA – highways and access roads anticipated to be used by Project vehicles are located in various locations across the Socio-economic RSA.
- Duration: short-term – the movement of Project-related equipment, materials and workers during construction will cause the effect; no perceptible increases in traffic are anticipated during the operations phase.
- Frequency: isolated – the movement of equipment, materials and workers on regional highways resulting in increases in traffic is confined to a specific phase of the assessment period (*i.e.,* construction phase).
- Reversibility: short-term – the Project-related increase in traffic is limited to the construction phase.
- Magnitude: low – construction within North Thompson River Provincial Park is planned for late fall/winter, therefore, construction traffic will not coincide with summer tourist months.
- Probability: high – Project-related traffic on highways and access roads will be present during construction.
- Confidence: high – transporting equipment and supplies will result in an increase in traffic, assuming that non-Project related traffic will remain constant.

Increase in Traffic-Related Injury and Mortality

Since the number of traffic collisions in a given area is associated with traffic volumes, an increase in Project-related traffic could be expected to result in a higher number of collisions, and with it an increase in the risk of traffic-related injuries or fatalities. It is not possible to quantify the extent of a potential increase or whether there would be a measureable increase, because the numbers of proposed Project-related vehicles in the area of North Thompson River Provincial Park are not currently known. However, there are several factors that may modify the frequency or severity of those collisions and injuries and that suggest approaches for Trans Mountain to use in minimizing the potential impacts on public safety. These factors are: numbers of vehicles; location of vehicles; and driver behaviour.

Number of Vehicles

Safety performance functions that have been developed for different roadway types confirm that the number of collisions expected in a given area relates directly to the volume of traffic on that roadway segment. In other words, more traffic equates with more collisions (Parisien 2012). By limiting or minimizing the additional traffic put onto a road, the risk of collisions and traffic injuries is also reduced.

Project traffic will comprise both vehicles used to transport equipment and supplies, and also vehicles used to transport workers. Of these, worker transport is more amenable to being reduced, through the use of buses or vans to transport workers rather than private vehicles.

Driver Behaviour

A number of driver behaviours can contribute to the risk and severity of collisions. Driver inattention was the number one contributing factor to collisions in BC in 2007 according to the BC Motor Vehicle Branch (Motor Vehicle Branch 2007); excessive speed was the second most frequent contributing factor.

The development and strict enforcement of policies on driver behaviour, among both employees and contractors, is essential for minimizing potential effects on traffic safety. These policies will include screening of driver abstracts, provisions on observance of posted speed limits, a ban on cell-phone or tablet use, mandatory seatbelt use, fatigue management, no driving while impaired and other behaviours that can influence safety.

The Project will increase the amount of traffic on public roads because of the need for transportation of equipment, supplies and workers to various locations along the narrowed pipeline corridor. Trans Mountain will develop detailed traffic estimates as construction and project planning continues; these detailed traffic estimates are not currently available. The increase in traffic is projected to occur mainly during the construction phase; little Project-related traffic is anticipated for the operations phase.

Mitigation measures include the development of site-specific Traffic Access and Control Plans; the use of shuttle buses, where feasible, to reduce the volume of traffic on the road; communication with local police and emergency services; the development and enforcement of mandatory minimum driving standards; and development of a driving complaint mechanism.

In summary, the Project will increase the number of vehicles in the Socio-economic RSA, both in terms of Project-related construction vehicles and vehicles used to transport workers. Evidence from the literature shows that an increase in traffic volumes results in an increased risk of traffic collisions. This in turn increases the risk of collision-related injuries and fatalities. The impact balance of this effect is characterized as negative since vehicle collisions pose a detriment to community health. The effects would extend throughout the Socio-economic RSA, and would manifest in those locations in which the Project uses vehicles on public roadways. Risk will be particularly high in collision “hot-spots” – locations (usually intersections) which have pre-existing high rates of traffic collisions. The duration is characterized as short-term and the frequency as isolated since the effect is primarily linked to the construction phase when the Project workforce will be large and when the movement of heavy machinery and vehicles is required. An increase in traffic-related injury and mortality is unlikely for the operations phase since there will be fewer workers and equipment requiring transport. The reversibility is similarly characterized as short-term since any effect would mainly be observed during the construction phase. The increase in risk of traffic-related injury and mortality is highly dependent upon the number and types of additional vehicles, the current road conditions and capacity of the roadways, driver behaviour, and the characteristics of the areas through which traffic will travel. While the addition of Project-related traffic creates an increase in collision risk, traffic-related collisions, injuries and fatalities are rare events; therefore, even though the risk increases, there is no certainty that any traffic-related injuries or fatalities will result from the increase in traffic. In addition, no regulatory standards exist for this area. The magnitude of effect is characterized as negligible to medium. (Table B7.2.1-2, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Socio-economic RSA – effects extend throughout the Socio-economic RSA wherever worker and Project-related traffic exists and would be a primary concern in current traffic accident hot-spots.
- Duration: short-term – the event causing the potential increase in traffic-related injury and mortality is the construction phase, when the Project workforce will be large and when heavy machinery and vehicles are required.
- Frequency: isolated – the event causing the potential increase in traffic-related injury and mortality is confined to the construction phase.
- Reversibility: short-term – residual increases in traffic related injury and mortality are considered to be limited to the construction phase.
- Magnitude: negligible to medium – no regulatory standards exist for this area. While the addition of Project-related traffic creates an increase in risk, traffic-related collisions, injuries and fatalities are rare events.
- Probability: low – the probability of occurrence is rated as low since traffic collisions, injuries and fatalities are rare events.
- Confidence: high – the literature showing this cause-effect relationship relates to other areas in BC and internationally, and some stakeholders are concerned about traffic accidents.

7.2.1.3 Summary

As identified in Table B7.2.1-2, there are no situations for visitor enjoyment and safety indicators that would result in a significant residual socio-economic effect. Consequently, it is concluded that the residual socio-economic effects of pipeline construction and operations on recreational values of North Thompson River Provincial Park related to visitor enjoyment and safety will be not significant.

7.3 Synopsis

The impacts of TMEP's construction and operation on the social and environmental values of North Thompson River Provincial Park will be minimized through mitigation and reclamation. Based on the Draft Stage 2 Detailed Proposal prepared for BC Parks, Trans Mountain has concluded that the TMEP:

- is consistent with the management objectives of North Thompson River Provincial Park;
- allows for operational efficiencies of an existing pipeline system that has been operating for over 60 years in what is now North Thompson River Provincial Park;
- will result in no significant adverse residual environmental and socio-economic effects;
- will conserve the biological diversity of natural ecosystems and maintains the recreational values within North Thompson River Provincial Park;
- compensation offsets will maintain, and in some instances enhance, the objectives of the park management plans; and
- will provide positive overall economic benefit to BC.

8.0 RECLAMATION IN NORTH THOMPSON RIVER PROVINCIAL PARK

The Reclamation Plan is built upon the Pipeline EPP and environmental surveys and identifies additional measures and activities to re-establish the ecological integrity of North Thompson River Provincial Park during Project construction. The measures and other work described in the Reclamation Plan will generally apply to the Project Footprint within North Thompson River Provincial Park. Ongoing consultation with BC Parks may entail further mitigation measures and revisions to the Reclamation Plan and as such, the final Reclamation Plan will be completed prior to construction. Additional site-specific reclamation plans (*i.e.,* riparian reclamation plans) may be required and involve further consultation with BC Parks, Aboriginal groups, stakeholders and the general public. Implementation of the measures included in the Reclamation Plan will commence during the construction phase and continue into the operations phase. Where warranted, follow-up plans will be developed to ensure that the mitigation measures, activities and other works identified in the Reclamation Plan are effective.

8.1 Reclamation Consultation

The development of the Reclamation Plan has been a collaborative effort between Trans Mountain, government agencies and interested stakeholders. In particular, input regarding reclamation measures was solicited and received from the Project environmental team (including fish, wetland, vegetation and wildlife experts) and BC Parks. Additional comments have been solicited from ENGOs and will continue throughout the preparation of the Reclamation Plan (Table 8.1-1).

TABLE B8.1-1

CONSULTATION CONTACTS

Stakeholder Group	Date of Contact	Method of Contact	Items Discussed
BC Parks	May 2, 2014	Phone conversation	Clearwater River, revegetation, old growth forest, seed mixes, weed and problem vegetation control and erosion.

8.2 General Reclamation Measures

Reclamation activities will be in keeping with North Thompson River Provincial Park's Purpose Statement and Zoning Plan and particular consideration will be given to the recreational and camping zones as well as to the natural environments found within the park.

8.2.1 Park Trails

Reclamation measures will be applied to re-establish park trails through the replacement of soil and/or aggregate surface material as well as the replacement of park/trail signage removed during construction.

8.2.2 Natural Regeneration

Where the potential for soil erosion and non-native invasive species infestation is low, and where it is anticipated that the root zone material contains a propagule bank (*e.g.,* seed, stem or root pieces) of suitable species, it may in some instances be preferable to not reseed the disturbed area. This revegetation method will facilitate the establishment of pre-disturbance vegetation through native propagules establishment on the disturbed area following clean-up and root zone material replacement. In areas with potential erosion and weed concerns, a native perennial or non-native annual grass cover crop species will be applied. The grass cover crop species will establish rapidly to control erosion and limit weed growth while pre-disturbance vegetation establishes.

Natural regeneration is preferred over seeding with commercially available native seed where practical and where it is anticipated that the pre-disturbance vegetation will re-establish on the disturbed area. However, care must be taken when using natural regeneration techniques to avoid invasion of non-native invasive species, as is often the case when paralleling other linear disturbances. Moist riparian environments that will regenerate easily in a short time frame are prime candidates for natural regeneration.

8.2.3 Woody Species Revegetation

Revegetation using native tree and shrub species will occur in select areas (*e.g.,* TWS and riparian zones) in accordance with Trans Mountains operations and maintenance procedures (*i.e.,* revegetation is allowed as long as the trenchline is not obscured from aerial monitoring, or access to the pipeline right-of-way for maintenance and regular inspections is not compromised).

Installation of Nursery-Grown Plant Plugs

TWS, riparian and special reclamation areas will be surveyed for evidence of naturally regenerating trees, specifically sites that are cleared of coniferous vegetation. If suitable levels of naturally regenerating (from seed or vegetative propagules) deciduous or coniferous trees are not observed, then these and other areas will be considered for the installation of nursery-grown plant plugs (*e.g.,* rooted stock plugs). Native seed will be secured and dormant woody species cuttings will be collected, as warranted. Deciduous and coniferous rooted plugs will be installed at pre-selected sites (*e.g.,* TWS, riparian areas or for line-of-sight breaks) as determined in consultation with BC Parks Conservation Specialists. Under the guidance of a Reclamation Specialist (or other qualified professional), planting crews will install the rooted stock plugs using standardized silviculture planting equipment and techniques. The rooted stock plugs will be installed at a specified density/distribution with the purpose of initiating an early ecological recovery trajectory that will, in time, emulate the adjacent undisturbed vegetation in form and function where not influenced by Trans Mountains operation and maintenance procedures.

Where it is determined that ungulate species may damage (browse or up-root) newly installed deciduous plants within riparian zones, protection of the trees via chemical (*e.g.,* animal repellent [DeerGuard]) or mechanical (*e.g.*, tree shields) methods may be warranted at the time of installation.

Installation of Locally Sourced Dormant Woody Species Transplants

At pre-determined locations where vegetation is disturbed by construction, the use of plant transplants may be considered. The use of dormant woody transfers is a cost effective and efficient method of re-establishing vegetation to disturbed locations. Unlike salvaging and storing dormant woody material during construction, transfers are dug when dormant, where warranted, from a location adjacent to the reclamation site that contains select plant species of a suitable size (conifers < 45 cm in height, deciduous trees < 2 cm stem calliper at ground level or 90 cm in height). Where a donor plant community is located adjacent to a potential reclamation site outside of park boundaries, a survey of the donor plant community will be completed to determine the level of plant extraction that could be achieved without affecting the form and/or function of the donor plant community.

8.2.4 Seeding of Native Grass Species

Seed mixes were developed in consultation with BC Parks and consist of species native to the park or within the vicinity of the park (Dwg. B-01 of the Draft Stage 2 Detailed Proposal). Seeding will be conducted as soon as practical following root zone material replacement. Drill or broadcast seeding of native seed mixes or a grass cover crop species will be conducted on most of the construction right-of-way, except where tree and shrub plantings occur. Seed mixes will be installed at locations indicated on the Environmental Alignment Sheets, unless otherwise requested by BC Parks Area Supervisor or Conservation Specialist.

8.2.5 Nutrient Management on Disturbed Forested Areas

A slow-release nitrogen fertilizer is proposed for application on lands that contain woody debris and/or wood chips mixed into the salvaged and replaced root zone material or that have been placed on cleared and ungrubbed portions of the construction right-of-way. The nitrogen fertilizer will serve to adjust the carbon-nitrogen ratio in these carbon rich environments to a level that will be conducive to the establishment of seeded grass species and naturally regenerating vegetation.

To avoid deposition or leaching of applied nutrient into the Clearwater River, nitrogen fertilizer will not be applied within a 30 m buffer to the Clearwater River. In addition, the fertilizer application rate will vary based on the level of woody debris and/or wood chips encountered within or on the surface of the root zone material, the soil texture and the slope of the land adjacent to the Clearwater River to ensure nutrient movement is minimized.

8.2.6 Erosion and Sediment Control

Erosion and sediment control (ESC) measures will be implemented to: maintain soil conservation along the proposed right-of-way, preserve existing vegetation on the adjacent land use, reduce the risk of sedimentation of Clearwater River during and following construction activities, and to facilitate the establishment of permanent vegetation along the proposed disturbance.

General ESC Measures

- Woody vegetation located on TWS areas will be cleared and not grubbed where root zone material salvage is not anticipated.
- Root zone material will be stored on cleared/un-grubbed TWS areas adjacent to the proposed right-of-way.
- Subsoil will be stored on geotextile when placed over ungrubbed TWS areas.
- Root zone material and grading material (subsoil) will be stored in separate piles so as not to admix.
- Following the replacement of trench and grade subsoil, recontour the area to match the adjacent landscape profile prior to root zone material replacement.
- Avoid, to the extent feasible, mixing of subsoil and root zone material during materials replacement.
- Install/re-establish coir logs, erosion control blanket or sediment fencing within the riparian area of the Clearwater River.
- Install a non-native annual or native perennial grass cover crop species in the riparian zone to minimize competition to regenerating and installed woody vegetation and a prescribed grass seed mix through broadcast or drill seeding methods on all other exposed soils. Ensure any seed mixes or cover crop species used are approved by BC Parks.

Specific ESC Measures

ESC measures that will be considered for use on the proposed construction right-of-way are described in the following subsections:

Coir Log, Erosion Control Blanket and Sediment Fence Installation

Coir logs composed of natural fibers are designed to reduce slope length and surface water velocities (Dwg B-02 of the Draft Stage 2 Detailed Proposal). Erosion control blankets prevent scour of surface soils, conserves soil moisture and promotes vegetation establishment (Dwg B-03 of the Draft Stage 2 Detailed Proposal). Sediment fencing filters sediment from surface water that has the potential to discharge into Clearwater River (Dwg B-04 of the Draft Stage 2 Detailed Proposal). These measures should be installed following clearing and monitored and maintained following construction until vegetation establishment occurs.

Diversion Berms

Diversion berms are intended to reduce slope length and runoff velocities, and divert runoff into well-vegetated areas. Diversion berms will be designed with a suitable spacing, slope gradient and berm height to effectively convey overland water flow, originating on the construction disturbance, away from the Clearwater River and other waterbodies (Dwg. B-05 of the Draft Stage 2 Detailed Proposal).

Rollback

Trans Mountain will avoid the use of Douglas-fir, grand fir and spruce for rollback within North Thompson Provincial Park. Select tree species (*e.g.,* pine) felled during construction will be used as rollback, within riparian zones and TWS areas to provide erosion control and habitat enhancement. The woody material felled during construction will be used as rollback, within the Clearwater River riparian zone and TWS area to provide erosion control and habitat enhancement. The woody rollback will provide microsites to aid in the re-establishment of woody vegetation and assist in the control of soil erosion along the proposed construction right-of-way where woody vegetation was cleared. To obtain material required for rollback, woody slash will be salvaged during construction clearing activities in suitable quantities to allow for the placement of rollback at select locations onto the construction right-of-way following root zone material replacement (Dwg. B-06 of the Draft Stage 2 Detailed Proposal).

Grass Seeding

Native seed mixes have been developed and native perennial and non-native annual cover crop species selected for use on construction disturbances within North Thompson River Provincial Park. An appropriate native grass seed mix, native perennial or annual non-native cover crop will be sown (drill or broadcast seeded) along the disturbed areas following root zone material replacement at an appropriate prescribed rate.

8.3 Specific Reclamation Issues

The biophysical features listed below warrant special consideration due to the difficulty in reclaiming and/or managing them. Specific reclamation and/or management plans will be developed from ongoing consultation with BC Parks personnel as well as field surveys.

8.3.1 Rare Plants and Communities

The protection of rare vascular and nonvascular plants and plant communities is important for maintenance of ecological integrity. Pre-construction surveys identified white wintergreen (*Pyrola elliptica*), a rare vascular plant, which will require special consideration before, during and after construction. Mitigation measures have been developed for this Project to accomplish effective protection of white wintergreen. These measures include:

- leaving gaps in the root zone material piles or subsoil piles to avoid the site;
- use protective matting and/or snow during the winter (mark the area in case snow melts) to mat over the population or community where it occurs on the Project area, and other areas where root zone material removal is not required, to protect vegetation from scraping and compacting (Dwg. B-07 of the Draft Stage 2 Detailed Proposal);
- monitoring the effectiveness of implemented mitigation measures during rare plant PCEM; and
- avoiding blanket use of herbicides within 30 m of, or between the range of, the provided UTM coordinates.

8.3.2 Weed and Vegetation Management Plan

Management of weeds and problem vegetation is essential to maintaining the ecological integrity of North Thompson River Provincial Park during and after Project construction. Trans Mountain will use an integrated vegetation management (IVM) approach that includes non-chemical, cultural and chemical methods to control and reduce the spread of weeds and problem vegetation. The non-chemical, cultural or chemical treatment methods used will vary with life-form and mode of reproduction of the species targeted and the location and extent of the infestation. Non-chemical and cultural treatments include hand-pulling, cultivation, mowing, burning, mulching and active restoration of native plant communities. Chemical treatments include either selective herbicides (*i.e.*, target specific plant species) or non-selective herbicides (*i.e.*, target all vegetation).

Trans Mountain will actively cooperate with BC Parks and other stakeholders to implement an IVM approach to weed and problem vegetation management as outlined in KMC's Integrated Vegetation Management Plan and the Weed and Vegetation Management Plan provided in Section 14.0 of Appendix C of the Pipeline EPP. Accurate records of weed infestations, management measures undertaken and the success of these measures will be maintained so that weed and vegetation management plans can be modified as necessary from year to year.

Specific weed and problem vegetation management measures for pre-construction, construction and post-construction are provided in the aforementioned Weed and Vegetation Management Plan. Further measures involving monitoring and control measures following construction are provided in Dwg. B-08 of the Draft Stage 2 Detailed Proposal.

Detailed weed and problem vegetation reports will be developed for site-specific locations, as required, following a pre-construction weed survey (scheduled for spring 2015) and consultation with BC Parks Conservation Specialists. Weed and problem vegetation infestations and recommended mitigation measures will be incorporated into the Environmental Alignment Sheets.

8.3.3 Watercourses

Stabilization of the banks and slopes of the Clearwater River and riparian areas prior to and immediately following construction, should a trenchless crossing be necessary, is critical to the restoration of the habitat at this watercourse. Mitigation measures have been developed to enhance the reclamation of the Clearwater River. These measures involve the installation of numerous bank and slope protecting structures including:

- log crib structures (Dwg. B-09 of the Draft Stage 2 Detailed Proposal);
- erosion control matting (Dwg B-03 of the Draft Stage 2 Detailed Proposal);
- revegetation grass rolls (Dwg. B-10 of the Draft Stage 2 Detailed Proposal);
- sediment fences (Dwg B-04 of the Draft Stage 2 Detailed Proposal);
- biodegradable coir geotextile wraps (Dwg. B-11 of the Draft Stage 2 Detailed Proposal);
- coniferous tree revetments (Dwg. B-12 of the Draft Stage 2 Detailed Proposal); and
- cobble or riprap armouring (Dwg. B-13 of the Draft Stage 2 Detailed Proposal).

If the open cut contingency method is employed for the Clearwater River crossing, a detailed riparian reclamation plan will be developed and will provide measures that contribute to the reclamation of watercourse banks and riparian areas disturbed by construction of the proposed Project (*i.e.,* erosion and sediment control measures and the planting of trees and shrubs) as per the guidelines identified in the DFO *Measures to Avoid Causing Harm to Fish and Fish Habitat*.

8.3.4 Wildlife Movement, Mortality and Human Encounters

The potential for wildlife vehicle collisions and human encounters may be higher in areas where the proposed route is in close proximity to park entrance roads, trails, campsites, RV pads and picnic areas. Native grass species with reduced palatability will be used for revegetation in these areas to avoid attracting ungulates and carnivores and increasing their mortality and human encounter risk (Dwg. B-01 of the Draft Stage 2 Detailed Proposal).

Measures to restore the effectiveness of wildlife movement corridors and that maintain biodiversity will be implemented during and after construction. These measures will include one or a combination of the following: using native plant species for restoration (Dwg. B-14 of the Draft Stage 2 Detailed Proposal); installing visual barriers along the right-of-way (Dwg. B-15 of the Draft Stage 2 Detailed Proposal); and the salvage and installation of wildlife habitat trees (Dwg. B-16 of the Draft Stage 2 Detailed Proposal).

DRAWINGS

LIST OF DRAWINGS

Drawing B-01	Seed Mix Detail – North Thompson River Provincial Park
Drawing B-02	Coir/Straw Log Installation
Drawing B-03	Erosion Control Matting/Blanket
Drawing B-04	Sediment Fence
Drawing B-05	Cross Ditches and Diversion Berms
Drawing B-06	Rollback
Drawing B-07	Rare Plant Ramp Protection
Drawing B-08	Cribwall Staked Logs
Drawing B-09	Streambank Protection - Grass Roll
Drawing B-10	Streambank Protection - Hedge Brush Layering
Drawing B-11	Streambank Protection – Coniferous Tree Revetment
Drawing B-12	Streambank Protection – Cobble and Riprap Armouring
Drawing B-13	Weed Control
Drawing B-14	Live Plant Salvage
Drawing B-15	Vegetation and Soil Berm Line of Sight
Drawing B-16	Typical Wildlife Tree Enhancement Feature

CRITERIA FOR IMPLEMENTATION

Seed mixes (see tables below) will be installed at locations indicated on the Environmental Alignment Sheets, unless otherwise requested by BC Parks Area Supervisor or Conservation Specialists.

Notes:

1. Species cultivars, where applicable, will be determined at the time of procurement based on availability and suitability as determined by Trans Mountain.
2. Native seed species will be obtained from local genomes to the extent feasible.
3. All seed mix species must have Certificates of Analysis to allow for the determination of weed and undesirable species content, and germination for each species seed lot in the mix.
4. Certificates of Analysis for each seed mix species will be reviewed by Trans Mountain prior to purchase. Any lot with unacceptable weed contamination or viability will be rejected.
5. Seed mix species that are unavailable in sufficient quantity or quality at a reasonable cost as determined by Trans Mountain at the time of procurement will be eliminated from the mix and the proportions of other species in the mix increased.
6. Drill seeding will be used on all segments to be seeded with the exception of slopes which are too steep to safely operate the tractor and seed drill, areas too wet to access with a tractor and seed drill without causing rutting and poor seed placement, stony areas which could cause damage to the equipment or impede the ability of the drill to properly place the seed, and any other areas which cannot be feasibly reached with the seed drill.

1. Drill seeding application methods will be used where it is determined that conditions allow and the seed mix can be sufficiently cleaned to pass through the drill calibration system for accuate dispersal of the seed mixture (it may not be possible to clean some had and mechanically collected local species genomes sufficiently for drill seeding methods).
2. The Environmental Inspector or Reclamation Manager, upon assessing ground conditions, will determine the seeding method to be used to achieve optimum results. For example, where soils are fine and the potential for erosion by wind is moderate to high, hydro seeding with mulch and tackifier may be condidered as the optimal seeding method for the field conditions.
3. Broadcast seeding method, will be used on lands where drill seeding is determined not suitable to facilitate seed mix establishment.
4. All seed drills and broadcast seeders will be calibrated for each seed mix using the manufacturer's recommended procedures; alternate calibration procedures may be used if approved by the Environmental Inspectors.
5. The seeding contractor will develop appropriate seeding procedures to ensure even distribution of all species in each seed mix and have these procedures approved by the Environmental Inspector. This may involve, but not be limited to:
   - using seed box agitators to prevent stratification of large and small seeds;
   - seeding large and small seed species from separate seed boxes, or in separate passes with the seeder; or
   - using an inert filler agent with the seed mix.
6. Seeding depth with seed drills will be 1-2 cm in fine textured soils and 1-3 cm in sandy soils.
7. During the construction final cleanup phase, before reclamation seeding, tracked equipment will be used to imprint soils at right angles to the direction of the slope (track packing). Track packing helps prevent soil erosion and provides micro sites to capture moisture for seed germination. Where it is determined that soil conditions and track packing is sufficient, no further harrowing or hand raking of topsoil will be implemented.
8. Where site and safety conditions allow, broadcast seed will be harrowed into a depth of 1-3 cm, using standard agricultural harrows or other approved equipment. Harrowing will be conducted immediately following broadcasting. Steep slopes that cannot be safely harrowed will be hand raked, if feasible, to incorporate seed.
9. Only the salvaged or cultivated width of the construction right-of-way will be seeded with minimal overlap onto undisturbed areas. Swing-out passes will be made to seed scalped areas adjacent to the cultivated portion as needed.
10. Complete coverage of the stripped area will be ensured by using a sufficient number of passes. Damage to the native sod adjacent to the disturbed portion of the construction right-of-way will be avoided.
11. Broadcast seeding will be delayed during high wind conditions, as directed by the Environmental Inspector.

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	SEED MIXES – BC PARKS		
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SEED MIXES

Cover Crop
A cover crop is a fast-germinating and establishing annual/biennial or short-lived perennial grass species that is seeded to quickly stabilise topsoil, control erosion and limit weed growth while pre-disturbance vegetation is restored. Short-lived perennial grass cover crop species include bluebunch wheatgrass, slender/awned wheatgrass or Canada wild rye. Short-lived annual/biennial cover crop specie includes annual ryegrass. Broadcast short-lived perennial grass species seed at 10 kg/ha or 100 grams/100 m^2 and annual/biennial cover crop species at 8 kg/ha or 80 grams/100 m^2

Non-attractant Seed Mix for Highways/Railways	
Mix #1	%WT
Rocky Mountain fescue	30
rough hair grass	40
spike trisetum	15
June grass	15
<u>seeding rate</u>	
broadcast seed at 18 kg/ha	
drill seed at 12 kg/ha	

Seed Mixes - North Thompson River Provincial Park				
	Closed Coniferous - Upland		Riparian	
Biogeoclimatic Zone	Mix #2	%WT	Mix #4	%WT
interior cedar hemlock/ engelmann spruce-subalpine fir	smooth wild rye	35	slender wheatgrass	75
	Rocky Mountain fescue	25	rough hair grass	25
	slender wheatgrass	20		
	rough hair grass	10	<u>seeding rate</u>	
	alpine bluegrass	10	broadcast seed at 5 kg/ha	
	<u>seeding rate</u>			
	broadcast seed at 18 kg/ha			
	drill seed at 12 kg/ha			

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TRANS MOUNTAIN EXPANSION PROJECT

TRANSMOUNTAIN

SEED MIXES

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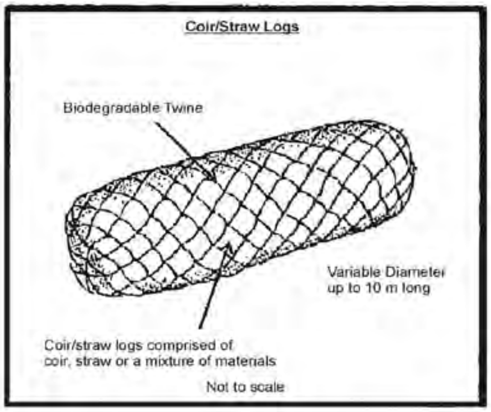

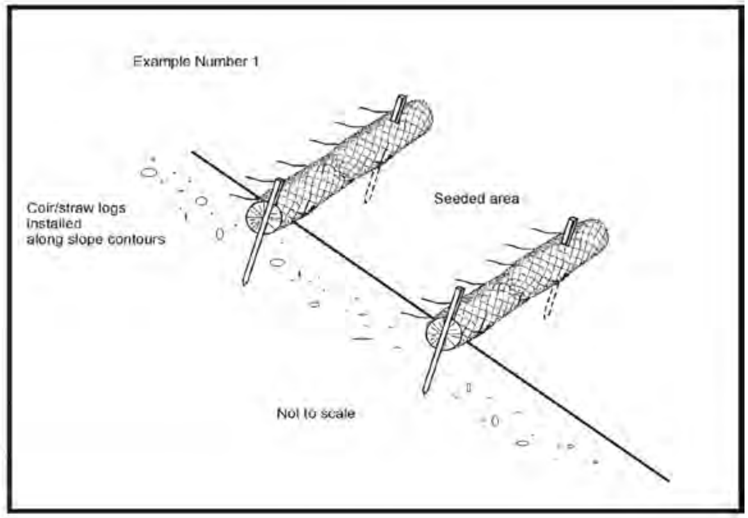

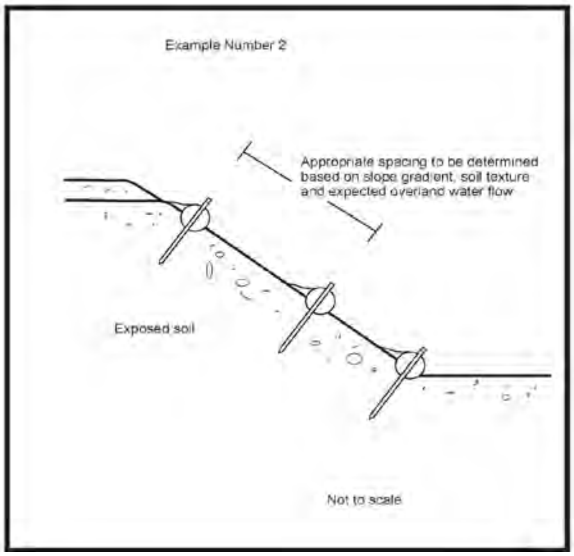

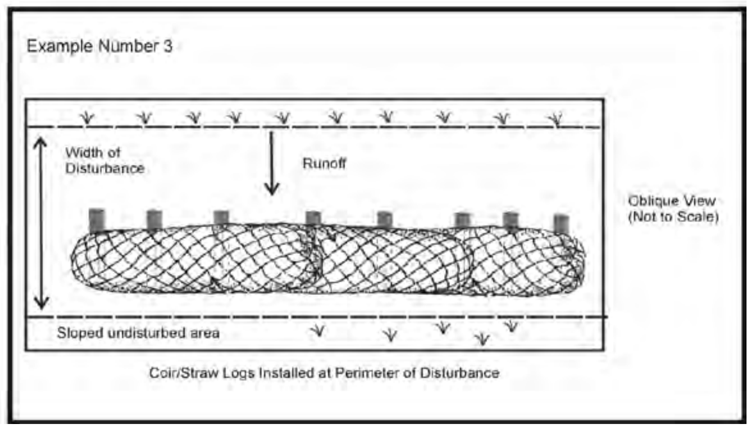

Notes:

1. Proper placement and design is critical and qualified specialists should be involved.
2. Install coir/straw logs in a shallow trench (~5-7.5 cm (2"-3") deep), perpendicular to the direction of flow and across the entire width of the disturbance. Each end of the coir/staw log should be turned slightly up slope to help retain water and prevent flow along the outside of the coir/straw log.
3. Each coir/straw log should be secured into the ground by wooded stakes spaced every 0.9-1.2 m (3'-4') across the length of the log. Stakes should be approximately 45 – 60 cm (18"-24") in length and should be driven through the centre of the coir/straw log and into the ground with approximately 5 cm (2") remaining above the coir/straw log. Stakes installed at each end of the coir/straw log should be placed approximately 5-15 cm (2"-6") from the outer edge of the log.
4. When joining two coir/straw logs together, either tightly abut both ends or overlap each log approximately 15 cm (6").
5. Store, move and install when dry.
6. Coir/straw logs may be seeded or dormant cuttings may be inserted.
7. Typical spacing is indicated below.

Slope Gradient (°)	Typical Spacing (approximate m (ft))
≥1:1	1.5 m (5')
2:1<1:1	3.0 m (10')
>4:1<2:1	5.2 m (17')
6:1-4:1	7.6 m (25')
<6:1	15.0 m (50')

Adapted from CAPP *et al.* (2005)

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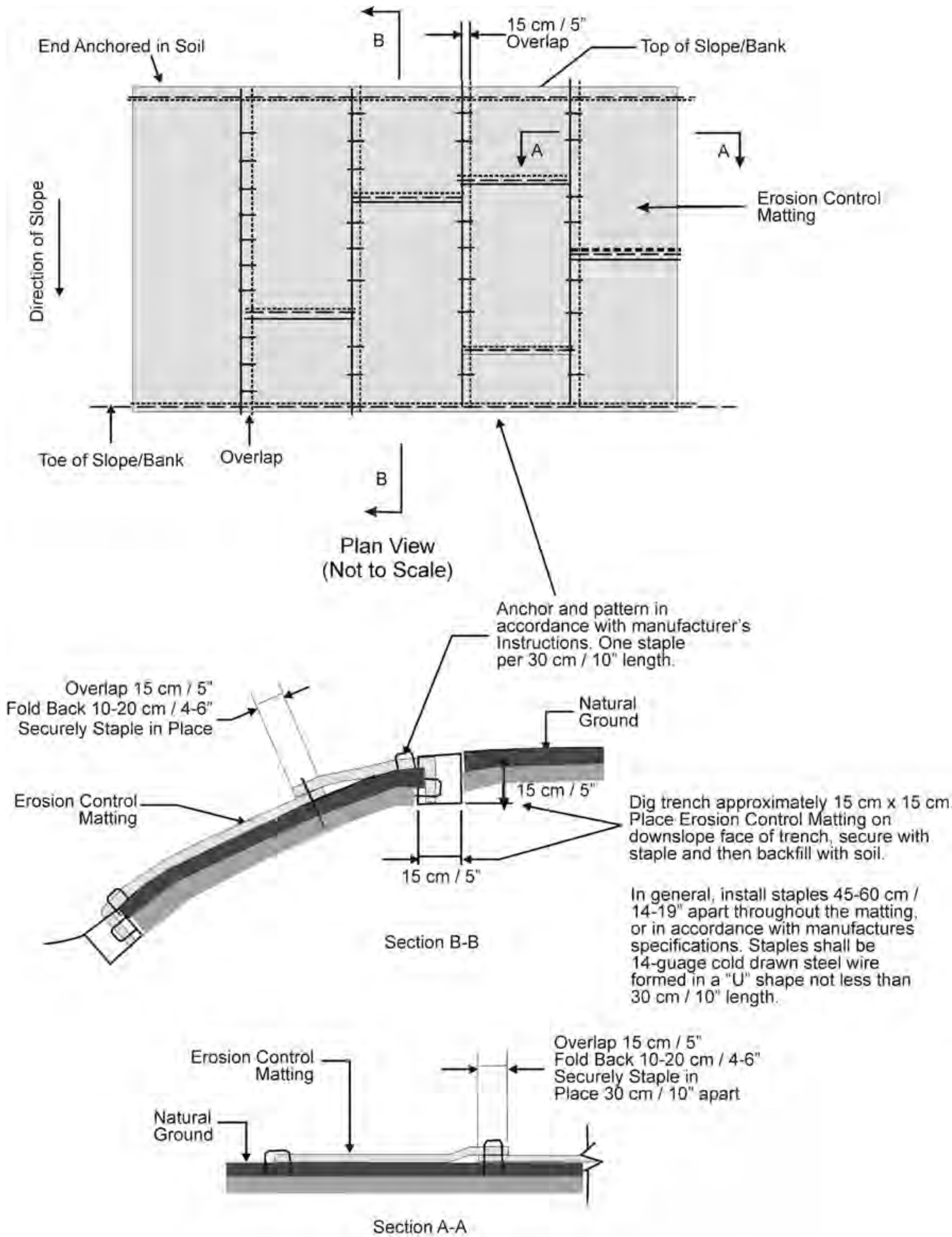
TRANS MOUNTAIN EXPANSION PROJECT

TRANSMOUNTAIN

COIR/STRAW LOG INSTALLATION

7894	August 2014	Drawing B-02



Note: When used at streambanks, erosion control matting should be secured to the bank using willow cuttings rather than staples.

Representation Only

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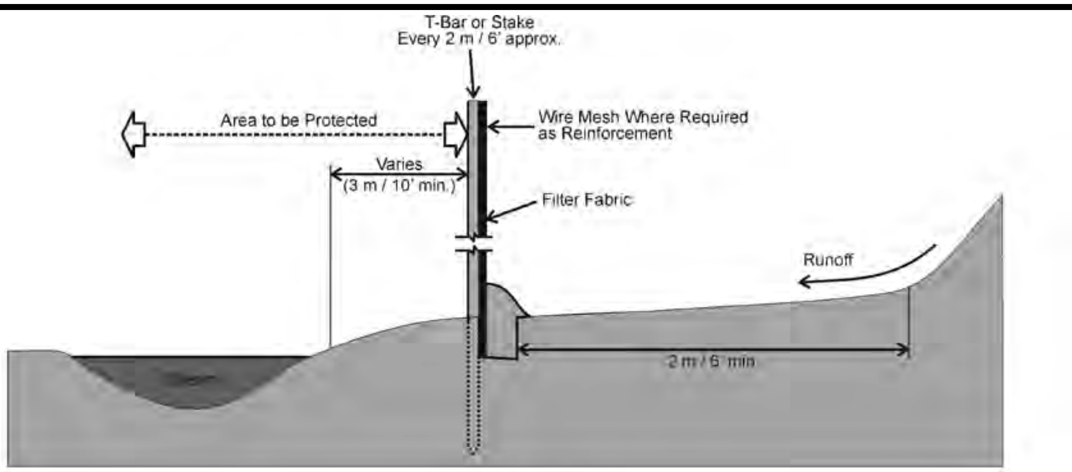
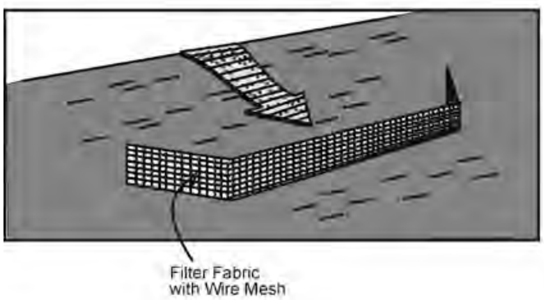
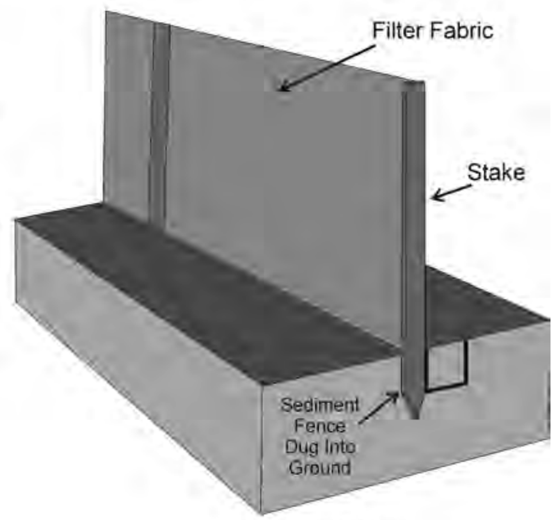
	EROSION CONTROL MATTING/BLANKET		
	7894	August 2014	Drawing B-03



Profile View
(Not to Scale)



Oblique View
(Not to Scale)



Oblique View
(Not to Scale)

Representation Only

Notes:

1. Watercourses that have moderate to high sensitivity of fish habitat and/or have steep approach slopes at the proposed crossings may need sediment fences during construction, as determined by Trans Mountain's Environmental Inspector(s).
2. Install sediment fences at the base of approach slopes to watercourses prior to clearing and grading using the method and materials above or other approved designs.
3. Ensure sediment fence is keyed into the substrate. Excavate a narrow trench, place the base of the sediment fence in the trench and place the fill back into the trench, securing the sediment fence in place.
4. Place sediment fences a minimum 2 m (6 feet), if feasible, from the toe of the slope in order to increase ponding volume.
5. Maintain sediment fences in place at the base of the approach slopes until revegetation of the construction right-of-way is complete.
6. In areas with frequent traffic, install two or more sediment fences in a staggered and overlapped configuration to allow vehicle passage without removal or opening of the sediment fence.
7. Ensure that sediment fences, if removed or damaged, are reinstalled or repaired prior to the end of the work day.
8. Install sediment fences, where warranted, to eliminate the flow of sediment from clean subsoil piles and disturbed areas into nearby wetlands.
9. Remove any sediment fences around wetlands that remain after the disturbed area is revegetated and the area is stable.

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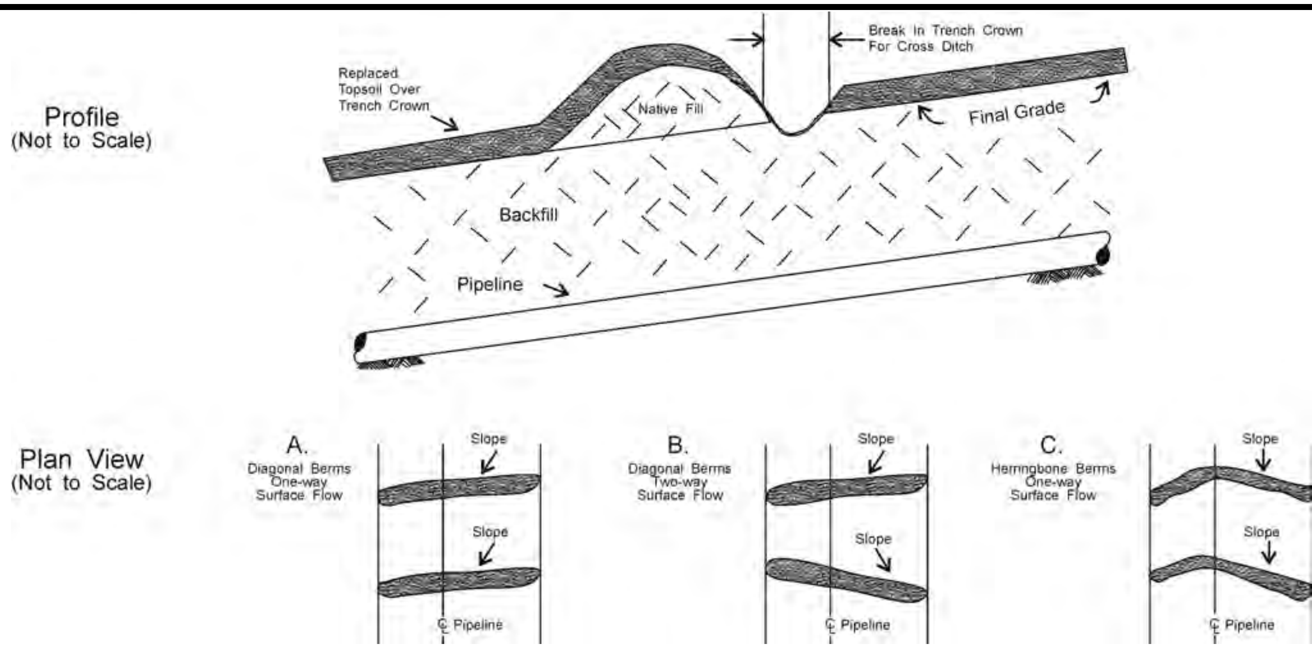
TRANS MOUNTAIN EXPANSION PROJECT

TRANSMOUNTAIN

SEDIMENT FENCE

7894	August 2014	Drawing B-04



Notes:

Representation Only

1. Install diversion berm and cross ditch on moderate and steep slopes on non-cultivated lands to divert surface water off the construction right-of-way. Install berms immediately downslope of trench breakers to collect seepage forced to the surface.
2. Skew berm across the construction right-of-way at downhill gradient of 5-10%.
3. Construct diversion berm of compacted native subsoils where extensive disturbance of the sod layer has occurred. Diversion berms should be constructed of timbers, imported logs or sandbags if disturbance of the sod layer is limited. Avoid use of organic material. Where native material is highly erodible, protect upslope of berm and base of cross ditch by burying a geotextile liner approximately 20 cm below the surface or armour upslope face of berm with earth-filled sand bags.
4. Typical diversion berm height and widths are approximately 0.75 m for summer construction and 1.0 m for winter construction. Trans Mountain shall inspect berms after heavy rains and the first spring following construction; replace or restore berms, if warranted.
5. Tie berms into existing berms on adjacent rights-of-way, where applicable.
6. Leave a break in trench crown immediately upslope of diagonal berm and cross ditch to allow passage of water across the construction right-of-way.
7. Use diagonal berms where direction of slope and surface water movement is oblique to construction right-of-way.
8. Use herringbone berm and cross ditch where direction of slope and surface water movement is parallel to construction right-of-way so runoff does not cross ditchline.
9. Determine location and direction of berm based on local topography and drainage patterns. Typical diversion berm spacing is indicated below.

Slope Gradient (º ;%)	Typical Spacing (m) Erosion Hazard*		
	High	Medium	Low
<7; <12	30-45	45-60	60 or more
7; 12	25	38	51
8; 14	22	33	44
9; 16	19	29	38
11; 19	16	24	32
14; 25	12	18	24
18; 33	9	14	18
27; 50	6	9	12

* High = fine sand and silts; medium = clays and coarse sands; low = rock or gravel.

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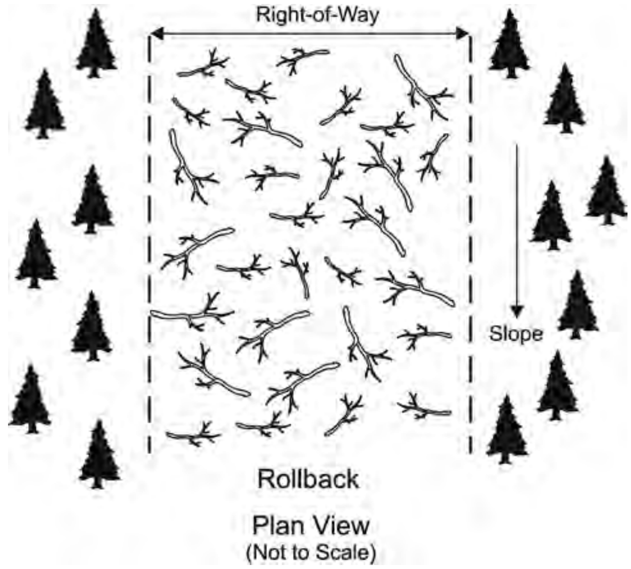
	CROSS DITCHES AND DIVERSION BERMS	
7894	August 2014	Drawing B-05



CRITERIA FOR IMPLEMENTATION

Slash and nonsalvageable timber may be used as rollback for erosion control where available and acceptable to the appropriate authority, as well as at strategic locations along the right-of-way for access control. Specific locations will be determined by Trans Mountain's Environmental Inspector(s) at the time of clearing. Do not use Douglas-fir, grand fir and spruce for rollback.

Notes:

1. Retain slash and nonsalvageable timber, where required, for use as rollback.
2. Larger diameter slash (*e.g.,* 10 cm in diameter or larger) should be used for rollback intended for riparian area access control, plant micro-sites establishment or as soil erosion control.
3. The amount of timber retained for use as rollback will be determined by Trans Mountain's Construction Supervisor(s) in consultation with Trans Mountain's Environmental Inspector(s) and the appropriate authority. Store material for rollback along the edges of the right-of-way.
4. Walk down rollback with a dozer on steep slopes, if safe to do so.
5. Spread slash and nonsalvageable timber evenly over the right-of-way where access is a concern. Do not walk down rollback.
6. Leave gaps in the rollback at obvious wildlife trails.

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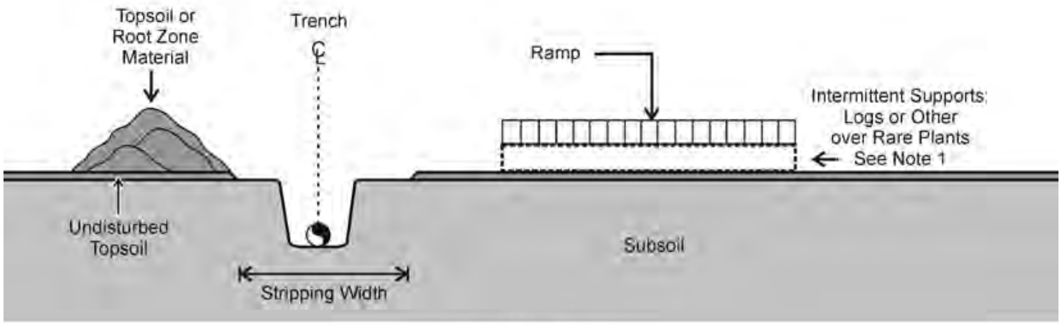
	ROLLBACK		
	7894	August 2014	Drawing B-06

NONFROZEN CONDITIONS:



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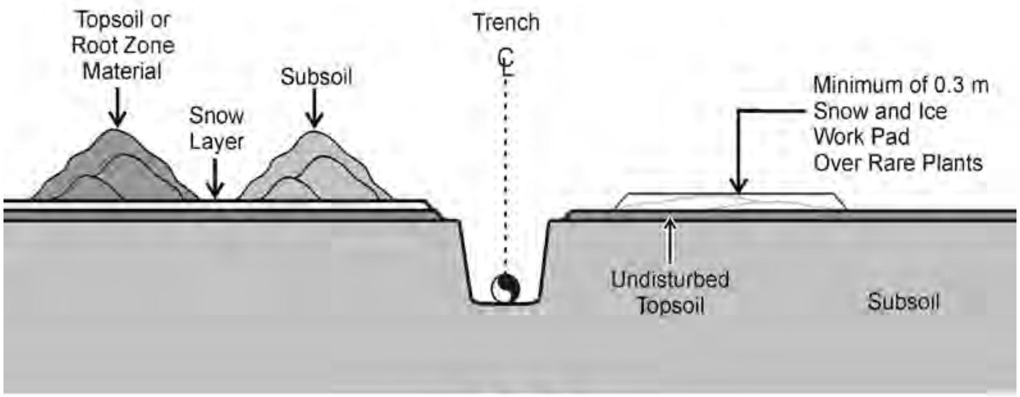
FROZEN CONDITIONS:



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Notes:

Nonfrozen Conditions

1. Place ramps on support structures (logs or other). Support structures will be spaced approximately 2 to 3 m along the length of the ramp. Ramps may be required on work side and subsoil side, as warranted, to protect the rare plant population or community.
2. Salvage topsoil/root zone material from the trench area (a minimum of 4-6 m).
3. Haul trench subsoil along the right-of-way away from the rare plant site, where necessary.

Frozen Conditions

4. When there is adequate snow, build a snow and ice work pad on the work side to a minimum of 0.3 m high. Build a snow and ice work pad on the subsoil side as warranted, to protect the rare plant population or community. During frozen conditions, without adequate snow to build a pad, use the above specifications to build a ramp.
5. Salvage topsoil/rootzone material from the trench area (a minimum of 4-6 m).
6. Monitor the integrity and effectiveness of the work pad by watching for rutting and cracking to the extent that the ground below the pad may become disturbed. Should this condition occur, temporarily suspend traffic and either reinforce the snow/ice work pad or install a ramp.

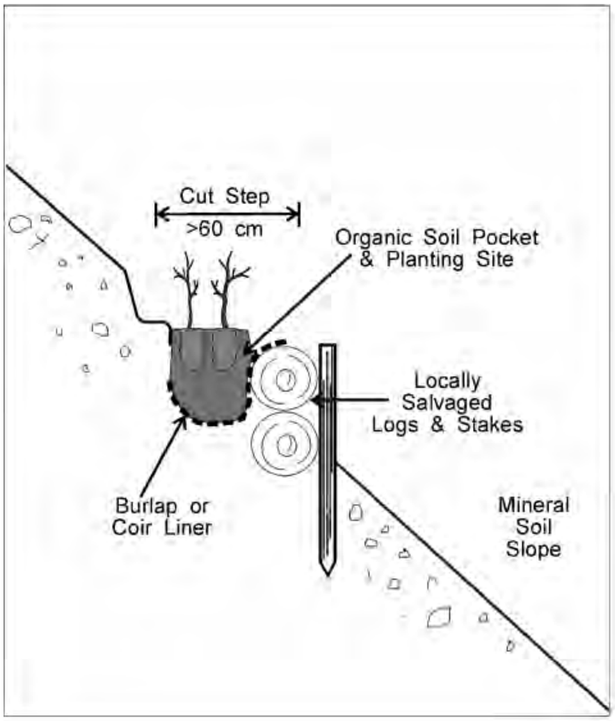
tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	RARE PLANT RAMP PROTECTION		
	7894	August 2014	Drawing B-07

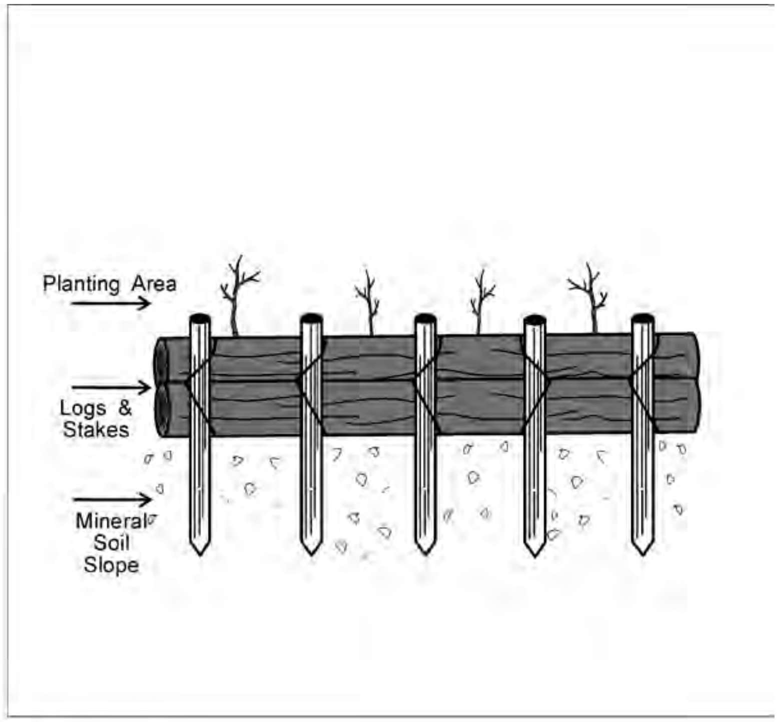
CRITERIA FOR IMPLEMENTATION:

Management of weeds and non-native plant species is of paramount concern to Trans Mountain. The goal of non-native species management for the Trans Mountain Expansion Project is to prevent the introduction and spread of non-native plants to control them, to the extent feasible, along the existing TMPL system. Accurate records of weed infestations, control measures undertaken and the success of control measures will be maintained so that weed management and control plans can be modified as necessary to ensure an effective program of ongoing weed monitoring and control.

Following are measures to be implemented during the reclamation and post construction monitoring of the Trans Mountain Expansion Project.

1. All reclamation equipment shall arrive for project work in a clean condition to minimize the risk of weed introduction. Any equipment which arrives in a dirty condition will not be allowed to work until it has been cleaned off at a suitable location.
2. Equipment passing through areas identified as having a weed problem will be cleaned prior to continuing work on the right-of-way.
3. Equipment clean-off stations will be established by the main pipeline contractor under the direction of the Trans Mountain's Environmental Inspector(s). The preferred method of clean-off will be pressurized water, weather permitting.
4. Weed growth will be specifically monitored by personnel trained in weed identification walking the right-of-way and recording the density and species of all weeds observed. Weed monitoring will be conducted by teams in a timely manner so that weed control plans can be developed.
5. Monitoring will be conducted prior to, during and as per PCEM requirements.
6. Frequency of monitoring may be increased where: high potential for weeds of management concern was identified prior to, during or following construction. Weeds will generally be monitored in the spring when weed seedlings can be identified and subsequently controlled, if warranted. Additional weed monitoring in the late summer prior to setting seed will be conducted where high weed concerns exist or where spring surveys identify the need for follow-up.
7. Areas of poor plant cover will be reseeded and weed control measures applied as required.
8. The equipment cleaning station will be assessed in fall, late spring and mid-summer for at least three growing seasons following construction. Subsequent monitoring will be at least once per season, depending on weed issues identified during previous years. Weed species of concern that are identified at the sites will be treated. Manual removal of plants or chemical treatment will occur. If weeds are manually removed when in flower, the weed material will be disposed of in an approved land-fill facility.





(Not to Scale)

At sites where erosion is a concern and where shrub plantings are required for reclamation, locally salvaged logs may be used to secure slopes and provide planting sites.

1. Sites where staked logs are to be installed will be selected by Trans Mountain's Environmental Inspector(s). When possible, sites will be selected prior to clearing and suitable local logs will be salvaged and stockpiled for later use.
2. Install staked logs during clean-up or reclamation phase. Where possible, use a backhoe to cut a step into the slope and push in a line of wood stakes. Note: take all necessary safety measures when working in proximity to pipeline.
3. With a qualified chainsaw operator, select and cut to fit suitable logs for horizontals. If necessary, the logs may be secured to the stakes using biodegradable rope.
4. Create a pocket behind the horizontally staked logs. The pocket can be used to install live shrub stakes and backfilled with topsoil/root zone material.
5. Where the planting pocket is required for rooted plugs or salvaged plantings, line the pocket with biodegradable fabric (burlap or coir). Bring the fabric over the top log. Fill the lined pocket with topsoil/root zone material or duff and tamp down. Install plants in pockets as directed by Trans Mountain's Environmental Inspector(s).

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	STAKED LOGS/LOG CRIBWALL FOR EROSION CONTROL		
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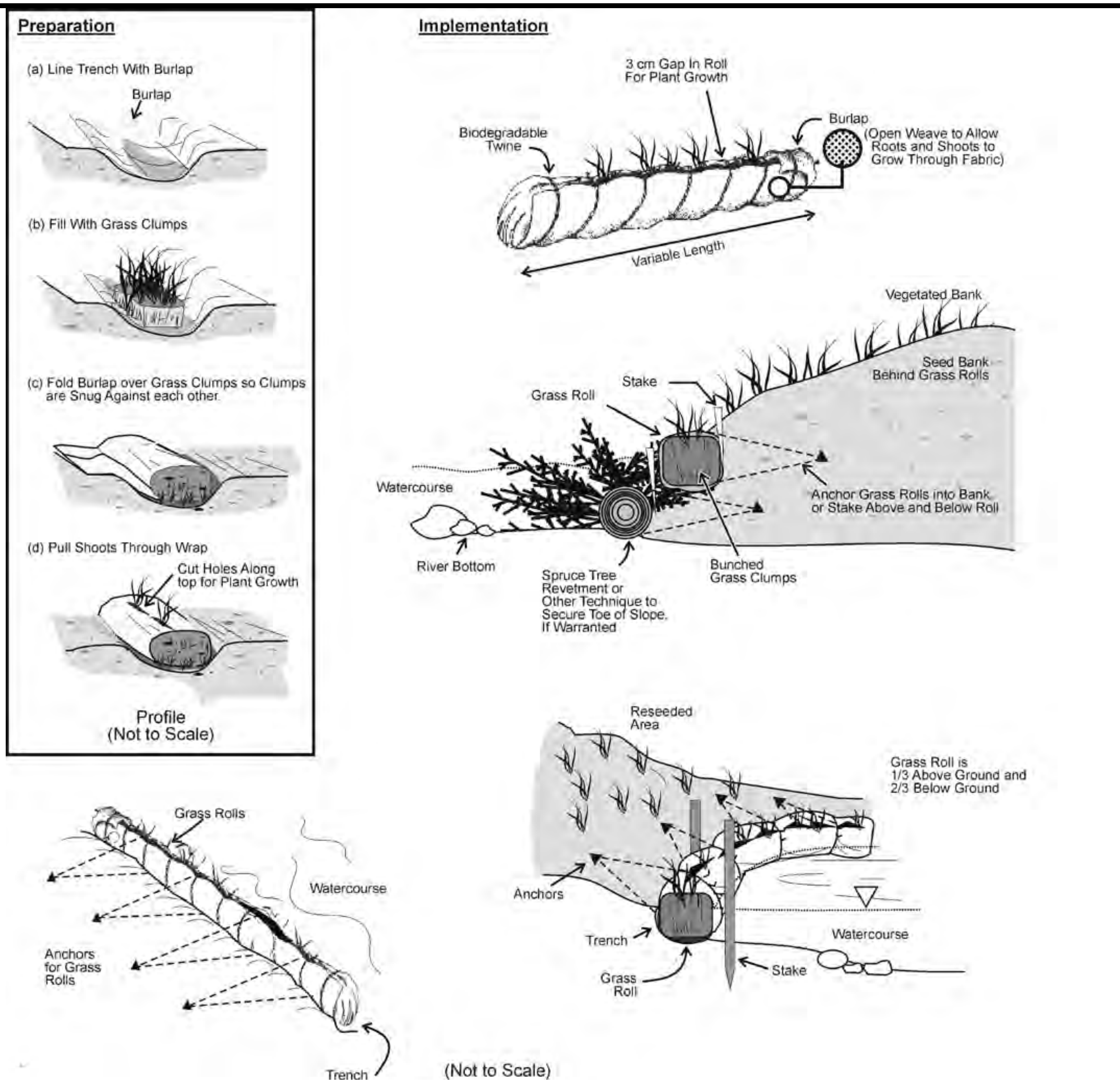

Notes:

1. Proper placement and design is critical and qualified aquatics or reclamation resource specialists should be involved.
2. Excavate a shallow trench along the ordinary high level watermark parallel to the toe of the bank and line with burlap.
3. Install sod in the middle of the roll and wrap with burlap covers. Tie with twine and cut slits to expose sections of sod.
4. Stake or anchor firmly, ensuring up and downstream ends are secured to prevent washing out.

Adapted from CAPP *et al.* (2005)

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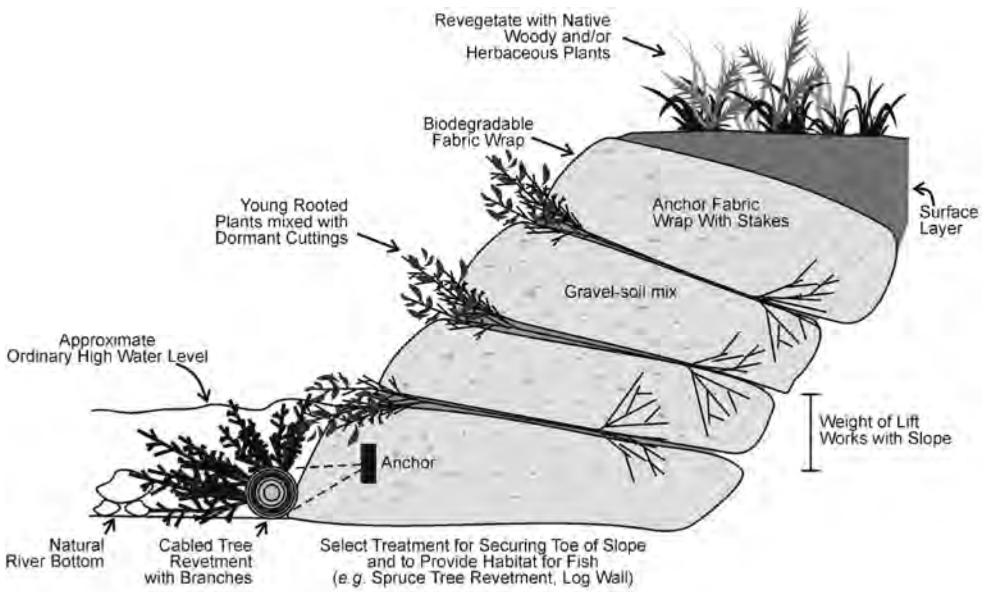
TRANS MOUNTAIN EXPANSION PROJECT

TRANSMOUNTAIN

STREAMBANK PROTECTION – GRASS ROLL

7894	August 2014	Drawing B-10



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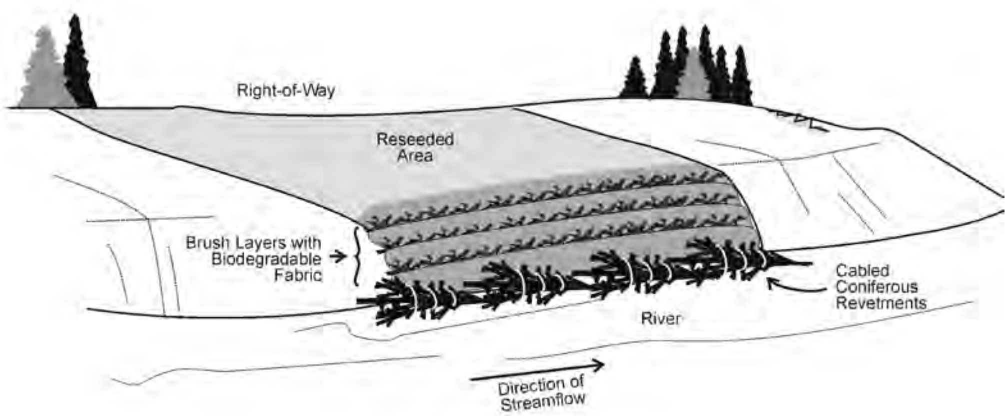


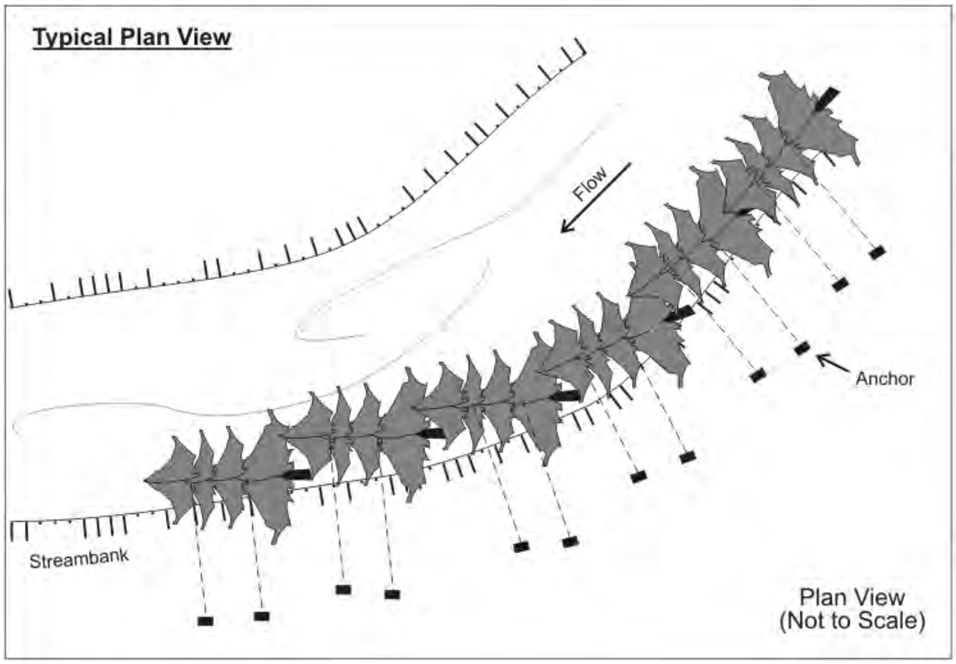
Oblique View
(Not to Scale)

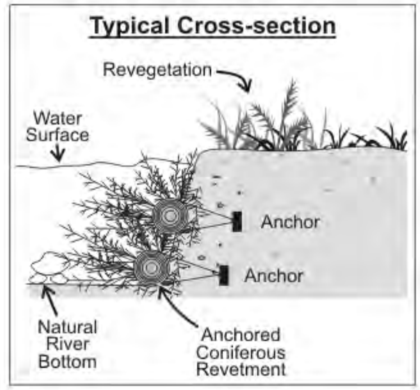
Notes:

1. Proper placement and design is critical and qualified specialists should be involved.
2. Secure the toe of the slope with appropriate technique (coniferous tree revetments, log wall, riprap, etc.).
3. Begin layering at the bottom of slope with first hedge/brush layer situated at the approximate ordinary high water level or lower. Select plant species suitable for site conditions.
4. To establish banks, install layers of soil filled biodegradable fabric (coir or equivalent) wraps. To make each layer, roll out the fabric parallel with the bank with one-third into the bank and two-thirds out (streamside). Form a step of soil approximately 30-40 cm (1-1.3 feet) high over the bank side fabric. Fold the stream side fabric over the soil step and firm into place.
5. Arrange locally salvaged live shrubs with roots (alder, rose ssp., etc.) with live stake material (willow, poplar, red osier dogwood) over the fabric wrap at 20 stems per metre, incorporate topsoil and firm into place.
6. Continue building layers of fabric soil wraps and live shrubs until original bank height is reached.
7. Use only dormant live shrub material. Keep transplants moist and install as soon as feasible following salvage. A mixture of plant species can mimic adjacent undisturbed vegetation.

Adapted from CAPP *et al.* (2005)

tera ENVIRONMENTAL CONSULTANTS	**TRANS MOUNTAIN EXPANSION PROJECT** TRANSMOUNTAIN		
	STREAMBANK PROTECTION – HEDGE/BRUSH LAYERING		
	7894	August 2014	Drawing B-11



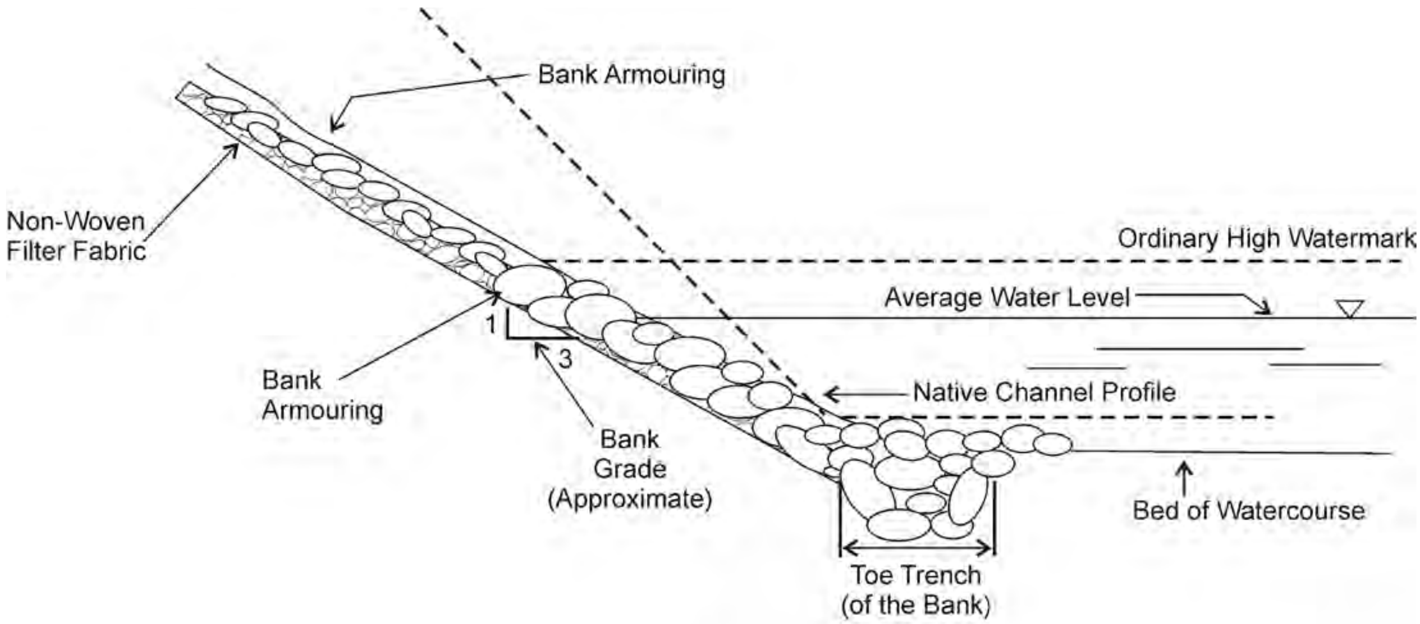


Notes:

1. Proper placement and design is critical and qualified specialists should be involved.
2. Select only good, sound, straight coniferous trees with adequate branches and a minimum length of 10 m.
3. Do not trim any branches and handle with care. Leave root ball intact if possible and transport the trees to the site with a minimum of handling to reduce damage to the branches. To the extent practical, remove soil material from the rootball before placing the tree instream. Place the trees lengthwise along or across the eroding bank to be protected beginning at the downstream end with the tips of the trees pointed in the downstream direction.
4. Begin assembly of the tree revetment at the downstream end and place tie back cable on the tree butt (largest end). Attach the cable to a suitable deadman or large armour rock with a drilled hole. Bury the anchor securely in the adjacent bank.
5. Place the butt of the next tree one-half the length of the previous tree or less upstream along the bank, so there is an overlap of the trees. If possible, cable the trees together in addition to cabling to an anchor buried in the bank.
6. Rock armour may be added along the toe of the slope, beneath the trees to reinforce the level of protection provided.
7. Maintenance, consisting of replacing severely damaged trees, will extend the life span.
8. Coniferous tree revetments also may be used as instream cover.

Adapted from CAPP *et al.* (2005)

tera ENVIRONMENTAL CONSULTANTS	**TRANS MOUNTAIN EXPANSION PROJECT** TRANSMOUNTAIN		
	STREAMBANK PROTECTION – CONIFEROUS TREE REVETMENT		
	7894	August 2014	Drawing B-12



Profile
(Not to Scale)

Notes:

1. Proper placement and design is critical and qualified specialists (*i.e.*, hydrotechnical engineers) should be involved.
2. Remove all stumps, organic matter and work material, and grade/prepare banks to a maximum slope as directed by a geotechnical engineer (≥ 45º).
3. Construct toe trench to key in bottom of armour protection into the bed and bank of the watercourse bank or adopt thickened toe option.
4. Install non-woven filter fabric or gravel filter layer at the ordinary high water level and above where cobble or riprap bank armouring will be implemented.
5. Place cleaned cobble or riprap on slope to be protected such that a well-interlocked, smooth layer is produced.
6. Key in up and downstream ends of the armoured bank in a manner such that it will not be outflanked.
7. Cobble/riprap should extend 0.5 m (min) above design flood level. If design flood level is above the top of the bank, cobble/riprap should be placed to the top of the bank.
8. Cobble/riprap should be flush with bank adjacent to the right-of-way.
9. Cobble/riprap placement should not compromise bed elevation.

Adapted from CAPP *et al.* (2005).

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	STREAMBANK PROTECTION – COBBLE OR RIPRAP ARMOURING		
	7894	August 2014	Drawing B-13

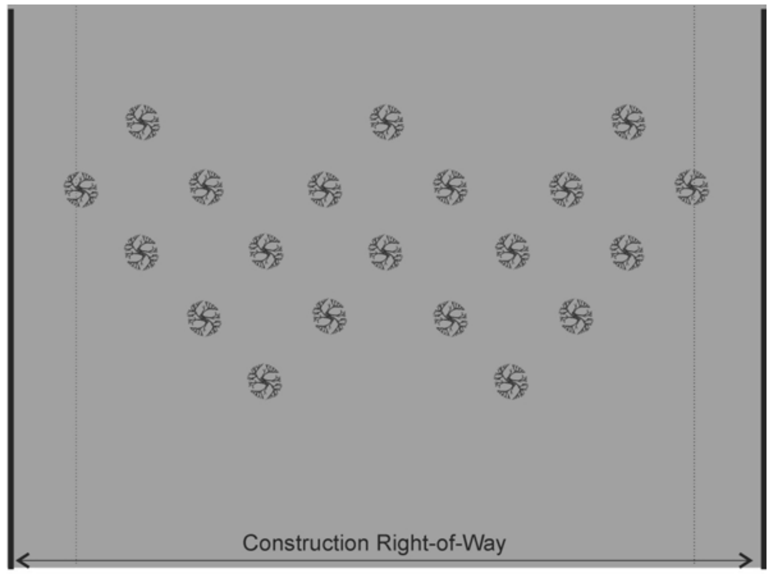
CRITERIA FOR IMPLEMENTATION

Live plant material salvage will generally be used for one of two reasons:

- salvage of shrubs with rootball; and
- salvage and transplant of rare plants.

All collection, salvage and transportation of live plant material will be conducted following approval by the appropriate regulatory authority.

Profile View
(Not to Scale)



Plan View
(Not to Scale)

Representation Only

SALVAGE OF SHRUBS WITH ROOTBALL

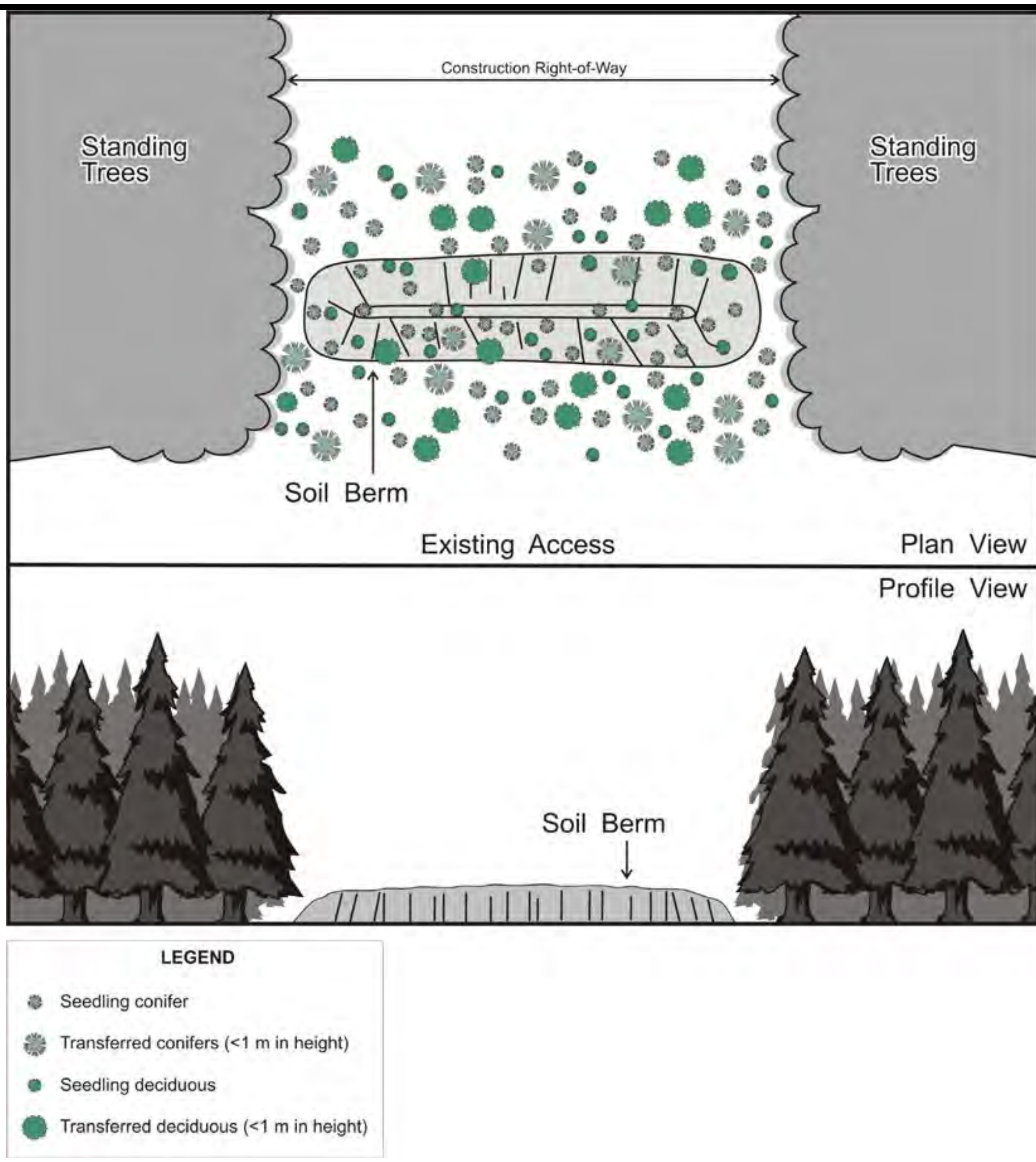
Shrubs for salvage will be selected by a qualified botanist/biologist and flagged prior to construction activities in that area.

1. To the extent possible, shrub salvage will be conducted during dormancy (senescence to bud break).
2. Shrub salvage will be timed to minimize period between salvage and restoration planting.
3. Prior to salvage, prune back shrub top growth as instructed by a qualified botanist/biologist. Salvage shrubs using a backhoe. Remove as large a rootball as feasible.
4. Cover the rootball of the salvaged plants with burlap or geotextile. Keep the covered rootball slightly moist (but not saturated) until the plants are replanted.

RARE PLANTS

1. Rare plants located along the construction right-of-way that require transplanting will be identified by a qualified botanist/biologist and will be flagged prior to clearing.
2. A qualified botanist/biologist will select a suitable receiving site for the plant(s). Ideally, the receiving site should be adjacent to the construction right-of-way, in an area having a similar microsite to where the rare plant(s) had been growing.
3. Delay salvaging activities until immediately prior to construction. Cut back or prune plants to be salvaged as recommended by Trans Mountain's Environmental Inspector(s) in consultation with a qualified botanist/biologist. Salvage designated plants using a shovel or backhoe. Remove as large a rootball as feasible. Cover the rootball of the salvaged plants with burlap or geotextile. Keep the covered rootball slightly moist (but not saturated) until the plants are replanted.
4. Replant the salvaged plant(s) in the receiving site as soon as feasible following salvage.

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	LIVE PLANT SALVAGE AND TRANSPLANT		
	7894	August 2014	Drawing B-14

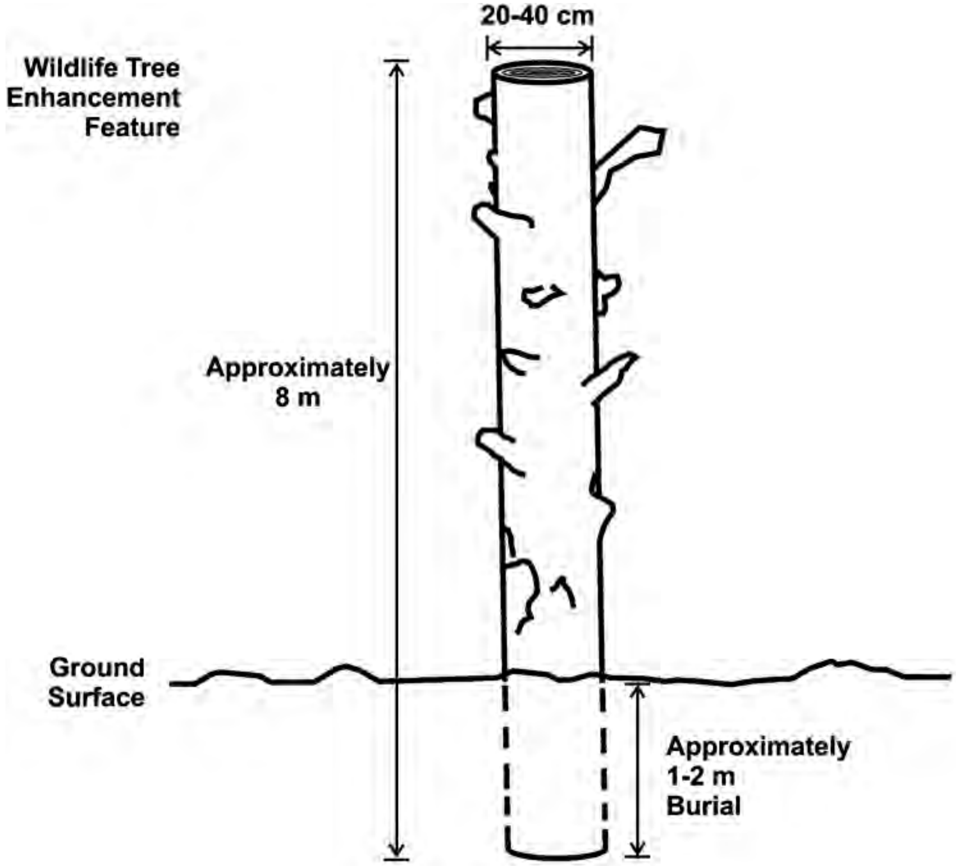


Representation Only

Notes:

1. Use subsoil to construct berm.
2. Locate berm across the entire width of the construction right-of-way.
3. Cover constructed berm with topsoil/root zone material.
4. Do not locate berm in drainages or depressions.
5. Ensure soil berm is of sufficient height to restrict line of sight down the construction right-of-way from existing access.
6. Plantings adjacent the berm on each side will be established no less than the width of the berm.
7. Plant suitable early and late seral plants together, adjacent, on the sides and top of the berm.
8. Transfer dormant, woody plant s <1 m in height from adjacent vegetated areas onto sides and adjacent areas of the berm.
9. Transfer dormant, woody plants at a density of 0.35 plant / m^2.
10. Plant seedling woody plants at a density of 1 plant / m^2.

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	VEGETATION AND SOIL BERM - LINE-OF-SIGHT BREAK		
	7894	August 2014	Drawing B-15



Restoration Phase Installation Detail

Not to Scale

Notes:

1. Salvage and store sound deciduous or coniferous tree trunks at the edge of the cleared right-of-way for use as wildlife tree enhancement features.

2. Tree trunks should be delimbed, but can have 10-30 cm long branch remnants protruding from the trunk.

3. Approximate tree size: 20-40 cm diameter and 8 m long.

4. During restoration phase, the trunk will be “planted” to a depth of approximately 1-2 m in temporary workspace to serve as an artificial snag (wildlife tree).

5. Location of enhancement feature to be determined by Environmental Inspector.

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	TYPICAL WILDLIFE TREE ENHANCEMENT FEATURE		
	7894	August 2014	Drawing B-16

BC Parks - LDB

TAB C – LAC DU BOIS GRASSLANDS PROTECTED AREA

August 2014
Rev. 0

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Prepared for:

TRANSMOUNTAIN

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1.0 LAC DU BOIS GRASSLANDS PROTECTED AREA

Established in 1996, Lac du Bois Grasslands Protected Area encompasses approximately 15,000 ha of native grassland communities, dry forests, rock outcrops, canyons, wetlands, ponds and small lakes near the City of Kamloops, BC. The protected area provides a representative area for unique grassland communities, only protected area where the three main grassland ecosystem types (upper, middle, and lower grasslands) occur in close proximity, thus fulfilling a special conservation role in representing the Thompson Basin and Northern Thompson Uplands Ecosections. Beyond the grasslands, ponderosa pines and bunchgrass transition to trembling aspen and open Douglas-fir forests. A regional location map for the Trans Mountain system is shown in Figure C2.1-1. This map shows the location of the Project relative to other features including Lac du Bois Grasslands Protected Area, major highways and communities.

Recreational activities within the protected area are limited to those compatible with the sensitive grassland and forest communities, such as hiking and mountain biking on designated trails. Cattle are a part of the history and culture of the protected area, and continue to graze in low numbers through much of the protected area. Traditional use of the area is confirmed by the discovery of historically significant pictographs and archaeological sites.

The protected area includes a representation of six major plant communities within a distance of only 20 km, including three grassland communities, making it unusual for the province. Grasslands represent less than 1% of BC’s land base, but provide habitat for 30% of BC’s species at risk. The diverse habitats in the protected area provide for a variety of wildlife, including California bighorn sheep, white tail and mule deer, moose, black bear, rattlesnakes, racers, gopher snakes, sharp-tail grouse, flammulated owls, burrowing owls, western long-billed curlews and waterfowl.

The management priority for Lac du Bois Grasslands Protected Area is conservation of the provincially and nationally significant grassland ecosystem. Most of the protected area (82%) is managed as a ‘Natural Environment Zone’ to protect ecological and scenic values and provide for compatible backcountry recreation in a relatively undisturbed natural environment (BC Parks 2004). The BC MOE has recently made additions to Lac du Bois Grasslands Protected Area. These additions were included to provide greater certainty for protection of sensitive grasslands and continuity of habitats for wildlife moving through the area.

This environmental and socio-economic assessment (ESA) took into consideration the protected area management objectives of Lac du Bois Grasslands Protected Area.

2.0 CORRIDOR SELECTION AND PROJECT ACTIVITIES

Early in 2012, Trans Mountain Pipeline ULC (Trans Mountain) conducted a preliminary route assessment of the existing Trans Mountain pipeline alignment to identify potential routing options for the Trans Mountain Expansion Project (TMEP or the Project) in Lac du Bois Grasslands Protected Area.

2.1 Existing Trans Mountain Pipeline Route

The existing Trans Mountain Pipeline (TMPL) right-of-way, located in the community of Westsyde in the City of Kamloops, was constructed 61 years ago, when the land was under agricultural use. Since the construction of the TMPL in 1952, the community of Westsyde has developed and grown along a broad terrace of the North Thompson River and considerable urban development has been encroaching upon the TMPL right-of-way. The protected area was first established in 1996 and in 2013, additional lands were added through a designated expansion. As such, these additions overlap the existing TMPL right-of-way at two short locations north of Westsyde and at a longer location (1.6 km) in the Batchelor Hills area further south (herein referred to as the Batchelor Addition).

2.2 Alternatives Considered

Trans Mountain considered two alternatives in the Lac du Bois Grasslands Protected Area and surrounding areas:

- a TMPL Alternative that parallels the existing TMPL right-of-way through Westsyde and two park extenstion; and
- a West Alternative that involves bypassing the community of Westsyde to the west by following a Telus Fibre Optic Transmission System (FOTS) right-of-way through Lac du Bois Grasslands Protected Area.

An evaluation of the alternative corridors in the Lac du Bois Grasslands Protected Area is provided in Table C2.2-1 and Figure C2.2-1. Both alternatives cross the Batchelor Addition, which is unavoidable. Figure C2.2.-1 also shows the narrowed pipeline corridor, which identifies the land that would be required for the purposes of constructing the Project within the Lac du Bois Grasslands Protected Area.

TABLE C2.2-1

EVALUATION OF ALTERNATIVE CORRIDORS – LAC DU BOIS GRASSLANDS PROTECTED AREA AND SURROUNDING AREAS (RK 828.4 TO RK 836.9 AND RK 842.3 TO RK 843.9)[1]

Factors	TMPL Alternative	West Alternative
LENGTHS		
Protected areas and protected areas (km) (name)	1.8 (Lac du Bois Grasslands Protected Area and Batchelor Addition) - would require boundary adjustment	10.1 (Lac du Bois Grasslands Protected Area and Batchelor Addition) - would require boundary adjustment
Length of pipeline corridor (km)	16.6	16.4
Length following existing TMPL right-of-way (km)	12.6	0.1
Length following other linear features (other pipelines, power lines, highways, roads, FOTS[2], railways, etc.) (km)	2.5	15.7
Length of "new" corridor (km)	1.5	0.6
Total parallels (km)	15.1	15.8
CROSSINGS		
No. of highway crossings	0	0
No. of road (arterial, collector, local) crossings	24	4
No. of main power line crossings	0	0
No. of distribution power line crossings	1	0
No. of railway crossings	0	0
Crossings of named rivers (No.)	0	0
Crossings of other watercourses (No.)	25	23

TABLE C2.2-1 Cont'd

Factors	TMPL Alternative	West Alternative
Crossings of named creeks (No.)	3 (Dairy Creek; McQueen Creek [in Lac du Bois Grasslands Protected Area]; Lanes Creek)	3 (Dairy Creek; McQueen Creek [in Lac du Bois Grasslands Protected Area]; Lanes Creek)
Total watercourses (No.)	28	26
LAND		
Indian Reserve (km) (name)	0	0
Provincial Crown (km)	23.6	15.3
Private (km)	14.5	1.8
Unknown Parcels (km)	0	0.9
No. of private parcels	72	4
ENVIRONMENT		
Length within Riparian Reserve Zone (km)	0.1	0
Woodlots crossed (km)	0.4	0
Wildlife Habitat Areas (km) (species), Old Growth Management Area (legal) (km), Old Growth Management Area (non-legal) (km), designated Ungulate Winter Range (km), wetlands crossed (km), and late winter or early winter habitat for mountain caribou (km) (Wells Gray or Groundhog)	0	0
SOCIO-ECONOMIC		
Agricultural Land Reserve (ALR) (km)	13.2	11.8 (4.4 km of ALR in Lac du Bois Grasslands Protected Area)
Community watersheds (No.)	0	0
Municipalities crossed	Kamloops	Kamloops
LRMP[2] area (km) (name)	16.6 (Kamloops LRMP)	16.4 (Kamloops LRMP)
LRMP Resource Management Zones crossed (km)	Tk'emlúps te Secwe̓pemc Traditional Territory (16.6) Visually Sensitive Areas (16.6) Settlement Resource Management Zone (3.7)	Tk'emlúps te Secwe̓pemc Traditional Territory (16.4) Visually Sensitive Areas (11.7) Critical Deer Winter Range (7.2)
ABORIGINAL AND STAKEHOLDER ENGAGEMENT		
Aboriginal Support	No major comments received to date. Engagement ongoing.	No major comments received to date. Engagement ongoing.
Stakeholder Support	Westsyde residents have expressed strong support for avoiding Westsyde and traversing Lac du Bois Grasslands Protected Area. If the West Alternative is not possible then this option is preferred by stakeholders.	Naturalists concerned about Lac du Bois Grasslands Protected Area and mitigation/compensation for environmental effects.
CONSTRUCTABILITY AND COST		
Constructability	TMPL parallel combined with complex in-street construction along Westsyde Road plus some residential backyard construction.	FOTS parallel along north west slope through Lac du Bois Grassland Protected Area.
Estimated Construction Cost ($ millions)	$50.00	$30.60

Notes: 1 The total length of the pipeline corridor denotes a point along the corridor where it would be necessary to deviate to avoid Lac du Bois Grasslands Protected Area and then rejoin the existing TMPL alignment. It does not represent the total length through Lac du Bois Grasslands Protected Area. This length is needed to compare the full extent of the route alternatives for comparison purposes.

2 LRMP = land and resource management plan

Orthomosaic maps that identify the land that would be required in Lac du Bois Grasslands Protected Area (*i.e*., the narrowed pipeline corridor) for the purposes of constructing the Project are provided in Figure C2.2-2.

2.2.1 TMPL Alternative

The TMPL Alternative parallels the existing TMPL right-of-way within the community of Westsyde, potentially disrupting 74 private landowners. Concerns have been raised by Westsyde residents on several occasions with regard to excavating yards to construct the pipeline along the right-of-way or within the community. The TMPL Alternative also traverses within the Lac du Bois Grasslands Protected Area boundaries for 0.2 km as well as the recently added Batchelor Addition for 1.6 km for a total of 1.8 km within the protected area.

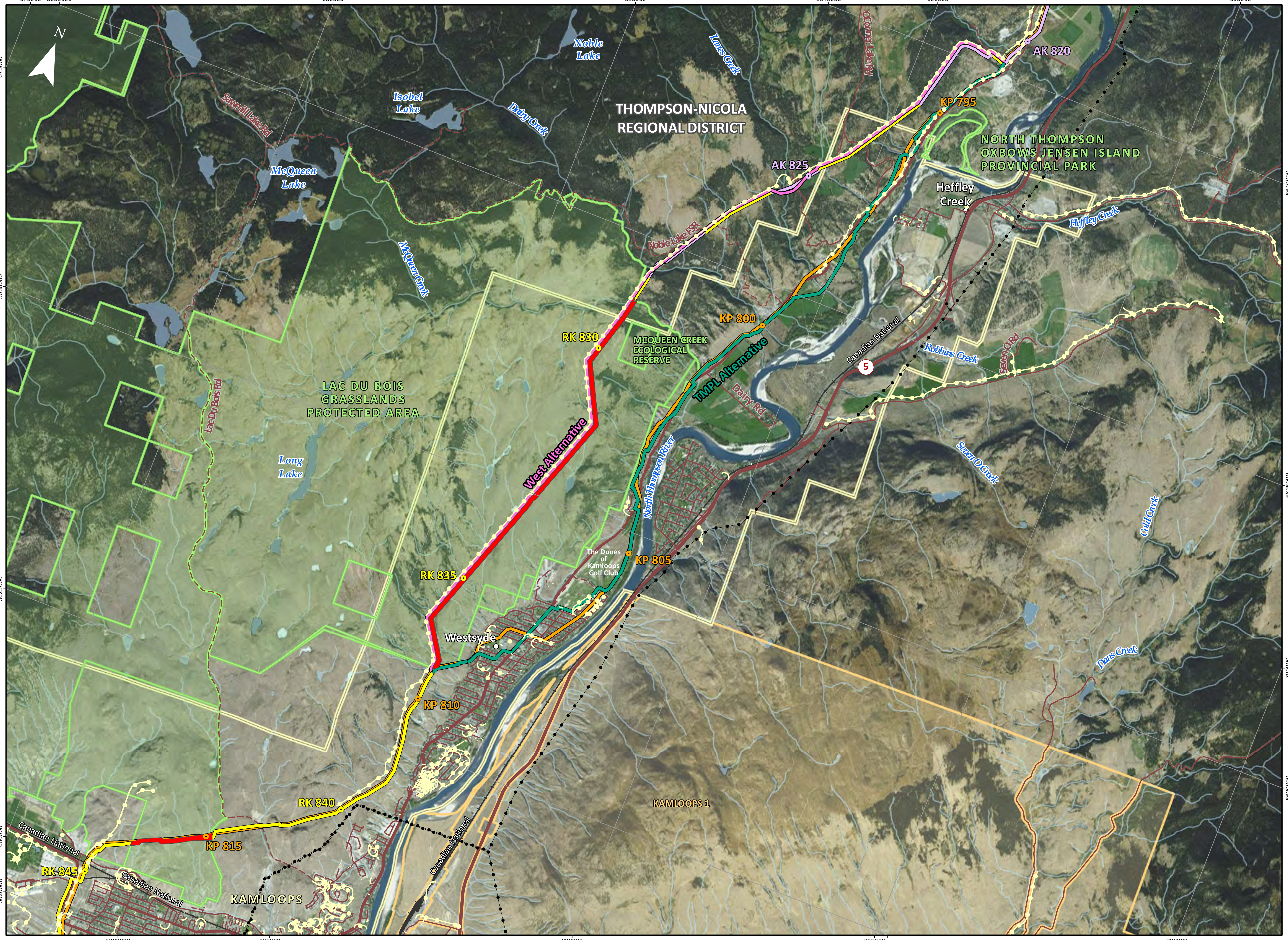
2.2.2 West Alternative

The West Alternative proposes to cross the protected area for 8.5 km following an existing linear disturbance, the Telus FOTS line, as well as crosses Lac du Bois Grasslands Protected Area in the recently added Batchelor Addition for 1.6 km for a total of 10.1 km within the protected area.

2.3 Preferred Alternative

During the consultation process, strong community support was expressed by some stakeholders for a corridor west of Westsyde through Lac du Bois Grasslands Protected Area following the FOTS right-of-way, while others raised concerns about effects of the Project on the protected area. Both alternative corridors were studied and evaluated from an environmental and socio-economic perspective.

It was concluded that, the West Alternative, also known as the original pipeline corridor, is preferred because it crosses slightly fewer watercourses, considerably fewer private land parcels and avoids the community of Westsyde. Trans Mountain made efforts to further minimize the proposed pipeline corridor in Lac du Bois Grasslands (*i.e.,* the narrowed pipeline corridor) in order to reduce the impacts to species at risk, parallels an esxisting disturbance (Telus Fots) and to restore the right-of-way to natural grassland vegetation following construction. The narrowed pipeline corridor passes through Lac du Bois Grasslands Protected Area at two locations: RK 828.4 to RK 836.9 and RK 842.3 to RK 843.9 (Batchelor Addition).



TRANS MOUNTAIN

FIGURE FIGURE C2.2-1

LAC DU BOIS GRASSLANDS PROTECTED AREA ALTERNATIVE CORRIDORS

TRANS MOUNTAIN EXPANSION PROJECT

Alternative Corridors

- TMPL Alternative
- West Alternative

- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- TMPL Kilometre Post (KP)
- TMEP Mapping Reference Line (As Filed)
- TMEP Mapping Reference Line (New Alignment)
- Trans Mountain Pipeline (TMPL)
- Narrowed Pipeline Corridor within Lac du Bois Grasslands Protected Area
- Facility Property Boundary
- Highway
- Paved Road
- Resource Road
- Railway
- Transmission Line
- Fiber-Optic Transmission System
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- Park / Protected Area

Projection: NAD 1983 UTM Zone 10N. Routing: Baseline TMPL & Facilities: provided by KMC, 2012; Proposed Alternative Routing Corridors provided by UPI, 2013, 2014. Reference Line & RK/AK provided by UPI, March 25 & 28, 2014; Transportation: IHS Inc., 2013, Natural Resources Canada, 2012; Geopolitical Boundaries: Natural Resources Canada, 2003, AltaLIS, 2013, IHS Inc., 2011, BC FLNRO, 2007 & ESRI, 2005; First Nation Lands: Government of Canada, 2014, AltaLIS, 2010 & IHS Inc., 2011; Hydrology: Natural Resources Canada, 2007-11 & BC FLNRO, 2008; Parks and Protected Areas: Natural Resources Canada, 2014, AltaLIS, 2012 & BC FLNRO, 2008; B/W & Colour Imagery: 2008-2011: Provided by KMC, 2012, ESRI (Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community).

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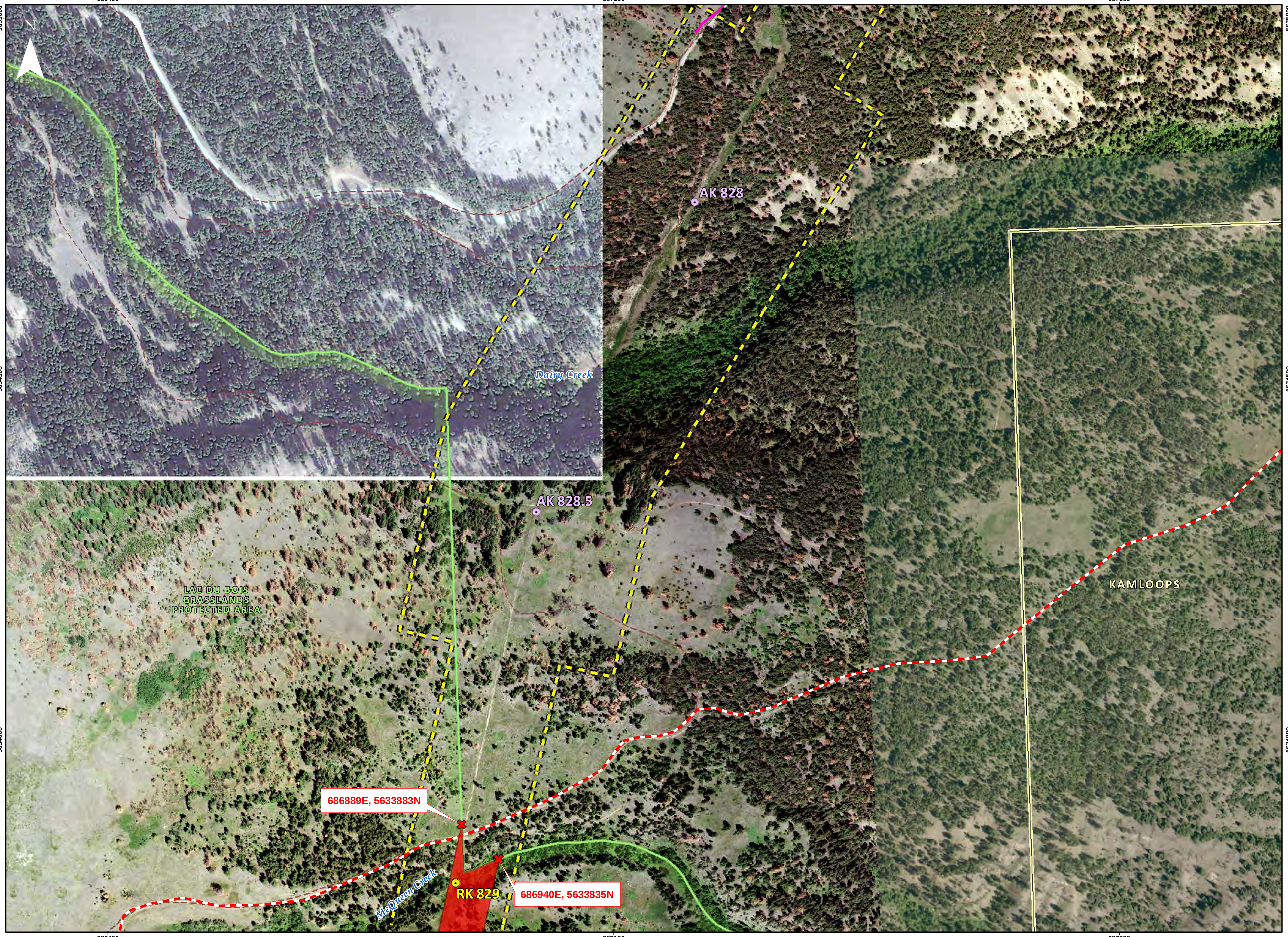

TRANS MOUNTAIN

FIGURE C.2.2-2
ORTHOMOSAIC MAPPING OF LAC DU BOIS GRASSLANDS PROTECTED AREA
SHEET 1 OF 12
TRANS MOUNTAIN EXPANSION PROJECT

- Start/End UTM Coordinate
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- TMPL Kilometre Post (KP)
- Existing Major Access
- Existing Secondary Access
- New Permanent Access
- New Temporary Access
- Deactivated Overgrown Access
- Narrowed Pipeline Corridor within Lac Du Bois Grasslands Protected Area
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Revised Pipeline Corridor
- Trans Mountain Expansion Project Proposed Alternative Pipeline Corridor
- Facility Property Boundary
- Highway
- Paved Road
- Resource Road
- Railway
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- Park / Protected Area

Projection: NAD 1983 UTM Zone 10N. Routing: Baseline TMPL & Facilities provided by KMC, 2012; Proposed Corridor V9.2 provided by UPI, June 5, 2014; RK/AK VF provided by UPI, March 28, 2014; Narrowed Pipeline Corridor provided by UPI, July 24, 2014; Access Roads: UPI, Jan. 24, 2014; Transportation: IHS Inc., 2013, Natural Resources Canada, 2012; Geopolitical Boundaries: IHS Inc., 2013; First Nation Lands: Government of Canada, 2014; Hydrology: Natural Resources Canada, 2007-2011 & BC FLNRO, 2008; Parks and Protected Areas: Natural Resources Canada, 2014, FLNRO, 2008; B/W & Colour Imagery: 2008-2011: Provided by KMC, 2012; NASA Geospatial Interoperability Program, 2005.

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TRANS MOUNTAIN

FIGURE C.2.2-2
ORTHOMOSAIC MAPPING OF LAC DU BOIS GRASSLANDS PROTECTED AREA
SHEET 2 OF 12
TRANS MOUNTAIN EXPANSION PROJECT

- Start/End UTM Coordinate
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- TMPL Kilometre Post (KP)
- Existing Major Access
- Existing Secondary Access
- New Permanent Access
- New Temporary Access
- Deactivated Overgrown Access
- Narrowed Pipeline Corridor within Lac Du Bois Grasslands Protected Area
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Revised Pipeline Corridor
- Trans Mountain Expansion Project Proposed Alternative Pipeline Corridor
- Facility Property Boundary
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- Park / Protected Area

Projection: NAD 1983 UTM Zone 10N. Routing: Baseline TMPL & Facilities provided by KMC, 2012; Proposed Corridor V9.2 provided by UPI, June 5, 2014; RK/AK VF provided by UPI, March 28, 2014; Narrowed Pipeline Corridor provided by UPI, July 24, 2014; Access Roads: UPI, Jan. 24, 2014; Transportation: IHS Inc., 2013, Natural Resources Canada, 2012; Geopolitical Boundaries: IHS Inc., 2013; First Nation Lands: Government of Canada, 2014; Hydrology: Natural Resources Canada, 2007-2011 & BC FLNRO, 2008; Parks and Protected Areas: Natural Resources Canada, 2014, FLNRO, 2008; B/W & Colour Imagery: 2008-2011: Provided by KMC, 2012; NASA Geospatial Interoperability Program, 2005.

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TRANS MOUNTAIN

FIGURE C.2.2-2
ORTHOMOSAIC MAPPING OF LAC DU BOIS GRASSLANDS PROTECTED AREA
SHEET 3 OF 12
TRANS MOUNTAIN EXPANSION PROJECT

- Start/End UTM Coordinate
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- TMPL Kilometre Post (KP)
- Existing Major Access
- Existing Secondary Access
- New Permanent Access
- New Temporary Access
- Deactivated Overgrown Access
- Narrowed Pipeline Corridor within Lac Du Bois Grasslands Protected Area
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Revised Pipeline Corridor
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- Facility Property Boundary
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- Railway
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- Park / Protected Area

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TRANS MOUNTAIN

FIGURE C.2.2-2
ORTHOMOSAIC MAPPING OF
LAC DU BOIS GRASSLANDS
PROTECTED AREA
SHEET 4 OF 12
TRANS MOUNTAIN EXPANSION PROJECT

- Start/End UTM Coordinate
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- TMPL Kilometre Post (KP)
- Existing Major Access
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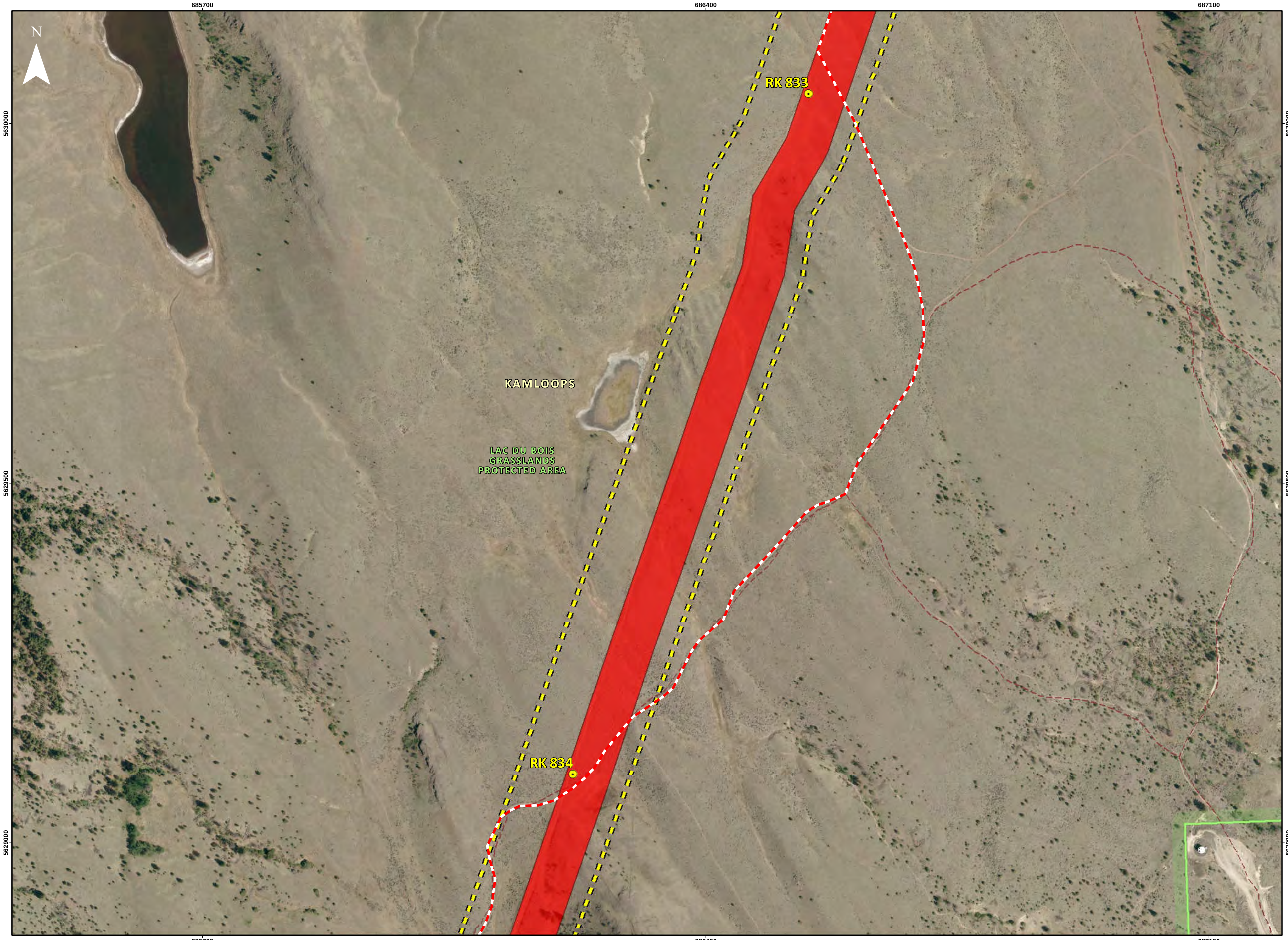

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FIGURE C.2.2-2
ORTHOMOSAIC MAPPING OF LAC DU BOIS GRASSLANDS PROTECTED AREA
SHEET 5 OF 12
TRANS MOUNTAIN EXPANSION PROJECT

Start/End UTM Coordinate
Reference Kilometre Post (RK)
Alternate Kilometre Post (AK)
TMPL Kilometre Post (KP)
Existing Major Access
Existing Secondary Access
New Permanent Access
New Temporary Access
Deactivated Overgrown Access
Narrowed Pipeline Corridor within Lac Du Bois Grasslands Protected Area
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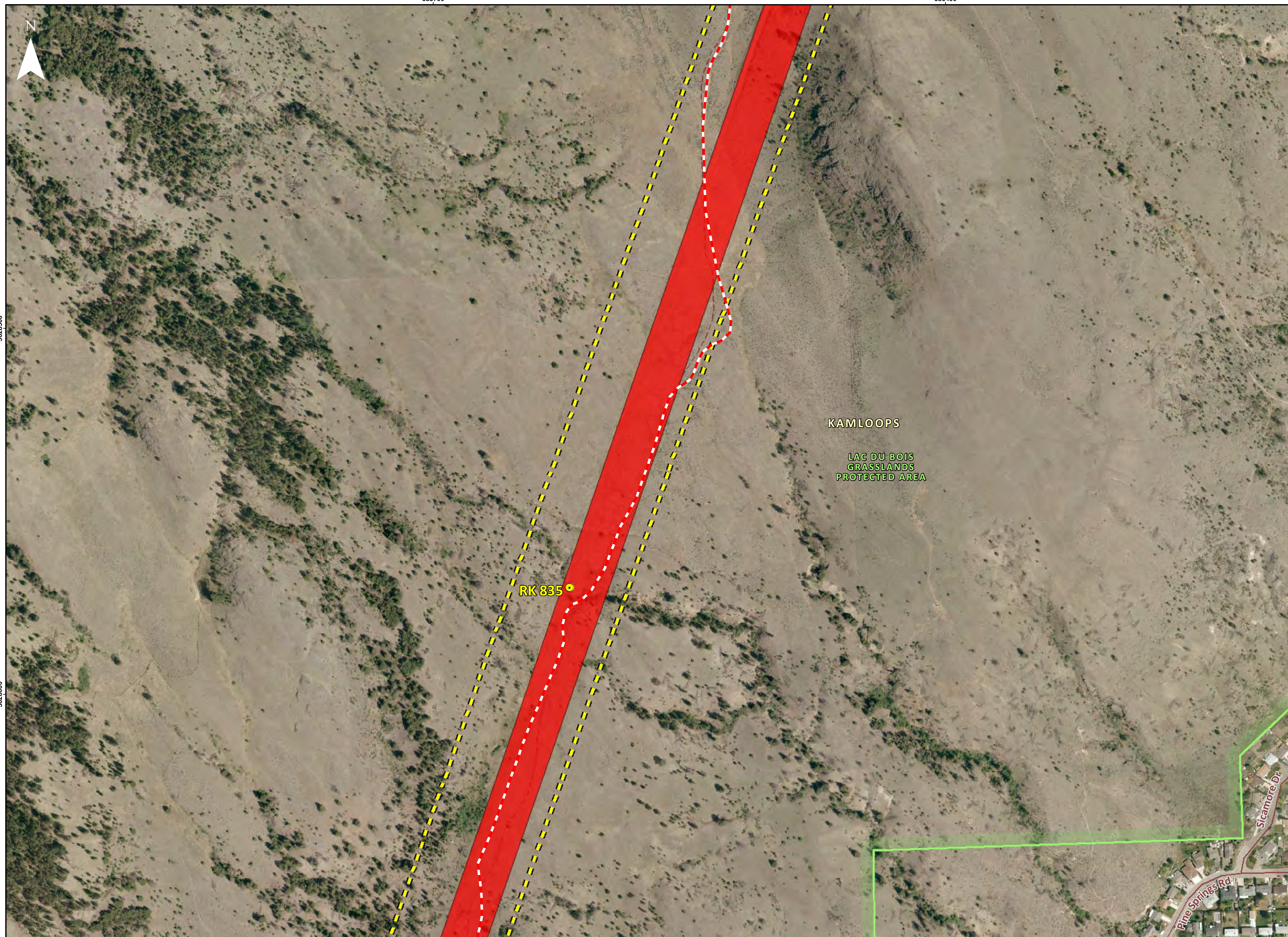

TRANS MOUNTAIN

FIGURE C.2.2-2
ORTHOMOSAIC MAPPING OF LAC DU BOIS GRASSLANDS PROTECTED AREA
SHEET 6 OF 12
TRANS MOUNTAIN EXPANSION PROJECT

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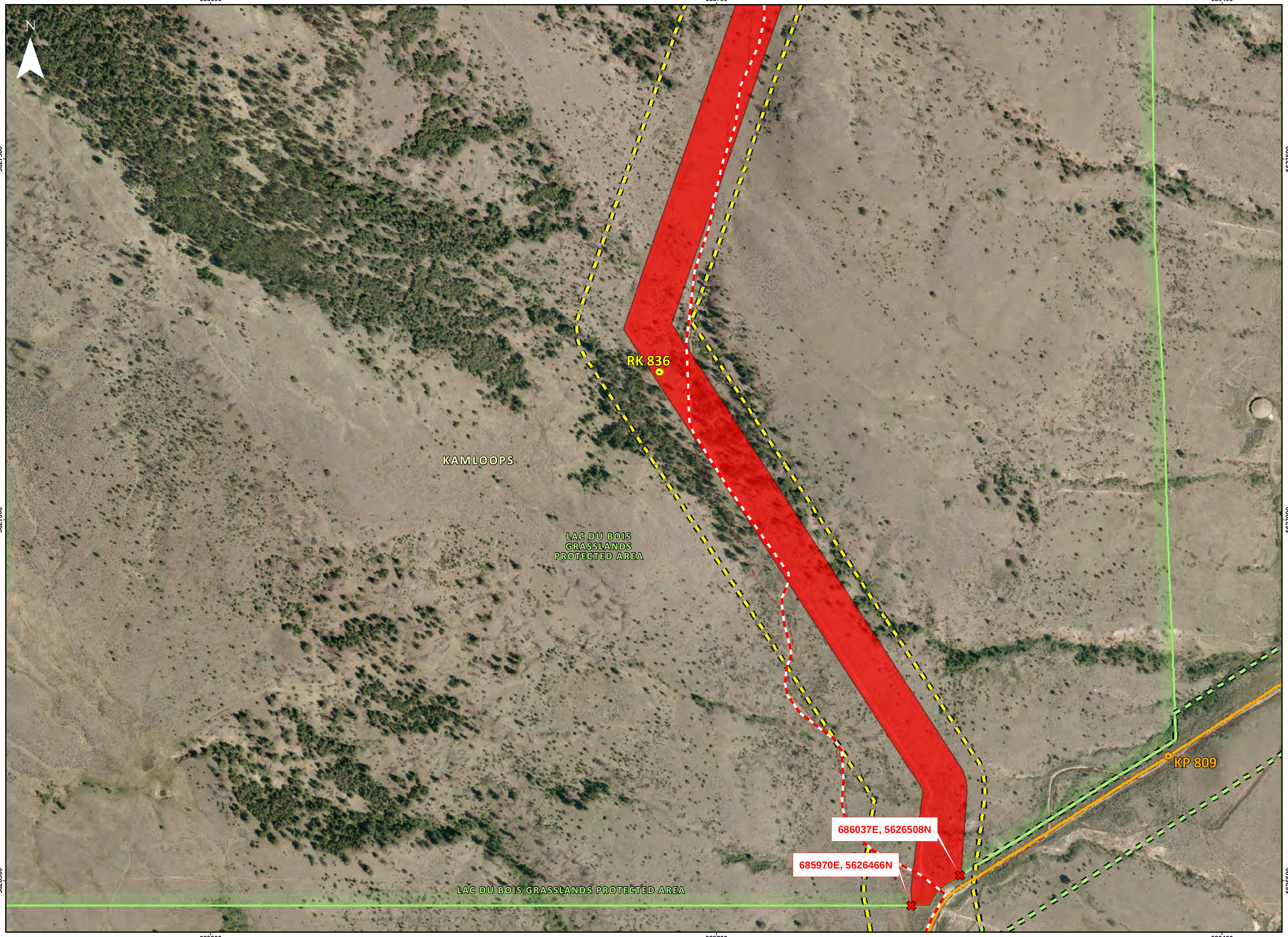

TRANS MOUNTAIN

FIGURE C.2.2-2
ORTHOMOSAIC MAPPING OF LAC DU BOIS GRASSLANDS PROTECTED AREA
SHEET 7 OF 12
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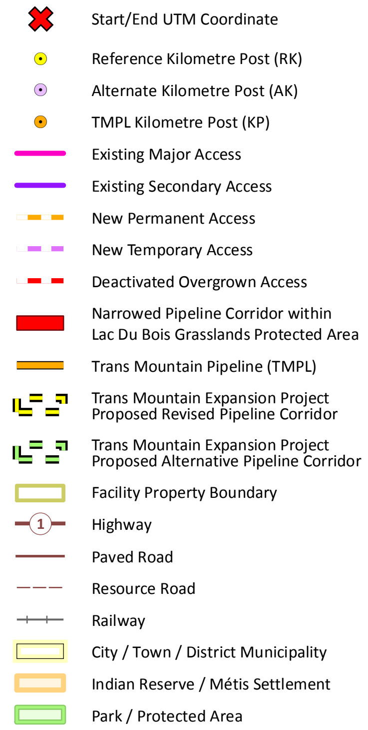

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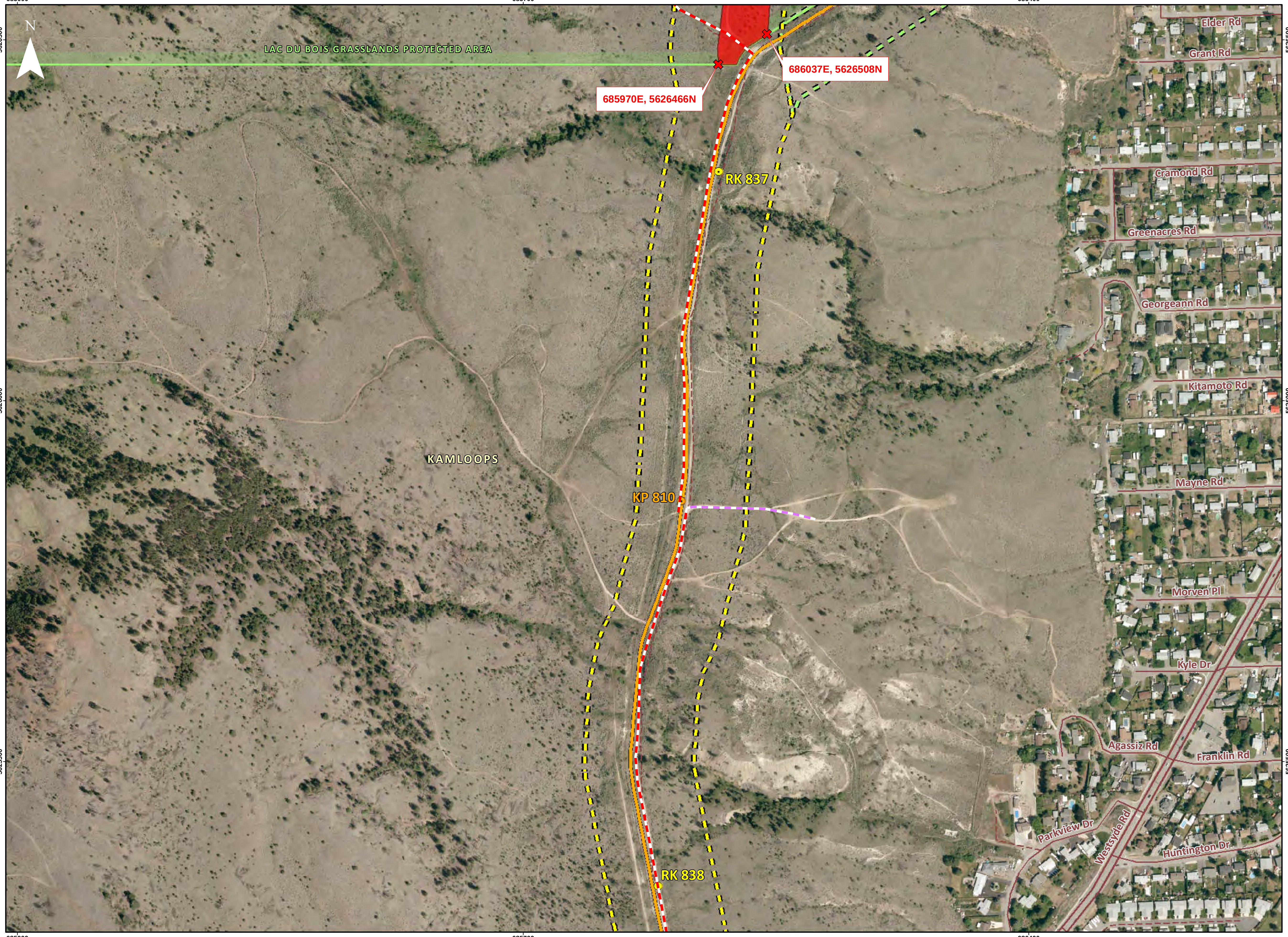

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FIGURE C.2.2-2
ORTHOMOSAIC MAPPING OF LAC DU BOIS GRASSLANDS PROTECTED AREA
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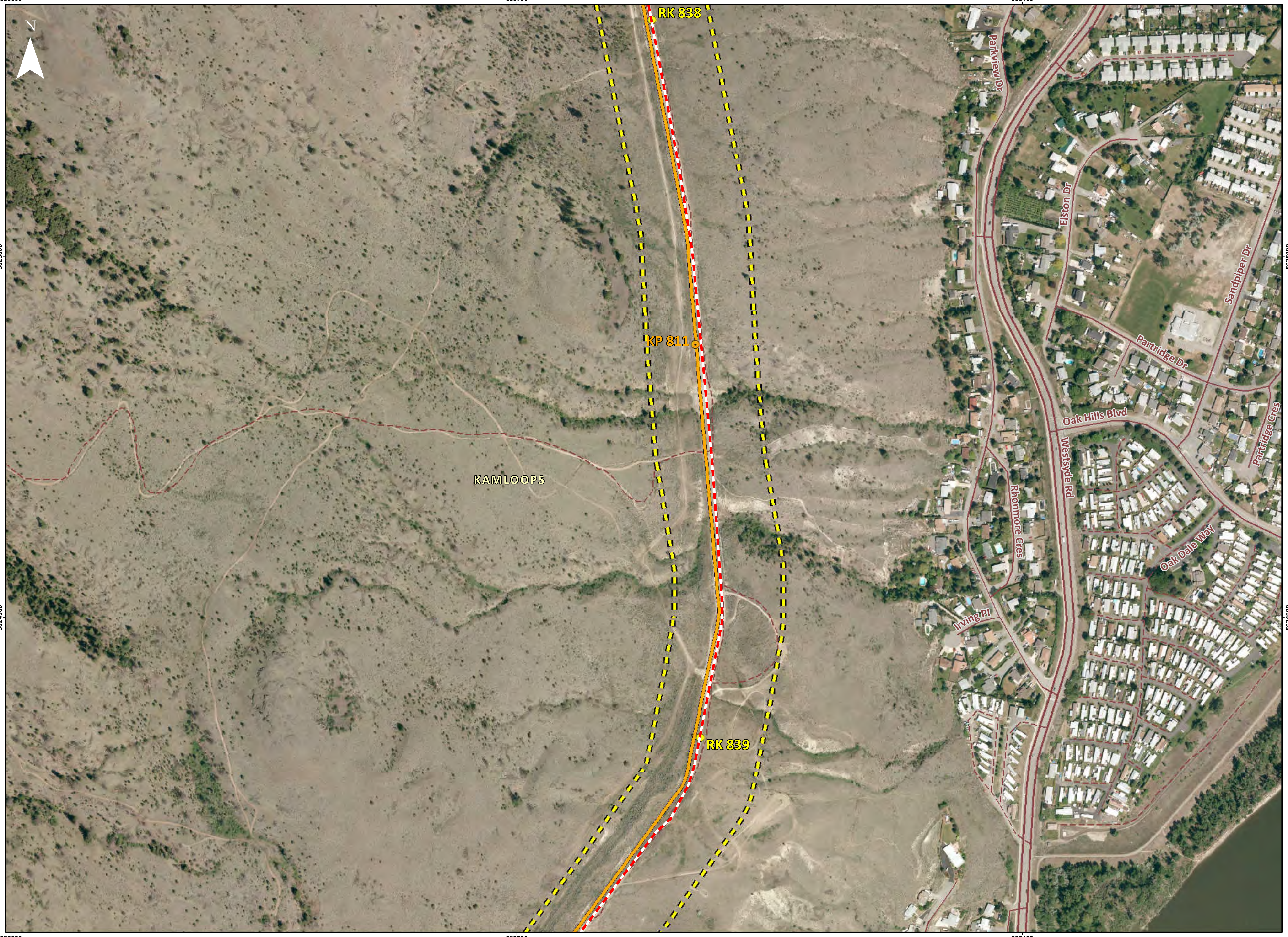

TRANS MOUNTAIN

FIGURE C.2.2-2
ORTHOMOSAIC MAPPING OF LAC DU BOIS GRASSLANDS PROTECTED AREA
SHEET 9 OF 12
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TRANS MOUNTAIN

FIGURE C.2.2-2
ORTHOMOSAIC MAPPING OF
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PROTECTED AREA
SHEET 10 OF 12
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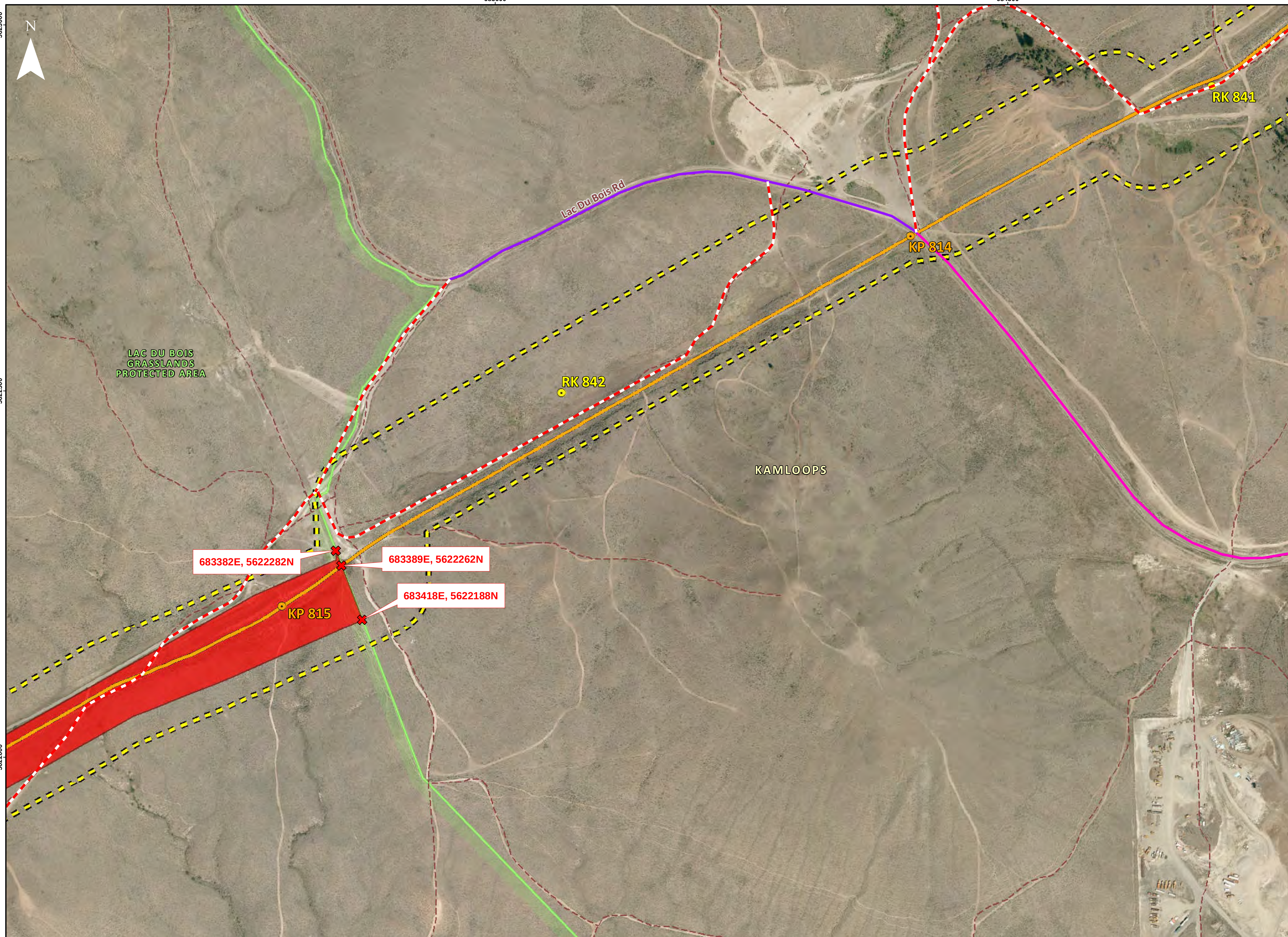

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FIGURE C.2.2-2
ORTHOMOSAIC MAPPING OF LAC DU BOIS GRASSLANDS PROTECTED AREA
SHEET 11 OF 12
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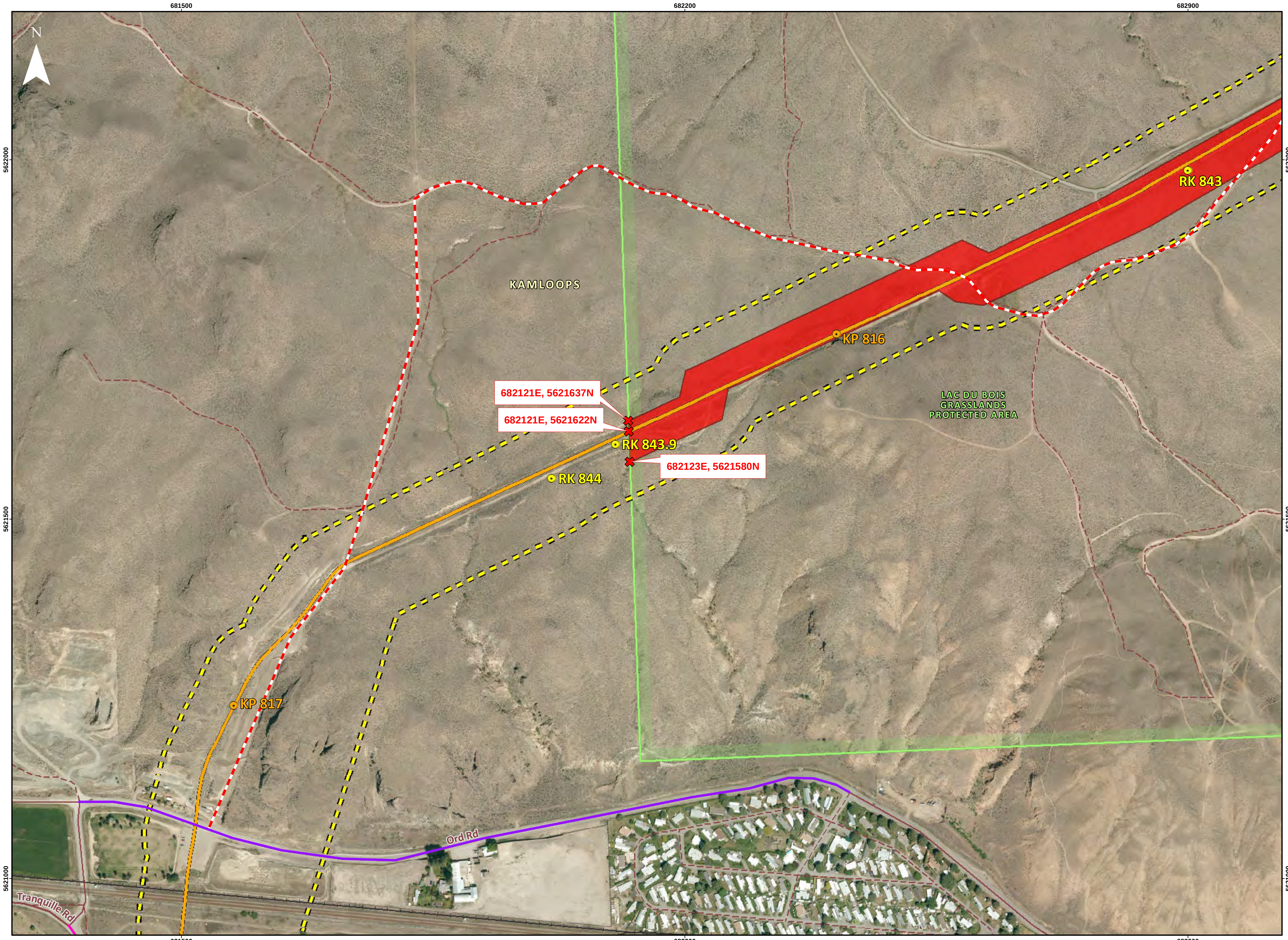

TRANS MOUNTAIN

FIGURE C.2.2-2
ORTHOMOSAIC MAPPING OF LAC DU BOIS GRASSLANDS PROTECTED AREA
SHEET 12 OF 12
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2.4 Project Components

The technical details of the components of the Project are summarized in Section 2.2.1 of the Introduction to the Draft Stage 2 Detailed Proposal.

The narrowed pipeline corridor generally parallels an existing Telus FOTS for approximately 8.1 km through the northern portion of Lac du Bois Grassland Protected Area (RK 828.4 to RK 836.9; Figure C2.2-1). The narrowed pipeline corridor then leaves the protected area and rejoins the existing TMPL right-of-way. Pipeline construction in this area will occur on a reduced width right-of-way (*e.g.,* reduced from typical 40-30 m, incorporating an 18 m permanent right-of-way and 12 m temporary workspace) to minimize disturbance. The total land required to construct the proposed Project within Lac du Bois Grasslands Protected Area is approximately 47.6 ha, including temporary workspace.

The narrowed pipeline corridor then generally parallels the TMPL right-of-way for approximately 1.6 km across the newly added Batchelor Addition to the protected area (RK 842.3 to RK 843.9). Conventional construction techniques are proposed for this segment and new disturbance will be minimized. The total land in the southern Bachelor Addition is estimated to be approximately 9.3 ha including temporary workspace.

Construction equipment will access the proposed construction right-of-way via existing access roads and will travel along the construction right-of-way to the site. No new access will be needed. Design, construction and operations of the pipeline will be in compliance with all applicable codes, standards and regulations.

2.5 Construction Schedule in Lac du Bois Grasslands Protected Area

Pending regulatory approval of the Project and approval of the Draft Stage 2 Detailed Proposal, mainline construction in Lac du Bois Grasslands Protected Area is tentatively scheduled to commence in Q3 2016 and extend through Q4 2016, with clearing activities scheduled for Q3 2016, outside of the migratory birds breeding and nesting period. Intensive construction activities including trenching, lowering-in and backfilling, will be conducted as quickly as possible in order to reduce the amount of time the trench is open. Proposed construction and clearing activities in Lac du Bois Grasslands Protected Area are expected to take place over a 30 day period (see Table C2.5-1). However, within that period, the various phases of construction will occur consecutively. A description of the construction activities is provided in Section 2.2.1 of the Introduction of the Draft Stage 2 Detailed Proposal.

TABLE C2.5-1

ESTIMATED PROJECT CONSTRUCTION AND OPERATIONS SCHEDULE

Major Activity	Anticipated Commencement of Major Activity	Estimated Duration of Major Activity
Pipeline Construction	Pending regulatory approval	30 days
Construction Survey	Q3 2016 prior to clearing	2 days
Clearing	Q3 2016	1 day
Topsoil or Root Zone Material Salvage	Q3 / Q4 2016	4 days
Blasting	Q3 / Q4 2016	1 day
Grading (if required)	Q3 / Q4 2016	4 days
Stringing, Bending and Welding	Q3 / Q4 2016	4 days
Trenching	Q3 / Q4 2016	2 days
Lowering-in	Q3 / Q4 2016	2 days
Backfilling	Q3 / Q4 2016	2 days
Testing	Q4 2017	4 days
Clean-up and Reclamation	Spring 2017	4 days
Operations	In-Service: Q4 2018	Over the first and second complete growing seasons following construction
Post-Construction Monitoring	--	5 years (growing seasons)
Line Patrols	--	Regular intervals
In-Line Inspections	--	As required
Vegetation/Weed Management	--	As required during lifespan
Maintenance Digs	Pending regulatory approval	As required during lifespan

3.0 ABORIGINAL ENGAGEMENT IN LAC DU BOIS GRASSLANDS PROTECTED AREA

As described in Section 3.0 of the Introduction of the Draft Stage 2 Detailed Proposal, the Aboriginal Engagement Program in Lac du Bois Grasslands Protected Area included 11 First Nations groups and two Tribal Associations that are potentially affected by Project activities within the protected area. Section 3.3 of the Introduction to the Draft Stage 2 Detailed Proposal documents Trans Mountain's engagement efforts with the following Aboriginal communities who have Aboriginal interests potentially affected by the proposed pipeline corridor in Lac du Bois Grasslands Protected Area:

- Tk'emlups te Secwepemc
- Skeetchestn Indian Band;
- Stk'emlupsemc te Secwepemc;
- Coldwater Indian Band;
- Siska Indian Band;
- Cook's Ferry Indian Band;
- Lower Nicola Indian Band;
- Lytton First Nation;
- Nicola Tribal Association;
- Nooaitch Indian Band;
- Shackan Indian Band;
- Oregon Jack Creek Band; and
- Neskonlith Indian Band.

4.0 PUBLIC CONSULTATION IN LAC DU BOIS GRASSLANDS PROTECTED AREA

As described in Section 4.2.3 of the Introduction to the Draft Stage 2 Detailed Proposal, the public consultation program consisted of a Community Workshop, an Environmental and Socio-Economic Assessment (ESA) Workshop and a Protected Areas Workshop. The following subsections provide a summary the interests and concerns raised relating to Lac du Bois Grasslands Protected Area at the ESA, Community and Protected Areas Workshops in Kamloops, BC.

4.1 Environmental and Socio-Economic Assessment Workshop

The ESA Workshop targeted local and regional subject matter experts from municipal, federal and provincial governments, local environmental and non-government organizations (ENGOs) and other environmental interests groups. In general, Trans Mountain invited participants to the ESA Workshops based on their specific technical and/or local knowledge, so they could provide input into the design of the ESA by providing information based on their topic of expertise: land, air and water.

From February 17 to February 28, 2013, invitations by phone and email were sent to stakeholders to solicit participation in an ESA Workshop on March 6, 2013 in Kamloops, BC. A number of follow-up phone calls were conducted to encourage invitees to participate. Of the 32 stakeholders that were invited, 10 organizations were represented.

Table C4.1-1 provides information on the attendees at the Kamloops ESA Workshop.

TABLE C4.1-1

PARTICIPANTS IN THE ESA WORKSHOP – BC INTERIOR

Group Type	Group
Academic	Thompson Rivers University
ENGO	Southern Interior Weed Management Committee (SIWMC)
	Fraser Basin Council
	BC Grassland Council
	BC Lake Stewardship society
Local Government	City of Kamloops
Provincial Government	Ministry of Forests, Lands and Natural Resource Operations
	Interior Health
	BC Parks
	Ministry of Mines

Stakeholders that registered to participate in the ESA Workshop were sent an email confirmation prior to the date of each workshop that included the agenda, a proposed workshop etiquette document, and an honorarium request form. The email also provided a username and password to a dedicated ESA web portal that contained the following pre-reading materials:

- Trans Mountain Expansion Project Overview;
- Environmental and Socio-Economic Assessment Overview;
- Air-based Module 1: Air Emissions;
- Air-based Module 2: GHG Emissions;
- Air-based Module: Acoustic Environment;
- Land-based Module 1: Physical and Meteorological Environment;
- Land-based Module 2: Soil and Soil Productivity;

- Land-based Module 3: Vegetation;
- Water-based Module 1: Water Quality and Quantity;
- Water-based Module 2: Fish and Fish Habitat;
- Water-based Module 3: Wetlands; and
- Accidents and Malfunctions.

At the workshop, the Project team provided attendees with a proposed overview of the ESA approach for the Project and sought the feedback of attendees on particular modules of the ESA including air, land and water. Input was solicited online for two weeks after each workshop.

Feedback received at these sessions, and afterwards, was shared with the relevant environmental disciplines and was considered in setting the scope for the Draft Stage 2 Detailed Proposal.

4.1.1 Summary of Outcomes at ESA Workshop

Table C4.1-2 provides information on the key topics, interests and concerns for the Kamloops ESA Workshop some of which relate to Lac du Bois Grasslands Protected Area.

TABLE C4.1-2

ESA WORKSHOP – BC INTERIOR

Topic	Summary of Interest or Concern	Lac du Bois Grasslands Protected Area Draft Stage 2 Detailed Proposal Section
Air Quality	Concerns with air quality issues using a slash and burn technique.	Section 7.1.4 of this tab.
	Dry vegetation makes this area hard to regenerate therefore dusts may not settle. Concerns with the high ATV and recreational uses on the right-of-ways in the area that may prevent regeneration.	Section 7.2.1 of this tab.
Fish and Fish Habitat	Mentioned that the stream status can be equal to the public sensitivity *e.g.,* sportfish/aquaculture and indicated an interest in timing of construction and impacts on water crossings.	Volume 6B of the Facilities Application.
	Participants noted that riparian habitat is of concern as it is important in limiting access.	Section 7.1.6 of this tab.
	Participants identified that *Species at Risk Act* (*SARA*) Listed species the west slope cutthroat and Salish sucker are not in the local area. Additions to *SARA* species included bull trout as it is provincially listed.	Section 6.0 and 7.1.6 of this tab.
	Participants suggested that benthic invertebrates can be a better indicator to include as they can show changes in their environment in a much shorter timeline than fish, create a better baseline and use for spill or long-term monitoring that from a public confidence and sport fishing are important.	Benthic invertebrates were not assessed. An explanation is provided in Section 7.2.3 of Volume 5A of the Facilities Application.
	Participants suggested that if species in watershed, should be dealt with at a watershed level.	Section 7.1.6 of this tab. Section 7.2.7 of Volume 5A of the Facilities Application.
Wetlands	Participant suggested considering physical size of wetland and source of wetland (groundwater vs. surface water).	Section 7.1.7 of this tab. Wetland Evaluation Technical Report (Volume 5C) of the Facilities Application.
	Wetland reclamation of previous Trans Mountain activities should be addressed and that these wetlands should not be used as a baseline.	Volume 6A of the Facilities Application.
	Participant suggested to consider grasslands and forested areas separately. Participant noted old growth management areas as one tool to look at old growth forests.	Section 7.1.8 of this tab. Section 7.2.8 of Volume 5A of the Facilities Application.
	Participant noted visual impacts/aesthetics are important for grasslands. For example, if vegetation regrowth does not blend, it is not visually pleasing. Issues with St. John's wort, orange hawk weed, tansy, sulphur cinquefoil and hoary alyssum.	Section 7.2.4 of Volume 5B of the Facilities Application.
	Noted that types of pre-planning are needed for seed collection gathering and collecting seed. Local source seed and propagation.	Volume 6B of the Facilities Application.

TABLE C4.1-2 Cont'd

Topic	Summary of Interest or Concern	Lac du Bois Grasslands Protected Area Draft Stage 2 Detailed Proposal Section
Wetlands (cont'd)	Concerns around removal of Russian weed grass along the Fibre optic line in Lac du Bois Grasslands Protected Area if the route through the protected area is selected.	Volume 6B of the Facilities Application.
	Participant noted reclamation could focus on local climate change and progressive way could be through small scale assisted migration. Trans Mountain has been very good at repopulating stands, maintain crested wheatgrass to stabilize soil and water resistance. Species like native bluebunch wheatgrass from North Dakota would not be adequate.	Mitigation measures related to re-seeding is discussed in Volume 6B of the Facilities Application.
Wildlife	Issues with habitat loss through direct or indirect methods through reduction of use and wildlife movement during construction and operations through mortality risks or increase in predation/access.	Section 7.1.9 of this tab.
	Participant raised concern due to predator prey relationships; for example caribou wolf dynamics on linear disturbances. These should be covered under mortality risk.	Wildlife Technical Report (Volume 5C) of the Facilities Application.

4.2 Community Workshops

On June 6, 2013, Trans Mountain held a Community Workshop in Kamloops, BC for identified stakeholders to provide an opportunity for local stakeholders to receive updated information and provide feedback on issues and concerns relative to their community especially as it related to routing and environmental studies. Some concerns raised were specific to provincial protected areas which provided a reference point for those attending Protected Areas Workshops in 2014.

Interested stakeholders were contacted by phone and email and invited to participate. A number of follow-up phone calls were conducted to encourage invitees to participate. Of the 31 community representatives that were invited, 13 attended. In some cases, organizations were represented by more than one attendee.

Table C4.2-1 provides information on the attendees at the Kamloops Community Workshop.

TABLE C4.2-1

PARTICIPANTS IN THE KAMLOOPS COMMUNITY WORKSHOP – LAC DU BOIS GRASSLAND PROTECTED AREA

Group Type	Group
Business	Kamloops Airport
Community	Kamloops Outdoor Club
	Kamloops Area Preservation Association
	Kamloops Chamber of Commerce
	Kamloops Trap and Skeet
	Kamloops North Shore Business Improvement Association
	Venture Kamloops
	Westsyde Community Association
ENGO	Grasslands Conservation Council of BC
	Kamloops Naturalist Club
Provincial Government	Representative for Cathy McLeod, MP

Interested stakeholders who were invited but did not attend the event include:

- Aberdeen Community Association;
- BC off-Road Motorcycle;

- City of Kamloops;
- Greater Kamloops ATV Association;
- Kamloops Bike Riders Association;
- Kamloops Central Business Improvement Association;
- Kamloops Fish and Game;
- Kamloops Hiking Club;
- Kamloops Snowmobile Association;
- Kamloops Trail Alliance;
- Kamloops Target Sports Association;
- Pineview Valley Community Association;
- Thompson Valley Rock Club; and
- Tourism Kamloops.

4.2.1 Summary of Consultation Outcomes at Community Workshop

Table C4.2-2 provides information on key topics, interests and concerns raised relating to Lac du Bois Grasslands Protected Area at the Kamloops Community Workshop.

TABLE C4.2-2

COMMUNITY WORKSHOP – LAC DU BOIS GRASSLAND PROTECTED AREA

Topic	Summary of Concern	Lac du Bois Grasslands Protected Area Draft Stage 2 Detailed Proposal Section
Air	None	N/A
Land	Concern that remediation should include a best practice approach using natural species. Note that there is little/no native seed stock and grasslands reclamation takes decades.	Section 9.0 of this tab.
	Request to consider expanding reclamation areas in Lac du Bois Grasslands Protected Area to include existing FOTS right-of-way, if routing is approved by BC Parks.	Section 9.0 of this tab.
	Concern about visual impact and aesthetics of construction in grasslands (changes to contour of hillsides).	Section 7.2.4 of Volume 5B of the Facilities Application.
	Wildlife habitat impacts – mule deer, grouse, burrowing owl, rattlesnake, badger.	Section 7.1.9 of this tab.
	Transfer of noxious weeds and invasive species in grasslands and agricultural areas.	Section 7.1.8 of this tab.
Human Activity and Land Use	If BC Parks approval is gained for Lac du Bois routing, all Project activity must be planned in consultation with grasslands stewardship groups and construction activity must take grasslands preservation into careful consideration. Community acceptance of Lac du Bois routing will be increased if reclamation is planned and implemented in conjunction with the Grasslands Conservation Council and Thompson Rivers University. Many concerns were raised about the potential routing through Lac du Bois Protected Area including: • protected area disturbance; • sensitivity regarding purposed of a protected area purpose – If this is allowed, what precedence does it set? • increase unauthorized access for ATVs in protected area due to construction activity and development of access roads;	Sections 2.0, 4.0 and 7.2.1 of this tab.

TABLE C4.2-2 Cont'd

Topic	Summary of Concern	Lac du Bois Grasslands Protected Area Draft Stage 2 Detailed Proposal Section
Human Activity and Land Use (cont'd)	• trouble with enforcing existing ATV use – some progress has been made. Will construction create a new problem? • impacts to cattle grazing; • impacts to bike and cross country trails; • impacts to wildlife viewing – curlew, owls, eagles, falcons, etc.; • proximity of right-of-way to McQueen Lake Outdoor School; and • proximity of McQueen Creek Ecological Reserve	See above
	Concerns about construction impacts on outdoor recreation in Lac du Bois – hiking, hunting, dog walking, snowmobiling, Christmas tree collection, cattle drives, hunting of grouse and deer. Fishing/icefishing.	Section 7.2.1 of this tab.
	Some Westsyde residents strongly support the Lac du Bois route option in order to bypass the Westsyde neighbourhood. They have also requested the relocation of the existing lines to the Lac du Bois right-of-way. Specific Westsyde concerns include impacts to the Rivers Trail bike route, proximity to houses, increase in traffic and impact to businesses.	Section 7.2.1 of this tab.

4.3 Lac du Bois Grasslands Protected Area Site Tour

On September 24, 2013, Trans Mountain and BC Parks led a group of interested parties comprised of local interest groups, landowners and Aboriginal representatives to visit the proposed pipeline corridor in Lac du Bois Grasslands Protected Area.

Table C4.4-1 provides information on the attendees at the Lac du Bois tour.

TABLE C4.4-1

PARTICIPANTS IN THE LAC DU BOIS GRASSLANDS PROTECTED AREA TOUR

Group Type	Group
Academic	Thompson Rivers University
Business	Verne Sunstrom Forestry Consulting
Community	Kamloops Thompson Trails Alliance
	Tranquille Livestock Association
ENGO	Kamloops Naturalist Club
	Grasslands Conservation Council
First Nations	St'kemlupsemc First Nation
	Skeetchestn First Nation
Local Government	City of Kamloops
Provincial Government	Ministry of Environment, BC Parks

4.3.1.1 Summary of Consultation at Lac du Bois Grasslands Protected Area Tour

Table C4.4-2 provides information on key topics, interests and concerns at Lac du Bois Grasslands Protected Area site tour.

TABLE C4.4-2

TOUR – LAC DU BOIS GRASSLANDS PROTECTED AREA

Topic	Summary of Concern	Lac du Bois Grasslands Protected Area Detailed Proposal Section
Air	None	N/A
Land	Concerns regarding remedial work on existing lines and increasing attractiveness of landscape. Carefully contour the completed right-of-way with natural landscape form.	Section 7.2.1 of this tab.
	Concerns expressed regarding new access roads to transport equipment.	No new access roads being considered for construction of the Project in Lac du Bois Grasslands Protected Area.
	Minimize width of disturbance.	Section 2.0 of this tab.
	Recontouring is a basic consideration to effective reclamation. Ability to recontour should guide route selection.	Section 2.0 of Introduction to Draft Stage 2 Detailed Proposal
	Replacing soil in the original horizons is critical – effective revegetation is dependent on soil quality.	Section 7.2.1 of this tab.
	Alfalfa, intermediate wheatgrass and orchard grass tend to stand out and look unnatural. Native species need to come from on-site genetic stock.	Section 9.0 of this tab.
	Signage needs to have minimal frequency and minimal visual impact.	Section 7.2.1 of this tab.
	Pipe and supplies flown in, in lieu of major redevelopment of roads to allow semi-trailer truck access.	No new access roads being considered for construction of the Project in Lac du Bois Grasslands Protected Area.
	Revegetate using best techniques available; possibly rangeland drill plus hand planting of shrub seed.	Section 9.0 of this tab.
	Add big sagebrush/rabbitbrush to revegetation process as needed to attain natural texture and color.	Section 9.0 of this tab.

Trans Mountain will consider all feedback raised to date and will work under the guidance of BC Parks to address concerns through construction, mitigation and reclamation techniques. A field trip of similar nature was offered to the SSN Aboriginal Groups and was planned for November 14, 2013. This was later postponed by SSN.

4.4 Protected Areas Workshop

On April 2, 2014, Trans Mountain held a Protected Areas Workshop for identified stakeholders in Kamloops, BC to discuss the proposed routing through Lac du Bois Grasslands Protected Area. Stakeholders were contacted by phone and email and invited to participate. An introductory email was sent to all selected participants on March 17, 2014, and a reminder to RSVP email was sent on March 24, 2014. Interested stakeholders who were unable to attend the event were invited to provide feedback through the online posting of workshop information. An agenda was distributed all attendees on April 1, 2014.

Attendees consisted of representatives from key community and environmental groups, First Nations, local government, public groups, federal and provincial agencies that may have an interest in the potential impacts of the proposed development in the Protected Area. Of the 22 stakeholder groups invited, 15 attended, with some groups having more than one attendee. A total of 26 attendees were present at the event. Local First Nations (Tk'emlups te Secwepemc, Skeetchestn Indian Band, Stk'emlupsemc te Secwepemc, Coldwater Indian Band, Siska Indian Band, Cook's Ferry Indian Band, Lower Nicola Indian Band, Nicola Tribal Association and Neskonlith Indian Band) were provided an opportunity to review and comment on the proposed protected areas routing, impacts and benefits through a parallel process, described in Section 3.2.3 of the Introduction to the Draft Stage 2. The list of attendees is provided in Table C4.3-1.

TABLE C4.3-1

PARTICIPANTS IN THE PROTECTED AREAS WORKSHOP – LAC DU BOIS GRASSLANDS PROTECTED AREA

Group Type	Group
Academic	Thompson Rivers University
Community	Kamloops Thompson Trails Alliance
	Kamloops Thompson Trails Alliance and Verne Sundstrom Forestry Consulting
	Tranquille Livestock Association
ENGO	Grasslands Conservation Council
	Kamloops Naturalist Club
	Nature Conservancy of Canada
First Nations	Tk'emlups te Secwepemc
	Lower Nicola Indian Band
First Nations (cont'd)	Skeetchestn Indian Band
	SSN
Local Government	City of Kamloops
Provincial Government	BC Ministry of Forests, Lands and Natural Resource Operations
	Ministry of Environment, BC Parks, Thompson Region

Interested stakeholders and Aboriginal communities who were invited but did not attend include:

- BC Wildlife Protected area;
- Cook's Ferry Indian Band;
- Frolek Cattle Company;
- Kamloops Bike Riders Association;
- Kamloops Hiking Club;
- Ministry of Transportation and Infrastructure;
- Neskonlith Indian Band;
- Nicola Tribal Association;
- Siska Indian Band;
- Thompson Rivers University Grad Student; and
- Westsyde Neighbourhood Association.

4.4.1 Summary of Outcomes of Consultation at Protected Areas Workshop

4.4.1.1 Concerns Raised

Table C4.3-2 provides information on key topics, interests and concerns at Lac du Bois Grasslands Protected Area at the Protected Areas Workshop.

TABLE C4.3-2

PROTECTED AREAS WORKSHOP – LAC DU BOIS GRASSLANDS PROTECTED AREA

Topic	Summary of Concern	Lac du Bois Grasslands Protected Area Draft Stage 2 Detailed Proposal Section
Air	None	N/A
Land	Lack of acknowledgement of Lac du Bois Grasslands Protected Area as a protected area: background, purpose, management objectives, and its special nature and importance environmentally and societal vs. surrounding lands.	Section 7.0 of this tab.
	Caution about sharing conservation data *e.g.,* the sites and habitat of species of concern in Lac du Bois Grasslands Protected Area.	N/A for the purposes of the Draft Stage 2 Detailed Proposal as this Proposal considers the impacts of the proposed pipeline on Lac du Bois Grasslands Protected Area.
	Concerns about timing of vegetation surveys, expertise in the grasslands and extending the extent to pick up other potentially impacted areas in Lac du Bois Grasslands Protected Area.	Schedule for rare plants survey was revised to address this concern.
Land (cont'd)	Concerns about monitoring the timing and seasonality of construction to avoid activities to restore impacted seasonal nesting sites for migratory birds and sharp-tailed grouse leks in Lac du Bois Grasslands Protected Area.	Section 7.1.9 of this tab.
	Concern with road development or use of roads leading to soil compaction during construction. Mitigate by upgrading roads and positioning reload sites at the top of the road near Lac du Bois Grasslands Protected Area.	Section 7.1.2 of this tab.
	Concern with introduction of invasive species in Lac du Bois Grasslands Protected Area.	Section 7.1.8 of this tab.
	Swifts nesting areas on the face of ridge around Lac du Bois Grasslands Protected Area.	Section 7.1.9 of this tab.
	High concern about impact of heavy equipment and pipe on land.	Soil compaction is discussed in Section 7.1.2 of this tab.
Human Activity and Land Use	Concerns around visual impact of pipeline markers and signage in Lac du Bois Grasslands Protected Area.	Section 7.2.1 of this tab.
	Birdwatchers frequent the ridge by Westsyde for bird viewing. There is a burrowing owl area where birds return to naturally north of KP 814. Studies have been compiled by Ducks Unlimited for bird use of wetlands along Duck Lake Road in Lac du Bois Grasslands Protected Area.	Section 7.1.10 of this Tab
	Collection of information on historical and contemporary First Nations cultural values and use of in Lac du Bois Grasslands Protected Area.	Section 7.1.12 of this tab.
	Fishing used to be common in Deep Lake. BC Fly Fisherman of Fish Game would have more information on current use in Lac du Bois Grasslands Protected Area.	N/A for the purposes of the Draft Stage 2 Detailed Proposal. Information about the current uses of Deep Lake has not been considered due to the lake not being crossed by the proposed pipeline corridor.
	Opening closed roads during construction becomes an invitation for unauthorized off highway vehicle (OHV) use in Lac du Bois Grasslands Protected Area.	Section 7.2.1 of this tab.

Trans Mountain will consider all feedback raised to date and will work under the guidance of BC Parks to address concerns through construction, mitigation and reclamation techniques.

4.4.1.2 Protected Area Benefits

Table C4.3-3 provides information on key ideas raised by stakeholders for identifying benefits to Lac du Bois Grasslands Protected Area. Trans Mountain has submitted this list of possible benefits to BC Parks for consideration against protected area management and benefit priorities. Participants were asked to prioritize the benefits that they believed were the most important to the protected area using a series of criteria which included:

- groups which would benefit (Community, Protected Areas and Trans Mountain);

- impact to ecological value;
- ease of implementation;
- cost effectiveness; and
- ability to partner with existing initiatives.

Based on the number of criteria items the idea applied to, ideas that benefited the greatest number of groups were determined and are outlined in Table C4.3-3.

TABLE C4.3-3

POTENTIAL PROTECTED AREA BENEFITS – LAC DU BOIS GRASSLANDS PROTECTED AREA

Summary of Potential Protected area Benefits	Priority
Signage that provides information on the ecological reasons for needing to stay within restricted areas (*i.e.,* First Nations uses and cattle grazing in Lac du Bois).	High
Contour existing disturbance in Lac du Bois Grasslands Protected Area (including TMPL).	High
Harden up legal access sites and dumping in ways suitable to Lac du Bois Grasslands Protected Area.	High
Trail development and enhanced educational components around the value of Lac du Bois Grasslands Protected Area.	High
Intensive vegetation survey and overall plan to manage grasslands and limit encroachment of Lac du Bois Grasslands Protected Area.	High
Protected area legacy fund for Lac du Bois Grasslands Protected Area.	High
Reclamation of disturbed OHV use areas coming up the ridge from Westsyde into Lac du Bois Grasslands Protected Area.	High
Extensive and intensive grassland reclamation beyond the pipeline corridor increasing native species and decreasing invasive species. Restore previous disturbance along Telus FOTS line.	High
Improvements to Long Lake Road in Lac du Bois Grasslands Protected Area.	High
Purchasing land for OHV recreational use outside to refocus use of Lac du Bois Protected Area.	Medium
Develop water resources (springs) in the ridge area to improve grazing practices and provide a water source for wildlife in Lac du Bois Grasslands Protected Area.	Medium
Concrete posts or fencing along Long Lake Road to limit OHV use in Lac du Bois Grasslands Protected Area.	Medium
There is a lack of enforcement around OHV use. Provide funding to support organizations who are stewards of Lac du Bois Grasslands Protected Area to patrol the area for misuse.	Medium
Buy out grazing permits in Lac du Bois Grasslands Protected Area and complete wetland reclamation.	Not Ranked[1]

Note: 1 Potential benefits that are not ranked are due to participants not having time or interest in completing the ranking process.

4.5 Other Consultation Activities

4.5.1 Industry

Since November 2013, Trans Mountain has been in discussion with Telus to develop a use agreement for their right-of-way. During the Project's stakeholder consultation meetings, open houses and workshops, concerns were raised related to invasive species and the current condition of rights-of way through Lac du Bois Grasslands Protected Area. Trans Mountain recognizes the opportunity to improve current conditions through collaboration with Telus. Trans Mountain is has worked with Telus to develop a use agreement for their right-of-way that would include monitoring and reclamation of the route with native vegetation.

4.5.2 Academia

Recognizing the unique nature of BC Interior grasslands, including the Lac du Bois Grasslands Protected Area, Trans Mountain entered into a research partnership with Thompson Rivers University in February 2013, to identify, optimal, native seed stock for grasslands reclamation. Research to date has included the gathering and propagation of geographically and genotypically diverse grass seed to identify the optimal variant for reclamation.

The next phase of research includes a potential partnership between Thompson Rivers University and Tk'emlups te Secwepemc to gather and propagate seed stock in Tk'emlups te Secwepemc's greenhouse and agricultural land. Trans Mountain also has been consulting with Grasslands Conservation Council to understand the complexities of this unique ecosystem.

4.5.3 Local Government

Trans Mountain has been consulting with the City of Kamloops on the construction of the proposed pipeline route in Lac du Bois Grasslands Protected Area since 2012. Trans Mountain has held numerous meetings with the City of Kamloops staff, described in Table C4.5.3-1. In all cases, City of Kamloops Administration expressed significant concern regarding the Westsyde routing. In addition, the route options considered were presented in an open council meeting on September 18, 2012, where the Mayor and Council posed questions to Trans Mountain in a public, televised setting.

City of Kamloops also attended and provided input into the Protected Area Workshop held on April 2, 2014, Kamloops ESA Workshop held on March 6, 2013 as well as the Lac du Bois Grasslands Protected Area Site Tour held on September 24, 2013.

Table 4.5.3-1 outlines Trans Mountains key public consultation activities with City of Kamloops.

TABLE C4.5.3-1

KEY CONSULTATION ACTIVITES WITH LOCAL GOVERNMENT STAKEHOLDERS FROM CITY OF KAMLOOPS

Stakeholder Group / Agency Name	Title of Contact	Method of Engagement Activity	Date of Consultation Activity	Reason for Engagement
City of Kamloops	Trades and Environmental Services Manager	In-person	July 4, 2012	Discuss Project, issues and concerns relating to the proposed routing and Westsyde residents.
City of Kamloops	Mayor	In-person	September 11, 2012	Discuss information sharing and grassland reclamation.
City of Kamloops	Mayor and Councillors	In-person	September 18, 2012	Discuss community and routing benefits with City of Kamloops Staff.
City of Kamloops	City Council Members	In-person	November 19, 2012	Review routing through City of Kamloops, particularly Westsyde neighbourhood. Discussion topics included Lac du Bois Grasslands Protected Area expansion, Westsyde routing options, long term plans for City of Kamloops.
City of Kamloops	City Council Members	In-person	March 6, 2013	Kamloops ESA Workshop (Refer to Section 4.1 for more details).
City of Kamloops	City Council Members	In-person	April 29, 2013	Discuss scope of Project, Public engagement, economic benefits, employment and routing.
City of Kamloops	City Council Members	In-person	September 24, 2013	Lac du Bois Grasslands Protected Area Site Tour (Refer to Section 4.3 for details on the tour).
City of Kamloops	City Council Members	In-person	November 5, 2013	Chamber presentation.
City of Kamloops	City Council Members	In-person	April 2, 2014	Protected Area Workshop (Refer to Table D4.2-2 for comments provided from stakeholders during this event).

5.0 ECONOMIC BENEFIT TO LAC DU BOIS GRASSLANDS PROTECTED AREA

A high level description of economic benefits to the province of BC resulting from the Project is provided in Section 5.0 of the Introduction of the Draft Stage 2 Detailed Proposal.

5.1 Estimated Workforce Requirements

The construction of the Project will involve a workforce of approximately 900 workers onsite at any given time for the duration of construction from the future Black Pines Pump Station to the Kamloops Pump Station, which includes Lac du Bois Grasslands Protected Area. The skills of the anticipated workforce will include heavy equipment operators, welders, labourers, mechanics, foremen, surveyors, inspectors and field office support personnel. Generally, during pipeline construction, pipeline crews and workers will use a combination of accommodation resources including: local commercial motels and hotels; private boarding arrangements; temporary work camps; and temporary or permanent RV sites. For Lac du Bois Grasslands Protected Area, workers will likely stay in Kamloops, BC.

6.0 SETTING OF LAC DU BOIS GRASSLANDS PROTECTED AREA

The environmental and socio-economic setting along the proposed and narrowed pipeline corridor within Lac du Bois Grasslands Protected Area is described in Table C6.0-1. Information collected for the setting was obtained both from desktop overviews and field assessments.

TABLE C6.0-1

SUMMARY OF BIOPHYSICAL AND SOCIO-ECONOMIC ELEMENTS AND CONSIDERATIONS IN LAC DU BOIS GRASSLANDS PROTECTED AREA

Biophysical and Socio-Economic Element	Summary of Considerations
Physical and Meteorological Environment	• The narrowed pipeline corridor within Lac du Bois Grassland Protected Area is located within the Interior Plateau Region, which is characterized by gentle to moderately sloping rolling uplands with rounded ridges and summits, valleys deeply dissecting the plateau, terraces, fluvial plains, fans and cones (Demarchi 2011, Holland 1976). • The narrowed pipeline corridor within Lac du Bois Grassland Protected Area is predominantly underlain by igneous and metamorphic rock as well as potential sandstones and carbonates (Bednarski 2009, Fulton 1984). • The surficial geology within Lac du Bois Grassland Protected Area is mapped as ablation till. • There are no areas of permafrost within the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area. • No areas of potential terrain instability are known to occur in the vicinity of the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area (NRCan 2007b, 2008, 2009). • The site is located in a zone of low seismic activity (NRCan 2010a). • The topography in the area is sloping with rolling hills. • No major tornadoes or hailstorms have been recorded in the vicinity of the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area (NRCan 2010b,c).
Soil and Soil Productivity	• A soils survey was conducted in March 2014 along the narrowed pipeline corridor within Lac du Bois Grasslands Protected Area. The soils along the narrowed pipeline corridor are primarily Orthic Dark Brown Chernozems (McQueen Soils), Orthic Brown Chernozem (Tranquille soils) Orthic Brown Chernozem with a saline lower subsoil (Tranquille soils with lower subsoil) and Eluviated and Orthic Eurtic Brunisols (Glossey 1 soils). Locations of these soil series along the narrowed pipeline corridor are presented on the accompanying Environmental Alignment Sheets. • McQueen soils that are exceedingly stony at the surface are found on the strongly sloping terrain. The dark brown topsoil is generally loam-textured and varies in thickness from 8-21 cm. Color differentiation between topsoils and subsoil is fair-good. These loam to sandy loam-textured till deposits are non-saline and non-sodic but usually moderately calcareous at shallow depths. • Tranquille soils are primarily found in the Batchelor Addition of Lac du Bois Grasslands Protected Area. The brown, loam-textured topsoil varies in thickness from 10-33 cm and is not easily distinguished from the brown to yellow underlying subsoil by colour. These soils are non-saline and non-sodic but can be moderately calcareous within 30 cm of the surface. • Tranquille soils with lower subsoil are grassland soils that are confined to a small area in Lac du Bois Grasslands Protected Area (RK 836.2 to RK 836.5). These brown, sandy, loam to loam textured topsoil are about 13 cm thick and are not easily distinguished from the brown to yellowish brown underlying subsoil by colour. These soils have a friable Bm horizon below the topsoil horizon to the 34 cm depth. A moderately calcareous Ck horizon occurs below the Bm horizon to the 70 cm depth. These soils have been recommended to be overstripped to the 20-25 cm depth so that sufficient surface material is available to cover the moderately saline lower subsoil. • Glossey 1 soils are associated with creeks and streams that flow through the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area. These soils are susceptible to wind erosion when the protective vegetation cover is removed. These soils also lack cohesion properties which will result in unstable trench walls when vertically ditched. • The narrowed pipeline corridor in Lac du Bois Grasslands Protected Area is located within the Agricultural Land Reserve (ALR) for 42% of the Protected Area.
Water Quality and Quantity	• The narrowed pipeline corridor through the protected area is located in the Lower North Thompson River and Thompson River watersheds of the Fraser River Basin. • The narrowed pipeline corridor within Lac du Bois Grasslands Protected Area crosses McQueen Creek and several unnamed drainages identified as either ephemeral non-classified drainages or non-visible channels. • McQueen Creek is provincially rated as an S6 intermittent watercourse. During fisheries field studies conducted in May 2013, streamflow at McQueen Creek was measured at 0.004 m^3/s and mean channel width and mean bank height was measured at 1.71 m and 0.27 m, respectively. During the site visit, the watercourse was noted as having soft ground with pugging evident, severe channel degradation, poor connectivity and poor water quality. • None of the unnamed drainages were determined to be flowing during fisheries field studies. • There are no provincial least biological risk windows for McQueen Creek or the unnamed drainages within the protected area. • No provincial or federal surficial geology mapping is available within the Lac du Bois Grasslands Protected Area. However, mapping completed by BGC Engineering (2013) indicates that surficial materials identified from RK 828.2 to RK 829.2 consists of fluvial sediments; RK 829.2 to RK 837.1 consists of glacial till; and RK 837.1 to RK 836.8 consists of colluvium. From RK 842.2 to RK 843.9, the surficial materials are identified as glacial till. • The bedrock underlying the pipeline corridor consists of Upper Triassic Nicola Group sedimentary rocks (mudstone, siltstone and shale).

TABLE C6.0-1 Cont'd

Biophysical and Socio-Economic Element	Summary of Considerations
Water Quality and Quantity (cont'd)	• No aquifers were mapped by the BC Ministry of Environment (MOE) within the Lac du Bois Grasslands Protected Area boundaries. However, Aquifer No. 282 defined as sand and gravel; high vulnerability, moderate productivity and low demand is situated just outside the protected area boundary to the south on the north side of the Thompson River, and Aquifer No. 283 defined as sand and gravel; moderate vulnerability and productivity and low demand is situated just outside the protected area boundaries along the east side in the North Thompson River valley. • Groundwater flows generally follow local topography with recharge occurring either directly over the unmapped aquifers or from the valley walls (mountain sides) with groundwater discharge feeding the local river systems or flowing within fluvial sediments subparallel to the valley axis. Sections of the narrowed pipeline corridor through the protected area are along steep slopes (elevation changes of 260 m between the Thompson River and the pipeline). • The area is susceptible to changes in groundwater flow patterns (*i.e.,* areas where the pipeline cuts across a slope).
Air Emissions and Greenhouse Gas Emissions (GHG)	• The nearest permanent residence to the Project is located approximately 500 m from the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area. • Existing factors affecting air quality in the Project area in Lac du Bois Grasslands include emissions from nearby residences, agricultural operations, intermittent vehicle traffic exhaust and oil and gas facilities. • The primary source of air emissions during construction will be from fuel combustion and dust related to the use of transportation vehicles and heavy duty equipment. During operations, emissions will be limited to transportation and equipment use during maintenance activities. Criteria air contaminants (CACs) expected to be emitted from Project-related construction activities include sulphur dioxides, nitrogen oxides, volatile compounds, carbon monoxide and particulate matter. • A temporary increase in airborne emissions is anticipated during pipeline construction but will not result in an increase in airborne emissions during operations and maintenance. Therefore, a detailed assessment of air and GHG is not warranted.
Acoustic Environment	• The nearest permanent residence to the Project is located approximately 500 m from the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area. • Current sources of noise emissions in the Project area are from intermittent sources such as vehicle traffic, agricultural operations and existing oil and gas facilities. • The City of Kamloops Bylaw No. 24-42, applies between 7:00 AM to 11:00 PM, in which no person shall construct, erect, reconstruct, alter, repair or demolish any building, structure, or thing of excavate or fill in land in any manner which disturbs the quiet, peace, rest, enjoyment, comfort or convenience of individuals or the public. • Construction and clearing are scheduled for Q3 / Q4 2016, when there are less recreational users in the protected area. • A temporary increase in noise levels is anticipated during pipeline construction. Noise from construction activities will be in compliance with the BC Oil and Gas Commission (BC OGC) *British Columbia Noise Control Practices and Guidelines* (BC OGC 2009). • Noise arising from construction activities and the potential effects on wildlife are discussed in 7.1.9 • Noise generated during operations is expected to be undetectable and will not contribute to ambient noise levels. A quantitative assessment of the acoustic environment is, therefore, not warranted.
Fish and Fish Habitat	• The narrowed pipeline corridor within Lac du Bois Grasslands Protected Area crosses 1 named watercourse (McQueen Creek) and 10 non-classified drainages. McQueen Creek is an intermittent stream which was classified as a nonfish-bearing S6 watercourse, with a low sensitivity ranking. The non-classified drainages crossed by the narrowed pipeline corridor are considered to have low sensitivity and no fish or fish habitat was present.
Wetlands Loss or Alteration	• The Lac du Bois Grasslands Protected Area is situated within the boundaries of the Thompson-Okanagan Plateau Ecoregion, a component of the Montane Cordillera Ecozone of Canada. Many of the wetlands within this region have been disturbed by urbanization and agriculture (Ecological Stratification Working Group 1995). • The Lac du Bois Grasslands Protected Area is located within the Intermountain Prairie Wetland Region. Wetlands characteristic of this region include marshes bordering fresh to saline ephemeral or semi-permanent shallow waters (Government of Canada 1986). • The Lac du Bois Grasslands Protected Area is located within the Interior Douglas-Fir (IDF), Bunchgrass (BG) and Ponderosa Pine (PP) Biogeoclimatic (BGC) zones. In the IDF BGC Zone, wetlands are often found in depressions, around open water, small streams and drainage channels. Wetlands classes include fens, marshes as well as shrubby swamps (BC Ministry of Forests [BC MOF] 1996b, Meidinger and Pojar 1991). In the BG BGC Zone, wetlands are common and include marshes and saline meadows in shallow basins and associated with ponds and lakes (BC MOF 1998a, Meidinger and Pojar 1991). In the PP BGC Zone, wetlands are not common but typical wetlands include marshes fringing alkaline ponds (BC MOF 1998b, Meidinger and Pojar 1991). • Wetlands provide habitat for native plants and wildlife species, including nesting and foraging habitat for a variety of bird species, forage and cover for ungulates and furbearers and breeding habitat for amphibians. Wetlands provide water storage, groundwater recharge and natural filtering of sediments. • There are no Ramsar Wetlands of International Importance (Bureau of the Convention on Wetlands 2014), Important Bird Areas (IBAs) (Bird Studies Canada and Nature Canada 2012), Western Hemisphere Shorebird Reserves (Western Hemisphere Shorebird Reserves Network 2014) or Migratory Bird Sanctuaries (Environment Canada 2013) located along the narrowed pipeline corridor within Lac du Bois Grasslands Protected Area.

TABLE C6.0-1 Cont'd

Biophysical and Socio-Economic Element	Summary of Considerations
Wetlands Loss or Alteration (cont'd)	• The Lac du Bois Grasslands Protected Area is located within a Ducks Unlimited Canada (DUC) Level 3 Priority Area, Eastern Boreal Forest (DUC 2014). The Level 3 Priority Landscapes are classified as Eastern Boreal Forest since it consists of characteristics similar to those found in the eastern reaches of this forest zone (DUC 2014). No DUC projects are crossed by the narrowed pipeline corridor within the Lac du Bois Grasslands Protected Area (Harrison pers. comm.), therefore, no additional mitigation or consultation is recommended. • There are five wetlands (four basin marshes and one flat swamp), classified according to the Canadian Wetland Classification System [National Wetland Working Group 1997]), encountered by the narrowed pipeline corridor within the Lac du Bois Grasslands Protected Area that were determined through a combination of helicopter reconnaissance, satellite imagery review and ground-based wetland surveys. Ground-based wetland surveys were conducted at four basin marshes (National Wetland Working Group 1997) on May 6, 2014. Table C6.0-2 provides details on the wetlands encountered by the narrowed pipeline corridor, including those that were ground-truthed in 2014. Several low lying areas were also noted in the Lac du Bois Grassland Protected Area along the narrowed pipeline corridor and these areas were determined not to be wetlands due to the lack of hydric soils and hydrophytic vegetation.
Vegetation	• Lac du Bois Grasslands Protected Area is located in the BG, PP and Interior IDF BGC Zones and is the only protected area where the three main grassland ecosystem types occur in close proximity (BC Ministry of Environment, Lands and Protected areas [MELP] 2000). • The BG zone is located at elevations below the PP zone in the western portion of the protected area. Two subzone variants, Thompson Very Dry Hot Bunchgrass (BGxh2) (RK 842.5 to RK 843.9) and Nicola Very Dry Warm Bunchgrass (BGxw1) (RK 829.4 to RK 836.9) occur within the protected area boundaries. The BGxh2 is characterized by widely spaced clumps of bluebunch wheatgrass, big sagebrush and early spring blooming plants, with cryptogamic crust in the spaces to protect the soil from erosion. The BGxw1 experiences a cooler and moister microclimate than the BGxh2 characterized by bluebunch wheatgrass, arrow-leaved balsamroot, nodding onion, Thompson's paintbrush and mariposa lily. Aspen patches can be found on moister soils, with giant wild rye found on moist seepage sites. • Only one subzone variant of the PP zone, Thompson Very Dry Hot Ponderosa Pine (PPxh2), occurs in the protected area. The PPxh2 has developed in the presence of fire, and is comprised of a mosaic of open ponderosa pine stands, mixed stands of pine and fir and grassland. Bluebunch wheatgrass, rough fescue, big sage, rabbit brush, yarrow and pasture sage are widespread in this variant. • Three IDF subzone variants are found in the protected area. The Thompson Very Dry Hot Interior Douglas-fir (IDFxh2a) is a grassland variant with rough fescue, Columbia needlegrass, Kentucky bluegrass, Junegrass and bluebunch wheatgrass occurring as common grasses. The Thompson Very Dry Hot Interior Douglas-fir (IDFxh2) is a forested variant at lower elevations with Douglas-fir as the dominant species and an understory of shrubs and flowering plants, such as common snowberry, saskatoon, creamy peavine and Indian paintbrush. The Thompson Dry Cool Interior Douglas Fir (IDFdk1) is distinguished by a mixed-age open forests with a herb-dominated understory with a high cover of pinegrass. • The narrowed pipeline corridor crosses large areas of grassland habitat, treed areas and riparian habitat. • No plant species designated under the BC *Wildlife Act* or BC Identified Wildlife are identified as having the potential to occur in the IDF, PP and BG BGC Zones. • A search of the BC Conservation Data Centre (CDC) database identified eight previous observations of Red-listed species and one observation of a Blue-listed species, Geyer's onion (*Allium geyeri* var. *tenerum*, S2S3), within 5 km of the narrowed pipeline corridor located within the protected area boundaries. The Red-listed species include two occurrences of Oregon checker-mallow (*Sidalcea oregana* var. *procera*, S1), two occurrences of toothcup meadow-foam (*Rotala ramosior*, S1), mock-pennyroyal (*Hedeoma hispida*, S1), tall beggarticks (*Bidens vulgata*, S1), Englemann's spike-rush (*Eleocharis engelmannii*, S1) and scarlet gaura (*Gaura coccinea*, S1). There were no known occurrences of rare ecological communities within 5 km of the narrowed pipeline corridor within the protected area (BC CDC 2012). • Early-season vegetation surveys were conducted in Lac du Bois Grasslands Protected Area on May 19 and 22, 2014. Late-season vegetation surveys were conducted July 2, 4, 5 and 6, 2014. One rare plant species was observed during the field visit and 16 rare ecological communities were observed during the field visit. The identified rare plant species was wedgescale orache (*Atriplex truncata* [S3, Blue]). The identified communities include five occurrences of big sagebush/bluebunch wheatgrass (S2, Red), one ponderosa pine/bluebunch wheatgrass-rough fescue (S2, Red), one trembling aspen/snowberry/Kentucky bluegrass (S2, Red), three ponderosa pine/bluebunch wheatgrass (S3, Blue), three rough fescue-bluebunch wheatgrass (S2, Red), two bluebunch wheatgrass-junegrass (S3, Blue) and one giant wildrye Herbaceous Vegetation (S2, Red). • Bryophyte and lichen collection were conducted as a component of the vegetation surveys, collected specimens are currently undergoing identification. • The Project is located in Emergency Bark Beetle Management Area (EBBMA) designated as Salvage/Limited Action for the Mountain Pine Beetle and Aggressive management areas for the Douglas Fir and Spruce Beetles (BC Ministry of Forests, Lands and Natural Resource Operations [MFLNRO] 2010). • Knapweed (including diffuse, spotted, and Russian) is known to be established extensively throughout the lower and middle grasslands, while toadflax, sulpur cinquefoil and houndstongue are also of serious concern within Lac du Bois Grasslands Protected Area (BC MELP 2000). Other non-native species in the protected area include Kentucky bluegrass, Canada bluegrass and crested wheatgrass. Weed species identified in 2014 include three Noxious species: dalmation toadflax was present in five locations ranging in abundance from a few plants to several patches; diffuse knapweed was present in two locations with abundance of a few plants and a few patches; and perennial sow-thistle recorded in a single location with several patches. A single patch each of two Nuisance species, lamb's-quarters and yellow salsify were also identified.

TABLE C6.0-1 Cont'd

Biophysical and Socio-Economic Element	Summary of Considerations
Wildlife and Wildlife Habitat	• The Lac du Bois Grasslands Protected Area website identifies California bighorn sheep, white tail and mule deer, moose, waterfowl, rattlesnake, sharp-tail grouse, flammulated owls, black bear, burrowing owls, western long-billed curlews, harriers, and waterfowl as wildlife species that occur in Lac du Bois Grasslands Protected Area (BC MOE 2013a). • The McQueen Ecological Reserve in Lac du Bois Grasslands Protected Area is not crossed by the narrowed pipeline corridor but is located within the Wildlife LSA. The McQueen Ecological Reserve contains a representative example of the Middle Grassland community (BC Parks n.d.). Typical vegetation includes bluebunch wheatgrass, Sandberg's bluegrass, rickly-pear cactus, and well-spaced ponderosa pine trees (mostly killed by mountain pine beetle in 2007-2009) (BC Parks n.d.). • Early candidate critical habitat for American badger, *jeffersonii* ssp. is identified along the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area (Environment Canada 2014a). Badgers use a wide variety of natural and human-modified open habitat types, including deserts, grasslands, forest clearings, alpine areas, agricultural fields, road rights-of-way and linear disturbances (Apps *et al.* 2001, Environment Canada 2014a). Predominant threats for badger populations in BC are attributed to urban, rural and road development, road mortality and trapping (*Jeffersonii* Badger Recovery Team 2008). • Early candidate critical habitat for Lewis's Woodpecker is also identified along the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area (Environment Canada 2014a). Lewis's woodpeckers nest in the cavities of trees, especially within ponderosa pine, black cottonwood and Douglas-fir (BC Ministry of Water, Lands and Air Protection [MWLAP] 2004, Environment Canada 2014a). The loss or degradation of suitable breeding habitat is believed to be a limiting factor for Lewis's Woodpecker in BC (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2010). • The narrowed pipeline corridor crosses burrowing owl range in the Thompson-Nicola region (BC CDC 2014). Re-introductions have occurred annually in several locations including Lac du Bois Grasslands Protected Area. In the Lac du Bois Grasslands Protected Area, the narrowed pipeline corridor is located approximately 1,400 m from the nearest burrowing owl re-introduction site (Grasslands Conservation Council of BC 2009). The program has not yet established a self-sustaining population. In 2005, 84 owls were released and they fledged 100 owlets. Approximately 15 owls returned from migration the following year (Environment Canada 2012). • The Lac du Bois Grasslands area, specifically Lac du Bois Grasslands Protected Area, contains the greatest number of sharp-tailed grouse leks in the Thompson Basin, and provides winter habitat for sharp-tailed grouse (Grasslands Conservation Council of British Columbia 2009). No sharp-tailed grouse or leks were observed during Project-specific sharp-tailed grouse surveys in Lac du Bois Grasslands Protected Area in 2013. • The Ecological Area Assessment for the Lac du Bois Grasslands Protected Area identifies habitat potential for Great Basin spadefoots in Batchelor Lake and in other alkaline ponds in the Lac du Bois Grasslands Protected Area, and recommends protection of these ponds by fencing and signage (Grasslands Conservation Council of British Columbia 2009). • The Ecological Area Assessment for the Lac du Bois Grasslands Protected Area identifies Batchelor Addition and the Lac du Bois Gateway areas as high value core habitat for western rattlesnake and other snake species including the racer, gopher snake and rubber boa. There are three known den sites in the area, and telemetry studies have shown extensive active seasonal movements. The Ecological Area Assessment recommends that wildlife fencing be considered if traffic increases on the Lac du Bois road and that signage be increased for motorized vehicle access control (Grasslands Conservation Council of British Columbia 2009). Western rattlesnake was identified in Lac du Bois Grasslands Protected Area during Project-specific surveys in 2013, and dens are known to occur near the narrowed pipeline corridor. • The vision statement in the draft Lac du Bois Grasslands Provincial Protected Area Management Plan identifies the following primary objectives: protecting and presenting representative native grassland ecosystems, managing grazing use for protected area biodiversity objectives, and maintaining conservation as a high priority (BC MELP 2004). An emphasis is placed on recognizing the fragile nature of grasslands, wetlands and riparian areas, and their importance for wildlife habitat and species at risk (BC MELP 2004).
Species at Risk	• No federally-listed fish species are located within watercourses crossed by the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area. • There are 21 vegetation species designated under Schedule 1 of *Species at Risk Act* (*SARA)* that have the potential to occur within the BG, IDF and PP BGC zones. • No plant species designated under Schedule 1 of *SARA* were assessed as having the potential to occur in the Vegetation RSA within Lac du Bois Grasslands Protected Area based on known range, occurrences and habitat requirements. • There were no known occurrences of plant species designated under Schedule 1 of *SARA* within 5 km of the Footprint within the Lac du Bois Grasslands Protected Area. • The following wildlife species at risk have the potential to occur in Lac du Bois Grasslands Protected Area based on range and habitat availability (BC CDC 2014, COSEWIC 2014, Environment Canada 2014b). Species at risk are defined here to include those species listed federally under Schedule 1 of *SARA* or by COSEWIC. Additional species that are listed provincially are provided at the end of the list. - Bank swallow: Threatened by COSEWIC; - Barn swallow: Threatened by COSEWIC, Blue-listed; - Bobolink: Threatened by COSEWIC, Blue-listed; - Burrowing owl: Endangered by *SARA* and COSEWIC, Red-listed; - Common nighthawk: Threatened by *SARA* and COSEWIC; - Ferruginous hawk: Threatened by *SARA* and COSEWIC; - Flammulated owl: Special Concern by SARA and COSEWIC, Blue-listed; - Horned grebe: Special Concern by COSEWIC;

TABLE C6.0-1 Cont'd

Biophysical and Socio-Economic Element	Summary of Considerations
Species at Risk (cont'd)	- Lewis's woodpecker: Threatened by *SARA* and COSEWIC, Red-listed; - Long-billed curlew: Special Concern by *SARA* and COSEWIC, Blue-listed; - Olive-sided flycatcher: Threatened by *SARA* and COSEWIC, Blue-listed; - Peregrine falcon, *pealei* ssp.: Special Concern by *SARA* and COSEWIC, Blue-listed; - Short-eared owl: Special Concern by *SARA* and COSEWIC, Blue-listed; - Western grebe: Special Concern by COSEWIC, Red-listed; - Western screech-owl, *macfarlanei* ssp.: Endangered by *SARA* and Threatened by COSEWIC, Red-listed; - Williamson's sapsucker: Endangered by *SARA* and COSEWIC, Blue-listed; - American badger, *jeffersonii* ssp.: Endangered by *SARA* and COSEWIC, Red-listed; - Little brown myotis: Endangered by COSEWIC; - Great Basin gopher snake, *deserticola* ssp.: Threatened by *SARA* and COSEWIC, Blue-listed; - North American racer: Special Concern by *SARA* and COSEWIC, Blue-listed; - Northern rubber boa: Special Concern by *SARA* and COSEWIC; - Painted turtle, Intermountain-Rocky Mountain population: Special Concern by *SARA* and COSEWIC, Blue-listed; - Western rattlesnake: Threatened by *SARA* and COSEWIC, Blue-listed; - Great Basin spadefoot: Threatened by *SARA* and COSEWIC, Blue-listed; and - Western toad: Special Concern by *SARA* and COSEWIC, Blue-listed. - Provincially-listed species: American avocet (Blue-listed); American bittern (Blue-listed); Brewer's sparrow, breweri ssp. (Red-listed); California gull (Blue-listed); canyon wren (Blue-listed); double-crested cormorant (Blue-listed); great blue heron, herodias ssp. (Blue-listed); green heron (Blue-listed); gyrfalcon (Blue-listed); prairie falcon (Red-listed); sharp-tailed grouse, columbianus ssp. (Blue-listed); western grebe; bighorn sheep (Blue-listed); fringed myotis (Blue-listed); western small-footed myotis (Blue-listed).
Heritage Resources	• There is archaeology potential throughout the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area due to numerous knolls, ridges and promontories. • There are no previously recorded archaeological sites within Lac du Bois Grasslands Protected Area. • In accordance with provincial legislation, in the event that any historical, archaeological or palaeontological resources are discovered during construction, construction activity in the vicinity of the discovery will be suspended until provincial authorities allow work to resume. • Approval under the BC *Heritage Act* will be acquired prior to commencement of construction.
Traditional Land and Resource Use	• To date no TLRU studies have been completed for the Project for the traditional territory within Lac du Bois Grasslands Protected Area. Independent third-party Cultural Heritage Studies are underway for Nicola Tribal Association, Tk'emlups te Secwépemc and Skeetchestn Indian Band. • One berry picking site was identified during field work for the Project. • During engagement the collection of information on historical and contemporary First Nations cultural values and use of Lac du Bois Grasslands Protected Area was requested, but no specific uses were identified.
Visitor Enjoyment and Safety	• The narrowed pipeline corridor crosses rolling grasslands utilized as trails and for nature study as well as access trails for residents (BC Parks 2000). • Outdoor recreational uses include cycling, fishing, hunting, dog walking, wildlife viewing and fishing activities.

TABLE C6.0-2

WETLAND CLASSES ENCOUNTERED ALONG THE NARROWED PIPELINE CORRIDOR THROUGH THE LAC DU BOIS GRASSLAND PROTECTED AREA

Wetland Class	Start RK	End RK	Legal Location
Basin Marsh (seasonal emergent marsh)/ Flat Swamp (shrubby swamp) complex	830.6	830.7	b-78-C/92-I-16
Flat Swamp (Broad-leaf treed swamp)	831.2	831.4	c-68-C/92-I-16
Basin Marsh (wet meadow)	832.6	832.6	b-58-C/92-I-16
Basin Marsh (wet meadow)	833.6	833.7	d-49-C/92-I-16
Basin Marsh (wet meadow)	834.0	834.1	a-49-C/92-I-16

7.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS AND MITIGATION

Using the assessment methodology described in Section 6.1 of the Introduction of the Draft Stage 2 Detailed Proposal of this report, the following subsections evaluate the potential environmental and socio-economic effects associated with construction and operations of the pipeline in Lac du Bois Grasslands Protected Area.

Environmental and socio-economic elements potentially interacting with the construction and operations of the pipeline in Lac du Bois Grasslands Protected Area are identified in Table C7.0-1.

TABLE C7.0-1

ELEMENT INTERACTION WITH PROPOSED PIPELINE COMPONENT IN LAC DU BOIS GRASSLANDS PROTECTED AREA

Element	Interaction with Pipeline Component	
	Construction	Operations
Conservational Values of Lac du Bois Grasslands Protected Area		
Physical and Meteorological Environment	Yes	Yes
Soil and Soil Productivity	Yes	Yes
Water Quality and Quantity	Yes	Yes
Air Emissions	Yes	Yes
Acoustic Environment	Yes	Yes
Fish and Fish Habitat	No – fish and fish habitat indicators are not anticipated to be disturbed during Project construction in Lac du Bois Grasslands Protected Area.	No – fish and fish habitat indicators are not anticipated to be disturbed during Project operations in Lac du Bois Grasslands Protected Area.
Wetlands	Yes	Yes
Vegetation	Yes	Yes
Wildlife and Wildlife Habitat	Yes	Yes
Species at Risk	Yes	Yes
Heritage Resources	Yes	No – since surface or buried heritage resource sites, if present, would have been disturbed as a result of construction activities, no interaction is anticipated during operation of the pipeline.
Traditional Land and Resource Use	Yes	Yes
Recreational Values of Lac du Bois Grasslands Protected Area		
Visitor Enjoyment and Safety	Yes	Yes

The potential environmental and socio-economic effects associated with the pipeline, as well as the accompanying proposed mitigation measures and resulting residual effects are presented for each environmental and socio-economic element. In addition, using the criteria presented in Table 6.2.6-1 of the Introduction of the Draft Stage 2 Detailed Proposal of this report, the evaluation of significance is provided for each potential residual effect associated with the applicable environmental and socio-economic element in the subsections below.

Many of the mitigation measures recommended in Section 7.0 and 8.0 are considered industry accepted best practices in pipeline construction, reclamation and operations. However, a number of enhanced measures are also recommended specific for Lac du Bois Grasslands Protected Area. The measures are discussed further in Sections 7.0 and 8.0, and are summarized in Table C7.0-2. The entirety of the wildlife mitigation presented in Table C7.1.9-2 is intended to be specific to Lac du Bois Grasslands Protected Area and, therefore, has not been repeated in Table C7.0-2.

TABLE C7.0-2

ENHANCED MITIGATION MEASURES RECOMMENDED IN LAC DU BOIS GRASSLANDS PROTECTED AREA

Element/Topic	Recommendations	Section Discussed
Wetlands	• As per the Lac Du Bois Management Plan a Weed Management Plan will be implemented at all wetlands crossed within the park	Section 7.1.7
Vegetation	• Conduct native seed collection for use in revegetation efforts at the site (Refer to Section 8.0 of this Parks Tab for Dwg. C 04). • Employ appropriate salvage, propagation and transplant technique for component species. • Install collected native seed and salvaged native plant species as detailed in the EPP and Environmental Alignment Sheets. • If deemed appropriate by BC Parks, implement a suitable cover crop of native short-lived perennial grass during reseeding to reduce competition from non-native invasive species.	Section 7.1.8
Reclamation	<u>Non-Native Invasive and Agronomic Plant Species Management Prior to Construction</u> • Conduct a pre-construction weed survey along the proposed construction right-of-way to determine the species, location and density of non-native invasive and agronomic species. • Trans Mountain will utilize the weed survey report to identify the distribution and density of undesirable vegetation and to implement the appropriate chemical and mechanical (where feasible) controls prior to construction. <u>Natural Regeneration</u> • Allow for natural regeneration in areas where potential soil erosion and non-native invasive species infestation is low, and where it is anticipated that the topsoil or root zone material contains a propagule bank (*e.g.,* seed, stem or root pieces) of suitable species. • Apply a native perennial or non-native annual grass cover crop species in areas with potential erosion and weed concerns. <u>Seeding of Native Grass Species</u> *Selection of Grass Species* • Collect native grass seeds with a suitable local genome from native grasslands within the vicinity of Lac du Bois Grasslands Protected Area. *Seed Mix Development* • Develop seed mixes in consultation with BC Parks that consist of species native to the protected and will reflect those species that are anticipated to be successfully collected and/or multiplied from local seed genomes. *Seedbed Preparation Following Topsoil/Root Zone Material Replacement* • Re-compact (*i.e.,* track pack) surface soil and create micro-sites to capture seed and surface water. • Apply hydromulch and tackifier on sloping terrain or where soils have a potential to erode due to wind and water. *Non-Native Invasive or Agronomic Species Management During Reclamation* • Sample and analyse salvaged topsoil/root zone material during construction for the presence of viable native, non-native invasive and agronomic plant species seed. • Monitor topsoil/root zone material windrows during construction for vegetation growth to identify germinating species seed. • Estimate the percentage (and establish a percentage threshold in consultation with BC Parks) of native vs undesirable species that are expected to germinate following topsoil replacement based on the results of topsoil/root zone material analysis of viable native, non-native invasive and agronomic plant species seed and observations of species seedlings on topsoil/root zone material windrows. Identify right-of-way segments for cover crop seeding/undesirable vegetation management, direct seeding and/or grass plug planting as follows: – implement cover crop seeding (non-native annual species seed) followed by chemical weed control (spot or broadcast application) of germinating non-native invasive and agronomic species seed if the level of germinating seed of these species exceeds the determined percentage threshold. Following chemical weed control, drill or broadcast native seed and/or install rooted stock plugs; or – drill or broadcast native seed and/or install rooted stock plugs if the anticipated level of germinating seed of non-native invasive and agronomic species seed does not exceed the determined percentage threshold. *Seeding of Grass Species* • Seed with an annual cover crop species (where undesirable vegetation exceeds a percentage threshold) or a perennial seed mix or cover crop species (where undesirable vegetation does not exceed a percentage threshold) as soon as practical following topsoil/root zone material replacement. • Drill or broadcast native seed mixes or grass cover crop species on most of the construction right-of-way or at locations indicated on the Environmental Alignment Sheets, unless otherwise requested by BC Parks Area Supervisor or Conservation Specialist.	Section 8.0

TABLE C7.0-2 Cont'd

Element/Topic	Recommendations	Section Discussed
Reclamation (cont'd)	<u>Nutrient Management on Disturbed Forested Areas</u> • Apply a slow-release nitrogen fertilizer on lands that contain woody debris and/or wood chips mixed into the salvaged and replaced root zone material or that have been placed on cleared and ungrubbed portions of the construction right-of-way. <u>Installation of Rooted Stock Grass Plugs</u> • Install rooted stock grass plugs with propagated native seed collected from a local genotype, along the construction right-of-way at select locations and at a specified density/distribution. <u>Specific Erosion and Sediment Control</u> • Apply a hydromulch/tackifier mixture to provide short-term protection to surface soils from wind and minor water erosion, and to provide surface mulch to promote seed germination and vegetation establishment. • Install diversion berms to reduce slope length and runoff velocities, and divert runoff away from watercourses/waterbodies and into well-vegetated areas. • Implement rollback using select tree species (*e.g.,* pine) felled during construction (avoid the use of Douglas-fir and spruce) within riparian zones and TWS areas to provide erosion control and habitat enhancement. • Seed using an appropriate native grass seed mix, native perennial or annual non-native cover crop, along the disturbed areas following root zone material replacement at an appropriate prescribed rate. <u>Protect Rare Plants and Communities</u> *Pre-Construction* • Conduct native seed collection for use in revegetation efforts at the site. • Consider employing appropriate salvage, propagation and transplant technique for component species. • Consider delaying clearing to allow seed set and to limit drying of the soils. *Construction* • Fence or clearly mark the site using flagging and inform all users of access restriction in the vicinity of flagged or fenced sites. • narrowing down the right-of-way or reorient the area of disturbance and protect the site using fencing or clearly mark the site using flagging and inform all users of access restrictions in the vicinity of flagged or fenced sites. • Leave gaps in the topsoil/root zone material piles or subsoil piles to avoid the site. • Avoid or reduce clearing of trees or shrubs in the vicinity or the site. • Reduce grubbing of roots within TWS areas, where feasible. • Mow or walk down rather than wholly remove shrubs, where feasible. • Use protective matting and/or snow during the winter (mark the area in case snow melts) to mat over the population or community where it occurs on the Project area, and other areas where topsoil/root zone material removal is not required, to protect vegetation from scraping and compacting. • Install collected native seed and salvaged native plant species as detailed in the Pipeline EPP and on the Environmental Alignments Sheets. *Post-Construction* • Monitor effectiveness of implanted mitigation measures during rare plant Post-construction Environmental Monitoring. • Avoid blanket use of herbicides within 30 m or, or between the range of, the provided UTM coordinates. Targeted spraying, wicking, mowing or hand-picking are acceptable weed control measures in proximity to rare plants and rare ecological communities and may be important to prevent competition with invasive plant species. <u>Weed Management</u> • Utilize Trans Mountain's integrated vegetation management (IVM) approach to manage weeds and problem vegetation. • Develop detailed weed and problem vegetation reports for site-specific locations, as required, following a pre-construction weed survey (scheduled for spring 2015) and consultation with BC Parks Conservation Specialists. Weed and problem vegetation infestations and recommended mitigation measures will be incorporated into the Environmental Alignment Sheets.	See above

7.1 Conservational Values of Lac du Bois Grasslands Protected Area

7.1.1 Physical and Meteorological Environment

This subsection describes the potential Project effects on the physical environment in Lac du Bois Grasslands Protected Area. The Physical Environment LSA consists of a 1 km wide band generally extending from the centre of the proposed pipeline corridor and facilities (*i.e.*, 500 m on both sides of the proposed pipeline corridor centre); shown in Figure 6.2.2-5 of the Introduction to the Stage Detailed Proposal.

All physical environment indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; however, only terrain instability and topography were determined to interact with pipeline construction and operations in Lac du Bois Grasslands Protected Area. There are no sites within Lac du Bois Grasslands Protected Area with the potential for acid rock drainage. The topography within Lac du Bois Grasslands Protected Area contains moderate or steep sloping terrain along the narrowed pipeline corridor.

7.1.1.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on physical environment indicators are listed in Table C7.1.1-1.

A summary of mitigation measures provided in Table C7.1.1-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines including BC OGC (2013) and BC Ministry of Energy and Mines (Price and Errington 1998).

TABLE C7.1.1-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON PHYSICAL ENVIRONMENT FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Physical Environment Indicator – Terrain Instability			
1.1 General Measures	LSA	• Blast bedrock encountered within trench depth only if ripping or typical trenching methods are not feasible [Section 8.3]. See additional blasting measures in Section 8.3 of the Pipeline EPP. • Assess the need for special trench compaction measures or equipment prior to commencement of backfilling [Section 8.4]. See additional backfilling measures in Section 8.4 of the Pipeline EPP. • Install subsoil cross ditches and berms on steep and moderate slopes, and treed lands in order to prevent runoff along the construction right-of-way and subsequent erosion [Section 8.6]. • Recontour the construction right-of-way, including the removal of temporary subsoil berms on grasslands and re-establish the pre-construction grades and drainage channels if frozen soil conditions prevented completion of this task during backfilling [Section 8.6]. • Confirm, prior to seeding/planting, that surface texturing is present on steep slopes. If warranted, establish mounds to create microsites on steep, wind exposed slopes where woody vegetation establishment is desirable to retain moisture and enhance vegetation establishment success by creating mounds on steep slopes or, where grass vegetation establishment is desirable, implement track cleat imprinting by aligning the final pass of bulldozers parallel to the slope during the final pass [Section 8.6]. • Revegetate as soon as feasible to reduce or avoid soil erosion and establish long-term cover. Seed immediately following topsoil/root zone material replacement [Section 8.6]. See additional erosion control and revegetation measures in Section 8.6 of the Pipeline EPP.	• Areas of terrain instability may occur as a result of construction activities.
1.2 Areas of instability due to sidehill terrain	LSA	• Replace grade material to a stable contour that will approximate the pre-construction contour, except where it is not practical or safe to do so.	• Areas of terrain instability may occur as a result of construction activities.
2. Physical Environment Indicator – Topography			
2.1 Alteration of topography along steep slopes	LSA	• Minimize grading on steep slopes, unless safety concerns are identified [Section 8.2]. • Install subsoil cross ditches and berms on steep and moderate slopes, and treed lands in order to prevent runoff along the construction right-of-way and subsequent erosion [Section 8.6]. • Recontour the construction right-of-way, including the removal of temporary subsoil berms on grasslands and re-establish the pre-construction grades and drainage channels if frozen soil conditions prevented completion of this task during backfilling [Section 8.6]. • Regrade areas with vehicle ruts, erosion gullies or where the trench has settled [Section 8.6]. • Rollback slash and small diameter, salvageable timber on steep slopes [Section 8.6].	• Topography may be altered at locations where cut slopes are too steep to be replaced to the pre-construction profile without creating areas of instability.

TABLE C7.1.1-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2.1 Alteration of topography along steep slopes (cont'd)	See above	• Apply hydromulch/hydroseed at a rate recommended by the supplier on steep recontoured slopes [Section 8.6]. • Confirm, prior to seeding/planting, that surface texturing is present on steep slopes. If warranted, establish mounds to create microsites on steep, wind exposed slopes where woody vegetation establishment is desirable to retain moisture and enhance vegetation establishment success by creating mounds on steep slopes or, where grass vegetation establishment is desirable, implement track cleat imprinting by aligning the final pass of bulldozers parallel to the slope during the final pass [Section 8.6].	• See above
2.2 Alteration of topography due to sidehill terrain	LSA	• Replace grade material to a stable contour that will approximate the pre-construction contour, except where it is not practical or safe to do so.	• Topography may be altered at locations where cut slopes are too steep to be replaced to the pre-construction profile without creating areas of instability.
2.3 Alteration of topography at areas of blasting	LSA	• Blast bedrock encountered within trench depth only if ripping or typical trenching methods are not feasible [Section 8.3]. • Dispose of excess blast rock and excavated rock at approved locations [Section 8.3]. • Dispose of excess rock displaced from the trench or from blasting on non-agricultural lands in discrete piles, windrows or scattered along the construction right-of-way, or as directed by BC Parks or appropriate regulatory authority [Section 8.6].	• Topography may be altered at locations where blasting occurs.

Notes: 1 LSA = Physical Environment LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.1.2 Significance Evaluation of Potential Residual Effects

Table C7.1.1-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Lac du Bois Grasslands Protected Area on the physical environment. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE C7.1.1-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON PHYSICAL ENVIRONMENT FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1. Physical Environment Indicator – Terrain Instability									
1(a) Areas of terrain instability may occur as a result of construction activities.	Negative	LSA	Short-term	Isolated	Short to medium-term	Low	High	High	Not significant
2. Physical Environment Indicator – Topography									
2(a) Topography may be altered at locations where cut slopes are too steep to be replaced to the pre-construction profile without creating areas of instability.	Negative	LSA	Short-term	Isolated	Permanent	Low to medium	High	High	Not significant
2(b) Topography may be altered at locations where blasting occurs.	Negative	LSA	Short-term	Isolated	Permanent	Low	High	High	Not significant

Notes: 1 LSA = Physical Environment LSA.
2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Physical Environment Indicator – Terrain Instability

Terrain Instability

Minor areas of terrain instability may occur along areas of the narrowed pipeline corridor as a result of the proposed construction activities (*e.g.,* grading, trenching and backfilling). The impact balance of this residual effect is considered negative since terrain instability could affect the safety of the pipe and result in surface erosion. Terrain along most of the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area is considered to be moderate or steep sloping terrain based the results of the Terrain Mapping and Geohazard Inventory (Volume 4A of the Facilities Application) and the soil survey.

During construction of the pipeline, removal of vegetation and root mass, grading, cut and fills and runoff controls could lead to localized areas of potential instability. Monitoring during construction will ensure any observed instability issues will be resolved early before potentially severe instability problems arise. Grade material will be replaced to a stable contour that will approximate the pre-construction contour, except where it is not practical or safe from a pipe integrity perspective or for public safety.

Regular aerial and ground patrols will be conducted to examine vegetation establishment and confirm mitigation measures are functioning as intended, as well as identify any new areas of potential instability. At any areas where erosion is observed, appropriate measures will be implemented to clean-up and stabilize the site. Monitoring of the reclaimed sites will continue until the site is determined to be in a stable condition.

The residual effect of terrain instability occurring as a result of planned construction activity is reversible in the short to medium-term and of low magnitude (Table C7.1.1-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Physical Environment LSA - terrain instability as a result of construction activities may extend beyond the construction workspace.
- Duration: short-term – the event causing potential terrain instability is construction of the pipeline (*e.g.,* grading, and rough clean-up).
- Frequency: isolated – the event causing potential terrain instability (*i.e.*, construction of the pipeline) is confined to a specific period.
- Reversibility: short to medium-term – most areas of terrain instability will be remediated within a year, however, some areas may require a second or third year of remedial effort to fully stabilize.
- Magnitude: low – the implementation of the proposed mitigation measures in addition to detailed engineering design is expected to effectively reduce the severity and extent of potential effects on terrain instability with Lac du Bois Grasslands Protected Area.
- Probability: high – terrain instability is likely to result from pipeline construction at localized areas.
- Confidence: high – based on data pertinent to the Project area and the experience of the assessment team.

Physical Environment Indicator – Topography

Alteration of Topography at Cut Slopes

As a result of construction, topography along the narrowed pipeline corridor may be altered at locations where cut slopes are too steep to be returned to the pre-construction profile. Alteration of topography was raised as concern at Kamloops Community Workshops, specifically along grassland areas between the proposed Black Pines Pump Station and the existing Kingsvale Pump Station.

Grading of the construction right-of-way must be sufficient to accommodate pipe stringing, welding, field bending, lowering-in and safe movement of pipe, equipment and personnel along the construction right-of-way. Grading along the construction right-of-way will vary from only topsoil/root zone material salvaging in some areas to extensive cuts and fills in other areas. The grade and trench rock along the construction right-of-way will be ripped mechanically using bulldozers and excavators, where practical. Following construction, Trans Mountain's objective will be to return slopes to their pre-construction profile along the construction right-of-way, including approach slopes at watercourse crossings.

Alteration of topography will be reduced by installing the pipeline adjacent to the existing TMPL right-of-way and other linear infrastructure (*e.g.,* Telus FOTS right-of-way). In Lac du Bois Grasslands Protected Area, the narrowed pipeline corridor will parallel the existing Telus FOTS right-of-way for most of its length and the existing TMPL right-of-way in the Batchelor Addition. The impact balance of this residual effect is considered negative since local topographic alteration is considered a detriment to the environment. Although this unavoidable consequence will be permanent in localized areas and of high probability, the magnitude is considered to be low to medium depending on the extent of topographic alteration, type of vegetative cover (*e.g.*, treed vs. grassland) and sensitivity of nearby receptors (Table C7.1.1-2, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Physical Environment LSA – alteration of topography may extend beyond the construction workspace.
- Duration: short-term – the event causing the potential alteration of topography is construction of the pipeline.
- Frequency: isolated – the event causing the potential alteration of topography (*i.e.*, construction of the pipeline) is confined to a specific period.
- Reversibility: permanent – alteration of topography resulting from slopes that are too steep to be restored to the pre-construction profile cannot be reversed.
- Magnitude: low to medium – the implementation of the proposed mitigation measures is expected to effectively reduce the potential effect of alteration of local topography, however, grassland areas where bedrock is likely to be encountered are particularly susceptible to visible alterations in topography.
- Probability: high – Trans Mountain's objective will be to return slopes to their pre-construction profile along the construction right-of-way, including approach slopes at watercourse crossings.
- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

Alteration of Topography from Blasting

Blasting of the trench and grade rock is expected to be required only after all reasonable means of excavation by mechanical equipment (*e.g.,* bulldozers, excavators) have been used and are unsuccessful in achieving the required results, and where deemed absolutely necessary by construction and blasting experts after detailed site examination. The impact balance of this residual effect is considered negative since local topographic alteration is considered a detriment to the environment. This unavoidable consequence will be permanent and of high probability. However, efforts will be made to reduce the area of permanent disturbance by ensuring blasting will only be conducted by licensed blasters and implementing controlled blasting techniques in accordance with Trans Mountain's Blasting Specification for grade and trench rock excavation. The Blasting Specification will be developed during detailed engineering design for the Project.

Detonation methods and procedures will be dependent on, among other factors, associated rock type and geological structure (solid, layered, or fractured). The rock type in Lac du Bois Grasslands Protected Area is mostly fractured. On occasion, control over the volume and extent of material removed may be limited due to difficulties in predicting extent and accuracy of blast parameters and indeterminate geologic structures and nearby terrain instabilities. Test blasting will be conducted at locations where blasting is required to evaluate ground damage and vibration and establish site-specific blasting parameters and procedures to reduce unintentional disturbances and potential instabilities.

To limit any unintended alterations in topography, a Blasting Management Plan will be prepared prior to construction to ensure blasting is performed in a manner that safeguards the public and environment, and alterations of terrain are controlled and limited to the required site dimensions for safe construction and pipeline installation. Given the anticipated limited extent of blasting along the construction right-of-way (*i.e.*, only in areas where excavation by mechanical equipment is unsuccessful), implementation of mitigation measures, and since most blasting will be conducted in remote areas well away from receptors and/or adjacent to terrain previously altered from existing linear infrastructure, magnitude is considered to be low (Table C7.1.1-2, point [2b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Physical Environment LSA – alteration of topography from blasting may extend beyond the construction workspace.
- Duration: short-term – the event causing the potential alteration of topography from blasting is construction of the pipeline.
- Frequency: isolated – the event causing the potential alteration of topography from blasting (*i.e.*, construction of the pipeline) is confined to a specific period.
- Reversibility: permanent – topography altered from blasting activities is unlikely to be restored to the pre-construction profile and cannot be reversed.
- Magnitude: low – the implementation of the proposed mitigation measures is expected to effectively reduce the potential effect of alteration of topography from blasting.
- Probability: high – there are localized areas along the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area (especially in the Batchelor Addition) where blasting activities will likely be necessary.
- Confidence: high - based on data pertinent to the Project area and the professional experience of the assessment team.

7.1.1.3 Summary

As identified in Table C7.1.1-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on the physical environment indicator of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Lac du Bois Grasslands Protected Area related to physical environment will be not significant.

7.1.2 Soil and Soil Productivity

This subsection describes the potential Project effects on soil and soil productivity in Lac du Bois Grasslands Protected Area. The Soil LSA consists of a 1 km wide band from the centre of the proposed pipeline corridor and facilities (*i.e.*, 500 m on both sides of the proposed pipeline corridor centre); shown in. Figure 6.2.2-5 of the Draft Stage 2 Detailed Proposal.

All soil and soil productivity indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; all of the indicators were determined to interact with pipeline construction and operations in Lac du Bois Grasslands Protected Area.

7.1.2.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on soil and soil productivity indicators are listed in Table C7.1.2-1.

A summary of mitigation measures provided in Table C7.1.2-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines including BC OGC (2010a) and Canadian Association of Petroleum Producers (CAPP) (1996, 1999, 2008).

TABLE C7.1.2-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON SOIL AND SOIL PRODUCTIVITY FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Soil Indicator – Soil Productivity				
1.1 Decreased topsoil/root zone material productivity during topsoil/root zone material salvaging	Soil series: Glossey 1, McQueen, Shallow McQueen, Tranquille, Tranquille with a saline lower subsoil	Footprint	<u>Topsoil/Root Zone Material Depth</u> • Soils in Lac du Bois Grasslands Protected Area are predominately McQueen soils (north end of the protected area) or Tranquille soils (towards the south of the protected area, including the Batchelor Addition). • Salvage all available topsoil (min. 10 cm and max. 40 cm) and root zone material (min. 15-20 cm or 50% organic material and 50% mineral soil) or as noted in the accompanying Environmental Alignment Sheets. • Overstrip topsoils to a total depth indicated on the Environmental Alignment Sheets at select locations with saline lower subsoils (Tranquille soils with a saline lower subsoil), or sands and gravels at depth which occurs on native grassland /or areas of high wind erosion (see the accompanying Environmental Alignment Sheets) [Section 8.2]. • Salvage surface material in unsaturated wetlands, giving extra attention to maintaining dormant root stocks for replacement, where feasible. Salvage a maximum of 40 cm of surface soil if the peat is deeper than 40 cm or to the depth of colour change where there is less than 40 cm of surface material. [Section 8.2]. • Salvage very shallow surface soils (*i.e.*, organic and mineral soils; shallow McQueen soils) to at least a 60-80 cm depth, unless the material is unsuitable (*e.g.,* bedrock, gravel, rock) [Section 8.2]. • See additional measures in Section 8.2 of the Pipeline EPP. <u>Topsoil/Root Zone Material Salvage (General)</u> • Implement the Wet/Thawed Soils Contingency Plan (see Appendix B of the Pipeline EPP) during wet/thawed soil conditions in the event wet or thawed soils are encountered during construction [Section 8.2]. • Accommodate BC Parks topsoil/root zone material salvage requests. Record any locations where BC Parks has requested topsoils handling which differs from the planned method [Section 8.2]. • Salvage topsoil/root zone material from areas to be graded and windrow to the closest edge of the construction right-of-way. Avoid overstripping. The area salvaged is to correspond to the area to be graded [Section 8.2]. See additional grading measures in Section 8.2 of the Pipeline EPP. • Store topsoil/root zone material prior to grading along the nearest pipeline construction right-of-way boundary taking into consideration space requirements for grade and trench spoil, existing nearby Telus FOTS line, local topography and drainage [Section 8.2]. • Keep trench spoil pile separate from topsoil/root zone material pile. [Section 8.3]. <u>Topsoil/Root Zone Material Salvage (Non-frozen)</u> • Salvage topsoil/root zone material from the entire construction right-of-way (where grading is necessary and at locations indicated on the Environmental Alignment Sheets [Section 8.2]. • Salvage topsoil from the trench and spoil pile area (see Drawing [Topsoil or Root Zone Material Salvage – Trench and Spoil Area] provided in Appendix R of the Pipeline EPP) at the locations indicated on the Environmental Alignment Sheets [Section 8.2]. • See additional topsoil/root zone material salvage measures in Section 8.2 of the Pipeline EPP. <u>Topsoil/Root Zone Material Salvage (Frozen)</u> • Pre-salvage topsoil/root zone material prior to freeze-up if feasible. Attempt to have all topsoil/root zone material salvage completed prior to October 31 where feasible f [Section 8.2]. • Salvage topsoil/root zone material from an area approximately 1 m wider than and centred over the trench (see Drawing [Topsoil or Root Zone Material Salvage – Trench Width] provided in Appendix R of the Pipeline EPP) at all locations during frozen soil conditions unless otherwise indicated on the Environmental Alignment Sheets [Section 8.2]. See additional measures in Section 8.2 of the Pipeline EPP.	• Mixing of topsoil/root zone material and subsoil.

TABLE C7.1.2-1 Cont'd

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.1 Decreased topsoil/root zone material productivity during topsoil/root zone material salvaging (cont'd)	See above	See above	• Salvage topsoil/root zone material from an area approximately 1 m wider than the trench and centred over the trench (see Drawing [Topsoil or Root Zone Material Salvage – Trench Width] provided in Appendix R of the Pipeline EPP) at all locations during frozen soil conditions unless otherwise indicated on the Environmental Alignment Sheets [Section 8.2]. See additional measures in Section 8.2 of Pipeline EPP. • During winter construction, avoid mixing snow with spoil material during backfill. Have trench spoil backfilled by the end of the working day to minimize hazards to wildlife, as well as reduce frost penetration. Ensure that all segments trenched during frozen soil conditions are backfilled prior to spring breakup [Section 8.4]. • Postpone compaction of frozen trench spoil until final clean-up in mid to late spring [Section 8.4]. <u>Topsoil/Root Zone Material Replacement</u> • Follow mitigation measures for backfilling as outlined in Section 8.4 of the Pipeline EPP. • Postpone replacement during wet conditions or high winds to prevent damage to soil structure or erosion of topsoil/root zone material [Section 8.6]. • Replace topsoil/root zone material evenly over all portions of the construction right-of-way that have been stripped. • Revegetate as soon as feasible to reduce or avoid soil erosion and establish long-term cover. Seed immediately following topsoil/root zone material replacement [Section 8.6]. • See additional topsoil/root zone material replacement mitigation measures in Section 8.6 of the Pipeline EPP.	• See above.
1.2 Decreased topsoil/root zone material productivity through trench instability during trenching	Soil series: Glossey 1	Footprint	• Suspend trenching and salvage a wider area of topsoil/root zone material if trench walls slough into trench and the potential for topsoil/ root zone material/subsoil mixing exists. Backslope trench walls until stable. Equip backhoe with a swamp bucket, if practical, to avoid or reduce trench sloughing [Section 8.3]. • Weld up pipe prior to trenching at locations with soils prone to sloughing (*i.e.,* Glossey 1 soils) in order to reduce the time the trench is open [Section 8.3]. • Limit the length of open trench and the time the trench will be left open to reduce the amount of trench sloughing, frost penetration and interference with wildlife, parks visitors [Section 8.3]. • Store salvaged root zone material at a sufficient distance from the trench so that topsoil/root zone material is not lost in the trench, if trench instability is anticipated [Section 8.3].	• Mixing of topsoil/root zone material and subsoil due to trench instability.
1.3 Decreased topsoil/root zone material productivity through mixing due to shallow topsoil/root zone material	Soil series: Glossey 1, McQueen, Shallow McQueen, Tranquille, Tranquille with a saline lower subsoil	Footprint	• Overstrip topsoils to a total depth indicated on the Environmental Alignment Sheets at select locations with saline lower subsoils, or sands and gravels at depth which occurs on native grassland, or areas of high wind erosion (see Environmental Alignment Sheets) [Section 8.2].	• Mixing of topsoil/root zone material and subsoil due to shallow topsoil/root zone material depths.
1.4 Decreased topsoil productivity through mixing due to poor colour change	Soil series: Glossey 1, Tranquille, Tranquille with a saline lower subsoil	Footprint	• Where soils are not readily distinguishable by colour, the Inspector(s) will provide direction based on an evaluation of soil texture and structure as well as the recommended depths noted on the Environmental Alignment Sheets [Section 8.2]. • Clearly identify topsoil and grade spoil piles with signs or staking where the topsoil/subsoil colour change is not obvious [Section 8.2].	• Mixing of topsoil/root zone material and subsoil due to poor colour change between topsoil/root zone material and subsoil.
1.5 Decreased soil productivity resulting from changes in evaporation and transpiration rates	Soil series: Glossey 1	Footprint	• Implement mitigation measures provided in points 2.1 of this table to reduce the loss of topsoil/root zone material through wind erosion for Glossey 1 soils. • Use only Certified Canada No. 1 or best available seed for cover crop. For native seed, the highest seed grade available will be obtained [Section 8.6].	• Reduction in soil productivity on grassland areas resulting from changes in evaporation and transpiration rates.

TABLE C7.1.2-1 Cont'd

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.5 (cont'd)	See above	See above	• Follow seeding and revegetation measures outlined in Section 8.6 of the Pipeline EPP.	• See above
1.6 Decreased soil productivity from disturbance (*e.g.*, maintenance dig activities) during operations	Soil series: Glossey 1, McQueen, Shallow McQueen, Tranquille, Tranquille with a saline lower subsoil	Footprint	• Implement the recommended soil handling procedures outlined in the Pipeline EPP to reduce the potential for a reduction in soil productivity when construction activities involving soil disturbance are necessary during operations of the pipeline. • Monitor areas along the construction right-of-way that are disturbed during operations and maintenance activities. Implement remedial measures, where warranted.	• Mixing of topsoil/root zone material and subsoil.
1.7 Decreased soil productivity from trench subsidence	Soil series: Glossey 1	Footprint	• Compact the backfill to reduce trench settlement by running a grader wheel over the backfill when the trench has been backfilled to the level of the surrounding ground. Take extra care to compact the trench at banks of watercourse crossings and wetlands that have been trenched [Section 8.4]. • Crown the trench with remaining spoil to allow for settlement. A larger crown will be needed to compensate for settlement after thawing allows the portion of the route constructed during frozen soil conditions [Section 8.4]. • See additional measures in Section 8.4 of the Pipeline EPP. • Feather-out excess trench spoil over the salvaged portion of the construction right-of-way during non-frozen soil conditions to avoid the creation of a permanent trench crown. Excess spoil will not be feathered-out over the salvaged area to an extent that may cause excessive subsidence of the trench [Section 8.4]. • Leave a trench crown during clean-up of peatlands and non-peat wetlands to allow for settlement of backfilled material within the trench [Section 8.6].	• Excessive trench subsidence or a remnant crown.
2. Soil Indicator – Soil Degradation				
2.1 Loss of topsoil/root zone material through wind erosion	Soil series: Glossey 1, McQueen, Shallow McQueen, Tranquille, Tranquille with a saline lower subsoil	Footprint	<u>General</u> • Tackify or apply water/snow or pack the topsoil/root zone material windrow with a sheep foot packer or other approved equipment, if the assessment by the Environmental Inspector(s) indicates that soils are likely to be prone to erosion by wind (see Soil Erosion and Sediment Control Contingency Plan in Appendix B of the Pipeline EPP) [Section 8.2]. • Assess the wind erosion hazard, competency of the sod and potential for soil pulverization due to droughty soils. Implement measures applicable to droughty, wind erodible soils to reduce the impact of soil pulverization and wind erosion (see Soil/Sod Pulverization Contingency Plan in Appendix B of the Pipeline EPP) [Section 8.2]. • Apply water or approved tackifier to exposed soil piles if wind erosion occurs in Lac du Bois Grasslands Protected Area [Section 8.2]. • Monitor soils windrows during the growing season for wind and water erosion, and weed growth until the soils are replaced. Implement additional mitigation measures to control erosion (see Soil Erosion and Sediment Control Contingency Plan in Appendix B of the Pipeline EPP) and weed growth when warranted (see Weed and Vegetation Management Plan in Appendix C of Pipeline EPP) [Section 8.2]. • Avoid removing excess small diameter slash in wooded areas with erodible soils [Section 8.6]. • Seed disturbed erodible soils on with a mixture of native seed and cover crop seed such as fall rye if seeding in late summer or annual oats if seeding in the winter, spring or early summer [Section 8.6]. • See additional measures in the Soil Erosion and Sediment Control Contingency Plan and Soil/Sod Pulverization Contingency Plan in Appendix B of the Pipeline EPP. • Apply hydromulch/hydroseed at a rate recommended by the supplier on steep recontoured slopes and/or where soil wind erosion may be problematic (see Environmental Alignment Sheets) [Section 8.6].	• Surface erosion of topsoil/root zone material can be expected until a vegetative cover is established.

TABLE C7.1.2-1 Cont'd

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2.1 Loss of topsoil/root zone material through wind erosion (cont'd)	See above	See above	Highly Erodible Soils • Install erosion control blanket, coir/straw logs or rollback on exposed moderately to highly erodible soils where there is potential for water or wind erosion prior to re-establishment of vegetation (see Drawings [Rollback] and [Erosion Control – Rollback in Riparian Areas] and [Coir/Straw Log Installation] and [Erosion Control Matting/Blanket] provided in Appendix R of the Pipeline EPP of Pipeline EPP) [Section 8.6]. • Install temporary fences to restrict grazing and trampling of the seeded construction right-of-way until vegetation becomes established or less palatable [Section 8.6].	• See above
2.2 Loss of topsoil/root zone material through water erosion	Soil series: Glossey 1, McQueen, Shallow McQueen, Tranquille, Tranquille with a saline lower subsoil	Footprint	• Postpone root grubbing until immediately prior to grading along segments of the construction right-of-way where pre-clearing occurred and where there is a potential for soil erosion to occur, due to sloping terrain and erodible soils [Section 8.1]. See additional grubbing measures in Section 8.1 of the Pipeline EPP. • Leave breaks in the trench crown at obvious drainages and wherever seepage occurs to reduce or avoid interference with natural drainage. Leave breaks in the crown at frequent intervals where sidehill is encountered. Compact backfill where breaks have been left [Section 8.4]. • Install temporary sediment fences, where warranted, to control sedimentation prior to final clean-up and the establishment of permanent erosion and sediment control measures (see Drawing [Sediment Fence] provided in Appendix R of the Pipeline EPP) [Section 8.6.2]. • Implement the Soil Erosion and Sediment Control Contingency Plan [Section 8.0 of Appendix B of the Pipeline EPP]. • Replace grade material to a stable contour that will approximate the pre-construction contour, except where it is not practical or safe to do so. When replacing sidehill or other graded areas is not practical due to the risk of slope failure, the Lead Activity Inspector, the Lead Environmental Inspector, the Inspector(s), the Construction Manager and a Geotechnical Engineer will discuss to determine an appropriate grade [Section 8.4]. • Recontour the construction right-of-way and re-establish the pre-construction grades and drainage channels if frozen soil conditions prevented completion of this task during backfilling [Section 8.6]. • Regrade areas with vehicle ruts, erosion gullies or where the trench has settled [Section 8.6]. • See additional measures to reduce water erosion at watercourses and wetlands in Sections 8.6 and 8.7 of the Pipeline EPP.	• Surface erosion of topsoil/root zone material can be expected until a vegetative cover is established.
2.3 Degradation of soil structure due to pulverization of soil and sod	Soil series: Glossey 1; McQueen, Shallow McQueen, Tranquille, Tranquille with a saline lower subsoil	Footprint	• Retain sod and the vegetation mat on all lands if a competent sod layer exists. In these areas, grade only where safety considerations dictate in order to reduce disturbance to sod and the vegetation mat. Grading of well-sodded lands will not be permitted on level terrain [Section 8.2]. • Assess the wind erosion hazard, competency of the sod and potential for soil pulverization due to droughty soils. Implement measures applicable to droughty, wind erodible soils to reduce the impact of soil pulverization and wind erosion (see Soil/Sod Pulverization Contingency Plan in Appendix B) [Section 8.2]. • Apply water or approved tackifier to disturbed areas if traffic and wind conditions result in pulverized soils and dust problems [Section 8.2]. • Cultivate or rip the full width of the construction right-of-way on bush or woodlands where poor sod development exists to a depth adequate to alleviate surface compaction and in a manner acceptable to BC Parks. Do not cultivate into the subsoil [Section 8.6]. • Limit cultivation in areas of fine textured soils to prevent pulverization of the soil (see Soil/Sod Pulverization Contingency Plan in Appendix B) [Section 8.6]. • Disc and harrow only if the site is to be seeded immediately; otherwise, leave the ripped topsoil in a rough condition to reduce wind erosion potential [Section 8.6].	• Pulverization resulting in fugitive dust and loss of soil structure can be expected during dry conditions.

TABLE C7.1.2-1 Cont'd

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2.3 Degradation of soil structure due to pulverization of soil and sod (cont'd)	See above	See above	• Disc or rip disturbed soils on hay where the sod layer has been broken or where topsoils are compacted and reseeding is warranted [Section 8.6].	• See above
2.4 Loss of topsoil/root zone material from disturbance (*e.g.,* maintenance dig activities) during operations	Soil series: Glossey 1, McQueen, Shallow McQueen, Tranquille, Tranquille with a saline lower subsoil	Footprint	• Implement the recommended soil handling procedures outlined in the Pipeline EPP to reduce the potential for soil degradation when maintenance activities involving soil disturbance are necessary during operations of the pipeline. • Monitor areas along the right-of-way that are disturbed during operations and maintenance activities. Implement remedial measures, where warranted.	• Surface erosion of topsoil/root zone material can be expected until a vegetative cover is established.
3. Soil Indicator – Bedrock and Stone Disposal				
3.1. Bedrock or large rocks within trench depth	Soil series: shallow McQueen	LSA	• Rip bedrock in trench, if encountered. Ripping is preferred over blasting [Section 8.3]. • Blast bedrock encountered within trench depth only if ripping or typical trenching methods are not feasible [Section 8.3]. See additional measures for blasting in Section 8.3 of the Pipeline EPP. • Haul excavated trench spoil that is not suitable for use as backfill (*e.g.,* excess bedrock) and dispose of at locations approved by the Lead Environmental Inspector and the Inspector(s) [Section 8.3]. • Ensure that bedrock excavated from the trench is not backfilled into the upper 50 cm of the trench if the potential exists for a reduction in land capability. Dispose of excess bedrock at locations approved BC Parks, where warranted, and the Lead Environmental Inspector and the Inspector(s). Known locations with shallow bedrock are identified on the Environmental Alignment Sheets [Section 8.4]. See additional measures for bedrock in Section 8.4 of the Pipeline EPP.	• Removal of bedrock or large rocks from trench depth may result in disposal issues.
4. Soil Indicator – Soil Contamination				
4.1. Soil contamination due to spot spills during construction	Soil series: Glossey 1, McQueen, Shallow McQueen, Tranquille, Tranquille with a saline lower subsoil	LSA	• Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into watercourses/wetlands/lakes. In the event of a spill, implement the Spill Contingency Plan (see Appendix B of the Pipeline EPP) [Section 7.0]. • Place tarps or other impermeable material on the ground to catch drippings from coating application at weld joints and areas where repairs to the coating are made. Dispose of spilled coating at approved locations [Section 8.3]. • Isolate test pumps, generators and fuel storage tanks with an impermeable lined dike or depression to capture and retain any spills of fuels or lubricants [Section 8.5].	• No residual effect identified.

Notes: 1 LSA = Soil LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.2.2 Significance Evaluation of Potential Residual Effects

Table C7.1.2-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Lac du Bois Grasslands Protected Area on the soil and soil productivity. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE C7.1.2-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON SOIL AND SOIL PRODUCTIVITY FOR LAC DU BOIS GRASSLAND PROTECTED AREA

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1. Soil Indicator – Soil Productivity									
1(a) Mixing of topsoil/root zone material and subsoil.	Negative	Footprint	Short-term	Periodic	Medium-term	Low	High	High	Not significant
1(b) Reduction in soil productivity on grassland areas from changes in evaporation and transpiration rates.	Negative	Footprint	Short-term	Periodic	Short to medium-term	Low	High	Moderate	Not significant
1(c) Excessive trench subsidence or a remnant crown.	Negative	Footprint	Short-term	Isolated	Short to medium-term	Low	High	High	Not significant
2. Soil Indicator – Soil Degradation									
2(a) Surface erosion of topsoil/root zone material can be expected until a vegetation cover is established.	Negative	Footprint	Short-term	Periodic	Medium-term	Low	High	High	Not significant
2(b) Pulverization resulting in fugitive dust and loss of soil structure can be expected during dry conditions.	Negative	Footprint	Short-term	Isolated	Short to medium-term	Low	Low to high	High	Not significant
3. Soil Indicator – Bedrock and Stone Disposal									
3(a) Bedrock or large rock removal may result in disposal issues.	Negative	LSA	Short-term	Isolated	Short to medium-term	Low	High	High	Not significant
4. Soil Indicator – Soil Contamination									
No residual effects identified.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes: 1 LSA = Soil LSA.
2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Soil Indicator – Soil Productivity

Root Zone Material and Subsoil Mixing

During the construction of the pipeline and, to a lesser extent, during maintenance activities, it is likely that a minor amount of root zone material and subsoil mixing will occur along the proposed construction right-of-way. The impact balance of this residual effect is considered negative since admixing could decrease soil productivity. A summary of the rationale for all of the significance criteria is provided in Table C7.1.2-2 (point 1[a]) and below.

- Spatial Boundary: Footprint – admixing is confined to the area of disturbance along the construction right-of-way.
- Duration: short-term – the events causing potential admixing are construction of the pipeline and maintenance-related activities, the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events causing potential admixing (*i.e.*, construction and maintenance-related activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: medium-term – loss of soil productivity due to minor topsoil/root zone material and subsoil mixing is expected to be reversed within 10 years given the implementation of mitigation measures during construction and, if necessary, the application of soil amendments post-construction.

- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table C7.1.2-1 and, if necessary, soil amendments applied post-construction.
- Probability: high – admixing is a common residual effect of pipeline construction and may also occur during maintenance activities.
- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and soil productivity.

Evaporation and Transpiration

Loss of vegetation and soil disturbance will result in changes to evaporation and transpiration rates on grassland areas following construction potentially reducing soil productivity. The potential effects on soil productivity will be reduced by scheduling construction activities in grassland areas during late summer/fall in some areas when vegetation will be either desiccated or harvested and soil will likely be dry.

Following tilling and seeding activities, evaporation and transpiration rates on the construction right-of-way will not differ from off the construction right-of-way unless compaction or lower nutrient levels from admixing reduce vegetation yield. Mitigation measures outlined in Table C7.1.2-1 and the Pipeline EPP will reduce the potential for changes of soil structure and available environmental nutrients. Furthermore, any notable decrease in soil productivity will be identified during post-construction environmental monitoring and appropriate procedures will be implemented (*e.g.,* soil compaction alleviation, fertilization, consultation with BC Parks).

The loss of vegetation on grassland areas will not result in any considerable alteration of wind patterns and resultant changes in evaporation rates of adjacent vegetation, nor are increased surface temperatures of bare soil resulting from losses in evaporative cooling expected to affect adjacent vegetation. In general, post-construction environmental monitoring reports for a recent large pipeline project on grasslands demonstrate that soil productivity on right-of-way and off right-of-way are comparable with proper revegetation (TERA 2009a,b, 2011a,b,c, 2012a, 2013a,b). Locations along the construction right-of-way where seeding or natural revegetation have not been as successful will be recorded and appropriate measures will be implemented (*e.g.,* fencing to prevent grazing, reseeding, soil decompaction, fertilization).

Through appropriate scheduling and implementation of soil conservation and vegetation management measures in Table C7.1.2-1 and the Pipeline EPP (Appendix A of this Proposal), the magnitude of changes in evaporation and transpiration resulting from pipeline construction is considered to be low. A reduction in soil productivity resulting from changes in evaporation and transpiration rates is considered reversible in the short to medium-term depending on land use, vegetation type and the success of soil handling and revegetation efforts (Table C7.1.2-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – reduction in soil productivity on grasslands resulting from changes in evaporation and transpiration rates are confined to the area of disturbance along the construction right-of-way.
- Duration: short-term – the events causing potential evaporation and transpiration rates are construction of the pipeline and maintenance-related activities, the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events causing reduction in soil productivity on grassland areas resulting from changes in evaporation and transpiration rates (*i.e.*, construction and maintenance-related activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: short to medium-term – depending on vegetation type and success of soil handling and revegetation efforts, potential reduction in soil productivity resulting from changes in evaporation and transpiration rates may take up to or more than one year but less than 10 years to alleviate.
- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table C7.1.2-1 and, if necessary, soil amendments applied post-construction. The results of recent post-construction environmental monitoring programs in grassland areas

demonstrate that changes in evaporation and transpiration rates are generally minor in severity and limited in extent.

- Probability: high – changes in evaporation and transpiration rates are common residual effects of pipeline construction and may also occur during maintenance activities.

- Confidence: moderate – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and changes in evaporation and transpiration rates from data outside of the Project area. Since the understanding is not from data within the Project area, the confidence is rated as moderate.

Trench Subsidence or Remnant Crown

Construction activities may result in localized areas of excessive trench subsidence and/or a remnant crown over the trench. The impact balance of this residual effect is considered negative since excessive trench subsidence or a remnant crown may reduce soil productivity through erosion and drainage issues. Trench subsidence and a remnant crown do not always occur during the year following construction and reclamation, and will be greatly influenced by the amount of precipitation. The reversibility of trench subsidence and/or a remnant crown is considered to be short to medium-term since remedial work associated with trench subsidence and/or a remnant crown typically occurs within a year of construction; however, localized trench subsidence may arise 2 to 3 years following construction (TERA 2009a,b, 2011a,b,c, 2012a, 2013a,b). With effective compaction of the backfilled trench and feathering out any remaining material over the trench, the magnitude of the effect of trench subsidence on soil and soil productivity is considered to be low (Table C7.1.2-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – trench subsidence or a remnant crown is confined to the trench line within the construction right-of-way.

- Duration: short-term – the event causing potential trench subsidence or a remnant crown is construction of the pipeline which is limited to the construction phase.

- Frequency: isolated – the event causing potential trench subsidence or a remnant crown (*i.e.*, construction activities) is confined to a specified phase of the assessment period.

- Reversibility: short to medium-term – remedial work associated with a remnant crown and trench subsidence typically is conducted within a year of construction, however, localized trench subsidence may also arise 2 to 3 years after construction.

- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table C7.1.2-1 and, if necessary, soil amendments applied post-construction. The results of recent post-construction environmental monitoring programs in grasslands demonstrate that trench subsidence or a remnant crown is generally minor in severity and limited in extent.

- Probability: high – trench subsidence or a remnant crown is a common residual effect of pipeline construction.

- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and trench subsidence/remnant crowns.

Soil Indicator – Soil Degradation

Surface Erosion of Root Zone Material

Construction and maintenance activities which disturb the soil will likely result in some surface erosion of topsoil/root zone material until a stable vegetative cover can be established, particularly on slopes which are more susceptible to water erosion. The impact balance of this residual effect is considered negative since erosion could decrease soil productivity. Based on the results of post-construction monitoring programs for pipeline projects in grasslands, issues related to erosion can generally be resolved within 2 to 3 years following final clean-up (TERA 2009a,b, 2011a,b,c, 2012a, 2013a,b). Similar measures are planned for the construction of the proposed pipeline. Consequently, minor surface erosion of topsoil/root zone material is considered to be reversible in the medium-term.

- Spatial Boundary: Footprint – surface erosion is confined to the area of disturbance along the construction right-of-way.
- Duration: short-term – the events causing surface erosion are construction of the pipeline and maintenance-related activities, the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events causing surface erosion (*i.e.*, construction and maintenance-related activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: medium-term – surface erosion is generally expected to be reversed within 2 to 3 years given the implementation of mitigation measures during construction and, if necessary, the application of soil amendments post-construction.
- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table C7.1.2-1 and, if necessary, soil amendments applied post-construction.
- Probability: high – surface erosion is a common residual effect of pipeline construction which can be addressed during post-construction environmental monitoring and may also occur during maintenance activities.
- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and soil degradation.

Degradation of Soil Structure from Pulverization

Construction activities during dry conditions may result in pulverization of soil and sod along the narrowed pipeline corridor in Lac du Bois Grassland Protected Area. The impact balance of this residual effect is negative since pulverization of soil and sod could lead to increased fugitive dust and loss of soil structure. Given the mitigation measures in Table C7.1.2-1 to reduce soil/sod pulverization, including the Soil/Sod Pulverization Contingency Plan, degradation of soil structure from pulverization is considered to be reversible in the short to medium-term (Table C7.1.2-2, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – degradation of soil structure from pulverization is confined to the area of disturbance along the construction right-of-way.
- Duration: short-term – the event causing degradation of soil structure from pulverization is construction of the pipeline.
- Frequency: isolated – the event causing degradation of soil structure from pulverization (*i.e.,* construction of the pipeline) is confined to a specified phase of the assessment period.
- Reversibility: short to medium-term – effects related to dust are reversible in less than one year (short-term); while the effects related to loss of soil structure is expected to take more than one year but less than 10 years to reverse the effect (medium-term).
- Magnitude: low – given the implementation of mitigation measures outlined in Table C7.1.2-1 and, if necessary, soil amendments applied post-construction.
- Probability: low to high – degradation of soil structure from pulverization is a common residual effect of pipeline construction but only in dry conditions so the likelihood varies by location along the construction right-of-way and weather conditions.
- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

Soil Indicator – Bedrock and Stone Disposal

Disposal Issues Resulting from Removal of Bedrock from the Trench

Bedrock or large rock removed from the trench by ripping or blasting may result in disposal issues depending on the volume accumulated.

Although there is potential to encounter bedrock within trench depth along the narrowed pipeline corridor, these areas are very minor in extent and conventional trenching methods are anticipated to be successful for most locations. However, localized blasting is anticipated along the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area (particularly within the Batchelor Addition). The impact balance of this effect is considered to be negative since removal of bedrock can impact the management of soils in Lac du Bois Grasslands Protected Area. The magnitude of this residual effect is considered to be low (Table C7.1.2-2, point 3[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Soil LSA – bedrock originating from disturbed portions of the construction right-of-way in Lac du Bois Grasslands Protected Area may result in disposal off right-of-way, including areas within the Soil LSA.
- Duration: short-term – the event causing disposal issues resulting from removal of bedrock from the trench is construction of the pipeline.
- Frequency: isolated – the event causing disposal issues resulting from removal of bedrock from the trench (*i.e.*, construction activities) is confined to a specified phase of the assessment period.
- Reversibility: short to medium-term – excess bedrock is typically disposed of within a year of construction.
- Magnitude: low – given the implementation of mitigation measures outlined in Table C7.1.2-1 and through post-construction environmental monitoring which will address any issues of excess bedrock after construction.
- Probability: high – based on similar projects, disposal issues resulting from removal of bedrock from the trench are a common residual effect of pipeline construction.
- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and bedrock disposal.

Soil Indicator – Soil Contamination

No residual effects of the construction and operations of the proposed pipeline were identified for the soil contamination indicator (Table C7.1.2-2). Consequently, no further assessment is warranted.

7.1.2.3 Summary

As identified in Table C7.1.2-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on soil and soil productivity indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on the conservational values of Lac du Bois Grasslands Protected Area related to soil and soil productivity will be not significant.

7.1.3 Water Quality and Quantity

This subsection describes the potential Project effects on water quality and quantity in Lac du Bois Grasslands Protected Area. The Water Quality and Quantity LSA is the area generally extending 100 m upstream of the centre of the proposed pipeline corridor to a minimum of 300 m downstream of the centre of the proposed pipeline corridor, as well as within 300 m of the proposed pipeline corridor, in potentially vulnerable groundwater areas in hydraulic connection with the Footprint and in consideration of surface water drainage patterns along the pipeline corridor; shown in Figure 6.2.2-5 of the Introduction to the Draft Stage 2 Detailed Proposal. The Aquatics RSA includes all watersheds directly affected by the proposed pipeline corridor and applies to surface water; shown in Figure 6.2.2-2 of the Introduction of the Draft Stage 2 Detailed Proposal.

All water quality and quantity indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; and all of them were determined to interact with pipeline construction and operations in Lac du Bois Grasslands Protected Area.

7.1.3.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on water quality and quantity indicators are listed in Table C7.1.3-1.

A summary of mitigation measures is provided in Table C7.1.3-1 was principally developed in accordance with Trans Mountain Standards as well as industry and provincial and federal regulatory guidelines including BC MOE (2010b), BC MOF (1995), BC MWLAP (2004), BC OGC (2013), CAPP *et al*. (2012) and Fisheries and Oceans Canada (DFO) (1995, 1999, 2013), as well as groundwater legislation under the *Oil and Gas Activities Act* (*Environmental Protection and Management Regulation*) and the *BC Environmental Assessment Act.* Table C7.1.3-2 provides the pipeline and vehicle crossing methods for watercourses encountered within Lac Du Bois Grassland Protected Area.

TABLE C7.1.3-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WATER QUALITY AND QUANTITY FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Water Quality and Quantity Indicator – Surface Water Quality			
1.1 Suspended sediment concentrations in the water column during instream activities	LSA	<u>Pipeline Crossing</u> • An isolated watercourse crossing method (*i.e.*, if water is present) and contingency open cut method (*i.e.*, if dry or frozen to bottom) have been selected in consideration of the size, environmental sensitivities of McQueen Creek and the period of construction (see Table C7.1.3-2). • Confirm with the Inspector(s) that all notifications and approvals and/or letters of advice are in place prior to commencing instream construction at McQueen Creek [Section 8.7]. • Grade away from the watercourses in Lac du Bois Grasslands Protected Area to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in the watercourses during grading [Section 8.2]. • Install a temporary sediment barrier (*e.g.,* sediment fences), where warranted, to eliminate the flow of sediment from spoil piles and disturbed areas into the watercourse [Section 8.7]. • Inspect temporary sediment control structures (*e.g.,* sediment fences, subsoil berms) installed on approach slopes, on a daily basis throughout crossing construction. Repair the structures before the end of the working day [Section 8.7]. • Dewater the segment of the watercourses between the dams when safe to do so. Pump any silt-laden water out between the dams to well-vegetated lands, away from the watercourse or to settling ponds [Section 8.7]. • Remove any accumulations of sediment within the isolation areas that resulted from crossing construction. Spread all sediment and unused trench spoil removed from the watercourse at a location above the high water mark where the materials will not directly re-enter the watercourse [Section 8.7]. • Install sack trench breakers back from the edge of watercourses where the banks consist of organic material to prevent sloughing of backfill into the channel [Section 8.7]. • Ensure that water from flumes, dam and pumps, diversion or other methods does not cause erosion or introduce sediment into the channel. Place rock rip rap, tarpaulins, plywood sheeting or other materials to control erosion at the outlet of pump hoses and flumes. Supplement the erosion control materials to control any erosion [Section 8.7].	• Reduction in surface water quality due to suspended sediment during instream activities during construction and site-specific maintenance activities.

TABLE C7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.1 Suspended sediment concentrations in the water column during instream activities (cont'd)	See above	Vehicle Crossing • McQueen Creek and the unnamed drainages that are flowing at the time of construction will be crossed using a ramp and culvert method. During dry/frozen conditions, McQueen Creek and the unnamed drainages will be crossed using a snow/icefill or other regulatory approved crossing method (see Table C7.1.3-2). All non-visible drainages will be forded. Temporary Fords • Ensure the use of a ford is a one-time crossing (over and back) or limit ford to a seasonally dry streambed [Section 8.7]. • Confine the use of fords to watercourses or segments of watercourses with low, stable banks and a stable substrate composed of materials such as gravel and bedrock. Trans Mountain will not grade the banks to create a ford [Section 8.7]. • Install matting, where warranted, to protect the bed and banks of a watercourse to be forded [Section 8.7]. Operations • Implement measures similar to construction under direction of Trans Mountain's Environmental, Health and Safety Management System for controlling erosion from banks and approach slopes during integrity digs conducted instream or in vicinity to the watercourse.	• See above
1.2 Erosion from approach slopes	LSA	Pipeline Crossing • Prohibit clearing of extra temporary workspace within the riparian buffer, only the trench and temporary workspace areas will be cleared. Ensure staging areas for watercourse crossing construction and spoil storage areas are located a minimum of 10 m from the banks of the watercourse boundaries. This distance may be reduced by the Lead Environmental Inspector and the Inspector(s) where appropriate controls are in place [Section 8.1]. • Restrict root grubbing to the area outside of the vegetated riparian buffer adjacent to the watercourse [Section 8.1]. • Install erosion control measures, where warranted, prior to commencing grading in the vicinity of the watercourse crossing [Section 8.2]. • Grade away from the watercourse to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in the watercourse during grading [Section 8.2]. • Install temporary berms on approach slopes to the watercourse and erect sediment fence(s) near the base of approach slopes following grading, where indicated in the Environmental Alignment Sheets. Inspect the temporary sediment control structures on a daily basis and repair before the end of each working day [Section 8.2]. • Install temporary erosion and sediment control structures (*e.g.,* sediment fences, coir logs) immediately following the completion of backfilling lands adjacent to the watercourse crossing where the potential for sedimentation of the watercourse exists (see Sediment Fence and Coir/Straw Log Installation Drawings provided in Appendix R of the Pipeline EPP) [Section 8.4]. • Seed riparian areas with an approved annual or perennial grass cover crop or native grass mix as soon as is feasible after construction (see Table C7.1.3.2) • Transplant dormant shrubs, or install dormant willow stakes or commercially grown rooted stock plants (plugs), where warranted, during reclamation of streambanks where riparian vegetation is present prior to construction. See additional measures outlined in the Reclamation Management Plan [Appendix C]]. • Install permanent erosion control measures, as outlined in the Reclamation Management Plan [Appendix C] unless otherwise approved by Trans Mountain to adjust for site conditions and suitability [Section 8.6]. • Install temporary fencing to allow the revegetation treatments to become established and avoid damage to the banks and riparian area by wildlife/livestock [Section 8.7]. • Monitor watercourse after construction as outlined in Section 9.0 of Volume 6A to assess the success of construction and reclamation mitigation measures following the temporary disturbance. Implement remedial measures, where warranted. Vehicle Crossings • Ensure that equipment used during construction of the vehicle crossing is used in a manner that reduces disturbance of the bed and banks and ensure bridge installation does not alter the stream bed or banks or require infilling of the channel [Section 8.7].	• Reduction in surface water quality due to erosion from banks and approach slopes.

TABLE C7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.2 Erosion from approach slopes (cont'd)	See above	• Seed disturbed areas on the banks and approaches as soon as practical with an approved grass cover crop species or native grass seed mix and implement sediment control measures to stabilize watercourse banks and prevent sedimentation of the watercourse, respectively. Follow measures provided in the Reclamation Management Plan of the Pipeline EPP [Section 8.7]. Operations • Implement measures similar to construction under direction of Trans Mountain's Environmental, Health and Safety Management System for controlling erosion from banks and approach slopes during integrity digs conducted instream or in vicinity to the watercourse	• See above

1.3 Reduction of surface water quality due to small spill during construction or site-specific maintenance activities	LSA	• Ensure the following separation distances are maintained between the watercourse when planning and constructing the pipeline, unless otherwise approved:
		  • fuel or hazardous material storage site - 300 m;
		  • burning site - 100 m; and
		  • oil change area - 100 m [Section 7.0].
		• Refer to the Pipeline EPP for additional measures for hazardous materials storage, servicing vehicles and spill equipment needs as well as cleaning of equipment.
		• Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into waterbodies. In the event of a spill, implement the Spill Contingency Plan [Appendix B] [Section 7.0].
		• Conduct refuelling a minimum of 100 m from any watercourse unless otherwise approved by the appropriate regulatory authority [Section 7.0]. See additional measures for refuelling near waterbodies in Section 7.0 of the Pipeline EPP.
			• Contamination of surface water due to a small spill during construction or site-specific maintenance activities.

2. Water Quality and Quantity Indicator – Surface Water Quantity			
2.1 Alteration of natural surface drainage patterns	LSA	• Maintain drainage across the construction right-of-way during all phases of construction [Section 7.0]. • Ensure the potential for soil erosion by water is reduced during construction activities by avoiding ponding of water or the unintentional channelization of surface water flow [Section 7.0]. • Provide surface drainage of adequate capacity across the construction right-of-way [Section 7.0]. • Reduce grading along the construction right-of-way, especially within watercourse/wetland vegetated buffers [Section 8.2]. • Leave hard plugs or install soft plugs at locations where the open trench could dewater a wetland or flood other areas [Section 8.3]. • Leave breaks in the trench crown at obvious drainages and wherever seepage occurs to reduce or avoid interference with natural drainage [Section 8.4]. • Recontour the construction right-of-way and stabilize approach slopes at watercourse crossings. Where reclamation of the pre-construction grade is not feasible due to risk of failure of fill on slopes or maintenance of an access trail, recontour to grades as directed by the Geotechnical Engineer in consultation with BC Parks [Section 8.6]. • Regrade areas with vehicle ruts, erosion gullies or where the trench has settled [Section 8.6]. • Implement similar mitigation measures during site-specific maintenance activities during operations. • See recommended mitigation measures outlined in Table C7.1.7-2 Wetland Loss or Alteration.	• Localized alteration of natural surface drainage patterns until trench settlement is complete.

TABLE C7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2.2 Disruption or alteration of streamflow	LSA	• Adhere to clearing guidelines for protection of streams and wetlands provided the Riparian Management Area Guidebook [Section 8.1]. • Fell trees away from the watercourse and away from limits of the construction right-of-way to reduce damage to the streambanks, bed and adjacent trees. Hand clear the area, if necessary, to reduce disturbance. Any trees, debris and soil inadvertently deposited within the ordinary high watermark will be promptly removed in a manner that avoids or reduces disturbance of the bed and banks. Trees will not be stood or hauled across the watercourse [Section 8.1]. • Do not place windrowed or fill material in the watercourse during grading [Section 8.2]. • Ensure streamflow, if present, is maintained at all times when trenching through a watercourse [Section 8.7]. • Ensure that new vehicle crossing structures are appropriate for the watercourse approaches, channel width and configuration, anticipated streamflow during the period of use, planned vehicle loads, and overall period/duration of use [Section 8.7]. • Re-establish streambanks and approaches immediately following construction of the watercourse crossing as outlined in the Reclamation Management Plan of the Pipeline EPP.	• Disruption and alteration of natural streamflow from instream activities.
3. Water Quality and Quantity Indicator – Groundwater Quality			
3.1 Groundwater or wells vulnerable to possible future contamination from a spill during construction	LSA	• Utilize Best Management Practices for spill prevention outlined in the Pipeline EPP including in areas where higher vulnerability wells and groundwater are identified. • Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into waterbodies. In the event of a spill, implement the Spill Contingency Plan (see Appendix B of Pipeline EPP) [Section 7.0]. • Re-establish or replace a potable water supply as required should a registered or known water well located within 30 m of the construction right-of-way be damaged (*i.e.,* diminishment in quantity and/or quality) during pipeline installation [Section 7.0].	• Contamination of groundwater as a result of a spill during construction.
3.2 Areas susceptible to blasting effects	LSA	• Notify BC Parks with water supply wells within the Water Quality and Quantity LSA before blasting is carried out and conduct investigations, where warranted, to assess groundwater conditions and risks [Section 6.0]. • Initiate pre-construction monitoring, where warranted, prior to the commencement of a specific activity during construction (*e.g.,* blasting). Monitoring may be necessary prior to, during and following construction or a specific construction activity in the vicinity of water wells or springs [Section 6.0]. • During Project field studies, the Hydrogeological Engineer in consultation with BC Parks will determine if springs and wells located in the immediate vicinity of the construction right-of-way will be sampled for water quality and flow rate prior to the start of construction. Locate and flag or fence registered or known water wells in the immediate vicinity of the construction right-of-way [Section 6.0]. • Monitor all registered or known potable water wells located within 200 m of any blasting prior to and following blasting. Monitoring will include measurement of well yields, static and pumping water levels as well as water sampling in accordance with Canadian Guidelines for Drinking Water Quality (Health Canada 2012) [Section 8.3]. • Re-establish or replace a potable water supply as required should a registered or known water well located within 30 m of the construction right-of-way be damaged *(i.e.,* diminishment in quantity and/or quality) during pipeline installation [Section 7.0].	• Elevated turbidity in groundwater as a result of silt release during blasting.
4. Water Quality and Quantity Indicator – Groundwater Quantity			
4.1 Areas susceptible to changes in groundwater flow patterns	LSA	• Monitor water encountered in the trench during trenching to determine if groundwater flow is being intercepted. If spring flow has been disrupted, seek and follow the advice of the Hydrogeological or Geotechnical Resource Specialist to maintain cross drainage within the trench (*e.g.,* installation of subdrains, trench breakers, etc.) [Section 8.3]. • Assess the need for well points or other dewatering methods, prior to commencing trenching, to intercept groundwater at site-specific locations before it enters the trench [Section 8.3]. • Prevent the pipeline trench and bedding from becoming a conduit for increased groundwater flow.	• Natural groundwater pathways may be bisected and create a sink (drain) for shallow groundwater.

TABLE C7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
4.1 Areas susceptible to changes in groundwater flow patterns (cont'd)	See above	• Install trench breakers to force groundwater seepage along the pipeline trench to the surface, if springs are encountered along the route. Install subdrains to divert shallow groundwater flow from the right-of-way [Section 8.4]. • Install trench breakers, where warranted, at the edge of perched wetlands to prevent the pipeline trench from acting as a drain (see Trench Breaker – Watercourse/Wetland Drawing in Appendix R of the Pipeline EPP) [Section 8.4]. • Install subdrains in association with trench breakers as directed by Trans Mountain's Engineer where there is evidence of seepage or a flowing spring on a slope once the trench is excavated (see Subdrains Drawing in Appendix R of the Pipeline EPP) [Section 8.4]. • Backfill clay/mineral soil first, if salvaged separately from organic material in shallow peatland areas, to ensure that cross drainage is maintained [Section 8.4].	• Flooding on the up-gradient side of the pipeline may result in creation of wet zones on ground surface. • Reduction of baseflow to local streams.
4.2 Areas of shallow groundwater susceptible to blasting effects	LSA	• See recommended mitigation measures for blasting outlined in potential effect 3.2 of this table.	• Reduction in water quantity if blasting damages the well or surrounding formation. • Enhancement of water quantity if blasting opens or unclogs fractures supplying existing water well.

Notes: 1 LSA = Water Quality and Quantity LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

TABLE C7.1.3-2

PROPOSED PIPELINE AND VEHICLE WATER CROSSING METHODS ALONG THE NARROWED PIPELINE CORRIDOR THROUGH LAC DU BOIS GRASSLAND PROTECTED AREA

Watercourse Name	RK	Fish Presence Captured or Observed (Previously Documented)	Sensitivity Rating	Provincial Instream Work Window	Least Risk Biological Window Proposed	Pipeline Crossing Method		Vehicle Crossing Method		Reclamation
						Recommended Primary	Recommended Contingency	Recommended Crossing Method (Flowing)	Recommended Crossing Method (Dry/Frozen)	
McQueen Creek	829.0	None	Low	None	Open	Isolation if water present	Open-cut if dry or frozen to bottom	Ramp and culvert	Snow/icefill or other regulatory approved crossing method	• Recontour banks using salvaged bank material, and install erosion control blanket and/or coir logs as required (see Drawings [Erosion Control Matting/Blanket] and [Coir/Straw Log Installation] provided in Appendix R of the Pipeline EPP). • If required, install riprap base below OHWL, keyed in to bed and underlain with filter cloth or gravel layer. • Install coir soil wrap(s) above OHWL (see Drawing [Streambank Protection – Hedge/Brush Layering] provided in Appendix R of the Pipeline EPP), or • Log crib structure made from natural logs may be used at the base of the bank (below the OHWL) if appropriate (may be a single log in height, typically a minimum of two logs are used) (see Drawing [Staked Logs/Log Cribwall for Erosion Control] provided in Appendix R of the Pipeline EPP). • Install rooted stock shrubs/trees and/or dormant shrub/tree stakes in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate woody vegetation recovery (see Drawing [Shrub Staking and Transplanting and [Rooted Stock Selection and Installation] provided in Appendix R of the Pipeline EPP).
Unnamed drainage	831.2	None(None)	Low	None	Open	Isolation If water is present	Open-cut if dry or frozen to bottom	Ramp and culvert	Ford	• Recontour bed and banks/approach slopes to pre-construction profiles and grades.
Unnamed drainage	831.8	None(None)	None	None	Open	Open-cut	Open-cut	Ford	Ford	• Recontour bed and banks/approach slopes to pre-construction profiles and grades.
Unnamed Drainage	832.3	None(None)	None	None	Open	Open-cut	Open-cut	Ford	Ford	• Recontour bed and banks/approach slopes to pre-construction profiles and grades.
Unnamed Drainage	832.3	None(None)	None	None	Open	Open-cut	Open-cut	Ford	Ford	• Salvage dormant riparian vegetation along the trench line (and vehicle crossing locations, where grading is required), keeping roots intact (*i.e.,* with a sufficient soil root-ball). Store salvaged dormant plants and plant material away from construction activities for replacement or installation during reclamation. Replace salvaged dormant riparian plants and plant material (stakes and brush) during reclamation (see Drawing [Shrub Staking and Transplanting] provided in Appendix R of the Pipeline EPP).

TABLE C7.1.3-2 Cont'd

Watercourse Name	RK	Fish Presence Captured or Observed (Previously Documented)	Sensitivity Rating	Provincial Instream Work Window	Least Risk Biological Window Proposed	Pipeline Crossing Method		Vehicle Crossing Method		Reclamation
						Recommended Primary	Recommended Contingency	Recommended Crossing Method (Flowing)	Recommended Crossing Method (Dry/Frozen)	
McQueen Creek	829.0	None	Low	None	Open	Isolation if water present	Open-cut if dry or frozen to bottom	Ramp and culvert	Snow/icefill or other regulatory approved crossing method	• Recontour banks using salvaged bank material, and install erosion control blanket and/or coir logs as required (see Drawings [Erosion Control Matting/Blanket] and [Coir/Straw Log Installation] provided in Appendix R of the Pipeline EPP). • If required, install riprap base below OHWL, keyed in to bed and underlain with filter cloth or gravel layer. • Install coir soil wrap(s) above OHWL (see Drawing [Streambank Protection – Hedge/Brush Layering] provided in Appendix R of the Pipeline EPP), or • Log crib structure made from natural logs may be used at the base of the bank (below the OHWL) if appropriate (may be a single log in height, typically a minimum of two logs are used) (see Drawing [Staked Logs/Log Cribwall for Erosion Control] provided in Appendix R of the Pipeline EPP). • Install rooted stock shrubs/trees and/or dormant shrub/tree stakes in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate woody vegetation recovery (see Drawing [Shrub Staking and Transplanting and [Rooted Stock Selection and Installation] provided in Appendix R of the Pipeline EPP).
Unnamed Drainage	833.2	None(None)	None	None	Open	Open-Cut	Open-cut	Ford	Ford	• Salvage dormant riparian vegetation along the trench line (and vehicle crossing locations, where grading is required), keeping roots intact (*i.e.,* with a sufficient soil root-ball). Store salvaged dormant plants and plant material away from construction activities for replacement or installation during reclamation. Replace salvaged dormant riparian plants and plant material (stakes and brush) during reclamation (see Drawing [Shrub Staking and Transplanting] provided in Appendix R of the Pipeline EPP). • Install rooted stock shrubs/trees and/or dormant tree/shrub stakes/brush in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate vegetation recovery (see Drawings [Shrub Staking and Transplanting] and [Rooted Stock Selection and Installation] provided in Appendix R of the Pipeline EPP).
Unnamed Drainage	833.6	None(None)	None	None	Open	Open-cut	Open-cut	Ford	Ford	• Salvage dormant riparian vegetation along the trench line (and vehicle crossing locations, where grading is required), keeping roots intact (*i.e.,* with a sufficient soil root-ball). Store salvaged dormant plants and plant material away from construction activities for replacement or installation during reclamation. Replace salvaged dormant riparian plants and plant material (stakes and brush) during reclamation (see Drawing [Shrub Staking and Transplanting] provided in Appendix R of the Pipeline EPP). • Install rooted stock shrubs/trees and/or dormant tree/shrub stakes/brush in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate vegetation recovery (see Drawings [Shrub Staking and Transplanting] and [Rooted Stock Selection and Installation] provided in Appendix R of the Pipeline EPP).
Unnamed Drainage	834.1	None(None)	None	None	Open	Open-Cut	Open-Cut	Ford	Ford	• Recontour bed and banks/approach slopes to pre-construction profiles and grades.

TABLE C7.1.3-2 Cont'd

Watercourse Name	RK	Fish Presence Captured or Observed (Previously Documented)	Sensitivity Rating	Provincial Instream Work Window	Least Risk Biological Window Proposed	Pipeline Crossing Method: Recommended Primary	Pipeline Crossing Method: Recommended Contingency	Vehicle Crossing Method: Recommended Crossing Method (Flowing)	Vehicle Crossing Method: Recommended Crossing Method (Dry/Frozen)	Reclamation
Unnamed Drainage	834.4	None(None)	None	None	Open	Open-Cut	Open-Cut	Ford	Ford	• Recontour bed and banks/approach slopes to pre-construction profiles and grades.
Unnamed Drainage	834.4	None(None)	None	None	Open	Open-Cut	Open-Cut	Ford	Ford	• Recontour bed and banks/approach slopes to pre-construction profiles and grades.
Unnamed Drainage	835.0	None(None)	None	None	Open	Open-Cut	Open-Cut	Ford	Ford	• Recontour bed and banks/approach slopes to pre-construction profiles and grades.
Unnamed Drainage	835.1	None(None)	None	None	Open	Open-Cut	Open-Cut	Ford	Ford	• Recontour bed and banks/approach slopes to pre-construction profiles and grades.
Unnamed Drainage	835.5	None(None)	None	None	Open	Open-Cut	Open-Cut	Ford	Ford	• Recontour bed and banks/approach slopes to pre-construction profiles and grades.
Unnamed Drainage	835.9	None(None)	None	None	Open	Open-Cut	Open-Cut	Ford	Ford	• Salvage dormant riparian vegetation along the trench line (and vehicle crossing locations, where grading is required), keeping roots intact (*i.e.*, with a sufficient soil root-ball). Store salvaged dormant plants and plant material away from construction activities for replacement or installation during reclamation. Replace salvaged dormant riparian plants and plant material (stakes and brush) during reclamation (see Drawing [Shrub Staking and Transplanting] provided in Appendix R of the Pipeline EPP). • Install rooted stock shrubs/trees and/or dormant tree/shrub stakes/brush in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate vegetation recovery (see Drawings [Shrub Staking and Transplanting] and [Rooted Stock Selection and Installation] provided in Appendix R of the Pipeline EPP).
Unnamed Drainage	836.2	None(None)	Low	None	Open	Open-Cut	Open-Cut	Ford	Ford	• Salvage dormant riparian vegetation along the trench line (and vehicle crossing locations, where grading is required), keeping roots intact (*i.e.*, with a sufficient soil root-ball). Store salvaged dormant plants and plant material away from construction activities for replacement or installation during reclamation. Replace salvaged dormant riparian plants and plant material (stakes and brush) during reclamation (see Drawing [Shrub Staking and Transplanting] provided in Appendix R of the Pipeline EPP). • Install rooted stock shrubs/trees and/or dormant tree/shrub stakes/brush in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate vegetation recovery (see Drawings [Shrub Staking and Transplanting] and [Rooted Stock Selection and Installation] provided in Appendix R of the Pipeline EPP).

TABLE C7.1.3-2 Cont'd

Watercourse Name	RK	Fish Presence Captured or Observed (Previously Documented)	Sensitivity Rating	Provincial Instream Work Window	Least Risk Biological Window Proposed	Pipeline Crossing Method		Vehicle Crossing Method		Reclamation
						Recommended Primary	Recommended Contingency	Recommended Crossing Method (Flowing)	Recommended Crossing Method (Dry/Frozen)	
Unnamed Drainage	836.7	None(None)	Low	None	Open	Isolation if water is present	Open-Cut if dry or frozen to the bottom	Ramp and Culvert	Snow/icefill or other regulatory approved crossing method	• Salvage dormant riparian vegetation along the trench line (and vehicle crossing locations, where grading is required), keeping roots intact (*i.e.,* with a sufficient soil root-ball). Store salvaged dormant plants and plant material away from construction activities for replacement or installation during reclamation. Replace salvaged dormant riparian plants and plant material (stakes and brush) during reclamation (see Drawing [Shrub Staking and Transplanting] provided in Appendix R of the Pipeline EPP). • Install rooted stock shrubs/trees and/or dormant tree/shrub stakes/brush in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate vegetation recovery (see Drawings [Shrub Staking and Transplanting] and [Rooted Stock Selection and Installation] provided in Appendix R of the Pipeline EPP).
Unnamed Drainage	837.0	None(None)	Low	None	Open	Isolation if water is present	Open-Cut if dry or frozen to the bottom	Ramp and Culvert	Snow/icefill or other regulatory approved crossing method	• Salvage dormant riparian vegetation along the trench line (and vehicle crossing locations, where grading is required), keeping roots intact (*i.e.,* with a sufficient soil root-ball). Store salvaged dormant plants and plant material away from construction activities for replacement or installation during reclamation. Replace salvaged dormant riparian plants and plant material (stakes and brush) during reclamation (see Drawing [Shrub Staking and Transplanting] provided in Appendix R of the Pipeline EPP). • Install rooted stock shrubs/trees and/or dormant tree/shrub stakes/brush in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate vegetation recovery (see Drawings [Shrub Staking and Transplanting] and [Rooted Stock Selection and Installation] provided in Appendix R of the Pipeline EPP).
Unnamed Drainage	842.3	None(None)	None	None	Open	Open-cut	Open-Cut	Ford	Ford	• Recontour bed and banks/approach slopes to pre-construction profiles and grades.
Unnamed Drainage	843.0	None(None)	Low	None	Open	Isolation if water present	Open-Cut if dry of frozen to the bottom	Ramp and Culvert	Snow/icefill or other regulatory approved crossing method	• Salvage dormant riparian vegetation along the trench line (and vehicle crossing locations, where grading is required), keeping roots intact (*i.e.,* with a sufficient soil root-ball). Store salvaged dormant plants and plant material away from construction activities for replacement or installation during reclamation. Replace salvaged dormant riparian plants and plant material (stakes and brush) during reclamation (see Drawing [Shrub Staking and Transplanting] provided in Appendix R of the Pipeline EPP). • Install rooted stock shrubs/trees and/or dormant tree/shrub stakes/brush in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate vegetation recovery (see Drawings [Shrub Staking and Transplanting] and [Rooted Stock Selection and Installation] provided in Appendix R of the Pipeline EPP).

7.1.3.2 Significance Evaluation of Potential Residual Effects

Table C7.1.3-3 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Lac du Bois Grasslands Protected Area on water quality and quantity. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE C7.1.3-3

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WATER QUALITY AND QUANTITY FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
				Duration	Frequency	Reversibility				
1	Water Quality and Quantity Indicator – Surface Water Quality									
1(a)	Reduction in surface water quality due to suspended sediment during instream activities during construction and site-specific maintenance activities.	Negative	LSA	Immediate to short-term	Isolated to occasional	Immediate	Low	High	High	Not significant
1(b)	Reduction in surface water quality due to erosion from banks and approach slopes.	Negative	LSA	Immediate to short-term	Isolated to occasional	Short to medium-term	Low to medium	Low	High	Not significant
1(c)	Contamination of surface water due to a small spill during construction or site-specific maintenance activities.	Negative	LSA	Immediate	Accidental	Short to medium-term	Low to high	Low	Moderate	Not significant
2	Water Quality and Quantity Indicator – Surface Water Quantity									
2(a)	Localized alteration of natural surface drainage patterns until trench settlement is complete.	Negative	LSA	Short-term	Isolated to occasional	Short to medium-term	Low	High	High	Not significant
2(b)	Disruption and alteration of natural streamflow from instream activities.	Negative	LSA	Immediate to short-term	Isolated to occasional	Short to medium-term	Low to medium	High	High	Not significant
3	Water Quality and Quantity Indicator – Groundwater Quality									
3(a)	Elevated turbidity in groundwater as a result of silt release during blasting.	Negative	LSA	Short-term	Accidental	Short-term	Medium	Low	Moderate	Not significant
3(b)	Contamination of groundwater as a result of a spill.	Negative	LSA	Immediate	Accidental	Short to medium-term	Low to high	Low	Moderate	Not significant
4	Water Quality and Quantity Indicator – Groundwater Quantity									
4(a)	Natural groundwater pathways may be bisected and create a sink (drain) for shallow groundwater.	Negative	LSA	Short-term	Periodic	Short to medium-term	Low	Low	Moderate	Not significant
4(b)	Flooding on the up-gradient side of the pipeline may result in the creation of wet zones on ground surface.	Negative	LSA	Short-term	Periodic	Short-term	Low	Low	Moderate	Not significant
4(c)	Reduction of base flow to local streams.	Negative	LSA	Short-term	Periodic	Short-term	Low	Low	Moderate	Not significant
4(d)	Reduction of water quantity if blasting damages the well or the surrounding formation.	Negative	LSA	Immediate	Accidental	Short-term	Low to medium	Low	Moderate	Not significant
4(f)	Enhancement of water quantity if blasting opens or unclogs fractures supplying existing water well.	Negative	LSA	Immediate	Accidental	Short-term	Negligible	Low	Moderate	Not significant

Notes: 1 LSA = Water Quality and Quantity LSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Water Quality and Quantity Indicator – Surface Water Quality

Instream Construction

Sediment runoff and increased turbidity/total suspended solids (TSS) from pipeline construction was noted as a concern during many of the stakeholder engagement events for the Project, including the Protected Areas Workshop in Clearwater in April 2014 and the Clearwater Community Workshop in June 2013.

McQueen Creek will be crossed using an isolated crossing method under flowing conditions and, if dry or frozen to bottom at the time of construction, an open cut method will be used. An isolated crossing method is also recommended in the unlikely event any non-classified drainages are flowing at the time of construction, otherwise, an open cut method will be used. Open cut crossings conducted under dry or frozen conditions are not expected to result in sediment release.

The selection of an appropriate isolated or open cut watercourse crossing technique designed to meet federal and provincial regulatory requirements, as well as implementation of erosion controls on the approaches to the watercourse crossing and riparian revegetation, are likely to substantially reduce the potential for adverse effects on surface water quality at McQueen Creek. During construction of the trenched crossing under flowing conditions, a minor and short-term sediment release is expected during installation and removal of the pipeline crossing structures. Trenched crossings are considered to have a negative impact balance since sediment input can temporarily decrease surface water quality.

When compared to conducting an open cut technique during flowing conditions, isolated crossing techniques reduce the amount of sediment introduced to flowing watercourses. During a completely isolated crossing by dam and pump or flume, a minor sediment release is expected during installation of the dams prior to the isolation and during removal of the downstream dam at the conclusion of the isolation. Recent evidence demonstrates that smaller watercourses that lack substantial subsurface flow can be readily isolated with minimal sediment introduction when proper design, construction and mitigation measures are applied (CAPP *et al*. 2005, Reid *et al.* 2002). Consequently, it is anticipated that average TSS levels during instream construction at McQueen Creek will be below turbidity/TSS guidelines.

Minor releases of sediment may also be associated with use of a temporary vehicle crossing (*i.e.*, ramp and culvert) at McQueen Creek, if required. However, given the recommended mitigation measures, elevated suspended sediment concentrations will be minimal and since pulses of suspended solids are generally expected to settle out of the water column within the zone of influence (ZOI) in a timeframe measuring from minutes to a few hours (*i.e.*, less than CCME's short-term guideline of 24 hours).

Given that suspended sediments are expected to settle out of the water column within the ZOI in a timeframe measuring from minutes to a few hours (*i.e.*, less than CCME's short-term guideline of 24 hours), residual effects on the surface water quality indicator during the trenched crossing and temporary vehicle crossing, if required, are reversible in the immediate-term and of low magnitude (Table C7.1.3-3, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – suspended sediments released during construction activities will be carried downstream until they disperse and/or naturally settle out within the predicted ZOI.
- Duration: immediate to short-term – the events causing the release of suspended sediments into surface water are instream construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.
- Frequency: isolated to occasional – the events causing the release of suspended sediments into McQueen Creek (*i.e.*, pipeline construction and maintenance activities) occur during construction and, for operations activities, intermittently and sporadically over the assessment period.
- Reversibility: immediate – an increase in suspended sediments is confined to a specific period not exceeding 24 hours after construction.

- Magnitude: low – an increase in suspended sediments is anticipated for a short timeframe and anticipated to be within CCME guidelines given the implementation of mitigation measures to reduce sedimentation.

- Probability: high – a trenched crossing method is recommended during potentially flowing conditions at the time of pipeline construction through McQueen Creek.

- Confidence: high – based on available research literature, data pertinent to previous crossings along the existing TMPL right-of-way and the professional experience of the assessment team.

Erosion from Approach Slopes and Banks

Following grading, it is possible for some erosion to occur on approach slopes and banks and cause sediment to enter the watercourse. The impact balance of this potential residual effect is considered negative since sediment input could decrease surface water quality.

The long-term conservation concern of protecting riparian habitat within the protected area will be supported through proper reclamation and post-construction monitoring. Mitigation measures will be identified on a site-specific basis and may include, for example: installation of temporary erosion control structures (*e.g.,* sediment fences); restoration to stabilize the banks (*e.g.,* soil wraps, brush layers, willow plantings and matting); seeding the disturbed banks and approaches with the appropriate cover crop species and native grass mix; installation of coir or other biodegradable erosion control fabric on the banks of the watercourse; installation of live dormant willow stakes or salvaged willow/shrub transplants or commercially grown rooted stock plugs in the banks of the watercourse; and monitoring to assess the success of construction and reclamation mitigation measures and implementation remedial measures, where warranted.

Proposed mitigation measures are expected to reduce the magnitude of erosion from approach slopes and banks on the surface water quality indicator to low to medium levels. This residual effect is reversible in the short to medium-term (Table C7.1.3-3, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – any sedimentation caused by erosion will be carried downstream until it disperses and/or naturally settles out within the predicted ZOI.

- Duration: immediate to short-term – the events causing the erosion and sedimentation of surface water are instream construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited any one year during the operations phase.

- Frequency: isolated to occasional – the events resulting in sedimentation caused by erosion of approach slopes and banks (*i.e.*, pipeline construction and operations activities [*e.g.*, integrity digs]) occur intermittently and sporadically in the event the crossing is unstable until mitigated.

- Reversibility: short to medium-term – vegetation may be re-established within one year of construction on gentle banks and approach slopes while revegetation of steeper approach slopes and banks may take longer than one growing season.

- Magnitude: low to medium – depending upon the amount of erosion that occurs.

- Probability: low – proven and effective industry standard mitigation measures are expected to control erosion on slopes and banks and prevent sediment from entering the watercourse.

- Confidence: high – based on data pertinent to the proposed crossing location at McQueen Creek and the professional experience of the assessment team.

Contamination of Surface Water Due to Small Spills

A spill during construction or site-specific maintenance activities could cause contamination of the surface water and would be considered to have a negative impact balance; however, with proper implementation of industry and government recommended mitigation measures, the effects can be limited. For example, during the construction of the TMX Anchor Loop Project, all fuel trucks, service trucks and pick-ups with box-mounted fuel tanks were required to carry spill prevention, containment and clean up materials. Furthermore, all hazardous material storage and oil changes, refuelling, and lubrication of industrial equipment were required to occur more than 100 m from a waterbody or watercourse except where secondary containment was provided. Spills or accidental release of potentially harmful materials (*i.e.*, oil or diesel fuel) were recorded. The Spill Contingency Plan was implemented on each spot spill and all spills were cleaned up as soon as they were discovered. During the TMX Anchor Loop Project, all spills were terrestrial, and no spills or leaks occurred in, or reached, a waterbody or watercourse (TERA 2009a).

Similar spill prevention mitigation is planned for the Project and spill prevention measures outlined in Table C7.1.3-1 and the Pipeline EPP will be followed. Fuel storage and handling practices will be monitored throughout construction of the Project to reduce spill risk. Should a leak be spotted or detected during construction of the pipeline, Trans Mountain will implement the Spill Contingency Plan. Depending on the nature and volume of a spill, the magnitude of change to water quality could vary from low to high. This residual effect is reversible in the short to medium-term and is of low probability (Table C7.1.3-3, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – a spill during construction or site-specific maintenance activities may extend beyond the narrowed pipeline corridor and evidence suggests that effect of most minor spills is localized.
- Duration: immediate – the event causing a potential reduction in surface water quality is a spill, the period of which is less than or equal to two days.
- Frequency: accidental – a spill into surface water occurs rarely over the assessment period.
- Reversibility: short to medium-term – the effects of a spill are not expected to last beyond one year, but may last longer depending on seasonal conditions and the extent and source of the spill.
- Magnitude: low to high – depending upon the volume, location and contaminant released.
- Probability: low – due to mitigation measures in place to reduce the potential for spills reaching McQueen Creek and affecting surface water quality.
- Confidence: moderate – spill location and effects of accidental spills cannot be accurately predicted.

Water Quality and Quantity Indicator – Surface Water Quantity

Alteration of Natural Drainage Patterns

With proper implementation of the industry-accepted standard mitigation practices that are proposed, disruption of surface flow patterns following construction or maintenance activities is expected to be minor through Lac du Bois Grassland Protected Area. By paralleling the existing TMPL right-of-way and Telus FOTS right-of-way and narrowing the construction right-of-way to the extent feasible through the protected area, effects to natural drainage patterns will be further reduced in support of the management objective to maintain the natural qualities and conditions of the protected area. Nevertheless, construction activities may contribute to some localized alteration of natural surface drainage patterns until trench settlement is complete. The impact balance of this potential residual effect is considered negative since it could alter or disrupt natural above ground hydrologic conditions within the protected area.

In the event that construction or maintenance activities result in changes in surface water regimes, corrective action, in consultation with the appropriate regulatory authorities, will be implemented to resolve the issue. The post-construction environmental monitoring program will identify any locations in the protected area with altered drainage patterns (*e.g.,* ponded water) and remedial work will be conducted, where warranted. Consequently, the residual effect is reversible in the short to medium-term. Some minor incidents (*e.g.*, ponding, minor flooding, erosion) are expected following construction and are considered to be within environmental standards, and therefore, of low magnitude (Table C7.1.3-3, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – although alteration of natural drainage patterns is generally confined to the disturbed portion of the construction right-of-way, potential changes in hydrology may extend beyond the pipeline right-of-way.
- Duration: short-term – the events causing alteration of natural drainage are pipeline construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year of the operations phase.
- Frequency: isolated to occasional – the events causing alteration of natural drainage (*i.e.*, pipeline construction and maintenance activities) occur during construction and, for operations activities, intermittently and sporadically over the assessment period.
- Reversibility: short to medium-term – it may take more than one year plus adequate precipitation levels in order for the trench crown to settle and natural drainage patterns to be restored.
- Magnitude: low – the potential for minor ponding, flooding or erosion exists until the natural drainage patterns are restored.
- Probability: high – minor trench settlement or a remnant crown are likely to occur as a result of pipeline construction or site-specific maintenance activities and, consequently, are likely to affect natural drainage patterns in localized areas.
- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

Alteration of Streamflow

Trenched pipeline crossing methods (*i.e.*, isolated or open cut) have the potential to result in alterations of natural streamflow. Crossing activities may contribute to some localized alteration of watercourse bed and banks until complete and stable restoration is achieved following construction. The impact balance of this potential residual effect is considered negative since it could alter or disrupt hydrologic conditions of the watercourse. However, with proper implementation of the industry-accepted standard mitigation practices that are proposed, alteration of natural streamflow resulting from an isolated or open cut pipeline crossing of McQueen Creek is expected to be minor.

In the event that construction or maintenance activities result in alterations to watercourse hydrology, corrective action, in consultation with the appropriate regulatory authorities, will be conducted to resolve the issue. The post-construction environmental monitoring program will identify locations of altered streamflow (*e.g.,* damaged bed and banks) and remedial work will be conducted. Consequently, the residual effect is reversible in the short to medium-term. Generally, the residual effect of altered bed and banks is considered to be within environmental standards for pipeline construction and, therefore, is of low to medium magnitude (Table C7.1.3-3, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – although alteration of natural streamflow is generally confined to the disturbed portion of watercourse bed and banks, potential changes in watercourse hydrology may extend beyond the pipeline right-of-way.
- Duration: immediate to short-term – the events causing alteration of natural streamflow are pipeline construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year of the operations phase.
- Frequency: isolated to occasional – the events causing alteration of natural streamflow (*i.e.*, pipeline construction and maintenance activities) occur during construction and, for operations activities, intermittently and sporadically over the assessment period.
- Reversibility: short to medium-term – it may take more than one year to fully restore and stabilize watercourse channel and associated flow conditions.

- Magnitude: low to medium – the potential for changes to streamflow exists but experience with past projects demonstrates that proper design and remedial work will reduce effect magnitude.
- Probability: high – alteration of bed and banks from an isolated or open cut crossing of McQueen Creek will result from pipeline construction or site-specific maintenance activities and, consequently, alteration of natural streamflow is likely to occur.
- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

Water Quality and Quantity Indicator – Groundwater Quality

Elevated Turbidity in Groundwater due to Effects from Sediment Release from Blasting

Increased turbidity in groundwater may be the result of the effects from sediment release during blasting. When blasting, the turbidity results from a release of sediment particles in the formation. The turbidity will decrease as the groundwater flows through the formation. Interconnected pores through which the groundwater flows are generally smaller than silt size particles causing the silt particles to be retained in the formation close to their source. This residual effect is considered to have a negative impact balance since elevated turbidity can affect groundwater quality. The residual effect of an elevated turbidity on groundwater quality is considered to be reversible in the short-term based on previous experience; particles either settle out or cannot pass through the pore space of the sediment (Table C7.1.3-3, point 3[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – particles in the groundwater naturally settle out within the LSA.
- Duration: short-term – the event causing the potential increase in turbidity of groundwater is blasting during construction.
- Frequency: accidental – the event causing the potential increase in turbidity occurs rarely over the assessment period.
- Reversibility: short-term – turbidity of groundwater is expected to decrease in the vicinity of the blasting.
- Magnitude: medium – depending upon the volume of sediment/silt introduced during blasting and the permeability of the formation.
- Probability: low – it is unlikely that blasting will release sediment or silt.
- Confidence: moderate – based on previous experience of the assessment team.

Contamination of Groundwater as a Result of a Spill During Construction

Contamination of groundwater may result if the spilled material migrates through the developed soil near the surface through the surficial materials into the first water-bearing unit. The rate of migration is dependent upon the permeability of the materials, presence or absence of fractures, the properties of the spilled contaminant (density, viscosity) and the vertical hydraulic gradients. A spill during the construction phase of the Project is likely to be noted quickly and be of small volume, and evidence suggests that the effects of most minor spills are localized.

The impact balance of this residual effect is considered negative since this could potentially affect groundwater quality. This residual effect is unlikely to extend beyond the Water Quality and Quantity LSA; it is considered to represent a short to long-term influence on the natural groundwater and surface water systems depending upon the volume of the spill, groundwater properties and overlying material. Spills where the spilled material contaminates groundwater within the Water Quality and Quantity LSA may occur accidentally over the construction phase of the Project (Table C7.1.3-3, point 3[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – a spill during construction activities may extend beyond the narrowed pipeline corridor but based on professional experience the effects of most minor spills are localized.
- Duration: immediate – the event causing potential contamination of groundwater is a spill, the period of which is less than one day.
- Frequency: accidental – a spill into groundwater during construction is rare.
- Reversibility: short to medium-term – the effects of a spill are not expected to last beyond one year, but may last longer depending upon the extent and source of the spill.
- Magnitude: low to high – depending upon the volume, location and contaminant released.
- Probability: low – due to mitigation measures in place to reduce the potential for spills migrating into the subsurface and affecting groundwater quality.
- Confidence: moderate – spill location and effects of accidental spills cannot be accurately predicted.

Water Quality and Quantity Indicator – Groundwater Quantity

Natural Groundwater Pathways May Be Bisected and Create a Sink (Drain) for Shallow Groundwater

Excavation of the trench in areas of shallow groundwater or springs, during pipeline construction, can alter groundwater and surface water flow patterns. This may result in the trench becoming a sink. That is, both groundwater and surface water intersecting the trench will flow into the trench resulting in changed flow patterns.

The backfill of the trench around the pipeline will consist of native backfill as much as practical in order to maintain the soil/formation permeability similar to the pre-construction permeability. For example, if the trench was backfilled with a higher permeability material, the filled trench could become a preferred pathway for groundwater flow and, consequently, permanently change the natural flow pattern. Where there is concern for increased permeability, a trench breaker would be installed.

Upon backfilling the trench with native backfill, groundwater flow patterns will typically revert to their pre-construction state. Where springs are encountered, advice will be sought for the Hydrogeological or Geotechnical Resource Specialist so that cross drainage within the trench can be maintained. The impact balance of this residual effect is considered negative since groundwater flow down-gradient could temporarily decrease because flow is directed along the pipeline (Table C7.1.3-3, point 4[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge could extend beyond the Footprint and into the LSA.
- Duration: short-term – the events causing the potential alteration of groundwater flow are construction of the pipeline and maintenance activities, the latter of which are limited to any one year during operations.
- Frequency: periodic – the events causing alteration of natural groundwater flow (*i.e.,* pipeline construction and maintenance activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: short to medium-term – residual effects are expected to reverse within one year.
- Magnitude: low – the potential for changes to groundwater flow exists but experience with past projects demonstrates that proper design and remedial work will reduce the severity of the effects.
- Probability: low – although the narrowed pipeline corridor crosses areas of shallow groundwater, areas with highly permeable materials near rivers and at crossings with fluvial or colluviums substrates and

known springs, with the implementation of the mitigation measures outlined in Table C7.1.3-1, alteration of groundwater flow as a result of pipeline construction is unlikely.

- Confidence: moderate – based on previous experience of the assessment team and shallow groundwater mapping has been completed using available provincial mapping and existing well log reports.

Flooding on the Up-Gradient Side of the Pipeline May Result in Creation of Wet Zones on Ground Surface

A reduction in the permeability of materials along the groundwater flow path may result in a rise in the groundwater table to the extent that ground to surface flooding occurs. This may occur if the trench spoil is not backfilled in the correct order or soils are not properly salvaged resulting in a change in permeability of the upper trench materials and blocking of near surface groundwater flows. The impact balance of this residual effect is considered negative since this could potentially affect recharge to local streams or wetlands and create permanently wet areas. This residual effect is considered to have a short-term influence on the natural groundwater and surface water systems as long as mitigation measures are applied (Table C7.1.3-3, point 4[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge away from the Footprint could affect an area within the LSA.
- Duration: short-term – the events causing the potential alteration of groundwater flow are construction of the pipeline and maintenance activities, the latter of which are limited to any one year during operations.
- Frequency: periodic – the events causing alteration of natural groundwater flow (*i.e.,* pipeline construction and maintenance activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: short-term – the effects of pipeline trench construction are not expected to last beyond one year once the trench has been backfilled as long as mitigation measures are applied.
- Magnitude: low – the potential for changes to groundwater flow exists but professional experience demonstrates that proper design and remedial work will reduce the effect.
- Probability: low – the proper construction of the pipeline trench and native backfill will reduce the occurrence of this effect.
- Confidence: moderate – based on previous experience and on data pertinent to the Project area.

Reduction of Base Flow to Local Streams

Dewatering of the pipeline trench during construction may result in lowering of the local water table which in the case of local streams may reduce the groundwater inflow (base flow) to streams. As indicated in Table C7.1.3-3 (point 4[c]), the extracted groundwater may be released to the ground or directly into a nearby stream in which case there would be minimal disruption of flow in the stream. The impact balance of this residual effect is considered negative due to the potential decrease of groundwater flow into local streams. This residual effect likely will not extend beyond the Water Quality and Quantity LSA to the watershed level, and, it is considered to represent a short-term influence on the natural groundwater and surface water systems (Table C7.1.3-3, point 4[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge away from the Footprint could affect an area within the LSA.

- Duration: short-term – the events causing the reduction in baseflow are the result of discharge during dewatering and occur while the trench is being constructed (either for pipeline installation or for pipeline daylighting during integrity digs).
- Frequency: periodic – the events causing alteration of natural groundwater flow (*i.e.,* pipeline construction and maintenance activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: short-term – the effects of pipeline trench construction are not expected to last beyond one year once the trench has been backfilled.
- Magnitude: low – the potential for changes to groundwater flow exists but professional experience demonstrates that proper design and remedial work will reduce effect magnitude.
- Probability: low – the proper construction of the pipeline trench and the use of native backfill will reduce the occurrence of this effect.
- Confidence: moderate – based on previous experience and on data pertinent to the Project area.

Reduction of Water Quantity if Blasting Damages the Well or the Surrounding Formation

A reduction in water quantity may occur if blasting closes or clogs fractures supplying an existing water well. Based on previous experience, this condition is unlikely to occur, although blasting or the movement of heavy equipment in the vicinity of a well may damage a well casing or cause collapse of a borehole.

The impact balance of this residual effect is considered negative since this could potentially affect the water supply to the wellbore. This residual effect is unlikely to extend beyond the Water Quality and Quantity LSA to the watershed level. It is considered to represent a short-term influence on the natural groundwater and surface water systems. In the case of a water supply well, should a well be damaged as a result of construction activities, Trans Mountain will re-establish or replace the potable water supply. Blasting activities where the integrity of the water well is affected within the Water Quality and Quantity LSA would accidentally occur over the construction phase of the Project (Table C7.1.3-3, point 4[d]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, it is unlikely that blasting activities would affect an area extending more than 300 m from the corridor.
- Duration: immediate – the event causing this effect is blasting which occurs over a period of less than or equal to two days.
- Frequency: accidental – a reduction in well water quantity as a result of blasting occurs rarely over the assessment period.
- Reversibility: short-term – once either the well has been damaged or the formation fractures have been closed or clogged, it is unlikely that they will re-open without outside influence. However, repair or replacement of the water supply well will ensure this effect is reversible.
- Magnitude: low to medium – the potential for well damage or changes to fracture systems as a result of blasting exists but experience with past projects demonstrates that proper design will reduce the magnitude of the effect.
- Probability: low – past experience indicates that this effect, although possible, occurs relatively rarely.
- Confidence: moderate – based on previous experience.

Enhancement of Water Quantity if Blasting Opens or Unclogs Fractures Supplying Existing Water Well

An increase in water quantity may occur if blasting opens or unclogs fractures supplying an existing water well. The blasting, if in proximity to a water well, may further prop open fractures increasing the amount of groundwater flow through the fractures. Blasting, if it occurs sufficiently close to the water well, may also loosen formation particles and scale (from well infrastructure) in the wellbore resulting in temporary increased turbidity of the water. In addition, damage to the well screen and casing may occur as a result of the blasting.

The impact balance of this residual effect may be considered negative since this could potentially increase the water supply or yield of the well at the expense of well integrity and well water quality. This residual effect is unlikely to extend beyond the Water Quality and Quantity LSA. It is considered to represent a short-term influence on the natural groundwater and surface water systems. Blasting activities resulting in enhanced water quantity within the Water Quality and Quantity LSA may occur accidentally during the construction phase of the Project. Blasting as well as the movement of heavy equipment should be conducted 100 m (non-explosives) to 200 m (explosives) away from existing water wells (Table C7.1.3-3, point 4[e]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA - depending upon the site-specific conditions, it is unlikely that blasting activities would affect an area extending more than 300 m from the narrowed pipeline corridor.
- Duration: immediate – the event causing this effect is blasting which lasts less than one day.
- Frequency: accidental – an increase in water quantity as a result of blasting occurs rarely over the assessment period.
- Reversibility: short-term – once fractures have been opened or unclogged they may remain open; however, the groundwater flow in a large scale will be unaffected and the well water supply may return to the pre-blasting balance.
- Magnitude: negligible – the potential for changes to fracture systems as a result of blasting exists but experience with past projects demonstrates that proper design will reduce effect magnitude as mentioned above.
- Probability: low – this is unlikely to occur if proper precautions are taken during blasting operations.
- Confidence: moderate – based on previous experience.

7.1.3.3 Summary

As identified in Table C7.1.3-3, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on water quality and quantity indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Lac du Bois Grasslands Protected Area related to water quality and quantity will be not significant.

7.1.4 Air Emissions

This subsection describes the potential Project effects on air emissions in Lac du Bois Grasslands Protected Area. The Air Quality RSA consists of a 5 km wide band generally extending from the Footprint (*e.g.*, 2.5 km on both sides of the Footprint); shown on Figure 6.2.2-5 of the Draft Stage 2 Detailed Proposal.

All air quality indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; however, only primary emissions of CACs was determined to interact with pipeline construction and operations in Lac du Bois Grasslands Protected Area. Formation of secondary ozone and emissions which have the potential to cause nuisance odours are associated with facilities, and since there are no Project facilities in Lac du Bois Grasslands Protected Area, these indicators do not interact with pipeline construction and operations.

7.1.4.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on air emissions indicators are listed in Table C7.1.4-1.

A summary of mitigation measures is provided in Table C7.1.4-1 was principally developed in accordance with industry accepted best practices and accepted pipeline construction methods for construction-related activities.

TABLE C7.1.4-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON AIR EMISSIONS

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Air Emissions Indicator – Primary Emissions of Criteria Air Contaminants and Volatile Organic Compounds			
1.1 Project contribution to emissions	RSA	• Restrict the duration that vehicles and equipment are allowed to sit and idle to less than one hour, unless air temperatures are less than 0°C [Section 7.0]. • Ensure equipment is well-maintained during construction to minimize air emissions [Section 7.0]. • Use multi-passenger vehicles for the transportation of crews to and from the job sites, where feasible [Section 7.0].	• Increase in air emissions during construction. • Increase in air emissions during site-specific maintenance and inspection activities.
1.2 Dust and smoke during construction	RSA	• Conduct burning in accordance with burning permit requirements and A Smoke Management Framework for British Columbia, as applicable. Comply with local government bylaws, the *Forest*, *Open Burning Smoke Control Regulation* (BC) and the *Forest Fire Prevention and Suppression Regulation* (BC) when burning slash [Section 7.0]. • Limit smoke production during slash disposal by limiting pile size, reducing fuel moisture content, maintenance of loose burning piles free of soil and by using burning sloops or large capacity shredders [Section 7.1]. • Permit burning only when conditions exist that allow for adequate dispersion of smoke so that high concentrations of smoke do not locally affect human health or wildlife. Avoid burning when temperature inversions are present or predicted [Section 8.1]. Water down construction sites and access roads, when warranted, as directed by Trans Mountain, to reduce or avoid the potential for dust emissions [Section 8.2].	• Increase in fugitive dust and smoke during construction.

Notes: 1 RSA = Air Quality RSA.

2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.4.2 Significance Evaluation of Potential Residual Effects

Table C7.1.4-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Lac du Bois Grassland Protected Area on the air emissions. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE C7.1.4-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON AIR EMISSIONS FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1. Air Emissions Indicator – Primary Emissions of Criteria Air Contaminants and Volatile Organic Compounds									
1(a) Increase in air emissions during construction.	Negative	RSA	Short-term	Isolated	Short-term	Medium	High	Moderate	Not significant
1(b) Increase in air emissions during site-specific inspection and maintenance activities.	Negative	RSA	Short-term	Periodic	Short-term	Low	High	Moderate	Not significant
1(c) Increase in fugitive dust and smoke during construction.	Negative	RSA	Short-term	Isolated	Short-term	Medium	High	Moderate	Not significant

Notes: 1 RSA = Air Quality RSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Air Emissions Indicator – Primary Emissions of Criteria Air Contaminants (CACs) and Volatile Organic Compounds (VOCs)

Increase in Air Emissions During Construction

The primary sources of air emissions during construction will be from fuel combustion while transporting crews to and from the work site and along the narrowed pipeline corridor, as well as from the operation of heavy equipment required for construction. Implementation of accepted pipeline construction methods as outlined in Table C7.1.4-1 is the preferred approach to reducing air emissions from pipeline construction.

The amount of CAC and VOC emissions associated with construction activities will be reduced by using multi-passenger vehicles for the transportation of crews to and from the job sites, to the extent feasible, as well as using well-maintained equipment. The residual effects of increased air emissions during construction are considered to have a negative impact balance, but they are expected to dissipate within the Air Quality RSA. Ambient concentrations of CAC and VOC are expected to be within provincial objectives and standards (BC MOE 2013b) and, therefore, of medium magnitude. Air emissions resulting from construction activities are considered to be reversible in the short-term (Table C7.1.4-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Air Quality RSA – potential increases in air emissions resulting from construction activities will dissipate within the Air Quality RSA.
- Duration: short-term – the event resulting in increased air emissions is construction of the pipeline.
- Frequency: isolated – the event resulting in increases in air emissions (*i.e.*, construction of the pipeline) is confined to a specific period.
- Reversibility: short-term – the residual effects are expected to reverse within less than one year for all contaminants after completion of construction.
- Magnitude: medium – an increase in air emissions will occur and may approach but are not expected to exceed environmental or regulatory standards; the increase will be short-lived and localized to the construction area.
- Probability: high – the equipment and vehicles used for construction will emit air contaminants.

- Confidence: moderate – based on a good understanding of the cause-effect relationship but reliant on vehicle and equipment estimates from previous projects.

Increase in Air Emissions During Site-Specific Inspection and Maintenance Activities

The primary sources of air emissions during operations will be from fuel combustion while transporting crews to and from the narrowed pipeline corridor during site-specific maintenance activities. Aerial patrols along the pipeline segments are unlikely to cause measurable increases of near-surface ambient CAC concentrations above background levels. Furthermore, it was assumed that the current frequency and duration of aerial patrols will be sufficient to serve the pipeline expansion associated with the Project.

The amount of air emissions associated with site-specific maintenance activities will be reduced by using multi-passenger vehicles for the transportation of crews to and from the job sites, to the extent feasible, as well as using well-maintained equipment. The residual effects of increased air emissions during site-specific maintenance activities are considered to have a negative impact balance. However, they are expected to dissipate within the Air Quality RSA and be well within provincial objectives and standards (BC MOE 2013b) and, therefore, will be of low magnitude. Air emissions resulting from site-specific inspections and maintenance activities are considered to be reversible in the short-term (Table C7.1.4-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Air Quality RSA – potential increases in air emissions resulting from site-specific maintenance activities (*e.g.*, vegetation management, integrity digs) will dissipate within the Air Quality RSA.
- Duration: short-term – the events resulting in increases in air emissions, are individual maintenance activities (*e.g.*, vegetation management, integrity digs) and each maintenance event will be completed within one year.
- Frequency: periodic – maintenance and operations-related activities (*e.g.*, vegetation management, integrity digs) will occur intermittently but repeatedly over the assessment period.
- Reversibility: short-term – the residual effects are expected to reverse within less than one year for all contaminants after completion of individual maintenance activities.
- Magnitude: low – periodic increases in air emissions during site-specific maintenance will be detectable but within normal variability of existing conditions with the implementation of proposed mitigation measures.
- Probability: high – the equipment and vehicles used for site-specific activities (*e.g.*, vegetation management, integrity digs) will emit air contaminants.
- Confidence: moderate – based on a good understanding of the cause-effect relationship and from current pipeline operations in the same regions; however, detailed information on equipment and vehicle usage for site-specific activities and the duration and frequency of future aerial patrol are not available.

Increase in Fugitive Dust Smoke During Construction

Smoke will be associated with the burning of slash along discrete segments of the narrowed pipeline corridor. In accordance with applicable provincial legislation pertaining to mulching depth requirements, not all non-merchantable timber can be disposed of by mechanical means; therefore, slash burning is required. Since the maximum depth of mulch will not exceed 5 cm or will be in accordance with the applicable provincial legislation, whichever is less, any remaining vegetation and non-salvageable timber not retained for rollback will be burned. The impact balance of this potential residual effect is considered to be negative since smoke could reduce local air quality This residual effect is reversible immediately or in the short-term after cessation of burning, depending on the size of the slash piles and conditions during burning, and of medium magnitude given the anticipated volume of slash along the narrowed pipeline corridor.

Emissions of particulate matter related to earth moving activities and use of heavy equipment during pipeline construction are expected to be greater than particulate matter emissions during pipeline operation.

Fugitive dust from equipment travelling on disturbed soil can be a major dust contributor during dry periods. An increase in dust on unpaved access roads will be confined to construction and reclamation activities completed during relatively dry, non-frozen conditions. Implementing accepted pipeline construction methods as outlined in Table C7.1.4-1 is the preferred approach to reducing air emissions from pipeline construction.

The impact balance of this potential residual effect is considered to be negative since dust and smoke could reduce air quality. Larger particles of fugitive dust and smoke will settle out via gravitational settling within a relatively short timeframe at any given location, while finer particles might remain suspended for more than two days. Therefore, this residual effect is reversible in the short-term. With the implementation of the recommended mitigation measures provided in Table C7.1.4-1, smoke during construction will be reduced. However, under some environmental conditions, the residual effect may still approach provincial objectives and standards (BC MOE 2013b); therefore, its magnitude is rated as low (Table C7.1.4-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Air Quality RSA – potential increases in dust and smoke resulting from construction may extend beyond the Footprint and into the Air Quality RSA.
- Duration: short-term – the event resulting in increases in dust and smoke is construction of the pipeline.
- Frequency: isolated – the event resulting in increases in dust and smoke (*i.e.*, construction of the pipeline) is confined to a specific period.
- Reversibility: short-term – the effects are expected to reverse within several days once construction or the maintenance activity is complete.
- Magnitude: low – a small volume of slash along the proposed pipeline corridor within Lac du Bois Grassland Protected Area is expected, and the mitigation measures provided in Table C7.1.4-1 will reduce smoke during construction.
- Probability: high – disposal of slash by burning is planned, unpaved roads will be used to access the right-of-way.
- Confidence: moderate – based on a good understanding of the cause-effect relationship, but the quantification of smoke emissions (*e.g.*, from slash burning) is based on data from outside the Project and reliable data for slash burning in the Project data are unavailable.

7.1.4.3 Summary

As identified in Table C7.1.4-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on air emissions indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on the conservational values of Lac du Bois Grasslands Protected Area related to air emissions will be not significant.

7.1.5 Acoustic Environment

This subsection describes the potential Project effects on the acoustic environment in Lac du Bois Grasslands Protected Area. The Acoustic Environment LSA consists of a 1.5 km band on both sides of the proposed pipeline corridor (*i.e.*, for a total width of 3.15 km).

All acoustic environment indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; all indicators were determined to interact with pipeline construction and operations in Lac du Bois Grasslands Protected Area. Since blasting is proposed for Lac du Bois Grasslands Protected Area, the vibrations indicator is anticipated to interact with pipeline construction.

7.1.5.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on the acoustic environment indicator are listed in Table C7.1.5-1.

A summary of mitigation measures provided in Table C7.1.5-1 was principally developed in accordance with industry accepted best practices as well as provincial regulatory guidelines including BC MOE (2012a).

TABLE C7.1.5-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON ACOUSTIC ENVIRONMENT FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Acoustic Environment Indicator – Sound levels			
1.1 Changes in sound levels during construction	LSA	• City of Kamloops Bylaw No. 24-42 applies between 7:00 AM to 11:00 PM. • Adhere to all federal (*i.e.,* Environment Canada, Motor Vehicle Safety Act, Oil and Gas Occupational Safety and Health Regulations, Health Canada) and provincial (*i.e.,* BC Noise Control Guideline Best Practices Guideline, Worker's Compensation Act, section 7.2 of the Occupational Health and Safety Regulations [BC Reg 296/97 as amended] Section 7.2 [BC Reg. 382/2004, s.1]) guidelines and regulations and legislation for noise management [Section 7.0]. • Noise abatement and construction scheduling will be considered at noise sensitive locations (*i.e.,* where there are more park users) and during noise sensitive periods [Section 7.0]. • Schedule intermittent noise producing events to avoid, where feasible, important habitat of wildlife species at risk/sensitive species/livestock during sensitive periods, where feasible [Section 7.0]. • Enforce vehicle speed limits and inform contractor truck drivers and equipment operators that engine retarder braking in urban areas is prohibited [Section 7.0]. • Maintain equipment in good working condition and in accordance with manufacturer guidelines [Section 7.0]. • Maintain noise suppression equipment on all construction machinery and vehicles in good order [Section 7.0]. • Use only the size and power of tools necessary limit noise from power tool operations. Locate stationary equipment, such as compressors and generators located away from noise receptors, to the extent feasible, and follow applicable municipal, provincial and federal guidelines [Section 7.0].	• Increase in sound levels during construction period.
1.2 Changes in sound level during operations	LSA	• Limit helicopter inspections to weekdays only to the extent practical. • Use of off-road vehicles for inspection should be limited to weekdays if feasible. • Maintain equipment in good working condition and in accordance with manufacturer guidelines. • Maintain noise suppression equipment on all construction machinery and vehicles in good order.	• Periodic noise events due to maintenance and inspections.
2. Acoustic Environment Indicator – Vibrations			
2.1 Changes in vibrations during construction	LSA	• Noise Management Plan will limit vibrations to acceptable levels.	• Increase in airborne/ground-borne vibrations during blasting aspects of construction period.

Notes: 1 LSA = Acoustic Environment LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.5.2 Significance Evaluation of Potential Residual Effects

Table C7.1.5-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Lac du Bois Grasslands Protected Area on the acoustic environment. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE C7.1.5-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON ACOUSTIC ENVIRONMENT FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Acoustic Environment Indicator – Sound Levels									
1(a) Increase in sound levels during construction period.	Negative	LSA	Short-term	Isolated	Short-term	Low to medium	High	Moderate	Not significant
1(b) Periodic noise events due to maintenance and inspections.	Negative	LSA	Short-term	Periodic	Immediate to short-term	Negligible to medium	High	High	Not significant
2. Acoustic Environment Indicator – Sound Levels									
2(a) Increase in airborne/ground-borne vibrations during blasting aspects of construction period.	Negative	LSA	Short-term	Isolated	Immediate	Low to medium	High	Moderate	Not significant

Notes: 1 LSA = Acoustic Environment LSA.
2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Acoustic Environment Indicator – Sound levels

Increase in Sound levels during Construction

Noise arising from construction and clearing activities will occur along the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area and this residual effect is considered to have a negative impact balance. Construction and clearing are scheduled for the Q3 / Q4 of 2016 in order to cause less disruption to recreational users of Lac du Bois Grasslands Protected Area. Clearing activities scheduled for Q3 2016 will also avoid the migratory bird breeding and nesting period

The duration of the sounds experienced is dependent on the activity; each type of sound will last only for the particular phase of construction (*e.g.,* clearing, trenching, welding, and reclamation). As described in Section 2.0, construction is expected to last for approximately 1 month within Lac du Bois Grasslands Protected Area. However, within that period, the various phases of construction will occur consecutively. Given the need to transition each phase, the time for maximum activity during each phase is limited. Sound may be noticeable to transient protected area users near the construction activities due to their intermittence and depending on the stage of construction that would be occurring. This may have the potential to cause some annoyance to users due to sensory disturbance

The frequency of sound emissions during each construction phase will be isolated, as construction is cyclic and involves use of mobile equipment and intermittent use of tools. The period over which the change in noise extends is the construction period and, therefore, the residual effect is conservatively considered to be of short-term reversibility. However, as soon as construction activity stops, the sound level changes are reversed.

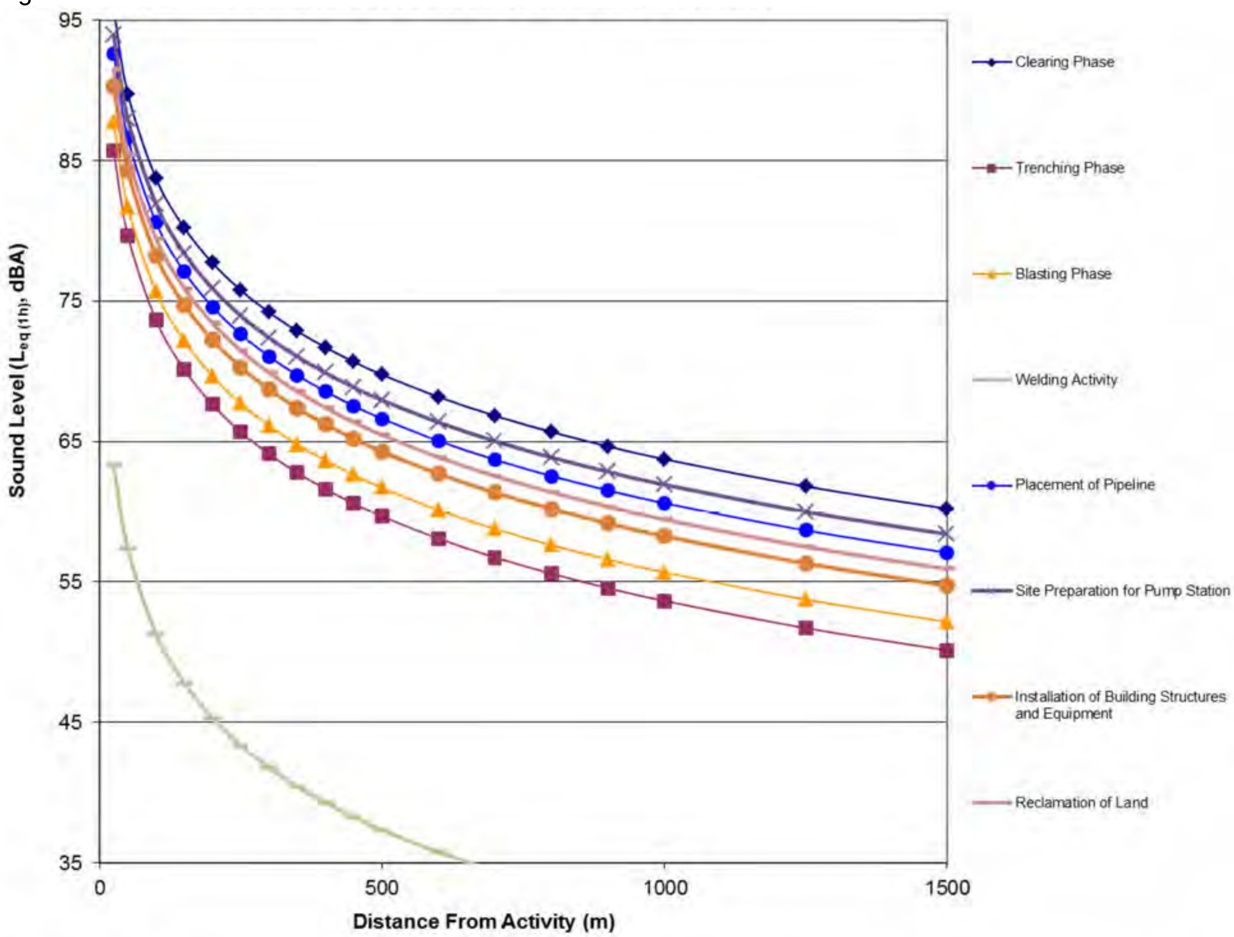
The results of predictive modelling for construction of the pipeline indicates the magnitude of changes in sound levels that will be experienced by people living within 1.5 km of the proposed pipeline corridor for a variety of construction activities. Noise controls that will be in use during the construction phase, particularly the use of silencers on mobile equipment and executing a communications plan with receptors are expected to control the amount of sound to within acceptable levels. Controlling the magnitude of sound level changes also limits the spatial extent of the potential change.

A generic model for various types of construction activities was developed, which indicates the maximum expected sound levels from an activity at various distances from that activity on an hourly basis. Given the normal variation in activity during the day for construction, actual sound levels over the full day are expected to be less, although planning for activity cycles is not conducted until later in the Project development process. The maximum hour is being compared to longer term (15 hour day) criteria as an indication of the potential for effect. The summary of results for construction activity is shown in Figure C7.1.5-1.

As shown in Figure C7.1.5-1, the magnitude of effect due to sound from Project construction varies depending on the distance between the construction activities and the surrounding receptors. As such, the evaluation of magnitude has been rated as low to medium to account for the variation in sound level between construction activities and any surrounding dwellings. Restriction to protected areas may need to occur to limit the sound level exposure to the public where required. Sounds would be noticeable to protected area users near construction activities, so annoyance regarding disturbance of the expected environment would occur when construction activities are occurring.

The types of equipment used and in turn, the sound emissions used for the assessment are similar to those used for construction of other developments such as highways or industrial protected areas. Day-long sound levels and the degree of variation in sound levels experienced from pipeline construction are expected to be similar to sounds perceived near these types of activities.

Figure C7.1.5-1 Predicted Construction Sound Level Estimates



Notes:
- Predicted noise levels account for distance attenuation (geometric spreading) only. Actual sound levels at distances greater than 300 m would be expected to be much less than those shown.
The quantity and type of each equipment used in each actvity phase is presented in the Terrestrial Noise and Vibration Technical Report (Volume 5C)

The significance evaluation of the potential residual effects of the proposed pipeline in Lac du Bois Grasslands Protected Area on the sound levels indicator. A summary of the rationale for all of the significance criteria is provided below (Table C7.1.5-2, point 1[a]).

- Spatial Boundary: Acoustic Environment LSA – compliance with the BC OGC Noise Control Best Practices Guidelines are achieved within the Acoustic Environment LSA.

- Duration: short-term – the events causing changes in sound levels will occur only during the construction phase.
- Frequency: isolated – the event causing changes in sound levels will occur only during the construction phase.
- Reversibility: short-term - the period over which the change in sound level extends is the construction period. However, all sound level changes will cease when construction activities have finished.
- Magnitude: low to medium - with the implementation of mitigation measures from Table C7.1.5-1, the changes in sound level are considered to be low to medium depending on the distance from construction activity.
- Probability: high – based on the proximity of residences to the narrowed pipeline corridor and recreational use of the protected area by park visitors.
- Confidence: high – based on the nature of data inputs.

Periodic Noise Events Due to Maintenance and Inspection

Noise from pipeline operations is limited to regular aerial and ground patrols, vegetation management and integrity digs. Sounds would be similar to those already heard in areas where the proposed pipeline corridor is adjacent to the existing TMPL right-of-way. Similar to noise during construction, noise resulting from periodic site-specific maintenance will be limited to the same receptors in close proximity to the narrowed pipeline corridor.

The spatial extent of the change in sound levels is limited to the Acoustic Environment LSA. Since maintenance activities are typically completed at any given location within a few minutes to hours (aerial patrols, vegetation management) or within several weeks (*e.g.*, integrity digs), the duration of the maintenance and inspection activities is short-term. The frequency of maintenance activities occur intermittently but repeatedly over the assessment period and, therefore, are considered to be periodic. The effect is reversible in the immediate to short-term as sound level changes due to maintenance activity will cease as soon as the maintenance activity stops.

While aerial patrols or vegetation management during operations may cause momentary sound levels to increase, the day and night average levels are not expected to change due to such short duration events. Although integrity digs may extend over several weeks, the amount and size of the equipment used during this activity is generally smaller than that used during pipeline construction. Nevertheless, the magnitude of the change in sound level during operations of the pipeline is considered to be of negligible magnitude for most operational activities and medium magnitude for integrity digs where there are no nearby human receptors. Sounds would be noticeable to protected area users near the activities, however, these would be transient sounds and annoyance is expected to be minimal for maintenance inspections. Some disturbance may occur if protected area users were near an integrity dig and the degree of annoyance would depend on the location and duration of the dig.

The inspections and maintenance are essential to safe pipeline operations so the probability of occurrence is rated as high. A summary of the rationale for all of the significance criteria is provided below (Table C7.1.5-2, point 1[b]).

- Spatial Boundary: Acoustic Environment LSA – the change in sound level during operations is confined to the Acoustic Environment LSA.
- Duration: short-term – the events causing changes in sound levels during operations (*i.e.*, maintenance activities) are completed within any one year during operations.
- Frequency: periodic – the events causing changes in sound levels during operations (*i.e.*, aerial patrols, vegetation management, integrity digs) occur intermittently but repeatedly over the assessment period.
- Reversibility: immediate to short-term – the changes in sound level associated with maintenance activities at any given location range from a few minutes to hours for aerial patrols and vegetation

management (immediate) to a few weeks for integrity digs (short-term). All sound level changes are reversible as the sound will cease when the inspection/maintenance is finished.

- Magnitude: negligible to medium – the sound level events associated with aerial patrols and vegetation management will have a short timeline, so changes to the day or night average levels are not expected. However, integrity digs that occur near residents may result in sound level changes that could affect day or night average levels.
- Probability: high – changes to sound levels will occur since inspections and maintenance are essential to safe pipeline operation.
- Confidence: high – based on experience of the assessment team.

Acoustic Environment Indicator – Vibration Levels

Increase in Airborne/Ground-Borne Vibrations During Blasting Aspects of Construction Period

The potential for the increase in vibration (airborne and ground-borne) levels for human receptors associated with increased Project construction is considered to have a negative impact balance. Based on the results of the analysis in the Terrestrial Noise and Vibration Technical Report of Volume 5C, the spatial extent of changes to vibration levels from pipeline construction are limited to a blast design specification of 50 mm/sec peak particle velocity (PPV) at the nearest structure or infrastructure within or near the proposed pipeline corridor. The duration of the vibration levels experienced at receptors is very short (dependent on size and formation of blasting pattern). The frequency of vibration emissions during construction will be limited, since it should only be used in areas that are needed and where ripping is not feasible (heavy equipment limitations, bedrock). All changes in vibration levels are immediately reversible. As soon as blasting construction activity stops, the vibration level changes are reversed.

Vibration controls that will be in use during the construction phase, limit blasting to daytime hours, vary shape and charge with respect to proximity to local receptors and executing a noise management plan are expected to limit vibration levels to within acceptable levels. Controlling the magnitude of vibration level also limits the spatial extent of the potential change.

The only variation in residual effects along the pipeline corridor is the magnitude of potential effects. The magnitude of the effect will vary depending on the distance between the blasting zone and the surrounding receptors. As the exact blasting zones have not been determined, the magnitude has been limited to a maximum of medium. This is due to the minimum setback distances required between the blast area and the general public of residences for safety and best blasting practise. Blast vibration would be noticeable to protected area users near the activities, however, annoyance is expected to be minimal for blasts due to the short duration.

Depending on the setback distances from blast to receptor the probability of occurrence may be high.

The predictive modelling used in the assessment of the acoustic environment has a level of uncertainty that is dependent on three main factors: the blasting source data; the precision of the vibration propagation model; and the accuracy of locations of blasting locations. Blasting configuration and design data were not available at this stage of the Project. Modelling was completed that uses key international standards for outdoor vibration propagation with a known uncertainty. Therefore, the confidence in the results was considered moderate. A summary of the rationale for all of the significance criteria is provided below (Table C7.1.5-2, point 2[a]).

- Spatial Boundary: Acoustic Environment LSA – effects associated with changes to vibration level extend to less than 100 m from the right-of-way in most areas, but are dependent on the location of the activity.
- Duration: short-term – the changes to vibration levels occur only during the construction phase.
- Frequency: isolated – the event causing changes to vibration levels occur only during the construction phase in which the activity is planned.

- Reversibility: immediate – the changes to vibration levels are associated with blasting activities which are anticipated to take 1 day within Lac du Bois Grassland Protected Area. All vibration level changes are reversible as the vibration will cease when construction is finished.
- Magnitude: low to medium – based on the anticipated effects at receptors, PPV at residences is expected to be less than the 50 mm/s design specification due to the blasting limit for the existing pipeline corridor and Telus FOTS right-of-way.
- Probability: high – based on the proximity of receptors to the narrowed pipeline corridor.
- Confidence: moderate – based on the nature of data inputs.

7.1.5.3 Summary

As identified in Table C7.1.5-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on the acoustic environment indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on the conservational values of Lac du Bois Grasslands Protected Area related to acoustic environment will be not significant.

7.1.6 Fish and Fish Habitat

There are no fish bearing watercourses crossed by the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area and, consequently an effects assessment was not conducted as there are no potential interactions with the fish and fish habitat indicators on the construction and operations.

7.1.7 Wetlands

This subsection describes the potential Project effects on the wetland loss or alteration in Lac du Bois Grasslands Protected Area. The Wetland LSA consists of a 300 m wide band generally from the proposed pipeline corridor (*i.e.,* 150 m on both sides of the proposed pipeline corridor centre); shown in Figure 6.2.2-5 of the Introduction of the Draft Stage 2 Detailed Proposal. The Wetland RSA includes all watersheds affected by the Project; shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal.

The measurement endpoint for the wetland loss or alteration indicator, wetland function, includes quantitative measurements of potential Project effects. Wetland function was evaluated at each wetland where ground-based field work was conducted along the narrowed pipeline corridor in 2014. The functions of wetlands crossed by the proposed pipeline corridor are reported on the premise that wetlands temporarily disturbed during construction would be revisited in the years following pipeline construction to document the progress of function returning to the wetland ecosystem and to ensure wetlands are on the trajectory of reaching pre-construction (*i.e.*, existing) conditions. Wetland functions documented during the evaluation of existing conditions (*i.e.*, pre-construction) will be compared to wetland functions observed along the reclaimed (*i.e.*, post-construction) construction right-of-way. The results of this comparison will be used to measure the effectiveness and efficiency of mitigation and reclamation measures, and provide support to the determination of loss or “no net loss” of wetland function. Details on the wetland functional categories are as follows:

- High Functional Conditions: wetlands that demonstrate many wetland functions expected for their class, with little to no anthropogenic disturbance, are high functioning wetlands. These wetlands are performing all expected wetland functions for their class (*e.g.*, vegetation and wildlife habitat function, hydrological function as well as water quality and substrate functions). Following construction, these wetlands are likely to recover to their wetland class, and no alterations to the existing wetland function qualities provided are anticipated.
- High-Moderate Functional Conditions: wetlands that demonstrate many wetland functions expected for their class, with light anthropogenic disturbance, are high-moderate functioning wetlands. These wetlands are mildly disturbed, which reduces the efficacy of the wetland to perform all wetland functions expected for the wetland class (*e.g.*, vegetation and wildlife habitat function, hydrological function as well as water quality and substrate functions). Following construction, these wetlands are likely to

recover to their wetland class, and no alterations to the existing wetland function qualities provided are anticipated.

- Low-Moderate Functional Conditions: wetlands that demonstrate some the wetland functions expected for their class, with moderate anthropogenic disturbance are low-moderate functioning wetlands. They are moderately disturbed throughout or have considerable disturbance to the wetland margins and riparian area. The disturbance reduces the efficacy of the wetland to perform wetland functions expected for the wetland class (*e.g.*, vegetation and wildlife habitat function, hydrological function as well as water quality and substrate function). Following construction, these wetlands may recover to their wetland class. However, the potential for a land use change (*e.g.*, cultivation) following construction may alter the wetland's ability to recover its wetland function qualities, which may impact the recovery trajectory.

- Low Functional Conditions: wetlands that demonstrate limited wetland functions expected for their class due to severe anthropogenic disturbance. These wetlands are severely disturbed, which impacts the efficacy of the wetland to perform wetland functions expected for the wetland class (*e.g.*, vegetation and wildlife habitat function, hydrological function as well as substrate function). Following construction, these wetlands have unlikely potential to recover to their wetland class, which will alter the type of wetland functions that were documented during existing surveys. Alternatively, these wetlands may not recover as functional wetlands (*i.e.*, necessary hydrology, soil and vegetation characteristics).

7.1.7.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on the wetland loss or alteration indicator are listed in Table C7.1.7-1.

A summary of mitigation measures is provided in Table C7.1.7-1 was principally developed in accordance with industry accepted best practices as well as industry, federal and provincial regulatory guidelines including the Federal Policy on Wetland Conservation (Environment Canada 1991), Wetland Ways (Wetland Stewardship Partnership 2009), as well as learnings from wetland post-construction environmental monitoring for previous pipeline projects (*e.g.,* Enbridge Pipelines Inc. [Enbridge] [TERA 2012bc], Kinder Morgan Canada Inc. [Kinder Morgan] [Critchley and Foote 2009, TERA 2011a,b,c,d, 2012a, 2013a,b,c] and NOVA Gas Transmission Ltd. [NOVA Gas] [TERA 2011g, 2012b]) and peer-reviewed publications on wetland function (Price *et al.* 2005, Ryder *et al.* 2005, Shem *et al.* 1993, Van Dyke *et al.* 1994).

TABLE C7.1.7-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WETLAND LOSS OR ALTERATION FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Wetland Loss or Alteration Indicator – Wetland Function			
1.1 Loss or alteration of wetlands of High Functional, High-Moderate, Low-Moderate and Low Functional Condition (*i.e.*, habitat, hydrology, biogeochemistry)	LSA	<u>Habitat</u> • Ensure that all applicable approvals, licenses and permits are in place prior to commencing applicable construction activities [Section 6.0]. • Adhere to applicable clearing guidelines for the protection of streams and wetlands provided in the Forest Practices Code, Riparian Management Area Guidebook in BC, where riparian management zones (widths) are identified based on stream or wetland class [Section 8.1]. • Fell all timber within the staked construction boundaries during survey line clearing. No fallen or leaning trees will be permitted outside of the staked construction boundaries or into watercourses/wetlands/lakes [Section 6.0]. • Protect vegetation mat from construction disturbance. Any temporary workspace (TWS) located within the boundary of a wetland must be approved by Trans Mountain's Inspector(s) [Section 7.0]. • Reduce the removal of vegetation in wetlands to the extent practical. Conduct ground level cutting, mowing or mulching or walking-down of wetland vegetation instead of grubbing. The method of removal of wetland vegetation is subject to approval by the Inspector(s) and Resource Specialist [Section 7.0]. • Narrow down the area of disturbance to the extent practical and clearly mark the area to be cleared [Section 7.0]. • Salvage flagged or fenced live trees or shrubs from the banks of wetlands if requested by the Inspector(s) or noted on the Environmental Alignment Sheets. Store salvaged trees and shrubs along the side of the construction right-of-way in a manner such that they do not dry out before replanting during reclamation [Section 7.0]. • Prohibit clearing of extra TWS within the riparian buffer, only the trench and TWS areas will be cleared. Ensure staging areas for watercourse/wetland crossing construction, grade/borrow areas for wetland ramps and spoil storage areas are located a minimum of 10 m from the banks of watercourses/wetland/lake boundaries. This distance may be reduced by the Lead Environmental Inspector and the Inspector(s) where appropriate controls are in place and where no riparian area is present (*e.g.,* disturbed lands that abut the watercourse banks or boundaries of the wetland) [Section 8.1]. • Restrict root grubbing in wet areas to avoid creation of bog holes [Section 8.1]. • Restrict root grubbing to the area located outside of the vegetated riparian buffer adjacent to watercourses, wetlands and lakes. There will be no grubbing within vegetated buffers adjacent to watercourses, wetland and lakes except along the trench line and, where warranted, at vehicle crossing areas. See additional grubbing measures in Section 8.1 of the Pipeline EPP. • Allow wetlands to recover naturally (i.e., do not seed wetland areas) [Section 8.6.3]. • Replant salvaged trees/shrubs along the disturbed riparian margins of the wetland as directed by Trans Mountain's Inspector(s) [Section 8.7.4]. • See Weed Management Plan in Appendix C of the Pipeline EPP. • See additional wetland measures in the Pipeline EPP. <u>Hydrology</u> • Install berms and/or cross ditches on approach slopes to wetlands, where warranted [Section 7.0]. • Maintain drainage across the construction right-of-way during all phases of construction [Section 7.0].	• Alteration of wetland habitat function during and following construction and maintenance activities until vegetation is re-established. • Alteration of wetland hydrological function during and following construction and maintenance activities until vegetation is re-established.

TABLE C7.1.7-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.1 Loss or alteration of wetlands of High Functional, High-Moderate, Low-Moderate and Low Functional Condition (*i.e.*, habitat, hydrology, biogeochemistry) (cont'd)	See above	• Grade away from watercourses and wetlands to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in watercourses or wetlands during grading. Keep wetland soils separate from upland soils [Section 8.2]. • Install sack trench breakers back from the edge of watercourses where the banks consist of organic material to prevent sloughing of backfill into the channel (see Trench Breaker – Watercourse/Wetland Drawing in Appendix R of the Pipeline EPP) [Section 8.4]. • Install trench breakers, where warranted, at the edge of perched wetlands to prevent the pipeline trench from acting as a drain (see Trench Breaker – Watercourse/Wetland Drawing in Appendix R of the Pipeline EPP) [Section 8.4]. • Do not dewater any wetland during isolated crossing construction [Section 8.7.4]. • Ensure that wetlands are reclaimed to their pre-construction profile. Remove all corduroy and ramps through sloughs or wetlands, in all circumstances [Section 8.4]. • Leave a trench crown during clean-up of wetlands to allow for settlement of backfilled material within the trench [Section 8.6.3]. • Re-establish surface drainage patterns in wetlands to as close to the pre-construction contours as practical during reclamation. [Section 8.6.3]. • Excavate the trench with wide pad, low-ground-pressure equipment or operate standard equipment from mats [Section 8.7.4]. • Store excavated material in a manner that does not interfere with natural drainage patterns. If necessary, haul spoil to a nearby location for storage (*e.g.,* for wet spoil that does not stack well) [Section 8.7.4]. • See additional wetland measures in the Pipeline EPP. <u>Biogeochemistry</u> • Install a temporary sediment barrier (*e.g.,* sediment fences), where warranted, to eliminate the flow of sediment from spoil piles and disturbed areas into nearby waterbodies including wetlands (see Sediment Fence Drawing in Appendix R of the Pipeline EPP) [Section 8.7.1]. • Implement the Wet/Thawed Soils Contingency Plan (see Appendix B of the Pipeline EPP) during wet/thawed soil conditions when wet or thawed soils are encountered during construction [Section 8.2]. • Avoid rutting and admixing of wetland soils during non-frozen soil conditions. Install appropriate ramps using mats (*e.g.,* swamp mats) or geotextile and spoil ramps [Section 8.7.4]. • Do not dispose of upland woody debris in mineral wetland [Section 8.1]. • Salvage the upper layer of root zone material (maximum of 0.5 m) over the trench area and retain for use in capping the trench following backfilling [Section 8.7.4]. • Use salvaged surface material or trench spoil as a containment/barrier (see Watercourse Crossing – Open Cut Method for Flowing Watercourses Drawing in Appendix R of the Pipeline EPP) if deep water is encountered and the trench area warrants isolation. Consider using spoil material from the trench line as a containment barrier where salvaged surface material is primarily composed of organic material and is likely not able to support a berm/barrier. Location to be determined by Inspector(s). Alternate dam devices such as an Aquadam or meter bags may also be used to isolate the trench area. Pump excess water from work area and trench to opposite side of berm or work ramp [Section 8.7.4]. • Pump water into stable and well-vegetated areas. Monitor discharge areas and change the hose discharge location if adequate natural filtration is no longer feasible and sedimentation could occur [Section 8.7.4]. • Backfill the trench with excavated trench spoil. Remove any excess trench spoil to an upland location approved by the appropriate regulatory authorities [Section 8.7.4].	• Alteration of wetland biogeochemical function during and following construction and maintenance activities until sedimentation is controlled and vegetation is re-established.

TABLE C7.1.7-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.1 Loss or alteration of wetlands of High Functional, High-Moderate, Low-Moderate and Low Functional Condition (*i.e.*, habitat, hydrology, biogeochemistry) (cont'd)	See above	• Replace any remaining salvaged upper soil (root zone) material over the trench area. Reclaim the wetland to as close as feasible to its pre-construction profile and ensure no permanent trench crown is left following trench crown subsidence [Section 8.7.4]. • Install temporary erosion and sediment control structures (*e.g.,* sediment fences, coir logs) immediately following the completion of backfilling lands adjacent to water crossings and wetlands where the potential for sedimentation of the watercourse or wetland exists (see Sediment Fence Drawing and Coir/Straw Log Installation Drawing in Appendix R of the Pipeline EPP) [Section 8.4]. • Maintain sediment fences in place at (non-peat) wetland boundaries, where warranted, until a vegetation cover has stabilized the adjacent construction areas [Section 7.0]. • See additional measures in the Pipeline EPP. <u>Monitoring</u> • Conduct Wetland Function Post-Construction Environmental Monitoring (PCEM) to review the recovery of wetland function within the construction right-of-way. <u>Operations</u> • Implement mitigation measures provided in this table during operations activities within a wetland.	• See above.
1.2 Contamination of wetland function (*i.e.*, habitat, hydrology, biogeochemistry) due to a spill during construction	LSA	• Bulk hazardous materials in temporary construction yards or other designated areas except for quantities required for the daily construction activities. Wastes will be stored in temporary construction yards or other designated areas and removed during final clean-up. Fuel, oil or hazardous materials required to be stored on-site will be stored within secondary containment that is to be located greater than 300 m from a watercourse, wetland or lake [Section 7.0]. • Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into waterbodies. In the event of a spill, implement the Spill Contingency Plan (see Appendix B of the Pipeline EPP) [Section 7.0]. • Do not store fuel, oil or hazardous material within 300 m of a watercourse or waterbody [Section 7.0]. • Do not wash equipment or machinery in watercourses, wetlands or lakes. Control wastewater from construction activities, such as equipment washing or cement mixing, to avoid discharge directly into any body of water [Section 7.0].	• Reduction of wetland habitat, hydrological and biogeochemical function in the event of a spill during construction (depending on the volume and type of substance spilled).

Notes: 1 LSA = Wetland LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix of this Proposal).

7.1.7.2 Site-Specific Wetland Mitigation Recommendation

Typically re-establishment of wetland vegetation will occur through natural regeneration of plant propagules located within the salvaged wetland substrate, where possible, in conjunction with a routine weed management plan (see accompanying Environmental Alignment Sheets). Following the final right-of-way determination, should any site-specific reclamation measures be required for any wetland crossed by the construction right-of-way they will be determined at that time.

7.1.7.3 Significance Evaluation of Potential Residual Effects

The quantitative analysis revealed that there are approximately 4.2 ha of wetlands located within the Wetland LSA within Lac du Bois Grasslands Protected Area. Of this, approximately 2.1 ha of wetlands are encountered by the narrowed pipeline corridor. It is estimated within the proposed pipeline corridor there are approximately 0.3 ha of wetlands with Low-Moderate Functional Condition and 1 ha of wetlands of Low Functional Condition. Table C7.1.7-2 provides a summary of the area of wetlands disturbed by the narrowed pipeline corridor within the Lac du Bois Protected Area. Based on the level of disturbance observed during the helicopter reconnaissance and representative ground-based wetland surveys within the Lac du Bois

Grasslands Protected Area, it is anticipated that the other wetlands located within the proposed pipeline corridor are of Low-Moderate and Low Functional Condition.

TABLE C7.1.7-2

PROJECT DISTURBANCE OF WETLAND FUNCTION WITHIN THE NARROWED PIPELINE CORRIDOR AND WETLAND LOCAL STUDY AREA IN LAC DU BOIS GRASSLANDS PROTECTED AREA

Total Wetland Area (Within Corridor and LSA) (ha)	Area of Wetlands within Corridor (ha)	Narrowed Pipeline Corridor (ha)[1]			
		High Functional	High-Moderate Functional	Low-Moderate Functional	Low Functional
4.2 ha	2.1 ha	--	--	0.3 ha	1 ha

Note: 1. Only wetlands where ground-based wetland surveys were conducted in 2014 were assigned a functional condition.

Table C7.1.7-3 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Lac du Bois Grasslands Protected Area on wetland loss or alteration. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE C7.1.7-3

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WETLAND LOSS OR ALTERATION FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
				Duration	Frequency	Reversibility				
1	Wetland Loss or Alteration Indicator – Wetland Function									
1(a)	Alteration of wetland habitat, hydrological and biogeochemical functions during and following construction and maintenance activities until vegetation is re-established, grade and natural flow patterns are restored and sedimentation is controlled.	Negative	LSA	Short-term	Periodic	Medium to long-term	Low	High	High	Not significant
1(b)	Reduction of wetland habitat, hydrological and biogeochemical functions in the event of a spill during construction.	Negative	LSA	Immediate	Accidental	Short to long-term	Low to high	Low	High	Not significant

Notes: 1 LSA = Wetland LSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Wetland Loss or Alteration Indicator – Wetland Function

The evaluation of wetland functional condition was used to assess the level of significance of the potential residual effects associated with the narrowed pipeline corridor. The functional conditions (*i.e.*, High Function, High-Moderate Function, Low-Moderate Function and Low Function) were determined based on the level of existing disturbance to the wetlands, the class of wetland (*i.e.*, ephemeral, seasonal, semi-permanent) and their capacity to provide certain functions on a landscape level. The evaluation of significance was based on the anticipated level of residual effect the pipeline construction and operations will have on these wetlands based on their pre-construction functional condition. Three components of wetland function (*i.e.*, wetland habitat, hydrological and biogeochemical) were used to help in this analysis.

Alteration of Wetland Habitat Function

Pipeline construction and maintenance activities within wetlands will likely result in some disruption of the function of wetlands within Lac du Bois Grasslands Protected Area, and this is considered to have a negative impact balance. Examples of potential adverse environmental effects on wetland habitat function are: potential changes in species composition; stress on plant species; interruption of wildlife movements; and fragmentation of natural habitats.

With proper construction methods and mitigation measures (*i.e.*, profile contours returned and the appropriate protection and use of the seedbank), these adverse effects can be successfully reduced. For example, Zimmerman and Wilkey (1992) monitored wetlands for effects on vegetation for 20 years post-disruption from pipeline construction. Findings of these long-term monitoring programs show that: adjacent natural wetland areas were not altered in type when the proper construction and mitigation measures were carried out (*i.e.*, wetland contours and elevations match those off the construction right-of-way); no non-native plant species invaded natural areas; and the right-of-way increased diversity.

Additional studies on the effects of pipeline construction on wetland vegetation (Shem *et al.* 1993, Van Dyke *et al.* 1994) report the following observations.

- *Wetland community effects*: at most sites, many plants from adjacent natural areas re-establish themselves on the right-of-way. Rights-of-way that have been constructed in a manner that wetland function is not lost (*e.g.,* profile contours returned and the appropriate restoration or maintenance of the seedbank through ensuring equipment arrives on-site clean and kept free of vegetative debris during construction) appear to have little effect on vegetation in the natural areas.

- *Wetland species diversity*: A greater number of wetland plants have been observed on the right-of-way than in the adjacent natural area. Rights-of-way increase the number and types of habitats in wetlands due to the growth of a variety of succession species. Although the impact balance on wetlands resulting from the disturbance created by the pipeline construction is negative (see Table C7.1.7-3), increased biodiversity is viewed positively since the plants that are regenerating on the right-of-way are native species that occur within the natural wetland habitat, and the result is that habitat function is not negatively impacted.

- *Construction and management practices*: Overall, vegetative cover on rights-of-way in wetlands in a variety of control plots (*i.e.*, various wetland types in areas throughout the US) is generally well-established within 1 to 3 years after pipeline construction when mitigation measures included returning wetland contours and elevations to pre-construction conditions. Minor differences in the final right-of-way surface elevation can strongly influence the type of vegetation that re-establishes on the right-of-way. Other examples of construction and management practices that ensure wetland vegetation will re-establish include conducting ground-level cutting, mowing or mulching of wetland vegetation instead of grubbing, directing grading away from wetlands and allowing natural recovery (*i.e.*, not seeding wetlands).

The effects of construction of a pipeline right-of-way on wetland vegetation and bird communities were investigated up to 2 years following construction by Santillo (1993). Results showed that at 2 years post-construction, wetlands were dominated by native hydrophytic graminoids. Also, in wetlands with no standing water, plant community composition and structure were found to be similar at the end of 2 years post-construction to what was observed pre-construction. Finally, results also showed that no new bird species were introduced as a result of the different habitat provided by the right-of-way after pipeline construction was conducted using appropriate mitigation measures (*e.g.,* re-establishing pre-construction contours within wetland boundary to ensure cross right-of-way drainage) that ensured seedbanks were restored on the construction right-of-way.

Increased plant diversity is discussed here as a finding of research presented in peer-reviewed available research literature (Santillo 1993, Shem *et al.* 1993, Van Dyke *et al.* 1994, Zimmerman and Wilkey 1992). The conclusion of the research was that although there was increased native plant diversity as a result of pipeline construction, the overall habitat function of the wetlands was not negatively impacted.

Increased biodiversity is viewed positively since the plants that are regenerating on the right-of-way are native wetland species, therefore, wetland habitat is not substantially altered. By opening up the canopy, plant species that generally cannot grow beneath a tree or shrub overstory will return to begin the plant succession stages and additional species will begin to inhabit the area.

Mitigation measures will be employed to reduce residual effects on wetlands within Lac du Bois Grassland Protected Area, depending on site-specific conditions and requirements (Table C7.1.7-1 and the Pipeline EPP). With the implementation of the proposed mitigation measures, the potential alteration of wetland habitat function is considered to be reversible in the medium to long-term for wetlands depending on the pre-construction vegetative cover, and of low magnitude. The proposed mitigation measures (*e.g.*, Weed Management Plan in Appendix C of the Pipeline EPP) that will be used to reduce the residual effects on wetlands within Lac du Bois Grasslands Protected Area aligns with the management objective of the protected area to maintain the natural quality and existing conditions of the protected area as the ultimate goal is to return wetlands to their pre-construction functional conditions.

Alteration of Wetland Hydrological Function

Pipeline installation or maintenance may cause potential changes to the hydrologic flow (*i.e.*, surface or groundwater flow) of a wetland by diverting water away from the wetland and/or impeding natural flow through the wetland. Excessive water diversion will result in an unnatural decrease of water flow within the wetland while flow impedance (*i.e.*, inadequate drainage) results in a more saturated wetland habitat.

Each of these alterations is an interruption to the natural hydrologic regime and is considered to have a negative impact balance. The vertical and horizontal water movements in wetlands are readily disrupted by any berm-like structure. For example, linear disturbances, such as pipelines and roads, can impound water on the upstream side of a wetland resulting in drying downstream and flooding upstream. Drying on the downslope face in treed wetlands (*e.g.,* treed swamps) can increase tree productivity, water demand and evapotranspiration, which facilitates further drying (Baisley 2012, Miller *et al. in prep.*). In mineral wetlands, this type of disturbance (*i.e.*, drying downstream) may also result in increases in productivity of drought tolerant wetland plant species (*e.g.,* grasses, some sedges and rushes) and water demand, which, similar to treed wetlands, can lead to further drying. The compounded drying can result in permanent alteration of mineral wetland hydrologic regime, overall wetland function and potentially ecosystem type (*e.g.,* treed wetland to forest or marsh to wet meadow or moist grassland) (Baisley 2012, Miller *et al. in prep.,* Sherwood 2012). On the upstream side, increased saturation from impounded water can result in the loss of trees and other woody vegetation, while allowing for the establishment of emergent vegetation in peatlands (Miller 2011) whereas in seasonal mineral wetlands, increased inundation may result in the decrease of emergent vegetation, the increase in aquatic vegetation and open water characteristics. Prolonged impoundment may potentially convert a treed wetland to an open water or marsh wetland and a more seasonal mineral wetland into a more permanent open water wetland.

The hydraulic conductivity of the wetland's substrate can also be affected by salvaging, compacting or mixing of the soil structure. In mineral wetlands, improper handling (*i.e.*, admixing, salvaged material drying) of salvaged mineral soil and wetland substrate can result in loss of salvaged material through wind erosion (*i.e.*, drying of material while stockpiled). Improper replacement of bottom soils can affect the permeability of the material (*i.e.*, permeable substrate becoming impermeable) as the result of admixing and compaction. These issues can affect a wetland’s ability to retain and slowly release flood waters to the groundwater, increase evaporative losses of stored water and limit a wetland’s storage capacity (*i.e.*, volume of water a wetland can retain). Storing salvaged material separately (*i.e.*, mineral soil separate from wetland substrate) and maintaining the moisture content can mitigate the effect of wind erosion while replacing salvaged material in the correct order (*i.e.*, mineral soil followed by wetland substrate) following construction can help to maintain bottom soil permeability, therefore, maintaining a wetland’s hydraulic conductivity capability.

Among the most important considerations for limiting disturbances to hydrological function are assuring that the reclamation of pre-construction elevations and contours are achieved (Gartman 1991), and that there will be no unnatural impedance to flow. Short-term disturbances to wetlands are expected during pipeline construction. Some alteration of hydrological function in wetlands can be expected during trenching, however, Q3 / Q4 2016 construction schedule in Lac du Bois Grassland Protected Area will reduce potential hydrologic changes since water flow is likely to be diminishing from peak levels. Surface materials at shallow depth (*i.e.*, the mineral soil) should be salvaged and stored separately from other material and sequentially replaced. This will reduce potential changes in the hydrological function of wetlands. If the construction right-of-way in the wetland is restored to its pre-construction profile and proper hydrologic throughflow is ensured by replacement of salvaged wetland substrates/upper soils, long-term effects on wetland hydrological function are not expected. Seedbank moisture regime recovery (*i.e.*, vegetation growth due to moisture), however, has proven to occur more slowly since surface material moisture levels are regulated either from vegetation removal (resulting in a wetter moisture regime than previous) or the drier conditions commonly present at wetland margins.

Standard pipeline construction and operational activities are designed to avoid circumstances that result in diversion and/or natural flow impedance of water in wetlands. With the implementation of the proposed mitigation measures, the residual effect of pipeline construction and maintenance activities on wetland hydrology is considered to be reversible in the medium to long-term and of low magnitude.

Alteration of Wetland Biogeochemical Function

Changes in wetland hydrologic regime can directly and indirectly affect wetland biogeochemical function. Directly, hydrologic regime can affect soil processes, nutrient availability and water chemistry. For example, soil decomposition rates are controlled by microbial respiration, which is affected by temperature and oxygen availability. Microbes preferentially use oxygen, however, under anaerobic, saturated conditions, the rate and type of respiration is altered (McLatchey and Reddy 1998). Additionally, the heat capacity of saturated soils is higher than that of dry soils. Therefore, decomposition rates are maintained by hydrologic regime through saturated conditions.

Impounding water flow due to linear disturbance can also directly impact wetland biogeochemistry. For example, in wetlands that receive nutrient inputs primarily from surface and groundwater sources, impeding water flow can result in nutrient delivery to downstream parts of the wetland being limited. However, recontouring and/or installing trench crown breaks may alleviate some of this nutrient stress.

Activity in or near wetlands during pipeline construction may result in an increased sediment supply and turbidity of surface waters (particularly in mineral wetlands), thereby, affecting biogeochemical function of the wetland. However, given the implementation of sedimentation control mitigation measures (*i.e.*, sediment fencing), the likelihood of alteration in this manner is reduced.

Indirectly, hydrologic regime can impact biogeochemical function by altering wetland habitat function. For example, decreases in water table position can increase tree productivity rates, which could decrease the quality of litter deposited to soil to increase nutrient turnover-times. This can change understory community composition due to nutrient and light limitations, soil processes (*e.g.,* decomposition rates), as well as further stimulating changes in wetland hydrologic regime through increased transpiration and interception by root systems (Baisley 2012, Kotowska 2012, Laiho *et al.* 2003).

Mitigation measures employed during construction and maintenance activities will reduce the residual effect. Consequently, the residual effect of pipeline construction and maintenance activities on wetland biogeochemistry is considered to be reversible in the medium to long-term and is of low magnitude.

A summary of the rationale for all of the significance criteria for all three components of wetland function (*i.e.*, habitat, hydrological and biogeochemical) is provided below (Table C7.1.7-3, point 1[a]).

- Spatial Boundary: Wetland LSA - alteration of habitat (*e.g.,* changes in vegetation species composition, stress on plant species, interruption of wildlife movements and fragmentation of natural habitats), hydrological (*e.g.,* changes in water level, impeded drainage) and biogeochemical function (*e.g.,* water quality, nutrient uptake) resulting from pipeline construction or maintenance activities may extend beyond the construction right-of-way.

- Duration: short-term – the events causing alteration of habitat, hydrological and biogeochemical function are construction of the pipeline and maintenance activities, the latter of which will be completed within any one year during the operations phase.

- Frequency: periodic - the events causing alteration of habitat, hydrological and biogeochemical function (*i.e.*, construction of the pipeline and maintenance activities) occur intermittently but repeatedly over the assessment period.

- Reversibility: medium to long-term – depending on the growth time of wetland species (medium-term) found along the narrowed pipeline corridor, the time required to reclaim pre-construction elevation and contours (medium-term) and the time for biogeochemical processes to be reclaimed (medium to long-term), the reversibility of the residual effect may take longer than one year with the possibility of being greater than 10 years.

- Magnitude: low – based on the proposed mitigation measures (*i.e.*, substrate being restored to pre-construction profile and allowing natural regeneration in wetlands) and the post-construction environmental monitoring literature demonstrates that wetlands are resilient provided habitat function is not permanently altered. If permanent loss or alteration of wetland habitat function is identified upon completion of the Wetland Function PCEM Program, Trans Mountain will consult with Environment Canada regarding potential remedial or compensatory measures to offset functional loss. However, permanent loss or alteration of wetland function is not anticipated at wetlands crossed by the proposed pipeline construction right-of-way since pipeline construction through wetlands is considered a temporary disturbance and experience indicates that residual effects on wetland function can be mitigated.

- Probability: high – the narrowed pipeline corridor crosses a number of wetlands within the Lac du Bois Grassland Protected Area and disturbances within these wetlands will likely occur during pipeline construction and site-specific maintenance activities.

- Confidence: high – based on available research literature, results of mitigation measures and post-construction environmental monitoring programs of past pipeline projects and the professional experience of the assessment team.

Effects on Wetlands from Spills During Construction

In the unlikely event of a fuel spill from equipment or a fuel truck near a wetland during construction, infiltration of fuel into surficial deposits and surface water is possible, and the effects would be considered to have a negative impact balance. The implementation of prevention measures (Table C7.1.6-1 and Pipeline EPP) is expected to mitigate small spills in wetlands. Spill mitigation is expected to result in some loss or disturbance of soil and vegetation. With the implementation of mitigation efforts, the effects of small spills on wetland function (*i.e.*, habitat, hydrological and biogeochemical) are considered to be reduced to low to high magnitude and reversible in the short to long-term (Table C7.1.7-3, point 1[b]).

- Spatial Boundary: Wetland LSA – alteration of wetland function (*i.e.*, habitat, hydrologic and biogeochemical) resulting from a spill during pipeline construction or maintenance activities may extend beyond the construction right-of-way.

- Duration: immediate – the event causing reduction of wetland function is a spill during construction, the period of which is less than or equal to two days.

- Frequency: accidental – contamination of wetlands from spills occurs rarely over the assessment period.

- Reversibility: short to long-term – depending on the volume and area affected by the spill.

- Magnitude: low to high – for potential reduction of wetland habitat, hydrological and biogeochemical functions.

- Probability: low – spills are unlikely to occur within wetlands.

- Confidence: high – based on available research literature, results of mitigation measures and post-construction environmental monitoring programs of past pipeline projects and the professional experience of the assessment team.

7.1.7.4 Summary

As identified in Table C7.1.7-3, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on wetland loss or alteration indicator of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Lac du Bois Grasslands Protected Area related to wetland loss or alteration will be not significant.

7.1.8 Vegetation

This subsection describes the potential Project effects on vegetation in Lac du Bois Grasslands Protected Area. The Vegetation LSA generally consists of a 300 m wide band from the centre of the proposed pipeline corridor (*e.g.*, 150 m on both sides of the centre of the proposed pipeline corridor); shown in Figure 6.2.2-5 of the Introduction to the Draft Stage 2 Detailed Proposal. The Vegetation RSA consists of a 2 km wide band generally from the centre of the proposed pipeline corridor centre and facilities (*e.g.*, 1,000 m on both sides of the centre of the proposed pipeline corridor); shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal.

All vegetation indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; and all of them were determined to interact with pipeline construction and operations in Lac du Bois Grasslands Protected Area.

7.1.8.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on vegetation resources are listed in Table C7.1.8-1.

A summary of mitigation measures is provided in Table C7.1.8-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines.

TABLE C7.1.8-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VEGETATION FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Vegetation Indicator – Vegetation Communities of Concern			
1.1 Loss or alteration of native vegetation	Footprint	• Confine all pre-clearing/mowing and general clearing activities within the staked/flagged construction right-of-way boundaries. Adhere to clearing/mowing restrictions associated with watercourses, wetlands, sensitive environmental features and buffer areas (at watercourse and wetland crossings). • Maintain low vegetation or vegetated ground mat within the vegetated buffer zone of wetlands, to the extent practical, by clearing only trees, walking-down low vegetation so low-lying vegetation remains intact. Limit grubbing of cleared/mowed trees/shrubs only to the trench line and work side area needed for the vehicle crossing to protect riparian areas [Section 8.1]. • Use hand clearing methods where directed by Trans Mountain's Lead Environmental Inspector and Inspector(s) to avoid or reduce disturbance to the ground surface on sensitive terrain [Section 8.1]. • Restrict root grubbing to the trench line and restrict root grubbing in wet areas to avoid creation of bog holes, minimize surface disturbance and encourage re-sprouting/natural regeneration of deciduous trees and shrubs. See additional clearing and grubbing measures in Section 8.1 of the Pipeline EPP. • Retain sod and the vegetation mat on all lands if a competent sod layer exists. In these areas, grade only where safety considerations dictate in order to reduce disturbance to sod and the vegetation mat. Grading of well-sodded lands will not be permitted on level terrain in these areas [Section 2.3.3 of Appendix C]. • Salvage topsoil in areas of equipment and vehicle travel where it is determined that soils may be prone to pulverization [Section 2.3.3 of Appendix C].	• Alteration of the composition of approximately 56.5 ha of native vegetation within Lac du Bois Grassland Protected Area.

TABLE C7.1.8-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.1 Loss or alteration of native vegetation (cont'd)	See above	• Tackify or apply water or hydromulch or pack the topsoil windrow with a sheep foot packer or other approved equipment, if the assessment by the Environmental Inspector(s) indicates that soils are likely to be prone to erosion by wind [Section 2.3.3 of Appendix C]. • Natural regeneration within wetlands is recommended, where possible, in conjunction with a routine weed management plan. Following the final right-of-way determination, should any site-specific reclamation measures be required for any wetland crossed by the construction right-of-way they will be determined at that time [Section 8.6.3]. • Determine the extent of disturbance to native grasslands (*e.g.,* compaction, rutting) and prepare the surface prior to seeding as per discussions with Trans Mountain's Lead Environmental Inspector and Inspector(s) [Section 8.6]. • Implement plant protection measures (e.g., soil mounds and berms, wind fencing and rollback) that work to minimize environmental stresses (*i.e.,* wind exposure, low soil moisture stress [desiccation]), to the extent feasible [Section 7.0 of Appendix C of Pipeline EPP]. • Seed disturbed lands with land uses that support native plant communities with native grass mixtures and rates as identified in the Reclamation Plan (Section 8.0 of the Draft Stage 2 Proposal). • Conduct native seed collection for use in revegetation efforts at the site [Section 6.0 of Appendix C]. • Use wild collected or multiplied native seed species from wild collection in consultation with the BC Parks Conservation Specialist. Conduct seeding and/or rooted stock plug installation as soon as practical following topsoil/root zone material replacement. • Conduct drill seeding of native species seed except where terrain limits drill seeding. In these situations, implement broadcast seeding methods. The locations where each seed species is to be applied will be identified on the Environmental Alignment Sheets. • For native seed, obtain the highest seed grade available. Do not accept seed lots that contain any Prohibited Noxious or Noxious weeds as identified in the Certificate of Analysis. Retain the Certificates of Analysis obtained for future documentation. The Certificates of Analysis will be presented to the BC Parks upon request [Section 8.6]. • Minimize foot traffic on newly seeded areas until grass establishment has taken place. Avoid vehicle traffic on seeded areas until the sod is re-established [Section 8.6, Section 10.0 of Appendix C]. • Plant native shrub/tree species, where warranted, depending on the site-specific objectives [Section 14.0 of Appendix C]. • Remove problem vegetation (*i.e.,* weeds or invasive species) when adjacent to or crossing a wetland and replace it with compatible, low-growing plant species that will out-compete problem vegetation [Section 14.0 of Appendix C]. • Refer to the Problem Vegetation Management Plan [Sections 14 of Appendix C] for management of non-native or invasive species. • See potential effect 3.1 of this table for mitigation regarding non-native or invasive species during construction and operations. • Monitor the effectiveness of revegetation efforts during the PCEM of the construction right-of-way. Conduct additional remedial work, where warranted.	• See above
1.2 Loss or alteration of grasslands in the BG BGC Zone	LSA	• See potential effect 1.1 of this table for mitigation regarding alteration of native vegetation. • Conduct a pre-construction weed survey and record problem vegetation (designated weeds) infestations on and immediately adjacent to the construction right-of-way [Section 6.0] [Section 14.0 of Appendix C of Pipeline EPP]. • Avoid environmentally sensitive areas, such as areas likely to have rare ecological communities. Where avoidance is impractical, develop site-specific mitigation measures in accordance with the Rare Ecological Community and Rare Plant Population Management Plan [Section 6.0 of Appendix C of Pipeline EPP].	• Some disturbance or alteration of grassland communities in the BG BGC Zone.

TABLE C7.1.8-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.2 Loss or alteration of grasslands in the BG BGC Zone (cont'd)	See above	• Avoid creating new disturbances and use of treed areas or native grasslands when selecting ancillary sites, to the extent feasible [Section 12.0]. • Consider employing appropriate salvage, propagation and transplant techniques for component species [Section 6.0 of Appendix C of Pipeline EPP]. • Retain sod and the vegetation mat on all lands if a competent sod layer exists. In these areas, grade only where safety considerations dictate in order to reduce disturbance to sod and the vegetation mat. Grading of well-sodded lands will not be permitted on level terrain [Section 8.2]. • Minimize trench width on native grasslands during trenching, to the extent feasible, in order to limit spoil storage requirements and sod disturbance [Section 8.3]. • Reduce the topsoil/root zone material salvage width at localized sensitive areas as shown on the Environmental Alignment Sheets or as directed by the Lead Environmental Inspector and Inspector(s) [Section 8.2]. • Salvage a blade width of topsoil/root zone material centered over the trench at locations indicated on the Environmental Alignment Sheets. Disc well-sodded lands prior to topsoil/root zone material salvage in order to facilitate topsoil salvage operations [Section 8.2]. • Backfill the trench as soon as practical [Section 8.4]. • Tackify or apply water or hydromulch or pack the topsoil windrow with a sheep foot packer or other approved equipment, if the assessment by the Environmental Inspector(s) indicates that soils are likely to be prone to erosion by wind [Section 2.3.3 of Appendix C]. • Employ a subsoiler plow (e.g., Paratiller) along segments of the construction right-of-way adjacent to the ditchline where topsoil salvage did not occur and subsoil compaction is severe. Do not use a subsoiler plow on native grasslands [Section 8.6]. • Avoid scalping of the vegetation mat/sod layer during topsoil/root zone material replacement on cleared/ungrubbed riparian vegetation, native grasslands. Use specialized equipment (*e.g.,* clean-up bucket) that limits the risk of scalping during the final pass of topsoil/root zone material replacement and is approved by Trans Mountain's Inspector(s) [Section 8.6]. • Determine the extent of disturbance to native grasslands (*e.g.,* compaction, rutting) and prepare the surface prior to seeding as per discussions with Trans Mountain's Lead Environmental Inspector and Inspector(s) [Section 8.6]. • Manage all problem vegetation along the construction right-of-way during all pipeline construction phases (*i.e.,* pre-construction, construction, post-construction environmental monitoring) and the operational phase [Section 14.0 of Appendix C of Pipeline EPP]. • Limit vehicle travel through problem vegetation infested areas [Section 14.0 of Appendix C of Pipeline EPP]. • Refer to potential effect 3.1 of this table for mitigation regarding non-native or invasive species and herbicide use during construction and operations. • Monitor the effectiveness of revegetation efforts during the post-construction environmental monitoring of the construction rights-of-way. Conduct additional remedial work, where warranted.	• See above

TABLE C7.1.8-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.3 Loss or alteration of rare ecological communities	LSA	• Conduct native seed collection for use in revegetation efforts at the site [Section 6.0 of Appendix C]. • Consider employing appropriate salvage, propagation and transplant techniques for component species [Section 6.0 of Appendix C]. • Water down construction sites and access roads, when warranted, to reduce or avoid the potential for dust emissions. Increase the frequency of watering roads and sites during periods of high risk (*e.g.,* high winds). Implement additional dust abatement measures (*e.g.,* covering topsoil windrows, installing sediment fences, applying a tackifier) will be implemented, when warranted, during clearing and construction activities. See additional measures to control dust in Section 8.2 of the Pipeline EPP. • Tackify or apply water or hydromulch or pack the topsoil windrow with a sheep foot packer or other approved equipment, if the assessment by the Environmental Inspector(s) indicates that soils are likely to be prone to erosion by wind [Section 2.3.3 of Appendix C]. • Implement plant protection measures (*e.g.,* soil mounds and berms, wind fencing and rollback) that work to minimize environmental stresses (*i.e.,* wind exposure, low soil moisture stress [desiccation]), to the extent feasible [Section 7.0 of Appendix C of Pipeline EPP]. • Implement site specific mitigation measures for rare plants and rare ecological communities as detailed in Table 4 of the Index Sheets of the accompanying Environmental Alignment Sheets. • Monitor the effectiveness of revegetation efforts during the post-construction environmental monitoring of the construction rights-of-way. Conduct additional remedial work, where warranted. • There were no rare plants or lichen species identified within the corridor during field surveys, therefore, there is no anticipated disturbance of rare plant and/or lichen occurrences.	• Some disturbance or alteration of a rare ecological community, if avoidance is not practical and mitigation measures do not completely protect a site. • If rare ecological communities are located adjacent to the construction right-of-way, they may be indirectly affected by changes in hydrology or light levels.
2. Vegetation Indicator – Plant and Lichen Species of Concern			
2.1 Loss or alteration of rare plant and/or lichen occurrences	LSA	• There was a rare plant occurrence located 52 m west of centre, adjacent to the construction right-of-way. • Flag or fence-off resource-specific environmental features (*e.g.,* rare plant species, rare ecological communities) prior to commencing construction in the vicinity of the resource site. See additional measures in the accompanying Environmental Alignment Sheets. • Install collected native seed and salvaged native plant species as detailed in the Pipeline EPP and Environmental Alignment Sheets. • Monitor effectiveness of revegetation efforts during PCEM of the construction right-of-way. Conduct additional remedial work, where warranted.	• If rare plant or lichen sub-populations are located adjacent to the construction right-of-way they may be affected by changes in dust, hydrology or light levels.
3. Vegetation Indicator – Presence of Infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern			
3.1 Weed introduction and spread	RSA	• Conduct a pre-construction weed survey and record problem vegetation (designated weeds) infestations on and immediately adjacent to construction right-of-way [Sections 6.0 and 14.0 of Appendix C]. • Implement weed management in consultation with BC Parks (*i.e.,* using proper application of chemical, mechanical or manual measures, or a combination of all) at locations identified within the pre-construction weed survey to a level that is consistent with weed management observed adjacent to the eventual construction right-of-way to reduce the potential for weed infestations following construction [Section 6.0]. Also refer to the Weed and Vegetation Management Plan [Section 14.0 of Appendix C]. • Ensure equipment arrives at all construction sites clean and free of soil or vegetative debris. Do not allow any equipment arriving in a dirty condition on site until it has been cleaned [Section 7.0]. • Power wash and misting stations will be established, where required, to clean equipment used during clearing and topsoil handling activities [Appendix F]. Shovel and compressed air cleaning stations for topsoil handling equipment will be established at selected locations to prevent the spread of weeds [Appendix J, Section 5.2].	• Weed introduction and spread.

TABLE C7.1.8-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
3.1 Weed introduction and spread (cont'd)	See above	• Restrict all vehicular traffic to the approved and staked construction right-of-way, workspace and access roads [Section 6.0]. • Monitor the topsoil and other soil piles for weed growth frequently during the growing season. Direct the contractor when warranted to take proactive measures to control weed growth [Section 7.0]. • Consider placing mats (*i.e.,* construction mats or swamp mats) over infested areas to reduce construction equipment transporting weed or plant material. Where mats are used, ensure they are free of soil, vegetation and debris prior to removing from the site [Section 7.0]. • Clean equipment (*i.e.,* shovel and sweep, pressurized water or compressed air) involved in topsoil/root zone material handling at weed-infested sites prior to leaving the location unless full right-of-way topsoil/root zone material salvage has been conducted. Clean equipment involved in topsoil handling at weed-infested sites prior to leaving the location [Section 7.0]. Consider salvaging topsoil from the full construction right-of-way during non-frozen conditions if localized weed infestations are encountered, as outlined in the Weed and Vegetation Management Plan [Section 7.0] [Section 14.0 of Appendix C of Pipeline EPP]. • Clean equipment (*i.e.,* shovel and sweep, pressurized water or compressed air) involved in topsoil/root zone material handling at weed-infested sites prior to leaving the location unless full right-of-way topsoil/root zone material salvage has been conducted. Clean equipment involved in topsoil handling at weed-infested sites prior to leaving the location [Section 7.0]. Revegetation using native blue bunch wheatgrass and/or rough fescue seed or rooted stock plugs will occur on the majority of the proposed right-of-way using a local genome if successfully collected or multiplied. In addition, native seed mixes will be used to aid in weed control and soil erosion. • For native seed, obtain the highest seed grade available. Do not accept seed lots that contain any Prohibited Noxious or Noxious weeds as identified in the Certificate of Analysis. Retain the Certificates of Analysis obtained for future documentation. The Certificates of Analysis will be presented to BC Parks upon request [Section 8.6]. • Limit vehicle travel through problem vegetation infested areas [Section 14.0 of Appendix C of the Pipeline EPP]. • The Weed and Vegetation Management Plan consists of vegetation management measures to be implemented in the short-term, during the pre-construction, construction and PCEM phases of Project construction and long-term, during regular operations and maintenance phase of the Project. Vegetation management measures to be implemented during both short-term and long-term periods in consultation with BC Parks [Section 14.0 of Appendix C of the Pipeline EPP]. • The use of herbicides for problem vegetation management along the construction right-of-way during construction and operations within the province of BC will be conducted in accordance with the Integrated Pest Management Regulation of BC as part of the BC *Integrated Pest Management Act* and in consultation with BC Parks [Section 14.0 of Appendix C of the Pipeline EPP]. • Monitor the effectiveness of revegetation efforts during the post-construction environmental monitoring of the construction rights-of-way. Conduct additional remedial work, where warranted. During regular maintenance and operations activities, incidental ground inspections for problem vegetation along the construction right-of-way may be conducted to determine the extent (percent cover, composition, distribution, location of infestations) of problem vegetation (i.e., presence of mature brush and trees, and weeds). Areas of new infestations, recommended treatment sites and BC Parks concerns will also be identified and documented during monitoring. To assist monitoring efforts, the baseline data collected during the pre-construction weed survey and the results of the PCEM Program will assist in establishing thresholds and determining if objectives of the Weed and Vegetation Management Plan are being met [Section 14.0].	• See above

Notes: 1 LSA = Vegetation LSA; RSA = Vegetation RSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of the Draft Stage 2 Detailed Proposal).

7.1.8.2 Significance Evaluation of Potential Residual Effects

Table C7.1.8-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Lac du Bois Grasslands Protected Area on vegetation. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE C7.1.8-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VEGETATION FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
				Duration	Frequency	Reversibility				
1.	Vegetation Indicator – Vegetation Communities of Concern									
1(a)	Alteration of the composition of approximately 56.5 ha of native vegetation within Lac du Bois Grassland Protected Area.	Negative	Footprint	Short-term	Periodic	Medium to long-term	Low to medium	High	High	Not significant
1(b)	Some disturbance or alteration of grassland communities in the BG BGC Zone.	Negative	LSA	Short-term	Periodic	Medium to long-term	Medium	High	High	Not significant
1(c)	Some disturbance or alteration of a rare ecological community, if avoidance is not practical and mitigation measures do not completely protect a site.	Negative	Footprint	Short-term	Periodic	Medium to long-term	Medium	High	High	Not significant
1(d)	If rare ecological communities are located adjacent to the construction right-of-way they may be indirectly affected by changes in hydrology or light levels.	Negative	LSA	Short-term	Periodic	Medium to long-term	Low	High	High	Not significant
2.	Vegetation Indicator – Plant and Lichen Species of Concern									
2(a)	If rare plant or lichen sub-populations are located adjacent to the construction right-of-way, they may be affected by changes in dust, hydrology or light levels.	Negative	LSA	Short-term	Periodic	Short to medium-term	Low	High	High	Not significant
3.	Vegetation Indicator – Presence of infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern									
3(a)	Weed introduction and spread.	Negative	RSA	Short-term	Periodic	Short to medium-term	Low to medium	High	High	Not significant

Notes: 1 LSA = Vegetation LSA; RSA = Vegetation RSA.
2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Vegetation Indicator – Alteration of Vegetation Communities of Concern

Alteration of Native Vegetation

Native bunchgrass ecosystems in BC are typically characterized by widely spaced bunchgrasses such as bluebunch wheatgrasses and rough fescue, sagebrush and other shrub species as well as early blooming plant species which are interspersed with a cryptogamic crust. Cryptogamic crust is a thin layer of lichens, mosses, algae, fungal hyphae and cyanobacteria on the soil surface.

Although some previous clearing has occurred in the Vegetation RSA for the Project, most of the vegetation communities within the Vegetation RSA in Lac du Bois Grasslands Protected Area remain intact. The Project parallels existing disturbance for its entire length within Lac du Bois Grasslands Protected Area. The narrowed pipeline corridor was routed along existing rights-of-way and other linear disturbance to the extent practical. Approximately 56.5 ha of vegetation may be disturbed or altered on the Footprint during construction and operations of the proposed pipeline.

Natural regeneration will be supported in Lac du Bois Grasslands Protected Area through the installation of locally collected native grass species to provide for the rapid establishment of vegetation cover to stabilize disturbed soils against soil erosion and provide competition to non-native invasive species infestation. Revegetation using native blue bunch wheatgrass and/or rough fescue seed or rooted stock plugs will occur on most of the proposed right-of-way using a local genome if successfully collected or multiplied. In addition, native seed mixes will be used to aid in weed control and soil erosion. Disturbed areas through native vegetation in protected areas will be seeded with the appropriate native seed mix. Although areas disturbed during construction and periodic maintenance activities will revegetate with the appropriate native species, species composition in the disturbed Footprint will be altered. Clearing of the right-of-way and temporary workspace and the maintenance of the right-of-way will result in the perpetuation of early seral vegetation in treed areas, which make up a total of approximately 480.9 ha of the RSA within Lac du Bois Grasslands Protected Area, approximately 23% of the total RSA. The hectares of treed vegetation was calculated using Terrestrial Ecosystem Mapping, which provides a conservative estimate of treed components of ecosystem polygons. The extent of altered vegetation communities will be limited by the implementation of mitigation measures outlined in Table C7.1.8-1 and in the Pipeline EPP and reclamation measures will speed the recovery.

Alteration of native vegetation due to competition for soil nutrients and moisture may occur while the Footprint is revegetating. However, the establishment of early successional communities in treed areas during reclamation and operations will resemble revegetation following natural disturbance since the species composition will favor early successional/colonial species, which are adapted for greater competition for nutrients and moisture (excepting the competition resulting from weedy non-native species).

Forb and graminoid species richness and abundance will increase over the operations phase of the Project as natural, low growing vegetation regenerates, but the Footprint will be maintained free of higher growing vegetation. During abandonment, the Footprint will be returned to an equivalent land capability compared to the pre-construction conditions.

No locally or regionally adopted threshold or standard exists against which the incremental change in vegetation composition can be assessed. This residual effect is limited to the Footprint, reversible in the medium to long-term and of low to medium magnitude (Table C7.1.8-2 point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – effects of pipeline construction and operations on the alteration of native vegetation is confined to the construction right-of-way.
- Duration: short-term – the events contributing to the alteration of native vegetation are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation management), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting alteration of native vegetation (*i.e.*, pipeline construction and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.
- Reversibility: medium to long-term – depending upon the associated land use and the growth time required for species in each affected area (*e.g.,* forb versus tree), changes to native vegetation community composition are considered reversible in the medium to long-term. The effects of the proposed pipeline on forb and graminoid species (*e.g.,* grasses, pasture sage) is expected to be reversible in the medium-term, whereas the effects on tree species (*e.g.,* Douglas-fir, ponderosa pine) are expected to be reversible in the long-term (more than 10 years) because the full right-of-way will be maintained free of higher growing vegetation until abandonment. Changes to bunchgrass communities characterized by a dominance of bunchgrass and cryptogamic crust are also expected to be reversible in the long-term due to the slower rate of recovery of some component species of the crust (Belnap 1993). Therefore, the overall alteration of the composition of vegetation along the Footprint will persist in the medium to long-term.

- Magnitude: low to medium – the narrowed pipeline corridor is located adjacent to existing disturbances for its entire length within the protected area boundaries and the construction of the pipeline will result in the clearing of approximately 56.5 ha of vegetation on the Footprint, which is considered to be within environmental standards given that best practices, objectives and provincial guidelines are being followed. Permanent loss of native vegetation is not anticipated to result from either the construction or operations of the proposed pipeline (low), however, returning the Footprint to an equivalent land capability during the abandonment phase could take years, as discussed under reversibility (medium). The indirect effects of Project construction and maintenance due to edge effects such as changes in light and moisture will be of low magnitude since they will not result in the loss of vegetation but only a localized change in vegetation community composition.

- Probability: high – the Footprint crosses native vegetation.

- Confidence: high – based on past pipeline projects and the professional experience of the assessment team.

Some Disturbance or Alteration of Grassland Communities in the BG BGC Zone

Approximately 56.5 ha of grassland is predicted to be directly disturbed or altered on the Footprint in the BG BGC zone within the protected area boundaries, while grassland communities in the Vegetation LSA may be indirectly altered during construction and operations of the proposed pipeline, which is considered to have a negative impact balance.

Areas of grassland within the Vegetation Footprint and Vegetation RSA were identified using the Biogeoclimatic Ecosystem Classification digital map available from the BC MFLNRO (2012). All areas within the BG BGC Zone (including subzone variants BGxh2 and BGxw1) were considered to be bunchgrass communities. Any bunchgrass communities intersected by the Vegetation Footprint are considered to be potentially altered. The amount of bunchgrass community intersected by the Footprint (approximately 56.5 ha) is a small component of the amount of bunchgrass community in the Vegetation RSA within the protected area boundaries (approximately 1,192.5 ha). Approximately 2.1% of bunchgrass communities in the Vegetation RSA are located on the Footprint in Lac du Bois Grasslands Protected Area.

The narrowed pipeline corridor parallels existing rights-of-way and other linear disturbances within the protected area boundaries for its entire length.

The visual effects of construction on grassland vegetation communities were raised as a concern during Kamloops ESA and Community Workshops. The mitigation measures suggested in Table C7.1.8-1 and in the Pipeline EPP take visual impact into consideration. Mitigation measures will be implemented before, during and after construction to minimize the residual effects on grassland vegetation communities. Specific mitigation to address visual effects includes:

- the trench will be backfilled as soon as practical (reducing moisture loss in the soil) (Section 8.4 of the Pipeline EPP);

- revegetation using native blue bunch wheatgrass and/or rough fescue seed or rooted stock plugs will occur on most of the proposed right-of-way using a local genome if successfully collected or multiplied;

- native seed mixes will be used to aid in weed control and soil erosion;

- seeding and/or rooted stock plug installation will be conducted as soon as practical following topsoil/root zone material replacement;

- problem vegetation will be managed along the construction right-of-way during all pipeline construction phases (*i.e.*, pre-construction, construction, post-construction environmental monitoring) and the operational phase [Section 12.0 of Appendix C of the Pipeline EPP]; and

- the effectiveness of revegetation efforts during post-construction environmental monitoring will be monitored following construction, keeping in mind visual effects.

Disturbed areas through native grassland in Lac du Bois Grasslands Protected Area will be seeded with wild collected or multiplied native seed species from wild collection. Although areas disturbed during construction and occasional maintenance activities will be allowed to revegetate with the appropriate native species, species composition in the disturbed Footprint will likely be altered. The implementation of site-specific mitigation for grassland rare ecological communities (detailed in Table 4 of the Index Sheets of the accompanying Environmental Alignment Sheets) will reduce residual effects on bunchgrass vegetation communities. The extent of altered vegetation communities will be limited by the implementation of mitigation measures outlined in Table C7.1.8-2 and the Pipeline EPP and reclamation measures will speed the recovery.

For the purposes of this assessment, the mechanisms by which alteration of grasslands communities act outside the Footprint (*i.e.*, edge effects) are assumed to vary according to factors of local vegetation and ecology. Furthermore, the indirect alteration of native vegetation has been characterized according to the proximity from existing or proposed disturbance and does not address variation in magnitude of residual effects for areas where native vegetation has been or may be indirectly altered by multiple sources of disturbance.

Alteration of grassland vegetation communities due to competition for soil nutrients and moisture may occur while the Footprint is revegetating. However, the establishment of early successional communities during reclamation will resemble revegetation following natural disturbance since the species composition will favor early successional/colonial species, which are adapted for greater competition pressure for nutrients and moisture (excepting the competition resulting from weedy non-native species). As a result, changes in competition for nutrients and moisture will not measurably contribute to the overall effect of pipeline construction on alteration of native grassland vegetation over the life of the operating pipeline.

Drill seeding (of wild collected or multiplied native seed species from wild collection) is the preferred method for revegetating the right-of-way, as prescribed in the Reclamation Plan, to facilitate the re-establishment of grassland communities. Where terrain limitations prevent the use of drill seeding broadcast seeding will be implemented. In addition, the effectiveness of bunchgrass reclamation measures will be monitored during post-construction environmental monitoring following construction.

The mitigation measures proposed above have been used successfully on other major pipeline construction projects for other sensitive vegetation communities. Following are some examples of revegetation success from other major pipeline construction projects on grassland communities.

Narrowing down of the right-of-way for sensitive communities was successfully conducted during construction at several locations on a large pipeline in the Central Alberta area (Alliance 2000a,b,c). At the South Saskatchewan River, shrubby vegetation important for wildlife was temporarily covered with geotextile pads during construction (Alliance 2000c). In addition, sensitive grasslands with thorny buffaloberry, considered important for wildlife, was ramped over during construction. The thorny buffaloberry was cut low to the ground and the root mat preserved (Alliance 2000c).

In order to protect Wilcox’s panicgrass (*Dichanthelium wilcoxianum*) (S1), a rare grass species, during construction of a pipeline project in 2001, the work site was narrowed by approximately 5 m, no grading was allowed and a blade width of sod was salvaged and placed on straw matting. The sod was then replaced and straw from the matting was then spread over the replaced sod. During post-construction environmental monitoring in 2004, approximately 3,000 plants were found (TERA 2004).

The TransCanada Keystone Pipeline Project intersected approximately 120 km of native rangeland, including lands within the Mixedgrass Natural Subregion of Alberta. A management plan was developed and implemented for the project, with the objective of establishing a positive successional trend towards plant communities present prior to construction. Second year post-construction environmental monitoring of the indicated that revegetation of desirable species continues to progress toward meeting the intent of the objective of the management plan (TransCanada Keystone Pipeline GP Ltd. 2012).

The Express Pipeline Ltd. Express Pipeline Project was approximately 435 km in length, most of which was situated in the Grassland Natural Region of Alberta. A long-term post-construction environmental monitoring project was conducted on native prairie lands along the construction right-of-way. Monitoring conducted in the 14th year following construction of the pipeline indicated that native plant communities had re-established on all monitoring sites where natural revegetation had been used (Kestrel Research Inc. and Gramineae Services Ltd. 2011).

Learnings from the TMX Anchor Loop Project (TERA 2011d, 2013b) relevant to grassland communities of concern include the following.

- Where sufficient native seed cannot be collected on or adjacent to the construction right-of-way or where the volume requirements of certain species (*i.e.*, native grass seed) exceed the capacity for native collection prior to construction, seed may be sourced from commercial seed companies and native seed collectors with documented collection locations within the same or similar Natural Subregion/BGC zone as the project reclamation site.

- Seeding of native grass species immediately following topsoil/root zone material replacement allowed for plant germination and emergence prior to soil crusting and at a time when establishing grass plants are able to compete with weed seedlings.

- Hydro-seeding with the use of a tackifier is an effective method of seeding areas with difficult access, when rapid vegetation establishment is required (aesthetic values) and where there is moderate to high risk of soil erosion due to wind or water on sloping terrain and/or erodible soils.

- Aerial seeding is an effective and efficient method of broadcast seeding the disturbed construction right-of-way where landscape features, wet soil conditions and a limited seeding window may restrict the use of other seeding methods.

- Bulldozer track packing (soil imprinting perpendicular to the slope) of the construction right-of-way during final clean-up allowed for the establishment of soil microsites that facilitated the capture of broadcast grass seed and precipitation, reduced the formation of rills from soil water erosion and promoted the establishment of vegetation cover.

- In areas of calcareous soils, treatments of compost (particularly light coverings of compost) resulted in the high vegetation cover. However, application of compost resulted in somewhat higher cover of weedy species than most other treatments evaluated. Hydroseeding was as effective at restoring native plant cover and in 70% of the hydroseeding areas studied the weed cover was less than 2%.

Application of herbicides to grassland vegetation communities during all pipeline construction phases (*i.e.*, pre-construction and construction) and operations phase (*i.e.*, post-construction environmental monitoring) could cause an alteration in the composition of the vegetation community, depending on the area, quantity and specificity of herbicide applied. However, the use of best practices in weed control and vegetation management reduces the potential for herbicide drift or effects to unintended areas or species. Vegetation management conducted by mechanical means (*i.e.*, cutting or mowing) will be favoured; if vegetation management by chemical means is the only feasible method it should be conducted with equipment that ensures the specificity of the application using park approved herbicides.

During regular maintenance and operations activities, incidental ground inspections for problem vegetation along the construction right-of-way may be conducted to determine the extent (percent cover, composition, distribution, location of infestations) of problem vegetation. Areas of new infestations, recommended treatment sites and BC Parks concerns will also be identified and documented during monitoring. To assist monitoring efforts, the baseline data collected during the pre-construction weed survey and the results of the post-construction environmental monitoring program will assist in establishing thresholds and determining if objectives of the Weed and Vegetation Management Plan are being met (Section 12.0 of Appendix C of the Pipeline EPP).

If the bunchgrass community cannot be avoided, then a narrowed strip of the bunchgrass community will be disturbed resulting in some alteration of the community, resulting in a negative impact balance. Based on the assessment of the bunchgrass vegetation communities that will be encountered during construction, the mitigation measures described above are considered to be appropriate and applicable to the Project. Consequently, the most acute and likely residual effects of pipeline construction on grassland vegetation communities are confined to the Vegetation LSA, are reversible in the medium to long-term and of medium magnitude (Table C7.1.8-2 point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Vegetation LSA – although alteration of grasslands is generally confined to the disturbed portion of the construction right-of-way, potential changes in hydrology and species composition may extend beyond the pipeline right-of-way.
- Duration: short-term – the events resulting in alteration of grassland community vegetation are construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation management), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in alteration of grassland community vegetation (*i.e.*, construction of the pipeline and maintenance activities) will occur intermittently but repeatedly during the operations phase of the Project.
- Reversibility: medium to long-term – establishing a cover of native grassland species or a cover crop species will occur over the medium-term, but greater species diversity, including the establishment of some grassland species (*i.e.*, fescue if it is present within the communities encountered or species comprising the cryptogamic crust), may occur more slowly (long-term). Weed introduction can take years of management to remediate, depending on the non-native species (*i.e.*, non-native grasses) and the specificity of the herbicide.
- Magnitude: medium – the narrowed pipeline corridor within Lac du Bois Grasslands Protected Area is located adjacent to existing disturbances to the extent practical and the construction of the pipeline will result in the clearing of approximately 56.5 ha of vegetation in the BG BGC Zone, which is approximately 11% of all bunchgrass communities in the Vegetation RSA. The Project will contribute to a combined loss or alteration of native grassland vegetation, however, there are no standards or thresholds that would otherwise indicate loss or alteration of native grassland vegetation is unacceptable given that best practices, objectives and provincial guidelines are being followed.
- Probability: high – the narrowed pipeline corridor crosses native grassland vegetation in the BG BGC Zone within the protected area boundaries.
- Confidence: high – confidence would be high based on past pipeline projects and the assessment team's understanding of the effects and mitigation.

Some Disturbance or Alteration of a Rare Ecological Community, if Avoidance is Not Practical and Mitigation Measures Do Not Completely Protect a Site

Rare plant surveys were conducted in May and July of 2014 within Lac du Bois Grasslands Protected Area, on lands where access was granted, as a component of the vegetation surveys. During the 2014 vegetation surveys, several occurences of seven BC CDC-listed rare ecological communities were observed within Lac du Bois Grasslands Protected Area.

Mitigation measures for rare ecological communities generally fall into categories of avoidance, (*e.g.,* realignment, change of work side, narrowing), reducing disturbance (*e.g.,* narrowing, adjusting workspaces, ramping/matting over) and alternative construction/reclamation techniques (*e.g.,* salvaging seed or sod, plant propagation, transplanting component species, separate root zone material salvage, delayed clearing, access management) (see Appendix C of the Pipeline EPP). These proposed mitigation measures have been used previously on other major pipeline construction projects with good success.

Learnings from the TMX Anchor Loop Project (TERA 2013b) pertinent to rare ecological communities (including wetland communities of concern) include the following.

- Natural regeneration is an effective means of revegetation in wetlands where construction disturbance is limited to the trench area and where accurate separation and replacement of trench materials is achieved.

- In wetlands, transplanting of sedge and bulrush species from local undisturbed donor sites into construction disturbed areas proved to be an effective method of revegetation as transfers established and spread within their respective habitats.

Mitigation is developed with a number of factors taken into account that include, however, are not limited to:

- component species;
- community size;
- rarity;
- construction timing;
- location of the community with respect to the proposed right-of-way;
- primary mode of component species reproduction;
- habitat and proximity of available habitat; and
- past mitigation success (of the community or similar communities).

Based on the assessment of the rare ecological communities that will be encountered during construction, the mitigation measures described above are considered to be appropriate and applicable to the Project. If mitigation measures do not completely protect the site, a disturbance or alteration of a portion of the community may occur and is considered to have a negative impact balance. For example, if a narrowed strip of a S1, S2 or S3 community will be disturbed it would result in some alteration of the community. In addition, temporarily covering of the site and implementing construction traffic restrictions may not completely protect the community. By basing mitigation on community ranking and abundance, in addition to its location on the construction right-of-way and the community type, any alteration of the local community, particularly S1 communities, will be reduced to a level such that the local community is not placed at risk. Consequently, the residual effect of pipeline construction on rare ecological communities and unique communities are of medium magnitude (Table C7.1.8-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – the potential disturbance or alteration of a rare ecological community is confined to the construction right-of-way.
- Duration: short-term – the events resulting in potential disturbance or alteration of a rare ecological community are construction of the pipeline or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in potential disturbance or alteration of a rare ecological community (*i.e.*, construction of the pipeline and maintenance activities) occur intermittently, however, repeatedly during the operations phase of the Project.
- Reversibility: medium to long-term – depending on the component species (*e.g.,* ponderosa pine and Douglas fir take years to grow to mature trees; additionally, some component species of cryptogamic crust will also take years to recover compared to common cattails or beaked sedge which can recolonize or re-establish in one growing season if the seed bank and habitat is available).
- Magnitude: medium – the potential disturbance or alteration of a rare ecological community is of medium magnitude since the effect is still within environmental standards given that best practices, objectives and provincial guidelines are being followed. Returning the footprint to an equivalent land capability and regrowth of a rare ecological community could take years, as discussed under reversibility.

- Probability: high – there are several occurrences of 7 rare ecological communities identified within the narrowed pipeline corridor during the vegetation surveys in 2014 and they may be traversed by the Footprint.
- Confidence: high – based on past pipeline projects, the professional experience of the assessment team and the results of post-construction environmental monitoring.

Indirect Effects to Rare Ecological Communities

With proper implementation of the industry-accepted standard mitigation practices that are proposed, disruption of surface flow patterns and light levels following construction or maintenance activities are expected to be minor along the narrowed pipeline corridor. However, construction and maintenance activities (*e.g.*, integrity digs) may contribute to some localized alteration of light levels and natural surface drainage patterns until trench settlement is complete and seeded vegetation has matured. The impact balance of this potential residual effect is considered negative since it could alter the moisture regime and light levels.

Indirect alteration of rare ecological communities adjacent to the Footprint may occur due to soil erosion. Some rare ecological communities may be more susceptible to erosion than others. Since the areas with greatest erosion risk will be seeded with native species, the indirect alteration of native vegetation as a result of erosion will not measurably contribute to the overall effect of pipeline construction on the alteration of rare ecological communities.

Given that indirect effects are, in part, caused by disturbance to vegetation structure associated with clearing activities, allowing disturbed areas to naturally revegetate may not alleviate indirect effects in treed areas (*e.g.,* ponderosa pine/bluebunch wheatgrass – rough fescue rare ecological communities which occur in Lac du Bois), but which make up a minor component of the RSA, where vegetation management is conducted or long-term persistence of the disturbance exists. Consequently, indirect effects to vegetation in treed areas are expected to persist until the pre-existing vegetation composition and structure is restored for the Footprint.

Alteration of native vegetation due to competition for soil nutrients and moisture may occur while the Footprint is revegetating. However, the establishment of early successional communities following construction will resemble revegetation following natural disturbance since the species composition will favor early successional/colonial species, which are adapted for greater competition pressure for nutrients and moisture (excepting the competition resulting from weedy non-native species).

The post-construction environmental monitoring program will identify any locations with altered drainage patterns (*e.g.,* ponded water) and remedial work will be conducted. Once pre-construction hydrology regimes are returned to a site, regeneration or revegetation of rare ecological communities will be more likely.

The effect of construction on adjacent rare ecological communities is deemed to have a negative impact balance. This residual effect is limited to the Vegetation LSA, reversible in the medium to long-term and of low magnitude since the narrowed pipeline corridor parallels other pipeline rights-of-way and disturbance for its entire length within the protected area boundaries (Table C7.1.8-2, point 1[d]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Vegetation LSA – although alteration of rare ecological communities is generally confined to the construction right-of-way, potential changes in hydrology and species composition may extend beyond the pipeline right-of-way.
- Duration: short-term – the events resulting in alteration of adjacent rare ecological communities are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation management), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in alteration of adjacent rare ecological communities (*i.e.*, pipeline construction and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.

- Reversibility: medium to long-term – it may take more than one year plus adequate precipitation levels in order for the trench crown to settle and natural drainage patterns to be restored, and it will take several years for vegetation in the treed areas of the grassland (*e.g.,* ponderosa pine areas) to grow back to former heights, which will prevent increased light from reaching surrounding plants in the ecological community.

- Magnitude: low – the narrowed pipeline corridor is located adjacent to existing disturbances to the extent practical and the residual effects are detectable but are still considered to be within environmental standards given that best practices, objectives and provincial guidelines are being followed.

- Probability: high – the narrowed pipeline corridor is adjacent to native vegetation with high potential to support rare ecological communities, including forested areas that will be affected by clearing vegetation during construction.

- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

Vegetation Indicator – Plant and Lichen Species of Concern

Indirect Effects to Rare Plant and Lichen Sub-Populations

During the 2014 rare plant surveys, one BC CDC-listed rare plant species was observed within Lac du Bois Protected Area, wedgescale orache (*Atriplex truncata)*. Based on the narrowed pipeline corridor the occurrence will be avoided by construction, but is located adjacent to the construction right-of-way. In the event that additional rare plant or lichen species are identified, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan (Section 7.0 of Appendix C of the Pipeline EPP). In the event that additional rare plant species are identified on or within 30 m of the construction right-of-way during construction, refer to the Rare Ecological Community and Rare Plant Population Discovery Contingency Plan (Section 7.0 of Appendix B of the Pipeline EPP).

With proper implementation of the industry-accepted standard mitigation practices that are proposed, disruption of surface flow patterns and light levels following construction or maintenance activities is expected to be minor along the narrowed pipeline corridor. However, construction activities may contribute to some localized alteration of natural surface drainage patterns until trench settlement is complete and vegetation has matured. The impact balance of this potential residual effect is considered negative since it could alter the moisture regime. In addition, dust deposition and the chemicals used to suppress dust have the potential to impact rare plants and lichens.

Indirect alteration of rare plant and lichen populations adjacent to the Project may occur due to soil erosion. Since the areas with greatest erosion risk will be seeded with native species, the indirect alteration of native vegetation as a result of erosion will not measurably contribute to the overall effect of the Project on the alteration of rare plant populations.

During construction and operations of the pipeline, vehicle traffic will increase dust deposition onto native vegetation adjacent to the Footprint which could include rare lichen populations. Use of dust suppressants has the potential to affect both plant and lichen species. During reclamation, dust due to Project traffic could also result in minor effects to rare lichens located adjacent to the right-of-way.

Alteration of native vegetation due to competition for soil nutrients and moisture may occur while the Footprint is revegetating. However, the establishment of early successional communities following construction will resemble revegetation following natural disturbance since the species composition will favor early successional/colonial species, which are adapted for greater competition pressure for nutrients and moisture (excepting the competition resulting from weedy non-native species).

Many rare species inhabit areas with specific hydrology regimes. If hydrology of an area is altered, rare plant or lichen species located adjacent to the construction right-of-way may be affected. For example, golden saxifrage requires moist but not submerged substrate to grow on. The post-construction environmental monitoring program will identify any locations with altered drainage patterns (*e.g.,* ponded water) and remedial work will be conducted. Consequently, the residual effect is reversible in the short to medium-term. This residual effect is of low magnitude since the narrowed pipeline corridor parallels other pipeline projects and disturbance for its entire length within the protected area (Table C7.1.8-2, point 2[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Vegetation LSA – although alteration of rare plant and lichen populations is generally confined to the disturbed portion of the construction right-of-way, potential changes in hydrology, dust and competition for nutrients may extend beyond the pipeline right-of-way.
- Duration: short-term – the events resulting in alteration of rare plant and lichen populations are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation management), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in alteration of rare plant and lichen populations via disruption of drainage patterns (*i.e.*, construction of the pipeline and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.
- Reversibility: short to medium-term – it may take more than one year plus adequate precipitation levels in order for the trench crown to settle and natural drainage patterns to be restored. The potential for effects from dust and dust suppressants exist until construction activities are completed.
- Magnitude: low – the narrowed pipeline corridor is located adjacent to existing disturbances to the extent practical. Residual effects are detectable, but are still considered to be within environmental standards given that best practices, objectives and provincial guidelines are being followed.
- Probability: high – one species of rare plant has been identified adjacent the narrowed pipeline corridor. The narrowed pipeline corridor crosses grassland and forested vegetation communities that provide potential habitat for rare plant and lichen species and the forested vegetation will be affected by clearing activities during construction.
- Confidence: high – based on past pipeline projects, the experience of the assessment team and the results of the rare plant surveys.

<u>Vegetation Indicator – Presence of Infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern</u>

Weed Introduction and Spread

Non-native and invasive species tend to be pioneer species with characteristics that can exploit recently disturbed ecosystems. Non-native and invasive species that occur at high densities on the landscape can exert competitive pressure on native vegetation and result in alteration of native vegetation. Weeds and non-native, invasive species were identified as a concern in both ESA and Community Workshops (*i.e.,* Kamloops).

In general, invasive species are most prevalent where the ground has been disturbed by anthropogenic activity. During the 2014 vegetation surveys, any weed species encountered were noted and their density/distribution was recorded.

Three provincially noxious species recorded: Dalmatian toadflax was present in five locations ranging in abundance from a few plants to several patches, diffuse knapweed present in two locations with abundances of a few plants and a few patches, and perennial sow-thistle recorded in a single location with several patches. Two nuisance species recorded: a single patch of lamb's-quarters in one location, and a single patch of yellow salsify (western goats beard) in one location. Some introduced pasture species were also present.

The information collected during the vegetation surveys allows for an understanding of baseline weed conditions and the magnitude of weed infestations encountered in areas supporting native vegetation along the narrowed pipeline corridor.

Mitigation measures outlined in Table C7.1.8-2 and in the Pipeline EPP are effective industry standard measures to reduce the potential for the introduction and spread of weeds. These measures will be implemented during both construction and maintenance of the Project. All problem vegetation along the construction right-of-way will be monitored during all pipeline construction phases (*i.e.,* pre-construction and construction) and the operations phase (*i.e.*, post-construction environmental monitoring) (Section 12.0 of Appendix C of the Pipeline EPP).

Experience during past pipeline construction programs has shown that, while weed infestations were encountered, the implementation of appropriate mitigation measures during construction resulted in limited weed issues (Alliance 2002, IPL 1995, Enbridge 2000, 2002, TERA 2012).

Specific learnings from the TMX Anchor Loop Project (TERA 2013b) regarding weed introduction and spread include:

- chemical and mechanical weed treatments were effective at controlling or suppressing non-native invasive broadleaf species of concern along and off the right-of-way, at temporary facilities and permanent facilities; and
- hand (manual) removal of vegetation in riparian areas (areas where chemical treatment was not allowed due to proximity to water) was effective in controlling or suppressing non-native broadleaf weeds.

In addition, the final post-construction environmental monitoring report for the TMX Anchor Loop Project indicated that after five years, the post-construction vegetation management program had effectively controlled or suppressed non-native invasive broadleaf species of concern, identified during the pre-construction survey, along the right-of-way (TERA 2013b).

The potential introduction or spread of Noxious weeds and invasive, non-native species may vary in the period required to reverse the effect depending on the land use affected and the species. Consequently, the residual effect is considered to be reversible in the short to medium-term and of low to medium magnitude (Table C7.1.8-2, point 3[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Vegetation RSA – potential weed introduction and spread resulting from pipeline construction and maintenance activities may extend beyond the Footprint and Vegetation LSA to the Vegetation RSA.
- Duration: short-term – the events resulting in potential weed introduction and spread are construction of the pipeline or site-specific maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in potential weed introduction and spread (*i.e.*, pipeline construction, operations and maintenance activities) occur during construction and intermittently, but, repeatedly over the assessment period.
- Reversibility: short to medium-term – depending on the weed species, the size/location of the weed occurrence and the associated land use.
- Magnitude: low to medium – the narrowed pipeline corridor parallels existing disturbances for its entire length within the protected area boundaries. Magnitude varies from low to medium depending on the weed or invasive plant species, affected land use and density/distribution of associated weed occurrences.
- Probability: high – pipeline construction is expected to cause some weed introduction and spread.
- Confidence: high – based on past pipeline projects, the professional experience of the assessment team and post-construction environmental monitoring results.

7.1.8.3 Summary

As identified in Table C7.1.8-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on vegetation indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on the conservational values of Lac du Bois Grasslands Protected Area relating to vegetation will be not significant.

7.1.9 Wildlife and Wildlife Habitat

This subsection describes the potential Project effects on wildlife and wildlife habitat in Lac du Bois Grasslands Protected Area. The Wildlife LSA is defined as the area within a 1 km buffer of the centre of the proposed pipeline corridor; shown in Figure 6.2.2-5 of the Introduction to the Draft Stage 2 Detailed Proposal. The Wildlife RSA is defined as the area within a 15 km buffer of the centre of the proposed pipeline corridor; shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal.

Wildlife and wildlife habitat indicators (Table 6.2.1-1 of the Introduction to the Draft Stage 2 Detailed Proposal) were considered in this evaluation and the following indicators may occur in Lac du Bois Grasslands Protected Area: moose; bats; grassland/shrub-steppe birds; early seral forest birds; riparian and wetland birds; short-eared owl; flammulated owl; Lewis's woodpecker; common nighthawk; olive-sided flycatcher; pond-dwelling amphibians; and arid habitat snakes.

7.1.9.1 Identified Potential Effects

Project construction and operational activities have the potential to affect wildlife and wildlife habitat through changes to habitat, movement and mortality risk. A summarized discussion of potential Project effects on wildlife and wildlife habitat specific to Lac du Bois Grasslands Protected Area is provided below. The potential effects associated with the construction and operations of the proposed pipeline on wildlife and wildlife habitat specific to Lac du Bois Grasslands Protected Area are listed in Table C7.1.9-1.

TABLE C7.1.9-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATION ON WILDLIFE AND WILDLIFE HABITAT FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures	Potential Residual Effect(s)
1 Change in habitat	LSA	• Refer to Table C.7.1.9-2 below: habitat loss/alteration, wildlife disturbance and attraction of wildlife during construction, mammal dens, species with special conservation status, mineral licks, bats, migratory birds, sharp-tailed grouse lek, raptor/owl nest, amphibian breeding pond, reptiles, Lewis's Woodpecker.	• Combined Project effects on wildlife and wildlife habitat in Lac du Bois Grasslands Protected Area.
2 Change in movement	LSA	• Refer to Table C.7.1.9-2 below: habitat loss/alteration, barriers to wildlife movement, wildlife disturbance and attraction of wildlife during construction, mineral licks, mammal dens, bats, migratory birds, sharp-tailed grouse lek, raptor/owl nest, amphibian breeding pond, reptiles, Lewis's Woodpecker.	
3 Increased mortality risk	LSA	• Refer to Table C.7.1.9-2 below: habitat loss/alteration, disturbance and attraction of wildlife during construction, mammal dens, species with special conservation status, bats, migratory birds, sharp-tailed grouse lek, raptor/owl nest, amphibian breeding pond, reptiles, Lewis's Woodpecker.	

Notes: 1 LSA = Wildlife LSA

Mitigation measures (as shown in the Pipeline EPP) that are particularly relevant to potential Project effects for wildlife and wildlife habitat in Lac du Bois Grasslands Protected Area are provided in Table C7.1.9-2 below. The mitigation measures were principally developed in accordance with industry accepted best practices, as well as industry and provincial regulatory guidelines.

TABLE C7.1.9-2

RECOMMENDED MITIGATION FOR WILDLIFE AND WILDLIFE HABITAT WITHIN LAC DU BOIS GRASSLANDS PROVINCIAL PARK

Concern	Recommended Mitigation[1]
Habitat Loss/Alteration	• Avoid activity during sensitive time periods for wildlife species to the extent feasible. • Share workspace with the adjacent existing TMPL right-of-way or other existing rights-of-way to reduce the construction right-of-way-width. • Do not clear timber, stumps, brush or other vegetation beyond the marked construction right-of-way boundary. • Where grading is not required, cut/mow/walk down shrubs and small diameter deciduous trees at ground level to facilitate rapid regeneration. • Implement the measures provided in Table C7.1.8-1 to reclaim disturbed habitat within the construction right-of-way. • Plant native tree seedlings and/or shrubs at select locations to be determined in the field by the Environmental Inspector, in consultation with the Wildlife Resource Specialist. • Avoid the use of pesticides (except for herbicides to control invasive plants or noxious weeds; only use as spot treatments and outside the migratory bird breeding season) (BC MOE 2012a). • Reduce the width of grubbing near watercourses, wetlands and through other wet areas to facilitate the restoration of shrub communities. • Reduce disturbance at riparian areas and or cut/mow/walk down shrubs and small diameter deciduous trees at ground level to facilitate rapid regeneration. • Limit vegetation control along the right-of-way and allow natural regeneration during the operations phase to the extent feasible. • Conduct pre-construction surveys to identify site-specific habitat features (*e.g.,* mineral licks) and implement the appropriate setbacks and/or timing windows.
Barriers to Wildlife Movement	• Conduct work as expeditiously as practical (*i.e.,* interval between front-end work activities such as grading and back-end activities such as clean-up) to reduce the length and duration of the open trench and to reduce potential barriers and hazards to wildlife. Refer to Table C2.5-1 for the length and duration of construction activities. • Locate gaps in pipe to allow wildlife movement in places that also facilitate construction such as at slope changes, crossings (*i.e.,* watercourse, road, pipeline right-of-way) and bends. Locations of gaps should coincide with gaps in spoil, slash piles and snow windrows. Locations can be determined by the Environmental Inspector. • Restore habitat connectivity by redistributing rollback over select locations on the pipeline right-of-way (e.g., where coarse woody debris occurs prior to construction), to provide cover and facilitate movement of wildlife. Specific locations are to be determined in the field by the Environmental Inspector and Wildlife Resource Specialist in discussion with provincial regulatory authorities. Avoid the use of Douglas-fir and spruce for rollback within Las du Bois Provincial Park...
Wildlife Disturbance and Attraction of Wildlife During Construction	• Schedule clearing and construction activities to avoid sensitive wildlife timing windows wherever feasible. • Minimize traffic and prohibit recreational use of all-terrain vehicles or snowmobiles by construction personnel on the pipeline right-of-way and at facilities. • Prohibit personnel from having pets on the pipeline right-of-way and at facilities. • Prohibit personnel from feeding or harassing wildlife. • Obey speed limits along access roads and the right-of-way. • Ensure that food waste and industrial waste are disposed of properly. • Report any issues related to wildlife encountered during construction and operations to the Environmental Inspector, who will report it to the appropriate regulatory authorities. • Implement the measures in the Wildlife Conflict Management Plan to prevent human/wildlife conflict and wildlife mortality (Appendix C of the Pipeline EPP).
Migratory Birds	• The migratory bird nesting period within Lac Du Bois Grasslands Protected Area is identified as the end of March to mid-August (Environment Canada 2014). • In the event that clearing or construction activities are scheduled during the migratory bird nesting period conduct nest sweeps within 7 days of activity. Use non-intrusive methods to conduct an area search for evidence of nesting (*e.g.,* presence of singing birds, territorial males, alarm calls, distraction displays). In the event an active nest is found, it will be subject to site-specific mitigation measures (*i.e.,* clearly marked protective buffer around the nest and/or non-intrusive monitoring).
Lewis's Woodpecker	• In the event that an active Lewis's woodpecker nest tree is found within or adjacent to the Project Footprint, consult with BC MFLNRO to discuss practical options and mitigation strategies. • Consider implementing the following bird conservation strategies for Lewis's woodpecker, retain cavity-bearing trees and snags as nesting habitat, initiate nest box programs in areas lacking cavities/snags, restore/expand riparian buffers (minimum 30 m and >300 m for at least 10% of stream length) where nests are found (Environment Canada 2013f). • A Mitigation Plan will be prepared for Lewis's woodpecker in consultation with BC MFLNRO.

TABLE C7.1.9-2 Cont'd

Concern	Recommended Mitigation[1]
Sharp-Tailed Grouse Lek	• Avoid activity in the area of identified sharp-tailed grouse leks from April 1 to May 31 (Surgenor pers. comm.). Activities are not recommended within 400 m of a sharp-tailed grouse lek (BC MWLAP 2004b). In the event an active sharp-tailed grouse lek is identified, consult with BC MFLNRO to discuss practical options and mitigation measures. • The clearing and construction schedule currently avoids the sensitive period of April 1 to May 31 for sharp-tailed grouse leks.
Raptor Nest	• Schedule clearing and construction activities outside of sensitive time periods for raptors. This will vary across BC (generally March to August) to the extent feasible. • In the event clearing is scheduled at a time when raptor nests will be active, in areas of suitable habitat conduct raptor nest searches prior to clearing to locate active raptor nests. In the event an active raptor nest is discovered, consult with the appropriate regulatory authorities to discuss practical options and mitigation measures. • Eagle, peregrine falcon, gyrfalcon, osprey and burrowing owl nests are protected year-round by the BC *Wildlife Act* and may not be cleared. The Guidelines for Raptor Conservation (BC MOE 2013e) provides information on sensitive breeding and nesting time periods and buffers for raptor nests according to their tolerance to human disturbance. These buffers range from 50 m to 500 m depending on the surrounding land use and species. During the breeding season, an additional 100 m “quiet” buffer is recommended. Clearly mark the appropriate buffers with fencing to prevent access to the nest. • If construction is unavoidable within the recommended year-round and breeding buffers, a Nest Management Plan addressing various mitigation (including nest monitoring during the breeding period) is recommended. • If construction activities require the removal of a raptor nest that is protected year-round under the BC *Wildlife Act* (*i.e.,* eagle, peregrine falcon, gyrfalcon, osprey and burrowing owl), Trans Mountain will work with the appropriate regulatory authorities to develop a Nest Removal Management and Compensation Plan. Upon confirmation the nest is inactive, nest removal should occur during the least risk window of August through December. When a nest is removed the installation of a replacement structure (*i.e.,* a platform on a pole or transplanted tree) should be erected in nearby suitable habitat (BC MOE 2013e).
Amphibian Breeding Pond	• Clearing and construction activities have been scheduled outside of the breeding and seasonal migration periods for amphibians. In Lac Du Bois Grasslands Protected Area, this can be from mid-April to mid-June (Wind pers. comm.). Protect identified amphibian breeding ponds by implementing appropriate buffers (150 m undeveloped; 100 m rural; 30 m urban) (BC MOE 2012a). • If the proposed pipeline right-of-way is located within the recommended setback distance of an amphibian breeding pond, consult with the appropriate regulatory authorities to discuss practical options and mitigation strategies. • Apply standard wetland construction and reclamation mitigation (*e.g.,* minimal disturbance, recontouring, reclamation, monitoring and remedial measures) to support habitat reclamation as needed. • Use snow packing and mats to avoid excessive soil compaction in the proximity of wetlands and watercourses. • Maintain natural hydrology of streams and wetlands during clearing, construction and clean-up activities. • Do not mow/brush vegetation within wetland riparian (fringe) areas during operation. • Conduct an amphibian salvage prior to clearing and construction activities at known amphibian breeding pond locations. Ensure the appropriate permit is obtained.
Reptiles	• In the event an active snake hibernacula is identified, implement a 150 m buffer (BC MOE 2012a), and avoid activity during the period of April 15 to September 30 (BC MWLAP 2004b), to the extent feasible. • Consult with BC MFLNRO to determine the location and need for additional site-specific mitigation measures (*e.g.,* exclusion fencing for the open trench or along vehicle travel lanes) at identified locations (e.g., Lac du Bois Road) where there is high potential for encountering snakes (Grasslands Conservation Council of British Columbia 2009). • All workers will receive education prior to commencing work, which will include best practices for avoiding snakes and appropriate protocols in the event a snake is detected at the work site. Refer to the Wildlife Conflict Management Plan in Appendix C of the Pipeline EPP.
Bats	• Protect bat roosts from disturbance by humans and other sensory disturbances (BC MOE 2012a). Implement a 125 m buffer from bat hibernacula (from October 1 to April 30 or maternity roost (from May 1 to August 31) (BC MWLAP 2004b). Consult with BC MFLNRO where disturbance of a hibernacula or maternity roost is unavoidable to discuss practical options and mitigation strategies. • Do not blast, remove rock or talus, or construct new roads in the area surrounding a hibernacula or maternity roost unless there is no other practical option. Consult with BC MFLNRO to discuss alternate mitigation (BC MWLAP 2004b). • Schedule blasting that may occur within 1 km of Keen’s long-eared myotis maternity roosts and hibernacula, to occur outside the period from October 1 to May 31 (BC MWLAP 2004b). Consider applying this best practice to other bat species.
Mammal Dens	• Contact provincial regulatory authorities to discuss the appropriate mitigation in the event an active mammal den (*e.g.,* American badger) is discovered on or near the work site. Mitigation may include establishing protective buffers, monitoring the den and/or modifying the construction schedule to avoid activity until the den is inactive.

TABLE C7.1.9-2 Cont'd

Concern	Recommended Mitigation[1]
Mineral Licks	• Implement a 100 m setback in the event a mineral lick is identified (BC OGC 2013). In the event that shifting/narrowing the pipeline right-of-way is not feasible to maintain the minimum setback from a mineral lick, consult with BC MFLNRO to discuss practical options and mitigation strategies. • Do not block well-used game trails to/from a mineral lick. • Avoid activities (*i.e.,* clearing, construction, helicopter overflights) near mineral licks during critical periods (May to November) (BC MWLAP 2004b), to the extent feasible. • Leave a gap in set-up pipe within the area of the mineral lick to allow wildlife to access the mineral lick. The locations of the gaps in strung pipe should coincide with gaps in strippings, spoil, snow and rollback windrows.
Species with Special Conservation Status	• In the event that a species with special conservation status is observed during construction, the appropriate regulatory authorities will be contacted to determine if additional mitigation measures are warranted. • Implement the Wildlife Species of Concern Discovery Contingency Plan in the event that wildlife species of concern are identified during construction.

Note: 1 Detailed mitigation measures are outlined in Table L-2 of Appendix L in the Pipeline EPP (Appendix A of this Proposal).

7.1.9.2 Significance Evaluation of Potential Residual Effects on Wildlife and Wildlife Habitat

The assessment of the residual combined effect on wildlife and wildlife habitat in Lac du Bois Grasslands Protected Area considered all of the assessment criteria defined in Table 6.2.1-1 of the Introduction to the Draft Stage 2 Detailed Proposal. The significance determinations incorporate professional judgment, which allows integration of all of the effects criteria ratings to provide relevant significance conclusions that are sensitive to context and facilitate decision-making (Lawrence 2007).

Table C7.1.9-3 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Lac du Bois Grasslands Protected Area on wildlife and wildlife habitat. The rationale used to evaluate the significance of the combined Project effects on wildlife and wildlife habitat in Lac du Bois Grasslands Protected Area is provided below.

TABLE C7.1.9-3

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WILDLIFE AND WILDLIFE HABITAT FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1(a) Combined Project effects on wildlife and wildlife habitat in Lac du Bois Grasslands Protected Area.	Negative	LSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not Significant

Notes: 1 LSA = Wildlife LSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Change in Habitat

Lac du Bois Grasslands Protected Area comprises various habitat types that support wildlife, including complex geology, open grasslands, mixed forests containing ponderosa pine and Douglas-fir, and riparian areas (BC MOE 2013a). The Project will change the amount of available effective habitat for wildlife in Lac du Bois Grasslands Protected Area. The likely mechanisms for changes in effective wildlife habitat include vegetation clearing, sensory disturbance (*e.g.,* human activity and noise), and soil handling (including trenching). The Project will increase the existing corridor width where it parallels the existing Telus FOTS line through forested areas, disturb native grassland vegetation, affect site-specific habitat features and require ongoing clearing as part of vegetation management during operations. Habitat loss and reduced habitat effectiveness can cause displacement of wildlife, and potentially result in the use of less suitable habitat, reduced foraging ability (Bird *et al.* 2004), increased energy expenditure (Jalkotzy *et al.* 1997) and lower reproductive success (Habib *et al.* 2007).

Clearing activities during construction of the Project will alter habitat structure, and result in direct habitat loss or alteration. Operations of the Project will also require ongoing vegetation management, resulting in the maintenance of forest habitat in earlier seral stages (herbaceous and shrub stages) until the pipeline is abandoned and the disturbed areas are reclaimed. Grassland and most shrub communities are expected to regenerate relatively quickly (medium-term) following construction and reclamation, although community composition may take longer than 10 years (*i.e.*, long-term) to return to pre-construction conditions in some locations. Clearing of the construction right-of-way and temporary workspace will reduce cover habitat and temporarily reduce forage availability. As cleared areas regenerate with early seral vegetation, forage availability will increase for some species. Soil handling and construction traffic on the right-of-way have potential to alter habitat characteristics for some wildlife species such as badger, amphibians and reptiles, as a result of soil compaction or changes in soil profile.

Indirect habitat loss or alteration occurs when habitat is available but the quality or effectiveness of the habitat is changed such that wildlife avoid the habitat or reduce their use of it. Reduced habitat effectiveness can occur as a result of fragmentation, creation of edges, or sensory disturbance (*e.g.,* noise, artificial light, proximity to facilities and infrastructure, human activity and traffic). Habitat fragmentation can cause habitat to become unsuitable for species with large territories or home ranges, alter predator-prey dynamics and allow for increased invasive or parasitic species abundance (*e.g.,* cowbird parasitism of songbird nests near forest edges). Changes in habitat suitability may also result from changes in water quality (*e.g.,* sedimentation) as a result of construction activities.

To minimize vegetation clearing and reduce the fragmentation and isolation of habitat patches, the narrowed pipeline corridor parallels existing linear disturbances (*i.e.* the existing Telus Fibre optic cable and the TMPL right-of-way) within Lac du Bois Grasslands Protected Area. The proposed mitigation measures in Table C7.1.9-2 and the Pipeline EPP are expected to reduce residual Project effects on wildlife and wildlife habitat. Supplemental and pre-construction surveys will be used to inform mitigation planning. In addition, consultation with Environment Canada regarding the Project's interaction with the candidate critical habitats for American badger and Lewis's woodpecker, and an appropriate approach for mitigating effects, has been initiated and is ongoing.

Proposed candidate critical habitat for American badger and for Lewis's woodpecker occur within Lac du Bois Grasslands Protected Area (Environment Canada 2014a). American badger habitat preferences include natural grasslands, open forested sites and soil that allows for digging (Environment Canada 2014a). Lewis's woodpecker, habitat preferences include forests dominated by ponderosa pine, Douglas-fir or black cottonwood, with emphasis on recent burns or trees with advanced decay (Environment Canada 2014a). Supplemental field surveys will be completed for the Project in 2014 within the protected area, which will allow for an evaluation of the biophysical attributes of the habitat within the proposed corridor as it relates to the draft attributes of the candidate critical habitats defined by Environment Canada (2014a,b). This information will be used to inform mitigation planning.

Change in Movement

Project construction and operations can alter wildlife movement by reducing habitat connectivity and creating barriers or filters to movement. A disturbance is considered a barrier when no movement occurs across it, or a filter if the rate of movement through the disturbance is less than it would be through intact habitat (Jalkotzy *et al.* 1997). Habitat fragmentation results when barriers to movement cause functional separation of habitats into smaller, isolated habitat patches (Andrén 1994, Jalkotzy *et al.* 1997). Species that have late age of first reproduction, low population densities, low reproductive rates, large home ranges, low fecundity, and move over large distances to disperse, find food and mate, display low resilience to habitat fragmentation (Dunne and Quinn 2009).

Application of the proposed mitigation measures in Table C7.1.9-2 and the Pipeline EPP is expected to reduce the magnitude of potential residual effects of Project construction and operations on wildlife movement.

Limiting the length of open trench, and maintaining periodic gaps in soil, slash, snow and pipe, where feasible, will limit barriers to wildlife movement during construction. Results of field surveys will inform site-specific mitigation to facilitate wildlife movement during construction. Given the open habitat along the proposed corridor with the Lac du Bois Grasslands Protected Area, Project effects on wildlife movement associated with clearing vegetation are expected to be of low magnitude once activities are completed and the Footprint is reclaimed.

Increased Mortality Risk

The Project has potential to increase wildlife mortality risk during construction as a result of loss or disruption of habitat (*e.g.,* nests, dens, overwintering sites), wildlife collisions with vehicles or equipment, and sensory disturbance (*e.g.,* nest abandonment).

Project-related vegetation clearing may affect the mortality risk of some wildlife species. Pre-construction surveys will identify any site-specific habitat features (*e.g.*, active nests) that warrant additional mitigation to avoid disruption or mortality of wildlife. Scheduling of clearing activities will consider the migratory bird nesting period. Otherwise, potential effects of clearing and construction on bird mortality risk during the nesting period will be mitigated by conducting non-intrusive area searches for evidence of nesting (*e.g.,* presence of singing birds, territorial males, alarm calls, distraction displays). Any active nests will be subject to site-specific mitigation measures.

Soil disturbance (including topsoil salvage, trenching, compaction on work surface) during construction has potential to cause mortality for ground-dwelling wildlife species. The immobility of ground-hibernating animals increases their vulnerability to soil disturbance during the winter (COSEWIC 2007). Active habitat features (*e.g.*, dens, burrows) will be identified during pre-construction field surveys and appropriate mitigation will be implemented to avoid disruption.

Mitigation to minimize the mortality risk for amphibians includes completing construction during winter to avoid direct effects on amphibians congregating at breeding sites or migrating from breeding sites. In the event there is a change in construction scheduling and activities occur during the growing season, mitigation to reduce potential effects on amphibian mortality risk includes conducting an amphibian salvage at breeding locations if amphibians are present during construction, moving any amphibians observed on the construction right-of-way or in the trench, using sediment fencing or other measures to redirect dispersing amphibians away from the construction site, and minimizing grubbing in shrubby wetland areas to avoid creating pitfall traps.

Vehicle traffic due to construction and operations of the Project may increase the risk of wildlife mortality due to vehicle collisions. With posting of low traffic speeds, signage and education of construction and operations contractors and employees, risk of wildlife injury or mortality associated with vehicle collisions is not expected to increase substantially as a result of the Project. Trans Mountain will consult with BC MFLNRO to determine the location and need for additional site-specific mitigation measures (*e.g.,* exclusion fencing for the open trench or along vehicle travel lanes) at identified locations (*e.g.,* Lac du Bois Road) where there is high potential to encounter snakes. Trans Mountain has also developed a Wildlife Conflict Management Plan (see Section 15 of Appendix C of the Pipeline EPP) to avoid potential conflict between Project personnel and the wildlife species most likely to be encountered along the Project and associated facilities.

Artificial night-time light sources attract songbirds that migrate at night and can increase bird mortality risk from collisions, excessive energy expenditure and predation (Jones and Francis 2003, Poot *et al.* 2008). The possible use of artificial night-time light sources within Lac du Bois Grasslands Protected Area will be short-term in duration and occur either during construction or during site-specific operations and maintenance activities. There are no permanent facilities planned within Lac du Bois Grasslands Protected Area that would require permanent artificial night-time light.

Summary of Effects Characterization Rationale for Wildlife and Wildlife Habitat

The following provides the evaluation of significance of potential residual effects on wildlife and wildlife habitat within the Lac du Bois Grasslands Protected Area (Table C7.1.9-3, point 1[a]).

- Spatial Boundary: Wildlife LSA – habitat changes (*e.g.,* clearing), alteration of movement (*e.g.,* fragmentation) and direct mortality risk (*e.g.,* disturbance of nests/den) are primarily limited to the Wildlife LSA.

- Duration: short-term – the events causing effects are construction and operational activities (*e.g.,* monitoring, vegetation management and site-specific maintenance), the latter of which are limited to any one year during operations.

- Frequency: periodic – the events causing effects (*i.e.,* clearing of the Footprint, traffic and activity) will occur during construction and intermittently during operations for monitoring, vegetation control and maintenance.

- Reversibility: long-term – effects are reversible in the long-term following decommissioning and abandonment, once native vegetation regenerates over the Project Footprint. Some herbaceous and shrub-dominated vegetation communities (*e.g.,* grasslands, wetlands) are likely to regenerate following construction over the medium-term, while forest and some shrub habitats require decades to regenerate (*i.e.*, long-term). Sensory disturbance and mortality risk associated with construction is reversible immediately upon completion of activities.

- Magnitude: medium – the Project generally parallels existing linear disturbances within the Lac du Bois Grasslands Protected Area, thereby reducing potential Project effects on wildlife habitat by minimizing the new disturbance footprint. Regulatory and ecological context are key considerations in the characterization of magnitude for residual effects of the Project on wildlife in Lac du Bois Grasslands Protected Area. The stated primary objectives of the protected area relevant to wildlife include protecting and presenting representative native grassland ecosystems, managing grazing use for protected area biodiversity objectives, and maintaining conservation as a high priority, in particular natural habitats important for wildlife and species at risk. The protected area provides habitat for numerous federally and provincially listed wildlife species at risk, which, in general, often have low resilience to habitat disturbance. The narrowed pipeline corridor crosses early candidate critical habitat for American badger and Lewis's woodpecker. Trans Mountain will use information from field surveys and consultation to develop appropriate mitigation to reduce the Project's residual effect on species at risk and critical habitats. Consultation with regulatory authorities regarding the Project's interaction with species at risk and critical habitats has been initiated. Trans Mountain is committed to continuing consultation to develop appropriate mitigation strategies for species at risk and their habitats. Through development of mitigation in consultation with regulatory authorities, and implementation of mitigation and monitoring, including adaptive measures where warranted, the residual Project effects on wildlife in the Lac du Bois Grasslands Protected Area are expected to remain within regulatory and ecological tolerance. Therefore, the magnitude of the residual effect is concluded to be medium.

- Probability: high – the Project will affect wildlife in the protected area through changes in habitat, movement and mortality risk.

- Confidence: moderate – the assessment is based on a good understanding of cause-effect relationships and relevant data. Limitations and uncertainty associated with available data pertinent to the Project area reduce the confidence level to moderate.

7.1.9.3 Summary

As identified in Table C7.1.9-3, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on wildlife and wildlife habitat indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Lac du Bois Grasslands Protected Area related to wildlife and wildlife habitat will be not significant.

7.1.10 Species at Risk

For the purpose of the assessment, species at risk are considered to include all federally-listed species of conservation concern (*i.e.*, COSEWIC or *SARA* Schedule 1 designation) (COSEWIC 2013, Environment

Canada 2013). Species identified as having the potential to occur along the narrowed pipeline corridor and in the element-specific RSAs are based on previous field assessments and existing data.

This subsection discusses the species at risk that have been identified as likely to occur within each element-specific RSA. The list of federal species at risk includes 25 wildlife species within the Wildlife RSA No federally-listed fish species are located within watercourses crossed by the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area and no federally-listed vegetation species occur within the Vegetation RSA.

The 25 wildlife species include:

- Bank swallow: Threatened by COSEWIC;
- Barn swallow: Threatened by COSEWIC, Blue-listed;
- Bobolink: Threatened by COSEWIC, Blue-listed;
- Burrowing owl: Endangered by *SARA* and COSEWIC, Red-listed;
- Common nighthawk: Threatened by *SARA* and COSEWIC;
- Ferruginous hawk: Threatened by *SARA* and COSEWIC;
- Flammulated owl: Special Concern by *SARA* and COSEWIC, Blue-listed;
- Horned grebe: Special Concern by COSEWIC;
- Lewis's woodpecker: Threatened by *SARA* and COSEWIC, Red-listed;
- Long-billed curlew: Special Concern by *SARA* and COSEWIC, Blue-listed;
- Olive-sided flycatcher: Threatened by *SARA* and COSEWIC, Blue-listed;
- Peregrine falcon, *pealei* ssp.: Special Concern by *SARA* and COSEWIC, Blue-listed;
- Short-eared owl: Special Concern by *SARA* and COSEWIC, Blue-listed;
- Western grebe: Special Concern by COSEWIC, Red-listed;
- Western screech-owl, *macfarlanei* ssp.: Endangered by *SARA* and Threatened by COSEWIC, Red-listed;
- Williamson's sapsucker: Endangered by *SARA* and COSEWIC, Blue-listed;
- American badger, *jeffersonii* ssp.: Endangered by *SARA* and COSEWIC, Red-listed;
- Little brown myotis: Endangered by COSEWIC;
- Great Basin gopher snake, *deserticola* ssp.: Threatened by *SARA* and COSEWIC, Blue-listed;
- North American racer: Special Concern by *SARA* and COSEWIC, Blue-listed;
- Northern rubber boa: Special Concern by *SARA* and COSEWIC;
- Painted turtle, Intermountain-Rocky Mountain population: Special Concern by *SARA* and COSEWIC, Blue-listed;
- Western rattlesnake: Threatened by *SARA* and COSEWIC, Blue-listed;

- Great Basin spadefoot: Threatened by *SARA* and COSEWIC, Blue-listed; and
- Western toad: Special Concern by *SARA* and COSEWIC, Blue-listed.

Potential effects of the Project on these species are assessed through the use of indicators in 7.1.9 Wildlife and Wildlife Habitat.

7.1.11 Heritage Resources

This subsection describes the potential Project effects on heritage resources in Lac du Bois Grasslands Protected Area. The Heritage Resources RSA consists of the broader landscape context extending beyond the Project Footprint, defined as an area of intersecting Borden Blocks (Borden and Duff 1952); shown in Figure 6.2.2.-2 of the Introduction to the Draft Stage 2 Detailed Proposal. A Borden Block measures 10 minutes of latitude by 10 minutes of longitude.

The potential for encountering heritage resources in Lac du Bois Grasslands Protected Area has been reduced by aligning the narrowed pipeline corridor to parallel the Telus FOTS right-of-way. Qualified archaeologists commenced an Archaeological Impact Assessment (AIA) for the BC portion of the narrowed pipeline corridor in July 2013 under Archaeological Research Permit 2013-165; the assessment of which is ongoing and will need to continue into the 2014 field season (including Lac du Bois Grasslands Protected Area). For the AIA, background data was reviewed and then was complemented with ground reconnaissance with targeted areas for more intensive visual inspection, and where warranted, shovel testing. The ground reconnaissance and shovel testing programs focused on areas along the narrowed pipeline corridor that are of moderate to high potential for archaeological, historic and palaeontological sites.

7.1.11.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on heritage resources indicators are listed in Table C7.1.11-1. A summary of mitigation measures is provided in Table C7.1.11-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines including BC OGC (2010) and CAPP (1999, 2001).

TABLE C7.1.11-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON HERITAGE RESOURCES FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][1]	Potential Residual Effect(s)
1. Heritage Resources Indicator – Archaeological Sites			
1.1 Disruption to previously unidentified archaeological sites during AIA	Footprint	• Follow any conditions or recommendations identified in the permits for the AIA for BC. • Suspend work in proximity (*i.e.,* within 30 m) to archaeological, palaeontological or historical sites (*e.g.,* modified bone, pottery fragments, fossils) discovered during construction. No work at that particular location shall continue until permission is granted by the appropriate regulatory authority. Follow the contingency measures identified in the Heritage Discovery Contingency Plan. • Arrange for emergency archaeological excavation of previously unidentified sites endangered by pipeline construction wherever such sites warrant attention and can be excavated without interfering with the construction schedule. When for practical reasons, the sites cannot be investigated, map and suitably flag these sites for later investigation. • Prohibit the collection of any historical, archaeological or palaeontological resources by Project personnel.	• No residual effect identified.

TABLE C7.1.11-1 Cont'd

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][1]	Potential Residual Effect(s)
1.1 Disruption to previously unidentified archaeological sites during AIA (cont'd)	See above	• Avoid, where possible, disturbance of geodetic or legal survey monuments, to the extent feasible during construction of the pipeline, Trans Mountain's Construction Manager will immediately report such disturbance to the appropriate regulatory authority. The contractor will restore or re-establish the monument, where feasible, in accordance with the instructions of the Dominion Geodesist.	• See above
1.2 Disturbance to known archaeological sites during AIA	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
1.3 Disturbance of previously unidentified archaeological sites during construction	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
2. Heritage Resources Indicator – Historic Sites			
2.1 Disturbance to previously unidentified historic sites during AIA	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
2.2 Disturbance of previously unidentified historic sites during AIA	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
3. Heritage Resources Indicator – Palaeontological Sites			
3.1 Disturbance of previously unidentified palaeontological sites during construction	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.

Note: 1 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.11.2 Potential Residual Effects

Heritage resources provide a window into past human experiences and the geological record, and by their very nature, are non-renewable. Once disturbed, the resource may be altered or even lost. Consequently, the primary mitigation measure in protecting heritage resources is avoidance, and secondarily, site specific mitigation developed in consultation with appropriate provincial regulatory authorities and approved by these authorities in fulfillment of Permit obligations may also be used. In order to better understand heritage resources and the historical information associated with these resources, disturbing the resource through excavations is an acceptable practice and, in many cases, the only method to collect in situ information to add to the archaeological record. Regardless of whether the excavation of the site is for academic or development purposes, the loss of heritage resource sites is generally offset by the recovery of knowledge about the site gained through meticulous identifying, cataloguing and preserving of artifacts and features in compliance with provincial guidelines.

7.1.11.3 Summary

Given that disturbances to heritage resources by the Project in Lac du Bois Grasslands Protected Area are effectively offset by knowledge gained through the mitigation approved by the provincial regulatory authorities, no residual effects on heritage resource indicators have been identified and, consequently, no further evaluation of the effects of the Project on heritage resources is warranted.

7.1.12 Traditional Land and Resource Use

This subsection describes the potential Project effects on the potential traditional land and resource use (TLRU) sites in Lac du Bois Grasslands Protected Area. The TLRU LSA includes the zones of influence of water quality and quantity, air emissions, acoustic environment, fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat and heritage resources since TLRU is dependent on these resources; shown in Figure 6.2.2-5 of the Introduction to the Draft Stage 2 Detailed Proposal. The TLRU RSA includes the RSA boundaries of water quality and quantity, air emissions, acoustic environment, fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat and heritage resources; shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal.

7.1.12.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on TLRU sites are listed in Table C7.1.12-1.

To date one traditional land and resource use (TLRU) site has been identified within the narrowed pipeline corridor within Lac du Bois Grasslands Protected Area. However, TLRU studies are still underway for Aboriginal groups with interests in Lac du Bois Grasslands Protected Area. Trans Mountain will continue to engage Aboriginal communities through all phases of the Project. Traditional land and resource use information received from participating communities will be reviewed in order to confirm literature results and mitigation measures including those provided in the Pipeline EPP. Any additional site-specific mitigation measures resulting from these studies will be provided in the updated Pipeline EPP prior to construction.

The construction of the Project has the potential to directly and indirectly disrupt subsistence sites and activities, as well as the broader ecological system, through the temporary physical disturbance of land or resources. Subsistence sites and activities may also be affected by Project activities resulting from limited access and/or increased public access to traditional harvesting areas and increased pressure on environmental resources.

The operations phase of the Project will affect TLRU primarily through temporary disturbances related to site-specific maintenance.

A summary of mitigation measures provided in Table C7.1.12-1 was principally developed in accordance with industry best practices and procedures and provincial regulatory authority guidelines related to specific elements such as vegetation, wetland loss or alteration, wildlife and wildlife habitat, and heritage resources.

TABLE C7.1.12-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON TRADITIONAL LAND AND RESOURCE USE FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Traditional Land and Resource Use Indicator – Subsistence Activities and Sites			
1.1 Disruption of use of trails and travelways	Footprint	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Upon Footprint finalization, applicable mitigation options listed below for previously identified trails and travelways within the narrowed pipeline corridor will be confirmed based on the following criteria: the location of the site with respect to the proposed area of development, the relative importance of the site to the community, and the potential for an alternative mitigation strategy to reduce or avoid sensory disturbance. • Should additional trails and travelways be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: - detailed recording and mapping to within 100 m on both sides of the pipeline right-of-way; in partnership with community representatives, a decision is then made about the relative importance of the trail and how best to maintain and control access; - signage or scheduling construction during periods of least impact; and/or - alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • Implement appropriate measures identified in the Heritage Resources Discovery Contingency Plan [Appendix B]. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Disturbance of trails and travelways during construction and site-specific maintenance.
	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during the construction and site-specific maintenance activities (refer to Section 7.2.1).
1.2 Alteration of plant harvesting sites	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Ensure equipment arrives at all construction sites clean and free of soil or vegetative debris. Inspect and identify equipment deemed to be acceptable with a suitable marker, such as a sticker. Do not allow any equipment arriving in a dirty condition onsite until it has been cleaned [Section 7.0].	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.

TABLE C7.1.12-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.2 Alteration of plant harvesting sites (cont'd)	See above	• Should additional plant harvesting sites be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: - limiting the use of chemical applications; - replacement of plant species during reclamation; - avoidance of the site; and/or - alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • See Section 7.1.8 Vegetation for additional mitigation measures. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• See above
1.3 Disruption of subsistence hunting activities	LSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • See Section 7.1.9 Wildlife and Wildlife Habitat for mitigation relevant to sensory disturbance, loss or alteration of wildlife habitat, injury and mortality. • Should additional hunting sites be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: - adhering to species specific timing constraints to the extent feasible; - leaving breaks in the pipeline trench to allow animals to cross; - limiting the use of chemical applications; and/or - alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • See Section 7.1.5 Acoustic Environment for additional mitigation measures. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.
1.4 Disruption of subsistence trapping activities	LSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Prohibit the vandalism or theft of trapper equipment or trapped animals if they are observed on the construction right of way or the construction site prior to clearing [Section 7.0]. • Should additional trapping sites or trap line equipment be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: - maintaining access to the trap line; - moving of trap line equipment by the trapper prior to construction; and/or - alternative site-specific mitigation strategies recommended by participating Aboriginal communities.	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.

TABLE C7.1.12-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.4 Disruption of subsistence trapping activities (cont'd)	See above	• See Section 7.1.5 Acoustic Environment for additional mitigation measures. • See Section 7.1.9 Wildlife and Wildlife for mitigation relevant to sensory disturbance, loss or alteration of wildlife habitat, and wildlife mortality. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• See above
2. Traditional Land and Resource Use Indicator – Cultural Sites			
2.1 Disturbance of gathering places	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • See Section 7.1.4 Air Emissions and Section 7.1.5 Acoustic Environment for measures pertaining to nuisance air and noise emissions, respectively. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site specific maintenance activities (refer to Section 7.2.1).
2.2 Disturbance of sacred sites	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • See Section 7.1.4 Air Emissions and Section 7.1.5 Acoustic Environment for measures pertaining to nuisance air and noise emissions, respectively. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site specific maintenance activities (refer to Section 7.2.1).

Notes: 1 LSA = TLRU LSA; RSA = TLRU RSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.12.2 Significance Evaluation of Potential Residual Effects

To date, one TLRU site has been identified along the narrowed pipeline corridor within Lac du Bois Grasslands Protected Area. However, Trans Mountain assumes that TLRU activities could be potentially practiced within the protected area.

Table C7.1.12-2 provides a summary of the significance evaluation of the potential residual socio-economic effects of the construction and operations of the proposed pipeline on TLRU indicators in Lac du Bois Grasslands Protected Area. The rationale used to evaluate the significance of each of the residual socio-economic effects is provided below.

TABLE C7.1.12-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON TRADITIONAL LAND AND RESOURCE USE FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

				Temporal Context						
	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance[2]
1	Traditional Land and Resource Use Indicator – Subsistence Activities and Sites									
1(a)	Disturbance of trails and travelways during site-specific maintenance.	Negative	Footprint	Short-term	Periodic	Short-term	Medium	Low	Moderate	Not significant
1(b)	Alteration of subsistence resources.	Negative	RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
1(c)	Disruption of subsistence activities during construction and site-specific maintenance.	Negative	RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
1(d)	Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site-specific maintenance activities.	Negative	RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant
2	Traditional Land and Resource Use Indicator – Cultural Sites									
2(a)	Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site-specific maintenance activities.	Negative	RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant

Notes: 1 LSA = TLRU LSA; RSA = TLRU RSA.
2 Mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal)

TLRU Indicator - Subsistence Activities and Sites

Disturbance of Trails and Travelways During Construction and Site-Specific Maintenance

The disturbance of trails and travelways during construction and site-specific maintenance is assessed individually in Table C7.1.12-2. Disturbance of trails and travelways during construction is anticipated to result from short-term physical disturbance of land and access limitations that may affect the practice of traditional activities by Aboriginal communities. Similar effects of reduced access may occur during periods of site-specific maintenance.

To date, no trails and travelways have been identified along the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area. If trails and travelways are identified in Lac du Bois Grasslands Protected Area during ongoing engagement with Aboriginal communities, the proposed mitigation measures described in Table C7.1.12-2 will be implemented to mitigate the potential adverse effects of the Project on these site types and will be dependent upon the type of site identified.

Additional measures to reduce the disruption of trails and travelways include notification regarding construction schedules and pipeline route maps, installing signage notifying of construction activities in the area and working with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members.

Despite the implementation of the proposed mitigation measures, traditional land and resource users may still be unable to use, or be deterred from using, certain areas at times during construction and periods of site-specific maintenance and consequently, the magnitude of the residual effect is considered to be medium (Table C7.1.12-2, point 1 [a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – trails, and travelways may be physically disturbed if occurring within the construction right-of-way and temporary workspace.

- Duration: short-term – events causing the effects will be construction activity or site-specific maintenance that would occur within any one year period during operations.
- Frequency: periodic – construction and site-specific maintenance activities will occur intermittently but repeatedly throughout the assessment period.
- Reversibility: short-term – effects will be focused on the construction phase or site-specific maintenance that would occur within any one year period during operations.
- Magnitude: medium – it is expected that Project-related disturbances would be temporary through the implementation of the proposed mitigation measures during construction and operations to reduce, but not eliminate, potential effects on disturbance of trails and travelways. Mitigation strategies are also in place in the event any unidentified subsistence sites are discovered.
- Probability: low - to date no trails and travelways have been identified within the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area.
- Confidence: moderate – based on Project information and the professional experience of the assessment team.

Alteration of Subsistence Resources

Subsistence resources may be disturbed or altered during construction and operations of the Project. The alteration of subsistence activities could manifest itself through changes to local harvesting locales, behavioral alteration or sensory disturbance of environmental resources or increased public access to traditional harvesting areas and increased pressure on environmental resources. The operations of the proposed Project will affect subsistence resources primarily due to temporary disturbances related to maintenance activities.

To date, one subsistence harvesting site has been identified along the narrowed pipeline corridor within Lac du Bois Grasslands Protected Area. If further subsistence harvesting sites are identified in Lac du Bois Grasslands Protected Area during ongoing engagement with Aboriginal communities the proposed mitigation measures described in Table C7.1.12-1 will be implemented to mitigate the potential adverse effects of the Project on these site types and include measures outlined under the assessment of relevant environmental resources (*e.g.,* air emissions, acoustic environment, fish and fish habitat, wildlife and wildlife habitat, vegetation, wetlands).

Despite the implementation of the proposed mitigation measures, traditional land and resource users may still be unable to use, or be deterred from using, certain areas at times during construction and periods of site-specific maintenance. Changes to the distribution and abundance of resources could in turn result in loss or alteration of harvesting areas, which could result in indirect effects such as harvesters having to spend more time and money to travel further for subsistence activities. Therefore, the magnitude of the residual effect is considered to be medium (Table C7.1.12-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: TLRU RSA – potential effects may extend beyond the Footprint into ZOI of target environmental resources.
- Duration: short-term – events causing the effects will be construction activity or site-specific maintenance that would occur within any one year period during operations.
- Frequency: periodic – construction and site-specific maintenance activities will occur intermittently but repeatedly throughout the assessment period.
- Reversibility: long-term – the effects of disturbance to traditionally harvested resources will be dependent on each target species' sensitivities and could extend greater than 10 years following decommissioning and abandonment, once native vegetation regenerates over the Project Footprint.

- Magnitude: medium – the effects assessment results for fish and fish habitat, wildlife and wildlife habitat, vegetation, wetlands indicates that effects to traditionally harvested resources may be detectable and is dependent on each target species' sensitivities.
- Probability: high – to date one subsistence resource has been identified by Aboriginal communities within the narrowed pipeline corridor in Lac du Bois Grasslands Protected Area.
- Confidence: moderate – based on Project information and the professional experience of the assessment team.

Disruption of Subsistence Activities During Construction and Site-Specific Maintenance

The disruption of subsistence hunting, trapping and plant gathering activities is a potential residual effect of interactions between traditional resource users and construction and operations activities of the Project. In the event that subsistence activities are disrupted by the construction or operations of the Project, the interruption could mean that the traditional resource user misses the harvest opportunity or that their participation is curtailed. The disruption of subsistence activities also refers to the possibility that traditional resource users could be prevented from accessing key harvesting areas resulting from limited access or increased public access to traditional harvesting areas. The operations of the proposed Project will affect subsistence activities primarily due to temporary disturbances related to site-specific maintenance.

To date, one subsistence harvesting site has been identified along the narrowed pipeline corridor within Lac du Bois Grasslands Protected Area. Trans Mountain also assumes that other subsistence activities could be potentially practiced within the protected area (Table C7.1.12-2, point 1[c]).

Aboriginal communities will be provided with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities. Signage will be installed, notifying of construction activities in the area. Trans Mountain will work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members. A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: TLRU RSA – the proposed Project may affect subsistence activities beyond the construction footprint and may also indirectly affect the distribution of traditional resource users in other areas of the TLRU RSA.
- Duration: short-term – events causing the effects will be construction activity or site-specific maintenance that would occur within any one year period during operations.
- Frequency: periodic – construction and site-specific maintenance activities will occur intermittently but repeatedly throughout the assessment period.
- Reversibility: long-term – the disruption of subsistence hunting, trapping, and plant gathering activities during construction is limited to the construction phase of the Project; however, changes to preferred harvesting locales could result in indirect effects such as harvesters having to spend more time and money to travel further for subsistence activities, and could extend greater than 10 years following decommissioning and abandonment, once native vegetation regenerates over the Project Footprint.
- Magnitude: medium – mitigation measures are in place in the event any unidentified subsistence activities and land users are discovered and given that the effects assessment results for vegetation, wetlands, and wildlife and wildlife habitat demonstrate that equivalent land use capability will be maintained by the application of the mitigation strategies described in this Draft Stage 2 Detailed Proposal and in the Pipeline EPP. It is expected that Project-related disruptions would be temporary through the implementation of the proposed mitigation measures during the construction and operations phases to reduce, but not eliminate, the potential effects on subsistence activities.
- Probability: high – to date one subsistence activity has been identified within the TLRU RSA. Further activities may be identified during ongoing TLRU studies.

- Confidence: moderate – based on Project information and the professional experience of the assessment team.

Sensory Disturbance for Aboriginal and Non-Aboriginal Local Residents and Land Users (from Nuisance Air Emissions and Noise)

The construction and site-specific maintenance of the Project may result in the sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (Table C7.1.12-2, point 1[d]). This potential residual effect is assessed under the Visitor Enjoyment indicator of Recreational Values in Section 7.2.1. The significance evaluation of this residual effect is provided in Section 7.2.1 which includes all land and resource users, provides an explanation of the rationale and significance criteria.

<u>TLRU Indicator – Cultural Sites</u>

Sensory Disturbance for Aboriginal and Non-Aboriginal Local Residents and Land Users (from Nuisance Air Emissions and Noise)

The construction and site-specific maintenance of the Project may result in the sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (Table C7.1.12-2, point 2[a]). This potential residual effect is assessed under the Visitor Enjoyment indicator of Recreational Values in Section 7.2.1. The significance evaluation of this residual effect is provided in Section 7.2.1 which includes all land and resource users, provides an explanation of the rationale and significance criteria.

7.1.12.3 Summary

As identified in Table C7.1.11-2, there are no situations for TLRU indicators that would result in a significant residual socio-economic effect. Consequently, it is concluded that the residual socio-economic effects of pipeline construction and operations on conservational values of Lac du Bois Grasslands Protected Area related to TLRU will be not significant.

7.2 Recreational Values of Lac du Bois Grasslands Protected Area

Lac du Bois Grasslands Protected Area offers unique recreational features due in part to the rolling grasslands and diverse aesthetic values. The protected area is also an important wildlife viewing area and contains with many beautiful vistas and viewing opportunities. Cycling, hiking, kite flying, picnicking, tobogganing and horseback riding are among some of the recreational opportunities enjoyed by protected area visitors in Lac du Bois Grasslands Protected Area.

7.2.1 Visitor Enjoyment and Safety

This subsection describes the potential Project effects on visitor enjoyment and safety values within Lac du Bois Grasslands Protected Area. This refers to the use of the land and resources by people, in both a consumptive and non-consumptive manner. Aesthetic attributes of human use areas are also considered in this discussion *(e.g.,* sensory disturbance, changes in viewshed*).*

Visitor enjoyment and safety amalgamates relevant components from the human occupancy and resource use (HORU) and infrastructure and services elements in Volume 5B of the Facilities Application, particularly indicators related to protected areas and protected areas, outdoor recreation use and transportation infrastructure. Spatial boundaries for visitor enjoyment follow the spatial boundaries outlined for the HORU element. Spatial boundaries for visitor safety follow the spatial boundaries outlined for the infrastructure and services element; shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal.

7.2.1.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on visitor enjoyment and safety indicators are listed in Table C7.2.1-1.

A summary of mitigation measures provided in Table C7.2.1-1 was principally developed in accordance with Trans Mountain standards and industry best practices. A full list of socio-economic mitigation measures is found in the Socio-economic Management Plan (SEMP) (Section 8.0) of the Pipeline EPP.

TABLE C7.2.1-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VISITOR ENJOYMENT AND SAFETY FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][1]	Potential Residual Effect(s)
1. Visitor Enjoyment and Safety Indicator – Visitor Enjoyment			
1.1 Physical disturbance to Lac du Bois Grasslands Protected Area	Footprint	• Minimize disturbance of valued natural features with a non-traditional human use (*e.g.,* recreational trails, recreational use areas, key use areas within Lac du Bois Grasslands Protected Area) during final route refinement to the extent practical [SEMP Section 8.4.6]. • Provide provincial and federal regulatory authorities, municipal/regional governments; Aboriginal communities, BC Parks, Crown tenure holders and recreational organizations with final routing information, including maps, as well as construction schedule information [SEMP Section 8.4.6]. • Install signs in Lac du Bois Grasslands Protected Area and known recreational use areas in the vicinity notifying users of construction activities and timing [SEMP Section 8.4.6]. • Develop and implement a communication plan for sharing information about key Project construction milestones and information with the general public in affected areas [SEMP Section 8.4.6]. • Ensure any changes in planned timing or location of construction activities is communicated to the public, relevant municipal and regional governments, Aboriginal communities, BC Parks, Crown tenure holders and formal recreation organizations in affected areas [SEMP Section 8.4.6]. • Apply all measures pertaining to HORU in the SEMP and all measures pertaining to notification and vegetation in the Pipeline EPP.	• Physical disturbance to natural and built features in protected areas during construction and site-specific maintenance.
1.2 Physical disturbance to facilities, including trails and trailheads, within Lac du Bois Grasslands Protected Area	HORU RSA	• Avoid disturbance of built features during final route refinement, to the extent practical [SEMP Section 8.4.6]. • Narrow the construction right-of-way at key locations to avoid valued built or natural features, to the extent practical [SEMP Section 8.4.6]. • Ensure closure signage is placed on affected established trails or trailheads. • Contact BC Parks and the City of Kamloops tourism office prior to construction activities and provide maps and schedules of the proposed construction activities to enable them relay information about possible trail and recreational use area closures [SEMP Section 8.4.6]. • Develop and implement a communication plan for sharing information about key Project construction milestones and information with the general public in affected areas [SEMP Section 8.4.6]. • Apply all measures pertaining to HORU in the SEMP and all measures pertaining to notification and vegetation in the Pipeline EPP.	• Decrease in quality of the outdoor recreational experience of Aboriginal and non-Aboriginal resource users during construction. • Decrease in quality of the outdoor recreational experience of Aboriginal and non-Aboriginal resource users during site-specific maintenance.
1.3 Change to access of protected area	HORU RSA	• Maintain access to established recreation features, through the clearing, construction and reclamation period [SEMP Section 8.4.6]. • Place signage on access roads in the vicinity of construction activities to ensure users are aware that construction activities are taking place [SEMP Section 8.4.6]. • Bore under paved and high use roads [SEMP Section 8.4.6]. • Where minor roads are crossed that may affect established community use/access routes, complete an open cut crossing within one day, to the extent practical [SEMP Section 8.4.6]. • Provide provincial and federal regulatory authorities, municipal/regional governments; Aboriginal communities, BC Parks, Crown tenure holders; and recreational organizations with final routing information, including maps, as well as construction schedule information [SEMP Section 8.4.3]. • Develop Traffic Control Plans for site specific sections of roads affected by the Project [SEMP Section 8.4.3]. • Develop a communication plan for activities that impact normal traffic flow, such as road closures, detours [SEMP Section 8.4.3]. • Develop and implement a communication plan for sharing information about key Project construction milestones and information with the general public in Lac du Bois Grasslands Protected Area [SEMP Section 8.4.6].	• Change in land use patterns during construction and site-specific maintenance. • Change in land use patterns during operations.

TABLE C7.2.1-1 Cont'd

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][1]	Potential Residual Effect(s)
1.3 Change to access of protected area (cont'd)	See above	• Ensure any changes in planned timing or location of construction activities is communicated to the public, relevant municipal and regional governments, Aboriginal communities, BC Parks, Crown tenure holders and formal recreation organizations in affected areas. • Apply all other measures pertaining to notification and access in the SEMP.	• See above
1.4 Sensory disturbance of land and resource users	HORU RSA	• Adhere to all federal and provincial guidelines and legislation for noise management. • Use only the size and power of tools necessary to limit noise from power tool operations. Ensure stationary equipment, such as compressors and generators, will be located away from noise receptors, to the extent feasible. • Maintain noise suppression equipment (*e.g.,* silencers) on all construction machinery and vehicles. • Enclose noisy equipment and use baffles such as material storage and subsoil piles, where and when feasible, to limit the transmission of noise beyond the construction site. • Restrict the duration that vehicles and equipment are allowed to site and idle to less than one hour, unless air temperature is less than 0°C. • To reduce air and noise emissions from Project-related vehicles, use multi-passenger vehicles for the transportation of crews to and from the job sites, where feasible. Actively encourage car-pooling when shuttle bus services are not practical.	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions, noise and visual effects) during construction and site-specific maintenance activities.
1.5 Alteration of viewsheds	HORU LSA	• To limit the effects of clearing in areas of new pipeline right-of-way, during reclamation use seeds that ensure vegetation regrowth blends with adjacent vegetation [SEMP Section 8.4.7). • Use seedlings and/or larger trees for vegetation screens that have been salvaged from the construction right-of-way or sourced from acceptable donor sites or commercially propagated rooted stock seedlings and container trees grown from a seed sources obtained from the same natural subregion/Biogeoclimatic Zone, as well as the same general latitude and elevation [EPP Section 8.0]. • Maintain an undisturbed vegetation screen between a new borrow site and an adjacent road [EPP Section 11.0]. • Develop and implement an issues tracking process to monitor and respond to Project-related socio-economic issues and opportunities that emerge during construction and reclamation [SEMP 8.4.11]. • Continue communication and engagement with stakeholders as the Project progresses [SEMP 8.4.11].	• Alteration of viewsheds.
2. Visitor Enjoyment and Safety Indicator – Visitor Safety			
2.1 Increased traffic due to transportation of workers and supplies	Socio-economic RSA	• Develop estimates of Project-related traffic volumes associated with all Project components, related to both the movement of workers and the movement of equipment and materials. • Continue to consult with the BC Ministry of Transportation and relevant municipalities regarding traffic volumes anticipated and the traffic management protocols. • Develop a traffic and Access Control Management Plan for the Project and Traffic Control Plans for particular contracts. • Where possible, provide daily shuttle bus service from designated staging areas to work sites. • Actively encourage carpooling for times when shuttles/buses is not practical or available. • Communicate with local police and emergency services personnel to keep these organizations informed of traffic schedules. • Develop a communication plan for activities that impact normal traffic flow, such as road closures, detours. • Apply all other transportation and traffic related measures outlines in the Pipeline EPP.	• Increase in traffic on highways and access roads during construction. • Sensory disturbances for Aboriginal local residents and land use (refer to potential effect 1.4 of this table). • Increase in traffic related injury and mortality.

Note: 1 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.2.1.2 Significance Evaluation of Potential Residual Effects

Table C7.2.1-2 provides a summary of the significance evaluation of the potential residual effects of the construction and operations of the Project in Lac du Bois Protected Area on visitor enjoyment and safety indicators. The rationale used to value the significance of each of the residual socio-economic effects is provided below.

TABLE C7.2.1-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VISITOR ENJOYMENT AND SAFETY FOR LAC DU BOIS GRASSLANDS PROTECTED AREA

	Potential Residual Effects	Impact Balance	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
				Duration	Frequency	Reversibility				
1.	Visitor Enjoyment and Safety Indicator - Visitor Enjoyment									
1(a)	Physical disturbance to natural and built features in protected areas during construction and site-specific maintenance.	Negative	Footprint	Short-term	Periodic	Short to medium-term	Medium	High	Moderate	Not significant
1(b)	Decrease in quality of the outdoor recreational experience of Aboriginal and non-Aboriginal resource users during construction.	Negative	HORU RSA	Short-term	Isolated	Short-term	Low	High	High	Not significant
1(c)	Decrease in quality of the outdoor recreational experience of Aboriginal and non-Aboriginal resource users during site-specific maintenance.	Negative	HORU RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant
1(d)	Change in land use patterns during construction and site-specific maintenance.	Negative	HORU RSA	Short-term	Periodic	Short-term	Medium	High	High	Not significant
1(e)	Change in land use patterns during operations.	Negative to positive	HORU RSA	Short-term	Isolated	Long-term	Medium	High	High	Not significant
1(f)	Sensory disturbances for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions, noise and visual effects) during construction and site-specific maintenance.	Negative	HORU RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant
1(g)	Alteration of viewsheds.	Negative	HORU LSA	Short-term	Isolated	Long-term	Low	High	High	Not significant
2.	Visitor Enjoyment and Safety Indicator – Visitor Safety									
2(a)	Increase in traffic on highways and access roads during construction.	Negative	Socio-economic RSA	Short-term	Isolated	Short-term	Low to medium	High	High	Not significant
2(b)	Increase in traffic related injury and mortality.	Negative	Socio-economic RSA	Short-term	Isolated	Short-term	Negligible to medium	Low	High	Not significant

Note: 1 Significant Residual Socio-economic Effect: A residual socio-economic effect is considered significant if the effect is predicted to be:
- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

Visitor Enjoyment and Safety Indicator – Visitor Enjoyment

Physical Disturbance to Natural and Built Features in Protected Areas During Construction and Site-Specific Maintenance

Lac du Bois Grasslands Protected Area will be crossed by the narrowed pipeline corridor during construction activities, as well as during periods of site-specific maintenance (*i.e.*, integrity digs).

Natural and built features within Lac du Bois Grasslands Protected Area - such as interpretive signs, protected parking lots, picnic areas, trees, rocks, watercourses and trails - may have intrinsic, interpretive and recreational value, which may be disturbed as a result of pipeline construction and site-specific maintenance. The narrowed pipeline corridor crosses rolling grasslands utilized as trails and for nature study as well as access trails for residents (BC Parks 2000).

Mitigation measures related to vegetation, wetlands, wildlife and wildlife habitat have been designed to reduce the amount of land disturbed in any protected area. Other key mitigation measures includes avoiding key valued natural or built features during right-of-way finalization, narrowing the right-of-way in certain areas, and restoring any trails or other valued features that may be disturbed. Even with the implementation of mitigation measures to reduce land disturbance, certain natural features with intrinsic value may be disrupted depending on the final right-of-way selection, resulting in a residual adverse effect. Assuming the implementation of all mitigation measures, the residual effect of the Project on natural and built features in protected areas is considered to be reversible in the short to medium-term (*i.e.*, residual effects will primarily occur during construction, but restoration of valued features or areas may extend into the first several years of operations). The magnitude of the effect is considered medium; though the effect may be primarily that of an inconvenience or nuisance, protected areas and protected areas have an intrinsic value to many users (Table C7.2.1-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – natural and built features within protected areas and protected areas will be directly affected by construction of the pipeline.
- Duration: short-term – the residual effect will be caused by construction and site-specific maintenance that may occur within any one year during operations.
- Frequency: periodic – the disturbance to natural and built features in protected areas and protected areas will be caused by construction and periods of site-specific maintenance that would occur intermittently but repeatedly during the assessment period.
- Reversibility: short to medium-term – disturbance to natural and built features will be primarily limited to the construction phase and periods of site-specific maintenance; but post-construction restoration of natural areas and features may extend into the first several years of operations.
- Magnitude: medium – given the intrinsic value of protected areas and protected areas, disruptions are considered a moderate modification in the socio-economic environment.
- Probability: high – construction activities will take place through protected areas and protected areas; therefore, disturbance of natural features with intrinsic value is likely.
- Confidence: moderate – particular valued built or natural features potentially disturbed will depend on right-of-way finalization.

Decrease in Quality of the Outdoor Recreational Experience of Aboriginal and Non-Aboriginal Resource Users

<u>Construction</u>

The outdoor recreational experiences of Aboriginal and non-Aboriginal resource users, such as cycling, hunting, dog walking and wildlife viewing may be affected by the physical disturbance of outdoor recreation areas during pipeline construction. Nuisance air emissions, noise and visual effects may also occur during the construction of the Project and affect all land users living, working or recreating in the vicinity of the final right-of-way.

The impact balance of this residual effect is considered negative; however, mitigation measures designed to communicate construction locations and timing to the users in the vicinity of the narrowed pipeline corridor will lessen the effect, since users will have the opportunity to choose an alternate location for recreational pursuits. Given the relatively short construction period at any given location, use of well-maintained equipment and limiting idling of equipment, the residual effect is considered to be of low magnitude and reversible in the short-term (Table C7.2.1-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – sensory disturbances caused by construction can extend into the HORU LSA and HORU RSA.
- Duration: short-term – the event causing the effect is construction activity.
- Frequency: isolated – the event causing the effect is confined to a specific period (*i.e.,* construction).
- Reversibility: short-term - the residual effect is limited to the construction phase.
- Magnitude: low – change may be detectable, but will primarily be that of an inconvenience or nuisance.
- Probability: high – Project construction activity will occur in areas used for outdoor recreation.
- Confidence: high – based feedback from stakeholders, location of the Project, and the professional experience of the assessment team.

Site-Specific Maintenance Activities

The outdoor recreational experience of Aboriginal and non-Aboriginal resource users, such as cycling, hunting, dog walking, and wildlife viewing may be affected by site-specific maintenance. Use of outdoor water and land based recreation areas, such as trails and trailheads, may be disturbed or disrupted by site-specific maintenance. Site-specific maintenance (*e.g.*, aerial patrols, vegetation management, integrity digs) will occur periodically throughout the operations phase of the Project. These activities will involve workers and equipment that could result in nuisance air and noise emissions.

The impact balance of this residual effect is considered negative. The effect is considered potentially negative because the narrowed pipeline corridor deviates from the existing TMPL right-of-way. The magnitude of this effect will be reduced through the use of well-maintained equipment, by limiting the idling of equipment and by scheduling activities to avoid peak recreational use times where practical. The residual effect is reversible in the short-term since site-specific maintenance activities will be completed within any one year of operations (Table C7.2.1-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – noise and air emissions caused by from site-specific maintenance activities can extend into the HORU LSA and HORU RSA.
- Duration: short-term – site-specific maintenance will be completed within any one year during operations.
- Frequency: periodic – the event causing the effect (*i.e.,* site-specific maintenance activities) occurs intermittently but repeatedly over the assessment period.
- Reversibility: short-term – site-specific maintenance will be completed in any one year during operations.
- Magnitude: low – change may be detectable, but will primarily be that of an inconvenience or nuisance.
- Probability: high – site-specific maintenance activities will be required as part of regular operations and will involve the use of heavy and light equipment and vehicles.
- Confidence: high – based on Project information and the professional experience of the assessment team.

Change in Land Use Patterns

Construction and Site-Specific Maintenance

Change in land use patterns in the HORU RSA during construction is anticipated to result from short-term physical disturbance of land, access roads and/or from alteration of traffic patterns, movements and volumes along highways and roads. A short-term disruption to access and use patterns could affect recreational) users who are deterred from visiting a particular location. Similar effects regarding reduced access to land due to disturbances for all use types would occur during periods of site-specific maintenance (*i.e.,* integrity digs).

Trans Mountain will employ mitigation measures that will assist in minimizing the above effects. Mitigation measures to reduce Project-related traffic (such as using multi-passenger vehicles and obeying traffic, road-use and safety laws) as well as low-impact road crossing construction methods will be implemented during Project construction activities, and will also minimize access and use disruptions. However, residual effects are still anticipated, as land disturbance through the protected area and increased traffic on select access routes are unavoidable during specific times of the Project. It was noted during the Kamloops Community Workshop that opening closed roads during construction could become an invitation for unauthorized ATV use in Lac du Bois Grasslands Protected Area.

The impact balance of this residual effect is considered negative, but these residual effects of disruption to access and use patterns of land is considered to be reversible in the short-term (*i.e.,* limited to the construction phase or periods of site-specific maintenance that would occur within any one year during operations). Even after the implementation of proposed mitigation measures, users may still be unable to use, or be deterred from using, certain areas at certain times. Recreationalists may alter their use destinations away from areas that interface with Project construction. Construction activity could affect resource based business practices (*e.g.,* agriculture), which could result in a loss of income for those reliant on natural resources or commercial locations for their livelihood. Given the potential implications for livelihood practices associated with a disruption to access and use patterns of some land use areas, the magnitude of this residual effect is considered to be medium (*i.e.,* more than an inconvenience or nuisance) (Table C7.2.1-2, point 1[d]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – access roads to use areas in the HORU RSA may be physically disturbed by construction activity and disrupted by construction-related traffic.
- Duration: short-term – the event causing the disruption to access and use is the construction phase and site-specific maintenance during operations.
- Frequency: periodic – the event causing the disruption to access and use would occur intermittently but repeatedly (*i.e.,* specific months of construction and during site-specific maintenance that would occur during any one year of operations).
- Reversibility: short-term – the residual effect is limited to the construction phase or periods of site-specific maintenance occurring within any one year during operations.
- Magnitude: medium – the change would be detectable and would extend beyond that of an inconvenience or nuisance where there are implications for livelihood practices.
- Probability: high – Project activities will disturb land use areas and may impede access to specific areas at select times.
- Confidence: high – based on Project information, regional land use and access patterns, and the professional experience of the assessment team.

Operations

Changes to land use patterns during operations may result from vegetation management on the pipeline right-of-way in areas where the narrowed pipeline corridor deviates from the existing TMPL right-of-way or other linear disturbances. Land use observed in areas of proposed new right-of-way includes summer tourism areas, hiking and access trails, horseback riding, bird watching and nature study (BC Parks 2000).

In the areas of new right-of-way, vegetation management during operations will involve the removal of trees or any vegetation that might restrict service and maintenance equipment along the pipeline right-of (though some low growth vegetation will be re-established). Areas of new cleared right-of-way could improve access for some users, including outfitters, trapping/hunting users, recreationalists, and traditional Aboriginal resource users. The use of the right-of-way as a recreational trail route was mentioned as a benefit in many communities during stakeholder consultation.

Any new cleared right-of-way could also contribute to fragmentation of certain land use areas over the longer term, resulting in a disruption to recreational use for both Aboriginal and non-Aboriginal resource users. For example, new right-of-way in areas used for hiking or mountain biking could result in land users not using the area; however, it could also result in improved recreational access. Fragmentation could also result in changes in the behaviour of wildlife, and it is possible that it would have negative effects on hunting activities for both Aboriginal and non-Aboriginal resource users in some areas.

A range of mitigation measures will be implemented to manage issues related to any long-term changes in access and land use patterns that emerge based on right-of-way finalization. These mitigation measures include: notifying all affected trappers, guide outfitters before construction so they can choose alternate locations for their activities; provide compensation, considering various forms, to private land and property owners and trappers according to established industry protocols where losses or damages are proven; communications measures with governments, residents and recreational users about site-specific maintenance activities; and measures to ensure minimization of vegetation disturbance and optimize reclamation. The impact balance of this residual effect is considered negative or positive, depending on the user. The reversibility of the effect is considered long-term, since changes to access and use patterns in areas where the narrowed pipeline corridor deviates from the existing TMPL right-of-way or other linear disturbances will extend throughout the operations phase. The magnitude of this residual effect is medium. Although the residual effect will be only a nuisance for some land users (*i.e.,* recreationalists), it may have implications (positive or negative) for livelihood practices for others (*i.e.*, trappers, Aboriginal, and commercial outdoor users) (Table C7.2.1-2, point 1[e]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – clearing of the new pipeline right-of-way may result in fragmentation of land use areas beyond the Footprint and HORU LSA throughout operations. However, it will occur only in the limited areas where new corridor is required (new corridor is proposed for only 10% of the proposed route).
- Duration: short-term – the event causing the change to land use and access is the construction of the pipeline.
- Frequency: isolated – the event causing the change in land use and access is the construction of the pipeline which is limited to a specific phase of the assessment period.
- Reversibility: long-term – the residual effect extends throughout operations.
- Magnitude: medium – after the implementation of the proposed mitigation measures change would be detectable and could have implications on livelihood practices for some land and resource users.
- Probability: high – new right-of-way will be cleared in select areas.
- Confidence: high – based on Project information, current land uses in the HORU RSA and the professional experience of the assessment team.

Sensory Disturbance for Aboriginal and Non-Aboriginal Local Residents and Land Users (From Nuisance Air Emissions, Noise and Construction-related Visual Effects) During Construction and Site-Specific Maintenance

Nuisance air emissions and noise will occur during the construction of the Project and may at times affect land users living, working or recreating in the vicinity of Project components. Possible effects may include air emissions and noise from construction equipment and vehicles, and dust from vehicles. Also, equipment, areas of land disturbance, and the activity of construction workers will be visible to nearby land and resource users during periods of construction and site-specific maintenance. There may also be periods of night lighting around construction sites. Consequently, the visual quality of the landscape adjacent to the right-of-way or other construction areas may be adversely affected by the Project over the short-term related to construction or maintenance activity.

The implementation of the proposed mitigation measures will reduce the effects of noise and air emissions on land users. Noise and air emissions levels will adhere to municipal by-laws and stay within regulated levels. Nuisance air and noise emissions will also occur for isolated periods of time at specific locations during periodic site-specific maintenance activities (*e.g.*, aerial patrols, vegetation management, integrity digs) during the operations phase of the Project. Potential effects on the acoustic environment and air emissions are assessed in Sections 7.1.4 and 7.1.5.

A wide range of mitigation measures will be in place to manage air and noise effects. These include complying with local noise legislation; notify potentially affected residents of any major construction activities that will occur at night; consideration of noise abatement and construction scheduling at noise sensitive locations and during noise-sensitive times, to limit disruption to sensitive receptors; watering down construction sites and access roads to control dust; and by limiting the idling of equipment. There are many mitigation measures that can also reduce the short-term visual effects of construction. Generally, narrowing of the construction pipeline right-of-way at shelterbelt locations to reduce the number of trees to be removed will reduce visual effects. Trees/shrubs will be installed at potential access points and viewsheds to the construction right-of-way to provide a visual screen to the construction right-of-way. Also, lighting for all construction activities will be directed downward, where feasible.

However, even with Trans Mountain's commitment to mitigation measures, some residual sensory disturbance is anticipated. The impact balance of this residual effect is considered negative, as it will likely be undesirable for nearby residents or land/resource users. Given the successful implementation of the mitigation measures, the residual effect of nuisance air emissions, noise and visual disruption is deemed low in magnitude, as it would be limited primarily to that of a nuisance of inconvenience. The effect would be short-term in duration and periodic in frequency, as sensory disturbance would be primarily caused by construction and intermittent but repeated periods of site-specific maintenance. The potential effect is considered reversible in the short-term (Table C7.2.1-2, point 1[f]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – noise and air emissions emanating from the construction can extend into the HORU LSA and HORU RSA.
- Duration: short-term – the event causing the sensory disturbance is construction activity or site-specific maintenance that would occur within any one year during operations.
- Frequency: periodic – the event causing the sensory disturbance would be focused during construction, but would occur intermittently but repeatedly due to site-specific maintenance.
- Reversibility: short-term – the residual effect is limited to the construction phase or site-specific maintenance activities that would occur within any one year during operations.
- Magnitude: low – the implementation of the proposed mitigation measures would effectively reduce the effects of noise and air emissions to that of a nuisance or inconvenience.
- Probability: high – construction and site-specific maintenance activities will involve the use of heavy equipment and vehicles.
- Confidence: high – based on a good understanding of cause-effect relationships and the professional experience of the assessment team.

Alteration of Viewsheds

The Project is anticipated to have longer term visual effects related the presence of the new pipeline right-of-way in select areas. This may affect the quality or experience of certain viewsheds for some land and resource users, including recreational users within Lac du Bois Grasslands Protected Area. The impact balance of this residual effect is considered negative, but low in magnitude as it is considered primarily that of a nuisance or inconvenience.

Potential long-term visual effects of new pipeline right-of-way will be reduced by maintaining existing vegetation buffers and reseeding of the right-of-way and temporary workspaces to reduce the visual intrusion of new areas of right-of-way.

Re-vegetation of disturbed land during reclamation as per methods described in Section 8.2.2 and at rates identified in the Reclamation Management Plan in the Pipeline EPP will ensure the right-of-way vegetation is visually compatible with adjacent areas over the long term. Installing tree/shrub plantings at potential new access points and viewsheds along the right-of-way will minimize the effect in areas of new right-of-way.

The overall residual visual effect of the new pipeline corridor is considered to be reversible in the long-term, as any new cleared right-of-way will be present throughout operations and until the Project is decommissioned and abandoned. However, the magnitude of residual visual effects is considered low. While Project features will be detectable from certain vantage points in the HORU LSA, the effect is considered to be that of a nuisance or inconvenience. The duration of the potential residual effect is considered short-term, and the frequency is considered isolated, as the event causing the alterations in viewshed (*i.e.,* clearing of right-of-way) occurs during the construction phase (Table C7.2.1-2, point 1[g]). Trans Mountain will continue to consult with stakeholders regarding visual effects and potential additional site-specific mitigation during the route finalization. A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU LSA – visual effects related to the pipeline extend beyond the pipeline right-of-way into the HORU LSA.
- Duration: short-term – the event causing the alteration of viewsheds (*i.e.*, clearing of the pipeline right-of-way) occurs during the construction phase.
- Frequency: isolated – the event causing the alteration of some viewsheds is confined to a specific period (*i.e.*, construction of the pipeline).
- Reversibility: long-term – the alteration of select viewsheds due to areas of new right-of-way clearing will last throughout the operations phase.
- Magnitude: low – while changes in certain viewsheds will be detectable, the potential effect is considered to be that of an inconvenience or nuisance. The alteration of the local viewsheds is expected to be reduced by the alignment of the pipeline right-of-way adjacent to existing linear features.
- Probability: high – the Project will involve clearing and construction activities.
- Confidence: high – the professional experience of the assessment team.

Visitor Enjoyment and Safety Indicator – Visitor Safety

Increase in Traffic on Highways and Access Roads During Construction

During construction, there will be an increase in traffic on highways and access roads due to Project-related vehicles. Construction-related traffic will include vehicles used for the transportation of equipment, supplies and workers to various locations along the narrowed pipeline corridor. Major highways that are likely to be used during construction within Lac du Bois Grasslands Protected Area include Highway 5.

Ground transport to the Lac du Bois Grasslands Protected Area construction spread and accommodation hub (City of Kamloops) would be primarily via Highway 5. It is anticipated that most regionally-based personnel would use ground transport from their home community to work locations. Pipeline staging areas will have a combination of work vehicles and crew buses. Existing Annual Average Daily Traffic (AADT) varies in the Project regions. Overall Monthly Average Daily Traffic (MADT) volumes have slightly increased from 2010 to 2012 with larger volumes occurring close to the City of Kamloops, likely due to commuters from the region as Kamloops is the largest city in the Fraser-Fort George/Thompson-Nicola Region. Throughout the Fraser-Fort George/Thompson-Nicola Region, MADT volumes are highest during the summer months. The addition of several hundred Project-related vehicles will more likely be perceptible on highways or highway sections with lower AADT values.

At the time of writing, detailed traffic estimates and logistics plans were not available for the proposed movement of Project workers, equipment and materials. Project effects on regional highway traffic, and how Project traffic compares to overall daily traffic volumes, will ultimately depend on the source of construction equipment, construction camp modules and other supplies and materials (especially pipe), as well as the methods used to transport these items to construction sites. Pipe and other materials obtained from Canadian or North American suppliers can be transported by rail, offloaded at rail sidings at key points within the Socio-economic RSA and transported relatively short distances by truck to construction sites.

Trans Mountain will develop detailed traffic estimates as construction and Project planning related to the movement of people, materials and equipment continues. Trans Mountain will also develop further logistics information on transportation modes and routes to be used during the construction phase, as well as timing transportation movements to each construction spread and/or facility location. This information will be further evaluated in the context of existing regional traffic volumes, and will become part of the overall information that is shared with local governments, Aboriginal communities, resource users and other stakeholders. This information will also be discussed with provincial transportation authorities during the course of the ongoing consultation planning and construction.

Trans Mountain will employ a number of measures to reduce Project-related vehicles and limit the effects associated with construction-related traffic, including providing daily shuttle bus services from staging areas to work sites and for local workers from pre-determined regional staging areas. It is anticipated that many major equipment deliveries will come to the region via rail to temporary stockpile sites along the narrowed pipeline corridor which will limit the distances travelled by heavy loads on regional highways. The increase in traffic will occur during the construction phase and the residual effect is considered to be reversible in the short-term (*i.e.*, limited to the construction phase). An increase in traffic over current operational movements related to workers and maintenance is not anticipated during the operations phase.

The impact balance of an increase in traffic during construction is considered to be negative, as it may contribute to disruption of existing traffic movement patterns and highway/road users. Highway 5 is one of the main access routes for Lac du Bois Grasslands Protected Area. An increase in traffic on this highway, particularly during summer months when there is a noticeable increase in traffic in some communities due to the tourist season, would be more than a nuisance or inconvenience to residents, travellers and other road users. While an increase in traffic due to the Project on the Trans-Canada Highway is not anticipated to be perceived by residents and other road users in the context of its heavy current use, any impediments to the movement of traffic in this busy area caused by the Project could be problematic. However, Trans Mountain will employ mitigation measures to ensure the effects are reduced.

Traffic disruptions could be more than a nuisance or inconvenience to residents, travelers and other road users in some areas. The disruption could result in the need for detours or the inability to access particular locations. Therefore, the magnitude of the residual effect is anticipated to be medium. Disruption to existing traffic movement on single-lane sections of highways could also result in a disruption to residents, travelers and other road users such as delays due to the presence of larger, slower vehicles and temporary road closures resulting in single-lane traffic movement. In Project areas where there are numerous national, provincial and municipal highways and other roads, options are available to road users, therefore, the magnitude of the residual effect in these areas is anticipated to be low.

The probability of occurrence of the residual effect is high, since daily travel will be required to and from the work sites and materials, equipment and workers must be brought to work sites at key points during construction. The level of confidence in the prediction is also high based on the limited number of alternative transportation routes in some socio-economic regions and since daily travel will be required to and from work sites. (Table C7.2.1-2, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Socio-economic RSA – highways and access roads anticipated to be used by Project vehicles are located in various locations across the Socio-economic RSA.
- Duration: short-term – the movement of Project-related equipment, materials and workers during construction will cause the effect; no perceptible increases in traffic are anticipated during the operations phase.
- Frequency: isolated – the movement of equipment, materials and workers on regional highways resulting in increases in traffic is confined to a specific phase of the assessment period (*i.e.,* construction phase).

- Reversibility: short-term – the Project-related increase in traffic is limited to the construction phase.
- Magnitude: low to medium – low in areas with multiple transportation route options; medium in areas with single access routes or where the increase in construction traffic coincides with summer tourist months.
- Probability: high – Project-related traffic on highways and access roads will be present during construction.
- Confidence: high – transporting equipment and supplies will result in an increase in traffic, assuming that non-Project related traffic will remain constant.

Increase in Traffic-Related Injury and Mortality

Since the number of traffic collisions in a given area is associated with traffic volumes, an increase in Project-related traffic could be expected to result in a higher number of collisions, and with it an increase in the risk of traffic-related injuries or fatalities. It is not possible to quantify the extent of a potential increase or whether there would be a measureable, increase, because the numbers of proposed Project-related vehicles in each area are not currently known. However, there are several factors that may modify the frequency or severity of those collisions and injuries and that suggest approaches for Trans Mountain to use in minimizing the potential impacts on public safety. These factors are: numbers of vehicles; location of vehicles; and driver behaviour.

Number of Vehicles

Safety performance functions that have been developed for different roadway types confirm that the number of collisions expected in a given area relates directly to the volume of traffic on that roadway segment. In other words, more traffic equates with more collisions (Parisien 2012). By limiting or minimizing the additional traffic put onto a road, the risk of collisions and traffic injuries is also reduced.

Project traffic will comprise both vehicles used to transport equipment and supplies, and also vehicles used to transport workers. Of these, worker transport is more amenable to being reduced, through the use of buses or vans to transport workers rather than private vehicles.

Location of Vehicles

Intersections are particularly hazardous with respect to collisions, as approximately 60% of all crashes in BC occur at intersections (Insurance Corporation of BC 2012a-k, Lord and Mannering 2010). Road safety snapshots produced by the Insurance Corporation of BC identify the high-crash intersections for select BC communities. These are noted in the Traffic and Access Control Management Plan in Appendix C of the Pipeline EPP (Appendix A of this Proposal) for communities for which this information is available. These intersections should be taken into account when planning Project traffic routes; but if they cannot be avoided, then drivers should be instructed to take particular caution should be taken around these intersections.

Driver Behaviour

A number of driver behaviours can contribute to the risk and severity of collisions. Driver inattention was the number one contributing factor to collisions in BC in 2007 according to the BC Motor Vehicle Branch (Motor Vehicle Branch 2007); excessive speed was the second most frequent contributing factor.

The development and strict enforcement of policies on driver behaviour, among both employees and contractors, is essential for minimizing potential effects on traffic safety. These policies will include screening of driver abstracts, provisions on observance of posted speed limits, a ban on cell-phone or tablet use, mandatory seatbelt use, fatigue management, no driving while impaired and other behaviours that can influence safety.

Concerns around traffic volume, congestion and safety have been raised as an issue in the context of the Project by a number of key informants. The Project will increase the amount of traffic on public roads because of the need for transportation of equipment, supplies and workers to various locations along the narrowed pipeline corridor. Trans Mountain will develop detailed traffic estimates as construction and project planning continues; these detailed traffic estimates are not currently available. The increase in traffic is projected to occur mainly during the construction phase; little Project-related traffic is anticipated for the operations phase.

Mitigation measures include the development of site-specific Traffic Access and Control Plans; the use of shuttle buses, where feasible, to reduce the volume of traffic on the road; communication with local police and emergency services; the development and enforcement of mandatory minimum driving standards; and development of a driving complaint mechanism.

In summary, the Project will increase the number of vehicles in the Socio-economic RSA, both in terms of Project-related construction vehicles and vehicles used to transport workers. Evidence from the literature shows that an increase in traffic volumes results in an increased risk of traffic collisions. This in turn increases the risk of collision-related injuries and fatalities. The impact balance of this effect is characterized as negative since vehicle collisions pose a detriment to community health. The effects would extend throughout the Socio-economic RSA, and would manifest in those locations in which the Project uses vehicles on public roadways. Risk will be particularly high in collision “hot-spots” – locations (usually intersections) which have pre-existing high rates of traffic collisions. The duration is characterized as short-term and the frequency as isolated since the effect is primarily linked to the construction phase when the Project workforce will be large and when the movement of heavy machinery and vehicles is required. An increase in traffic-related injury and mortality is unlikely for the operations phase since there will be fewer workers and equipment requiring transport. The reversibility is similarly characterized as short-term since any effect would mainly be observed during the construction phase. The increase in risk of traffic-related injury and mortality is highly dependent upon the number and types of additional vehicles, the current road conditions and capacity of the roadways, driver behaviour, and the characteristics of the areas through which traffic will travel. While the addition of Project-related traffic creates an increase in collision risk, traffic-related collisions, injuries and fatalities are rare events; therefore, even though the risk increases, there is no certainty that any traffic-related injuries or fatalities will result from the increase in traffic. In addition, no regulatory standards exist for this area. The magnitude of effect is characterized as negligible to medium. The probability of occurrence is rated as low since, as noted above, traffic accidents are rare. The level of confidence in this evaluation is high, since the literature showing this cause-effect relationship relates to other areas in BC and internationally (Table C7.2.1-2, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Socio-economic RSA – effects extend throughout the Socio-economic RSA wherever worker and Project-related traffic exists and would be a primary concern in current traffic accident hot-spots.
- Duration: short-term – the event causing the potential increase in traffic-related injury and mortality is the construction phase, when the Project workforce will be large and when heavy machinery and vehicles are required.
- Frequency: isolated – the event causing the potential increase in traffic-related injury and mortality is confined to the construction phase.
- Reversibility: short-term – residual increases in traffic related injury and mortality are considered to be limited to the construction phase.
- Magnitude: negligible to medium – no regulatory standards exist for this area. While the addition of Project-related traffic creates an increase in risk, traffic-related collisions, injuries and fatalities are rare events.
- Probability: low – the probability of occurrence is rated as low since traffic collisions, injuries and fatalities are rare events.
- Confidence: high – the literature showing this cause-effect relationship relates to other areas in BC and internationally, and some stakeholders are concerned about traffic accidents.

7.2.1.3 Summary

As identified in Table C7.2.1-2, there are no situations for visitor enjoyment and safety indicators that would result in a significant residual socio-economic effect. Consequently, it is concluded that the residual socio-economic effects of Project construction and operations on recreational values of Lac du Bois Grasslands Protected Area such as visitor enjoyment and safety will be not significant.

7.3 Synopsis

The impacts of TMEP's construction and operations on the social and environmental values of Lac du Bois Grasslands Protected Area will be minimized through mitigation and reclamation. Based on the Draft Stage 2 Detailed Proposal prepared for BC Parks, Trans Mountain has concluded that the TMEP:

- is consistent with the management objectives of Lac du Bois Grasslands Provincial Protected area;
- will result in no significant adverse residual environmental or socio-economic effects;
- will conserve the biological diversity of natural ecosystems and maintains the recreational values within Lac du Bois Grasslands Protected Area;
- compensation offsets will maintain, and in some instances enhance, the objectives of the protected area management plans; and
- will provide positive overall economic benefit to BC.

8.0 RECLAMATION IN LAC DU BOIS GRASSLANDS PROTECTED AREA

The Reclamation Plan is built upon the Pipeline EPP and environmental surveys and identifies additional measures and activities to re-establish the ecological integrity of Lac du Bois Grasslands Protected Area during Project construction. The measures and other work described in the Reclamation Plan will generally apply to the Project Footprint within Lac du Bois Grasslands Protected Area. Ongoing consultation with BC Parks may entail further mitigation measures and revisions to the Reclamation Plan and as such, the final Reclamation Plan will be completed prior to construction. Additional site-specific reclamation plans (*i.e.,* reforestation of TWS plans) may be required and entail further consultation with BC Parks, Aboriginal groups, stakeholders and the general public. Implementation of the measures included in the Reclamation Plan will commence during the construction phase and continue into the operations phase. Where warranted, follow-up plans will be developed to ensure that the mitigation measures, activities and other works identified in the Reclamation Plan are effective.

8.1 Reclamation Consultation

The development of the Reclamation Plan has been a collaborative effort between Trans Mountain, government agencies and interested stakeholders. In particular, input regarding reclamation measures was solicited and received from the Project environmental team (including fish, wetland, vegetation and wildlife experts) and BC Parks. Additional comments have been solicited from ENGOs and will continue throughout the preparation of the Reclamation Plan (Table 8.1-1).

TABLE 8.1-1

CONSULTATION CONTACTS

Stakeholder Group	Date of Contact	Method of Contact	Items Discussed
BC Parks	May 22, 2014	Field Visit	Park revegetation and reclamation requirements

8.2 General Reclamation Measures

Reclamation activities will be in keeping with Lac du Bois Grasslands Protected Area's Management Direction Statement and particular consideration will be given to the ecological integrity of the rare ecological communities and sensitive upland environments (*e.g.,* alkaline flats) within Lac du Bois Grasslands Protected Area.

8.2.1 Non-native Invasive and Agronomic Plant Species Management Prior to Construction

Non-native invasive plant species management is a key component of the reclamation program within Lac du Bois Grasslands Protected Area. Prior to construction, a weed survey will be completed within Lac du Bois Grasslands Protected Area on the proposed construction right-of-way to determine the species, location and density of non-native invasive and agronomic species. Trans Mountain will temporarily utilize the Telus FOTS right-of-way where it abuts the proposed TMEP right-of-way. Trans Mountain has made an agreement with Telus to use their right-of-way during construction and have agreed to the following in regards to reclamation:

> *"TMPL shall restore and replant the surface of the Telus Right-of-Way with native grasses. TMLP agrees that the nature of the restoration (including the plan and strategy for replanting the Telus Right-of-Way and the specific native grass seeds which will be used in the replanting) shall be determined in consultation among Telus, TMPL and the BC Ministry of Environment, Land and Parks."*

During baseline early and late season rare plant surveys conducted by Trans Mountain, two agronomic species (crested wheatgrass and alfalfa) were observed growing on the Telus FOTS right-of-way. At the time of the survey, it was also observed that these species have not migrated off of the FOTS right-of-way and into the adjacent and, primarily native, plant community. To meet the goals for the management of non-native invasive and agronomic species within the protected area, Trans Mountain will utilize the weed survey report to identify the distribution and density of undesirable vegetation and to implement the appropriate chemical and mechanical (where feasible) controls. It is anticipated, the results of the pre-construction vegetation management will reduce the spread of undesirable species along the right-of-way during construction as well as their establishment following topsoil replacement.

8.2.2 Revegetation

8.2.2.1 *Natural Regeneration*

Where the potential for soil erosion and non-native invasive and agronomic species infestation is low, and where it is anticipated that the topsoil/root zone material contains a seed bank of suitable native species, it may in some instances be preferable to not re-seed the disturbed area (*e.g.,* wetlands and alkaline flats). This revegetation method will facilitate the establishment of pre-disturbance vegetation through native seed germination and establishment on the disturbed area following clean-up and topsoil/root zone material replacement. In areas with potential erosion and weed concerns, a native perennial or non-native annual grass cover crop species will be applied. The cover crop species will establish rapidly to control erosion and limit weed growth while pre-disturbance vegetation establishes.

Natural regeneration is preferred over seeding with commercially available native seed where it is practical and where it is anticipated that pre-disturbance vegetation will re-establish on the disturbed area. However, care must be taken when using natural regeneration techniques to avoid invasion of non-native invasive and agronomic species (*e.g.,* crested wheatgrass), as is often the case when paralleling other linear disturbances. High moisture/low-lying areas (*e.g.,* wetlands) that have the potential to regenerate rapidly as well as areas where suitable native seed may not be available (*e.g.,* alkaline flats), are prime candidates for natural regeneration.

8.2.2.2 *Selection of Grass Species*

BC Parks representatives have requested the use of native grass species with a suitable local genome for revegetation of the construction disturbances within Lac du Bois Grasslands Protected Area. In an effort to meet the request of BC Parks, Trans Mountain have engaged the local Tk'emlups te Secwepemc through the Tk'emlups Forestry Development Corporation (TFDC). In July 2014, the TFDC collected approximately 275 kg of native seed from native grasslands within the vicinity of Lac du Bois Grasslands Protected Area. A large portion of the collected seed contained blue bunch wheatgrass and other native species indigenous to the protected area. The collected seed will be cleaned, native species will be separated, and non-native invasive and agronomic species removed. The separated native species seed will either be direct seeded on the construction right-of-way, used in native seed multiplication plots to increase the volume of seed available for direct seeding, or used for rooted stock plug propagation and planting of the proposed construction right-of-way. Trans Mountain will continue to work with TFDC and Thompson Rivers University to identify the most appropriate methods of acquiring local native grass seed for Project reclamation.

In the event local native grass seed collection and/or seed multiplication efforts do not meet the seed mix (or native perennial cover crop) species volume requirements for the Project, then commercially available native species seed will be required to make up the balance.

8.2.2.3 *Seed Mix Development*

Seed mixes were developed and native perennial and non-native annual grass cover crop species will be selected in consultation with BC Parks. Seed mixes will consist of species native to the protected area and will reflect those species that are anticipated to be successfully collected and/or multiplied from local seed genomes (Dwg. C-01 of the Draft Stage 2 Detailed Proposal).

8.2.2.4 *Seedbed Preparation following Topsoil/Root Zone Material Replacement*

Following topsoil/root zone material replacement, the construction right-of-way will be track packed to recompact the surface soil and create micro-sites to capture seed and surface water. On sloping terrain or where soils (*e.g.,* fine sand or silt textures or alkaline soils) have the potential to erode due to wind or water, tackifier and hydromulch will be applied.

8.2.2.5 *Non-native Invasive or Agronomic Species Management during Reclamation*

In recognition of the uncertainty of the volume of native species seed that will be available at the time of reclamation, as well as the level of non-native invasive and agronomic species that will germinate following topsoil replacement, Trans Mountain proposes the following mitigation measures to reduce the level undesirable vegetation and increase the success of native species establishment following reclamation:

- sample and analyse salvaged topsoil/root zone material during construction for the presence of viable native, non-native invasive and agronomic plant species;
- monitor topsoil/root zone material windrows during construction for vegetation growth to identify germinating species seed; and
- estimate the percentage (and establish a percentage threshold) of native vs undesirable species that are expected to germinate following topsoil replacement based on the results of topsoil/root zone material analysis of viable native, non-native invasive and agronomic plant species seed and observations of species seedlings on topsoil/root zone material windrows. Identify right-of-way segments for cover crop seeding/undesirable vegetation management, direct seeding and/or grass plug planting as follows:
  - implement cover crop seeding (non-native annual species seed) followed by chemical weed control (spot or broadcast application) of germinating non-native invasive and agronomic species seed if the level of germinating seed of these species exceeds the determined percentage threshold. Following chemical weed control, drill or broadcast native seed and/or install rooted stock plugs; or
  - drill or broadcast native seed and/or install rooted stock plugs if the anticipated level of germinating seed of non-native invasive and agronomic species seed does not exceed the determined percentage threshold.

8.2.2.6 *Nutrient Management on Disturbed Forested and Shrub Land Areas*

A slow-release nitrogen fertilizer is proposed for application on lands that contain woody debris and/or wood chips mixed into the salvaged and replaced root zone material or that have been placed on cleared and ungrubbed portions of the construction right-of-way. The nitrogen fertilizer will serve to adjust the carbon-nitrogen ratio in these carbon rich environments to a level that will be conducive to the establishment of seeded grass species and naturally regenerating vegetation.

To avoid deposition or leaching of applied nutrient into waterbodies, nitrogen fertilize will not be applied within a 30 m buffer to wetlands or watercourses. In addition, the fertilizer application rate will vary based on the level of woody debris and/or wood chips encountered within or on the surface of the root zone material, the soil texture and the slope of the land adjacent to waterbodies to ensure nutrient movement is minimized.

8.2.2.7 *Seeding of Grass Species*

Seeding of an annual cover crop species (where undesirable vegetation exceeds a percentage threshold) or a perennial seed mix or cover crop species (where undesirable vegetation does not exceed a percentage threshold) will be conducted as soon as practical following topsoil/root zone material replacement (Dwg. C-01 of the Draft Stage 2 Detailed Proposal). Drill or broadcast seeding of native seed mixes or grass cover crop species will be conducted on most of the right-of-way, except where natural regeneration of native vegetation is the preferred method. Seed mixes will be installed at locations indicated on the Environmental Alignment Sheets, unless otherwise requested by the BC Parks Area Supervisor or Conservation Specialist.

8.2.2.8 *Installation of Rooted Stock Grass Plugs*

Due to the challenges of acquiring sufficient volumes of key native grass species seed for direct seeding during reclamation (*e.g.,* rough fescue), small volumes of native seed collected from a local genotype could be propagated as rooted stock plugs and installed on the construction right-of-way at select locations. Under the guidance of a Reclamation Specialist (or other qualified professional), planting crews will install the rooted stock plugs using standardized silviculture planting equipment and techniques. The rooted stock plugs will be installed at a specified density/distribution with the purpose of supporting the re-establishment of biological diversity across the construction right-of-way and to assist with initiation of an early ecological recovery trajectory that will, in time, emulate the adjacent undisturbed vegetation in form and function where not influenced by Trans Mountains operation and maintenance procedures.

8.2.3 Erosion and Sediment Control

Erosion and sediment control (ESC) measures will be implemented to maintain soil conservation along the proposed right-of-way, preserve existing vegetation on the adjacent land use as well as to facilitate the establishment of permanent vegetation along the proposed disturbance.

General ESC Measures

- Woody vegetation located on TWS areas will be cleared and not grubbed where topsoil/root zone material salvage is not anticipated.
- Topsoil/root zone material will be stored on cleared/ungrubbed TWS areas adjacent to the proposed right-of-way.
- Subsoil will be stored on geotextile when placed over ungrubbed TWS areas.
- Topsoil/root zone material and grading material (subsoil) will be stored in separate piles so as not to admix.
- Following the replacement of trench and grade subsoil, recontour the area to match the adjacent landscape profile prior to topsoil/root zone material replacement.
- Avoid, to the extent feasible, mixing of subsoil and topsoil/root zone material during materials replacement.
- Replacement of subsoil and topsoil/root zone material will be managed to avoid mixing soils and to provide conditions favorable for plant growth.
- Apply hydromulch and/or tackifier at disturbed right-of-way locations where there is potential for soil erosion due to wind or water.
- Install a non-native annual or native perennial cover crop species and a prescribed grass seed mix through broadcast or drill seeding methods on all exposed soils except wetland areas. Ensure any seed mixes and cover crop species used are approved by the BC Parks.

Specific ESC Measures

ESC measures that will be considered for use on the proposed construction right-of-way are described in the following subsections:

Hydromulch/Tackifier Application

An applied hydromulch/tackifier mixture is designed to provide short-term protection to surface soils from wind erosion and minor water erosion, and to provide a surface mulch to promote seed germination and vegetation establishment.

Diversion Berms

Diversion berms are intended to reduce slope length and runoff velocities, and divert runoff into well-vegetated areas. Diversion berms will be designed with a suitable spacing, slope gradient and berm height to effectively convey overland water flow onto stable off right-of-way vegetation (Dwg. C-02 of the Draft Stage 2 Detailed Proposal).

Rollback

Trans Mountain will avoid the use of Douglas-fir and spruce for rollback within Las du Bois Provincial Park. Select tree species (*e.g.,* pine) felled during construction will be used in these locations as rollback, to the extent allowable, to provide erosion control and habitat enhancement. woody material felled during construction will be used in these locations as rollback, to the extent allowable, to provide erosion control and habitat enhancement. The woody rollback will provide microsites to aid in the re-establishment of woody vegetation and assist in the control of soil erosion along the proposed right-of-way where woody vegetation was cleared. To obtain material required for rollback, woody slash will be salvaged during construction clearing activities in suitable quantities to allow for the placement of rollback at select locations onto the construction right-of-way following topsoil/root zone material replacement. (Dwg. C-03 of the Draft Stage 2 Detailed Proposal).

Grass Seeding

Native seed mixes and native perennial and non-native annual cover crop species are proposed and will be confirmed with BC parks for use on construction disturbances within Lac du Bois Grasslands Protected Area (Dwg. C-01 of the Draft Stage 2 Detailed Proposal). An appropriate native grass seed mix, or native perennial or annual non-native cover crop species will be sown along the disturbed areas following topsoil replacement at an appropriate prescribed rate. Disturbed areas containing wetland vegetation will be left to natural regeneration.

8.3 Specific Reclamation Issues

The biophysical elements listed below warrant special consideration due to the difficulty in reclaiming and/or managing them. Specific reclamation and/or management plans will be developed from ongoing consultation with BC Parks personnel as well as field surveys.

8.3.1 Rare Plants and Communities

Protection of rare vascular and nonvascular plants and plant communities is important for maintenance of ecological integrity. Pre-construction surveys identified seven rare plant communities which will require special consideration before, during and after construction. Mitigation measures have been developed for this Project to accomplish effective protection of the rare plant populations and communities. These measures include:

- before pre-construction:
  - conduct native seed collection for use in revegetation efforts at the site (Dwg. C-04 of the Draft Stage 2 Detailed Proposal);
  - consider employing appropriate salvage, propagation and transplant technique for component species; and
  - consider delaying clearing to allow seed set and to limit drying of the soils.
- during construction:
  - fence or clearly mark the site using flagging and inform all users of access restriction in the vicinity of flagged or fenced sites;
  - narrowing down the right-of-way or reorient the area of disturbance and protect the site using fencing or clearly mark the site using flagging and inform all users of access restrictions in the vicinity of flagged or fenced sites (Dwg. C-05 of the Draft Stage 2 Detailed Proposal);
  - leave gaps in the topsoil/root zone material piles or subsoil piles to avoid the site;
  - avoid or reduce clearing of trees or shrubs in the vicinity or the site;
  - reduce grubbing of roots within TWS areas, where feasible;

  - mow or walk down rather than wholly remove shrubs, where feasible;
  - use protective matting and/or snow during the winter (mark the area in case snow melts) to mat over the population or community where it occurs on the Project area, and other areas where topsoil/root zone material removal is not required, to protect vegetation from scraping and compacting (Dwg. C-06 of the Draft Stage 2 Detailed Proposal); and
  - install collected native seed and salvaged native plant species as detailed in the Pipeline EPP and on the Environmental Alignments Sheets.
- after construction:
  - monitor effectiveness of implanted mitigation measures during rare plant Post-construction Environmental Monitoring; and
  - avoid blanket use of herbicides within 30 m or, or between the range of, the provided UTM coordinates. Targeted spraying, wicking, mowing or hand-picking are acceptable weed control measures in proximity to rare plants and rare ecological communities and may be important to prevent competition with invasive plant species.

8.3.2 Weed and Vegetation Management Plan

Management of weeds and problem vegetation is essential to maintaining the ecological integrity of Lac du Bois Grasslands Protected Area during and after Project construction. Trans Mountain will use an integrated vegetation management (IVM) approach that includes non-chemical, cultural and chemical methods to control and reduce the spread of weeds and problem vegetation. The non-chemical, cultural or chemical treatment methods used will vary with life-form and mode of reproduction of the species targeted and the location and extent of the infestation. Non-chemical and cultural treatments include hand-pulling, cultivation, mowing, burning, mulching and active restoration of native plant communities. Chemical treatments include either selective herbicides (*i.e.*, target specific plant species) or non-selective herbicides (*i.e.*, target all vegetation).

Trans Mountain will actively cooperate with BC Parks and other stakeholders to implement an IVM approach to weed and problem vegetation management as outlined in Kinder Morgan Canada's Integrated Vegetation Management Plan and the Weed and Vegetation Management Plan provided in Section 14.0 of Appendix C of the Pipeline EPP. Accurate records of weed infestations, management measures undertaken and the success of these measures will be maintained so that weed and vegetation management plans can be modified as necessary from year to year.

Specific weed and problem vegetation management measures for pre-construction, construction and post-construction are provided in the aforementioned Weed and Vegetation Management Plan. Further measures involving monitoring and control measures following construction are provided in (Dwg. C-07 of the Draft Stage 2 Detailed Proposal).

Detailed weed and problem vegetation reports will be developed for site-specific locations, as required, following a pre-construction weed survey (scheduled for spring 2015) and consultation with BC Parks Conservation Specialists. Weed and problem vegetation infestations and recommended mitigation measures will be incorporated into the Environmental Alignment Sheets.

DRAWINGS

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Drawing C-05	Narrow Down Fencing
Drawing C-06	Rare Plant Ramp Protection
Drawing C-07	Weed Control

CRITERIA FOR IMPLEMENTATION

Seed mixes (see tables below) will be installed at locations indicated on the Environmental Alignment Sheets, unless otherwise requested by BC Parks Area Supervisor or Conservation Specialist.

Notes:

1. Species cultivars (and genotypes if available), where applicable, will be determined at the time of procurement based on availability and suitability as determined by Trans Mountain.
2. Native seed species will be obtained from local genomes (through collection or multiplication) to the extent feasible.
3. All seed mix species must have Certificates of Analysis to allow for the determination of weed and undesirable species content, and germination for each species seed lot used in the seed mix.
4. Certificates of Analysis for each seed mix species will be reviewed by Trans Mountain prior to use or purchase. Any lot with unacceptable weed contamination or viability will be rejected.
5. Seed mix species that are unavailable in sufficient quantity or quality at a reasonable cost as determined by Trans Mountain at the time of procurement will be eliminated from the mix and the proportions of other species in the mix increased.
6. Drill seeding will be used, where feasible, with the exception of slopes which are too steep to safely operate the tractor and seed drill, areas too wet to access with a tractor and seed drill without causing rutting and poor seed placement, stony areas which could cause damage to the equipment or impede the ability of the drill to properly place the seed, and any other areas which cannot be feasibly reached with the seed drill.
7. Drill seeding application methods will be used where it is determined that conditions allow and the seed mix can be sufficiently cleaned to pass through the drill calibration system for accuate dispersal of the seed mixture (it may not be possible to clean some had and mechanically collected local species genomes sufficiently for drill seeding methods).
8. The Environmental Inspector or Reclamation Manager, upon assessing ground conditions, will determine the seeding method to be used to achieve optimum results. For example, where soils are fine and the potential for erosion by wind is moderate to high, hydro seeding with mulch and tackifier may be condidered as the optimal seeding method for the field conditions.
9. Broadcast seeding method, will be used on lands where drill seeding is determined not suitable to facilitate seed mix establishment.
10. All seed drills and broadcast seeders will be calibrated for each seed species or seed mix using the manufacturer's recommended procedures; alternate calibration procedures may be used if approved by the Environmental Inspectors.
11. The seeding contractor will develop appropriate seeding procedures to ensure even distribution of all species in each seed mix and have these procedures approved by the Environmental Inspector. This may involve, but not be limited to:
    - using seed box agitators to prevent stratification of large and small seeds;
    - seeding large and small seed species from separate seed boxes, or in separate passes with the seeder; or
    - using an inert filler agent with the seed mix.
12. Seeding depth with seed drills will be 1-2 cm in fine textured soils and 1-3 cm in sandy soils.
13. During the construction final cleanup phase, before reclamation seeding, tracked equipment will be used to imprint soils at right angles to the direction of the slope (track packing). Track packing helps prevent soil erosion and provides micro sites to capture moisture for seed germination. Where it is determined that soil conditions and track packing is sufficient, no further harrowing or hand raking of topsoil will be implemented.
14. Only the salvaged or cultivated width of the construction right-of-way will be seeded with minimal overlap onto undisturbed areas. Swing-out passes will be made to seed scalped areas adjacent to the cultivated portion as needed.
15. Complete coverage of the stripped area will be ensured by using a sufficient number of passes. Damage to the native sod adjacent to the disturbed portion of the construction right-of-way will be avoided.
16. Broadcast seeding will be delayed during high wind conditions, as directed by the Environmental Inspector.

SEED MIXES

The following proposed native grass seed mixes have been formulated to reflect the native grass species composition of the plant communities observed during Project rare plant surveys conducted in LdB Park in 2013 and 2014. A native grass species collection program is currently being conducted by Trans Mountain in cooporation with the Tk'emlups First Nation in an effort to collect native grass species of a suitable genome for use during reclamation. Due to the uncertainty of native grass seed-set and viability each year, Trans Mountain is uncertain of the grass species and seed volumes that will be available for direct seeding, use as foundation seed stock during seed multiplication or rooted stock plug production. The proposed seed mixes may be modified to reflect the availability of native collected/multiplied species seed, suitable commercially available seed or where select species are propagated and installed as rooted stock plugs.

Cover Crop
A cover crop is a fast-germinating and establishing annual/biennial or short-lived perennial grass species that is seeded to quickly stabilise topsoil, control erosion and limit weed growth while pre-disturbance vegetation reestablishes. Short-lived perennial grass cover crop species include slender/awned wheatgrass or Canada wild rye. Short-lived annual/biennial cover crop specie includes annual ryegrass. Broadcast short-lived perennial grass species seed at 10 kg/ha or 100 grams/100 m^2 and annual/biennial cover crop species at 8 kg/ha or 80 grams/100 m^2.

Seed Mixes – Lac Du Bois Protected Area			
Biogeoclimatic Zone	Rare Ecological Community	Mix #1	%WT
Bunchgrass	trembling aspen / common snowberry / Kentucky bluegrass	blue bunch wheatgrass rough fescue slender wheatgrass June grass seeding rate broadcast seed at 10-12 kg/ha drill seed at 6-8 kg/ha	40 30 15 15
		Mix #2	%WT
Bunchgrass	rough fescue / blue bunch wheatgrass	rough fescue blue bunch wheatgrass Rocky Mountain fescue needle and thread grass seeding rate broadcast seed at 10-12 kg/ha drill seed at 6-8 kg/ha	50 20 15 15
		Mix #3	%WT
Bunchgrass	blue bunch wheatgrass / June grass	blue bunch wheatgrass June grass Rocky Mountain fescue needle and thread grass seeding rate broadcast seed at 10-12 kg/ha drill seed at 6-8 kg/ha	60 20 10 10
		Mix #4	%WT
Bunchgrass	ponderosa pine / blue bunch wheatgrass	blue bunch wheatgrass rough fescue June grass Cusick's bluegrass seeding rate broadcast seed at 10-12 kg/ha drill seed at 6-8 kg/ha	45 30 15 10
		Mix #5	%WT
Bunchgrass	big sagebrush / blue bunch wheatgrass	blue bunch wheatgrass rough fescue June grass Rocky Mountain fescue seeding rate broadcast seed at 10-12 kg/ha drill seed at 6-8 kg/ha	40 20 20 20
		Mix #6	%WT
Bunchgrass	native shrubland / FOTS	blue bunch wheatgrass June grass needle and thread grass Sandberg's bluegrass seeding rate broadcast seed at 10-12 kg/ha drill seed at 6-8 kg/ha	40 30 20 10

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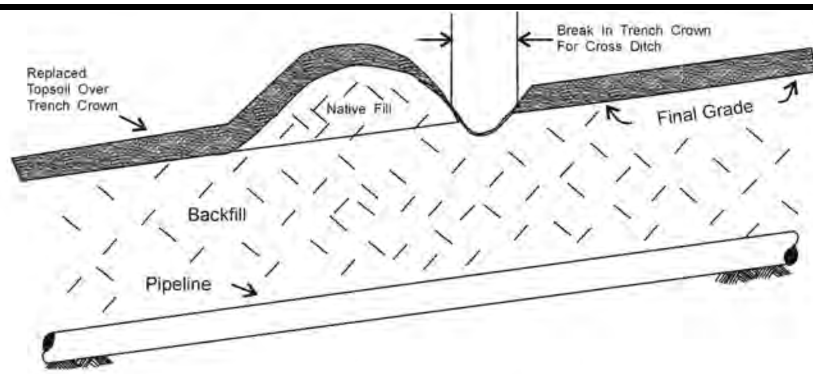
TRANS MOUNTAIN EXPANSION PROJECT

TRANSMOUNTAIN

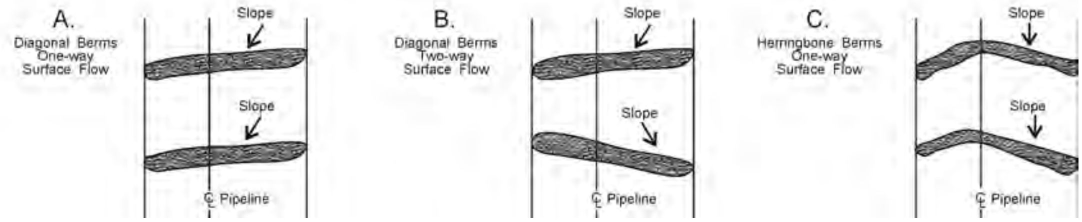
SEED MIXES

7894	August 2014	Drawing C-01

Profile
(Not to Scale)



Plan View
(Not to Scale)



Notes:

Representation Only

1. Install diversion berm and cross ditch on moderate and steep slopes on non-cultivated lands to divert surface water off the construction right-of-way. Install berms immediately downslope of trench breakers to collect seepage forced to the surface.
2. Skew berm across the construction right-of-way at downhill gradient of 5-10%.
3. Construct diversion berm of compacted native subsoils where extensive disturbance of the sod layer has occurred. Diversion berms should be constructed of timbers, imported logs or sandbags if disturbance of the sod layer is limited. Avoid use of organic material. Where native material is highly erodible, protect upslope of berm and base of cross ditch by burying a geotextile liner approximately 20 cm below the surface or armour upslope face of berm with earth-filled sand bags.
4. Typical diversion berm height and widths are approximately 0.75 m for summer construction and 1.0 m for winter construction. Trans Mountain shall inspect berms after heavy rains and the first spring following construction; replace or restore berms, if warranted.
5. Tie berms into existing berms on adjacent rights-of-way, where applicable.
6. Leave a break in trench crown immediately upslope of diagonal berm and cross ditch to allow passage of water across the construction right-of-way.
7. Use diagonal berms where direction of slope and surface water movement is oblique to construction right-of-way.
8. Use herringbone berm and cross ditch where direction of slope and surface water movement is parallel to construction right-of-way so runoff does not cross ditchline.
9. Determine location and direction of berm based on local topography and drainage patterns. Typical diversion berm spacing is indicated below.

Slope Gradient (º ;%)	Typical Spacing (m) Erosion Hazard*		
	High	Medium	Low
<7; <12	30-45	45-60	60 or more
7; 12	25	38	51
8; 14	22	33	44
9; 16	19	29	38
11; 19	16	24	32
14; 25	12	18	24
18; 33	9	14	18
27; 50	6	9	12

* High = fine sand and silts; medium = clays and coarse sands; low = rock or gravel.

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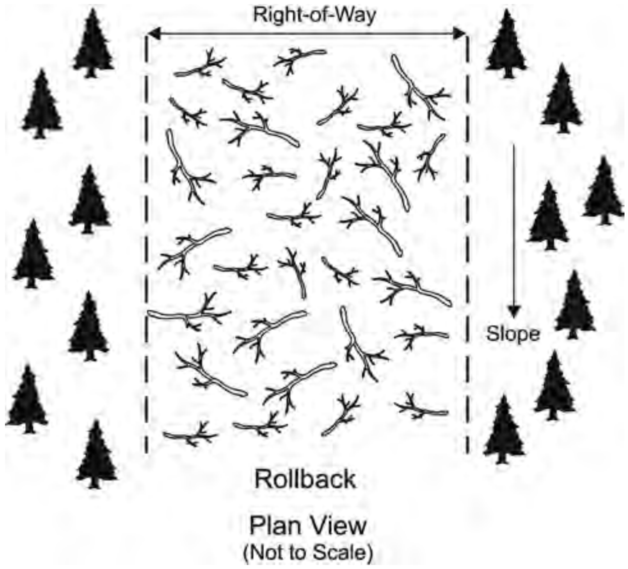
TRANSMOUNTAIN

CROSS DITCHES AND DIVERSION BERMS

7894	August 2014	Drawing C-02



CRITERIA FOR IMPLEMENTATION

Slash and nonsalvageable timber may be used as rollback for erosion control where available and acceptable to the appropriate authority, as well as at strategic locations along the right-of-way for access control. Specific locations will be determined by Trans Mountain's Environmental Inspector(s) at the time of clearing. Do not use Douglas-fir for rollback.

Notes:

1. Retain slash and nonsalvageable timber, where required, for use as rollback.
2. Larger diameter slash (*e.g.,* 10 cm in diameter or larger) should be used for rollback intended for access control, plant micro-sites establishment or as soil erosion control.
3. The amount of timber retained for use as rollback will be determined by Trans Mountain's Construction Supervisor(s) in consultation with Trans Mountain's Environmental Inspector(s) and the appropriate authority. Store material for rollback along the edges of the right-of-way.
4. Walk down rollback with a dozer on steep slopes, if safe to do so.

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	ROLLBACK		
	7894	August 2014	Drawing C-03

Native Seed Collection

CRITERIA FOR IMPLEMENTATION

Native seed will be collected from areas of undisturbed native vegetation, either on the right-of-way or at suitable locations off the right-of-way with the approval of the appropriate government agency prior to construction. Seeds of select species will be collected and stored or propagated to increase seed volumes or produce transplantable seedlings.

Notes:

1. Potential locations where native seed will be collected from the right-of-way have been determined from the results of field surveys.

2. Potential sites will be inspected in the field to assess for contamination with undesirable species and the presence of target desirable species.

3. Seed will be collected by a qualified botanical expert using an appropriate method. Collections will be conducted numerous times throughout the growing season, in order to collect seed from as many species as possible.

4. All phases of native seed collection work will be documented for tracking, including: species collected; location; date; amounts; and storage location.

5. The seed will be processed and cleaned under the supervision of a botanical expert. Viability and weed content tests will be conducted.

6. The seed will be stored in appropriate facilities under the supervision of a botanical expert.

7. Collected and reproduced native seed will be provided to the seeding contractor prior to the initiation of seeding selected areas. Seeding operations will be supervised by the Environmental Inspector. Seeding procedures, areas and rates will be determined by a botanical advisor expert on site-specific conditions.

8. For species with small volumes of collected seed, the seeds will be cultivated under greenhouse conditions to either increase the volume of seed or produce plant plugs that can be transplanted.

Rare Plant Seed Collection

CRITERIA FOR IMPLEMENTATION

Rare plant seed will be collected from rare plants along the right-of-way that cannot be avoided or protected during construction.

Notes:

1. Potential locations where rare plant seed will be collected from the right-of-way have been determined from the results of field surveys.

2. Seed will be collected by a qualified botanical expert using an appropriate method.

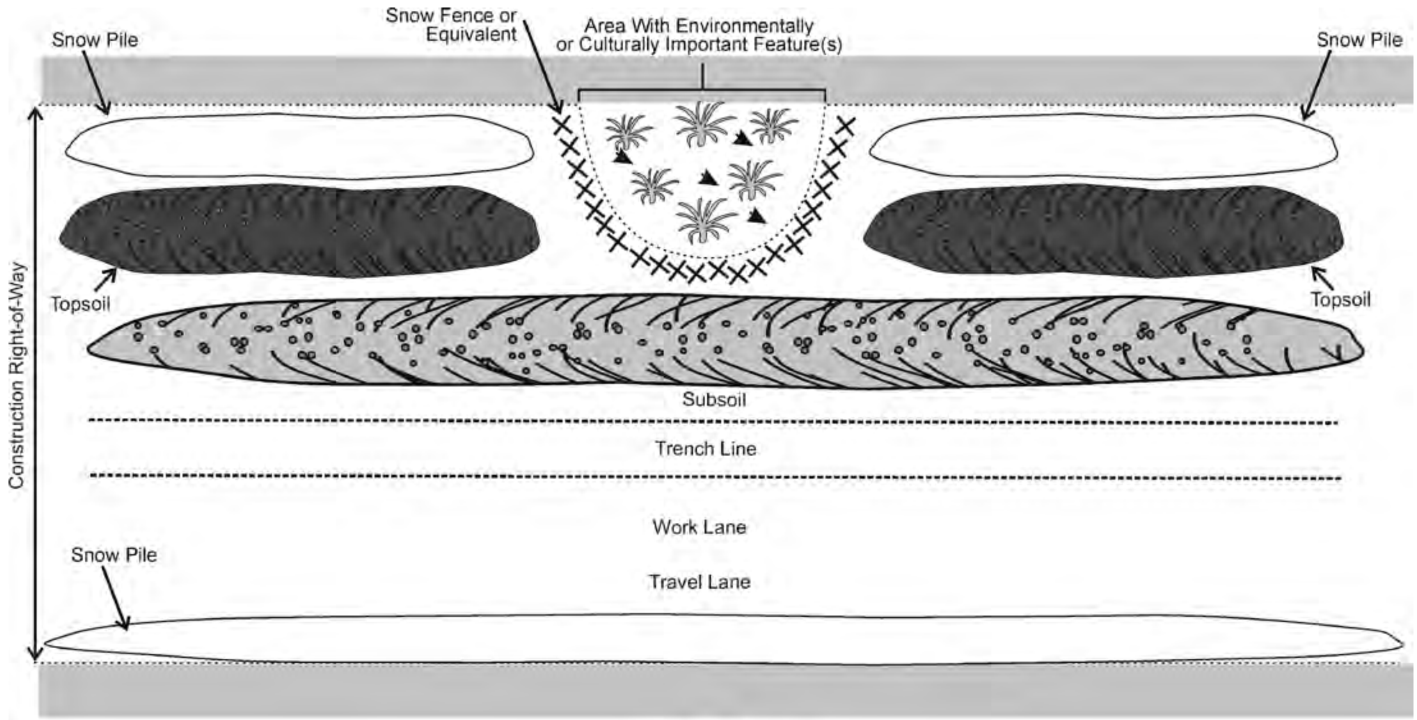
3. All phases of rare plant seed collection work will be documented for tracking, including: species collected; location; date; amounts; and storage location.

4. The seed will be processed and cleaned, under the supervision of a botanical expert. Viability and weed content tests will be conducted.

5. The seed will be stored in appropriate facilities under the supervision of a botanical expert.

6. Collected rare plant seed will be provided to the restoration contractor prior to the initiation of seeding selected areas under the direct supervision of a botanical expert. Seeding operations will be supervised by the Environmental Inspector. Seeding procedures, areas and rates will be determined by a botanical expert based on site-specific conditions.

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	Native and Rare Plant Seed Collection		
	7894	August 2014	Drawing C-04



Plan View
(Not to Scale)

Representation Only

Criteria for Implementation:

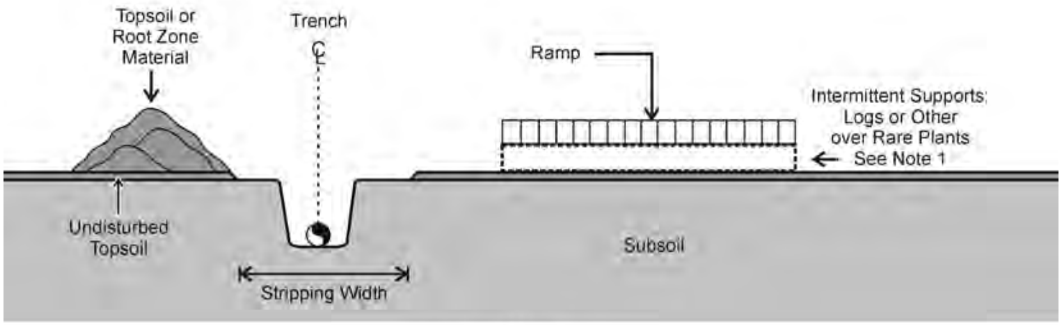
The width of the construction right-of-way will be narrowed to avoid site-specific features such as archaeological sites, rare plants, sensitive ecological communities and site-specific wildlife habitat. The specific features will be fenced or otherwise protected throughout the duration of construction.

Notes:

1. Identify and stake or flag the boundaries of the feature to be protected prior to commencement of surveying activities where it encroaches on the construction right-of-way. Ensure the specific feature is flagged with the appropriate colour of flagging for the resource to be protected.
2. Clearly post signs prohibiting workers or equipment from entering the fenced area.
3. Where narrowing on the work side or subsoil side is sufficient to protect the feature, minimize the workspace to as narrow an area as safely feasible.
4. Where further narrowing is necessary, develop site-specific plans to complete construction through the area while protecting the feature.
5. Maintain fencing and barriers until all construction and reclamation activities are completed.

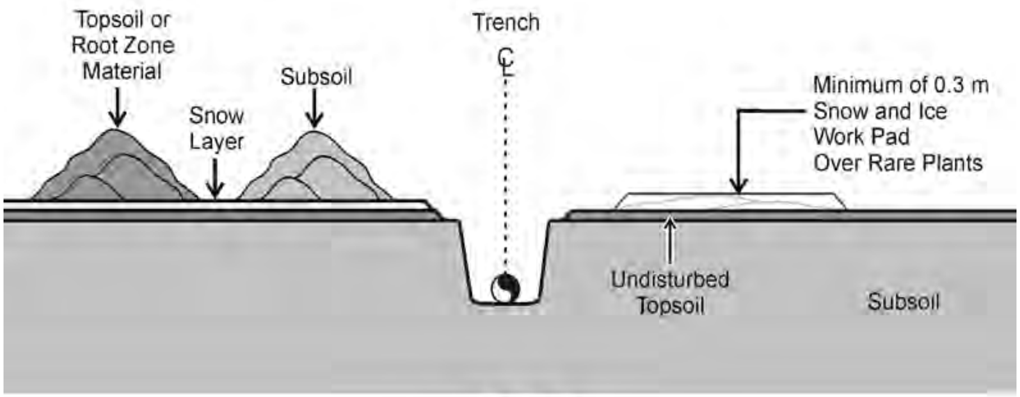
tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	NARROW DOWN FENCING		
	7894	August 2014	Drawing C-05

NONFROZEN CONDITIONS:



Profile
(Not to Scale)

FROZEN CONDITIONS:



Profile
(Not to Scale)

Notes:

<u>Nonfrozen Conditions</u>

1. Place ramps on support structures (logs or other). Support structures will be spaced approximately 2 to 3 m along the length of the ramp. Ramps may be required on work side and subsoil side, as warranted, to protect the rare plant population or community.
2. Salvage topsoil/root zone material from the trench area (a minimum of 4-6 m).
3. Haul trench subsoil along the right-of-way away from the rare plant site, where necessary.

<u>Frozen Conditions</u>

4. When there is adequate snow, build a snow and ice work pad on the work side to a minimum of 0.3 m high. Build a snow and ice work pad on the subsoil side as warranted, to protect the rare plant population or community. During frozen conditions, without adequate snow to build a pad, use the above specifications to build a ramp.
5. Salvage topsoil/rootzone material from the trench area (a minimum of 4-6 m).
6. Monitor the integrity and effectiveness of the work pad by watching for rutting and cracking to the extent that the ground below the pad may become disturbed. Should this condition occur, temporarily suspend traffic and either reinforce the snow/ice work pad or install a ramp.

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	RARE PLANT RAMP PROTECTION	
7894	August 2014	Drawing C-06

CRITERIA FOR IMPLEMENTATION:

Management of weeds and non-native plant species is of paramount concern to Trans Mountain. The goal of non-native species management for the Trans Mountain Expansion Project is to prevent the introduction and spread of non-native plants to control them, to the extent feasible, along the existing TMPL system. Accurate records of weed infestations, control measures undertaken and the success of control measures will be maintained so that weed management and control plans can be modified as necessary to ensure an effective program of ongoing weed monitoring and control.

Following are measures to be implemented during the reclamation and post-construction monitoring of the Trans Mountain Expansion Project.

1. All reclamation equipment shall arrive for project work in a clean condition to minimize the risk of weed introduction. Any equipment which arrives in a dirty condition will not be allowed to work until it has been cleaned off at a suitable location.
2. Equipment passing through areas identified as having a weed problem will be cleaned prior to continuing work on the right-of-way.
3. Equipment clean-off stations will be established by the main pipeline contractor under the direction of the Trans Mountain's Environmental Inspector(s). The preferred method of clean-off will be pressurized water, weather permitting.
4. Weed growth will be specifically monitored by personnel trained in weed identification walking the right-of-way and recording the density and species of all weeds observed. Weed monitoring will be conducted by teams in a timely manner so that weed control plans can be developed.
5. Monitoring will be conducted prior to, during and as per PCEM requirements.
6. Frequency of monitoring may be increased where: high potential for weeds of management concern was identified prior to, during or following construction. Weeds will generally be monitored in the spring when weed seedlings can be identified and subsequently controlled, if warranted. Additional weed monitoring in the late summer prior to setting seed will be conducted where high weed concerns exist or where spring surveys identify the need for follow-up.
7. Areas of poor plant cover will be reseeded and weed control measures applied as required.
8. The equipment cleaning station will be assessed in fall, late spring and mid-summer for at least three growing seasons following construction. Subsequent monitoring will be at least once per season, depending on weed issues identified during previous years. Weed species of concern that are identified at the sites will be treated. Manual removal of plants or chemical treatment will occur. If weeds are manually removed when in flower, the weed material will be disposed of in an approved land-fill facility.

BC Parks - Bridal Veil



TAB D – BRIDAL VEIL FALLS PROVINCIAL PARK

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1.0 BRIDAL VEIL FALLS PROVINCIAL PARK

Bridal Veil Falls Provincial Park (BVFPP) is a day use area located on the south side of the Fraser River, approximately 16 km east of Chilliwack and adjacent to private sector tourist attractions. The park is approximately 32 ha and is located at the site of the ancient village of Popkum dating back to the 1700s. Conservation and recreation are the two key roles of the park. The scenic value of the park is important to both local residents and travelers. Present day use activities include picnicking, hiking and viewing the falls. The trail to the falls is a 20 minute walk from the parking lot, offering easy hiking and nature study opportunities for the majority of visitors.

The park was established in 1965 as a Class A, Category 3 park. As mentioned in the Bridal Veils Master Plan, the existing Trans Mountain pipeline (TMPL) right-of-way bisects the park for 0.4 km in the northwest corner of the park and continues on through the southeast portion of the Popkum Reserve #2 which is immediately adjacent to the park. The park was originally privately-owned and covered under easement number 152475C. The Oregon forestsnail (*Allogona townsediana*) is known occur within the park and is a Red-listed species in BC.

The objectives of the park management plan are for the provision and conservation of recreation and scenic viewing for both highway travelers and local residents. The purpose of the Natural Environment Zone within the park is to ensure the maintenance or reclamation, if required, of the natural environment setting of the park.

This environmental and socio-economic assessment (ESA) took into consideration the park management objectives of Bridal Veil Falls Provincial Park.

2.0 CORRIDOR SELECTION AND PROJECT ACTIVITIES

Early in 2012, Trans Mountain Pipeline ULC (Trans Mountain) conducted a preliminary route assessment of the existing Trans Mountain Pipeline (TMPL) alignment to identify potential routing options for the Trans Mountain Expansion Project (TMEP or the Project) in Bridal Veil Falls Provincial Park. As one of the core routing criteria, Trans Mountain sought to follow the existing TMPL right-of-way to the maximum extent practical, deviating from the TMPL route only where necessary to reduce environmental and socio-economic impacts or to address technical or safety issues.

2.1 Existing Trans Mountain Pipeline Route

The existing TMPL crosses the Bridal Veil Falls Provincial Park for 0.4 km in the northwest corner of the park. The existing TMPL continues on through the southeast portion of the Popkum Reserve #2 which is immediately adjacent to the park. The park was originally privately-owned and covered under easement number 152475C.

2.2 Alternatives Considered

In the Facilities Application, Trans Mountain considered two options around Bridal Veil Falls Provincial Park:

- the North Alternative, that crosses to the north side of the Highway 1 and parallels a BC Hydro transmission line, crosses Cheam Lake Wetlands Regional Park for a short distance and avoids Popkum Indian Reserve #2 and the park; and
- the TMPL Modified Alternative that parallels the existing TMPL corridor except for a deviation around Bridal Veil Falls Provincial Park and Popkum Reserve #2 .

Through Trans Mountain's public engagement program and feedback received from local governments, interest groups and public members, Trans Mountain listened to concerns expressed regarding the close proximity of the proposed pipeline corridor to the Cheam Lake Wetlands Regional Park and re-assessed its route alternatives. Based on this feedback, Trans Mountain undertook a further detailed study to determine additional viable routing options surrounding the area and proposed what is now known as the Proposed Pipeline Corridor through the park and Popkum Reserve #2.

In summary, Trans Mountain has considered three pipeline corridors in the vicinity of the park, including:

- Previously Proposed Pipeline Corridor (Cheam Lake Wetland Regional Park) also known as the "North Alternative" for the purposes of the Draft Stage 2 Detailed Proposal;
- Proposed Revised Pipeline Corridor (Bypass); also known as the "TMPL Modified Alternative" for the purposes of the Draft Stage 2 Detailed Proposal; and
- Proposed Pipeline Corridor (BVFPP/Popkum Reserve #2); also known as the "Proposed Pipeline Corridor" for the purposes of the Draft Stage 2 Detailed Proposal.

At the Parks Workshop in Chilliwack, BC (described in Section 4.2 of this Tab), BC Parks Officials requested that Trans Mountain consider the use of a trenchless construction technique to avoid disturbance to the surface of the park. Given the level of protection afforded for Bridal Veil Falls Provincial Park, Trans Mountain plans to assess this option and will propose to conduct geotechnical studies in 2015 to determine if a trenchless construction technique is feasible. If a trenchless construction technique is deemed to be geotechnically feasible, this option will be advanced. A trenchless alignment would follow the proposed revised pipeline corridor which includes the existing TMPL right-of-way. If a trenchless construction technique is not technically feasible, then the proposed pipeline corridor (BVFPP/Popkum Reserve #2) remains the best option and would allow for use of the existing cleared TMPL right-of-way and provide future operational synergies. Construction within the park would use minimal impact techniques by narrowing the construction footprint where the terrain and surface conditions allow. A trenchless construction technique would minimize the environmental effects that may occur within in the park as a result of the Project to the extent practical which will be determined and discussed with BC Parks during the detailed design phase of the Project. This alternative is referred to as the Proposed Revised Pipeline Corridor (BVFPP/Popkum Reserve #2 – Trenchless Option).

An evaluation of the alternative corridors in Bridal Veil Falls Provincial Park is provided in Table D2.2-1 and Figure D2.2.-1. Figure D2.2.-1 also shows the narrowed pipeline corridor, which identifies the land that would be required for the purposes of constructing the Project within Bridal Veil Falls Provincial Park.

TABLE D2.2-1

EVALUATION OF ALTERNATIVE CORRIDORS –BRIDAL VEIL FALLS PROVINCIAL PARK AND SURROUNDING AREAS (AK 1078.7 TO AK 1081.2)

Factors	Previously Proposed Pipeline Corridor "North Alternative"	Proposed Pipeline Corridor (BVFPP/Popkum Reserve #2) "Proposed Pipeline Corridor"	Proposed Revised Pipeline Corridor (Bypass) "TMPL Modified Alternative"	Proposed Revised Pipeline Corridor (BVFPP/Popkum Reserve #2 – Trenchless Option)
LENGTHS				
Parks and protected areas (km) (name)	0.1 (Cheam Lake Wetland Regional Park) 0.2 (Park Reserve Zone)	0.4 (Bridal Veil Falls Provincial Park)	0.2 (Park Reserve Zone)	0.4 (Bridal Veil Falls Provincial Park)
Length of pipeline corridor (km)[1]	2.8	2.9	3.1	2.9
Length following existing TMPL right-of-way (km)	0	2.9	2.2	2.9
Length following other linear features (other pipelines, power lines, highways, roads, fibre-optic lines, railways, etc.) (km)	2.0	0	0.6	0
Length of "new" corridor (km)	0.8	0	0.3	0
Total parallels (km)	2.0	2.9	2.8	2.9
CROSSINGS				
No. of highway crossings	2	1	1	1
No. of road (arterial, collector, local) crossings	5	6	7	6
No. of TMPL crossings	2	0	2	0
No. of foreign line crossings	1	2	3	2
No. of fibre-optic/other cable crossings	2	4	3	4
No. of main power line crossings	2	2	2	2
No. of distribution power line crossings	0	0	1	0
No. of railway crossings	0	0	0	1
Crossings of named rivers (No.)	0	0	0	0
Crossings of named creeks (No.)	1 (Bridal Creek)	1 (Bridal Creek)	1 (Bridal Creek)	1 (Bridal Creek)
Crossings of other watercourses (No.)	1	4	4	4
Total watercourses (No.)	2	5	5	5
GEOTECHNICAL				
Length crossing slopes > 50% on the fall line (km)	0	0	0	0
Length crossing slopes > 50% on sidehill (km)	0	0	0	0
Natural hazard potential (km)	High: 0 Medium: 0.03 Low: 2.77	High: 0 Medium: 0.03 Low: 2.82	High: 0 Medium: 0.03 Low: 3.06	High: 0 Medium: 0.03 Low: 2.82
Length of thin veneer of overburden or exposed bedrock (km)	0	0.3	0.5	0
HYDRAULICS				
Minimum elevation (m)	30	30	30	30
Maximum elevation (m)	61.3	93.2	77.7	93.2

TABLE D2.2-1 Cont'd

Factors	Previously Proposed Pipeline Corridor "North Alternative"	Proposed Pipeline Corridor (BVFPP/Popkum Reserve #2) "Proposed Pipeline Corridor"	Proposed Revised Pipeline Corridor (Bypass) "TMPL Modified Alternative"	Proposed Revised Pipeline Corridor (BVFPP/Popkum Reserve #2 – Trenchless Option)
Acceptability	Yes	Yes	Yes	Yes
LAND				
Indian Reserve (km)(name)	0	0.2 (Popkum Reserve # 2)	0	0.2 (Popkum IR No. 2)
Provincial Crown (km)	0.2	1.6	1.6	1.1
Private (km)	2.6	1.1	1.5	1.1
Unknown Parcels (km)	0	0	0	0
No. of private parcels	15	9	10	9
ENVIRONMENT				
Length within Riparian Reserve Zone (km)	0	0	0	0
Wetlands crossed (km)	0.2	0.1	0.1	0.1
SOCIO-ECONOMIC				
Agricultural Land Reserve (km)	2.0	0	0	0
Designated Recreational Use areas crossed (crossed or km parallel)	2.0	0	0	0.3 (Camperland RV Resort) 0.4 (Bridal Falls Golf Course [Rural])
Residential Use Zones crossed (km)	0	0.3 (Camperland RV Resort) 0.4 (Bridal Falls Golf Course [Rural])	0.2 (Camperland RV Resort) 0.4 (Bridal Falls Golf Course [Rural])	1.0 (Rural) 0.1 (Country Residential)
Commercial Use Areas crossed (km)	0.5 (Tourist Recreation Commercial [Minter Gardens])	0.2 (Bridal Falls Water Park) 0.3 (Tourist Recreation Commercial [Minter Gardens])	0.2 (Bridal Falls Water Park) 0.1 (Unknown Highway Commercial) 0.2 (Rainbow Ranch RV Park) 0.4 (Bridal Falls RV Park) 0.3 (Tourist Recreation Commercial [Minter Gardens])	0.2 (Bridal Falls Water Park) 0.3 (Tourist Recreation Commercial [Minter Gardens])
Length crossing Mineral, Aggregates and Oil and Gas Resources (km)	0	0	0	0
Community watersheds (No.)	0	0	0	0
Municipalities crossed (km)(name)	0	0	0	0
CONSTRUCTABILITY AND COST				
Constructability	Deviates from TMPL to cross Highway 1 and a BC Hydro right-of-way, then parallels a BC Hydro right-of-way across flat terrain, crosses through Cheam Lake Wetland Regional Park (for approximately 100 m), then enters into a flat farmland area before crossing Highway 9 to rejoin TMPL in the Minter Gardens site.	Follows TMPL through an RV Park, BVFPP and Popkum Reserve # 2. Then continues alongside TMPL through a golf course and driving range, followed by a 250 m trenchless crossing of Highway 1 into the Minter Gardens site. Relatively easy terrain throughout with some restricted right-of-way in the RV Park and BVFPP.	Follows TMPL through an RV Park, skirts to the north and west of BVFPP, and Popkum Reserve # 2. Would involve in street construction (low traffic volumes). Continues alongside TMPL through a golf course and driving range, followed by a 250 m trenchless crossing of Highway 1 into the Minter Gardens site. Relatively easy terrain throughout with some restricted right-of-way in the RV Park and BVFPP.	Follows TMPL through an RV Park, BVFPP and Popkum Reserve #2. A trenchless construction technique would be used to install TMEP through BVFPP and a portion of Popkum Reserve #2. TMEP then continues alongside TMPL through Popkum Reserve #2, a golf course and driving range (using conventional construction), followed by a 250 m trenchless crossing of the Trans-Canada Highway into the Minter Gardens site.

TABLE D2.2-1 Cont'd

Factors	Previously Proposed Pipeline Corridor "North Alternative"	Proposed Pipeline Corridor (BVFPP/Popkum Reserve #2) "Proposed Pipeline Corridor"	Proposed Revised Pipeline Corridor (Bypass) "TMPL Modified Alternative"	Proposed Revised Pipeline Corridor (BVFPP/Popkum Reserve #2 – Trenchless Option)
Estimated Construction Cost ($ millions)	6.5	9.5	10.3	10.2

Note: 1 The total length of the pipeline corridor denotes a point along the corridor where it would be necessary to deviate to avoid Bridal Veil Falls Provincial Park and then rejoin the existing TMPL alignment. It does not represent the total length through Bridal Veil Falls Provincial Park. This length is needed to compare the full extent of the route alternatives for comparison purposes.

Orthomosaic maps that identify the land that would be required in Bridal Veil Falls Provincial Park (*i.e.,* the narrowed pipeline corridor) for the purposes of constructing the Project are provided in Figure D2.2-2.

2.2.1 North Alternative

The North Alternative crosses to the north side of the Highway 1 and parallels a BC Hydro transmission line, crosses Cheam Lake Wetland Regional Park for a short distance and avoids Popkum Reserve #2 and Bridal Veil Falls Provincial Park. This alternative crosses Rural, Country Residential and suburban residential land use zones, a Park Reserve zone, the Agricultural Land Reserve, and Minter Gardens, a former tourist attraction which has recently closed and is being considered for redevelopment. Based on feedback from stakeholders and public members at community workshops and open houses, this alternative is no longer being considered given the environmental sensitivity surrounding the Cheam Lake Wetlands Regional Park.

2.2.2 TMPL Modified Alternative

The TMPL Modified Alternative parallels the existing TMPL right-of-way except for a deviation around Popkum Reserve #2 and around Bridal Veil Falls Provincial Park before crossing to the north side of the Highway 1. This alternative crosses Rural, Suburban Residential 2, and Highway Commercial land use zones, a Park Reserve, Bridal Falls Water Park, Camperland RV Resort, Rainbow Ranch RV Park, Bridal Falls RV Park, Bridal Falls Golf Course and Minter Gardens.

2.2.3 Proposed Pipeline Corridor

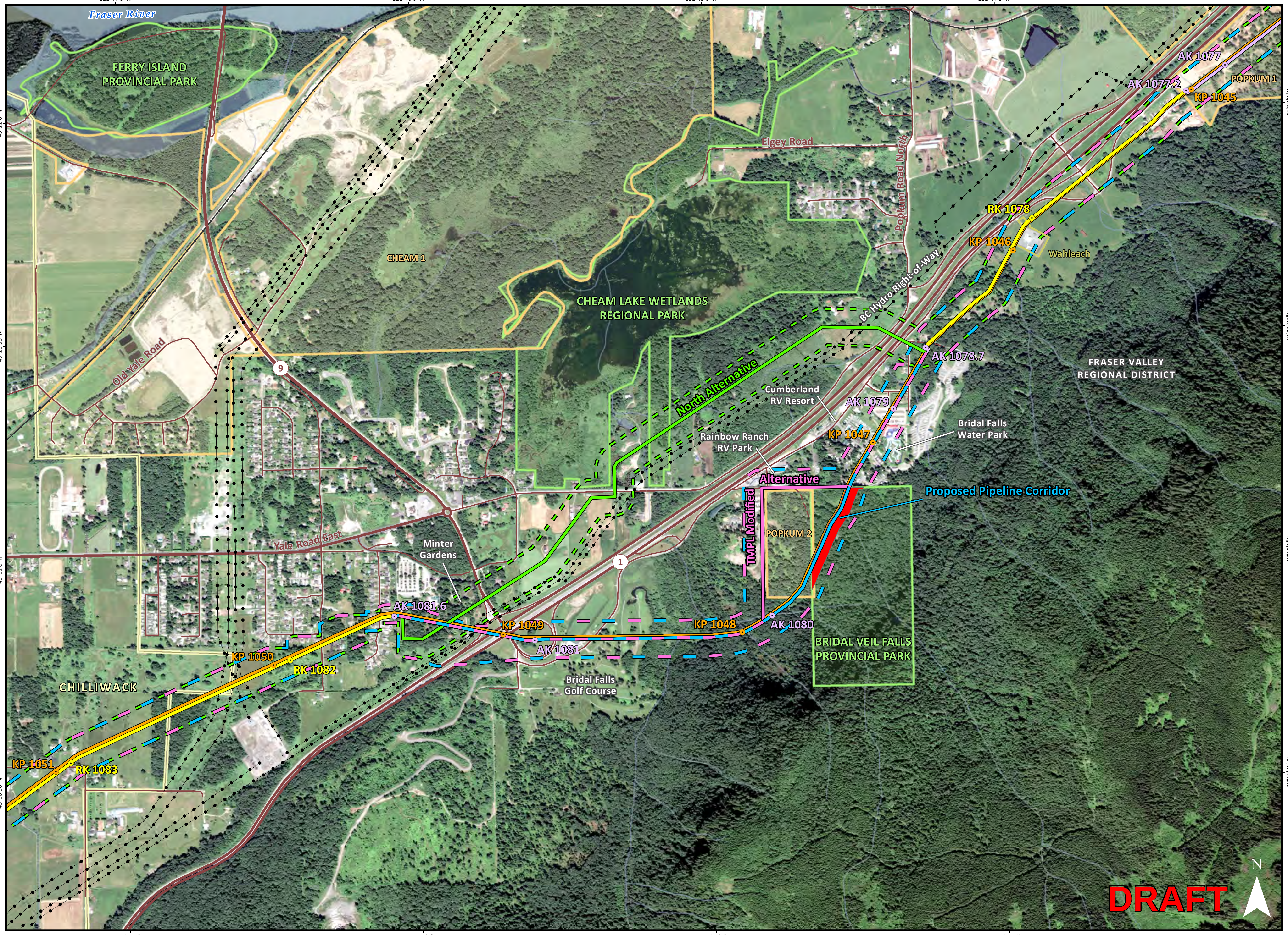
The Proposed Pipeline Corridor parallels the existing TMPL right-of-way through Bridal Veil Falls Provincial Park and Popkum Reserve #2 before crossing to the north side of the Highway 1. This alternative crosses Rural and Country Residential land use zones, a Park Reserve zone, Bridal Falls Water Park, Camperland RV Resort, Bridal Falls Golf Course and Minter Gardens.

2.2.4 Proposed Revised Pipeline Corridor (BVFPP/Popkum Reserve #2 – Trenchless Option)

The Proposed Revised Pipeline Corridor parallels TMPL through Camperland RV Resort, Bridal Veil Falls Provincial Park and Popkum Reserve #2. Pending the results of the geotechnical feasibility study to be conducted in 2015 for this alternative, Trans Mountain proposes to cross the park via a trenchless construction technique, resulting in minimal surface disturbance to the park. The proposed revised pipeline corridor continues to parallel TMPL through the Popkum Reserve #2, the golf course, and a driving range using conventional construction techniques followed by a trenchless crossing of Highway 1 into Minter Gardens.

2.3 Preferred Pipeline Corridor

Based on the results of ongoing public engagement and consultation as well as engineering studies, the proposed revised pipeline corridor is the option that follows the existing TMPL right-of-way through Bridal Veil Falls Provincial Park and Popkum Reserve #2. Trans Mountain is currently considering two construction techniques *(i.e.*, trenchless and conventional) for installing the pipeline along this alignment. The feasibility of using a trenchless construction technique will be determined following the completion of geotechnical studies, which are planned for 2015. Should the geotechnical conditions be favourable for the use of a trenchless construction technique, Trans Mountain will utilize trenchless technology to install the pipeline through Bridal Veil Falls Provincial Park. However, should the conditions not be favourable for the use of trenchless technology, the pipeline would be installed using conventional construction techniques, albeit on a narrowed footprint (the narrowed pipeline corridor), through the park.



TRANS MOUNTAIN

FIGURE D2.2-1

BRIDAL VEIL FALLS PROVINCIAL PARK ALTERNATIVE CORRIDORS

TRANS MOUNTAIN EXPANSION PROJECT

Alternative Corridors

- TMPL Modified Alternative
- Proposed Pipeline Corridor
- North Alternative

- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- TMPL Kilometre Post (KP)
- TMEP Mapping Reference Line (As Filed)
- TMEP Mapping Reference Line (New Alignment)
- Trans Mountain Pipeline (TMPL)
- Narrowed Pipeline Corridor within Bridal Veil Falls Provincial Park
- Facility Property Boundary
- Highway
- Paved Road
- Resource Road
- Railway
- Transmission Line
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- Park / Protected Area

Projection: NAD 1983 UTM Zone 10N. Routing: Baseline TMPL & Facilities: provided by KMC, 2012; Proposed Alternative Routing Corridors provided by UPI, 2013-2014. Reference Line & RK/AK provided by UPI, March 25 & 28, 2014; Transportation: IHS Inc., 2013, Natural Resources Canada, 2012; Geopolitical Boundaries: Natural Resources Canada, 2003, AltaLIS, 2013, IHS Inc., 2011, BC FLNRO, 2007 & ESRI, 2005; First Nation Lands: Government of Canada, 2014, AltaLIS, 2010 & IHS Inc., 2011; Hydrology: Natural Resources Canada, 2007-11 & BC FLNRO, 2008; Parks and Protected Areas: Natural Resources Canada, 2014, AltaLIS, 2012 & BC FLNRO, 2008; B/W & Colour Imagery: 2008-2011: Provided by KMC, 2012, NASA Geospatial Interoperability Program, 2005; ESRI, 2005 (Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community).

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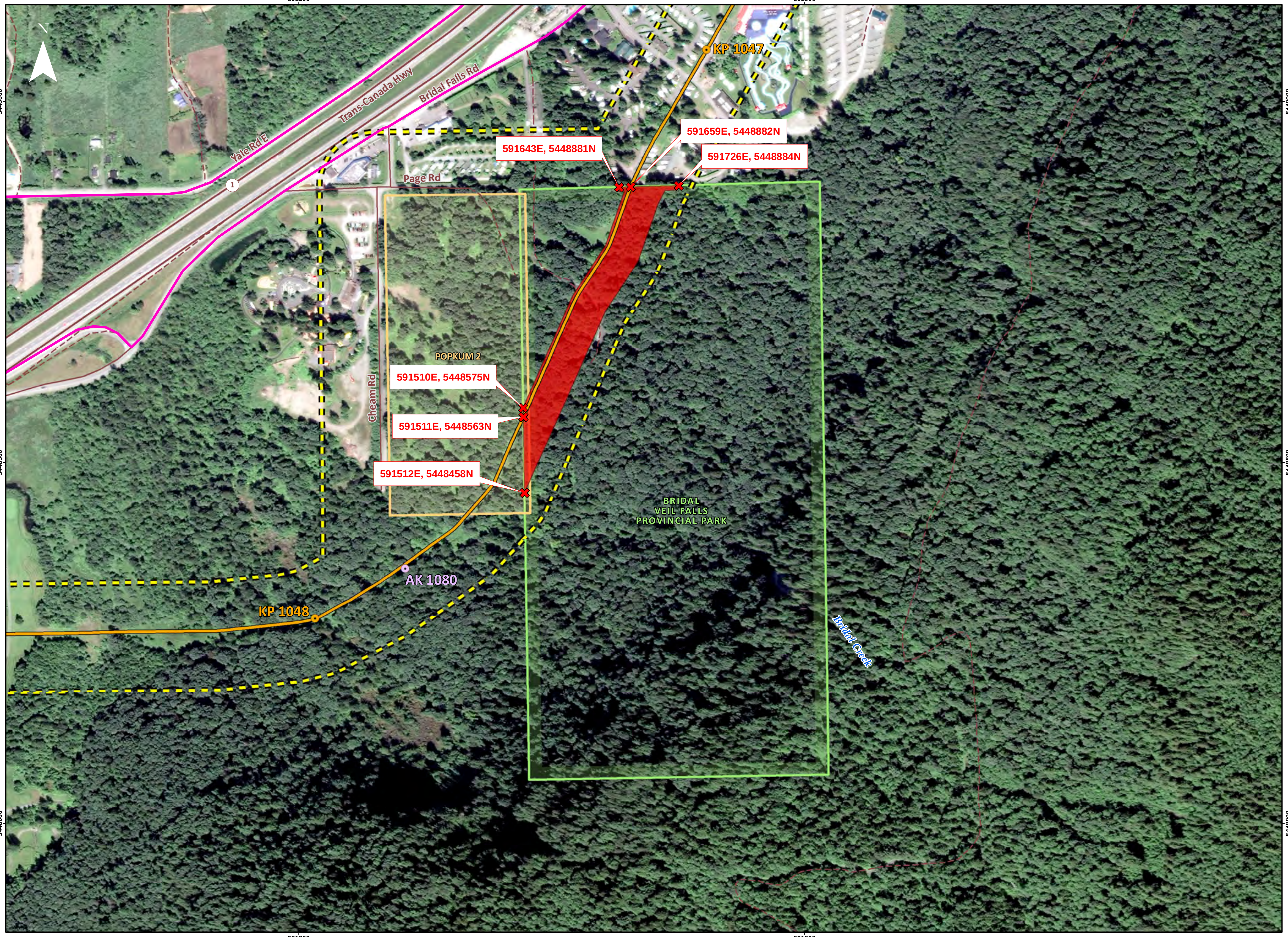

TRANS MOUNTAIN

FIGURE D.2.2-2
ORTHOMOSAIC MAPPING OF BRIDAL VEIL FALLS PROVINCIAL PARK
SHEET 1 OF 1
TRANS MOUNTAIN EXPANSION PROJECT

- Start/End UTM Coordinate
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- TMPL Kilometre Post (KP)
- Existing Major Access
- Existing Secondary Access
- New Permanent Access
- New Temporary Access
- Deactivated Overgrown Access
- Narrowed Pipeline Corridor within Bridal Veil Falls Provincial Park
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Revised Pipeline Corridor
- Trans Mountain Expansion Project Proposed Alternative Pipeline Corridor
- Facility Property Boundary
- Highway
- Paved Road
- Resource Road
- Railway
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- Park / Protected Area

Projection: NAD 1983 UTM Zone 10N. Routing: Baseline TMPL & Facilities provided by KMC, 2012; Proposed Corridor V9.2 provided by UPI, June 5, 2014; RK/AK VF provided by UPI, March 28, 2014; Narrowed Pipeline Corridor provided by UPI, July 24, 2014; Access Roads: UPI, Jan. 24, 2014; Transportation: IHS Inc., 2013, Natural Resources Canada, 2012; Geopolitical Boundaries: IHS Inc., 2013; First Nation Lands: Government of Canada, 2014; Hydrology: Natural Resources Canada, 2007-2011 & BC FLNRO, 2008; Parks and Protected Areas: Natural Resources Canada, 2014, FLNRO, 2008; B/W & Colour Imagery: 2008-2011: Provided by KMC, 2012; NASA Geospatial Interoperability Program, 2005.

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2.4 Project Components

The technical details of the components of the Project are summarized in Section 2.2.1 of the Introduction to the Draft Stage 2 Detailed Proposal.

The total land required to construct the proposed Project within Bridal Veil Falls Provincial Park is approximately 2.04 ha. Pipeline construction in the this area will occur on a reduced width right-of-way (*i.e.,* reduced from typical 40 m to 30 m incorporating an 18 m permanent right-of-way and 12 m temporary workspace) to minimize disturbance (see Figure D2.2-1).

Construction equipment will access the proposed construction right-of-way via existing access roads and will travel along the construction right-of-way to the site. No new access will be needed. Design, construction and operations of the pipeline will be in compliance with all applicable codes, standards and regulations.

2.5 Construction Schedule in Bridal Veil Falls Provincial Park

Pending regulatory approval of the Project and approval of the Draft Stage 2 Detailed Proposal, mainline construction in Bridal Veil Falls Provincial Park is tentatively scheduled to commence in Q3 2017 and extend through Q4 2017, with clearing activities scheduled for Q3 2017, outside of the migratory birds breeding and nesting period if a conventional construction technique is required. Intensive construction activities including trenching, lowering-in and backfilling, will be conducted as quickly as possible in order to reduce the amount of time the trench is open. Proposed construction and clearing activities in Bridal Veil Falls Provincial Park are expected to occur over a 14 day period (see Table D2.5-1). However, within that period, the various phases of construction will occur consecutively. A description of the construction activities is provided in Section 2.2.1 of the Introduction of the Draft Stage 2 Detailed Proposal.

TABLE D2.5-1

ESTIMATED PROJECT CONSTRUCTION AND OPERATIONS SCHEDULE

Major Activity	Anticipated Commencement of Major Activity	Estimated Duration of Major Activity
Pipeline Construction	Pending regulatory approval	14 days
Construction Survey	Q3 / Q4 2016 prior to clearing	1 day
Clearing	Q3 / Q4 2016	1 day
Topsoil or Root Zone Material Salvage	Q3 / Q4 2017	1 day
Grading (if required)	Q3 / Q4 2017	1 day
Stringing, Bending and Welding	Q3 / Q4 2017	2 days
Trenching	Q3 / Q4 2017	1 day
Lowering-in	Q3 / Q4 2017	1 day
Backfilling	Q3 / Q4 2017	1 day
Testing	Q4 2017	2 days
Clean-up and Reclamation	Q4 2017	2 days
Operations	In-Service: Q4 2018	Over the first and second complete growing seasons following construction
Post-Construction Monitoring	--	5 years (growing seasons)
Line Patrols	--	Regular intervals
In-Line Inspections	--	As required
Vegetation/Weed Management	--	As required during lifespan
Maintenance Digs	Pending regulatory approval	As required during the lifespan

3.0 ABORIGINAL ENGAGEMENT IN BRIDAL VEIL FALLS PROVINCIAL PARK

As described in Section 3.0 of the Introduction of the Draft Stage 2 Detailed Proposal, the Aboriginal Engagement Program in Bridal Veil Falls Provincial Park included 11 First Nations groups that are potentially affected by Project activities in the park. Section 3.3 of the Introduction to the Draft Stage 2 Detailed Proposal documents Trans Mountain's engagement efforts with the following Aboriginal communities who have Aboriginal interests potentially affected by the proposed pipeline corridor in Bridal Veil Falls Provincial Park:

- Popkum First Nation;
- Peters Band;
- Seabird Island Nation;
- Shw'ow'hamel First Nation;
- Cheam First Nation;
- Skwah First Nation;
- Union Bar First Nation;
- Yale First Nation;
- Skawahlook First Nation;
- Kwah-kwah-aplit First Nation; and
- Soowahlie Indian Band.

4.0 PUBLIC CONSULTATION IN BRIDAL VEIL FALLS PROVINCIAL PARK

As described in Section 4.2.3 of the Introduction of the Draft Stage 2 Detailed Proposal, the public consultation program consisted of a Community Workshop, and Parks Workshop. The following subsections provide a summary of the attendees invited and interests and concerns raised relating to Bridal Veil Falls Provincial Park.

4.1 Community Workshop

On June 17, 2013, Trans Mountain held a Community Workshop in Chilliwack, BC for identified stakeholders to provide an opportunity for local stakeholders to receive updated information and provide feedback on issues and concerns relative to their community especially as it related to routing and environmental studies. Some concerns raised were specific to provincial parks which provided a reference point for those attending Parks Workshops in 2014.

Interested stakeholders were contacted by phone and email and invited to participate. A number of follow-up phone calls were made to encourage invitees to participate. Of the 39 community representatives that were invited, 18 attended. In some cases, organizations were represented by more than one attendee.

Table D4.1-1 provides information on the attendees at Chilliwack Community Workshop.

TABLE D4.1-1

PARTICIPANTS IN THE COMMUNITY WORKSHOP – BRIDAL VEIL FALLS PROVINCIAL PARK

Group Type	Group
Community	Chilliwack School District
ENGO	BC Wildlife Federation
	Chilliwack River Action Committee
	Pacific Salmon Foundation
	Skowkale Hatchery
Local Government	City of Chilliwack – Engineering, Fire Department, Public Works and Manager of Long Range Planning
Provincial Government	Ministry of Transportation and Infrastructure

Interested stakeholders who were invited but did not attend the event include:

- Alton Streamkeepers;
- Chilliwack Chamber of Commerce;
- Chilliwack Fish & Game Protective Association;
- Chilliwack Vedder River Clean-up Society;
- Chilliwack River Hatchery;
- Downtown Chilliwack Business Improvement Association;
- Fraser Basin Council;
- Fraser River Salmon Society;
- Fraser Health Authority;
- Guide Outfitters Association of BC;
- Recreation Outfitters Inc.;

- Rotary Club of Chilliwack;
- Spectra Energy;
- STS Guiding Services; and
- Tourism Chilliwack.

4.1.1 Summary of Outcome of Community Workshop

The route option through Bridal Veil Falls Provincial Park at the time of the Chilliwack Community Workshop was not under consideration. Participants did express concerns in Table D4.1-2 relating to Bridal Veil Falls Provincial Park.

TABLE D4.1-2

COMMUNITY WORKSHOP – BRIDAL VEIL FALLS PROVINCIAL PARK

Topic	Summary of Concern	Bridal Veil Falls Provincial Park Draft Stage 2 Detailed Proposal Section
Air	None.	N/A
Land	Participant expressed concern with soil compaction post construction.	Section 7.1.2 of this tab
	Participant noted that consideration and protection of native medicinal plants was important.	Section 7.1.12 of this tab
	Participant expressed concern with endangered species such as the Oregon forestsnail and the potential for impact to their habitat.	Section 7.1.9 of this tab
Human Activity and Land Use	Participant expressed concern regarding the impact to Bridal Veil Falls Provincial Park during construction and after operations.	Section 7.0 of this tab
Water	Participant expressed concern with the protection of spawning channels (salmon) around/through Bridal Falls Veil Provincial Park during construction and operations of the pipeline.	Section 7.1.6 of this tab

4.2 Parks Workshop

On March 27, 2014, Trans Mountain held a Parks Workshop for identified stakeholders in Chilliwack, BC, for Bridal Veil Falls Provincial Park. Potentially interested stakeholders were contacted by phone and email and invited to participate. An introductory email was sent to all selected participants on March 14, 2014, and a reminder to RSVP email was sent on March 16, 2014. Interested stakeholders who were unable to attend the event were invited to provide feedback through the online posting of the workshop information. An agenda was distributed to all attendees on March 24, 2014.

Attendees consisted of representatives from First Nations, key community groups, local government, public groups and federal and provincial agencies that may have an interest in the potential impacts of the proposed development on Bridal Veil Falls Provincial Park. Of the 27 stakeholder groups invited, 10 attended, with some groups having more than one attendee. A total of 18 attendees were present at the event. Local First Nations (Popkum First Nation, Peters Band, Seabird Island Nation, Shw’ow’hamel First Nation, Cheam First Nation, Union Bar First Nation, Yale First Nation, Skawahlook First Nation, Nooaitch First Nation and Chawathil First Nation) were provided an opportunity to review and comment on the proposed Parks routing, impacts and benefits through a parallel process. The list of attendees is provided in Table D4.2-1.

TABLE D4.2-1

PARTICIPANTS IN THE PARKS WORKSHOP – BRIDAL VEIL FALLS PROVINCIAL PARK

Group Type	Group
Business/First Nations	Jakes Construction
ENGO	BC Wildlife Federation
	Chilliwack Field Naturalist
	Wilderness Committee
First Nations	Cheam First Nation
	Popkum First Nation
	Shxw'ow'hamel First Nation
	Chawathil First Nation
Local Government	Fraser Valley Regional District
Provincial Government	Ministry of Environment, BC Parks
Federal Government	Environment Canada

Interested stakeholders who were invited but did not attend the event include:

- Back Country Horsemen of BC;
- BC Enviro Network;
- Ducks Unlimited;
- Canadian Parks and Wilderness Society;
- City of Chilliwack;
- Federation of BC Naturalist;
- Fraser Valley Invasive Plant Council;
- Fraser Valley Mountain Bike Association;
- Fraser Valley Watershed Coalition;
- Freshwater Fisheries Society BC;
- Horse Council BC;
- Ministry of Transportation and Infrastructure;
- Nature Conservancy of Canada;
- Outdoor Recreation Council of BC; and
- Pacific Salmon Foundation.

4.2.1 Summary of Outcomes of Consultation at Parks Workshop

4.2.1.1 Concerns Raised

Table D4.2-2 provides information on key topics, interests and concerns relating to Bridal Veil Falls Provincial Park at the Parks Workshop.

TABLE D4.2-2

PARKS WORKSHOP – BRIDAL VEIL FALLS PROVINCIAL PARK

Topic	Summary of Concern	Bridal Veil Falls Provincial Park Draft Stage 2 Detailed Proposal Section
Air	None.	N/A
Land	One participant wanted to ensure it was documented that they did not want pipelines in parks at all. Anywhere.	Section 2.0 of this tab
	Limit the length of time that the trench would be open during construction.	Section 2.5 of this tab for estimated duration of construction activities. Construction will be conducted as expediously as possible.
	Understand ecosystem interconnections and connectivity. Insects and berries should be as important as any other part of the ecosystem.	Section 7.0 of this tab
	Soil contamination resulting from construction or a spill. Recommend that a soil baseline is recorded before and after either event.	Section 7.1.2 of this tab
	Movement of sediment and erosion of banks in Bridal Creek.	Section 7.1.3 of this tab
Human Activity and Land Use	None.	N/A
Water	None.	N/A

Trans Mountain will consider all feedback raised to date and will work under the guidance of BC Parks to address concerns through construction, mitigation and reclamation techniques.

4.2.1.2 Parks Benefits

Table D4.2-3 provides information on key ideas raised by stakeholders for identifying benefits to Bridal Veil Falls Provincial Park. Trans Mountain has submitted this list of possible benefits to BC Parks for consideration against Park management and benefit priorities. Participants were asked to prioritize the benefits that they believed were the most important to the park using a series of criteria which included:

- groups which would benefit (Community, Parks and Trans Mountain);
- impact to ecological value;
- ease of implementation;
- cost effectiveness; and
- ability to partner with existing initiatives.

Based on the number of criteria items the idea applied to, ideas that benefited the greatest number of groups and were easy to implement were determined and are outlined in Table D4.2-3.

TABLE D4.2-3

POTENTIAL PARKS BENEFITS – BRIDAL VEIL FALLS PROVINCIAL PARK

Summary of Potential Park Benefit	Priority
Educational Programs in schools and in Park to share an understanding of the environment.	Medium
Funding for Park Rangers, Staff and volunteers.	Low
Park Boundary extension.	Low
Interest in extending Bridal Veil Falls trails and viewing platform (100 m). Currently a safety issue.	Not Ranked[1]

Note: 1 Potential benefits that are not ranked are due to participants not having time or interest in completing the ranking process.

4.3 Other Consultation Activities

4.3.1 Local Government

Trans Mountain has consulted with the local government in the Fraser Valley, including the City of Chilliwack and Fraser Valley Regional District, regarding construction of the proposed pipeline in Bridal Veil Falls Provincial Park. In early discussions with the Fraser Valley Regional District and the public, the North Alternative (refer to Section 2.2.1) was met with considerable opposition with respect to crossing the Cheam Wetlands Regional Park; the City of Chilliwack and Fraser Valley Regional District indicated the route through Bridal Veil Falls Provincial Park would be more acceptable. On March 18, 2014, Trans Mountain responded to questions from Fraser Valley River District which included concerns regarding the effects of Project construction and subsequent the disturbance of sensitive habitat, interfering with migratory birds and disruption of protected species such as the Great Blue Heron who have a rookery in Cheam Lake Wetlands Regional Park.

The City of Chilliwack and Fraser Valley Regional District indicated a preference for the proposed pipeline routing through Bridal Veil Falls Provincial Park as a better option than through Cheam Wetlands Regional Park.

Table D4.3.1-1 outlines Trans Mountain's key public consultation activities with Fraser Valley Regional District and City of Chilliwack.

TABLE D4.3.1-1

KEY CONSULTATION ACTIVITES WITH LOCAL GOVERNMENT STAKEHOLDERS FROM FRASER VALLEY REGIONAL DISTRICT AND CITY OF CHILLIWACK

Stakeholder Group/ Agency Name	Title of Contact	Method of Engagement Activity	Date of Consultation Activity	Reason for Engagement
City of Chilliwack	Staff	In-person	April 8. 2013	Discuss routing, including near Cheam Wetlands Regional Park.
Fraser Valley Regional District	Fraser Valley Regional District Board	In-person	May 28, 2013	Presentation to Fraser Valley Regional District Board. Board member expressed concern regarding the study corridor in Cheam Wetlands Regional Park. Board member indicated the Cheam Wetlands is a valuable resource and should receive nothing less than the highest standard of care.
City of Chilliwack	Stakeholders, including City staff	In-person	June 17, 2013	Community Workshop. City of Chilliwack staff raised concerns regarding spills and the effect on Cheam Lake area as well as spawning channels around Bridal Creek and impacts to Bridal Veil Falls Provincial Park during construction.
City of Chilliwack Fraser Valley Regional District	Mayor and staff, City of Chilliwack and Chair and staff, Fraser Valley Regional District	In-person	December 4, 2013	Discuss pipeline safety and emergency response, the route options near Cheam Wetlands Regional Parks and the preference for the route through Bridal Veil Falls Provincial Park.
City of Chilliwack	Staff	Email	March 7, 2014	Update on the optimization of Trans Mountain's route alternatives based on technical studies and feedback received from landowners, neighbours, and public.
Fraser Valley Regional District	Fraser Valley Regional District	Letter	March 18, 2014	Response to letter from Fraser Valley Regional District.
Fraser Valley Regional District	Fraser Valley Regional District	In-person	March 27, 2014	Parks Workshop (Refer to Table D4.2-2 for comments provided from stakeholders during this event).
Fraser Valley Regional District	Fraser Valley Regional District	In person	March 27, 2014	Community Workshop. No concern expressed about BVFPP or Cheam Park.

5.0 ECONOMIC BENEFIT TO BRIDAL VEIL FALLS PROVINCIAL PARK

A description of economic benefits to the province of BC resulting from the Project is provided in Section 5.0 of the Introduction of the Draft Stage 2 Detailed Proposal.

5.1 Estimated Workforce Requirements

The construction of the Project will involve a workforce of approximately 400 workers onsite at any given time for the duration of construction from the Hope Pump Station to Wahleach Pump Station, including Bridal Veil Falls Provincial Park. The skills of the anticipated workforce will include heavy equipment operators, welders, labourers, mechanics, foremen, surveyors, inspectors and field office support personnel. Generally, during pipeline construction, pipeline crews and workers will use a combination of accommodation resources, including local commercial motels and hotels, private boarding arrangements, temporary work camps, and temporary or permanent RV sites.

6.0 SETTING OF BRIDAL VEIL FALLS PROVINCIAL PARK

The environmental and socio-economic setting along the proposed or narrowed pipeline corridor within Bridal Veil Falls Provincial Park is described in Table 6.0-1. Information collected for the setting was obtained both from desktop overviews and field assessments.

TABLE D6.0-1

SUMMARY OF BIOPHYSICAL AND SOCIO-ECONOMIC ELEMENTS AND CONSIDERATIONS IN BRIDAL VEIL FALLS PROVINCIAL PARK

Biophysical and Socio-Economic Element	Summary of Considerations
Physical and Meteorological Environment	• The narrowed pipeline corridor in Bridal Veil Falls Provincial Park lies in the Skagit Range Subdivision of the Coast Mountains Physiographic Region immediately adjacent to the Fraser Lowland (Holland 1976). • Bedrock types are dominated by sedimentary rocks, often intruded by granitic batholiths. • The topography of the area surrounding the narrowed pipeline corridor in Bridal Veil Falls Provincial Park is undulating to gently sloping (TERA Environmental Consultants [TERA] 2013). • Some bedrock exposures occur at higher elevations. The underlying bedrock consists of the Paleozoic Chilliwack Group undivided sedimentary rocks; including, pelite, sandstone, conglomerate rocks. • There are no areas of permafrost within Bridal Veil Falls Provincial Park (Geological Survey of Canada 1995). • There are no major documented earthquakes, landslides or avalanches in the vicinity of the narrowed pipeline corridor in Bridal Veil Falls Provincial Park (Natural Resources Canada [NRCan] 2005). However, slopes within the general area of the site are prone to mass wasting and fluvial events such as debris flows and debris torrents. The narrowed pipeline corridor is located within Seismic Zone 4 where peak horizontal ground acceleration ranges from 0.16 to 0.23 at a probability of exceedance of 10% in 50 years (NBCC 1985). The maximum probability for liquefaction is between 20% and 40% in 50 years (BC MSRM 1994).
Soil and Soil Productivity	• A soils survey was conducted in March 2014 along the narrowed pipeline corridor within Bridal Veil Falls Provincial Park. The soils along the narrowed pipeline corridor in Bridal Veil Falls Provincial Park are classified as Orthic Sombric Brunisol and Orthic Humo-Ferric Podzol (Kenworthy soils). Locations of these soils series along the narrowed pipeline corridor are presented on the accompanying Environmental Alignment Sheets. • These soils are characterized by sandy loam to loam textured, often gravelly colluvium, which a topsoil thickness of 10-20 cm. The topsoil horizons are easily distinguished from subsoils by colour. These soils are extremely acidic. • These soils are located on the lower mountain slopes on undulating to gently sloping colluvial fans. • These soils are moderately susceptible to wind erosion.
Water Quality and Quantity	• The narrowed pipeline corridor through the park is located in the Harrison River Watershed of the Fraser River Basin. • The narrowed pipeline corridor crosses one fish-bearing watercourse (Bridal Creek) within Bridal Veil Falls Provincial Park. • Bridal Creek is provincially rated as an S5 perennial watercourse through the park. During fisheries field studies conducted in March and April 2014, streamflow at Bridal Creek was measured at 0.09 m^3/s and mean channel width and mean bank height was measured at 3.2 m and 0.23 m, respectively. • No provincial or federal surficial geology mapping is available within the Bridal Veil Falls Provincial Park. However, mapping completed by BGC Engineering (2013) indicates that colluvium surficial deposits occur throughout most of the park area, and fluvial deposits are present in the down-gradient areas to the north, towards the Fraser River. • Unconsolidated aquifer #6, the Chilliwack-Rosedale aquifer, underlies the northwestern corner of the Bridal Veil Falls Provincial Park, and consists of sand and gravel material deposited by the Fraser River. The aquifer has been classified as high vulnerability, high productivity and low demand. • Groundwater flows generally follow local topography with recharge occurring either directly over the unmapped aquifers or from the valley walls (mountain sides) to the southeast, with groundwater discharge feeding the local river systems or flowing within fluvial sediments subparallel to the valley axis. • One well (BC Ministry of Environment [MOE] #19353; listed as abandoned in 1965) lies within the park boundary (outside the mapped aquifer). This well lies outside the narrowed pipeline corridor. Outside of the park area, in its vicinity, two wells (#49650 and #35247; water level depths of 8.2 m below ground (mbg) and 10.7 mbg) occur within the narrowed pipeline corridor, and four wells (#53797, #76064, #58008, #50237; water levels 10.7 mbg to 15.2 mbg) occur close to the pipeline corridor. Well use varies from domestic to commercial and unknown. • The area is susceptible to changes in groundwater flow patterns (*i.e.,* areas where the pipeline is at the base of a steep slope). The sharp break in slope suggests that there may be artesian conditions (*i.e.,* seeps and/or springs).

TABLE D6.0-1 Cont'd

Biophysical and Socio-Economic Element	Summary of Considerations
Air Emissions and Greenhouse Gas Emissions (GHG)	• Air quality in the area of Bridal Veil Falls is primarily a function of anthropogenic sources or emissions such as those arising from vehicle traffic on Highway 1, as well as from agricultural, commercial and industrial equipment. • The nearest permanent residence to the Project is located approximately 400 m from the narrowed pipeline corridor in Bridal Veil Falls Provincial Park. • The primary source of air emissions during construction will be from fuel combustion and dust related to the use of transportation and heavy-duty equipment. During operations, emissions will be limited to transportation and equipment use during maintenance activities. Criteria air contaminants (CACs) expected to be emitted from Project-related activities include sulphur dioxides, volatile compounds, carbon monoxide and particulate matter. • A temporary increase in airborne emissions is anticipated during pipeline construction but will not result in an increase in airborne emissions during operations and maintenance. Therefore, a detailed assessment of air and GHG is not warranted.
Acoustic Environment	• Current noise emissions in the area are from vehicle traffic on Highway 1 as well as from agricultural equipment. • Clearing and construction is scheduled for Q3/Q4 of 2017, when there are fewer recreational users within the park. • A temporary increase in noise levels is anticipated during construction. Noise from construction activities will be in compliance with the BC Oil and Gas Commission (BC OGC) *British Columbia Noise Control Best Practices Guidelines* (BC OGC 2009). • Noise arising from construction activities and the potential effects on wildlife are discussed in Section 7.1.9. • Noise generated during operations is expected to be undetectable and will not contribute to ambient noise levels. A quantitative assessment of the acoustic environment is, therefore, not warranted.
Fish and Fish Habitat	• The narrowed pipeline corridor crosses one fish-bearing watercourse (Bridal Creek). Bridal Creek has been rated as low fish habitat potential for spawning, rearing, overwintering and migration of salmonids within the zone of influence (ZOI). Fish have been captured downstream and upstream of the ZOI, however, multiple barriers to fish passage exist between the fish-bearing section of Bridal Veil Creek and the ZOI. During the fisheries field studies conducted in March and April 2014, coho salmon was documented upstream from the Bridal Creek watercourse crossing. • Bridal Creek is provincially rated as an S3 perennial watercourse. During fisheries field studies conducted in March and April 2014, streamflow at Bridal Creek was measured at 0.09 m^3/s and mean channel width and mean bank height was measured at 3.2 m and 0.23 m, respectively.
Wetlands Loss or Alteration	• Bridal Veil Falls Provincial Park is located within the Lower Mainland Ecoregion, a component of the Pacific Maritime Ecozone of Canada. Moist areas in the Lower Mainland Ecoregion are characterized by Douglas-fir, western hemlock and western red cedar (Ecological Stratification Working Group 1995). • Bridal Veil Falls Provincial Park is located within the Pacific Temperate Wetland Region. Wetlands characteristic of this region include fens, swamps and bogs. Floodplains and deltas can contain extensive marshes (Government of Canada 1986). • Bridal Veil Falls Provincial Park is located within the Costal Western Hemlock (CWH) Biogeoclimatic (BGC) Zone of BC. In the CWH BGC Zone, wetlands are often found in depressions, around open water, small streams and drainage channels. Wetland classes include fens, marshes and shrubby swamps (BC Ministry of Forests [MOF] 1999, Meidinger and Pojar 1991). • Wetlands provide habitat for native plants and wildlife species, including nesting and foraging habitat for a variety of bird species, forage and cover for ungulates and fur-bearers and breeding habitat for amphibians. Wetlands provide water storage, groundwater recharge and natural filtering of sediments. • There are no Ramsar Wetlands of International Importance (Bureau of the Convention on Wetlands 2014), Important Bird Areas (IBAs) (Bird Studies Canada and Nature Canada 2012), Western Hemisphere Shorebird Reserves (Western Hemisphere Shorebird Reserve Network 2014) or Migratory Bird Sanctuaries (Environment Canada 2013) located within Bridal Veil Falls Provincial Park. • Ducks Unlimited Canada (DUC) has identified three levels of priority for wetland conservation in Canada. Priority areas are threatened landscapes identified for conservation in order to provide a healthier environment for waterfowl. Bridal Veil Falls Provincial Park is located within a DUC Level 2 Priority Area, the BC Coastal Areas and Estuaries (DUC 2014). The narrowed pipeline corridor does not cross any DUC projects within Bridal Veil Falls Provincial Park (Harrison pers. comm.), therefore, no additional mitigation or consultation is recommended. • No wetlands were identified as being crossed by the narrowed pipeline corridor within Bridal Veil Falls Provincial Park during helicopter reconnaissance (September 2012 and May 2013) and satellite imagery review (1:10,000).
Vegetation	• Bridal Veil Falls Provincial Park is located in the Coastal Western Hemlock (CWH) BGC Zone. The landscape of the CWH BGC zone consists largely of western hemlock, western redcedar, and Douglas-fir forests. The understory of zonal ecosystems consists of a variable herb layer and a high proportion of feathermosses. A mixture of other evergreen and deciduous trees are also common in the CWH zone, including amabilis fir, yellow-cedar, Sitka spruce, shore pine, red alder and bigleaf maple. Drier portions are found the central and southern parts of the CWH zone. Shore pine can be found in very dry, well-drained sites, and very dry sites, such as in bogs. Black cottonwood, red alder, and Sitka spruce occur along river floodplains and riparian areas (Meidinger and Pojar 1991).

TABLE D6.0-1 Cont'd

Biophysical and Socio-Economic Element	Summary of Considerations
Vegetation (cont'd)	• Bridal Veil Falls Provincial Park is located in the Dry Maritime Coastal Western Hemlock subzone (CWHdm). The CWHdm subzone occurs at low elevations in the southwest region of BC (Green and Klinka 1994). Zonal sites are dominated by Douglas-fir, western redcedar and western hemlock. Shrubs that can occur include salal and red huckleberry (Green and Klinka 1994). The age range of trees in this park area is projected to be between 41 and 120 years (BC Ministry of Forests, Lands and Natural Resource Operations [MFLNRO] 2013b). The Project runs along the northwestern portions of the Park below the steep valley wall where moisture is received from above. The Project crosses Bridal Creek and moist, rich ecosystems occur where the corridor crosses the park. The narrowed pipeline corridor parallels the existing TMPL right-of-way within a young forest structural stage (<80 yrs old) and is highly disturbed with roads, trails and recreational development. • A total of 16 vascular plant species and 4 lichen species are listed under Schedule 1 of the *Species at Risk Act* (*SARA*) that have the potential to occur in the CWH zone (BC Conservation Data Centre [CDC] 2014). One previously recorded Element Occurrence of cliff paintbrush listed on *SARA* Schedule 1 is known to occur within 5 km of the Vegetation RSA on Cheam Peak (Environment Canada 2014b, BC CDC 2014), but not within the park boundaries. Cliff paintbrush is currently listed as Threatened under *SARA* (BC CDC 2014). No previously recorded Element Occurrences of plant species listed pursuant to the British Columbia *Wildlife Act* are known to occur within the Vegetation RSA (BC CDC 2014) or within the park boundaries. • A search of the BC CDC database identified three previous occurrences of red-listed rare plant species, tall bugbane, peacock vinyl lichen (*Leptogium polycarpum*) and Roell's brotherella (*Brotherella roellii*), as well as three previous observations of Blue-listed rare plant species, cliff paintbrush (*Castilleja rupicola*), blue vervain (*Verbena hastata* var. *scabra*) and short-fuited Smelowskia (*Smelowskia ovalis*), within the 5 km of the narrowed pipeline corridor through Bridal Veil Falls Provincial Park. Known occurrences of peacock vinyl lichen, Roell's brotherella and blue vervain are known to occur within 1 km of the narrowed pipeline corridor through Bridal Veil Falls Provincial Park (BC CDC 2014). • The CWHdm subzone has the potential to host six red-listed and eleven blue-listed rare ecological communities. No rare plant species or rare ecological communities were identified during these surveys. Additional late-season surveys are planned in 2014 to augment early-season surveys in the park. • The Project is not located in Emergency Bark Beetle Management Area (EBBMA) and is not designated as Salvage/Limited Action for Mountain Pine Beetle and Aggressive management areas for the Douglas Fir and Spruce Beetles (BC MFLNRO 2010). • There are no Legal or Non-legal Old Growth Management Areas (OGMAs) along the narrowed pipeline corridor within Bridal Veil Falls Provincial Park. • Vegetation surveys were conducted in the northern portion of the park on April 25 to 28, 2014. No rare plants, rare lichen or rare ecological communities were observed. • A summary of weed issues along the narrowed pipeline corridor, including the Fraser Valley Regional District (FVRD), is provided in Table. 5.4.3-1 in the Vegetation Technical Report of Volume 5C of the Facilities Application. No provincially or regionally Noxious weeds were identified within the park in 2014. Three species designated as Noxious in other regions were recorded: quackgrass, as a few patches in a single location; great burdock, as a single plant in one location; and, cleavers, as a single patch in one location. Several nuisance species were also present, including: creeping buttercup, annual bluegrass, common plantain and several garden escapee species.
Wildlife and Wildlife Habitat	• The Bridal Veil Falls Park Master Plan identifies the primary management objectives of Bridal Veil Falls Provincial Park as conservation and preservation of the park for recreation and scenic viewing (BC Ministry of Lands, Parks and Housing [MLPH] 1984). Although wildlife are known to frequent the park, there are no specific objectives that pertain to wildlife due its small size and low resource diversity (BC MLPH 1984). The Bridal Veil Falls Provincial Park website identifies bird habitat as being present within the park, in addition to habitat suitable for transient species such as Columbia blacktail deer and black bear (BC MOE 2013a). • Draft mapping provided by Environment Canada (2014a) indicates that candidate critical habitat for Oregon forestsnail may occur within the narrowed pipeline corridor and adjacent areas in Bridal Veil Falls Provincial Park. Oregon forestsnails are typically found in riparian and other wetland habitats, occupy home ranges between 18 – 400 m^2, are poor dispersers, have relatively low population densities, and require woody debris and stinging nettle for mating purposes (Edworthy *et al.* 2012, Environment Canada 2014a, Steensma *et al.* 2009). Habitat loss is a primary threat for Oregon forestsnail (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2002). • Draft mapping provided by Environment Canada (2014a) indicates that early candidate critical habitat for Pacific giant salamander may occur along the narrowed pipeline corridor in Bridal Veil Falls Provincial Park. Pacific giant salamander require both aquatic and terrestrial habitat for different life stages. Preferred breeding streams for pacific giant salamander are cool, well-oxygenated and have gravel and pebble substrate with refuges large enough to cover a salamander (Pacific Giant Salamander Recovery Team 2010, Environment Canada 2014b). During terrestrial life phases Pacific giant salamanders inhabit moist forested habitats close to the streams (Pacific Giant Salamander Recovery Team 2010, Environment Canada 2014b). Habitat loss is a primary threat for Pacific giant salamander (Pacific Giant Salamander Recovery Team 2010).

TABLE D6.0-1 Cont'd

<table>
<tr><th>Biophysical and Socio-Economic Element</th><th>Summary of Considerations</th></tr>
<tr><td>Wildlife and Wildlife Habitat (cont'd)</td><td>Bridal Veil Falls Provincial Park is located within the southwestern edge of the Threatened North Cascades Grizzly Bear Population Unit (GBPU) (BC MFLNRO 2012b).The North Cascades GBPU has an estimated population of six individuals (BC MFLNRO 2012b). The management objective for Threatened GBPUs in BC is population recovery to prevent range contraction and ensure long-term population viability (BC MFLNRO 2012b). A North Cascades Grizzly Bear Recovery Team was initiated to restore this population to viable status. Seven objectives of the Recovery Plan were established including: providing habitat of sufficient quality and quantity; preventing population fragmentation and maintain genetic diversity; increasing the total number of grizzly bears in the North Cascades; minimizing the potential for human/bear conflict; minimizing human-caused mortality of grizzly bears; increasing scientific and public knowledge and support for grizzly bear recovery; and facilitating interagency cooperation and management (North Cascades Grizzly Bear Recovery Team 2004).
Supplemental field surveys for the Project will be completed in Bridal Veil Falls Provincial Park in 2014.</td></tr>
<tr><td>Species at Risk</td><td>A total of 16 vascular plant species, 4 non-vascular plant species and 4 lichen species are listed under Schedule 1 of SARA that have the potential to occur in the CWH zone (BC CDC 2014). One previously recorded Element Occurrence of cliff paintbrush listed on SARA Schedule 1 is known to occur within 5 km of the Vegetation RSA on Cheam Peak (Environment Canada 2103b, BC CDC 2014), but not within the park boundaries. Cliff paintbrush is currently listed as Threatened under SARA (BC CDC 2014). No previously recorded Element Occurrences of plant species listed pursuant to the British Columbia Wildlife Act are known to occur within the Vegetation RSA (BC CDC 2014) or within the park boundaries. No SARA or COSEWIC listed plants were observed during early-season rare plant surveys in 2014.
One previously recorded Element Occurrence of tall bugbane (Actea elata var. elata) listed as Endangered by COSEWIC is known to occur within the 5 km of the Vegetation RSA on the southwest slopes of Mount Archibald (BC CDC 2014), but not within the park boundaries. Tall bugbane is also listed on the BC Identified Wildlife Management Strategy under the Category of Species at Risk (Web Mapping Service [IWMS 2004]. Roell's brotherella (Brotherella roellii) is listed as Endangered by COSEWIC and is known to occur adjacent to the Park in the Popkum Reserve #2. Peacock vinyl (Leptogium polycarpum) is listed as Special Concern by COSEWIC and was known to occur near the Bridal Falls area, but is presumed to be extirpated since 2009 (COSEWIC 2011).
Potential habitat for tall bugbane habitat is generally in montane forests, which do not occur along the narrowed pipeline corridor within the park boundaries. Tall bugbane can also be found in moist, mature western red cedar-hemlock mixed forests, therefore there is potential for its presence in the Park (Penny 2004). Peacock vinyl lichen occurs in low elevations on the branches and mossy trunks of deciduous trees, particularly bigleaf maple and red alder, in mid-successional stands. Peacock vinyl is possibly extirpated from the Bridal Veil Falls Park area (BC CDC 2014). There is low potential habitat for cliff paintbrush along the narrowed pipeline corridor within the park boundaries due to its rocky subalpine/alpine habitat requirements (BC MOE 2009).
A total of 2 aquatic species at risk have the potential to occur within the Bridal Veil Falls Provincial Park Aquatics RSA based on historical data. Coho salmon (Interior Fraser River populations) is currently listed as Endangered by COSEWIC and was observed within the park boundaries. Bull trout (South Coast BC populations) is currently listed as Special Concern by COSEWIC and provincially Blue-listed. Bull trout occurs within the Aquatics RSA, however, their presence is unlikely to occur within the park boundaries due to low fish habitat potential and fish passage barriers.
The following wildlife species at risk have the potential to occur in Bridal Veil Falls Provincial Park based on range and habitat availability (BC CDC 2014, COSEWIC 2014, Environment Canada 2014b). Species at risk are defined here to include those species listed federally under Schedule 1 of SARA or by COSEWIC. Additional species that are listed provincially are provided at the end of the list.
Grizzly bear: Special Concern by COSEWIC, Blue-listed;
Little brown myotis: Endangered by COSEWIC;
Mountain beaver, rufa ssp.: Special Concern by SARA and COSEWIC, Blue-listed;
Band-tailed pigeon: Special Concern by SARA and COSEWIC, Blue-listed;
Bank swallow: Threatened by COSEWIC;
Barn swallow: Threatened by COSEWIC, Blue-listed;
Common nighthawk: Threatened by SARA and COSEWIC;
Great blue heron, fannini ssp.: Special Concern by SARA and COSEWIC, Blue-listed;
Northern goshawk: Threatened by SARA and COSEWIC, Red-listed;
Olive-sided flycatcher: Threatened by SARA and COSEWIC, Blue-listed;
Short-eared owl: Special Concern by SARS and COSEWIC, Blue-listed
Coastal tailed frog: Special Concern by SARA and COSEWIC, Blue-listed;
Pacific giant salamander: Threatened by SARA and COSEWIC, Red-listed;
Northern rubber boa: Special Concern by SARA and COSEWIC;
Monarch: Special Concern by SARA and COSEWIC, Blue-listed; and
Oregon forestsnail: Endangered by SARA and COSEWIC, Red-listed.
Provincially-listed species: Sooty grouse (Blue-listed); Long-tailed weasel (Red-listed); Olympic shrew (Red-listed); Snowshoe hare washingtonii ssp. (Red-listed); Trowbridge's shrew (Blue-listed)</td></tr>
</table>

TABLE D6.0-1 Cont'd

Biophysical and Socio-Economic Element	Summary of Considerations
Heritage Resources	• There is archaeological potential throughout the narrowed pipeline corridor in Bridal Veil Falls Provincial Park due to creek proximity, and historical and Culturally Modified Trees (CMT) potential. • There are no previously recorded archaeological sites traversed by the narrowed pipeline corridor in Bridal Veil Falls Provincial Park. • In accordance with provincial legislation, in the event that any historical, archaeological or palaeontological resources are discovered during construction, construction activity in the vicinity of the discovery will be suspended until provincial authorities allow work to resume. • Approval under the BC *Heritage Act* will be acquired prior to commencement of construction.
Traditional Land Use	• To date, Popkum First Nation and Leq':mel First Nation have submitted a traditional land and resource use (TLRU) report. Ts'elxwéyeqw Tribe Management Limited (TTML) is a management council that represents Cheam First Nation, Skowkale First Nation, Yakweakwioose First Nation, Aitchelitz First Nation, Skwah First Nation, Kwaw-kwaw-apilt First Nation, Soowahlie First Nation, Shxwha:y Village, Tzeachten First Nation, Squiala First Nation. These Nations represented by TTML have completed an Integrated Cultural Assessment which includes information for their traditional territory within Bridal Veil Falls Provincial Park. Independent third-party TLRU studies are underway for Seabird Island First Nation, Yale First Nation and Shx'wow'hamel First Nation. • A medicinal plant gathering site and a sacred site were identified at Bridal Veil Falls by Leq'a:mel First Nation for the Project; however these sites are not within the narrowed pipeline corridor and Leq'a:mel First Nation did not request any mitigation for these sites.
Visitor Enjoyment and Safety	• The narrowed pipeline corridor crosses picnic tables, car parking, information shelter, a bathroom shelter, walking paths, trails, small foot bridges, a service area and a mowed grassy area. • Outdoor recreational uses include hiking, dog walking and wildlife viewing. • Access to Bridal Veil Falls Provincial Park is off Highway 1, which enhances the park's value. The access road is crossed by the narrowed pipeline corridor at approximately AK 1079.6.

7.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS AND MITIGATION

Using the assessment methodology described in Section 6.1 of the Introduction of the Draft Stage 2 Detailed Proposal of this report, the following subsections evaluate the potential environmental and socio-economic effects associated with construction and operations of the pipeline within Bridal Veil Falls Provincial Park.

Environmental and socio-economic elements potentially interacting with the construction and operations of the pipeline in Bridal Veil Falls Provincial Park are identified in Table D7.0-1.

TABLE D7.0-1

ELEMENT INTERACTION WITH PROPOSED PIPELINE COMPONENT IN BRIDAL VEIL FALLS PROVINCIAL PARK

Element	Interaction with Pipeline Component	
	Construction	Operations
Conservational Values of Bridal Veil Falls Provincial Park		
Physical and Meteorological Environment	Yes	Yes
Soil and Soil Productivity	Yes	Yes
Water Quality and Quantity	Yes	Yes
Air Emissions	Yes	Yes
Acoustic Environment	Yes	Yes
Fish and Fish Habitat	Yes	Yes
Wetlands	No – wetlands are not anticipated to be disturbed during Project construction in Bridal Veil Falls Provincial Park.	No – wetlands are not anticipated to be disturbed during Project construction in Bridal Veil Falls Provincial Park.
Vegetation	Yes	Yes
Wildlife and Wildlife Habitat	Yes	Yes
Species at Risk	Yes	Yes
Heritage Resources	Yes	No – since surface or buried heritage resource sites, if present, would have been disturbed as a result of construction activities, no interaction is anticipated during operations of the pipeline in Bridal Veil Falls Provincial Park.
Traditional Land and Resource Use	Yes	Yes
Recreational Values of Bridal Veil Falls Provincial Park		
Visitor Enjoyment and Safety	Yes	Yes

The potential environmental and socio-economic effects associated with the pipeline, as well as the accompanying proposed mitigation measures and resulting residual effects are presented for each environmental and socio-economic element. In addition, using the criteria presented in Table 6.2.6-1 of the Introduction of the Draft Stage 2 Detailed Proposal, the evaluation of significance is provided for each potential residual effect associated with the applicable environmental and socio-economic element in the subsections below.

Many of the recommended mitigation measures are considered industry accepted best practices in pipeline construction, reclamation and operations. However, a number of enhanced measures are also recommended specific for Bridal Veil Falls Provincial Park. The measures are discussed further in Section 8.0 and are summarized in Table D7.0-2. The entirety of the wildlife mitigation presented in Table D7.1.9-2 is intended to be specific to Bridal Veil Falls Provincial Park and, therefore, has not been repeated in Table D7.0-2.

TABLE D7.0-2

ENHANCED MITIGATION MEASURES RECOMMENDED IN BRIDAL VEIL FALLS PROVINCIAL PARK

Element/Topic	Recommendations	Section Discussed
Reclamation	<u>Narrowing Down</u> • Minimize the width of the construction right-of-way in an area as is safely feasible to reduce the clearing of old growth trees within Bridal Veil Falls Provincial Park. • Mark or protect (i.e., fence) old growth trees throughout the duration of construction and reclamation activities. <u>Park Trails</u> • Re-establish park trails following the replacement of soil and/or aggregate surface material as well as the replacement of park/trail signage removed during construction. <u>Natural Regeneration</u> • Allow for natural regeneration in areas where potential soil erosion and non-native invasive species infestation is low, and where it is anticipated that the topsoil or root zone material contains a propagule bank (*e.g.,* seed, stem or root pieces) of suitable species. • Apply a native perennial or non-native annual grass cover crop species in areas with potential erosion and weed concerns. <u>Woody Species Revegetation</u> *Installation of Nursery-Grown Plant Plugs* • Install nursery-grown plant plugs (*e.g.,* rooted stock plugs) in TWS, riparian and special reclamation areas, where suitable levels of naturally regenerating (from seed or vegetative propagules) deciduous or coniferous trees are not observed. • Secure native seed and collect dormant woody species cuttings, as warranted. • Install deciduous and coniferous rooted plugs at pre-selected sites (*e.g.,* TWS, riparian areas or for line-of-sight breaks) as determined in consultation with BC Parks Conservation Specialists. *Installation of Locally Sourced Dormant Woody Species Transplants* • Use plant transplants at pre-determined locations where vegetation is disturbed by construction. <u>Nutrient Management on Disturbed Forested Areas</u> • Apply a slow-release nitrogen fertilizer on lands that contain woody debris and/or wood chips mixed into the salvaged and replaced root zone material or that have been placed on cleared and ungrubbed portions of the construction right-of-way. <u>Seeding of Native Grass Species</u> • Develop seed mixes in consultation with BC Parks that consist of species native to the park or within the vicinity of the park. • Drill or broadcast seed native seed mixes or grass cover crop species on most of the construction right-of-way or at locations indicated on the Environmental Alignment Sheets, unless otherwise requested by BC Parks Area Supervisor or Conservation Specialist. <u>Specific Erosion and Sediment Control</u> • Install coir logs, erosion control blankets and sediment fences following clearing. Monitor and maintain following construction until vegetation establishment occurs. • Install diversion berms to reduce slope length and runoff velocities, and divert runoff away from watercourses/waterbodies and into well-vegetated areas. • Implement rollback using select tree species (*e.g.,* pine) felled during construction (avoid the use of Douglas-fir and spruce) within riparian zones and TWS areas to provide erosion control and habitat enhancement. • Seed (drill or broadcast seeded) using an appropriate native grass seed mix, native perennial or annual non-native cover crop, along the disturbed areas following root zone material replacement at an appropriate prescribed rate. <u>Weed Management</u> • Utilize Trans Mountain's integrated vegetation management (IVM) approach to manage weeds and problem vegetation. • Develop detailed weed and problem vegetation reports for site-specific locations, as required, following a pre-construction weed survey (scheduled for spring 2015) and consultation with BC Parks Conservation Specialists. Weed and problem vegetation infestations and recommended mitigation measures will be incorporated into the Environmental Alignment Sheets. <u>Watercourses</u> • Stabilize banks and slopes of watercourse and riparian areas prior to and immediately following construction (crib structures, erosion control matting, revegetation grass rolls, sediment fences, biodegradable coir geotextile wraps, coniferous tree revetments, cobble or riprap armouring). <u>Wildlife Movement, Mortality and Human Encounters</u> • Seed using native grass species with reduced palatability in areas where potential wildlife vehicle collisions and human encounters may be higher. • Install visual barriers along the right-of-way and salvaged wildlife habitat trees to restore the effectiveness of wildlife movement corridors.	Section 8.0

7.1 Conservation Values of Bridal Veil Falls Provincial Park

7.1.1 Physical and Meteorological Environment

This subsection describes the potential Project effects on the physical environment in Bridal Veils Falls Provincial Park. The Physical Environment LSA consists of a 1 km wide band generally extending from the centre of the proposed pipeline corridor and facilities (*i.e.*, 500 m on both sides of the proposed pipeline corridor centre); shown in Figure 6.2.2-6 of the Introduction to the Draft Stage 2 Detailed Proposal.

All physical environment indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; however, only terrain instability was determined to interact with pipeline construction and operations in Bridal Veil Falls Provincial Park. There are no sites within Bridal Veil Falls Provincial Park with the potential for acid rock drainage. The topography within Bridal Veil Falls Provincial Park is relatively stable with gently undulating slopes along the narrowed pipeline corridor.

7.1.1.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on physical environment indicators are listed in Table D7.1.1-1.

A summary of mitigation measures provided in Table D7.1.1-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines including BC OGC (2013) and BC Ministry of Energy and Mines (Price and Errington 1998).

TABLE D7.1.1-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON PHYSICAL ENVIRONMENT FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Physical Environment Indicator – Terrain Instability			
1.1 General Measures	LSA	• Assess the need for special trench compaction measures or equipment prior to commencement of backfilling [Section 8.4]. See additional backfilling measures in Section 8.4 of the Pipeline EPP. • Recontour the construction right-of-way and re-establish the pre-construction grades and drainage channels if frozen soil conditions prevented completion of this task during backfilling [Section 8.6]. • Revegetate as soon as feasible to reduce or avoid soil erosion and establish long-term cover. Seed immediately following root zone material replacement [Section 8.6]. See additional erosion control and revegetation measures in Section 8.6 of the Pipeline EPP.	• Areas of terrain instability may occur as a result of construction activities.

Notes: 1 LSA = Physical Environment LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.1.2 Significance Evaluation of Potential Residual Effects

Table D7.1.1-2 provides a summary of the significance evaluation of the potential residual environmental effect of the construction and operations of the proposed pipeline in Bridal Veil Falls Provincial Park on the physical environment. The rationale used to evaluate the significance of the residual environmental effect is provided below.

TABLE D7.1.1-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECT OF PIPELINE CONSTRUCTION AND OPERATIONS ON PHYSICAL ENVIRONMENT FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Residual Effect		Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1	Physical Environment Indicator – Terrain Instability									
1(a)	Areas of terrain instability may occur as a result of construction activities.	Negative	LSA	Short-term	Isolated	Short to medium-term	Low	High	High	Not significant

Notes: 1 LSA = Physical Environment LSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Physical Environment Indicator – Terrain Instability

Terrain Instability

Minor areas of terrain instability may occur along areas of the narrowed pipeline corridor as a result of the proposed construction activities (*e.g.,* grading, trenching and backfilling). The impact balance of this residual effect is considered negative since terrain instability could affect the safety of the pipe and result in surface erosion. Terrain along most of the proposed pipeline corridor in Bridal Veil Falls Provincial Park is considered to be stable (*i.e.,* undulating to gently sloping), based on observations and operating experience of the existing TMPL system to date, as well as the results of the Terrain Mapping and Geohazard Inventory (Volume 4A of the Facilities Application).

During construction of the pipeline, removal of vegetation and root mass, grading, cut and fills and runoff controls could lead to localized areas of potential instability. Monitoring during construction will ensure any observed instability issues will be resolved early before potentially severe instability problems arise. Grade material will be replaced to a stable contour that will approximate the pre-construction contour, except where it is not practical or safe from a pipe integrity perspective or for public safety.

Regular aerial and ground patrols will be conducted to examine vegetation establishment and confirm mitigation measures are functioning as intended, as well as identify any new areas of potential instability. At any areas where erosion is observed, appropriate measures will be implemented to clean-up and stabilize the site. Monitoring of the reclaimed sites will continue until the site is determined to be in a stable condition.

The residual effect of terrain instability occurring as a result of planned construction activity is reversible in the short to medium-term and of low magnitude (Table D7.1.1-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Physical Environment LSA - terrain instability as a result of construction activities may extend beyond the construction workspace.
- Duration: short-term – the event causing potential terrain instability is construction of the pipeline (*e.g.,* grading, and rough clean-up).
- Frequency: isolated – the event causing potential terrain instability (*i.e.*, construction of the pipeline) is confined to a specific period.
- Reversibility: short to medium-term – most areas of terrain instability will be remediated within a year, however, some areas may require a second or third year of remedial effort to fully stabilize.

- Magnitude: low – the implementation of the proposed mitigation measures in addition to detailed engineering design is expected to effectively reduce the severity and extent of potential effects on terrain instability within Bridal Veil Falls Provincial Park.
- Probability: high – terrain instability is likely to result from pipeline construction at localized areas.
- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

7.1.1.3 Summary

As described in Table D7.1.1-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on the physical environment indicator of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Bridal Veil Falls Provincial Park related to physical environment will be not significant.

7.1.2 Soil and Soil Productivity

This subsection describes the potential Project effects on the soil and soil productivity in Bridal Veil Falls Provincial Park. The Soil LSA consists of a 1 km wide band from the centre of the proposed pipeline corridor and facilities (*i.e.,* 500 m on both sides of the proposed pipeline corridor centre); shown in Figure 6.2.2-6 of the Introduction to the Draft Stage 2 Detailed Proposal.

All soil and soil productivity indicators (Table 6.2.1-1 of Introduction to the Draft Stage 2 Detailed Proposal) were considered in this evaluation; however, only soil productivity, soil degradation and soil contamination indicators were determined to interact with pipeline construction and operations in Bridal Veil Falls Provincial Park. Soils in Bridal Veil Falls Provincial Park are not stony, and therefore, pipeline construction and operations does not interact with the bedrock and stone disposal indicator.

7.1.2.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on soil and soil productivity indicators are listed in Table D7.1.2-1.

A summary of mitigation measures provided in Table D7.1.2-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines including BC OGC (2010a) and Canadian Association of Petroleum Producers (CAPP) (1996, 1999, 2008).

TABLE D7.1.2-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON SOIL AND SOIL PRODUCTIVITY FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Soil Indicator – Soil Productivity				
1.1 Decreased topsoil/root zone material productivity during topsoil/root zone material salvaging	Soil series: Kenworthy	Footprint	Topsoil/Root Zone Material Depth • Salvage all available topsoil (min. 10 cm and max. 32 cm) and root zone material from Kenworthy soils in Bridal Veil Falls Provincial Park, using the Environmental Alignment Sheets as a guide [Section 8.2]. Topsoil/Root Zone Material Salvage (General) • Implement the Wet/Thawed Soils Contingency Plan (See Appendix B of the Pipeline EPP) during wet/thawed soil conditions in the event wet or thawed soils are encountered during construction [Section 8.2]. • Accommodate BC Parks topsoil/root zone material salvage requests. Record any locations where BC Parks has requested soil handling which differs from the planned method [Section 8.2]. • Salvage topsoil/root zone material from areas to be graded and windrow to the closest edge of the construction right-of-way. Avoid overstripping. The area salvaged is to correspond to the area to be graded [Section 8.2]. See additional grading measures in Section 8.2 of the Pipeline EPP. • Store topsoil/root zone material prior to grading along the nearest pipeline construction right-of-way boundary taking into consideration space requirements for grade and trench spoil, local topography and drainage [Section 8.2]. • Keep trench soil pile separate from topsoil/root zone material pile [Section 8.3]. Topsoil/Root Zone Material Salvage (Non-frozen) • Salvage topsoil/root zone material from the entire construction right-of-way (see Drawing [Topsoil or Root Zone Material Salvage in Forest – Full Right-of-Way] provided in Appendix R) where grading is necessary [Section 8.2]. • Salvage topsoil from twice the width of the trench centred over the trench throughout the park; strip a wider area if grading is necessary [Section 8.2]. • See additional topsoil/root zone material salvage measures in Section 8.2 of the Pipeline EPP.	• Mixing of topsoil/root zone material and subsoil.
1.1 Decreased topsoil/root zone material productivity during topsoil/root zone material salvaging (cont'd)	See above	See above	Topsoil/Root Zone Material Replacement • Follow mitigation measures for backfilling as outlined in Section 8.4 of the Pipeline EPP. • Postpone topsoil/root zone material replacement during wet conditions or high winds to prevent damage to soil structure or erosion of topsoil/root zone material [Section 8.6]. • Replace topsoil/root zone material evenly over all portions of the construction right-of-way that have been stripped. • Revegetate as soon as feasible to reduce or avoid soil erosion and establish long-term cover. Seed immediately following topsoil/root zone material replacement [Section 8.6]. • See additional topsoil/root zone material replacement mitigation measures in Section 8.6 of the Pipeline EPP.	• See above.

TABLE D7.1.2-1 Cont'd

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.2 Decreased soil productivity from trench subsidence	Soil series: Kenworthy	Footprint	• Compact the backfill to reduce trench settlement by running a grader wheel over the backfill when the trench has been backfilled to the level of the surrounding ground. Take extra care to compact the trench at banks of Bridal Creek following isolation [Section 8.4]. • Crown the trench with remaining spoil to allow for settlement. A larger crown will be needed to compensate for settlement after thawing allows the portion of the route constructed during frozen soil conditions [Section 8.4]. • Feather-out existing trench spoil over the salvaged portion of the construction right-of-way to avoid the creation of a permanent trench crown. Excess spoil will not be feathered-out over the salvaged area to an extent that may cause excessive subsidence of the trench [Section 8.4]. • Postpone feathering-out of excess spoil along segments of the route constructed during frozen soil conditions until after the spring breakup and the trench has settled [Section 8.4]. • See additional measures in Section 8.4 of the Pipeline EPP.	• Excessive trench subsidence or known remnant crown.
1.3 Decreased soil productivity from disturbance (*e.g.,* maintenance dig activities) during operations	Soil series: Kenworthy	Footprint	• Implement the recommended soil handling procedures outlined in the Pipeline EPP to reduce the potential for a reduction in soil productivity when construction activities involving soil disturbance are necessary during operations of the pipeline. • Monitor areas along the construction right-of-way that are disturbed during operations and maintenance activities. Implement remedial measures, where warranted.	• Mixing of topsoil/root zone material and subsoil.
2. Soil Indicator – Soil Degradation				
2.1 Loss of topsoil/root zone material through wind erosion	Soil series: Kenworthy	Footprint	• Tackify or apply water/snow or pack the topsoil/root zone material windrow with a sheep foot packer or other approved equipment, if the assessment by the Environmental Inspector(s) indicates that the soils are likely to be prone to wind erosion (see Soil Erosion and Sediment Control Contingency Plan in Appendix B of the Pipeline EPP) [Section 8.2]. • Apply water or approved tackifer to exposed soil piles if wind erosion occurs in Bridal Veil Falls Provincial Park. • Monitor soil windrows during the growing season for wind erosion, and weed growth until the soils are replaced. Implement additional mitigation measures to control erosion (see Soil Erosion and Sediment Control Contingency Plan in Appendix B) and weed growth when warranted (see Weed and Vegetation Management Plan in Appendix C) [Section 8.2]. • Avoid removing excess small diameter slash in wooded areas with erodible soils [Section 8.6]. • See additional measures in the Soil Erosion and Sediment Control Contingency Plan and Soil/Sod Pulverization Contingency Plan in Appendix B of the Pipeline EPP.	• Surface erosion of topsoil/root zone material can be expected until a vegetative cover is established.
2.2. Loss of topsoil/root zone material from disturbance (*e.g.,* maintenance dig activities) during operations	Soil series: Kenworthy	Footprint	• Implement the recommended soil handling procedures outlined in the Pipeline EPP to reduce the potential for soil degradation when maintenance activities involving soil disturbance are necessary during operations of the pipeline. • Monitor areas along the right-of-way that are disturbed during operations and maintenance activities. Implement remedial measures, where warranted.	• Surface erosion of topsoil/root zone material can be expected until a vegetative cover is established.

TABLE D7.1.2-1 Cont'd

Potential Effect	Location	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
3. Soil Indicator – Soil Contamination				
3.1 Soil contamination due to spot spills during construction	Soil series: Kenworthy	Footprint	• Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into Bridal Creek. In the event of a spill, implement the Spill Contingency Plan (see Appendix B of the Pipeline EPP) [Section 7.0]. • Place tarps or other impermeable material on the ground to catch drippings from coating application at weld joints and areas where repairs to the coating are made. Dispose of spilled coating at approved locations [Section 8.3]. • Avoid locating test pumps, generators and fuel storage within park boundaries, if feasible. If not feasible, install test pumps, generators and fuel storage tanks with impermeable lined dike or depression to capture and retain any spills of fuels or lubricants [Section 8.5].	• No residual effect identified.

Notes: 1 LSA = Soil LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.2.2 Significance Evaluation of Potential Residual Effects

Table D7.1.2-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Bridal Veil Falls Provincial Park on soil and soil productivity indicators. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE D7.1.2-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON SOIL AND SOIL PRODUCTIVITY FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1. Soil Indicator – Soil Productivity									
1(a) Mixing of topsoil/root zone material and subsoil.	Negative	Footprint	Short-term	Periodic	Medium-term	Low	High	High	Not significant
1(b) Excessive trench subsidence or a remnant crown.	Negative	Footprint	Short-term	Isolated	Short to medium-term	Low	High	High	Not significant
2. Soil Indicator – Soil Degradation									
2(a) Surface erosion of topsoil/root zone material can be expected until a vegetation cover is established.	Negative	Footprint	Short-term	Periodic	Medium-term	Low	High	High	Not significant
3. Soil Indicator – Soil Contamination									
No residual effects identified.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes: 1 LSA = Soil LSA.
2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Soil Indicator – Soil Productivity

Topsoil/Root Zone Material and Subsoil Mixing

During the construction of the pipeline and, to a lesser extent, during maintenance activities, it is likely that a minor amount of topsoil/root zone material and subsoil mixing will occur along the proposed construction right-of-way. The impact balance of this residual effect is considered negative since admixing could decrease soil productivity. A summary of the rationale for all of the significance criteria is provided in Table D7.1.2-2 (point 1[a]) and below.

- Spatial Boundary: Footprint – admixing is confined to the area of disturbance along the construction right-of-way.
- Duration: short-term – the events causing potential admixing are construction of the pipeline and maintenance-related activities, the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events causing potential admixing (*i.e.*, construction and maintenance-related activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: medium-term – loss of soil productivity due to minor topsoil/root zone material and subsoil mixing is expected to be reversed within 10 years given the implementation of mitigation measures during construction and, if necessary, the application of soil amendments post-construction. The results of recent post-construction environmental monitoring programs in forested and mountainous areas demonstrate that topsoil/root zone material mixing with subsoil is alleviated within a few years post-construction.
- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table D7.1.2-2 and, if necessary, soil amendments applied post-construction. The results of recent post-construction environmental monitoring programs in forested and mountainous areas demonstrate that topsoil/root zone material mixing with subsoil is generally minor in severity and limited in extent.
- Probability: high – admixing is a common residual effect of pipeline construction and may also occur during maintenance activities.
- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and soil productivity.

Trench Subsidence or Remnant Crown

Construction activities may result in localized areas of excessive trench subsidence and/or a remnant crown over the trench due to Kenworth soils found in Bridal Veil Falls Provincial Park being moderately susceptible to wind erosion. The impact balance of this residual effect is considered negative since excessive trench subsidence or a remnant crown may reduce soil productivity through erosion and drainage issues. Trench subsidence and a remnant crown do not always occur during the year following construction and reclamation, and will be greatly influenced by the amount of precipitation. The reversibility of trench subsidence and/or a remnant crown is considered to be short to medium-term since remedial work associated with trench subsidence and/or a remnant crown typically occurs within a year of construction; however, localized trench subsidence may arise 2 to 3 years following construction (TERA 2009a,b, 2011a,b,c, 2012a, 2013a,b). With effective compaction of the backfilled trench and feathering out any remaining material over the trench, the magnitude of the effect of trench subsidence on soil and soil productivity is considered to be low (Table D7.1.2-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – trench subsidence or a remnant crown is confined to the trench line within the construction right-of-way.
- Duration: short-term – the event causing potential trench subsidence or a remnant crown is construction of the pipeline which is limited to the construction phase.

- Frequency: isolated – the event causing potential trench subsidence or a remnant crown (*i.e.*, construction activities) is confined to a specified phase of the assessment period.
- Reversibility: short to medium-term – remedial work associated with a remnant crown and trench subsidence typically is conducted within a year of construction, however, localized trench subsidence may also arise 2 to 3 years after construction.
- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table D7.1.2-2 and, if necessary, soil amendments applied post-construction. The results of recent post-construction environmental monitoring programs in forested and mountainous areas demonstrate that trench subsidence or a remnant crown is generally minor in severity and limited in extent.
- Probability: high – trench subsidence or a remnant crown is a common residual effect of pipeline construction.
- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and trench subsidence/remnant crowns.

Soil Indicator – Soil Productivity

Surface Erosion of Topsoil/Root Zone Material

Construction and maintenance activities which disturb the soil will likely result in some surface erosion of topsoil/root zone material until a stable vegetative cover can be established. The impact balance of this residual effect is considered negative since erosion could decrease soil productivity. It is expected that a vegetative cover can be established within a year with the seeding of a rapidly establishing cover crop in addition to the appropriate seed mix for the location. Minor surface erosion of topsoil/root zone material is considered to be reversible in the medium-term (Table D7.1.2-2, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – surface erosion is confined to the area of disturbance along the construction right-of-way.
- Duration: short-term – the events causing surface erosion are construction of the pipeline and maintenance-related activities, the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events causing surface erosion (*i.e.*, construction and maintenance-related activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: medium-term – surface erosion is generally expected to be reversed within 2 to 3 years given the implementation of mitigation measures during construction and, if necessary, the application of soil amendments post-construction.
- Magnitude: low – given the implementation of industry-standard and provincial regulatory mitigation measures outlined in Table D7.1.2-1 and, if necessary, soil amendments applied post-construction.
- Probability: high – surface erosion is a common residual effect of pipeline construction which can be addressed during post-construction environmental monitoring and may also occur during maintenance activities.
- Confidence: high – there is a good understanding by the assessment team of cause-effect relationships between pipeline construction and soil degradation.

Soil Indicator – Soil Contamination

No residual effects of the construction and operations of the proposed pipeline were identified for the soil contamination indicator (Table D7.1.2-2). Consequently, no further assessment is warranted.

7.1.2.3 Summary

As identified in Table D7.1.2-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on soil and soil productivity indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Bridal Veil Falls Provincial Park related to soil and soil productivity will be not significant.

7.1.3 Water Quality and Quantity

This subsection describes the potential Project effects on water quality and quantity in Bridal Veil Provincial Park. The Water Quality and Quantity LSA is the area generally extending 100 m upstream of the centre of the proposed pipeline corridor to a minimum of 300 m downstream of the centre of the proposed pipeline corridor, as well as within 300 m of the proposed pipeline corridor, in potentially vulnerable aquifer areas in hydraulic connection with the Footprint and in consideration of surface water drainage patterns along the pipeline corridor; shown in Figure 6.2.2-6 of the Introduction to the Draft Stage 2 Detailed Proposal. The Aquatics RSA includes all watersheds directly affected by the proposed pipeline corridor and applies to surface water; shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal.

All water quality and quantity indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; and all of them were determined to interact with pipeline construction and operations in Bridal Veil Falls Provincial Park.

7.1.3.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline in Bridal Veil Falls Provincial Park on water quality and quantity indicators are listed in Table D7.1.3-1.

A summary of mitigation measures provided in Table D7.1.3-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial and federal regulatory guidelines including BC MOE (2010b), BC MOF (1995), BC Ministry of Water, Land and Air Protection (MWLAP) (2004), BC OGC (2013), CAPP *et al*. (2012) and Fisheries and Oceans Canada (DFO) (1995, 1999, 2013), as well as groundwater legislation under the *Oil and Gas Activities Act* (*Environmental Protection and Management Regulation*) and the *BC Environmental Assessment Act.* Table D7.1.3-2 provides the pipeline and vehicle crossing methods for Bridal Creek within Bridal Veil Falls Provincial Park.

TABLE D7.1.3-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WATER QUALITY AND QUANTITY FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Water Quality and Quantity Indicator – Surface Water Quality			
1.1 Suspended sediment concentrations in the water column during instream activities	LSA	<u>Pipeline Crossing</u> • The pipeline crossing method proposed for Bridal Creek is an isolation with water quality monitoring (see Table D7.1.3-2). • Confirm with the Inspector(s) that all notifications and approvals and/or letters of advice are in place prior to commencing instream construction at Bridal Creek [Section 8.7]. • Grade away from Bridal Creek to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in Bridal Creek during grading [Section 8.2]. • Install a temporary sediment barrier (*e.g.,* sediment fences), where warranted, to eliminate the flow of sediment from spoil piles and disturbed areas into Bridal Creek [Section 8.7]. • Inspect temporary sediment control structures (*e.g.,* sediment fences, subsoil berms) installed on approach slopes, on a daily basis throughout crossing construction. Repair the structures, before the end of the working day [Section 8.7]. • Develop a water quality monitoring plan to monitor for sediment events during the isolated trenched crossing of Bridal Creek. If monitoring reveals that sediment values are approaching threshold values, the water quality monitors will notify the Lead Environmental Inspector and Inspector(s) who, with the Construction Manager and contractor, will develop corrective actions [Section 8.7]. • Construct the crossing in accordance with applicable existing provincial and federal guidelines (*e.g.*, mitigation measures recommended in the *Fisheries Act* self-assessment) as well as the conditions of the *Fisheries Act* authorization, if applicable. • Dewater the segment of Bridal Creek between the dams and where safe to do so. Pump any silt-laden water out between the dams to well-vegetated lands, away from Bridal Creek or to settling ponds [Section 8.7]. • Remove any accumulations of sediment within the isolation areas that resulted from crossing construction. Spread all sediment and unused trench spoil removed from Bridal Creek at a location above the high water mark where the materials will not directly re-enter Bridal Creek [Section 8.7]. • Install sack trench breakers back from the edge of Bridal Creek where the banks consist of organic material to prevent sloughing of backfill into the channel [Section 8.7]. • Ensure that water from flumes, dam and pumps, diversion or other methods does not cause erosion or introduce sediment into the channel. Place rock rip rap, tarpaulins, plywood sheeting or other materials to control erosion at the outlet of pump hoses and flumes. Supplement the erosion control materials to control any erosion [Section 8.7]. <u>Operations</u> • Implement measures similar to construction under direction of Trans Mountain's Environmental, Health and Safety Management System to reduce suspended sediment released during integrity digs conducted instream.	• Reduction in surface water quality due to suspended sediment during instream activities during construction and site-specific maintenance activities.
1.2 Erosion from approach slopes	LSA	<u>Pipeline Crossing</u> • Prohibit clearing of extra temporary workspace within the riparian buffer, only the trench and temporary workspace areas will be cleared. Ensure staging areas for the Bridal Creek crossing construction and spoil storage areas are located a minimum of 10 m from the banks of the watercourse boundaries. This distance may be reduced by the Lead Environmental Inspector and the Inspector(s) where appropriate controls are in place [Section 8.1].	• Reduction in surface water quality due to erosion from banks and approach slopes.

TABLE D7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.2 Erosion from approach slopes (cont'd)	See above	• Restrict root grubbing to the area outside of the vegetated riparian buffer adjacent to Bridal Creek [Section 8.1]. • Install erosion control measures, where warranted, prior to commencing grading in the vicinity of the Bridal Creek crossing [Section 8.2]. • Grade away from Bridal Creek to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in Bridal Creek during grading [Section 8.2]. • Install temporary berms on approach slopes to Bridal Creek and erect sediment fence(s) near the base of approach slopes following grading, where indicated in the Environmental Alignment Sheets. Inspect the temporary sediment control structures on a daily basis and repair before the end of each working day [Section 8.2]. • Install sack trench breakers back from the edge of Bridal Creek where the banks consist of organic material to prevent sloughing of backfill into the channel (see Trench Breaker – Watercourse / Wetland Drawing in Appendix R of the Pipeline EPP] [Section 8.4]. • Install temporary erosion and sediment control structures (*e.g.,* sediment fences, coir logs) immediately following the completion of backfilling lands adjacent to the Bridal Creek crossing where the potential for sedimentation of the watercourse exists (see Sediment Fence and Coir/Straw Log Installation Drawings provided in Appendix R of the Pipeline EPP) [Section 8.4]. • Seed riparian areas with an approved annual or perennial grass cover crop or native grass mix as soon as is feasible after construction. • Transplant dormant shrubs, or install dormant willow stakes or commercially grown rooted stock plants (plugs), where warranted, during reclamation of streambanks where riparian vegetation is present prior to construction. • Install permanent erosion control measures, as outlined in the Reclamation Management Plan [Appendix C] unless otherwise approved by Trans Mountain to adjust for site conditions and suitability [Section 8.6]. • Install temporary fencing to allow the revegetation treatments to become established and avoid damage to the banks and riparian area by wildlife [Section 8.7]. • Monitor Bridal Creek after construction to assess the success of construction and reclamation mitigation measures following the temporary disturbance. Implement remedial measures, where warranted. <u>Operations</u> • Implement measures similar to construction under direction of Trans Mountain's Environmental, Health and Safety Management System for controlling erosion from banks and approach slopes during integrity digs conducted instream or in vicinity to Bridal Creek.	• See above

1.3 Reduction of surface water quality due to small spill during construction or site-specific maintenance activities	LSA	• Ensure the following separation distances are maintained between Bridal Creek when planning and constructing the pipeline, unless otherwise approved:
		  • fuel or hazardous material storage site - 300 m;
		  • burning site - 100 m; and
		  • oil change area - 100 m [Section 7.0].
		• Refer to the Pipeline EPP for additional measures for hazardous materials storage, servicing vehicles and spill equipment needs as well as cleaning of equipment.
		• Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into Bridal Creek. In the event of a spill, implement the Spill Contingency Plan [Appendix B] [Section 7.0].
		• Conduct refuelling a minimum of 100 m from any watercourse unless otherwise approved by the appropriate regulatory authority [Section 7.0]. See additional measures for refuelling near waterbodies in Section 7.0 of the Pipeline EPP.
			• Contamination of surface water due to a small spill during construction or site-specific maintenance activities.

TABLE D7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2. Water Quality and Quantity Indicator – Surface Water Quantity			
2.1 Alteration of natural surface drainage patterns	LSA	• Maintain drainage across the construction right-of-way during all phases of construction [Section 7.0]. • Ensure the potential for soil erosion by water is reduced during construction activities by avoiding ponding of water or the unintentional channelization of surface water flow [Section 7.0]. • Provide surface drainage of adequate capacity across the construction right-of-way [Section 7.0]. • Reduce grading along the construction right-of-way, especially within Bridal Creek's vegetated buffers [Section 8.2]. • Leave hard plugs or install soft plugs at locations where the open trench could flood other areas [Section 8.3]. • Leave breaks in the trench crown at obvious drainages and wherever seepage occurs to reduce or avoid interference with natural drainage [Section 8.4]. • Recontour the construction right-of-way and stabilize approach slopes of the Bridal Creek crossing. Where reclamation of the pre-construction grade is not feasible due to risk of failure of fill on slopes or maintenance of an access trail, recontour to grades as directed by the Geotechnical Engineer [Section 8.6]. • Regrade areas with vehicle ruts, erosion gullies or where the trench has settled [Section 8.6]. • Implement similar mitigation measures during site-specific maintenance activities during operations.	• Localized alteration of natural surface drainage patterns until trench settlement is complete.
2.2 Disruption or alteration of streamflow	LSA	• Adhere to clearing guidelines for protection of streams provided the Riparian Management Area Guidebook [Section 8.1]. • Fell trees away from Bridal Creek and away from limits of the construction right-of-way to reduce damage to the streambanks, bed and adjacent trees. Hand clear the area, if necessary, to reduce disturbance. Any trees, debris and soil inadvertently deposited within the ordinary high watermark will be promptly removed in a manner that avoids or reduces disturbance of the bed and banks. Trees will not be stood or hauled across the Bridal Creek [Section 8.1]. • Do not place windrowed or fill material in Bridal Creek during grading [Section 8.2]. • Ensure streamflow, if present, is maintained at all times when trenching through Bridal Creek [Section 8.7]. • Ensure that new vehicle crossing structures (*i.e.*, clear-span bridge) are appropriate for Bridal Creek approaches, channel width and configuration, anticipated streamflow during the period of use, planned vehicle loads, and overall period/duration of use [Section 8.7]. • Re-establish streambanks and approaches immediately following construction of the watercourse crossing as outlined in the Reclamation Management Plan of the Pipeline EPP.	• Disruption and alteration of natural streamflow from instream activities.
3. Water Quality and Quantity – Groundwater Quality			
3.1 Shallow groundwater with existing contamination encountered during trench construction	LSA	• Ensure contaminated soil and water are not transported off-site or disposed until analytical results have been received as per federal and provincial regulations. The Construction Manager and Environmental Inspector will provide notification as to when excavations can be backfilled [Section 8.3]. • Notify and adhere to the advice of the Trans Mountain Environment, Health and Safety Department or Trans Mountain's Lead Environmental Inspector and Environmental Inspector(s) at locations where water potentially contaminated with hydrocarbons or other materials is to be discharged from the trench. Measures may include the use of tank trucks to haul discharged water to an appropriate disposal facility/site, ensuring the intake is submerged below the surface sheen, lab testing and use of sorbent booms to hold the sheen away from the pump intake [Section 8.3].	• No residual effect identified.
3.2 Areas susceptible to sedimentation in the aquifer	LSA	• Assess the grain size; if it is poorly graded and coarse material, the installation of filter fabric at the base of the trench to prevent migration of fine sediment into the aquifer during trenching over highly vulnerable aquifers.	• Elevated turbidity in groundwater as a result of sedimentation.

TABLE D7.1.3-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
3.3 Aquifers (including unconfined aquifers) or wells vulnerable to possible future contamination from a spill during construction	LSA	• Utilize Best Management Practices for spill prevention outlined in the Pipeline EPP including in areas where higher vulnerability wells and aquifers are identified. • Ensure that during construction no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into waterbodies. In the event of a spill, implement the Spill Contingency Plan (see Appendix B of Pipeline EPP) [Section 7.0]. • Re-establish or replace a potable water supply as required should a registered or known water well located within 30 m of the construction right-of-way be damaged (*i.e.,* diminishment in quantity and/or quality) during pipeline installation [Section 7.0].	• Contamination of aquifer as a result of a spill during construction.
4. Water Quality and Quantity Indicator – Groundwater Quantity			
4.1 Areas susceptible to changes in groundwater flow patterns	LSA	• Monitor water encountered in the trench during trenching to determine if groundwater flow is being intercepted. If spring flow has been disrupted, seek and follow the advice of the Hydrogeological or Geotechnical Resource Specialist to maintain cross drainage within the trench (*e.g.,* installation of subdrains, trench breakers, etc.) [Section 8.3]. • Assess the need for well points or other dewatering methods, prior to commencing trenching, to intercept groundwater at site-specific locations before it enters the trench [Section 8.3]. • Prevent the pipeline trench and bedding from becoming a conduit for increased groundwater flow. • Install trench breakers to force groundwater seepage along the pipeline trench to the surface, if springs are encountered along the route. Install subdrains to divert shallow groundwater flow from the right-of-way [Section 8.4]. • Install subdrains in association with trench breakers as directed by Trans Mountain's Engineer where there is evidence of seepage or a flowing spring on a slope once the trench is excavated (see Subdrains Drawing in Appendix R of the Pipeline EPP) [Section 8.4]. • Backfill clay/mineral soil first, if salvaged separately from organic material in shallow peatland areas, to ensure that cross drainage is maintained [Section 8.4].	• Flooding on the up-gradient side of the pipeline may result in creation of wet zones on ground surface. • Reduction of baseflow to local streams.
4.2 Areas where dewatering may be necessary during pipeline construction activities	LSA	• Monitor water encountered in the trench during trenching to determine if groundwater flow is being intercepted. If spring flow has been disrupted, seek and follow the advice of the Hydrogeological or Geotechnical Resource Specialist to maintain cross drainage within the trench (*e.g.,* installation of subdrains, trench breakers, etc.) [Section 8.3]. • Assess the need for well points or other dewatering methods, prior to commencing trenching, to intercept groundwater at site-specific locations before it enters the trench [Section 8.3]. • Install trench breakers to force groundwater seepage along the pipeline trench to the surface, if springs are encountered along the route. Install subdrains to divert shallow groundwater flow from the right-of-way [Section 8.4].	• Natural groundwater pathways may be bisected and create a sink (drain) for discharge for shallow groundwater.
4.3 Areas where dewatering may be necessary during pipeline construction activities	LSA	• Dewater the trench when laying pipe in areas with high water tables. Place pumps on a tray or within an excavated sump lined with polyethylene sheeting above the ordinary high water level of the watercourse. Pump water onto stable and well vegetated areas, tarpaulins or sheeting at least 50 m from the nearest waterbody in a manner that does not cause erosion or any unfiltered or silted water to re-enter a watercourse [Section 8.3]. See additional dewatering measures in Section 8.3 of the Pipeline EPP. • Use floating suction hose and elevated intake, or other measures approved by Trans Mountain's Environmental Inspector(s), to prevent sediment from being sucked from the bottom of the trench. Secure the pump intake a minimum of 30 cm above the bottom of the trench [Section 8.3].	• Change in natural groundwater levels and stream recharge due to the discharge of groundwater to surface water systems if not practical to discharge trench water to ground.

Notes: 1 LSA = Water Quality and Quantity LSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

TABLE D7.1.3-2

PROPOSED PIPELINE AND VEHICLE WATERCROSSING METHODS ALONG THE NARROWED PIPELINE CORRIDOR THROUGH BRIDAL VEIL FALLS PROVINCIAL PARK

Watercourse Name	AK	Fish Presence Captured or Observed (Previously Documented)[1]	Sensitivity Rating	Provincial Instream Work Window	Least Risk Biological Window Proposed	Pipeline Crossing Method		Vehicle Crossing Method		Reclamation
						Recommended Primary	Recommended Contingency	Recommended Crossing Method (Flowing)	Recommended Crossing Method (Dry/Frozen)	
Bridal Creek	1079.5	CO (CCT, CM, CO, CP, MW, PCC, RB, SB)	Low	July 15 – August 15	Open	Isolation with water quality monitoring	N/A	Clear-Span bridge	N/A	*Prior to Instream Work* • Identify any instream site-specific features at the crossing proposed and record their location *(e.g.,* root wad, large woody debris, large boulders). Salvage these for use later. *During Instream Work* • Salvage upper coarse-textured substrate material from the channel and banks, and stockpile separately from lower substrate. *At the Completion of Instream Work* • Return Bridal Creek's) bed and banks to their preconstruction configuration and alignment. • Cap disturbed area of the channel and banks with salvaged substrate; extend replacement of cobbles and boulders to the ordinary high water level (OHWL) if adequate material is available. • Replace any site-specific features that are important for fishes or other aquatic organisms (*i.e.,* as initially salvaged or as directed by Trans Mountain's Environmental Inspector). • Install the appropriate temporary erosion and sediment control measures, where warranted (*e.g.,* sediment fence, erosion control blanket, coir logs, etc.). • Seed with an appropriate grass mix and/or cover crop species as directed in the Reclamation Management Plan for the Project. • Recontour banks using salvaged bank material, and install erosion control blanket and/or coir logs as required (see Drawings [Erosion Control Matting/Blanket] and [Coir/Straw Log Installation] provided in Appendix R of the Pipeline EPP). • If required, install riprap base below ordinary high water level (OHWL), keyed in to bed and underlain with filter cloth or gravel layer. • Install coir soil wrap(s) above the OHWL (see Drawing [Streambank Protection – Hedge/Brush Layering] provided in Appendix R of the Pipeline EPP).r • Log crib structure made from natural logs may be used at the base of the bank (below the OHWL) if appropriate (may be a single log in height, typically a minimum of two logs are used) (see Drawing [Staked Logs/Log Cribwall for Erosion Control] provided in Appendix R of the Pipeline EPP). • Install rooted stock shrubs/trees and/or dormant shrub/tree stakes in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate woody vegetation recovery (see Drawing [Shrub Staking and Transplanting and [Rooted Stock Selection and Installation] provided in Appendix R of the Pipeline EPP).

Note: 1 CO = Coho salmon; CCT = Coastal cutthroat trout; CM = Chum salmon; CP = Carp; MW = Mountain whitefish; PCC = Peamouth chub; RB = Rainbow trout; SB = stickleback (General)

7.1.3.2 Significance Evaluation of Potential Residual Effects

Table D7.1.3-3 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Bridal Veil Falls Provincial Park on water quality and quantity indicators. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE D7.1.3-3

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WATER QUALITY AND QUANTITY FOR BRIDAL VEIL FALLS PROVINCIAL PARK

				Temporal Context						
Potential Residual Effects		Impact Balance	Spatial Boundary[1]	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance[2]
1	Water Quality and Quantity Indicator – Surface Water Quality									
1(a)	Reduction in surface water quality due to suspended sediment during instream activities during construction and site-specific maintenance activities.	Negative	LSA	Immediate to short-term	Isolated to occasional	Immediate	Low	High	High	Not significant
1(b)	Reduction in surface water quality due to erosion from banks and approach slopes.	Negative	LSA	Immediate to short-term	Isolated to occasional	Short to medium-term	Low to medium	Low	High	Not significant
1(c)	Contamination of surface water due to a small spill during construction or site-specific maintenance activities.	Negative	LSA	Immediate	Accidental	Short to medium-term	Low to high	Low	Moderate	Not significant
2	Water Quality and Quantity Indicator – Surface Water Quantity									
2(a)	Localized alteration of natural surface drainage patterns until trench settlement is complete.	Negative	LSA	Short-term	Isolated to occasional	Short to medium-term	Low	High	High	Not significant
2(b)	Disruption and alteration of natural streamflow from instream activities.	Negative	LSA	Immediate to short-term	Isolated to occasional	Short to medium-term	Low to medium	High	High	Not significant
3	Water Quality and Quantity Indicator – Groundwater Quality									
3(a)	Elevated turbidity in groundwater.	Negative	LSA	Short-term	Accidental	Short-term	Medium	Low	Moderate	Not significant
3(b)	Contamination of aquifer as a result of a spill.	Negative	LSA	Immediate	Accidental	Short to medium-term	Low to high	Low	Moderate	Not significant
4	Water Quality and Quantity Indicator – Groundwater Quantity									
4(a)	Flooding on the up-gradient side of the pipeline may result in the creation of wet zones on ground surface.	Negative	LSA	Short-term	Periodic	Short to medium term	Low	Low	Moderate	Not significant
4(b)	Flooding on the up-gradient side of the pipeline may result in the creation of wet zones on ground surface.	Negative	LSA	Short-term	Periodic	Short-term	Low	Low	Moderate	Not significant
4(c)	Reduction of base flow to local streams.	Negative	LSA	Short-term	Periodic	Short-term	Low	Low	Moderate	Not significant
4(d)	Change in natural groundwater levels and stream recharge due to the discharge of groundwater to surface water systems if not practical to discharge trench water to ground.	Negative	LSA	Short-term	Isolated	Short-term	Low	Low	Moderate	Not significant

Notes: 1 LSA = Water Quality and Quantity LSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Water Quality and Quantity Indicator – Surface Water Quality

Instream Construction

Sediment runoff and increased turbidity/TSS from pipeline construction was noted as a concern during the Parks Workshop in Chilliwack in March 2014. The selection of appropriate watercourse crossing techniques designed to meet federal and provincial regulatory requirements, as well as implementation of erosion controls on the approaches to the watercourse crossing and riparian revegetation, are likely to substantially reduce the potential for adverse effects on surface water quality at Bridal Creek. During construction of the trenched crossing, a minor and short-term sediment release is expected during installation and removal of the pipeline crossing structures. Trenched crossings are considered to have a negative impact balance since sediment input can temporarily decrease surface water quality.

Turbidity/total suspended solids (TSS) guidelines have been established for instream activities. At the federal level, DFO (2000) discusses ‘levels of risk’ associated with increases in TSS concentration in watercourses and indicates increases of <100 mg/L above background present low risk to fish and their habitat, while an increase of 100-200 mg/L presents a moderate risk. An excess of 400 mg/L was an unacceptable risk, but duration of exposure also needs to be taken into account (also see Birtwell 1999). The Canadian Council of Minister of Environment (CCME) guideline value for protection of aquatic life from short-term (24 hour) exposure is no more than 25 mg/L above existing levels (CCME 2007). Aquatic resources are protected by ensuring that concentration of TSS does not exceed CCME (2007) guidelines. BC guidelines specify that induced turbidity may not exceed background by more than 8 nephelometric turbidity units (NTU) during any 24 hour period or by more than 2 NTU when the duration of sediment input is between 24 hours and 30 days. Where flow is naturally turbid, induced turbidity may not exceed background by more than 8 NTU at any time when background is between 8 and 80 NTU, or by 10% at any time when background is greater than 80 NTU (BC MWLAP 2004).

The pipeline crossing method proposed for Bridal Creek is an isolation with water quality monitoring. When compared to the open cut technique, isolated crossing techniques reduce the amount of sediment introduced to flowing watercourses. During a completely isolated crossing by dam and pump or flume, a minor sediment release is expected during installation of the dams prior to the isolation and during removal of the downstream dam at the conclusion of the isolation. Recent evidence demonstrates that smaller watercourses that lack substantial subsurface flow can be readily isolated with minimal sediment introduction when proper design, construction and mitigation measures are applied (CAPP *et al*. 2005, Reid *et al.* 2002). Consequently, it is anticipated that average TSS levels during instream construction at Bridal Creek will be below turbidity/TSS guidelines.

Measures in Table D7.1.3-1 and the Pipeline EPP, including continual monitoring of sediment release (*i.e.*, turbidity and TSS), will be implemented during crossing design and construction to reduce the magnitude and duration of the sediment pulse.

Given that suspended sediments are expected to settle out of the water column within the ZOI in a timeframe measuring from minutes to a few hours (*i.e.*, less than CCME’s short-term guideline of 24 hours), residual effects on the surface water quality indicator during the trenched crossing, are reversible in the immediate-term and of low magnitude (Table D7.1.3-3, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – suspended sediments released during construction activities will be carried downstream until they disperse and/or naturally settle out within the predicted ZOI.
- Duration: immediate to short-term – the events causing the release of suspended sediments into surface water are instream construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.
- Frequency: isolated to occasional – the events causing the release of suspended sediments into Bridal Creek (*i.e.,* pipeline construction and maintenance activities) occur during construction and, for operations activities, intermittently and sporadically over the assessment period.

- Reversibility: immediate – an increase in suspended sediments is confined to a specific period not exceeding 24 hours after construction.

- Magnitude: low – an increase in suspended sediments is anticipated for a short timeframe and anticipated to be within CCME guidelines given the implementation of mitigation measures to reduce sedimentation.

- Probability: high – a trenched crossing method is recommended during potentially flowing conditions at the time of pipeline construction through Bridal Creek.

- Confidence: high – based on available research literature, data pertinent to previous crossings along the existing TMPL right-of-way and the professional experience of the assessment team.

Erosion from Approach Slopes and Banks

Following grading, it is possible for some erosion to occur on approach slopes and banks and cause sediment to enter Bridal Creek. The impact balance of this potential residual effect is considered negative since sediment input could decrease surface water quality.

The long-term objective of conserving the natural scenic features of the park will be supported through proper reclamation and post-construction monitoring. Mitigation measures will be identified on a site-specific basis and may include, for example: installation of temporary erosion control structures (*e.g.,* sediment fences); restoration to stabilise the banks (*e.g.,* soil wraps, brush layers, willow plantings and matting); seeding the disturbed banks and approaches with the appropriate cover crop species and native grass mix; installation of coir or other biodegradable erosion control fabric on the banks of the watercourse; installation of live dormant willow stakes or salvaged willow/shrub transplants or commercially grown rooted stock plugs in the banks of the watercourse; and monitoring to assess the success of construction and reclamation mitigation measures and implementation remedial measures, where warranted.

Proposed mitigation measures are expected to reduce the magnitude of erosion from approach slopes and banks on the surface water quality indicator to low to medium levels. This residual effect is reversible in the short to medium-term (Table D7.1.3-3, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – any sedimentation caused by erosion will be carried downstream until it disperses and/or naturally settles out within the predicted ZOI.

- Duration: immediate to short-term – the events causing the erosion and sedimentation of surface water are instream construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited any one year during the operations phase.

- Frequency: isolated to occasional – the events resulting in sedimentation caused by erosion of approach slopes and banks (*i.e.,* pipeline construction and operations activities [*e.g.,* integrity digs]) occur intermittently and sporadically in the event the crossing is unstable until mitigated.

- Reversibility: short to medium-term – vegetation may be re-established within one year of construction on gentle banks and approach slopes while revegetation of steeper approach slopes and banks may take longer than one growing season.

- Magnitude: low to medium – depending upon the amount of erosion that occurs.

- Probability: low – proven and effective industry standard mitigation measures are expected to control erosion on slopes and banks and prevent sediment from entering Bridal Creek.

- Confidence: high – based on data pertinent to the proposed crossing location at Bridal Creek and the professional experience of the assessment team.

Contamination of Surface Water Due to Small Spills

A spill during construction or site-specific maintenance activities could cause contamination of the surface water and would be considered to have a negative impact balance; however, with proper implementation of industry and government recommended mitigation measures, the effects can be limited. For example, during the construction of the TMX Anchor Loop Project through Mount Robson Provincial Park, all fuel trucks, service trucks and pick-ups with box-mounted fuel tanks were required to carry spill prevention, containment and clean up materials. Furthermore, all hazardous material storage and oil changes, refuelling, and lubrication of industrial equipment were required to occur more than 100 m from a waterbody or watercourse except where secondary containment was provided. Spills or accidental release of potentially harmful materials (*i.e.*, oil or diesel fuel) were recorded. The Spill Contingency Plan was implemented on each spot spill and all spills were cleaned up as soon as they were discovered. During the TMX Anchor Loop Project, all spills were terrestrial, and no spills or leaks occurred in, or reached, a waterbody or watercourse (TERA 2009a).

Similar spill prevention mitigation is planned for the Project and spill prevention measures outlined in Table D7.1.3-1 and the Pipeline EPP will be followed. Fuel storage and handling practices will be monitored throughout construction of the Project to reduce spill risk. Should a leak be spotted or detected during construction of the pipeline, Trans Mountain will implement the Spill Contingency Plan. Depending on the nature and volume of a spill, the magnitude of change to water quality could vary from low to high. This residual effect is reversible in the short to medium-term and is of low probability (Table D7.1.3-3, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – a spill during construction or site-specific maintenance activities may extend beyond the Footprint and evidence suggests that effect of most minor spills is localized.
- Duration: immediate – the event causing a potential reduction in surface water quality is a spill, the period of which is less than or equal to two days.
- Frequency: accidental – a spill into surface water occurs rarely over the assessment period.
- Reversibility: short to medium-term – the effects of a spill are not expected to last beyond one year, but may last longer depending on seasonal conditions and the extent and source of the spill.
- Magnitude: low to high – depending upon the volume, location and contaminant released.
- Probability: low – due to mitigation measures in place to reduce the potential for spills reaching Bridal Creek and affecting surface water quality.
- Confidence: moderate – spill location and effects of accidental spills cannot be accurately predicted.

Water Quality and Quantity Indicator – Surface Water Quantity

Alteration of Natural Drainage Patterns

With proper implementation of the industry-accepted standard mitigation practices that are proposed, disruption of surface flow patterns following construction or maintenance activities is expected to be minor through Bridal Veil Falls Provincial Park. By paralleling the existing TMPL right-of-way and narrowing the construction right-of-way to the extent feasible through the park, effects to natural drainage patterns will be further reduced in support of the management objective to maintain the scenic features of the park. Nevertheless, construction activities may contribute to some localized alteration of natural surface drainage patterns until trench settlement is complete. The impact balance of this potential residual effect is considered negative since it could alter or disrupt natural above ground hydrologic conditions within the park.

In the event that construction or maintenance activities result in changes in surface water regimes, corrective action, in consultation with the appropriate regulatory authorities, will be implemented to resolve the issue. The post-construction environmental monitoring program will identify any locations in the park with altered drainage patterns (*e.g.,* ponded water) and remedial work will be conducted, where warranted.

Consequently, the residual effect is reversible in the short to medium-term. Some minor incidents (*e.g.*, ponding, minor flooding, erosion) are expected following construction and are considered to be within environmental standards, and therefore, of low magnitude (Table D7.1.3-3, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – although alteration of natural drainage patterns is generally confined to the disturbed portion of the construction right-of-way, potential changes in hydrology may extend beyond the pipeline right-of-way.
- Duration: short-term – the events causing alteration of natural drainage are pipeline construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year of the operations phase.
- Frequency: isolated to occasional – the events causing alteration of natural drainage (*i.e.*, pipeline construction and maintenance activities) occur during construction and, for operations activities, intermittently and sporadically over the assessment period.
- Reversibility: short to medium-term – it may take more than one year plus adequate precipitation levels in order for the trench crown to settle and natural drainage patterns to be restored.
- Magnitude: low – the potential for minor ponding, flooding or erosion exists until the natural drainage patterns are restored.
- Probability: high – minor trench settlement or a remnant crown are likely to occur as a result of pipeline construction or site-specific maintenance activities and, consequently, are likely to affect natural drainage patterns in localized areas.
- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

Alteration of Streamflow

Isolated pipeline crossing methods have the potential to result in alterations of natural streamflow. Crossing activities may contribute to some localized alteration of the bed and banks of Bridal Creek until complete and stable restoration is achieved following construction. The impact balance of this potential residual effect is considered negative since it could alter or disrupt hydrologic conditions of the watercourse. However, with proper implementation of the industry-accepted standard mitigation practices that are proposed, alteration of natural streamflow resulting from the isolated crossing of Bridal Creek is expected to be minor.

In the event that construction or maintenance activities result in alterations to watercourse hydrology, corrective action, in consultation with the appropriate regulatory authorities, will be conducted to resolve the issue. The post-construction environmental monitoring program will identify locations of altered streamflow (*e.g.,* damaged bed and banks) and remedial work will be conducted. Consequently, the residual effect is reversible in the short to medium-term. Generally, the residual effect of altered bed and banks is considered to be within environmental standards for pipeline construction and, therefore, is of low to medium magnitude (Table D7.1.3-3, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – although alteration of natural streamflow is generally confined to the disturbed portion of Bridal Creek's bed and banks, potential changes in the hydrology of Bridal Creek may extend beyond the pipeline right-of-way.
- Duration: immediate to short-term – the events causing alteration of natural streamflow are pipeline construction or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year of the operations phase.
- Frequency: isolated to occasional – the events causing alteration of natural streamflow (*i.e.*, pipeline construction and maintenance activities) occur during construction and, for operations activities, intermittently and sporadically over the assessment period.

- Reversibility: short to medium-term – it may take more than one year to fully restore and stabilize watercourse channel and associated flow conditions.
- Magnitude: low to medium – the potential for changes to streamflow exists but experience with past projects demonstrates that proper design and remedial work will reduce effect magnitude.
- Probability: high – alteration of bed and banks from an isolated or open cut crossing of Bridal Creek will result from pipeline construction or site-specific maintenance activities and, consequently, alteration of natural streamflow is likely to occur.
- Confidence: high – based on data pertinent to the Project area and the professional experience of the assessment team.

Water Quality and Quantity Indicator – Groundwater Quality

Elevated Turbidity in Groundwater

Increased turbidity in groundwater may result from a release of sediment particles in the formation where the pipeline is installed below the water table, which will decrease as the groundwater flows through the formation. Interconnected pores through which the groundwater flows are generally smaller than silt size particles causing the silt particles to be retained in the formation close to their source. This residual effect is considered to have a negative impact balance since elevated turbidity can affect groundwater quality. The residual effect of an elevated turbidity on groundwater quality is considered to be reversible in the short-term based on previous experience; particles either settle out or cannot pass through the pore space of the sediment (Table D7.1.3-3, point 3[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – particles in the groundwater naturally settle out within the LSA.
- Duration: short-term – the event causing the potential increase in turbidity of groundwater is construction activities where the pipeline is installed below the water table.
- Frequency: accidental – the event causing the potential increase in turbidity occurs rarely over the assessment period.
- Reversibility: short-term – turbidity of groundwater is expected to decrease in the vicinity of the area where the pipeline is below the water table.
- Magnitude: medium – depending upon the volume of sediment/silt introduced and the permeability of the formation.
- Probability: low – it is unlikely that construction activities where the pipeline is installed below the water table will release sediment or silt.
- Confidence: moderate – based on previous experience of the assessment team.

Contamination of an Aquifer as a Result of a Spill During Construction

Contamination of an aquifer may result if the spilled material migrates through the developed soil near the surface through the surficial materials into the first water-bearing unit. The rate of migration is dependent upon the permeability of the materials, presence or absence of fractures, the properties of the spilled contaminant (density, viscosity) and the vertical hydraulic gradients. A spill during the construction phase of the Project is likely to be noted quickly and be of small volume, and evidence suggests that the effects of most minor spills are localized.

The impact balance of this residual effect is considered negative since this could potentially affect water quality in the aquifer. This residual effect is unlikely to extend beyond the Water Quality and Quantity LSA; it is considered to represent a short to long-term influence on the natural groundwater and surface water systems depending upon the volume of the spill, and the properties of the aquifer and overlying material.

Spills where the spilled material contaminates an aquifer within the Water Quality and Quantity LSA may occur accidentally over the construction phase of the Project (Table D7.1.3-3, point 3[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – a spill occurring during construction activities may extend beyond the narrowed pipeline corridor but based on professional experience the effects of most minor spills are localized.
- Duration: immediate – the event causing potential contamination of the aquifer is a spill, the period of which is less than one day.
- Frequency: accidental – a spill released into groundwater during construction is rare.
- Reversibility: short to medium-term – the effects of a spill are not expected to last beyond one year, but may last longer depending upon the extent and source of the spill.
- Magnitude: low to high – depending upon the volume, location and contaminant released.
- Probability: low – due to mitigation measures in place to reduce the potential for spills migrating into the subsurface and affecting groundwater quality.
- Confidence: moderate – spill location and effects of accidental spills cannot be accurately predicted.

Water Quality and Quantity Indicator – Groundwater Quantity

Natural Groundwater Pathways May Be Bisected and Create a Sink (Drain) for Shallow Groundwater

Excavation of the trench in areas of shallow groundwater or springs, during pipeline construction, can alter groundwater and surface water flow patterns. This may result in the trench becoming a sink. That is, both groundwater and surface water intersecting the trench will flow into the trench resulting in changed flow patterns.

The backfill of the trench around the pipeline will consist of native backfill material as much as practical in order to maintain the soil/formation permeability similar to the pre-construction permeability. For example, if the trench was backfilled with a higher permeability material, the filled trench could become a preferred pathway for groundwater flow and, consequently, permanently change the natural flow pattern. Where there is concern for increased permeability, a trench breaker would be installed.

Upon backfilling the trench with native backfill, groundwater flow patterns will typically revert to their pre-construction state. Where springs are encountered, advice will be sought for the Hydrogeological or Geotechnical Resource Specialist so that cross drainage within the trench can be maintained. The impact balance of this residual effect is considered negative since groundwater flow down-gradient could temporarily decrease because flow is directed along the pipeline (Table D7.1.3-3, point 4[a]). Where there is concern for increased permeability, a trench breaker would be installed. A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge could extend beyond the Footprint and into the LSA.
- Duration: short-term – the events causing the potential alteration of groundwater flow are construction of the pipeline and maintenance activities, the latter of which are limited to any one year during operations.
- Frequency: periodic – the events causing alteration of natural groundwater flow (*i.e.,* pipeline construction and maintenance activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: short to medium-term – residual effects are expected to reverse within one year.

- Magnitude: low – the potential for changes to groundwater flow exists but experience with past projects demonstrates that proper design and remedial work will reduce the severity of the effects.
- Probability: low – narrowed pipeline corridor with the implementation of the mitigation measures outlined in Table D7.1.3-1, alteration of groundwater flow as a result of pipeline construction is unlikely.
- Confidence: moderate – based on previous experience of the assessment team and shallow groundwater mapping has been completed using available provincial mapping and existing well log reports.

Flooding on the Up-Gradient Side of the Pipeline May Result in Creation of Wet Zones on Ground Surface

A reduction in the permeability of materials along the groundwater flow path may result in a rise in the groundwater table to the extent that ground to surface flooding occurs. This may occur if the trench spoil is not backfilled in the correct order or soils are not properly salvaged resulting in a change in permeability of the upper trench materials and blocking of near surface groundwater flows. The impact balance of this residual effect is considered negative since this could potentially affect recharge to shallow aquifers or local streams and create permanently wet areas. This residual effect is considered to have a short-term influence on the natural groundwater and surface water systems as long as mitigation measures are applied (Table D7.1.3-3, point 4[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge away from the Footprint could affect an area within the LSA.
- Duration: short-term – the events causing the potential alteration of groundwater flow are construction of the pipeline and maintenance activities, the latter of which are limited to any one year during operations.
- Frequency: periodic – the events causing alteration of natural groundwater flow (*i.e.,* pipeline construction and maintenance activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: short-term – the effects of pipeline trench construction are not expected to last beyond one year once the trench has been backfilled as long as mitigation measures are applied.
- Magnitude: low – the potential for changes to groundwater flow exists but professional experience demonstrates that proper design and remedial work will reduce the effect.
- Probability: low – the proper construction of the pipeline trench and native backfill will reduce the occurrence of this effect.
- Confidence: moderate – based on previous experience and on data pertinent to the Project area.

Reduction of Base Flow to Local Streams

Dewatering of the pipeline trench during construction may result in lowering of the local water table which in the case of local streams may reduce the groundwater inflow (base flow) to Bridal Creek. The impact balance of this residual effect is considered negative due to the potential decrease of groundwater flow into Bridal Creek. This residual effect likely will not extend beyond the Water Quality and Quantity LSA to the watershed level, and, it is considered to represent a short-term influence on the natural groundwater and surface water systems (Table D7.1.3-3, point 4[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge away from the Footprint could affect an area within the LSA.

- Duration: short-term – the events causing the reduction in baseflow are the result of discharge during dewatering and occur while the trench is being constructed (either for pipeline installation or for pipeline daylighting during integrity digs).
- Frequency: periodic – the events causing alteration of natural groundwater flow (*i.e.,* pipeline construction and maintenance activities) occur intermittently but repeatedly over the assessment period.
- Reversibility: short-term – the effects of pipeline trench construction are not expected to last beyond one year once the trench has been backfilled.
- Magnitude: low – the potential for changes to groundwater flow exists but professional experience demonstrates that proper design and remedial work will reduce effect magnitude.
- Probability: low – the proper construction of the pipeline trench and the use of native backfill will reduce the occurrence of this effect.
- Confidence: moderate – based on previous experience and on data pertinent to the Project area.

Change in Natural Groundwater Levels and Stream Recharge Due to the Discharge of Groundwater to Surface Water Systems if Not Practical to Discharge Trench Water to Ground

Shallow groundwater will be present in the subsurface in many areas along the narrowed pipeline corridor; at Bridal Veil Falls Provincial Park, it is likely to occur at breaks in slope. During pipeline construction, it is common practice to dewater the trench to allow the pipe to be laid down in a dry environment. Extracted groundwater from the dewatering operations will be disposed to ground where possible, but in areas where this is not practical, the water may be discharged away from the area, directly into a water body (post-treatment), or stormwater discharge system causing local groundwater levels and flow patterns to be temporarily disrupted. The impact balance of this residual effect is considered negative since this could potentially affect recharge to local streams or shallow aquifers. This residual effect is confined to the Water Quality and Quantity LSA and is considered to represent a short-term influence on the natural groundwater and surface water systems. Dewatering activities where the extracted groundwater cannot be returned to ground are unlikely to occur given the proposed mitigation measures in Table D7.1.3-1 and in the Pipeline EPP. The residual effects in areas of discharge of collected groundwater are expected to reverse within one year when seasonal precipitation replenishes the aquifer (Table D7.1.3-3, point 4[d]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Water Quality and Quantity LSA – depending upon the site-specific conditions, dewatering activities and groundwater discharge away from the Footprint could extend to the LSA.
- Duration: short-term – the event causing the discharge of groundwater from the trench is the construction of the pipeline.
- Frequency: isolated – dewatering activities are expected to occur at specific locations/times over the construction phase of the Project.
- Reversibility: short-term – residual effects are expected to reverse within one year once seasonal precipitation recharges the aquifer.
- Magnitude: low – it is not expected that dewatering activities will noticeably affect groundwater flow patterns given the implementation of mitigation measures.
- Probability: low – it is unlikely that groundwater flow patterns will be affected by dewatering activities given the implementation of proposed mitigation measures.
- Confidence: moderate – shallow groundwater mapping has been completed using available provincial mapping and existing well log reports.

7.1.3.3 Summary

As identified in Table D7.1.3-3, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on water quality and quantity indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Bridal Veil Falls Provincial Park related to water quality and quantity will be not significant.

7.1.4 Air Emissions

This subsection describes the potential Project effects on the air emissions in Bridal Veil Falls Provincial Park. The Air Quality RSA consists of a 5 km wide band generally extending from the Footprint (*i.e.*, 2.5 km on both sides of the Footprint); shown in Figure 6.2.2-6 of the Introduction to the Draft Stage 2 Detailed Proposal.

All air quality indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; however, only primary emissions of CACs was determined to interact with pipeline construction and operations in Bridal Veil Falls Provincial Park. The formation of secondary ozone and nuisance odours indicators are associated with facilities, and since there are no Project facilities proposed in Bridal Veil Falls Provincial Park, these indicators do not interact with pipeline construction and operations.

7.1.4.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on air emissions indicators are listed in Table D7.1-4-1.

A summary of mitigation measures provided in Table D7.1.4-1 was principally developed in accordance with industry accepted best practices and accepted pipeline construction methods for construction-related activities.

TABLE D7.1.4-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON AIR EMISSIONS FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Air Emissions Indicator – Primary Emissions of Criteria Air Contaminants and Volatile Organic Compounds			
1.1 Project contribution to emissions	RSA	• Restrict the duration that vehicles and equipment are allowed to sit and idle to less than one hour, unless air temperatures are less than 0°C [Section 7.0]. • Ensure equipment is well-maintained during construction to minimize air emissions [Section 7.0]. • Use multi-passenger vehicles for the transportation of crews to and from the job sites, where feasible [Section 7.0].	• Increase in air emissions during construction. • Increase in air emissions during site-specific maintenance and inspection activities.
1.2 Dust and smoke during construction	RSA	• Avoid burning slash in the Lower Mainland Region where air quality is an issue. Mulch in place or chip/haul slash to an approved disposal location [Section 8.1]. • Water down construction sites and access roads, when warranted, as directed by Trans Mountain, to reduce or avoid the potential for dust emissions [Section 8.2].	• Increase in fugitive dust during construction.

Notes: 1 RSA = Air Quality RSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.4.2 Significance Evaluation of Potential Residual Effects

Table D7.1.4-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Bridal Veil Falls Provincial Park on the air emissions indicator. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE D7.1.4-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON AIR EMISSIONS FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Air Emissions Indicator – Primary Emissions of Criteria Air Contaminants and Volatile Organic Compounds									
1(a) Increase in air emissions during construction.	Negative	RSA	Short-term	Isolated	Short-term	Medium	High	Moderate	Not significant
1(b) Increase in air emissions during site-specific inspection and maintenance activities.	Negative	RSA	Short-term	Periodic	Short-term	Low	High	Moderate	Not significant
1(c) Increase in fugitive dust during construction.	Negative	RSA	Short-term	Isolated	Immediate	Low	Low	Moderate	Not significant

Notes: 1 RSA = Air Quality RSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Air Emissions Indicator – Primary Emissions of Criteria Air Contaminants (CACs) and Volatile Organic Compounds (VOCs)

Increase in Air Emissions During Construction

The primary sources of air emissions during construction will be from fuel combustion while transporting crews to and from the work site and along the narrowed pipeline corridor, as well as from the operation of heavy equipment required for construction. Implementation of accepted pipeline construction methods as outlined in Table D7.1.4-1 is the preferred approach to reducing air emissions from pipeline construction.

The amount of CAC and VOC emissions associated with construction activities will be reduced by using multi-passenger vehicles for the transportation of crews to and from the job sites, to the extent feasible, as well as using well-maintained equipment. The residual effects of increased air emissions during construction are considered to have a negative impact balance, but they are expected to dissipate within the Air Quality RSA. Ambient concentrations of CAC and VOC are expected to be within provincial objectives and standards (BC MOE 2013a) and, therefore, of medium magnitude. Air emissions resulting from construction activities are considered to be reversible in the short-term (Table D7.1.4-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Air Quality RSA – potential increases in air emissions resulting from construction activities will dissipate within the Air Quality RSA.
- Duration: short-term – the event resulting in increased air emissions is construction of the pipeline.
- Frequency: isolated – the event resulting in increases in air emissions (*i.e.*, construction of the pipeline) is confined to a specific period.
- Reversibility: short-term – the residual effects are expected to reverse within less than one year for all contaminants after completion of construction.
- Magnitude: medium – an increase in air emissions will occur and may approach but are not expected to exceed environmental or regulatory standards; the increase will be short-lived and localized to the construction area.
- Probability: high – the equipment and vehicles used for construction will emit air contaminants.

- Confidence: moderate – based on a good understanding of the cause-effect relationship but reliant on vehicle and equipment estimates from previous projects.

Increase in Air Emissions During Site-Specific Inspection and Maintenance Activities

The primary sources of air emissions during operations will be from fuel combustion while transporting crews to and from the proposed pipeline corridor during site-specific maintenance activities. Aerial patrols along the pipeline segments are unlikely to cause measurable increases of near-surface ambient CAC concentrations above background levels. Furthermore, in the absence of more detailed information, it was assumed that the current frequency and duration of aerial patrols will be sufficient to serve the pipeline expansion associated with the Project.

The amount of air emissions associated with site-specific maintenance activities will be reduced by using multi-passenger vehicles for the transportation of crews to and from the job sites, to the extent feasible, as well as using well-maintained equipment. The residual effects of increased air emissions during site-specific maintenance activities are considered to have a negative impact balance. However, they are expected to dissipate within the Air Quality RSA and be well within provincial objectives and standards (BC MOE 2013a) and, therefore, will be of low magnitude. Air emissions resulting from site-specific inspections and maintenance activities are considered to be reversible in the short-term (Table D7.1.4-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Air Quality RSA – potential increases in air emissions resulting from site-specific maintenance activities (*e.g.*, vegetation management, integrity digs) will dissipate within the Air Quality RSA.
- Duration: short-term – the events resulting in increases in air emissions, are individual maintenance activities (*e.g.*, vegetation management, integrity digs) and each maintenance event will be completed within one year.
- Frequency: periodic – maintenance and operations-related activities (*e.g.*, vegetation management, integrity digs) will occur intermittently but repeatedly over the assessment period.
- Reversibility: short-term – the residual effects are expected to reverse within less than one year for all contaminants after completion of individual maintenance activities.
- Magnitude: low – periodic increases in air emissions during site-specific maintenance will be detectable but within normal variability of existing conditions with the implementation of proposed mitigation measures.
- Probability: high – the equipment and vehicles used for site-specific activities (*e.g.*, vegetation management, integrity digs) will emit air contaminants.
- Confidence: moderate – based on a good understanding of the cause-effect relationship and from current pipeline operations in the same regions; however, detailed information on equipment and vehicle usage for site-specific activities and the duration and frequency of future aerial patrol are not available.

Increase in Fugitive Dust During Construction

Emissions of particulate matter related to earth moving activities and use of heavy equipment during pipeline construction are expected to be greater than particulate matter emissions during pipeline operation. Fugitive dust from equipment travelling on disturbed soil can be a major dust contributor during dry periods. Implementing accepted pipeline construction methods as outlined in Table D7.1.4-1 is the preferred approach to reducing air emissions from pipeline construction.

The impact balance of this potential residual effect is considered to be negative since dust could reduce air quality. However, given the short period of construction within Bridal Veil Falls Provincial Park and with the implementation of the recommended mitigation measures provided in Table D7.1.4-1, dust during construction will be reduced; therefore, the magnitude is rated as low (Table D7.1.4-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Air Quality RSA – potential increases in dust resulting from construction may extend beyond the Footprint and into the Air Quality RSA.
- Duration: short-term – the event resulting in increases in dust is construction of the pipeline.
- Frequency: isolated – the event resulting in increases in dust (*i.e.*, construction of the pipeline) is confined to a specific period.
- Reversibility: immediate – the effects are expected to reverse within less than 2 days once construction or the maintenance activity is complete.
- Magnitude: low – given the short period of construction activity in Bridal Veil Falls Provincial Park and the mitigation measures provided in Table D7.1.4-1 will reduce dust during construction.
- Probability: low – existing roads such as Bridal Falls Road and Popkum South Road will be used to access the right-of-way.
- Confidence: moderate – based on the professional experience of the assessment team.

7.1.4.3 Summary

As identified in Table D7.1.4-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on the air emissions indicator of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Bridal Veil Falls Provincial Park related to air emissions will be not significant.

7.1.5 Acoustic Environment

This subsection describes the potential Project effects on the acoustic environment in Bridal Veil Falls Provincial Park. The Acoustic Environment LSA consists of a 1.5 km band on both sides of the proposed pipeline corridor (*i.e.*, a total width of 3.15 km).

All acoustic environment indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; however, only the sound levels indicator was determined to interact with pipeline construction and operations in Bridal Veil Falls Provincial Park. There is no blasting proposed for Bridal Veil Falls Provincial Park and, therefore, the vibrations indicator is not anticipated to interact with pipeline construction.

7.1.5.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on the acoustic environment indicator are listed in Table D7.1.5-1.

A summary of mitigation measures provided in Table D7.1.5-1 was principally developed in accordance with industry accepted best practices and accepted pipeline construction methods for construction-related activities.

TABLE D7.1.5-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON ACOUSTIC ENVIRONMENT FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Acoustic Environment Indicator – Sound levels			
1.1 Changes in sound levels during construction	LSA	• Adhere to all federal (*i.e.,* Environment Canada, *Motor Vehicle Safety Act*, Oil and Gas Occupational Safety and Health Regulations, Health Canada) and provincial *(i.e.,* BC Noise Control Guideline Best Practices Guideline, *Worker's Compensation Act*, section 7.2 of the Occupational Health and Safety Regulations [BC Reg 296/97 as amended] Section 7.2 [BC Reg. 382/2004, s.1]) guidelines and regulations and legislation for noise management [Section 7.0]. • Schedule intermittent noise producing events to avoid, where feasible, important habitat of wildlife species at risk/sensitive species during sensitive periods, where feasible [Section 7.0]. • Enforce vehicle speed limits and inform contractor truck drivers and equipment operators that engine retarder braking in urban areas is prohibited [Section 7.0]. • Maintain equipment in good working condition and in accordance with manufacturer guidelines [Section 7.0]. • Maintain noise suppression equipment on all construction machinery and vehicles in good order [Section 7.0]. • Use only the size and power of tools necessary limit noise from power tool operations. Locate stationary equipment, such as compressors and generators located away from noise receptors, to the extent feasible, and follow applicable municipal, provincial and federal guidelines [Section 7.0].	• Increase in sound levels during construction period.
1.2 Changes in sound level during operations	LSA	• Limit helicopter inspections to weekdays only to the extent practical. • Use of off-road vehicles for inspection should be limited to weekdays if feasible. • Maintain equipment in good working condition and in accordance with manufacturer guidelines. • Maintain noise suppression equipment on all construction machinery and vehicles in good order.	• Periodic noise events due to maintenance and inspections.

Notes: 1 LSA = Acoustic Environment LSA.

2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.5.2 Significance Evaluation of Potential Residual Effects

Table D7.1.5-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Bridal Veil Falls Provincial Park on the acoustic environment indicator. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE D7.1.5-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON ACOUSTIC ENVIRONMENT FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Residual Effects		Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
				Duration	Frequency	Reversibility				
1.	Acoustic Environment Indicator – Sound Levels									
1(a)	Increase in sound levels during construction period.	Negative	LSA	Short-term	Isolated	Short-term	Low	High	High	Not significant
1(b)	Periodic noise events due to maintenance and inspections.	Negative	LSA	Short-term	Periodic	Immediate to short-term	Negligible to medium	High	High	Not significant

Notes: 1 LSA = Acoustic Environment LSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Acoustic Environment Indicator – Sound levels

Increase in Sound levels during Construction

Noise arising from construction and clearing activities will occur along the narrowed pipeline corridor in Bridal Veil Falls Provincial Park and this residual effect is considered to have a negative impact balance. Clearing and construction are scheduled for Q3 / Q4 of 2017 in order to cause less disruption to recreational users of Bridal Veil Falls Provincial Park. Clearing activities will also avoid the migratory bird breeding and nesting period.

As described in Section 2.0, construction is expected to last for approximately 14 days along the narrowed pipeline corridor in Bridal Veil Falls Provincial Park. In addition, construction equipment and vehicles will be equipped with noise abatement equipment (*e.g*., mufflers). There may be some situations where after hours noise such as generators or pumps may be used. A summary of the rationale for all of the significance criteria is provided below (Table D7.1.5-2, point 1[a]).

- Spatial Boundary: Acoustic Environment LSA – noise resulting from construction activities may transmit beyond the construction right-of-way.
- Duration: short-term – the events causing changes in sound levels will occur only during the construction phase.
- Frequency: isolated – the event causing changes in sound levels will occur only during the construction phase.
- Reversibility: short-term - the period over which the change in sound level extends is the construction period. However, at any specific location along the narrowed pipeline corridor, all sound level changes will cease when construction activities have finished.
- Magnitude: low – the increased nuisance noise may affect recreational users.
- Probability: high – heavy machinery and other construction equipment required for construction will produce noise above baseline conditions while in use.
- Confidence: high – based on the professional experience of the assessment team.

Periodic Noise Events Due to Maintenance and Inspection

Noise from pipeline operations is limited to regular aerial and ground patrols, vegetation management and integrity digs. Sounds would be similar to those already heard in areas where the narrowed pipeline corridor is adjacent to the existing TMPL right-of-way. Similar to noise during construction, noise resulting from periodic site-specific maintenance will be limited to the same receptors in close proximity to the narrowed pipeline corridor.

The spatial extent of the change in sound levels is limited to the Acoustic Environment LSA. Since maintenance activities are typically completed at any given location within a few minutes to hours (aerial patrols, vegetation management) or within several weeks (*e.g.*, integrity digs), the duration of the maintenance and inspection activities is short-term. The frequency of maintenance activities occur intermittently but repeatedly over the assessment period and, therefore, are considered to be periodic. The effect is reversible in the immediate to short-term as sound level changes due to maintenance activity will cease as soon as the maintenance activity stops.

While aerial patrols or vegetation management during operations may cause momentary sound levels to increase, the day and night average levels are not expected to change due to such short duration events. Although integrity digs may extend over several weeks, the amount and size of the equipment used during this activity is generally smaller than that used during pipeline construction. Nevertheless, the magnitude of the change in sound level during operations of the pipeline is considered to be of negligible magnitude for most operational activities. The inspections and maintenance are essential to safe pipeline operations so the probability of occurrence is rated as high (Table D7.1.5-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Acoustic Environment LSA – the change in sound level during operations is confined to the Acoustic Environment LSA.
- Duration: short-term – the events causing changes in sound levels during operations (*i.e.*, maintenance activities) are completed within any one year during operations.
- Frequency: periodic – the events causing changes in sound levels during operations (*i.e.*, aerial patrols, vegetation management, integrity digs) occur intermittently but repeatedly over the assessment period.
- Reversibility: immediate to short-term – the changes in sound level associated with maintenance activities at any given location range from a few minutes to hours for aerial patrols and vegetation management (immediate) to a few weeks for integrity digs (short-term). All sound level changes are reversible as the sound will cease when the inspection/maintenance is finished.
- Magnitude: negligible to medium – the sound level events associated with aerial patrols and vegetation management will have a short timeline, so changes to the day or night average levels are not expected. However, integrity digs that occur near residents may result in sound level changes that could affect day or night average levels.
- Probability: high – changes to sound levels will occur since inspections and maintenance are essential to safe pipeline operation.
- Confidence: high – based on the professional experience of the assessment team.

7.1.5.3 Summary

As identified in Table D7.1.5-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on the acoustic environment indicator of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on the conservational values of Bridal Veil Falls Provincial Park related to acoustic environment will be not significant.

7.1.6 Fish and Fish Habitat

This subsection describes the potential Project effects on the fish and fish habitat in Bridal Veil Falls Provincial Park. The Fish and Fish Habitat LSA consists of the area extending 100 m upstream from the centre of the proposed pipeline corridor to a minimum of 300 m downstream from the centre of the proposed pipeline corridor at defined watercourses. The Fish and Fish Habitat LSA also includes the area of riparian vegetation to a width of 30 m back from each bank edge within the width of the construction right-of-way. The Aquatics RSA includes all watersheds directly affected by the Project; shown in Figure 6.2.2-1 of the Introduction to the Draft Stage 2 Detailed Proposal.

Fish and fish habitat indicators (*i.e.,* riparian habitat, instream habitat and fish mortality or injury) (Table 6.2.1-1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; each of which were determined to interact with pipeline construction and operations in Bridal Veil Falls Provincial Park. Fish and fish habitat species indicators (*i.e.,* bull trout/Dolly Varden, Chinook salmon, coastal cutthroat trout, coho salmon and rainbow trout/steelhead) with an observed/captured or historical presence within Bridal Veil Falls Provincial Park Aquatics RSA (*i.e.,* Harrison River Watershed) were also considered in this evaluation and are discussed in Section 7.1.6.2.

7.1.6.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on fish and fish habitat indicators are listed in Table D7.1.6-1.

A summary of mitigation measures provided in Table D7.1.6-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines including BC MWLAP (2004), CAPP (2004), CAPP *et al.* (2012), and DFO (1995, 2013a, 2014).

TABLE D7.1.6-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON FISH AND FISH HABITAT FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Fish and Fish Habitat Indicator – Riparian Habitat			
1.1 Riparian habitat loss or alteration during construction	Footprint	• Recontour banks using salvaged bank material, and install erosion control blanket and/or coir logs as required (see Drawings [Erosion Control Matting/Blanket] and [Coir/Straw Log Installation] provided in Appendix R of the Pipeline EPP). • Install rooted stock shrubs/trees and/or dormant shrub/tree stakes in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate woody vegetation recovery (see Drawing [Shrub Staking and Transplanting and [Rooted Stock Selection and Installation] provided in Appendix R of the Pipeline EPP). • Maintain sediment fences or equivalent sediment control structure in place at the base of approach slopes until revegetation of the construction right-of-way is complete. • Install mounds on contours in riparian areas, to reduce erosion and to enhance woody vegetation establishment [Section 8.6]. • Install rollback on the construction right-of-way within riparian areas to prevent erosion and sedimentation into Bridal Creek and provide micro-sites to enhance woody vegetation establishment [Section 8.6]. • See additional reclamation mitigation measures in Table D7.1.3-2.	• Riparian habitat loss or alteration due to construction activities.
1.2 Riparian habitat alteration during maintenance and operations	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• Clearing or disturbance of riparian habitat during maintenance and operations.

TABLE D7.1.6-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.3 Contamination from spills during construction and maintenance	RSA	• Review and adhere to the general mitigation measures provided in Section 7.0 of the Pipeline EPP related to equipment washing, inspection of hydraulic, fuel and lubrication systems of equipment, equipment servicing and refuelling as well as fuel storage in proximity to Bridal Creek in Bridal Veil Falls Provincial Park during watercourse crossing construction [Section 8.7]. • Use non-toxic, biodegradable hydraulic fluids in all equipment that will work instream if/when flowing water will be encountered during construction if requested by the Inspector(s) [Section 8.7]. • Do not store fuel, oil or hazardous material within 300 m of Bridal Creek [Section 7.0]. • Ensure pump intakes are placed in a manner that reduces or avoids disturbance to the streambed and are screened in accordance with the DFO screening requirements, to prevent the entrapment of fish or wildlife (*Freshwater Intake End-of-Pipe Fish Screen Guideline)* [Section 8.5]. • Utilize screen pump intakes with a maximum mesh size of 2.54 mm and with a maximum approach velocity of 0.038 m/s, where fish habitat is present [Section 8.5].	• Contamination of riparian habitat from spills during construction and maintenance.
2. Fish and Fish Habitat Indicator – Instream Habitat			
2.1 Instream habitat alteration	RSA	General • An isolated watercourse crossing method has been selected for Bridal Creek in consideration of the size, environmental sensitivities and the period of construction (see Table D7.1.3-2). • Trans Mountain will work with regulatory authorities to determine the necessary approvals, licenses and permits needed for construction of the pipeline or associated components prior to the commencement of the permitted activity in Bridal Veil Falls Provincial Park. The contractor(s), subcontractors and the Inspector(s) will be provided with copies of all approvals/licenses and permits including the most recent updates and revisions, and will comply with all conditions presented to Trans Mountain. Trans Mountain will resolve any inconsistencies between approval/permit conditions and contract documents prior to commencement of the construction activity [Section 3.0]. • Review and adhere to applicable provincial instream work window and least risk biological window (see Table D7.1.3-2) and all resource-specific measures outlined in the mitigation tables for aquatic resources provided in Appendix I of the Pipeline EPP [Section 8.7]. • Follow the DFO Self-Assessment Process and applicable Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a, 2014) outlining conditions and measures to avoid serious harm to fish or any permanent alteration to, or destruction of, fish habitat when working in or near Bridal Creek [Section 8.7]. • Ensure all necessary equipment, personnel and materials are on-site and ready for installation prior to commencing instream work. Complete all work as quickly as practical to limit the duration of disturbance [Section 8.7]. • Re-establish streambanks and approaches of Bridal Creek immediately following construction as outlined in the Reclamation Management Plan (see Appendix C of the Pipeline EPP) [Section 8.6]. Pipeline Crossings • At Bridal Creek, conduct an isolated crossing at the time of construction [Section 8.7]. • Dewater the segment of Bridal Creek between the dams and where safe to do so. Pump any sediment-laden water out between the dams to well-vegetated lands, away from Bridal Creek or to settling ponds [Section 8.7]. • Remove any accumulations of sediment within the isolation areas that resulted from crossing construction. Spread all sediment and unused trench spoil removed from Bridal Creek at a location above the high water mark where the materials will not directly re-enter Bridal Creek [Section 8.7]. • Ensure that water from flumes, dam and pumps, diversion or other methods does not cause erosion or introduce sediment into the channel. Place rock rip rap, tarpaulins, plywood sheeting or other materials to control erosion at the outlet of pump hoses and flumes. Supplement the erosion control materials to control any erosion [Section 8.7].	• Alteration of instream habitat within the ZOI.

TABLE D7.1.6-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2.1 Instream habitat alteration (cont'd)	See above	Vehicle Crossings • At Bridal Creek, a clear span bridge will be constructed for vehicle and equipment crossing during construction (see Table D7.1.3-2). Install, use and remove bridges in accordance with the measures identified in the DFO Self-Assessment Process (DFO 2014) [Section 8.7]. • Ensure bridge is clean prior to installation and dispose of soil at an appropriate location [Section 8.7]. • Implement erosion control measures as soon as a disturbance of the vegetation mat occurs [Section 8.7]. • Stabilize and revegetate areas disturbed during installation and removal of a bridge; install erosion control measures, where warranted, to control surface erosion until vegetation is established [Section 8.7].	• See above.
2.2 Contamination from spills during construction	RSA	• Review and adhere to the general mitigation measures in Section 7.0 of the Pipeline EPP related to equipment washing, inspection of hydraulic, fuel and lubrication systems of equipment, equipment servicing and refuelling as well as fuel storage in proximity to Bridal Creek during watercourse crossing construction [Section 8.7]. • Do not store fuel, oil, or hazardous material within 300 m of Bridal Creek [Section 7.0]. • Use non-toxic, biodegradable hydraulic fluids in all equipment that will work instream if/when flowing water will be encountered during construction if requested by the Inspector(s) [Section 8.7]. • See recommended mitigation measures for potential effect 1.3 of this table.	• Contamination of instream habitat from spills during construction.
3. Fish and Fish Habitat Indicator – Fish Mortality or Injury			
3.1 Fish mortality or injury during construction	RSA	• Determine the presence of any aquatic or riparian plants and pests prior to the commencement of construction activities within the riparian buffer. Notify the contractor of any special measures to be implemented to prevent the transfer of these organisms from one watercourse to another [Section 8.7]. • Follow the DFO Self-Assessment Process and applicable DFO Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a, 2014) and measures outlined in Section 8.7 of Pipeline EPP, when working in or near Bridal Creek. • Prohibit recreational fishing by Project personnel on or in the vicinity of the construction right-of-way. The use of the construction right-of-way to access fishing sites is prohibited [Section 7.0]. • Ensure all water intakes are screened in accordance with DFO's *Freshwater End-of-Pipe Fish Screen Guideline*. Ensure the screens are free of debris during pumping [Section 8.7]. • Monitor to assess the immediate effects of crossing construction. Also monitor sediment release (*i.e.,* turbidity and TSS) throughout the crossing construction period, if required [Section 8.7]. • Assign a Qualified Environment Professional (QEP) to salvage fish with an electrofishing unit from the isolated area prior to and during dewatering and trenching at isolated water crossings in accordance with the Fish Collection Permit (see Appendix D), if those permits are determined to be necessary. Note that the application for a Fish Collection Permit is to be submitted 10 working days (minimum) prior to the scheduled isolation of Bridal Creek. Release all captured fish to areas downstream of the crossing that provide suitable habitat [Section 8.7]. • Clean fish salvage equipment (*e.g.,* waders, boots, nets) of soil, and disinfect with 100 mg/L chlorine bleach before using in any watercourse to prevent the spread of pathogens (*e.g.,* invasive plant species). Ensure that washed off soil is disposed of at a location that will prevent the reintroduction of these untreated materials into Bridal Creek [Section 8.7]. • See recommended mitigation measures outlined in potential effects 1.3 and 2.1 of this table.	• Increased fish mortality or injury due to construction activities.
3.2 Fish mortality or injury from spills during construction	RSA	• See recommended mitigation measures outlined in potential effect 3.1 of this table.	• Increased fish mortality or injury from spills during construction activities.

TABLE D7.1.6-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
3.3 Increased suspended sediment concentrations within the ZOI during instream construction	LSA	General • Grade away from Bridal Creek to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in Bridal Creek during grading. [Section 8.2]. • Ensure temporary berms and/or sediment fence installed following grading (see Section 8.2 of the Pipeline EPP) will adequately control runoff from entering the open trench in the vicinity of the Bridal Creek crossing [Section 8.3]. • Inspect temporary sediment control structures (*e.g.,* sediment fences, subsoil berms) installed on approach slopes, on a daily basis throughout crossing construction. Repair the structures before the end of the working day [Section 8.7]. • Ensure all necessary equipment, personnel and materials are on-site and ready for installation prior to commencing instream work. Complete all work as quickly as practical to limit the duration of disturbance [Section 8.7]. • Monitor temporary vehicle crossings (*i.e.,* clear span bridge) to ensure that erosion control measures are adequate and stream flow is not disrupted [Section 8.7]. • Develop water quality monitoring plans for Bridal Creek. If monitoring reveals that sediment values are approaching threshold values, the water quality monitors will notify the Lead Environmental Inspector and Inspector(s) who, with the Construction Manager and contractor, will develop corrective actions [Section 8.7]. • Dewater the segment of Bridal Creek between the dams and where safe to do so. Pump any sediment-laden water out between the dams to well-vegetated lands, away from Bridal Creek or to settling ponds [Section 8.7]. • Remove any accumulations of sediment within the isolation areas that resulted from crossing construction. Spread all sediment and unused trench spoil removed from Bridal Creek at a location above the high water mark where the materials will not directly re-enter Bridal Creek [Section 8.7]. • Ensure that water from flumes, dam and pumps, diversion or other methods does not cause erosion or introduce sediment into the channel. Place rock rip rap, tarpaulins, plywood sheeting or other materials to control erosion at the outlet of pump hoses and flumes. Supplement the erosion control materials to control any erosion [Section 8.7]. • See additional monitoring measures in Section 8.7 of the Pipeline EPP. Vehicle Crossings • Implement erosion control measures as soon as a disturbance of the vegetation mat occurs [Section 8.7]. • Stabilize and revegetate areas disturbed during installation and removal of a bridge; install erosion control measures, where warranted, to control surface erosion until vegetation is established [Section 8.7]. • See recommended mitigation measures for potential effect 1.2 outlined in Table D7.1.3-1 Water Quality and Quantity.	• Increased fish mortality or injury due to increased suspended sediment concentrations within the ZOI during instream construction.
3.4 Interbasin transfer of aquatic organisms	RSA	• Determine the presence of any aquatic or riparian plants and pests prior to the commencement of construction activities within the riparian buffer. Notify the contractor of any special measures to be implemented to prevent the transfer of these organisms from one watercourse to another [Section 8.7]. • Ensure that test water withdrawn from one drainage basin is not allowed to enter natural waters of another drainage basin [Section 8.5].	• No residual effect identified.
3.5 Blockage of fish movements	LSA	• Ensure maintenance of downstream flow conditions (*i.e.,* quantity and quality) at all times when constructing an isolated crossing. If a pump-around method is used to maintain downstream flow, back-up pumping capacity must be onsite and ready to take over pumping immediately if operating pumps fail. Pumps are to be continuously monitored to ensure flow is maintained at all times until the dam materials are removed and normal flow is restored to the channel [Section 8.7]. Vehicle Crossings • Ensure temporary vehicle crossing structures do not disrupt fish passage at Bridal Creek and do not interfere with or impede flow or navigation at any location [Section 8.7]. • Construct or install temporary vehicle access across Bridal Creek in a manner that follows provincial and federal guidelines [Section 8.7].	• Temporary blockage of fish movements.

TABLE D7.1.6-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
3.6 Effects on fish species of concern	RSA	• Implement applicable measures from the Fish Species of Concern Contingency Plan (see Appendix B of the Pipeline EPP) should fish species of concern be discovered during construction [Section 8.7]. • See recommended mitigation measures outlined in potential effects 3.1 to 3.5 of this table. • See recommended mitigation measures outlined in potential effect 2.2 of this table.	• Fish species of concern may be affected by an increase in suspended sediment concentration, habitat alteration within the ZOI and increased potential for mortality and injury.

Notes: 1 LSA = Fish and Fish Habitat LSA; RSA = Aquatics RSA.

2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.6.2 Significance Evaluation of Potential Residual Effects

Table D7.1.6-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the pipeline on fish and fish habitat indicators. The rationale used in the evaluation of significance of each of the residual environmental effects is provided below. An evaluation of significance is not required for those potential effects where no residual effect is identified (*i.e.,* interbasin transfer of aquatic organisms).

TABLE D7.1.6-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON FISH AND FISH HABITAT FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1 Fish and Fish Habitat Indicator – Riparian Habitat									
1(a) Riparian habitat loss or alteration due to construction activities.	Negative	Footprint	Short-term	Isolated	Medium to long-term	Low	High	High	Not significant
1(b) Clearing or disturbance of riparian habitat during maintenance and operations.	Negative	Footprint	Immediate to short-term	Occasional	Medium to long-term	Low	Low	High	Not significant
1(c) Contamination of riparian habitat from spills during construction and maintenance.	Negative	RSA	Immediate	Accidental	Short to long-term	Low	Low	High	Not significant
2. Fish and Fish Habitat Indicator – Instream Habitat									
2(a) Alteration of instream habitat within the ZOI.	Negative	RSA	Short-term	Isolated	Short to medium-term	Low	High	High	Not significant
2(b) Contamination of instream habitat from spills during construction.	Negative	RSA	Immediate	Accidental	Short to medium-term	Low	Low	High	Not significant
3. Fish and Fish Habitat Indicator – Fish Mortality and Injury									
3(a) Increased fish mortality or injury due to construction activities.	Negative	RSA	Immediate to short-term	Isolated	Medium-term	Low	Low	High	Not significant
3(b) Increased fish mortality or injury from spills during construction activities.	Negative	RSA	Immediate	Accidental	Short to long-term	Low	Low	High	Not significant
3(c) Increased fish mortality or injury due to increased suspended sediment concentrations within the ZOI during instream construction.	Negative	LSA	Immediate to short-term	Isolated	Medium-term	Low to medium	Low	High	Not significant
3(d) Temporary blockage of fish movements.	Negative	LSA	Immediate to short-term	Isolated	Immediate to short-term	Low	Low	High	Not significant

TABLE D7.1.6-2 Cont'd

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
1	Fish and Fish Habitat Indicator – Riparian Habitat									
3(e)	Fish species of concern may be affected by an increase in suspended sediment concentration, habitat alteration within the ZOI and increased potential for mortality or injury.	Negative	RSA	Immediate to short-term	Isolated	Short-term	Low	Low	Moderate	Not significant

Notes: 1 LSA = Fish and Fish Habitat LSA; RSA = Aquatics RSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Fish and Fish Habitat Indicator – Riparian Habitat

Riparian Habitat Loss or Alteration Due to Construction Activities

Riparian vegetation within the construction right-of-way and TWS will be disturbed at the Bridal Creek isolated trenched watercourse crossing where a temporary vehicle crossing will also be installed. The impact balance of this residual effect is considered to be negative. During construction, disturbance to riparian vegetation will be kept to a minimum, leaving as much existing riparian vegetation intact as practical and efforts to control erosion and sedimentation in disturbed areas will be implemented. Disturbed riparian areas will be seeded following construction with appropriate native seed mix along with a quick establishing cover crop. Riparian areas of both banks will be revegetated with woody plant material to match species found within the Park. Revegetation mitigation measures are presented in the Pipeline EPP.

The maximum potential disturbance would be 2,700 m^2 as a result of pipeline construction if the entire riparian area, to the width of the construction right-of-way and 30 m from the top of the bank was removed at the Bridal Creek crossing, however, the actual disturbance to riparian habitat is expected to be less. Clearing of riparian vegetation will only occur within the pipeline easement and TWS will not be cleared within the riparian buffer.

The residual effect of pipeline construction on clearing riparian vegetation, although negative, is considered to be of low magnitude given the implementation of industry standard and provincially and federally recommended mitigation measures and monitoring of revegetation success at watercourse crossings post-construction. The residual effect is considered to be reversible in the medium to long-term, depending on the pre-existing vegetation community (*e.g.,* shrubs regenerate within several years, however, tree regrowth is expected to extend into the long-term) (Table D7.1.6-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – clearing or disturbance of riparian vegetation is confined to the Footprint.
- Duration: short-term – the event causing the alteration of riparian vegetation is construction of the pipeline and temporary vehicle crossings.
- Frequency: isolated – the event causing clearing or disturbance of riparian vegetation (*i.e.,* construction of the pipeline and temporary vehicle crossings) is confined to a specific period.
- Reversibility: medium to long-term – depending upon the pre-existing vegetation community (*e.g.,* shrubs and/or trees).
- Magnitude: low – based on implementation of mitigation measures, including revegetation, and the results of PCEM programs which demonstrate the effectiveness of the measures proposed.

- Probability: high – alteration of riparian vegetation is expected to occur at both the Bridal Creek crossing and vehicle crossing.
- Confidence: high – based on a good understanding by the assessment team of trenched (isolated) and vehicle crossing methods and associated effects on riparian vegetation.

Clearing or Disturbance of Riparian Habitat During Maintenance and Operations

Routine vegetation control at the proposed crossing along the proposed pipeline right-of-way and during operations will exclude riparian areas. However, a situation may occur during the life of the operating pipeline where riparian vegetation disturbance may be necessary to accommodate maintenance activities (*e.g.,* in the event of a flood event that causes scouring over the pipeline trench that would require measures to restore depth of cover and pipe integrity). The residual effect of clearing riparian habitat during pipeline operations is of low magnitude and reversible in the medium to long-term (Table D7.1.6-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – clearing or disturbance of riparian vegetation is confined to the Footprint.
- Duration: immediate to short-term – the event causing alteration of riparian vegetation during operations is maintenance activities which may take less than 2 days (i.e., immediate) or may take more than 2 days but less than one year (i.e., short-term).
- Frequency: occasional – any maintenance activities required at Bridal Creek will occur intermittently and sporadically over the assessment period.
- Reversibility: medium to long-term – depending upon the pre-existing vegetation community (e.g., shrubs or trees) and the extent of clearing or alteration of riparian vegetation required for maintenance activities to take place.
- Magnitude: low – based on the implementation of industry standard and provincially and federally recommended mitigation measures during operations phases of the Project and the results of PCEM programs which demonstrate the effectiveness of the measures proposed.
- Probability: low – clearing within the riparian area is not expected to occur during operations.
- Confidence: high – based on the professional experience of the assessment team.

Contamination of Riparian Habitat from Spills During Construction and Maintenance

In the event of spot spills, or a more serious fuel truck release, the adverse residual effects would be considered to be negative since a spill could contaminate the riparian habitat. However, given the implementation of spill contingency and clean-up measures which would reduce the magnitude and reversibility of the residual effects, it is not anticipated that such a spill would result in a significant adverse effect.

Spills are cleaned up immediately within the construction right-of-way during construction and maintenance activities, and occur even more rarely in riparian habitat, therefore, the probability of a significant adverse residual effect is low (Table D7.1.6-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – spills resulting in the contamination of riparian habitat may extend beyond the construction right-of-way and, consequently, beyond the Fish and Fish Habitat LSA.
- Duration: immediate – the event causing contamination is a spill, the period of which is less than or equal to 2 days.
- Frequency: accidental – contamination from spills occurs rarely over the assessment period.

- Reversibility: short to long-term – depending on the nature and volume of the spill as well as the level of sensitivity of the receiving environment and the pre-existing vegetation community (*e.g.,* shrubs or trees).
- Magnitude: low – based on the sensitivity of the receiving environment and volume of the spill, although it is anticipated that most spills will be cleaned up during the construction period.
- Probability: low – based on established mitigation measures to prevent a spill.
- Confidence: high – based on the professional experience of the assessment team.

Fish and Fish Habitat Indicator – Instream Habitat

Alteration of Instream Habitat within the Zone of Influence

The pipeline corridor selection criteria included reducing the number of watercourse crossings to the extent practical, crossing watercourses perpendicular to the banks and paralleling an existing right-of-way. The proposed crossing techniques and mitigation measures have taken into consideration the sensitivity of Bridal Creek, including habitat characteristics, fish species present, and instream work windows, in addition to the construction schedule, and technical and economic feasibility of the crossing. The introduction of fine sediment to watercourses from instream activities, right-of-way runoff and erosion can have sub-lethal (*e.g.,* irritation of gill tissue) or lethal (*e.g.,* suffocation of developing embryos) effects on fish, and can also cause downstream sediment deposition that alters substrate composition and modifies the availability and suitability of habitat for spawning, overwintering and/or rearing (Anderson *et al.* 1996, Newcombe and MacDonald 1991).

Bank stabilization through the application of native seed mixes with quick germinating cover crops, in addition to enhanced revegetation efforts including geotextiles or biostabilization, will be the preferred methods of stabilizing watercourse banks disturbed as a result of pipeline construction.

The implementation of the proposed mitigation measures, in accordance with the DFO Self-Assessment Process and applicable DFO Measures to Avoid Causing Harm to Fish and Fish Habitat will reduce the potential for serious harm to fish or any permanent alteration to, or destruction of, fish habitat as a result of trenched pipeline crossings and temporary vehicle crossings. Nevertheless, a Section 35 Authorization from DFO will be applied for, and fish habitat compensation/offset will be implemented as defined in the Authorization, should serious harm to fish or any permanent alteration to, or destruction of, fish habitat be expected as a result of construction activities. In the event that serious harm to fish or any permanent alteration to, or destruction of, fish habitat is expected and a fish habitat compensation/offset plan is required, the fish habitat compensation/offset plan will be used to ensure compliance with DFO's Fisheries Protection Policy (DFO 2013a).

The maximum area of instream habitat that may be disturbed by construction of the proposed pipeline in Bridal Creek Provincial Park is 282 m^2, however, the actual disturbance to instream habitat is expected to be less. Instream habitat may also be disturbed during the construction of vehicle crossings (clear span bridge); however, the disturbed area is anticipated to be minor.

The residual effects of the Project on instream habitat are expected to be reversible in the short to medium-term for the Bridal Creek crossing in Bridal Veil Falls Provincial Park. In addition, with the successful implementation of mitigation proposed, the effects will be reduced to low magnitude (Table D7.1.6-2, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – alteration of instream habitat may extend beyond the Fish and Fish Habitat LSA due to downstream sediment transport and deposition.
- Duration: short-term– the event causing alteration of instream habitat is watercourse crossing construction.
- Frequency: isolated – the event causing alteration of instream habitat is confined to the construction phase.

- Reversibility: short to medium-term – any sediments that result in deposition on the substrate of a watercourse are expected to be flushed from the system following the first annual flushing event after construction and, if any fish habitat compensation/offset measures are implemented, they should be implemented during construction and/or within the first year following construction of the watercourse crossing.

- Magnitude: low – based on the effectiveness of the proposed mitigation, the anticipated level of effects of the alteration of instream habitat and the implementation of a compensation/offset plan if serious harm to fish or any permanent alteration to, or destruction of, fish habitat is anticipated.

- Probability: high – Bridal Creek has documented fish presence and will be crossed using a trenched isolated crossing method.

- Confidence: high – based on a good understanding by the assessment team of trenched crossing methods and associated effects on instream habitat.

Contamination of Instream Habitat from Spills During Construction

In the event of spot spills, or a more serious fuel truck release in or near Bridal Creek, the residual effects would be considered to be negative since the health of Bridal Creek could be affected. However, given the implementation of spill contingency and clean-up measures and the overall low fish habitat potential ratings of Bridal Creek, it is not anticipated that such a spill would result in a significant adverse effect. Furthermore, the probability of an instream spill event is low (Table D7.1.6-2 point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatic RSA – spills resulting in the contamination of instream habitat may extend beyond the Footprint and the Fish and Fish Habitat LSA.

- Duration: immediate – the event causing contamination is an accidental spill during construction, the period of which is less than or equal to 2 days.

- Frequency: accidental – contamination from spills occurs rarely, if at all, during the assessment period.

- Reversibility: short to medium-term – depending on the nature and volume of the spill of Bridal Creek to adverse residual effects resulting from contamination.

- Magnitude: low – based on the sensitivity of the receiving environment or fish species, and the volume of the spill, although it is anticipated that most spills will be cleaned up during the construction period.

- Probability: low – based on established mitigation measures to prevent a spill.

- Confidence: high – based on the professional experience of the assessment team.

Fish and Fish Habitat Indicator – Fish Mortality and Injury

Increased Fish Mortality or Injury Due to Construction Activities

Some construction activities may lead to an increase in fish mortality or injury. Efforts to remove fish from isolated areas prior to construction may contribute to fish injury and lead to increased fish mortality. Increased sedimentation from construction activities may cause behavioural or sub-lethal/lethal effects to fish and is discussed in the subsection Increased Fish Mortality or Injury Due to Increased Suspended Sediment Concentrations Within the ZOI During Instream Construction.

With the successful implementation of the recommended mitigation measures, the residual effects of construction activities on fish mortality and injury is considered reversible in the medium-term, is of low magnitude based upon the extent, timing and duration of construction activities, and is of low probability (Table D7.1.6-2, point 3[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – fish mortality or injury may result from watercourse crossing construction activities and fish rescue and from construction of the temporary vehicle crossing, which may occur outside the Fish and Fish Habitat LSA.

- Duration: immediate to short-term – the event causing fish mortality or injury is construction of the watercourse crossing which will take less than one year but may take more than 2 days at the Bridal Creek crossing location.
- Frequency: isolated – the event causing fish mortality or injury (*i.e.,* construction of the pipeline) is confined to a specific period.
- Reversibility: medium-term – loss of one or more individuals could affect population scale for several years, or until those individuals can be replaced.
- Magnitude: low – based on the implementation of mitigation measures proven to be effective, extent, timing and duration of construction activities, and with appropriate regulatory authorizations, if applicable.
- Probability: low – mitigation measures will be implemented to prevent fish mortality or injury.
- Confidence: high – based on the professional experience of the assessment team.

Increased Fish Mortality or Injury from Spills During Construction Activities

A potential spot spill, or a more serious fuel truck release at Bridal Creek during construction activities, could cause behavioural or sub-lethal/lethal effects on fish within the ZOI. A spill, such as a fuel truck rollover in or near a stream, during construction could cause increased fish mortality or injury and would be considered to have a negative impact balance, however, proper spill contingency and clean up measures would reduce the magnitude and increase the reversibility of the residual effects.

Spills are cleaned up immediately within the construction right-of-way during construction activities, and occur even more rarely instream, the probability of a significant adverse residual effect is low (Table D7.1.6-2 point 3[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – Depending on the flow conditions of the contaminated water body the effects of a spill could extend beyond the Fish and Fish Habitat LSA.
- Duration: immediate – the event causing increased fish mortality or injury is a spill, the period of which is less than or equal to 2 days.
- Frequency: accidental – fish mortality of injury from spills occurs rarely over the assessment period.
- Reversibility: short to long-term – depending upon the nature and volume of the spill as well as the level of sensitivity of the receiving population.
- Magnitude: low– depending on the sensitivity of the receiving fish species and volume of the spill.
- Probability: low – mitigation measures will be implemented to prevent fish mortality or injury.
- Confidence: high – based on the professional experience of the assessment team.

Increased Fish Mortality or Injury Due to Increased Suspended Sediment Concentrations Within the ZOI During Instream Construction

Pipeline corridor selection criteria included reducing the number of waterbody crossings, and temporary vehicle crossings, to the extent practical. An evaluation of increased suspended solid concentrations during instream construction is provided in Section 7.1.3 Water Quality and Quantity. Through the selection of appropriate watercourse crossing techniques, vehicle crossing methods and the implementation of surface erosion controls and riparian area revegetation as outlined in Tables D7.1.3-2 and D7.1.6-1 and in the Pipeline EPP, the potential for adverse effects on aquatic systems in Bridal Creek due to suspended solids in the water column is reduced.

Suspended sediment released at isolated crossings during instream activities could cause behavioural or sub-lethal/lethal effects on fish within the ZOI. Suspended sediment concentrations will be monitored during instream activity to confirm that TSS averages remain below the CCME standard of 25 mg/L above baseline (CCME 2007). This is the level, based on 24 hours exposure, when mortalities of the most sensitive life history stage can begin to occur (Newcombe 1994).

There is a level of risk to aquatic resources as a result of high levels of sediment discharge caused by instream construction activities. The Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2002) are often used to ensure aquatic resources are protected during instream activities. These guidelines indicate that a biologically important average increase in TSS concentration over a short-term period (*i.e.,* 24 h) is 25 mg/L above the background level (CCME 2002). DFO (2000) has identified risk levels to protect aquatic resources. The risk levels are determined based on the relationship between increasing suspended sediment concentrations and the level of risk that increasing sediment concentrations can have on fish and fish habitat. DFO (2000) indicates that concentrations < 25 mg/L, 25-100 mg/L, 100-200 mg/L, 200-400 mg/L and > 400 mg/L have very low, low, moderate, high and unacceptable risk, respectively. Additional background on these risk levels is discussed in Birtwell (1999).

Minor releases of sediment may be associated with the use of temporary vehicle crossings. Although elevated suspended sediment concentrations may result from instream construction and vehicle crossing use, pulses of suspended solids are generally expected to settle out of the water column within the ZOI in a timeframe measuring from minutes to a few hours.

With the implementation of mitigation measures outlined in Tables D7.1.3-2 and D7.1.6-1 and the Pipeline EPP, the likelihood of fish mortality or injury in Bridal Creek arising from suspended sediment during instream construction is low (Table D7.1.6-2, point 3[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Fish and Fish Habitat LSA – Project activities causing an increase in suspended sediment will be limited to the Fish and Fish Habitat LSA associated with Bridal Creek.
- Duration: immediate to short-term – the event causing fish mortality or injury due to suspended sediment is instream construction, the period of which is likely to be of short-term duration (several days) due to the assumption that flowing water will be present at time of construction.
- Frequency: isolated – the event causing fish mortality or injury is confined to a specific period.
- Reversibility: medium-term – loss of one or more individuals could affect population scale for several years, or until those individuals can be replaced.
- Magnitude: low to medium – based on the implementation of mitigation measures proven to be effective, regulatory authorizations and, where warranted, the implementation of fish habitat compensation/offset.
- Probability: low – mitigation measures will be implemented to prevent fish mortality or injury and are anticipated to be effective.
- Confidence: high – based on available research literature and the professional experience of the assessment team.

Temporary Blockage of Fish Movements

As a result of construction activities using traditional methods to isolate sections of channel, localized blockage of fish movements may occur for the duration of instream construction. The impact balance of this potential residual effect is considered negative since it could affect the ability of fish species to migrate upstream or downstream of the crossings.

The mitigation measures outlined in Table D7.1.6-1 and the Pipeline EPP will reduce the potential for blockage of fish movements by instream construction. The residual effect of the blockage of fish movements is considered to be reversible in the immediate to short-term and well within environmental standards and, consequently, of low magnitude (Table D7.1-6.2, point 3[d]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Fish and Fish Habitat LSA – blockage of fish movements may extend immediately upstream and downstream of the construction right-of-way during instream construction along the pipeline corridor.
- Duration: immediate to short-term – the event causing blockage of fish movements is pipeline construction (*i.e.,* instream construction of the pipeline), the period of which is less than one year at the Bridal Creek watercourse crossing.
- Frequency: isolated – the event causing blockage of fish movements (*i.e.,* construction of the watercourse crossing) is confined to a specific period at Bridal Creek.
- Reversibility: immediate to short-term – any blockage due to instream watercourse construction would be removed upon completion of construction of the Bridal Creek watercourse crossing, which may take less than or equal to two days (*i.e.,* immediate) but may take longer (*i.e.,* short-term).
- Magnitude: low – the implementation of the proposed mitigation measures is expected to effectively reduce the potential effects on fish movements.
- Probability: low – since appropriate construction timing windows and mitigation measures will be implemented to prevent fish mortality or injury.
- Confidence: high – based on the professional experience of the assessment team.

Effects to Fish Species of Concern

Several fish species of concern (*i.e.,* federally and/or provincially listed or a fish and fish habitat indicator species) are known to occur in the Bridal Veil Falls Provincial Park Aquatics RSA (*i.e.,* Harrison River Watershed). COSEWIC and/or provincially listed species within Bridal Veil Falls Provincial Park Aquatics RSA include, bull trout/Dolly Varden, coastal cutthroat trout and coho salmon. Fish and fish habitat indicator species that may occur within the Bridal Veil Falls Provincial Park Aquatics RSA include, bull trout/Dolly Varden, Chinook salmon, coho salmon and coastal cutthroat trout and rainbow trout/steelhead. Bull trout are provincially Blue-listed (BC CDC 2014) as well as listed as a species of Special Concern by COSEWIC (COSEWIC 2014). Coho salmon (*i.e.,* Interior Fraser River population) have been identified by COSEWIC as Endangered (COSEWIC 2014). Coastal cutthroat trout is provincially Blue-listed species (BC CDC 2014). Chinook salmon and rainbow trout are neither provincially nor federally listed. Due to low habitat potential and fish passage barriers, bull trout/Dolly Varden and Chinook salmon are unlikely to occur within the park boundaries.

Vehicle and pipeline crossing methods have been selected to reduce Project-specific effects in consideration of presence and use by fish species of concern in Bridal Creek. The crossing will be conducted using an isolated crossing method. In addition to low habitat potential within the ZOI, migration potential for fish is limited due to multiple barriers within the Fish and Fish Habitat LSA.

Bull trout and Dolly Varden coexist and hybridize in Coast Mountain Drainages. Where the two species overlap, they can be difficult to tell apart, although their morphology is different (McPhail 2007). Dolly Varden are a true coastal and anadromous species, which regularly enters the ocean. Its distribution does not typically extend far inland (McPhail 2007). Dolly Varden are generally smaller than bull trout, inhabiting the streams. Bull trout are typically larger and distributed in cool waters throughout the interior, but are absent from many coastal rivers (McPhail 2007). Bull trout, in particular, are susceptible to degraded water and habitat conditions from land disturbance (*i.e.,* roads, oil and gas developments, forest harvesting, mining developments) (ASRD 2012, Brewin *et al*. 2001, Hammond 2004). Hybridization and competitive interactions with other species (*e.g.,* non-native brook) can also cause declines in bull trout populations (McPhail 2007). Contamination, loss or alteration of instream habitat is the greatest contributor of effects to this indicator.

Chinook salmon are the largest anadromous species to complete life-history events (*i.e.,* spawning and rearing) in the Fraser River mainstem and associated tributaries. Chinook may migrate as far as 600 km inland (McPhail 2007). Chinook salmon are susceptible to direct and indirect habitat loss (COSEWIC 2006) which makes contamination, loss or alteration of instream habitat and riparian habitat both equal contributors of effects to this indicator.

Coastal cutthroat trout are widely distributed throughout the coasts of BC (McPhail 2007). Declines in coastal cutthroat trout populations can be attributed to habitat loss and degradation (*e.g.,* forestry and urbanization) and overharvesting (Costello 2008, McPhail 2007). Due to coastal cutthroat trout's susceptibility to anthropogenic habitat manipulation and degradation, contamination, loss or alteration of instream and riparian habitat are both equal contributors of effects to this indicator.

Coho salmon have an extensive distribution within BC. Coho salmon are susceptible to natural and anthropogenic habitat degradation (COSEWIC 2002a). However, according to TEK participants, coho are more durable than other salmon varieties and are best at adapting to changing conditions. Contamination, loss or alteration of instream habitat and riparian habitat are both equal contributors of effects to this indicator.

Rainbow trout are a cool water salmonid species with widespread distribution throughout BC. Rainbow trout/steelhead have not been considered a conservation concern (McPhail 2007); however, the species is representative of overall effects to fish and fish habitat. Rainbow trout/steelhead are migratory in nature and will swim to new areas should habitat conditions change (Natural Resources Conservation Service 2000); however, contamination, loss or alteration of instream habitat would still be the major contributor to effects on this species.

With the successful implementation of recommended mitigation strategies, the residual effect of the construction of the pipeline on fish species of concern is considered to be reversible in the short-term and of low magnitude (Table D7.1.6-2, point 3[e]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Aquatics RSA – fish species of concern may be affected by an increase in suspended sediment concentrations downstream of watercourse crossings or habitat alteration from trenched isolated crossing methods.
- Duration: immediate to short-term – the event causing fish species of concern to be affected is instream construction of the pipeline.
- Frequency: isolated – the event causing fish species of concern to be affected (*i.e.,* watercourse crossing construction) is confined to a specific period.
- Reversibility: short-term – the residual effects of pipeline construction on fish species of concern is limited to the construction phase and a short time thereafter until habitat conditions are restored to their original state.
- Magnitude: low – the implementation of the proposed mitigation measures is expected to effectively reduce the potential effects on fish species of concern.
- Probability: low – based on a steep creek gradient within the ZOI making fish passage difficult, the presence of upstream and downstream barriers restricting migration within the Fish and Fish Habitat LSA, and the successful implementation of mitigation measures outlined in Table D7.1.6-2.
- Confidence: moderate – based on the professional experience of the assessment team.

7.1.6.3 Summary

As identified in Table D7.1.6-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on fish and fish habitat indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Bridal Veil Falls Provincial Park related to fish and fish habitat will be not significant.

7.1.7 Wetlands

There are no wetlands crossed by the narrowed pipeline corridor in Bridal Veil Falls Provincial Park and, consequently an effects assessment was not conducted as there are no wetland interactions within the wetland indicator on the construction and operation of the Project.

7.1.8 Vegetation

This subsection describes the potential Project effects on vegetation in Bridal Veil Falls Provincial Park. The Vegetation LSA generally consists of a 300 m wide band from the centre of the proposed pipeline corridor (*i.e.*, 150 m on both sides of the centre of the proposed pipeline corridor); shown in Figure 6.2.2-6 of the Introduction to the Draft Stage 2 Detailed Proposal. The Vegetation RSA consists of a 2 km wide band generally from the centre of the proposed pipeline corridor centre and facilities (*i.e.*, 1,000 m on both sides of the centre of the proposed pipeline corridor); shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal.

All vegetation indicators (Table 6.2-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation; and all of them were determined to interact with pipeline construction and operations in Bridal Veil Falls Provincial Park.

7.1.8.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline in Bridal Veil Falls Provincial Park on vegetation indicators are listed in Table D7.1.8-1.

A summary of mitigation measures is provided in Table D7.1.8-1 was principally developed in accordance with industry and provincial regulatory guidelines.

TABLE D7.1.8-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VEGETATION FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP reference[2]]	Potential Residual Effect(s)
1. Vegetation Indicator – Vegetation Communities of Concern			
1.1 Loss or alteration of native vegetation	Footprint	• Confine all pre-clearing/mowing and general clearing activities within the staked/flagged construction right-of-way boundaries. Adhere to clearing/mowing restrictions associated with Bridal Creek, sensitive environmental features and buffer areas (at the Bridal Creek crossing). • Maintain low vegetation or vegetated ground mat within the riparian buffer zone of Bridal Creek, to the extent practical, by clearing only trees, walking-down low vegetation so low-lying vegetation remains intact. Limit grubbing of cleared/mowed trees/shrubs only to the trench line and work side area needed for the vehicle crossing to protect riparian areas [Section 8.1]. • Use hand clearing methods where directed by Trans Mountain's Lead Environmental Inspector and Inspector(s) to avoid or reduce disturbance to the ground surface on sensitive terrain [Section 8.1]. • Restrict root grubbing to the trench line and restrict root grubbing in wet areas to avoid creation of bog holes, minimize surface disturbance and encourage re-sprouting/natural regeneration of deciduous trees and shrubs. See additional clearing and grubbing measures in Section 8.1. • Within the vicinity of the construction right-of-way, collect dormant woody plant material (deciduous stakes/brush) and select suitably sized transplants (small conifer/deciduous trees/shrubs) from a suitable donor site following approval from the applicable land manager [Section 7.0 of Appendix C]. • Use a grass cover crop and/or native grass seed mix that has been developed for use at riparian areas to support the establishment of installed and naturally regenerating native woody plant material and plants and to provide erosion protection in the short-term [Section 7.0 of Appendix C]. • Seed disturbed lands with land uses that support native and non-native plant communities with native and non-native grass mixtures and rates, respectively, as identified in the Reclamation Plan (Section 8.0 of the Draft Stage 2 Detailed Proposal)	• Alteration of the composition of up to 1.8 ha of vegetation in Bridal Veil Falls Provincial Park.

TABLE D7.1.8-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP reference[2]]	Potential Residual Effect(s)
1.1 Loss or alteration of native vegetation (cont'd)	See above	• For native seed, the highest seed grade available will be obtained. Do not accept seed lots that contain any Prohibited Noxious or Noxious weeds as identified in the Certificate of Analysis. Retain the Certificates of Analysis obtained for both agronomic and native seed for future documentation. The Certificates of Analysis will be presented to BC Parks upon request [Section 8.6]. • Minimize foot traffic on newly seeded areas until grass establishment has taken place. Vehicle traffic will be avoided on seeded areas until the sod is re-established [Section 8.6] [Section 10.0 of Appendix C]. • Plant native shrub/tree species, where warranted, depending on the site-specific objectives [Section 14.0 of Appendix C]. • Remove problem vegetation (*i.e.,* weeds or invasive species) when adjacent to Bridal Creek and replace it with compatible, low-growing plant species that will out-compete problem vegetation [Section 14.0 of Appendix C]. • Refer to the Problem Vegetation Management Plan [Sections 14 of Appendix C] for management of non-native or invasive species. • See potential effect 3.1 of this table for mitigation regarding non-native or invasive species during construction and operations. • Monitor the effectiveness of revegetation efforts during the PCEM of the construction rights-of-way. Conduct additional remedial work, where warranted.	• See above.
1.2 Loss or alteration of rare ecological communities	LSA	• See potential effect 1.1 of this table for mitigation regarding alteration of native vegetation. • Additional late-season vegetation surveys will be conducted in August 2014. • If previously unidentified occurrences of vegetation communities of concern are found during supplemental rare plant surveys, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan [Section 6.0 of Appendix C]. • Site-specific mitigation will include avoidance, narrowing the construction right-of-way, fencing or protecting [Section 6.0 of Appendix C, Appendix J]. • Flag or fence-off resource-specific environmental features (e.g., rare plant species, rare ecological communities) prior to commencing construction in the vicinity of the resource site. See additional mitigation in Section 6.0 of the Pipeline EPP. • Implement the resource-specific mitigation measures associated with vascular and non-vascular plant species of concern as well as rare and unique plant communities on or adjacent to the staked construction boundaries as outlined in the environmental resource-specific mitigation tables for rare plant/rare ecological communities provided in Table°2 of the Index Sheets and as shown in the Environmental Alignment Sheets. • Suspend activity if previously unidentified rare ecological communities are found on or adjacent to the construction right-of-way. Implement the Rare Ecological Communities or Rare Plant or Species Discovery Contingency Plan [Section 7.0 of Appendix B]. • Fence off the area where the rare plant community is traversed [Narrow Down Fencing Drawing in Appendix R] [Section 6.0 of Appendix C]. • Water down construction sites and access roads, when warranted, to reduce or avoid the potential for dust emissions. Increase the frequency of watering roads and sites during periods of high risk (*e.g.,* high winds). Implement additional dust abatement measures (*e.g.,* covering topsoil windrows, installing sediment fences, applying a tackifier) will be implemented, when warranted, during clearing and construction activities. See additional measures to control dust in Section 8.2 of the Pipeline EPP. • Recontour the landscape to pre-construction conditions [Section 7.0 of Appendix C].	• Some disturbance or alteration of a rare ecological community, if avoidance is not practical and mitigation measures do not completely protect a site. • If rare ecological communities are located adjacent to the construction right-of-way, they may be indirectly affected by changes in hydrology or light levels.

TABLE D7.1.8-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP reference[2]]	Potential Residual Effect(s)
1.2 Loss or alteration of rare ecological communities (cont'd)	See above	• Restrict the application of herbicide within 30 m of known rare plant populations or rare ecological communities. Spot spraying, wicking, mowing or hand-picking are acceptable weed control measures in proximity to rare plants, rare lichens and vegetation communities of concern [Section 7.0]. • Monitor the effectiveness of revegetation efforts during the post-construction environmental monitoring of the construction rights-of-way. Conduct additional remedial work, where warranted.	• See above.
2. Vegetation Indicator – Plant and Lichen Species of Concern			
2.1 Loss or alteration of rare plant and/or lichen occurrences	LSA	• Additional late-season vegetation surveys will be conducted in 2014. • See potential effect 1.3 of this table for mitigation applicable to the loss or alteration of rare ecological communities. • Flag or fence-off resource-specific environmental features (*e.g.,* rare plant species, rare ecological communities) prior to commencing construction in the vicinity of the resource site. See additional measures in Section 6.0 of the Pipeline EPP. • Apply only water or non-toxic and non-persistent chemical products as approved to access roads for dust control at park locations [Section 9.0]. • Water down construction sites and access roads, when warranted, to reduce or avoid the potential for dust emissions. Increase the frequency of watering roads and sites during periods of high risk (*e.g.,* high winds). Implement additional dust abatement measures (*e.g.,* covering topsoil windrows, installing sediment fences, applying a tackifier) will be implemented, when warranted, during clearing and construction activities. See additional measures to control dust in Section 8.2 of the Pipeline EPP. • Recontour the landscape to pre-construction conditions [Section 7.0 of Appendix C]. • Restrict general application of herbicide within 30 m of rare plant populations or rare ecological communities. Spot spraying, wicking, mowing or hand-picking are acceptable measures for weed control in these areas [Section 7.0 of Appendix C]. • Monitor the effectiveness of revegetation efforts during the post-construction environmental monitoring of the construction rights-of-way. Conduct additional remedial work, where warranted.	• Some disturbance or alteration of a rare plant occurrence, if avoidance is not practical and mitigation measures do not completely protect a site. • Some disturbance or alteration of a rare lichen occurrence, if avoidance is not practical and mitigation measures do not completely protect a site. • If rare plant or lichen sub-populations are located adjacent to the construction right-of-way they may be affected by changes in dust, hydrology or light levels. • If vegetation species at risk sub-populations are located adjacent to the construction right-of-way they may be affected by changes in dust, hydrology or light levels.
3. Vegetation Indicator – Presence of Infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern			
3.1 Weed introduction and spread	RSA	• Conduct a pre-construction weed survey and record problem vegetation (designated weeds) infestations on and immediately adjacent to the construction right-of-way [Section 6.0] [Section 14.0 of Appendix C]. • Implement weed management in consultation with BC Parks (*i.e.,* using proper application of chemical, mechanical or manual measures, or a combination of all) at locations identified within the pre-construction weed survey to a level that is consistent with weed management observed adjacent to the eventual construction right-of-way to reduce the potential for weed infestations following construction [Section 6.0]. Also refer to the Weed and Vegetation Management Plan [Section 14.0 of Appendix C]. • Ensure equipment arrives at all construction sites clean and free of soil or vegetative debris. Do not allow any equipment arriving in a dirty condition on site until it has been cleaned [Section 7.0]. • Power wash and misting stations will be established, where required, to clean equipment used during clearing and topsoil handling activities [Appendix F]. Basic shovel and sweep cleaning will be conducted on clearing and topsoil handling equipment before moving equipment off of cultivated fields. In addition, shovel and compressed air cleaning stations for topsoil handling equipment will be established at selected locations to prevent the spread of weeds [Appendix J] [Section 5.2]. • Restrict all vehicular traffic to the approved and staked construction right-of-way, workspace and access roads [Section 6.0].	• Weed introduction and spread.

TABLE D7.1.8-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP reference[2]]	Potential Residual Effect(s)
3.1 Weed introduction and spread	See above	• Monitor the topsoil and other soil piles for weed growth frequently during the growing season. Direct the contractor when warranted to take proactive measures to control weed growth [Section 7.0]. • Consider placing mats (i.e., construction mats or swamp mats) over infested areas to reduce construction equipment transporting weed or plant material. Where mats are used, ensure they are free of soil, vegetation and debris prior to removing from the site [Section 7.0]. • Consider salvaging topsoil from the full construction right-of-way during non-frozen conditions if localized weed infestations are encountered, as outlined in the Weed and Vegetation Management Plan [Section 7.0] [Section 14.0 of Appendix C]. • Clean equipment (*i.e.,* shovel and sweep, pressurized water or compressed air) involved in topsoil/root zone material handling at weed-infested sites prior to leaving the location unless full right-of-way topsoil/root zone material salvage has been conducted. Clean equipment involved in topsoil handling at weed-infested sites prior to leaving the location [Section 7.0]. • For native seed, the highest seed grade available will be obtained. Do not accept seed lots that contain any Prohibited Noxious or Noxious weeds as identified in the Certificate of Analysis. Retain the Certificates of Analysis obtained for native seed for future documentation. The Certificates of Analysis will be presented to the Crown land authority upon request [Section 8.6]. • Limit vehicle travel through problem vegetation infested areas [Section 14.0 of Appendix C]. • The Weed and Vegetation Management Plan consists of vegetation management measures to be implemented in the short-term, during the pre-construction, construction and PCEM phases of Project construction and the long-term, during the regular operations and maintenance phase of the Project. Vegetation management measures to be implemented during both short-term and long-term periods in consultation with BC Parks [Section 14.0 of Appendix C]. • The use of herbicides for problem vegetation management along the construction right-of-way during construction and operations in BC will be conducted in accordance with the Integrated Pest Management Regulation of BC as part of the BC *Integrated Pest Management Act* and in consultation with BC Parks [Section 14.0 of Appendix C]. • Monitor the effectiveness of revegetation efforts during the post-construction environmental monitoring of the construction rights-of-way. Conduct additional remedial work, where warranted. • During regular maintenance and operations activities, incidental ground inspections for problem vegetation along the construction right-of-way may be conducted to determine the extent (percent cover, composition, distribution, location of infestations) of problem vegetation (*i.e.,* presence of mature brush and trees, and weeds). • Areas of new infestations, recommended treatment sites and BC Parks concerns will also be identified and documented during monitoring. To assist monitoring efforts, the baseline data collected during the pre-construction weed survey and the results of the PCEM Program will assist in establishing thresholds and determining if objectives of the Weed and Vegetation Management Plan are being met [Section 14.0 of Appendix C].	• See above.

Notes: 1 LSA = Vegetation LSA; RSA = Vegetation RSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of the Draft Stage 2 Detailed Proposal).

7.1.8.2 Significance Evaluation of Potential Residual Effects

Table D7.1.8-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operations of the proposed pipeline in Bridal Veil Falls Provincial Park on vegetation. The rationale used to evaluate the significance of each of the residual environmental effects is provided below.

TABLE D7.1.8-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VEGETATION FOR BRIDAL VEIL FALLS PROVINCIAL PARK

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
				Duration	Frequency	Reversibility				
1.	Vegetation Indicator – Vegetation Communities of Concern									
1(a)	Alteration of the composition of up to 1.8 ha of vegetation.	Negative	Footprint	Short-term	Periodic	Medium to long-term	Low	High	High	Not significant
1(b)	Some disturbance or alteration of a rare ecological community, if avoidance is not practical and mitigation measures do not completely protect a site.	Negative	Footprint	Short-term	Periodic	Medium to long-term	Medium	Low	High	Not significant
1(c)	If rare ecological communities are located adjacent to the construction right-of-way they may be indirectly affected by changes in hydrology or light levels.	Negative	LSA	Short-term	Periodic	Medium to long-term	Low	Low	Moderate	Not significant
2	Vegetation Indicator – Plant and Lichen Species of Concern									
2(a)	Some disturbance or alteration of a rare plant occurrence, if avoidance is not practical and mitigation measures do not completely protect a site.	Negative	Footprint	Short-term	Periodic	Medium to long-term	Medium	High	Moderate	Not significant
2(b)	Some disturbance or alteration of a rare lichen occurrence, if avoidance is not practical and mitigation measures do not completely protect a site.	Negative	Footprint	Short-term	Periodic	Short to medium-term	Medium	High	Moderate	Not significant
2(c)	If rare plant or lichen sub-populations are located adjacent to the construction right-of-way, they may be affected by changes in dust, hydrology or light levels.	Negative	LSA	Short-term	Periodic	Short to long-term	Low	High	Moderate	Not significant
2(d)	If vegetation species at risk sub-populations are located adjacent to the construction right-of-way they may be affected by changes in dust, hydrology or light levels.	Negative	LSA	Short-term	Periodic	Medium to long-term	Medium	Low	High	Not significant
3.	Vegetation Indicator – Presence of infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern									
3(a)	Weed introduction and spread.	Negative	RSA	Short-term	Periodic	Short to medium-term	Low to medium	High	High	Not significant

Notes: 1 LSA = Vegetation LSA; RSA = Vegetation RSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Vegetation Indicator – Alteration of Vegetation Communities of Concern

Alteration of Native Vegetation

The Project parallels existing disturbance for its entire length within Bridal Veil Falls Provincial Park. The park is in close proximity to the district of Chilliwack, BC, and adjacent to the Highway 1 where the degree of anthropogenic disturbance from tourism and recreation in the Vegetation RSA is moderate within the boundaries of Bridal Veil Falls Provincial Park.

The narrowed pipeline corridor through Bridal Veil Falls Provincial Park was routed to parallel the existing TMPL route. Using a TEM disturbance layer on GIS imagery to calculate undisturbed native vegetation, up to approximately 1.8 ha of vegetation may be disturbed or altered on the Footprint with the park boundaries during construction and operations of the proposed pipeline. The alteration of native vegetation is considered to have a negative impact balance.

Disturbed areas in parks and protected areas will be seeded with the appropriate native seed mix. Cover crops will be used for initial soil stabilization and weed control. Although areas disturbed during construction and periodic maintenance activities will revegetate with the appropriate native species, species composition in the disturbed Footprint will be altered. Clearing of the right-of-way and temporary workspace and the maintenance of the right-of-way will result in the perpetuation of early seral vegetation. The extent of altered vegetation communities will be limited by the implementation of mitigation measures outlined in Table D7.1.8-2 and in the Pipeline EPP and reclamation measures will speed the recovery.

Specific learnings from the TMX Anchor Loop Project PCM (TERA 2013b) relevant to the alteration of native vegetation, such as the native vegetation found within Bridal Veil Falls Provincial Park, include the following.

- Localized broadcast-seeding of native forb species resulted in limited establishment success.
- Timely salvage, storage and replacement of topsoil/root zone material allowed for the preservation of propagules (*e.g.*, seed, root pieces, spores) located in the surface soil to remain viable.
- Where grubbing was avoided in riparian areas adjacent to crossings of streams, native deciduous plants re-sprouted the spring after clearing and native plants established from seed located within the undisturbed surface soil.
- Willow staking was an effective means of revegetating the banks of watercourses when coordinated with construction clean-up and reclamation.
- Protection of installed woody plant species from ungulate browsing was achieved through the use of constructive panel fencing.
- The establishment success of installed woody plant species and naturally-regenerating native forb species was observed to be low in riparian areas with limited grass establishment due to dry and/or low nutrient soils (*i.e.*, gravelly or with high woody debris content) or where a native riparian seed mix was not applied. To improve survival success of installed woody species and to encourage species diversity through the natural regeneration of native plants from the soil seed bank, seed riparian areas with a short-lived perennial native grass species to stabilize surface soils and reduce competition to installed and naturally-regenerating plants.

Alteration of native vegetation due to competition for light, soil nutrients and moisture may occur while the Footprint is revegetating. However, the establishment of early successional communities during reclamation and operations will resemble revegetation following natural disturbance since the species composition will favor early successional/colonial species, which are adapted for greater competition pressure for light, nutrients and moisture (excepting the competition resulting from weedy non-native species).

During construction, operations and reclamation of the Project, there will be a decrease in woody species richness and abundance due to site clearing within the Footprint, but due to edge effects there may be increases in woody species richness and abundance in areas adjacent to the Footprint. The extra temporary workspace will be allowed to revegetate after construction. Forb and graminoid species richness and abundance will increase over the operations phase of the Project as natural, low growing vegetation regenerates. During abandonment, the Footprint will be returned to an equivalent land capability compared to the pre-construction conditions.

By preserving native vegetation using the mitigation highlighted in Table D7.1.8-1 and the Pipeline EPP, the Project will achieve the objectives of the land use plans for the areas traversed by the narrowed pipeline corridor. Objectives of the management plan include maintaining natural vegetation throughout the development process and preserving natural vegetation in all undeveloped and riparian areas (BC MLPH 1984).

No locally or regionally adopted threshold or standard exists against which the incremental change in vegetation composition can be assessed. This residual effect is limited to the Footprint, reversible in the medium to long-term and of low magnitude (Table D7.1.8-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – effects of pipeline construction and operations on the alteration of native vegetation is confined to the construction right-of-way.
- Duration: short-term – the events contributing to the alteration of native vegetation are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation management), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting alteration of native vegetation (*i.e.*, pipeline construction and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.
- Reversibility: medium to long-term – depending upon the associated land use and the growth time required for species in each affected area (*e.g.,* forb versus tree), changes to native vegetation community composition are considered reversible in the medium to long-term. The effects of the proposed pipeline on forb species (*e.g.,* bunchberry, ferns) is expected to be reversible in the medium-term, whereas the effects on tree species (*e.g.,* western hemlock, western redcedar) are expected to be reversible in the long-term (more than 10 years) due to the time it takes for higher growing vegetation to grow. Therefore, the overall alteration of the composition of vegetation along the Footprint will persist in the medium to long-term.
- Magnitude: low – the narrowed pipeline corridor is located adjacent to existing disturbances for its entire length within the park boundaries and the construction of the pipeline will result in the clearing of approximately 1.8 ha of vegetation on the Footprint, which is considered to be within environmental standards given that best practices and provincial guidelines are being followed. The secondary role of the park is to allow recreation and tourism development to occur within the pipeline corridor (BC MLPH 1984). While permanent loss of native vegetation is not anticipated to result from either the construction or operations of the proposed pipeline, returning the Footprint to an equivalent land capability during the abandonment phase could take years, as discussed under reversibility. The indirect effects of Project construction and maintenance due to edge effects such as changes in light and moisture will be of low magnitude since they will not result in the loss of vegetation but only a localized change in vegetation community composition.
- Probability: high – the Footprint crosses native vegetation.
- Confidence: high – based on past pipeline projects and the professional experience of the assessment team.

Some Disturbance or Alteration of a Rare Ecological Community, if Avoidance is Not Practical and Mitigation Measures Do Not Completely Protect a Site

Early-season vegetation surveys have been conducted in 2014 on small segments of the narrowed pipeline corridor in the northern portion of Bridal Veil Falls Provincial Park. During the 2014 rare plant surveys, no occurrences of BC CDC-listed rare ecological communities were observed within the Footprint. Supplemental vegetation surveys are also planned to be conducted in August 2014 on the Footprint through the park. In the event that rare ecological communities are identified in the Footprint during supplemental surveys, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan (Section 5.0 of Appendix C of the Pipeline EPP).

Mitigation measures for rare ecological communities generally fall into categories of avoidance, (*e.g.,* realignment, change of work side, narrowing), reducing disturbance (*e.g.,* narrowing, adjusting workspaces, ramping/matting over) and alternative construction/reclamation techniques (*e.g.,* salvaging seed or sod, plant propagation, transplanting component species, separate root zone material salvage, delayed clearing, access management) (see Appendix C of the Pipeline EPP). These proposed mitigation measures have been used previously on other major pipeline construction projects with good success.

Learnings from the TMX Anchor Loop Project (TERA 2013b) pertinent to rare ecological communities include the following.

- Natural regeneration is an effective means of revegetation in rare ecological communities where construction disturbance is limited to the trench area and where accurate separation and replacement of trench materials is achieved.

Mitigation is developed with a number of factors taken into account that include, however, are not limited to:

- component species;
- community size;
- rarity;
- construction timing;
- location of the community with respect to the proposed right-of-way;
- primary mode of component species reproduction;
- habitat and proximity of available habitat; and
- past mitigation success (of the community or similar communities).

Based on the assessment of the rare ecological communities that may be encountered during construction, the mitigation measures described above are considered to be appropriate and applicable to the Project. If mitigation measures do not completely protect the site, a disturbance or alteration of a portion of the community may occur and is considered to have a negative impact balance. By basing mitigation on community ranking and abundance, in addition to its location on the construction right-of-way and the community type, any alteration of the local community, particularly S1 communities, will be reduced to a level such that the local community is not placed at risk. Consequently, the residual effect of pipeline construction on rare ecological communities and unique communities are of medium magnitude (Table D7.1.8-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – the potential disturbance or alteration of a rare ecological community is confined to the construction right-of-way.
- Duration: short-term – the events resulting in potential disturbance or alteration of a rare ecological community are construction of the pipeline or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in potential disturbance or alteration of a rare ecological community (*i.e.*, construction of the pipeline and maintenance activities) occur intermittently, however, repeatedly during the operations phase of the Project.
- Reversibility: medium to long-term – depending on the component species (*e.g.,* western redcedar and western hemlock [western redcedar/sword fern community]) will take years to grow to mature trees.
- Magnitude: medium – the potential disturbance or alteration of a rare ecological community is of medium magnitude since the effect is still within environmental standards given that best practices, objectives and provincial guidelines are being followed. Returning the Footprint to an equivalent land capability and regrowth of a rare ecological community could take years, as discussed under reversibility.
- Probability: low – No rare ecological communities were identified within the narrowed pipeline corridor during the early-season vegetation surveys in 2014. Based on ecosystem mapping results, there is potential for rare ecological communities to exist in the park, however, the forests along the pipeline corridor are in a young forest structural stage which do not support rare ecological community classification. Furthermore, the ecosystems along the Footprint are disturbed from recreational development, tourism activity and previous pipeline corridor clearing.

- Confidence: high – confidence is high based on past pipeline projects, field survey results and the professional experience of the assessment team.

Indirect Effects to Rare Ecological Communities

With proper implementation of the industry-accepted standard mitigation practices that are proposed, disruption of surface flow patterns and light levels following construction or maintenance activities are expected to be minor along the narrowed pipeline corridor. However, construction and maintenance activities (*e.g.*, integrity digs) may contribute to some localized alteration of light levels and natural surface drainage patterns until trench settlement is complete and seeded and/or naturally regenerated vegetation has matured. The impact balance of this potential residual effect is considered negative since it could alter the moisture regime and light levels. Indirect alteration of rare ecological communities adjacent to the Footprint may occur due to soil erosion. Some rare ecological communities may be more susceptible to erosion than others. Since the areas with greatest erosion risk will be seeded with native species or an annual cover crop (or otherwise stabilized with erosion control blankets, coir matting, or woody slash [Section 6.0 of Appendix C and Section 8.6.3 of the Pipeline EPP]), the indirect alteration of native vegetation as a result of erosion will not measurably contribute to the overall effect of pipeline construction on the alteration of rare ecological communities.

Increased distance of light penetration due to clearing will result in an indirect alteration of native vegetation (*i.e.*, the native species making up the rare ecological community). For example, some forested communities are characterized by low light penetration due to dense tree canopy. If part of the community is cleared, the light penetrating to the understory will change the species composition along the edges of the community where clearing occurred. However, this effect will not substantially contribute to the alteration of native vegetation beyond the effects detailed in relation to the clearing of native vegetation. Additionally, during the course of reclamation, as revegetation progresses, light penetration will generally decrease over time.

Given that indirect effects are, in part, caused by disturbance to vegetation structure associated with clearing activities, allowing disturbed areas to naturally revegetate may not alleviate indirect effects where vegetation management is conducted or long-term persistence of the disturbance exists. Consequently, indirect effects to vegetation are expected to persist until the pre-existing vegetation composition and structure is restored for the Footprint. The corridor passes through previously disturbed areas where development is authorized, such as trails and recreation structures. Open canopy trails are present along the corridor where previous pipeline corridor clearing has occurred, enabling light to pass through the forest canopy where the corridor is planned.

During the construction and operations of the pipeline, there will be a decrease in woody species richness and abundance due to clearing within the Footprint, but due to edge effects there may be increases in woody species richness and abundance in areas adjacent to the Footprint. Forb and graminoid species richness and abundance will increase following construction as natural vegetation regenerates.

Alteration of native vegetation due to competition for light, soil nutrients and moisture may occur while the Footprint is revegetating. However, the establishment of early successional communities following construction will resemble revegetation following natural disturbance since the species composition will favor early successional/colonial species, which are adapted for greater competition pressure for light, nutrients and moisture (excepting the competition resulting from weedy non-native species).

The post-construction environmental monitoring program will identify any locations with altered drainage patterns (*e.g.,* ponded water) and remedial work will be conducted. Once pre-construction moisture regimes are returned to a site, regeneration or revegetation of rare ecological communities will be more likely.

The effect of construction on adjacent rare ecological communities is deemed to have a negative impact balance. This residual effect is limited to the Vegetation LSA, reversible in the medium to long-term and of low magnitude since the narrowed pipeline corridor parallels other pipeline rights-of-way and disturbance for its entire length within the park boundaries (Table D7.1.8-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Vegetation LSA – although alteration of rare ecological communities is generally confined to the construction right-of-way, potential changes in hydrology, light levels and species composition may extend beyond the pipeline right-of-way.
- Duration: short-term – the events resulting in alteration of adjacent rare ecological communities are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation management), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in alteration of adjacent rare ecological communities (*i.e.*, pipeline construction and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.
- Reversibility: medium to long-term – it may take more than one year plus adequate precipitation levels in order for the trench crown to settle and natural drainage patterns to be restored, and it will take several years for vegetation to grow back to former heights, which will prevent increased light from reaching surrounding plants in the ecological community.
- Magnitude: low – the narrowed pipeline corridor is located adjacent to existing disturbances to the extent practical and the residual effects are detectable but are still considered to be within environmental standards given that best practices, objectives and provincial guidelines are being followed.
- Probability: low – the narrowed pipeline corridor within Bridal Veil Falls Provincial Park is adjacent to native vegetation with high potential to support rare ecological communities. However, given that forests along the corridor are in a young forest structural stage and that no rare ecological communities have been observed within the corridor it is less likely that any vegetation communities of concern will be located adjacent to the Footprint.
- Confidence: moderate – confidence is high based on past pipeline projects, field survey results and the professional experience of the assessment team. However, confidence will increase following late-season 2014 supplemental surveys.

<u>Vegetation Indicator – Plant and Lichen Species of Concern</u>

Some Disturbance or Alteration of a Rare Plant Occurrence, if Avoidance is Not Practical and Mitigation Measures Do Not Completely Protect a Site

During the early-season 2014 rare plant surveys in Bridal Veil Falls Provincial Park, which were a component of the vegetation surveys, no BC CDC-listed rare plant species were observed within the park boundaries. If rare plant occurrences are identified during the late-season 2014 surveys mitigation measures will be developed. Mitigation measures for rare plant species generally fall into categories of avoidance (*e.g.,* realignment, change of work side, narrowing), reducing disturbance (*e.g.,* narrowing, adjusting workspaces, ramping/matting over) and alternative construction/reclamation techniques (*e.g.,* salvaging seed or sod, plant propagation, transplanting, separate strippings salvage, delay clearing, access management). These proposed mitigation measures have been used previously on other major pipeline construction projects with good success.

Rare plant surveys within Bridal Veil Falls Provincial Park were conducted during the early-season in 2014 and supplemental rare plant surveys are planned for the late-season to address areas of high rare plant potential that were identified during the early-season survey. In the event that rare plant species are identified in the Footprint during supplemental surveys, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan (Section 7.0 of Appendix C of the Pipeline EPP). In the event that rare plant species are identified on or within 30 m of the construction right-of-way during construction, refer to the Rare Ecological Community and Rare Plant Population Discovery Contingency Plan (Section 7.0 of Appendix B of the Pipeline EPP).

Based on the assessment of the rare plants with potential to be encountered during construction, the mitigation measures described above are considered likely to be appropriate and applicable to the Project. However, if mitigation measures do not completely protect the site, a disturbance or alteration of a portion of the population or community may occur. Mitigation is developed with a number of factors taken into account that include, however, are not limited to:

- species;
- population size;
- rarity;
- growth form of the plant (i.e., annual, biennial, perennial);
- construction timing;
- location of the population with respect to the Footprint;
- primary mode of species reproduction;
- mode and magnitude of propagule dispersal;
- habitat and proximity of available habitat; and
- past mitigation success (of the species or similar species).

By basing mitigation on these factors, any disturbance or alteration of a rare plant population, particularly those ranked S1, would be reduced to a level such that the population is not placed at risk (Table D7.1.8-2 point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – the potential disturbance or alteration of a rare plant population is confined to the construction right-of-way.
- Duration: short-term – the events resulting in potential disturbance or alteration of a rare plant population are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation maintenance), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events causing potential disturbance or alteration of a rare plant population (*i.e.*, construction of the pipeline and maintenance activities) occur intermittently but repeatedly at some locations during the operations phase of the Project.
- Reversibility: medium to long-term – depending on the species, the construction method (*e.g.,* narrowing the right-of-way or matting over, compared to transplanting) and the landscape. For example, golden saxifrage has been documented to revegetate previously disturbed rights-of-way within a few years following post-construction environmental monitoring (Alliance 2002) as long as the landscape is recontoured and the hydrology returns to pre-construction conditions (medium-term).
- Magnitude: medium – the potential disturbance or alteration of a rare plant population is of medium magnitude since the effect is considered to be within environmental standards given that best practices, objectives and provincial guidelines are being followed.
- Probability: high – there were no rare plant populations identified within the narrowed pipeline corridor within the park boundaries during the early-season surveys in 2014. Additional rare plant surveys are planned for August 2014. It is possible that rare plant populations will be found within the Footprint.
- Confidence: moderate – confidence is moderate based on past pipeline projects, the experience of the assessment team and the results of the rare plant surveys. However, confidence will increase after 2014 late-season surveys within the park boundaries have been completed.

Some Disturbance or Alteration of a Rare Lichen Occurrence, if Avoidance is Not Practical and Mitigation Measures Do Not Completely Protect a Site

During the 2014 early-season rare plant surveys in Bridal Veil Falls Provincial Park, which were a component of the vegetation surveys, no BC CDC-listed rare lichen populations were observed. In the event that rare lichen populations are observed during the late-season 2014 surveys mitigation measures will be developed. Mitigation measures for rare lichen species generally fall into categories of avoidance, (*e.g.* realignment, change of work side, narrowing), reducing disturbance (*e.g.,* narrowing, protective matting, snow cover in winter) and alternative construction/reclamation techniques (*e.g.,* relocation of substrates, transplanting of thalli or peds, inoculation using vegetative fragments). These proposed mitigation measures have been used previously on other major pipeline construction projects with good success, but in general, fencing and avoiding is the mitigation that has the greatest likelihood of success, as compared to transplanting, and is the preferred conservation strategy.

Avoidance was highly successful in protecting rare species along the TMX Anchor Loop Project. Of the sites monitored in 2010 where fence and avoid procedures were employed, 93% had retained the rare lichen species targeted for mitigation (TERA 2011a).

Based on the assessment of the rare lichens with potential to be encountered during pipeline construction, the mitigation measures described above are considered likely to be appropriate and applicable to the Project. However, if mitigation measures do not completely protect the site, a disturbance or alteration of a portion of the population may occur. Mitigation is developed with a number of factors taken into account that include, but are not limited to:

- species;
- population size;
- rarity;
- construction timing;
- location of the population with respect to the Footprint;
- preference substrate and proximity of available substrates; and
- past mitigation success (of the species or similar species).

By basing mitigation on these factors, any disturbance or alteration of a rare lichen population, particularly those ranked S1, would be reduced to a level such that the population is not placed at risk.

Supplemental vegetation surveys are planned during the late-season of 2014 at the end of July and early August in Bridal Veil Falls Provincial Park. In the event that rare lichen species are identified within the Footprint during supplemental surveys, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan (Section 7.0 of Appendix C of the Pipeline EPP). In the event that rare plant species are identified on or within 30 m of the construction right-of-way during construction, refer to the Rare Ecological Community and Rare Plant Population Discovery Contingency Plan (Section 7.0 of Appendix B of the Pipeline EPP).

The effect of construction on rare lichen populations is deemed to have a negative impact balance. This residual effect is limited to the Footprint, reversible in the short to medium-term and of medium magnitude since the narrowed pipeline corridor parallels other pipeline projects and disturbance for its entire length within the park boundaries (Table D7.1.8-2, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – the potential disturbance or alteration of a rare lichen population is confined to the construction right-of-way.

- Duration: short-term – the events resulting in potential disturbance or alteration of a rare lichen population are construction of the pipeline or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.

- Frequency: periodic – the events resulting in potential disturbance or alteration of a rare lichen population (*i.e.*, construction of the pipeline and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.

- Reversibility: short to medium-term – depending on the species and the mitigation measures applied. Based on post-construction environmental monitoring results from TMX Anchor Loop, effects on rare lichens were generally resolved in 3 to 5 years (*i.e.,* it was apparent in 3 to 5 years of post-construction environmental monitoring whether the population would survive or not) (TERA 2011a).

- Magnitude: medium – the potential disturbance or alteration of a rare lichen population is of medium magnitude since the effect is still within environmental standards given that best practices, objectives and provincial guidelines are being followed.

- Probability: high – there were no rare lichen populations identified within the narrowed pipeline corridor during the early-season rare plant surveys in 2014 within the park boundaries, but it is possible that rare lichen populations will be found within the Footprint.

- Confidence: moderate – confidence is moderate based on past pipeline projects, the experience of the assessment team and the results of the rare plant surveys. However, confidence will increase following the planned 2014 late-season surveys.

Indirect Effects to Rare Plant and Lichen Sub-Populations

With proper implementation of the industry-accepted standard mitigation practices that are proposed, disruption of surface flow patterns and light levels following construction or maintenance activities is expected to be minor along the narrowed pipeline corridor. However, construction activities may contribute to some localized alteration of light levels and natural surface drainage patterns until trench settlement is complete and vegetation has matured. The impact balance of this potential residual effect is considered negative since it could alter the moisture regime and light levels. In addition, dust deposition and the chemicals used to suppress dust have the potential to impact rare plants and lichens.

Increased distance of light penetration due to clearing will result in an indirect alteration of native vegetation (*i.e.*, the native species making up the habitat for rare plant populations). If part of a treed community is cleared, the light penetrating to the understory will change the species composition along the edges of the community where clearing occurred and the increased air flow will alter humidity within the area. However, this effect will not substantially contribute to the alteration of native vegetation beyond the effects detailed in relation to the clearing of native vegetation. Additionally, during the course of reclamation, as revegetation progresses, light penetration and air flow will generally decrease over time.

Given that indirect effects are, in part, caused by disturbance to vegetation structure associated with clearing activities, allowing disturbed areas to naturally revegetate may not alleviate indirect effects where vegetation management is conducted or long-term persistence of the disturbance exists. Consequently, indirect effects to rare plant and lichen populations are expected to persist until the pre-existing vegetation composition and structure is restored for the Footprint.

During construction and operations of the pipeline, vehicle traffic will increase dust deposition onto native vegetation adjacent to the Footprint which could include rare lichen populations. Use of dust suppressants has the potential to affect both plant and lichen species. During reclamation, dust due to Project traffic could also result in minor effects to rare lichens located adjacent to the right-of-way.

Alteration of native vegetation due to competition for light, soil nutrients and moisture may occur while the Footprint is revegetating. However, the establishment of early successional communities following construction will resemble revegetation following natural disturbance since the species composition will favor early successional/colonial species, which are adapted for greater competition pressure for light, nutrients and moisture (excepting the competition resulting from weedy non-native species).

Many rare species inhabit areas with specific hydrology and light regimes. If hydrology of an area is altered, rare plant or lichen species located adjacent to the construction right-of-way may be affected. For example, tall bugbane requires moist but not submerged substrate to grow on. The post-construction environmental monitoring program will identify any locations with altered drainage patterns (*e.g.,* ponded water) and remedial work will be conducted. Consequently, the residual effect is reversible in the short to long-term. This residual effect is of low magnitude since the narrowed pipeline corridor parallels other pipeline projects and disturbance for its entire length within the park boundaries (Table D7.1.8-2, point 2[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Vegetation LSA – although alteration of rare plant and lichen populations is generally confined to the disturbed portion of the construction right-of-way, potential changes in hydrology, dust and light levels may extend beyond the pipeline right-of-way.
- Duration: short-term – the events resulting in alteration of rare plant and lichen populations are clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs, vegetation management), the latter of which are limited to any one year during the operations phase.
- Frequency: periodic – the events resulting in alteration of rare plant and lichen populations via disruption of drainage patterns and altered light levels (*i.e.*, construction of the pipeline and maintenance activities) occur intermittently but repeatedly during the operations phase of the Project.
- Reversibility: short to long-term – it may take more than one year plus adequate precipitation levels in order for the trench crown to settle and natural drainage patterns to be restored and along extra temporary workspace it will take years for vegetation to grow back to former heights, which is what affects the light levels reaching surrounding plants. The full right-of-way will be maintained free of higher growing vegetation until abandonment (long-term). The potential for effects from dust and dust suppressants exist until construction activities are completed.
- Magnitude: low – the narrowed pipeline corridor is located adjacent to existing disturbances to the extent practical. Residual effects are detectable, but are still considered to be within environmental standards given that best practices, objectives and provincial guidelines are being followed.
- Probability: high – the narrowed pipeline corridor crosses forested vegetation communities that provide potential habitat for rare plant and lichen species and the forested vegetation will be affected by clearing activities during construction.
- Confidence: moderate – confidence is moderate based on past pipeline projects, the experience of the assessment team and the results of the rare plant surveys. However, confidence will increase following the planned 2014 late-season surveys.

Indirect Effects to Vegetation Species at Risk

Federally-listed vegetation species at risk (*i.e.*, designated by COSEWIC or on *SARA* Schedule 1) identified as having potential to occur along the narrowed pipeline corridor in Bridal Veil Falls Provincial Park are described in Section 6.0 of this tab.

While tall bugbane (*Actea elata* var. *elata*), peacock vinyl lichen (*Leptogium polycarpum*), Roell's brotherella (*Brotherella roellii*) and cliff paintbrush (*Castilleja rupicola*) have the potential to occur within the Vegetation RSA, no previously recorded Element Occurrences of plant species listed pursuant to the British Columbia *Wildlife Act* or *SARA* are known to occur within the park boundaries (BC CDC 2014).

Potential habitat for tall bugbane habitat is generally in montane forests, which do not occur along the narrowed pipeline corridor within the park boundaries. Tall bugbane can also be found in shady, moist, mixed, mature western red cedar-hemlock forests and deciduous stands. Peacock vinyl lichen occurs in low elevations on branches and (mossy) trunks of deciduous trees, particularly bigleaf maple and red alder, in rather well-lit, mid-successional stands. Previously recorded occurrences of peacock vinyl lichen range from less than 100 m to 89 km from the narrowed pipeline corridor with the closest occurrences near Bridal Falls and Hope, suggesting the interaction potential may be high (BC CDC 2014). Roell's brotherella is a moss that is known to occur on coarse woody debris in mixed forests adjacent to the Bridal Veil Falls Provincial Park. There is low potential habitat for cliff paintbrush to occur along the narrowed pipeline corridor within the park boundaries due to its affinity to exposed rocky outcrops on mountain slopes. No *SARA* listed or BC *Wildlife Act* rare plant species were identified during early-season vegetation surveys in 2014. Based on these findings, the key vegetation species at risk that have potential to occur in the park is tall bugbane and Roell's brotherella.

During additional surveys planned during the late-season growing period in 2014, any potential habitats, such as those described above, will be examined in the park for potential populations of tall bugbane and peacock vinyl lichen, as well as for any other potential vegetation species at risk in areas of the park that were not surveyed in the early-season of 2014.

The narrowed pipeline corridor has been aligned to reduce disturbance to native vegetation by paralleling existing linear disturbances to the extent practical and by utilizing workspace on adjacent existing rights-of-way.

The *SARA* states that no person shall destroy any part of the habitat of a species listed as Endangered or Threatened and that no species listed as Endangered or Threatened can be damaged or destroyed. Section 97 of *SARA* states that this is an indictable offense for which there are monetary penalties. For species designated as Endangered or Threatened on Schedule 1, a Recovery Strategy must be provided within one year of their designation. Critical habitat is defined in a species-specific Recovery Strategy and is based on the best available information.

Protection measures and environmental management techniques for vegetation species at risk are provided in Appendix C of the Pipeline EPP. Mitigation measures for vegetation species at risk should be those of avoidance (*e.g.* realignment, change of work side, narrowing).

Based on the assessment of the vegetation species at risk with potential to be encountered during construction (*i.e.* tall bugbane and peacock vinyl lichen), the mitigation measures described above are considered likely to be appropriate and applicable to the Project. Due to the restrictions around damaging or destroying *SARA*-listed plant or lichen species, any populations should be avoided by construction and operations, so there should not be any disturbance or alteration of a portion of a population. A summary of the rationale for all of the significance criteria is provided below (Table D7.1.8-2, point 2[d]).

- Spatial Boundary: Vegetation LSA – the potential disturbance or alteration of a vegetation species at risk would not occur on the construction right-of-way since mitigation will avoid any impacts, but could indirectly affect portions of a population adjacent to the right-of-way in the Vegetation LSA through changes to dust, light or moisture levels.

- Duration: short-term – the events resulting in potential indirect effects to a vegetation species at risk is clearing during construction of the pipeline or maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.

- Frequency: periodic – the events resulting in potential indirect effects to a vegetation species at risk may occur during construction and intermittently but repeatedly (*i.e.*, maintenance activities) during the operations phase of the Project.

- Reversibility: medium to long-term – depending on the site-specific conditions and the mitigation measures applied.

- Magnitude: medium – the potential disturbance or alteration of a vegetation species at risk would be of high magnitude since residual effects would exceed regulatory standards, but any vegetation species at risk populations will be avoided and indirect effects will be mitigated. Residual effects will not exceed regulatory standards.

- Probability: low – while there were no vegetation species at risk identified within the narrowed pipeline corridor within the park boundaries during the early-season rare plant surveys in 2014, late-season surveys have not been conducted. With mitigation from Table D7.1.8-1 and the Pipeline EPP applied, it is concluded that there is a low probability that vegetation species at risk will interact with the Footprint.

- Confidence: high – based on past pipeline projects, the professional experience of the assessment team and the results of the early-season surveys.

Vegetation Indicator – Presence of Infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern

Weed Introduction and Spread

Non-native and invasive species tend to be pioneer species with characteristics that can exploit recently disturbed ecosystems. Non-native and invasive species that occur at high densities on the landscape can exert competitive pressure on native vegetation and result in alteration of native vegetation.

In general, invasive species are most prevalent where the ground has been disturbed by anthropogenic activity. During the 2014 early-season vegetation surveys, any weed species encountered were noted and their density/distribution was recorded.

No provincially or regionally noxious weeds were recorded. Three species designated as noxious in other regions were recorded. The information collected during the vegetation surveys allows for an understanding of baseline weed conditions and the magnitude of weed infestations encountered in areas supporting native vegetation along the narrowed pipeline corridor.

Mitigation measures outlined in Table D7.1.8-1 and in the Pipeline EPP are effective industry standard measures to reduce the potential for the introduction and spread of weeds. These measures will be implemented during both construction and maintenance of the Project. All problem vegetation along the construction right-of-way will be monitored during all pipeline construction phases (*i.e.,* pre-construction and construction) and the operations phase (*i.e.*, post-construction environmental monitoring) (Section 12.0 of Appendix C of the Pipeline EPP).

Experience during past pipeline construction programs has shown that, while weed infestations were encountered, the implementation of appropriate mitigation measures during construction resulted in limited weed issues (Alliance 2002, IPL 1995, Enbridge 2000, 2002, TERA 2012a).

Specific learnings from the TMX Anchor Loop Project (TERA 2013b) regarding weed introduction and spread include:

- chemical and mechanical weed treatments were effective at controlling or suppressing non-native invasive broadleaf species of concern along and off the right-of-way, at temporary facilities and permanent facilities; and
- hand (manual) removal of vegetation in riparian areas (areas where chemical treatment was not allowed due to proximity to water) was effective in controlling or suppressing non-native broadleaf weeds.

In addition, the final post-construction environmental monitoring report for the TMX Anchor Loop Project indicated that after five years, the post-construction vegetation management program had effectively controlled or suppressed non-native invasive broadleaf species of concern, identified during the pre-construction survey, along the right-of-way (TERA 2013b).

The potential introduction or spread of Noxious weeds and invasive, non-native species may vary in the period required to reverse the effect depending on the land use affected and the species. Consequently, the residual effect is considered to be reversible in the short to medium-term and of low to medium magnitude (Table D7.1.8-2, point 3[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Vegetation RSA – potential weed introduction and spread resulting from pipeline construction and maintenance activities may extend beyond the Footprint and Vegetation LSA to the Vegetation RSA.
- Duration: short-term – the events resulting in potential weed introduction and spread are construction of the pipeline or site-specific maintenance activities (*e.g.,* integrity digs), the latter of which are limited to any one year during the operations phase.

- Frequency: periodic – the events resulting in potential weed introduction and spread (*i.e.*, pipeline construction, operations and maintenance activities) occur during construction and intermittently, but, repeatedly over the assessment period.

- Reversibility: short to medium-term – depending on the weed species, the size/location of the weed occurrence and the associated land use.

- Magnitude: low to medium – the narrowed pipeline corridor parallels existing disturbances for its entire length within the park boundaries and the north end of the narrowed pipeline corridor is adjacent to a tourism and recreation area with potential for higher densities of weeds than native land uses. Based on consultation, weeds are a concern in populated areas. Magnitude varies from low to medium depending on the weed or invasive plant species, affected land use and density/distribution of associated weed occurrences.

- Probability: high – pipeline construction is expected to cause some weed introduction and spread.

- Confidence: high – based on past pipeline projects, the professional experience of the assessment team and post-construction environmental monitoring results.

7.1.8.3 Summary

As identified in Table D7.1.8-2, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on vegetation indicators of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservational values of Bridal Veil Falls Provincial Park related to vegetation will be not significant.

7.1.9 Wildlife and Wildlife Habitat

This subsection describes the potential Project effects on wildlife and wildlife habitat in Bridal Veil Falls Provincial Park. The Wildlife LSA is defined as the area within a 1 km buffer of the centre of the proposed pipeline porridor; shown in Figure 6.2.2-6 of the Introduction to the Draft Stage 2 Detailed Proposal. The Wildlife RSA is defined as the area within a 15 km buffer of the centre of the proposed pipeline corridor; shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal.

Wildlife and wildlife habitat indicators (Table 6.2.1-1 of Introduction to Draft Stage 2 Detailed Proposal) were considered in this evaluation and the following indicators may occur in Bridal Veil Falls Provincial Park: grizzly bear; forest furbearers; coastal riparian small mammals; bats; mature/old forest birds; early seral forest birds; riparian and wetland birds; great blue heron; bald eagle; common nighthawk; olive-sided flycatcher; and stream-dwelling amphibians.

7.1.9.1 Identified Potential Effects

Project construction and operational activities have the potential to affect wildlife and wildlife habitat through changes to habitat, movement and mortality risk. A summarized discussion of potential Project effects on wildlife and wildlife habitat specific to Bridal Veil Falls Provincial Park is provided below. Potential effects associated with the construction and operations of the proposed pipeline on wildlife and wildlife habitat are listed in Table D7.1.9-1.

TABLE D7.1.9-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATION ON WILDLIFE AND WILDLIFE HABITAT FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures	Potential Residual Effect(s)
1 Change in habitat	LSA	• Refer to Table D7.1.9-2 below: habitat loss/alteration, wildlife disturbance and attraction of wildlife during construction, mammal dens, species with special conservation status, mineral licks, bats, migratory birds, raptor/owl nest, reptiles, stream-dwelling amphibians, Oregon forestsnail.	• Combined Project effects on wildlife and wildlife habitat in Bridal Veil Falls Provincial Park.
2 Change in movement	LSA	• Refer to Table D7.1.9-2 below: habitat loss/alteration, barriers to wildlife movement, wildlife disturbance and attraction of wildlife during construction, mineral licks, mammal dens, bats, migratory birds, raptor/owl nest, stream-dwelling amphibians, Oregon forestsnail.	
3 Increased mortality risk	LSA	• Refer to Table D7.1.9-2 below: habitat loss/alteration, disturbance and attraction of wildlife during construction, mammal dens, species with special conservation status, bats, migratory birds, raptor/owl nest, reptiles, stream-dwelling amphibians, Oregon forestsnail.	

Notes: 1 LSA = Wildlife LSA.

Mitigation measures (as shown in the Pipeline EPP that are particularly relevant to potential Project effects on wildlife and wildlife habitat in Bridal Veil Falls Provincial Park are provided in Table D7.1.9-2 below. The mitigation measures were principally developed in accordance with industry accepted best practices, as well as industry and provincial regulatory guidelines.

TABLE D7.1.9-2

RECOMMENDED MITIGATION FOR WILDLIFE AND WILDLIFE HABITAT WITHIN BRIDAL VEIL FALLS PROVINCIAL PARK

Concern	Recommended Mitigation[1]
Habitat Loss/Alteration	• Avoid activity during sensitive time periods for wildlife species to the extent feasible. • Share workspace with the adjacent existing TMPL right-of-way or other existing rights-of-way to reduce the construction right-of-way-width. • Do not clear timber, stumps, brush or other vegetation beyond the marked construction right-of-way boundary. • Where grading is not required, cut/mow/walk down shrubs and small diameter deciduous trees at ground level to facilitate rapid regeneration. • Use natural recovery as the preferred method of reclamation on level terrain and at wetlands unless otherwise requested by the regulator and where bio-engineering (*e.g.,* shrub staking/planting) will be conducted. • Plant native tree seedlings and/or shrubs at select locations to be determined in the field by the Environmental Inspector, in consultation with the Wildlife Resource Specialist. • Avoid the use of pesticides (except for herbicides to control invasive plants or noxious weeds; only use as spot treatments and outside the migratory bird breeding season) (BC MOE 2012a). • Reduce the width of grubbing near watercourses and through other wet areas to facilitate the restoration of shrub communities. • Reduce disturbance at riparian areas, and cut/mow/walk down shrubs and small diameter deciduous trees at ground level to facilitate rapid regeneration. • Limit vegetation control along the right-of-way and allow natural regeneration during the operations phase to the extent feasible. • Conduct pre-construction surveys to identify site-specific habitat features (*e.g.,* mineral licks) and implement the appropriate setbacks and/or timing windows.

TABLE D7.1.9-2 Cont'd

Concern	Recommended Mitigation[1]
Barriers to Wildlife Movement	• Conduct work as expeditiously as practical (*i.e.,* interval between front-end work activities such as grading and back-end activities such as clean-up) to reduce the length and duration of the open trench and to reduce potential barriers and hazards to wildlife. Refer to Table D2.5-1 for the length and duration of construction activities. • Locate gaps in pipe to allow wildlife movement in places that also facilitate construction such as at slope changes, crossings (*i.e.,* watercourse, road, pipeline right-of-way) and bends. The locations of the gaps should coincide with gaps in spoil and slash piles windrows. The locations can be determined in the field by the Environmental Inspector. • Restore habitat connectivity by redistributing large-diameter slash (rollback) over select locations on the pipeline right-of-way (*e.g.,* where high levels of coarse woody debris occur prior to construction), to provide cover and facilitate movement of wildlife. Specific locations are to be determined in the field by the Environmental Inspector and Wildlife Resource Specialist in discussion with provincial regulatory authorities. Avoid using Douglas-fir and spruce for rollback in Bridal Veil Falls Provincial Park.
Wildlife Disturbance and Attraction of Wildlife During Construction	• Schedule clearing and construction activities to avoid sensitive wildlife timing windows wherever feasible. • Minimize traffic and prohibit recreational use of all-terrain vehicles or snowmobiles by construction personnel on the pipeline right-of-way and at facilities. • Prohibit personnel from having pets on the pipeline right-of-way and at facilities. • Prohibit personnel from feeding or harassing wildlife. • Obey speed limits along access roads and the right-of-way. • Ensure that food waste and industrial waste are disposed of properly. • Report any issues related to wildlife encountered during construction and operations to the Environmental Inspector, who will report it to the appropriate regulatory authorities. • Implement the measures in the Wildlife Conflict Management Plan to prevent human/wildlife conflict and wildlife mortality (Appendix C of the Pipeline EPP).
Migratory Birds	• The migratory bird nesting period within Bridal Veil Provincial Park is identified as mid-March to mid-August (Environment Canada 2014). • In the event that clearing or construction activities are scheduled during the migratory bird nesting period conduct nest sweeps within 7 days of activity. Use non-intrusive methods to conduct an area search for evidence of nesting (*e.g.,* presence of singing birds, territorial males, alarm calls, distraction displays). In the event an active nest is found, it will be subject to site-specific mitigation measures (*i.e.,* clearly marked protective buffer around the nest and/or non-intrusive monitoring).
Raptor Nest	• Schedule clearing and construction activities outside of sensitive time periods for raptors (generally March to August), to the extent feasible. • In the event clearing is scheduled at a time when raptor nests will be active, in areas of suitable habitat conduct raptor nest searches prior to clearing to locate active raptor nests. In the event an active raptor nest is discovered, consult with the appropriate regulatory authorities to discuss practical options and mitigation measures. • Eagle, peregrine falcon, gyrfalcon , osprey and burrowing owl nests are protected year-round by the BC *Wildlife Act* and may not be cleared. The Guidelines for Raptor Conservation (BC MOE 2013e) provides information on sensitive breeding and nesting time periods and buffers for raptor nests according to their tolerance to human disturbance. These buffers range from 50 m to 500 m depending on the surrounding land use and species. During the breeding season, an additional 100 m “quiet” buffer is recommended. Clearly mark the appropriate buffers with fencing to prevent access to the nest. • If construction is unavoidable within the recommended year-round and breeding buffers, a Nest Management Plan addressing various mitigation (including nest monitoring during the breeding period) is recommended. • If construction activities require the removal of a raptor nest that is protected year-round under the BC *Wildlife Act* (*i.e.,* eagle, peregrine falcon, gyrfalcon, osprey and burrowing owl), Trans Mountain will work with the appropriate regulatory authorities to develop a Nest Removal Management and Compensation Plan. Upon confirmation the nest is inactive, nest removal should occur during the least risk window of August through December. When a nest is removed the installation of a replacement structure (*i.e.,* a platform on a pole or transplanted tree) should be erected in nearby suitable habitat (BC MOE 2013e).

TABLE D7.1.9-2 Cont'd

Concern	Recommended Mitigation[1]

Stream-Dwelling Amphibian – Coastal Tailed Frog and Pacific Giant Salamander	• Maintain a 30 m setback distance (core buffer) from streams identified as coastal tailed frog habitat, where disturbance is to be avoided, to the extent feasible. Minimize disturbance within an additional 20 m buffer extending beyond the core buffer (BC MOE 2012a), where feasible.
	• Maintain a 50 m setback distance (core buffer) from streams identified as Pacific giant salamander habitat, where disturbance is to be avoided, to the extent feasible. Minimize disturbance within an additional 30 m buffer extending beyond the core buffer (BC MOE 2012a), where feasible.
	• Place large coarse woody debris on the pipeline right-of-way after construction, from either the 30 m setback boundary of the streambank to 100 m distance from suitable (*i.e.,* known or likely to be occupied) streams for coastal tailed frog and Pacific giant salamander (BC MWLAP 2004b).
	• If a trenched stream crossing method is necessary, implement the following measures:
	  ◦ Use existing access to facilitate construction, where feasible. If no existing access is available, limit instream crossings to one vehicular/equipment crossing to install an appropriate temporary crossing to facilitate construction. Remove crossings following construction.
	  ◦ Limit riparian disturbance to the maximum extent feasible within 50 m of coastal tailed frog streams. Clear only the minimum workspace necessary to facilitate construction. Use hand clearing methods within 50 m of the stream.
	  ◦ Where slopes exceed 60%, riparian avoidance buffers should extend beyond the top of the ravine.
	  ◦ Clearly mark and/or fence off riparian buffers prior to clearing and construction.
	  ◦ Install and maintain appropriate erosion control measures to prevent sedimentation during and following construction.
	  ◦ Maintain stream flows throughout construction.
	  ◦ Following construction, reclaim disturbed riparian areas using best available techniques to encourage rapid regeneration of native riparian vegetation. Monitor and implement remedial measures to ensure riparian restoration is adequate.
	• Conduct an amphibian salvage prior to clearing and construction activities at known coastal tailed frog and Pacific giant salamander breeding locations. Note that coastal tailed frog and Pacific giant salamander use the same stream year-round, therefore, this mitigation is applicable year-round. In the event that coastal tailed frogs and/or Pacific giant salamanders are identified on the pipeline right-of-way during construction, the following mitigation is recommended:
	  ◦ remove the frogs/salamanders to the closest suitable upstream habitat, if it is safe to do so;
	  ◦ ensure frogs/salamanders are not held for longer than necessary to move them to the closest suitable habitat;
	  ◦ ensure frogs/salamanders are not held for more than two to four hours under any circumstances; and
	  ◦ frogs/salamanders must be captured, held, transported and released humanely.

Stream-Dwelling Amphibian – Coastal Tailed Frog and Pacific Giant Salamander (cont'd)	• Use sediment control measures from Standards and Best Practices for Instream Works (BC MWLAP 2004a). • Review opportunities to enhance the habitat by planting/allowing native vegetation growth that provides a protective buffer along streams, and maintain stream habitat complexity (*i.e.,* a natural meandering channel with stabilized banks, and step-pool morphologies) (BC MWLAP 2004b).
Oregon Forestsnail	• Clearing is scheduled to avoid spring-early summer (March-June) when snails are most active on the surface and depositing eggs (BC MOE 2007). If clearing or construction occurs in spring, conduct a pre-construction survey in areas with high habitat suitability (*e.g.,* patches of stinging nettle, dense herbaceous vegetation with fringecup or other moisture-loving plants, riparian areas, or other suitable moist sites) in late March or early April to the end of June prior to vegetation clearing (BC MOE 2007). • If a snail is found, move it off the construction footprint. Install barrier fencing at the time of the survey to deflect movements of snails away from the construction footprint. Maintain the fencing until construction activities are complete (BC MOE 2007). • Restore riparian zones and natural drainage patterns as soon as practical after construction (BC MOE 2007). • Retain big leaf maples, especially large diameter trees, wherever feasible (BC MOE 2007). • Restrict heavy machinery and vehicles to the construction footprint (BC MOE 2007). • Clean machinery and boots prior to use to avoid introducing non-native species (BC MOE 2007). • Avoid compaction of soil, disturbance of herbaceous plants and removal of coarse woody debris (BC MOE 2007), to the extent practical. • Manage construction waste and pollutants to prevent contamination of snail habitat (BC MOE 2007). • During operations, retain coarse woody debris on the pipeline right-of-way, including large-diameter downed logs; limit vegetation control (mowing) to leave undisturbed patches of stinging nettle and other herbaceous vegetation where concentrations of snails or patches of high-quality habitat occur (BC MOE 2007). • If clearing of the right-of-way is needed for operations, use hand clearing methods and mechanical clearing rather than herbicides (BC MOE 2007).

TABLE D7.1.9-2 Cont'd

Concern	Recommended Mitigation[1]
Reptiles	• In the event an active snake hibernacula is identified, implement a 150 m buffer (BC MOE 2012a), and avoid activity during the period of April 15 to September 30 (BC MWLAP 2004b), to the extent feasible. • Consult with BC MFLNRO to determine the location and need for additional site-specific mitigation measures (*e.g.,* exclusion fencing for the open trench or along vehicle travel lanes) at identified locations. • All workers will receive education prior to commencing work, which will include best practices for avoiding snakes and appropriate protocols in the event a snake is detected at the work site. Refer to the Wildlife Conflict Management Plan in Appendix C of the Pipeline EPP.
Bats	• Protect bat roosts from disturbance by humans and other sensory disturbances (BC MOE 2012a). Implement a 125 m buffer from bat hibernacula (from October 1 to April 30 or maternity roost (from May 1 to August 31) (BC MWLAP 2004b). Consult with BC MFLNRO where disturbance of a hibernacula or maternity roost is unavoidable to discuss practical options and mitigation measures.
Mammal Dens	• Contact provincial regulatory authorities to discuss the appropriate mitigation in the event an active den is discovered on or near the work site. Mitigation may include establishing protective buffers, monitoring the den and/or modifying the construction schedule to avoid activity until the den is inactive. • A setback of 50 m from active bear dens is recommended (BC OGC 2013).
Mineral Licks	• Implement a 100 m setback in the event a mineral lick is identified (BC OGC 2013). In the event that shifting/narrowing the pipeline right-of-way is not feasible to maintain the minimum setback from a mineral lick, consult with BC MFLNRO to discuss practical options and mitigation strategies. • Do not block well-used game trails to/from a mineral lick. • Avoid activities (*i.e.,* clearing, construction, helicopter overflights) near mineral licks during critical periods (May to November) (BC MWLAP 2004b), to the extent feasible. • Leave a gap in set-up pipe within the area of the mineral lick to allow wildlife to access the mineral lick. The locations of the gaps in strung pipe should coincide with gaps in strippings, spoil and rollback windrows.
Beaver Dams/Lodges	• In the event that beaver dams or lodges will be disturbed, submit a notification to the appropriate regional Habitat Officer of the BC MFLNRO at least 45 days prior to beaver dam removal, as per Section 40 of the Water Regulation. Following this notification, obtain a Ministry of Natural Resource Operations Wildlife Sundry Permit to remove a beaver dam. Standards and best practices for beaver dam removal identified in the BC Standards and Best Practices for Instream Works (BC MWLAP 2004a) will be applied.
Species with Special Conservation Status	• In the event that a species with special conservation status is observed during construction, the appropriate regulatory authorities will be contacted to determine if additional mitigation measures are warranted. • Implement the Wildlife Species of Concern Discovery Contingency Plan in the event that wildlife species of concern are identified during construction.

Note: 1 Detailed mitigation measures are outlined in Table L-2 of Appendix L in the Pipeline EPP (Appendix A of this Proposal).

7.1.9.2 Significance Evaluation of Potential Residual Effects on Wildlife and Wildlife Habitat

The assessment of the residual combined effect on wildlife and wildlife habitat in Bridal Veil Falls Provincial Park considered all of the assessment criteria defined in Table 6.2.1-1 of the Introduction to the Draft Stage 2 Detailed Proposal. The significance determinations incorporate professional judgment, which allows integration of all of the effects criteria ratings to provide relevant significance conclusions that are sensitive to context and facilitate decision-making (Lawrence 2007). The sensitivity of wildlife species that may occur in or near the park was considered in the determination of magnitude.

Table D7.1.9-3 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operation of the proposed pipeline in Bridal Veil Falls Provincial Park on wildlife and wildlife habitat. The rationale used to evaluate the significance of the residual effect on wildlife and wildlife habitat in Bridal Veil Falls Provincial Park is provided below.

TABLE D7.1.9-3

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON WILDLIFE AND WILDLIFE HABITAT FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1(a) Combined Project effects on wildlife and wildlife habitat in Bridal Veil Falls Provincial Park.	Negative	LSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not Significant

Notes: 1 LSA = Wildlife LSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Change in Habitat

Bridal Veil Falls Provincial Park comprises various habitat types that support wildlife, including low-elevation valleys with western red cedar, western hemlock, broadleaf maple and red alder, and riparian areas associated with Bridal Creek (BC MOE 2013a). The Project will change the amount of available effective habitat for wildlife in Bridal Veil Falls Provincial Park. The likely mechanisms for changes in effective wildlife habitat include vegetation clearing, sensory disturbance (*e.g.,* human activity and noise), the crossing of Bridal Creek, and soil handling (including trenching). The Project will increase the existing corridor width (since it parallels the existing TMPL right-of-way within Bridal Veil Falls Provincial Park) and require ongoing clearing as part of vegetation management during operations. Habitat loss and reduced habitat effectiveness can cause displacement of wildlife, and potentially result in the use of less suitable habitat, reduced foraging ability (Bird *et al.* 2004), increased energy expenditure (Jalkotzy *et al.* 1997) and lower reproductive success (Habib *et al.* 2007).

Clearing activities during construction of the Project will alter habitat structure, and result in direct habitat loss or alteration. Operations of the Project will also require ongoing vegetation management, resulting in the maintenance of forest habitat in earlier seral stages (herbaceous and shrub stages) until the pipeline is abandoned and the disturbed areas are reclaimed. Clearing of the construction right-of-way and temporary workspace will reduce cover habitat and temporarily reduce forage availability. As cleared areas regenerate with early seral vegetation, forage availability will increase for some species (*e.g.,* browse for deer; increased forage for bears and early seral habitat species). For example, grizzly bears may use pipeline rights-of-way for foraging and for travel (McKay *et al.* 2013). Vegetation clearing for the Project will decrease available habitat for forest and shrub-reliant species over the medium to long-term. The openings created by the Project may increase certain habitat types for species that use open areas (*e.g.,* common nighthawk foraging) and for habitat generalists (*e.g.,* corvids, some songbirds such as dark-eyed junco) (Jalkotzy *et al.* 1997).

Indirect habitat loss or alteration occurs when habitat is available but the quality or effectiveness of the habitat is changed such that wildlife avoid the habitat or reduce their use of it. Reduced habitat effectiveness can occur as a result of fragmentation, creation of edges, or sensory disturbance (*e.g.,* noise, artificial light, proximity to facilities and infrastructure, human activity and traffic). Habitat fragmentation can cause habitat to become unsuitable for species with large territories or home ranges, alter predator-prey dynamics and allow for increased invasive or parasitic species abundance (*e.g.,* cowbird parasitism of songbird nests near forest edges). Changes in habitat suitability may also result from changes in vegetation communities due to increased light penetration at clearing edges that causes increased understory vegetation growth, or from changes in water quality (*e.g.,* sedimentation, deposition of airborne contaminants).

The proposed mitigation measures (Table D7.1.9-2 and Pipeline EPP) are expected to reduce residual Project effects on wildlife and wildlife habitat. To minimize vegetation clearing and reduce the fragmentation and isolation of habitat patches, the narrowed pipeline corridor parallels the existing TMPL right-of-way within Bridal Veil Falls Provincial Park. Other mitigation measures such as avoiding activity during sensitive time periods for wildlife species, to the extent possible; reducing the width of grubbing near watercourses to facilitate the reclamation of shrub communities; and limiting vegetation control along the right-of-way and allowing natural regeneration during the operations phase to the extent feasible will also help reduce residual Project effects on wildlife and wildlife habitat. The proposed crossing of Bridal Creek will be designed to limit disturbance to the stream channel and riparian area to the extent feasible, and to prevent erosion and sedimentation.

Proposed candidate critical habitat for Oregon forestsnail and early candidate critical habitat for Pacific giant salamander occur within Bridal Veil Falls Provincial Park (Environment Canada 2014a). For Oregon forestsnail, habitat preferences include a moist microclimate, abundance of coarse woody debris and the presence of stinging nettle (*Urtica dioica*) (Environment Canada 2014b). Habitat preferences for Pacific giant salamander include a dense understory and shady streams with coarse, rocky substrates (Environment Canada 2014b). Supplemental field surveys will be completed for the Project, which will allow for an evaluation of the biophysical attributes of the habitat within the proposed corridor as it relates to the draft attributes of the candidate critical habitats defined by Environment Canada (2014a,b). This information will be used to inform mitigation planning.

Change in Movement

Project construction and operations can alter wildlife movement by reducing habitat connectivity and creating barriers or filters to movement. A disturbance is considered a barrier when no movement occurs across it, or a filter when the rate of movement through the disturbance is less than it would be through intact habitat (Jalkotzy *et al.* 1997). Habitat fragmentation results when barriers to movement cause functional separation of habitats into smaller, isolated habitat patches (Andrén 1994, Jalkotzy *et al.* 1997). Species that have late age of first reproduction, low population densities, low reproductive rates, large home ranges, low fecundity, and move over large distances to disperse, find food and mate, display low resilience to habitat fragmentation (Dunne and Quinn 2009).

The increased corridor width may cause an incremental barrier effect for some wildlife species. In some cases, linear developments have been shown to block, delay or deflect ungulate movements, potentially restricting or reducing access to some parts of their range (Harper *et al.* 2001). Studies on small mammal movements in the boreal forest have concluded that pipeline rights-of-way may act as barriers or filters to movement of flying squirrels, red squirrels and marten (Marklevitz 2003). Forest gaps have been shown to affect movements of forest birds (Bayne *et al.* 2005, Desrochers and Hannon 1997, Fleming and Schmiegelow 2002) and owls (COSEWIC 2008). Wider corridor widths increase barrier effects on bird movements more than narrower corridors (Desrochers and Hannon 1997), and parallel forest openings can cause a cumulative barrier effect at the landscape scale for some species (Bélisle and St. Clair 2001). Construction of the Project may create barriers to amphibian movement (*e.g.,* spoil piles, brush piles, traffic, strung pipe, open trench). Construction may also interfere with Oregon forestsnail movement; however, due to their sedentarynature and poor dispersal capability (*e.g.,* Edworthy *et al.* 2012, Steensma *et al.* 2009), interference to their movement will likely be minimal.

Changes in movement patterns can also occur since some species may be attracted to the rights-of-way. The Footprint will create increased forage availability for some wildlife species once vegetation communities regenerate to early seral vegetation after reclamation. This may attract some wildlife to the right-of-way and, therefore, affect their normal movement patterns. Rights-of-way may also provide travel routes for predators such as grizzly bears (McKay *et al.* 2013). Bats have also been shown to use linear landscape features for movement, which provide navigational references and flight corridors for some bat species (Hein *et al.* 2009, Verboom and Huitema 1997). Birds that use open spaces for hunting, foraging or nesting may also benefit.

Application of the proposed mitigation measures (Table D7.1.9-2 and Pipeline EPP) is expected to reduce the magnitude of potential residual effects of Project construction and operations on wildlife movement. Limiting the length of open trench, maintaining periodic gaps in soil, slash, and pipe, where feasible, will limit barriers to wildlife movement during construction. Limiting the construction right-of-way by utilizing shared workspace on the existing TMPL right-of-way will reduce the Project's potential for habitat fragmentation. Redistributing large-diameter slash (coarse woody debris) over select locations on the right-of-way and promoting regeneration of native vegetation, including shrubs and trees, will contribute to maintaining habitat connectivity by reducing limitations to movement of wildlife across the right-of-way. The Project is expected to result in a filter, but not complete barrier to movement of some wildlife species.

Increased Mortality Risk

The Project has potential to increase wildlife mortality risk during construction as a result of loss or disruption of habitat (*e.g.,* nests, dens, overwintering sites), changes to predator/prey dynamics (*i.e.* attracting prey species to early seral vegetation establishing on the disturbance), wildlife collisions with vehicles or equipment, and sensory disturbance (*e.g.,* nest abandonment).

Project construction (clearing, soil handling) may affect the mortality risk of some wildlife species. Pre-construction surveys will identify any site-specific habitat features that warrant additional mitigation to avoid disruption or mortality of wildlife. Scheduling of clearing activities will consider sensitive timing windows for wildlife (*e.g.*, migratory bird nesting period). Where sensitive timing windows cannot be avoided, Trans Mountain will work with appropriate regulatory authorities to develop and implement appropriate alternate mitigation.

Oregon forestsnail mortality may occur if they are encountered and undetected during construction of the Project as they are sedentary and unable to move away from disturbance in a timely manner (Zevit *et al.* 2012). Oregon forestsnail mortality risk may be particularly high if construction occurs when Oregon forestsnail are hibernating as the hibernating forestsnail may be difficult to detect. Oregon forestsnail bury themselves 2 – 7cm into leaf litter and hibernate between early-November and mid-March (Steensma *et al.* 2009). Trans Mountain will develop and implement appropriate mitigation, monitoring and, where warranted, adaptive measures in consultation with regulatory authorities.

Linear corridors can potentially affect wildlife mortality risk from trapping, hunting and poaching due to access development, since these activities are often associated with roads or other linear corridors that create access (Collister *et al.* 2003, Wiacek *et al.* 2002). The Project does not create a new linear corridor within the park.

Vehicle traffic due to construction and operations of the Project may increase the risk of wildlife mortality due to vehicle collisions. With posting of low traffic speeds, signage and education of construction and operations contractors and employees, risk of wildlife injury or mortality associated with vehicle collisions is not expected to increase substantially as a result of the Project. Wildlife conflicts with personnel may occur during construction and operations of the Project, such as wildlife attraction to garbage and debris, and human encroachment. Trans Mountain has developed a Wildlife Conflict Management Plan (see Section 15, Appendix C of the Pipeline EPP to reduce and address the potential conflict between Project personnel and the wildlife species most likely to be encountered along the Project.

Artificial night-time light sources attract songbirds that migrate at night and can increase bird mortality risk from collisions, excessive energy expenditure and predation (Jones and Francis 2003, Poot *et al.* 2008). The possible use of artificial night-time light sources within Bridal Veil Falls Provincial Park will be short-term in duration and occur either during construction or during site-specific operations and maintenance activities. There are no permanent facilities planned within Bridal Veil Falls Provincial Park that would require permanent artificial night-time light.

Amphibian species that will potentially interact with the Project are not freeze-tolerant, and require thermally-stable retreat habitat to overwinter. Suitable hibernation habitats include abandoned small mammal burrows, cover objects or soil (provided soil texture is loose enough to allow burrowing below the depth of frost). The immobility of ground-hibernating animals increases their vulnerability to soil disturbance during the winter.

Summary of Effects Characterization Rationale for Wildlife and Wildlife Habitat

The following provides the evaluation of significance of potential residual effects on wildlife and wildlife habitat within Bridal Veil Falls Provincial Park (Table D7.1.9-3, point 1[a]).

- Spatial Boundary: Wildlife LSA – habitat changes (*e.g.,* clearing), alteration of movement (*e.g.,* barriers during construction) and mortality risk (*e.g.,* disturbance of occupied habitat feature) are primarily limited to the Wildlife LSA.

- Duration: short-term – the events causing effects are construction and operational activities (*e.g.,* monitoring, vegetation management and site-specific maintenance), the latter of which are limited to any one year during operations.

- Frequency: periodic – the events causing effects (*i.e.,* clearing of the Footprint, traffic and activity) will occur during construction and intermittently during operations for monitoring, vegetation control and maintenance.

- Reversibility: long-term – effects are reversible in the long-term following decommissioning and abandonment, once native vegetation regenerates over the Project Footprint. Herbaceous and shrub-dominant habitats are expected to regenerate to similar ecological stages and habitat function in the medium-term following completion of reclamation. However, reclamation of forested habitat will take longer than 10 years (*i.e.,* long-term). Sensory disturbance and mortality risk associated with construction is reversible immediately upon completion of activities.

- Magnitude: medium – regulatory and ecological context are key considerations in the characterization of magnitude for residual effects of the Project on wildlife in Bridal Veil Falls Provincial Park. The stated management objectives of the park relevant to wildlife include protection of the ecological integrity of riparian habitats and providing for recreational opportunities such as wildlife viewing. Residual effects on ecological integrity (*e.g.*, habitat intactness and connectivity) are reduced by paralleling the existing TMPL right-of-way, minimizing the footprint, and reclamation of the footprint to native vegetation. The park provides habitat for wildlife species at risk, which, in general, often have low resilience to habitat disturbance. The narrowed pipeline corridor crosses proposed critical habitat for Oregon forestsnail, early critical habitat for Pacific giant salamander, and the threatened North Cascades grizzly bear population unit. The current habitat value of the narrowed pipeline corridor in Bridal Veil Falls Provincial Park for these species is reduced by the existing TMPL right-of-way, the proximity to Highway 1 and the recreational use of the park. Trans Mountain will use information from field surveys and consultation with provincial regulatory authorities to develop appropriate mitigation that reduces the Project's residual effect on wildlife and their habitat. Through development of mitigation in consultation with regulatory authorities, and implementation of mitigation and monitoring, including adaptive measures where warranted, the residual Project effects on wildlife in Bridal Veil Falls Provincial Park are expected to remain within regulatory and ecological tolerance. Therefore, the magnitude of the residual effect is concluded to be medium.

- Probability: high – the Project will affect wildlife in the park through changes in habitat, movement and mortality risk.

- Confidence: moderate – the assessment is based on a good understanding of cause-effect relationships and relevant data. Limitations and uncertainty associated with available data pertinent to the Project area reduce the confidence level to moderate.

7.1.9.3 Summary

As identified in Table D7.1.9-3, there are no situations where there is a high probability of occurrence of a permanent or long-term residual environmental effect on wildlife and wildlife habitat of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual environmental effects of pipeline construction and operations on conservation values of Bridal Veil Falls Provincial Park related to wildlife and wildlife habitat will be not significant.

7.1.10 Species at Risk

For the purpose of the assessment, species at risk are considered to include all federally-listed species of conservation concern (*i.e.*, COSEWIC or *SARA* Schedule 1 designation) (COSEWIC 2013, Environment Canada 2014b). Species identified as having the potential to occur along the narrowed pipeline corridor and in the element-specific RSAs are based on previous field assessments and existing data.

This subsection discusses the species at risk that have been identified as likely to occur within each element-specific RSA. The list of federal species at risk includes 2 aquatic species within the Aquatics RSA, 15 wildlife species within the Wildlife RSA, 16 vascular plant species, 4 lichen species and 4 non-vascular plant species within the Vegetation RSA.

The 2 aquatic species include:

- bull trout: Special Concern by COSEWIC (South Coast BC populations), Blue-listed; and
- coho salmon: Endangered by COSEWIC (Interior Fraser River populations).

The 15 wildlife species include:

- Grizzly bear: Special Concern by COSEWIC, Blue-listed;
- Little brown myotis: Endangered by COSEWIC;
- Mountain beaver, rufa ssp.: Special Concern by SARA and COSEWIC, Blue-listed;
- Band-tailed pigeon: Special Concern by SARA and COSEWIC, Blue-listed;
- Bank swallow: Threatened by COSEWIC;
- Barn swallow: Threatened by COSEWIC, Blue-listed;
- Common nighthawk: Threatened by SARA and COSEWIC;
- Great blue heron, fannini ssp.: Special Concern by SARA and COSEWIC, Blue-listed;
- Northern goshawk: Threatened by SARA and COSEWIC, Red-listed;
- Olive-sided flycatcher: Threatened by SARA and COSEWIC, Blue-listed;
- Short-eared owl: Special Concern by SARS and COSEWIC, Blue-listed;
- Coastal tailed frog: Special Concern by SARA and COSEWIC, Blue-listed;
- Pacific giant salamander: Threatened by SARA and COSEWIC, Red-listed;
- Northern rubber boa: Special Concern by SARA and COSEWIC;
- Monarch: Special Concern by SARA and COSEWIC, Blue-listed; and
- Oregon forestsnail: Endangered by SARA and COSEWIC, Red-listed.

The 16 vascular plant species include:

- bog bird's-foot lotus *(Hosackia pinnata)*: Endangered by COSEWIC and *SARA*, Red-listed;
- deltoid balsamroot (*Balsamorhiza deltoidea*): Endangered by COSEWIC and *SARA,* Red-listed;
- Gray's desert-parsley *(Lomatium grayi)*: Threatened by COSEWIC and *SARA*, Red-listed;
- Macoun's meadow-foam *(Limnanthes macounii)*: Threatened by COSEWIC and *SARA,* Red-listed;
- phantom orchid (*Cephalanthera austiniae)*: Threatened by COSEWIC and *SARA*, Red-listed;

- pink sand-verbena (*Abronia umbellate* var. *breviflora*): Endangered by COSEWIC and *SARA*, Red-listed;
- prairie lupine *(Lupinus Lepidus)*: Endangered by COSEWIC and *SARA,* Red-listed;
- purple sanicle (*Sanicula bipinnatifida*): Threatened by COSEWIC and *SARA*, Red-listed;
- rayless goldfields *(Lasthenia glaberrima)*: Endangered by COSEWIC and *SARA*, Red-listed;
- streambank lupine *(Lupinus rivularis*): Endangered by COSEWIC and *SARA,* Red-listed;
- tall woolly-heads *(Psiloraphus elatior*): Endangered by COSEWIC and *SARA*, Red-listed;
- Vancouver Island beggarticks (*Bidens amplissima*): Special Concern by COSEWIC and *SARA*, Blue-listed;
- white meconella (*Meconella oregano*): Endangered by COSEWIC and *SARA*, Red-listed;
- white-top aster (*Sericocarpus rigidus*): Special Concern by COSEWIC and *SARA*, Red-listed;
- whitebark pine (*Pinus albicaulis)*: Endangered by COSEWIC and *SARA*, Blue-listed; and
- yellow montane violet (*Viola praemorsa* ssp. *praemorsa):* Endangered by COSEWIC and *SARA*, Red-listed.

The four lichen species include:

- cryptic paw (*Nephroma occultum*): Special Concern by COSEWIC and *SARA*, Blue-listed;
- oldgrowth specklebelly (*Pseudocyphellaria rainierensis*): Special Concern by COSEWIC and *SARA*, Blue-listed;
- seaside bone (*Hypogymnia heterophylla*): Threatened by COSEWIC and *SARA*, Red-listed; and
- seaside centipede (*Heterodermia sitchensis*): Endangered by COSEWIC and *SARA*, Red-listed.

The four non-vascular plant species include:

- banded cord-moss (*Entosthodon fascicularis):* Special Concern by COSEWIC and *SARA*, Blue-listed;
- poor pocket moss (*Fissidens pauperculus*): Endangered by COSEWIC and *SARA*, Red-listed;
- rigid apple moss (*Bartramia stricta*): Endangered by COSEWIC and *SARA*, Red-listed; and
- silver hair moss (*Fabronia pusilla*): Endangered by COSEWIC and *SARA*, Red-listed.

Potential effects of the Project on these species are assessed through the use of indicators in Section 7.1.8 Vegetation and 7.1.9 Wildlife and Wildlife Habitat.

7.1.11 Heritage Resources

This subsection describes the potential Project effects on the heritage resources in Bridal Veil Falls Provincial Park. The Heritage Resources RSA consists of the broader landscape context extending beyond the Project Footprint, defined as an area of intersecting Borden Blocks (Borden and Duff 1952); shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal. A Borden Block measures 10 minutes of latitude by 10 minutes of longitude.

The potential for encountering heritage resources in Bridal Veil Falls Provincial Park has been reduced by aligning the narrowed pipeline corridor to parallel the existing TMPL right-of-way. Qualified archaeologists commenced an Archaeological Impact Assessment (AIA) for the BC portion of the narrowed pipeline corridor in July 2013 under Archaeological Research Permit 2013-165. The AIA within Bridal Veil Falls Provincial Park is expected to be conducted in 2014. For the AIA, background data was reviewed and then was complemented with ground reconnaissance with targeted areas for more intensive visual inspection, and where warranted, shovel testing. The ground reconnaissance and shovel testing programs focused on areas along the narrowed pipeline corridor that are of moderate to high potential for archaeological, historic and palaeontological sites.

7.1.11.1 Identified Potential Effects

The potential effects associated with the construction and operations of the Project on heritage resources are listed in Table D7.1.11-1.

A summary of mitigation measures is provided in Table D7.1.11-1 was principally developed in accordance with industry accepted best practices as well as industry and provincial regulatory guidelines including BC OGC (2010) and CAPP (1999, 2001).

TABLE D7.1.11-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON HERITAGE RESOURCES FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][1]	Potential Residual Effect(s)
1. Heritage Resources Indicator – Archaeological Sites			
1.1 Disruption to previously unidentified archaeological sites during AIA	Footprint	• Follow any conditions or recommendations identified in the permits for the AIA for BC. • Suspend work in proximity (*i.e.,* within 30 m) to archaeological, palaeontological or historical sites (*e.g.,* modified bone, pottery fragments, fossils) discovered during construction. No work at that particular location shall continue until permission is granted by the appropriate regulatory authority. Follow the contingency measures identified in the Heritage Discovery Contingency Plan [Appendix B of the Pipeline EPP]. • Arrange for emergency archaeological excavation of previously unidentified sites endangered by pipeline construction wherever such sites warrant attention and can be excavated without interfering with the construction schedule. When for practical reasons, the sites cannot be investigated, map and suitably flag these sites for later investigation [Section 7.0]. • Prohibit the collection of any historical, archaeological or palaeontological resources by Project personnel [Section 7.0]. • Avoid, where possible, disturbance of geodetic or legal survey monuments, to the extent feasible during construction of the pipeline, Trans Mountain's Construction Manager will immediately report such disturbance to the appropriate regulatory authority. The contractor will restore or re-establish the monument, where feasible, in accordance with the instructions of the Dominion Geodesist [Section 7.0].	• No residual effect identified.

TABLE D7.1.11-1 Cont'd

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][1]	Potential Residual Effect(s)
1.2 Disturbance to known archaeological sites during AIA	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
1.3 Disturbance of previously unidentified archaeological sites during construction	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
2. Heritage Resources Indicator – Historic Sites			
2.1 Disturbance to previously unidentified historic sites during AIA	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
2.2 Disturbance of previously unidentified historic sites during AIA	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.
3. Heritage Resources Indicator – Palaeontological Sites			
3.1 Disturbance of previously unidentified palaeontological sites during construction.	Footprint	• See recommended mitigation measures outlined in potential effect 1.1 of this table.	• No residual effect identified.

Note: 1 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.11.2 Potential Residual Effects

Heritage resources provide a window into past human experiences and the geological record, and by their very nature, are non-renewable. Once disturbed, the resource may be altered or even lost. Consequently, the primary mitigation measure in protecting heritage resources is avoidance, and secondarily, site specific mitigation developed in consultation with appropriate provincial regulatory authorities and approved by these authorities in fulfillment of Permit obligations may also be used. In order to better understand heritage resources and the historical information associated with these resources, disturbing the resource through excavations is an acceptable practice and, in many cases, the only method to collect in situ information to add to the archaeological record. Regardless of whether the excavation of the site is for academic or development purposes, the loss of heritage resource sites is generally offset by the recovery of knowledge about the site gained through meticulous identifying, cataloguing and preserving of artifacts and features in compliance with provincial guidelines.

7.1.11.3 Summary

Given that disturbances to heritage resources by the Project in Bridal Veil Falls Provincial Park are effectively offset by knowledge gained through the mitigation approved by the provincial regulatory authorities, no residual effects on heritage resource indicators have been identified and, consequently, no further evaluation of the effects of the Project on heritage resources is warranted.

7.1.12 Traditional Land and Resource Use

This subsection describes the potential Project effects on potential traditional land and resource use (TLRU) sites in Bridal Veil Falls Provincial Park. The TLRU LSA includes the zones of influence of water quality and quantity, air emissions, acoustic environment, fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat and heritage resources since TLRU is dependent on these resources; shown in Figure 6.2.2-6 of the Introduction to the Draft Stage 2 Detailed Proposal. The TLRU RSA includes the RSA boundaries of water quality and quantity, air emissions, acoustic environment, fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat and heritage resources; shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal.

7.1.12.1 Identified Potential Effects

The potential effects associated with the construction and operations of the Project on traditional land and resource use (TLRU) are listed in Table D7.1.12-1.

To date, no TLRU sites have been identified within the narrowed pipeline corridor in Bridal Veil Falls Provincial Park. However, Trans Mountain will continue to engage Aboriginal communities through all phases of the Project. Traditional land and resource use information received from participating communities will be reviewed in order to confirm literature results and mitigation measures including those provided in the Pipeline EPP. Any additional site-specific mitigation measures resulting from these studies will be provided in the updated Pipeline EPP prior to construction.

The construction of the Project has the potential to directly and indirectly disrupt subsistence sites and activities, as well as the broader ecological system, through the temporary physical disturbance of land or resources. Subsistence sites and activities may also be affected by Project activities resulting from limited access and/or increased public access to traditional harvesting areas and increased pressure on environmental resources.

The operations phase of the Project will affect TLRU primarily through temporary disturbances related to site-specific maintenance.

A summary of mitigation measures provided in Table D7.1.12-1 was principally developed in accordance with industry accepted best practices and procedures and provincial regulatory authority guidelines related to specific elements such as fish and fish habitat, vegetation, wildlife and wildlife habitat, and heritage resources.

TABLE D7.1.12-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON TRADITIONAL LAND AND RESOURCE USE FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Traditional Land and Resource Use Indicator – Subsistence Activities and Sites			
1.1 Disruption of use of trails and travelways	Footprint	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Upon Footprint finalization, applicable mitigation options listed below for previously identified trails and travelways within the narrowed pipeline corridor will be confirmed based on the following criteria: the location of the site with respect to the proposed area of development, the relative importance of the site to the community, and the potential for an alternative mitigation strategy to reduce or avoid sensory disturbance. • Should additional trails and travelways be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: – detailed recording and mapping to within 100 m on both sides of the pipeline right-of-way; in partnership with community representatives, a decision is then made about the relative importance of the trail and how best to maintain and control access; – signage or scheduling construction during periods of least impact; and/or – alternative site-specific mitigation strategies recommended by participating Aboriginal communities.	• Disturbance of trails and travelways during construction and site-specific maintenance.

TABLE D7.1.12-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.1 Disruption of use of trails and travelways (cont'd)	See above	• Implement appropriate measures identified in the Heritage Resources Discovery Contingency Plan [Appendix B]. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• See above.
	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during the construction and site-specific maintenance activities (refer to Section 7.2.1).
1.2 Alteration of plant harvesting sites	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Ensure equipment arrives at all construction sites clean and free of soil or vegetative debris. Inspect and identify equipment deemed to be acceptable with a suitable marker, such as a sticker. Do not allow any equipment arriving in a dirty condition onsite until it has been cleaned [Section 7.0]. • Should additional plant harvesting sites be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: – limiting the use of chemical applications; – replacement of plant species during reclamation; – avoidance of the site; and/or – alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • See Section 7.1.8 Vegetation for additional mitigation measures. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.
1.3 Disruption of subsistence hunting activities	LSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • See Section 7.1.9 Wildlife and Wildlife Habitat for mitigation relevant to sensory disturbance, loss or alteration of wildlife habitat, injury and mortality.	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.

TABLE D7.1.12-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.3 Disruption of subsistence hunting activities (cont'd)	See above	• Should additional hunting sites be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: – adhering to species specific timing constraints to the extent feasible; – leaving breaks in the pipeline trench to allow animals to cross; – limiting the use of chemical applications; and/or – alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • See Section 7.1.5 Acoustic Environment for additional mitigation measures. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• See above.
1.4 Disruption of subsistence trapping activities	LSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Prohibit the vandalism or theft of trapper equipment or trapped animals if they are observed on the construction right of way or the construction site prior to clearing [Section 7.0]. • Should additional trapping sites or trap line equipment be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: – maintaining access to the trap line; – moving of trap line equipment by the trapper prior to construction; and/or – alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • See Section 7.1.5 Acoustic Environment for additional mitigation measures. • See Section 7.1.9 Wildlife and Wildlife for mitigation relevant to sensory disturbance, loss or alteration of wildlife habitat, and wildlife mortality. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.
1.5 Disruption of subsistence fishing activities	LSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • Prohibit recreational fishing by Project personnel on or in the vicinity of the construction right of way. The use of the construction right of way to access fishing sites is prohibited [Section 7.0].	• Alteration of subsistence resources. • Disruption of subsistence activities during construction and site-specific maintenance.

TABLE D7.1.12-1 Cont'd

Potential Effect	Spatial Boundary[1]	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.5 Disruption of subsistence fishing activities (cont'd)	See above	• Should additional fishing sites be identified during ongoing engagement with Aboriginal communities, implement the TLU Sites Discovery Contingency Plan [Appendix B]. Mitigation may include one or more of the following measures: – recording and mapping of fishing locales; – strict adherence to the legislation, standards and guidelines set by provincial and federal regulatory authorities for watercourse crossings; and/or – alternative site-specific mitigation strategies recommended by participating Aboriginal communities. • See Section 7.1.3 Water Quality and Quantity for mitigation measures relevant to potential effects on water quality and quantity. • See Section 7.1.6 Fish and Fish Habitat for mitigation measures relevant to potential effects on fish and fish habitat. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• See above
2. Traditional Land and Resource Use Indicator – Cultural Sites			
2.1 Disturbance of gathering places	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • See Section 7.1.4 Air Emissions and Section 7.1.5 Acoustic Environment for measures pertaining to nuisance air and noise emissions, respectively. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site specific maintenance activities (refer to Section 7.2.1).
2.2 Disturbance of sacred sites	RSA	• Provide Aboriginal communities with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities [Section 4.0]. • Install signage notifying of construction activities in the area [Section 4.0]. • Work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members [Section 4.0]. • See Section 7.1.4 Air Emissions and Section 7.1.5 Acoustic Environment for measures pertaining to nuisance air and noise emissions, respectively. • Implement applicable mitigation measures listed above during maintenance activities (*e.g.,* integrity digs).	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site specific maintenance activities (refer to Section 7.2.1).

Notes: 1 LSA = TLRU LSA; RSA = TLRU RSA.
2 Detailed mitigation measures are outlined in the Pipeline EPP (Appendix A of this Proposal).

7.1.12.2 Significance Evaluation of Potential Residual Effects

To date, Trans Mountain has not been made aware of any use of the lands within the narrowed pipeline corridor in Bridal Veil Falls Provincial Park for traditional activities. Nevertheless, Trans Mountain assumes that TLRU activities could be potentially practiced within the park.

Table D7.1.12-2 provides a summary of the significance evaluation of the potential residual socio-economic effects of the construction and operations of the proposed pipeline on TLRU indicators in Bridal Veil Falls Provincial Park. The rationale used to evaluate the significance of each of the residual socio-economic effects is provided below.

TABLE D7.1.12-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON TRADITIONAL LAND AND RESOURCE USE FOR BRIDAL VEIL FALLS PROVINCIAL PARK

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
				Duration	Frequency	Reversibility				
1	Traditional Land and Resource Use Indicator – Subsistence Activities and Sites									
1(a)	Disturbance of trails and travelways during site-specific maintenance.	Negative	Footprint	Short-term	Periodic	Short-term	Medium	Low	Moderate	Not significant
1(b)	Alteration of subsistence resources.	Negative	RSA	Short-term	Periodic	Long-term	Medium	Low	Moderate	Not significant
1(c)	Disruption of subsistence activities during construction and site-specific maintenance.	Negative	RSA	Short-term	Periodic	Long-term	Medium	Low	Moderate	Not significant
1(d)	Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site-specific maintenance activities.	Negative	RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant
2	Traditional Land and Resource Use Indicator – Cultural Sites									
2(a)	Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions and noise) during construction and site-specific maintenance activities.	Negative	RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant

Notes: 1 LSA = TLRU LSA; RSA = TLRU RSA.

2 Significant Residual Socio-economic Effect: A residual socio-economic effect is considered significant if the effect is predicted to be:

- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

Traditional Land and Resource Use Indicator – Subsistence Activities and Sites

The following discusses the significance rationale for the potential residual effects identified related to the subsistence activities and sites indicator.

Disturbance of Trails and Travelways During Construction and Site-Specific Maintenance

Disturbance of trails and travelways during construction is anticipated to result from short-term physical disturbance of land and access limitations that may affect the practice of traditional activities by Aboriginal communities. Similar effects of reduced access may occur during periods of site-specific maintenance.

To date, no trails and travelways have been identified along the narrowed pipeline corridor within Bridal Veil Falls Provincial Park. If trails and travelways are identified along the narrowed pipeline corridor in Bridal Veil Falls Provincial Park during ongoing engagement with Aboriginal communities, the proposed mitigation measures described in Table D7.1.12-1 will be implemented to mitigate the potential adverse effects of the Project on these site types and will be dependent upon the type of site identified.

Additional measures to reduce the disruption of trails and travelways include notification regarding construction schedules and pipeline route maps, installing signage notifying of construction activities in the area and working with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members.

Despite the implementation of the proposed mitigation measures, traditional land and resource users may still be unable to use, or be deterred from using, certain areas at times during construction and periods of site-specific maintenance and consequently, the magnitude of the residual effect is considered to be medium (Table D7.1.12-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Footprint – trails, and travelways may be physically disturbed if occurring within the construction right-of-way and TWS.
- Duration: short-term – events causing the effects will be construction activity or site-specific maintenance that would occur within any one year period during operations.
- Frequency: periodic – construction and site-specific maintenance activities will occur intermittently but repeatedly throughout the assessment period.
- Reversibility: short-term – effects will be focused on the construction phase or site-specific maintenance that would occur within any one year period during operations.
- Magnitude: medium – it is expected that Project-related disturbances would be temporary through the implementation of the proposed mitigation measures during construction and operations to reduce, but not eliminate, potential effects on disturbance of trails and travelways. Mitigation strategies are also in place in the event any unidentified subsistence sites are discovered.
- Probability: low - to date no trails and travelways have been identified within the narrowed pipeline corridor in Bridal Veil Falls Provincial Park.
- Confidence: moderate – based on Project information and the professional experience of the assessment team.

Alteration of Subsistence Resources

Subsistence resources may be disturbed or altered during construction and operations of the Project. The alteration of subsistence activities could manifest itself through changes to local harvesting locales, behavioral alteration or sensory disturbance of environmental resources or increased public access to traditional harvesting areas and increased pressure on environmental resources. The operations of the proposed pipeline will affect subsistence resources primarily due to temporary disturbances related to maintenance activities.

To date, no subsistence harvesting sites have been identified within the narrowed pipeline corridor in Bridal Veil Falls Provincial Park. If subsistence harvesting sites are identified along the narrowed pipeline corridor in Bridal Veil Falls Provincial Park during ongoing engagement with Aboriginal communities, the proposed mitigation measures described in Table D7.1.12-1 will be implemented to mitigate the potential adverse effects of the Project on these site types and include measures outlined under the assessment of relevant environmental resources (*e.g.,* air emissions, acoustic environment, fish and fish habitat, wildlife and wildlife habitat, vegetation).

Despite the implementation of the proposed mitigation measures, traditional land and resource users may still be unable to use, or be deterred from using, certain areas at times during construction and periods of site-specific maintenance. Changes to the distribution and abundance of resources could in turn result in loss or alteration of harvesting areas, which could result in indirect effects such as harvesters having to spend more time and money to travel further for subsistence activities. Therefore the magnitude of the residual effect is considered to be medium (Table D7.1.12-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: TLRU RSA – potential effects may extend beyond the Footprint into ZOI of target environmental resources.
- Duration: short-term – events causing the effects will be construction activity or site-specific maintenance that would occur within any one year period during operations.
- Frequency: periodic – construction and site-specific maintenance activities will occur intermittently but repeatedly throughout the assessment period.

- Reversibility: long-term – the effects of disturbance to traditionally harvested resources will be dependent on each target species' sensitivities and could extend greater than 10 years following decommissioning and abandonment, once native vegetation regenerates over the Project Footprint.

- Magnitude: medium – the effects assessment results for fish and fish habitat, wildlife and wildlife habitat and vegetation indicates that effects to traditionally harvested resources may be detectable and is dependent on each target species' sensitivities.

- Probability: low – to date no subsistence resources have been identified by Aboriginal communities within the narrowed pipeline corridor in Bridal Veil Falls Provincial Park.

- Confidence: moderate – based on Project information and the professional experience of the assessment team.

Disruption of Subsistence Activities During Construction and Site-Specific Maintenance

The disruption of subsistence hunting, fishing, trapping and plant gathering activities is a potential residual effect of interactions between traditional resource users and construction and operations activities of the Project. In the event that subsistence activities are disrupted by the construction or operations of the Project, the interruption could mean that the traditional resource user misses the harvest opportunity or that their participation is curtailed. The disruption of subsistence activities also refers to the possibility that traditional resource users could be prevented from accessing key harvesting areas resulting from limited access or increased public access to traditional harvesting areas. The operations of the proposed Project will affect subsistence activities primarily due to temporary disturbances related to site-specific maintenance.

To date, Trans Mountain has not been made aware of any subsistence activities along the narrowed pipeline corridor within Bridal Veil Falls Provincial Park. Nevertheless, Trans Mountain assumes that subsistence activities could be potentially practiced within the park, although of low probability (Table D7.1.12-2, point 1[c]).

Aboriginal communities will be provided with the anticipated construction schedule and pipeline route maps, a minimum of two weeks prior to the start of construction in the vicinity of their respective communities. Signage will be installed, notifying of construction activities in the area. Trans Mountain will work with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members. A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: TLRU RSA – the proposed Project may affect subsistence activities beyond the construction footprint and may also indirectly affect the distribution of traditional resource users in other areas of the TLRU RSA.

- Duration: short-term – events causing the effects will be construction activity or site-specific maintenance that would occur within any one year period during operations.

- Frequency: periodic – construction and site-specific maintenance activities will occur intermittently but repeatedly throughout the assessment period.

- Reversibility: long-term – the disruption of subsistence hunting, trapping, fishing and plant gathering activities during construction is limited to the construction phase of the Project, however, changes to preferred harvesting locales could result in indirect effects such as harvesters having to spend more time and money to travel further for subsistence activities, and could extend greater than 10 years following decommissioning and abandonment, once native vegetation regenerates over the Project Footprint.

- Magnitude: medium – mitigation measures are in place in the event any unidentified subsistence activities and land users are discovered and given that the effects assessment results for fish and fish habitat, vegetation, wetlands, and wildlife and wildlife habitat demonstrate that equivalent land use capability will be maintained by the application of the mitigation strategies described in this Draft Stage 2 Detailed Proposal and in the Pipeline EPP. It is expected that Project-related disruptions would be temporary through the implementation of the proposed mitigation measures during the construction and operations phases to reduce, but not eliminate, the potential effects on subsistence activities.

- Probability: low – to date no subsistence activities and land users have been identified within the TLRU RSA.
- Confidence: moderate – based on Project information and the professional experience of the assessment team.

Sensory Disturbance for Aboriginal and Non-Aboriginal Local Residents and Land Users (from Nuisance Air Emissions and Noise)

The construction and site-specific maintenance of the Project may result in the sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (Table D7.1.12-2, point 1[d]). This potential residual effect is assessed under the Visitor Enjoyment indicator of Recreational Values in Section 7.2.1. The significance evaluation of this residual effect is provided in Section 7.2.1 which includes all land and resource users, provides an explanation of the rationale and significance criteria.

Traditional Land and Resource Use Indicator – Cultural Sites

The following discusses the significance rationale for the potential residual effect identified related to the cultural sites indicator.

Sensory Disturbance for Aboriginal and Non-Aboriginal Local Residents and Land Users (from Nuisance Air Emissions and Noise)

The construction and site-specific maintenance of the Project may result in the sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (Table D7.1.12-2, point 2[a]). This potential residual effect is assessed under the Visitor Enjoyment indicator of Recreational Values in Section 7.2.1. The significance evaluation of this residual effect is provided in Section 7.2.1 which includes all land and resource users, provides an explanation of the rationale and significance criteria.

7.1.12.3 Summary

As identified in Table D7.1.12-2, there are no situations for TLRU indicators that would result in a significant residual socio-economic effect. Consequently, it is concluded that the residual socio-economic effects of pipeline construction and operations on the conservational values of Bridal Veil Falls Provincial Park related to TLRU will be not significant.

7.2 Recreational Values of Bridal Veil Falls Provincial Park

Bridal Veil Falls Provincial Park is a popular park for picnicking, hiking and viewing the falls. The park offers hiking and natural study opportunities for park visitors and heavily shaded viewing areas as well as picnicking areas which creates a pleasant environment and acts as a buffer to the noise sources and air emissions along Highway 1.

7.2.1 Visitor Enjoyment and Safety

This subsection describes the potential Project effects on visitor enjoyment and safety values within Bridal Veil Falls Provincial Park. This refers to the use of the land and resources by people, in both a consumptive and non-consumptive manner. Aesthetic attributes of human use areas are also considered in this *discussion (e.g.,* sensory disturbance, changes in viewshed).

Visitor enjoyment and safety amalgamates relevant components from the human occupancy and resource use (HORU) and infrastructure and services elements in Volume 5B of the Facilities Application, particularly indicators related to parks and protected areas, outdoor recreation use and transportation infrastructure. Spatial boundaries for visitor enjoyment follow the spatial boundaries outlined for the HORU element. Spatial boundaries for visitor safety follow the spatial boundaries outlined for the infrastructure and services element; shown in Figure 6.2.2-2 of the Introduction to the Draft Stage 2 Detailed Proposal.

7.2.1.1 Identified Potential Effects

The potential effects associated with the construction and operations of the proposed pipeline on visitor enjoyment and safety indicators are listed in Table D7.2.1-1.

A summary of mitigation measures provided in Table D7.2.1-1 was principally developed in accordance with industry accepted best practices. A full list of socio-economic mitigation measures is found in the Socio-economic Management Plan (SEMP) (Section 8.0) of the Pipeline EPP.

TABLE D7.2.1-1

POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VISITOR ENJOYMENT AND SAFETY FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1. Visitor Enjoyment and Safety Indicator – Visitor Enjoyment			
1.1 Physical disturbance to Bridal Veil Falls Provincial Park	Footprint	• Minimize disturbance of valued natural features with a non-traditional human use (*e.g.*, recreational trails, recreational use areas, key use areas within Bridal Veil Falls Provincial Park) during final route refinement to the extent practical [SEMP Section 8.4.6]. • Provide provincial and federal regulatory authorities, municipal/regional governments; Aboriginal communities; BC Parks and recreational organizations with final routing information, including maps, as well as construction schedule information [SEMP Section 8.4.6]. • Install signs in Bridal Veil Falls Provincial Park and known recreational use areas in the vicinity notifying users of construction activities and timing [SEMP Section 8.4.6]. • Develop and implement a communication plan for sharing information about key Project construction milestones and information with the general public in affected areas [SEMP Section 8.4.6]. • Ensure any changes in planned timing or location of construction activities is communicated to the public, relevant municipal and regional governments, Aboriginal communities, BC Parks and formal recreation organizations in affected areas [SEMP Section 8.4.6]. • Apply all measures pertaining to HORU in the SEMP and all measures pertaining to notification and vegetation in the Pipeline EPP.	• Physical disturbance to natural and built features in protected areas during construction and site-specific maintenance.
1.2 Physical disturbance to facilities, including trails and trailheads, within Bridal Veil Falls Provincial Park	HORU RSA	• Avoid disturbance of built features during final route refinement, to the extent practical [SEMP Section 8.4.6]. • Narrow the construction right-of-way at key locations to avoid valued built or natural features, to the extent practical [SEMP Section 8.4.6]. • Ensure closure signage is placed on affected established trails or trailheads. • Contact appropriate regulatory authorities and municipal tourism offices prior to construction activities and provide maps and schedules of the proposed construction activities to enable them relay information about possible trail and recreational use area closures [SEMP Section 8.4.6]. • Develop and implement a communication plan for sharing information about key Project construction milestones and information with the general public in affected areas [SEMP Section 8.4.6]. • Apply all measures pertaining to HORU in the SEMP and all measures pertaining to notification and vegetation in the Pipeline EPP.	• Decrease in quality of the outdoor recreational experience of Aboriginal and non-Aboriginal resource users during construction.

TABLE D7.2.1-1 Cont'd

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
1.3 Change to access of protected area	HORU RSA	• Maintain access to established recreation features, through the clearing, construction and reclamation period [SEMP Section 8.4.6]. • Deactivate and reclaim temporary access routes and sites where required to construct the Project once Project construction is complete [SEMP Section 8.4.6]. • Place signage on access roads in the vicinity of construction activities to ensure users are aware that construction activities are taking place [SEMP Section 8.4.6]. • Bore under paved and high use roads [SEMP Section 8.4.6]. • Where minor roads are crossed that may affect established community use/access routes, complete an open cut crossing within one day, to the extent practical [SEMP Section 8.4.6]. • Provide provincial and federal regulatory authorities, municipal/regional governments; Aboriginal communities; BC Parks; and recreational organizations with final routing information, including maps, as well as construction schedule information [SEMP Section 8.4.3]. • Develop Traffic Control Plans for site specific sections of roads affected by the Project [SEMP Section 8.4.3]. • Develop a communication plan for activities that impact normal traffic flow, such as road closures, detours [SEMP Section 8.4.3]. • Develop and implement a communication plan for sharing information about key Project construction milestones and information with the general public in affected areas [SEMP Section 8.4.6]. • Ensure any changes in planned timing or location of construction activities is communicated to the public, relevant municipal and regional governments, Aboriginal communities, BC Parks and formal recreation organizations in affected areas. • Apply all other measures pertaining to notification and access in the SEMP.	• Change in land use patterns during construction and site-specific maintenance.
1.4 Sensory disturbance of land and resource users	HORU RSA	• Adhere to all federal and provincial guidelines and legislation for noise management. • Use only the size and power of tools necessary to limit noise from power tool operations. Ensure stationary equipment, such as compressors and generators, will be located away from noise receptors, to the extent feasible. • Maintain noise suppression equipment (*e.g.*, silencers) on all construction machinery and vehicles. • Enclose noisy equipment and use baffles such as material storage and subsoil piles, where and when feasible, to limit the transmission of noise beyond the construction site. • Restrict the duration that vehicles and equipment are allowed to site and idle to less than 1 hour, unless air temperature is less than 0°C. • To reduce air and noise emissions from Project-related vehicles, use multi-passenger vehicles for the transportation of crews to and from the job sites, where feasible. Actively encourage car-pooling when shuttle bus services are not practical.	• Sensory disturbance for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions, noise and visual effects) during construction and site-specific maintenance activities.

TABLE D7.2.1-1 Cont'd

Potential Effect	Spatial Boundary	Key Recommendations/Mitigation Measures [EPP Reference][2]	Potential Residual Effect(s)
2. Visitor Enjoyment and Safety Indicator – Visitor Safety			
2.1 Increased traffic due to transportation of workers and supplies	Socio-economic RSA	• Develop estimates of Project-related traffic volumes associated with all Project components, related to both the movement of workers and the movement of equipment and materials. • Continue to consult with the BC Ministry of Transportation and relevant municipalities regarding traffic volumes anticipated and the traffic management protocols. • Develop a traffic and Access Control Management Plan for the Project and Traffic Control Plans for particular contracts. • Where possible, provide daily shuttle bus service from designated staging areas to work sites. • Actively encourage carpooling for times when shuttles/buses is not practical or available. • Communicate with local police and emergency services personnel to keep these organizations informed of traffic schedules. • Develop a communication plan for activities that impact normal traffic flow, such as road closures, detours. • Apply all other transportation and traffic related measures outlines in the Pipeline EPP.	• Increase in traffic on highways and access roads during construction. • Sensory disturbances for Aboriginal local residents and land use (refer to potential effect 1.4 of this table). • Increase in traffic related injury and mortality.

Note: 1 Detailed mitigation measures are outlined in the SEMP and the Pipeline EPP (Appendix A of this Proposal).

7.2.1.2 Significance Evaluation of Potential Residual Effects

Table D7.2.1-2 provides a summary of the significance evaluation of the potential residual effects of the construction and operations of the proposed pipeline in Bridal Veil Falls Provincial Park on visitor enjoyment and safety indicators. The rationale used to value the significance of each of the residual socio-economic effects is provided below.

TABLE D7.2.1-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PIPELINE CONSTRUCTION AND OPERATIONS ON VISITOR ENJOYMENT AND SAFETY FOR BRIDAL VEIL FALLS PROVINCIAL PARK

Potential Residual Effects	Impact Balance	Spatial Boundary	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[1]
1. Visitor Enjoyment and Safety Indicator - Visitor Enjoyment									
1(a) Physical disturbance to natural and built features in protected areas during construction and site-specific maintenance.	Negative	Footprint	Short-term	Periodic	Short to medium-term	Medium	High	Moderate	Not significant
1(b) Decrease in quality of the outdoor recreational experience of Aboriginal and non-Aboriginal resource users during construction.	Negative	HORU RSA	Short-term	Isolated	Short-term	Low	High	High	Not significant
1(c) Change in land use patterns during construction and site-specific maintenance.	Negative	HORU RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant
1(d) Sensory disturbances for Aboriginal and non-Aboriginal local residents and land users (from nuisance air emissions, noise and visual effects) during construction and site-specific maintenance.	Negative	HORU RSA	Short-term	Periodic	Short-term	Low	High	High	Not significant

TABLE D7.2.1-2 Cont'd

Potential Residual Effects	Impact Balance	Spatial Boundary	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[1]
2. Visitor Enjoyment and Safety Indicator – Visitor Safety									
2(a) Increase in traffic on highways and access roads during construction.	Negative	Socio-economic RSA	Short-term	Isolated	Short-term	Low to medium	High	High	Not significant
2(b) Increase in traffic related injury and mortality.	Negative	Socio-economic RSA	Short-term	Isolated	Short-term	Negligible to medium	Low	High	Not significant

Note: 1 Significant Residual Socio-economic Effect: A residual socio-economic effect is considered significant if the effect is predicted to be:
- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

Visitor Enjoyment and Safety Indicator – Visitor Enjoyment

Physical Disturbance to Natural and Built Features in Protected Areas During Construction and Site-Specific Maintenance

Bridal Veil Falls Provincial Park will be crossed by the narrowed pipeline corridor during construction activities, as well as during periods of site-specific maintenance (*i.e.*, integrity digs).

Natural and built features within Bridal Veil Falls Provincial Park - such as interpretive signs, parking lots, picnic areas, trees, rocks, watercourses and trails - may have intrinsic, interpretive and recreational value, which may be disturbed as a result of pipeline construction and site-specific maintenance. The narrowed pipeline corridor crosses the Bridal Veil Falls Provincial Park access road at approximately AK 1079.6, picnic tables, car parking, an information shelter, a bathroom shelter, walking paths, trails, small foot bridges, a service area and a mowed grassy area. The park Master Plan notes that group picnicking is a popular activity on the grass area (BC MLPH 1984).

Mitigation measures related to vegetation, wetlands, wildlife and wildlife habitat and fish and fish habitat have been designed to reduce the amount of land disturbed in any park or protected area. Other key mitigation measures includes avoiding key valued natural or built features during right-of-way finalization, narrowing the right-of-way in certain areas, and restoring any trails or other valued features that may be disturbed. Even with the implementation of mitigation measures to reduce land disturbance, certain natural features with intrinsic value may be disrupted depending on the final right-of-way selection, resulting in a residual adverse effect. Assuming the implementation of all mitigation measures, the residual effect of the Project on natural and built features in protected areas is considered to be reversible in the short to medium-term (*i.e.*, residual effects will primarily occur during construction, but reclamation of valued features or areas may extend into the first several years of operations). The magnitude of the effect is considered medium; though the effect may be primarily that of an inconvenience or nuisance, parks and protected areas have an intrinsic value to many users (Table D7.2.1-2, point 1[a]). A summary of the rationale for all of the significance criteria is provided below

- Spatial Boundary: Footprint – natural and built features within parks and protected areas will be directly affected by construction of the pipeline.
- Duration: short-term – the residual effect will be caused by construction and site-specific maintenance that may occur within any one year during operations.
- Frequency: periodic – the disturbance to natural and built features in parks and protected areas will be caused by construction and periods of site-specific maintenance that would occur intermittently but repeatedly during the assessment period.

- Reversibility: short to medium-term – disturbance to natural and built features will be primarily limited to the construction phase and periods of site-specific maintenance; but post-construction restoration of natural areas and features may extend into the first several years of operations.
- Magnitude: medium – given the intrinsic value of parks and protected areas, disruptions are considered a moderate modification in the socio-economic environment.
- Probability: high – construction activities will take place through parks and protected areas; therefore, disturbance of natural features with intrinsic value is likely.
- Confidence: moderate – particular valued built or natural features potentially disturbed will depend on right-of-way finalization.

Decrease in Quality of the Outdoor Recreational Experience of Aboriginal and Non-Aboriginal Resource Users

Bridal Veil Falls Provincial Park provides day use recreational opportunities for picnicking, walking and viewing (BC MLPH 1984). The park's primary use is as a rest stop and picnic area for Highway 1 travelers; however it is also a destination site for local and regional residents (BC MLPH 1984).

The outdoor recreational experiences of Aboriginal and non-Aboriginal resource users, such as hiking, dog walking and wildlife viewing may be affected by the physical disturbance of outdoor recreation areas during pipeline construction. Nuisance air emissions, noise and visual effects may also occur during the construction of the Project and affect all land users living, working or recreating in the vicinity of the final right-of-way.

The impact balance of this residual effect is considered negative; however, mitigation measures designed to communicate construction locations and timing to the users in the vicinity of the narrowed pipeline corridor will lessen the effect, since users will have the opportunity to choose an alternate location for recreational pursuits. Given the relatively short construction period at any given location, use of well-maintained equipment and limiting idling of equipment, the residual effect is considered to be of low magnitude and reversible in the short-term (Table D7.2.1-2, point 1[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – sensory disturbances caused by construction can extend into the HORU LSA and HORU RSA.
- Duration: short-term – the event causing the effect is construction activity.
- Frequency: isolated – the event causing the effect is confined to a specific period (*i.e.,* construction).
- Reversibility: short-term - the residual effect is limited to the construction phase.
- Magnitude: low – change may be detectable, but will primarily be that of an inconvenience or nuisance.
- Probability: high – Project construction activity will occur in areas used for outdoor recreation.A summary of the rationale for all of the significance criteria is provided below.
- Confidence: high – based feedback from stakeholders, location of the Project, and the professional experience of the assessment team.

Change in Land Use Patterns During Construction and Site-Specific Maintenance

Change in land use patterns in the HORU RSA during construction is anticipated to result from short-term physical disturbance of land, access roads and/or from alteration of traffic patterns, movements and volumes along highways and roads. A short-term disruption to access and use patterns could affect recreational users who are deterred from visiting a particular location. Similar effects regarding reduced access to land due to disturbances for all use types would occur during periods of site-specific maintenance (*i.e.,* integrity digs). Changes to land use patterns in the HORU RSA during operations are not anticipated since the pipeline corridor does not deviate from the existing TMPL right-of-way within the park.

Trans Mountain will employ mitigation measures that will assist in minimizing the above effects. Mitigation measures to reduce Project-related traffic (such as using multi-passenger vehicles and obeying traffic, road-use and safety laws) as well as low-impact road crossing construction methods will be implemented during Project construction activities, and will also minimize access and use disruptions. However, residual effects are still anticipated, as land disturbance through a range of land use areas and increased traffic on select access routes are unavoidable during specific times of the Project.

The impact balance of this residual effect is considered negative, but these residual effects of disruption to access and use patterns of land is considered to be reversible in the short-term (*i.e.,* limited to the construction phase or periods of site-specific maintenance that would occur within any one year during operations). Even after the implementation of proposed mitigation measures, users may still be unable to use, or be deterred from using, certain areas at certain times. Recreationalists may alter their use destinations away from areas that interface with Project construction. Magnitude is considered low because change may be detectable, but will primarily be that of an inconvenience or nuisance (Table D7.2.1-2, point 1[c]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – access roads to use areas in the HORU RSA may be physically disturbed by construction activity and disrupted by construction-related traffic.
- Duration: short-term – the event causing the disruption to access and use is the construction phase and site-specific maintenance during operations.
- Frequency: periodic – the event causing the disruption to access and use would occur intermittently but repeatedly (*i.e.,* specific months of construction and during site-specific maintenance that would occur during any one year of operations).
- Reversibility: short-term – the residual effect is limited to the construction phase or periods of site-specific maintenance occurring within any one year during operations.
- Magnitude: low – change may be detectable, but will primarily be that of an inconvenience or nuisance.
- Probability: high – Project activities will disturb land use areas and may impede access to specific areas at select times.
- Confidence: high – based on Project information, regional land use and access patterns, and the professional experience of the assessment team.

Sensory Disturbance for Aboriginal and Non-Aboriginal Local Residents and Land Users (From Nuisance Air Emissions, Noise and Construction-related Visual Effects) During Construction and Site-Specific Maintenance

As of 1984, the park has received approximately 100,000 visitors annually; the majority of visitors visited the park between May and September (80%) (BC MLPH 1984). The park gate is closed from approximately mid-October to early-April (BC Parks 2014). The park Master Plan anticipates that demand of park services will grow with increased traffic volumes (BC Ministry of Lands, Parks and Housing 1984).

Nuisance air emissions and noise will occur during the construction of the Project and may at times affect land users living, working or recreating in the vicinity of Project components. Possible effects may include air emissions and noise from construction equipment and vehicles, and dust from vehicles. Also, equipment, areas of land disturbance, and the activity of construction workers will be visible to nearby land and resource users during periods of construction and site-specific maintenance. There may also be periods of night lighting around construction sites. Consequently, the visual quality of the landscape adjacent to the right-of-way or other construction areas may be adversely affected by the Project over the short-term related to construction or maintenance activity.

The implementation of the proposed mitigation measures will reduce the effects of noise and air emissions on land users. Noise and air emissions levels will adhere to municipal by-laws. Nuisance air and noise emissions will also occur for isolated periods of time at specific locations during periodic site-specific maintenance activities (*e.g.*, aerial patrols, vegetation management, integrity digs) during the operations phase of the Project. Potential effects on the acoustic environment and air emissions are assessed in Sections 7.1.4 and 7.1.5.

A wide range of mitigation measures will be in place to manage air and noise effects. These include complying with local noise legislation; using only the size and power of tools necessary to limit noise from power tool operations; ensuring stationary equipment, such as compressors and generators, will be located away from noise receptors, to the extent feasible; maintaining noise suppression equipment (*e.g.,* silencers) on all construction machinery and vehicles; enclosing noisy equipment and use baffles such as material storage and subsoil piles, where and when feasible, to limit the transmission of noise beyond the construction site; and by limiting the idling of equipment.

However, even with Trans Mountain's commitment to mitigation measures, some residual sensory disturbance is anticipated. The impact balance of this residual effect is considered negative, as it will likely be undesirable for nearby residents or land/resource users. Given the successful implementation of the mitigation measures, the residual effect of nuisance air emissions, noise and visual disruption is deemed low in magnitude, as it would be limited primarily to that of a nuisance of inconvenience. The effect would be short-term in duration and periodic in frequency, as sensory disturbance would be primarily caused by construction and intermittent but repeated periods of site-specific maintenance. The potential effect is considered reversible in the short-term (Table D7.2.1-2, point 1[d]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: HORU RSA – noise and air emissions emanating from construction can extend into the HORU LSA and HORU RSA.
- Duration: short-term – the event causing the sensory disturbance is construction activity or site-specific maintenance that would occur within any one year during operations.
- Frequency: periodic – the event causing the sensory disturbance would be focused during construction, but would occur intermittently but repeatedly due to site-specific maintenance.
- Reversibility: short-term – the residual effect is limited to the construction phase or site-specific maintenance activities that would occur within any one year during operations.
- Magnitude: low – the implementation of the proposed mitigation measures would effectively reduce the effects of noise and air emissions to that of a nuisance or inconvenience.
- Probability: high – construction and site-specific maintenance activities will involve the use of heavy equipment and vehicles.
- Confidence: high – based on a good understanding of cause-effect relationships and the professional experience of the assessment team.

Visitor Enjoyment and Safety Indicator – Visitor Safety

Increase in Traffic on Highways and Access Roads During Construction

During construction, there will be an increase in traffic on highways and access roads due to Project-related vehicles. Construction-related traffic will include vehicles used for the transportation of equipment, supplies and workers to various locations along the narrowed pipeline corridor. Highway 1 will be the major highway most likely to be used for construction of the Project within the Bridal Veil Falls Provincial Park. Access to Bridal Veil Falls Provincial Park is off Highway 1, which enhances the park's value. The access road is crossed by the narrowed pipeline corridor at approximately AK 1079.6. It is a paved, high grade road which is planned on being bored. The park Master Plan anticipates that demand of park services will grow with increased traffic volumes (BC MLPH 1984).

Ground transportation to the Bridal Veil Falls Provincial Park construction spread would be primarily via Highway 1. It is anticipated that most regionally-based personnel would use ground transport from their home community to work locations. Pipeline staging areas will have a combination of work vehicles and crew buses. Existing Annual Average Daily Traffic (AADT) varies in the Project regions. Overall Monthly Average Daily Traffic (MADT) volumes have remained consistent from 2010 to 2012. The permanent traffic measurement sites located near Hope and in Chilliwack for Highway 1 are considered seasonal, as evidenced by the difference in monthly average daily traffic between winter and summer months. Increased traffic during summer months is likely due to travel associated with tourism and recreation.

At the time of writing, detailed traffic estimates and logistics plans were not available for the proposed movement of Project workers, equipment and materials. Project effects on regional highway traffic, and how Project traffic compares to overall daily traffic volumes, will ultimately depend on the source of construction equipment, construction camp modules and other supplies and materials (especially pipe), as well as the methods used to transport these items to construction sites. Pipe and other materials obtained from Canadian or North American suppliers can be transported by rail, offloaded at rail sidings at key points within the Socio-economic RSA and transported relatively short distances by truck to construction sites.

Trans Mountain will develop detailed traffic estimates as construction and Project planning related to the movement of people, materials and equipment continues. Trans Mountain will also develop further logistics information on transportation modes and routes to be used during the construction phase, as well as timing transportation movements to each construction spread and/or facility location. This information will be further evaluated in the context of existing regional traffic volumes, and will become part of the overall information that is shared with local governments, Aboriginal communities, resource users, BC Parks and other stakeholders. This information will also be discussed with provincial transportation authorities during the course of the ongoing consultation planning and construction.

Trans Mountain will employ a number of measures to reduce Project-related vehicles and limit the effects associated with construction-related traffic near and within Bridal Veil Falls Provincial Park, including providing daily shuttle bus services from staging areas to work sites and for local workers from pre-determined regional staging areas. It is anticipated that many major equipment deliveries will come to the region via rail or ship to temporary stockpile sites along the narrowed pipeline corridor which will limit the distances travelled by heavy loads on regional highways. The increase in traffic will occur during the construction phase and the residual effect is considered to be reversible in the short-term (*i.e.*, limited to the construction phase). The frequency will be isolated since the increase in traffic is confined to a specific phase of the assessment period (*i.e.*, construction phase). An increase in traffic over current operational movements related to workers and maintenance is not anticipated during the operations phase.

The impact balance of an increase in traffic during construction is considered to be negative, as it may contribute to disruption of existing traffic movement patterns and highway/road users. Highway 1 is one of the main access routes for Bridal Veil Falls Provincial Park. An increase in traffic on these highways, particularly during summer months when there is a noticeable increase in traffic in some communities due to the tourist season, would be more than a nuisance or inconvenience to residents, travellers and other road users. While an increase in traffic due to the Project on the Highway 1 is not anticipated to be perceived by residents and other road users in the context of its heavy current use, any impediments to the movement of traffic in this busy area caused by the Project could be problematic. Certain sections of the Highway 1, such as between Hope and Chilliwack, experience substantial traffic congestion and delays on summer long weekends; any Project construction occurring on long weekends would compound this issue (Simmill pers. comm.). However, Trans Mountain will employ mitigation measures to ensure the effects are reduced.

Traffic disruptions could be more than a nuisance or inconvenience to residents, travelers and other road users in some areas. The disruption could result in the need for detours or the inability to access particular locations. Therefore, the magnitude of the residual effect is anticipated to be medium. Disruption to existing traffic movement on single-lane sections of highways, could also result in a disruption to residents, travelers and other road users such as delays due to the presence of larger, slower vehicles and temporary road closures resulting in single-lane traffic movement. In Project areas where there are numerous national, provincial and municipal highways and other roads, options are available to road users, therefore, the magnitude of the residual effect in these areas is anticipated to be low.

The probability of occurrence of the residual effect is high, since daily travel will be required to and from the work sites and materials, equipment and workers must be brought to work sites at key points during construction. The level of confidence in the prediction is also high based on the limited number of alternative transportation routes in some socio-economic regions and since daily travel will be required to and from work sites. (Table D7.1.1-2, point 2[a]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Socio-economic RSA – highways and access roads anticipated to be used by Project vehicles are located in various locations across the Socio-economic RSA.
- Duration: short-term – the movement of Project-related equipment, materials and workers during construction will cause the effect; no perceptible increases in traffic are anticipated during the operations phase.
- Frequency: isolated – the movement of equipment, materials and workers on regional highways resulting in increases in traffic is confined to a specific phase of the assessment period (*i.e.,* construction phase).
- Reversibility: short-term – the Project-related increase in traffic is limited to the construction phase.
- Magnitude: low to medium – low in areas with multiple transportation route options; medium in areas with single access routes or where the increase in construction traffic coincides with summer tourist months.
- Probability: high – Project-related traffic on highways and access roads will be present during construction.
- Confidence: high – transporting equipment and supplies will result in an increase in traffic, assuming that non-Project related traffic will remain constant.

Increase in Traffic-Related Injury and Mortality

Since the number of traffic collisions in a given area is associated with traffic volumes, an increase in Project-related traffic could be expected to result in a higher number of collisions, and with it an increase in the risk of traffic-related injuries or fatalities. It is not possible to quantify the extent of a potential increase or whether there would be a measureable, increase, because the numbers of proposed Project-related vehicles in the area of Bridal Veil Falls Provincial Park are not currently known. However, there are several factors that may modify the frequency or severity of those collisions and injuries and that suggest approaches for Trans Mountain to use in minimizing the potential impacts on public safety. These factors are: numbers of vehicles; location of vehicles; and driver behaviour.

Number of Vehicles

Safety performance functions that have been developed for different roadway types confirm that the number of collisions expected in a given area relates directly to the volume of traffic on that roadway segment. In other words, more traffic equates with more collisions (Parisien 2012). By limiting or minimizing the additional traffic put onto a road, the risk of collisions and traffic injuries is also reduced.

Project traffic will comprise both vehicles used to transport equipment and supplies, and also vehicles used to transport workers. Of these, worker transport is more amenable to being reduced, through the use of buses or vans to transport workers rather than private vehicles.

Driver Behaviour

A number of driver behaviours can contribute to the risk and severity of collisions. Driver inattention was the number one contributing factor to collisions in BC in 2007 according to the BC Motor Vehicle Branch (Motor Vehicle Branch 2007); excessive speed was the second most frequent contributing factor.

The development and strict enforcement of policies on driver behaviour, among both employees and contractors, is essential for minimizing potential effects on traffic safety. These policies will include screening of driver abstracts, provisions on observance of posted speed limits, a ban on cell-phone or tablet use, mandatory seatbelt use, fatigue management, no driving while impaired and other behaviours that can influence safety.

Concerns around traffic volume, congestion and safety have been raised as an issue in the context of the Project by a number of key informants (Hanlan, Hannah, Humphreys, Kreiner pers. comm.). The Project will increase the amount of traffic on public roads because of the need for transportation of equipment, supplies and workers to various locations along the narrowed pipeline corridor. Trans Mountain will develop detailed traffic estimates as construction and project planning continues; these detailed traffic estimates are not currently available. The increase in traffic is projected to occur mainly during the construction phase; little Project-related traffic is anticipated for the operations phase.

Mitigation measures include the development of site-specific Traffic Access and Control Plans; the use of shuttle buses, where feasible, to reduce the volume of traffic on the road; communication with local police and emergency services; the development and enforcement of mandatory minimum driving standards; and development of a driving complaint mechanism.

In summary, the Project will increase the number of vehicles in the Socio-economic RSA, both in terms of Project-related construction vehicles and vehicles used to transport workers. Evidence from the literature shows that an increase in traffic volumes results in an increased risk of traffic collisions. This in turn increases the risk of collision-related injuries and fatalities. The impact balance of this effect is characterized as negative since vehicle collisions pose a detriment to community health. The effects would extend throughout the Socio-economic RSA, and would manifest in those locations in which the Project uses vehicles on public roadways. Risk will be particularly high in collision "hot-spots" – locations (usually intersections) which have pre-existing high rates of traffic collisions. The duration is characterized as short-term and the frequency as isolated since the effect is primarily linked to the construction phase when the Project workforce will be large and when the movement of heavy machinery and vehicles is required. An increase in traffic-related injury and mortality is unlikely for the operations phase since there will be fewer workers and equipment requiring transport. The reversibility is similarly characterized as short-term since any effect would mainly be observed during the construction phase. The increase in risk of traffic-related injury and mortality is highly dependent upon the number and types of additional vehicles, the current road conditions and capacity of the roadways, driver behaviour, and the characteristics of the areas through which traffic will travel. While the addition of Project-related traffic creates an increase in collision risk, traffic-related collisions, injuries and fatalities are rare events; therefore, even though the risk increases, there is no certainty that any traffic-related injuries or fatalities will result from the increase in traffic. In addition, no regulatory standards exist for this area. The magnitude of effect is characterized as negligible to medium. The probability of occurrence is rated as low since, as noted above, traffic accidents are rare. The level of confidence in this evaluation is high, since the literature showing this cause-effect relationship relates to other areas in BC and internationally (Table D7.2.1-2, point 2[b]). A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Socio-economic RSA – effects extend throughout the Socio-economic RSA wherever worker and Project-related traffic exists and would be a primary concern in current traffic accident hot-spots.
- Duration: short-term – the event causing the potential increase in traffic-related injury and mortality is the construction phase, when the Project workforce will be large and when heavy machinery and vehicles are required.
- Frequency: isolated – the event causing the potential increase in traffic-related injury and mortality is confined to the construction phase.
- Reversibility: short-term – residual increases in traffic related injury and mortality are considered to be limited to the construction phase.
- Magnitude: negligible to medium – no regulatory standards exist for this area. While the addition of Project-related traffic creates an increase in risk, traffic-related collisions, injuries and fatalities are rare events.
- Probability: low – the probability of occurrence is rated as low since traffic collisions, injuries and fatalities are rare events.
- Confidence: high – the literature showing this cause-effect relationship relates to other areas in BC and internationally, and some stakeholders are concerned about traffic accidents.

7.2.1.3 Summary

As identified in Table D7.2.1-2, there are no situations for visitor enjoyment and safety indicators that would result in a significant residual socio-economic effect. Consequently, it is concluded that the residual socio-economic effects of pipeline construction and operations on recreational values of Bridal Veil Falls Provincial Park such as visitor enjoyment and safety will be not significant.

7.3 Synopsis

The impacts of TMEP's construction and operations on the social and environmental values of Bridal Veil Falls Provincial Park will be minimized through mitigation and reclamation. Based on the Draft Stage 2 Detailed Proposal prepared for BC Parks, Trans Mountain has concluded that the TMEP:

- is consistent with the management objectives of the Bridal Veil Falls Master Plan;
- allows for operational efficiencies of an existing pipeline system that has been operating for over 60 years in what is now Bridal Veil Falls Provincial Park;
- will result in no significant adverse residua environmental and socio-economic effects;
- will conserve the biological diversity of natural ecosystems and maintains the recreational values within Bridal Veil Falls Provincial Park;
- compensation offsets will maintain, and in some instances enhance, the objectives of the park management plans; and
- will provide positive overall economic benefit to BC.

8.0 RECLAMATION IN BRIDAL VEIL FALLS PROVINCIAL PARK

The Reclamation Plan is built upon the Pipeline EPP and environmental surveys and identifies additional measures and activities to re-establish the ecological integrity of Bridal Veil Falls Provincial Park during Project construction. The measures and other work described in the Reclamation Plan will generally apply to the Project Footprint within Bridal Veil Falls Provincial Park. Ongoing consultation with BC Parks may entail further mitigation measures and revisions to the Reclamation Plan and as such, the final Reclamation Plan will be completed prior to construction. Additional site-specific reclamation plans (*i.e.,* revegetation plan) may be required and involve further consultation with BC Parks, Aboriginal groups, stakeholders and the general public. Implementation of the measures included in the Reclamation Plan will commence during the construction phase and continue into the operations phase. Where warranted, follow-up plans will be developed to ensure that the mitigation measures, activities and other works identified in the Reclamation Plan are effective.

8.1 Reclamation Consultation

The development of the Reclamation Plan has been a collaborative effort between Trans Mountain, government agencies and interested stakeholders. In particular, input regarding reclamation measures was solicited and received from the Project environmental team (including fish, wetland, vegetation and wildlife experts) and BC Parks. Additional comments have been solicited from ENGOs and will continue throughout the preparation of the Reclamation Plan (Table 8.1-1).

TABLE D8.1-1

CONSULTATION CONTACTS

Stakeholder Group	Date of Contact	Method of Contact	Items Discussed
BC Parks	May 23, 2014	In person meeting at Bridal Veil Falls Provincial Park	Tourism, revegetation, old growth forest, seed mixes, weed and problem vegetation control and erosion.

8.2 General Reclamation Measures

Reclamation activities will be in keeping with Bridal Veil Falls Provincial Park's Master Plan and particular consideration will be given to the recreational and tourism zones as well as to the natural environments found within the park.

8.2.1 Narrowing Down

The width of the construction right-of-way will be minimized to as narrow an area as is safely feasible to reduce the clearing of old growth trees within Bridal Veil Falls Provincial Park. The old growth trees will be marked or otherwise protected (*i.e.,* fenced) throughout the duration of construction and reclamation activities.

8.2.2 Park Trails

Reclamation measures will be applied to re-establish park trails through the replacement of soil and/or aggregate surface material as well as the replacement of park/trail signage taken down during construction.

8.2.3 Natural Regeneration

Where the potential for soil erosion and non-native invasive species infestation is low, and where it is anticipated that the topsoil or root zone material contains a propagule bank (*e.g.,* seed, stem or root pieces) of suitable species, it may in some instances be preferable to not re-seed the disturbed areas (*e.g.,* wetlands). This revegetation method will facilitate the establishment of pre-disturbance vegetation through native propagule establishment on the disturbed area following clean-up and topsoil/root zone material replacement. In areas with potential erosion and weed concerns, a native perennial or non-native annual grass cover crop species will be applied. The grass cover crop species will establish rapidly to control erosion and limit weed growth while pre-disturbance vegetation establishes.

Natural regeneration is preferred over seeding with commercially available native seed where it is practical and where it is anticipated that the pre-disturbance vegetation will re-establish on the disturbed area. However, care must be taken when using natural regeneration techniques to avoid invasion of non-native invasive species, as is often the case when paralleling other linear disturbances. Moist riparian and wetland environments that will regenerate easily in a short time frame are prime candidates for natural regeneration.

8.2.4 Woody Species Revegetation

Revegetation using native tree and shrub species will occur in select areas (*e.g.,* TWS and riparian zones) in accordance with Trans Mountain's operations and maintenance procedures (*i.e.,* revegetation is allowed as long as the trenchline is not obstructed from aerial monitoring, or access to the pipeline right-of-way for maintenance and regular inspections is not compromised).

Installation of Nursery-Grown Plant Plugs

TWS, riparian and special reclamation areas will be surveyed for evidence of naturally regenerating trees, specifically sites that are cleared of coniferous vegetation. If suitable levels of naturally regenerating (from seed or vegetative propagules) deciduous or coniferous trees are not observed, then these and other areas will be considered for the installation of nursery-grown plant plugs (*i.e.,* rooted stock plugs). Native seed will be secured (through either purchase or collection) and dormant woody species cuttings will be collected, as warranted. Deciduous and coniferous rooted plugs will be installed at pre-selected sites (*e.g.,* TWS, riparian areas or for line-of-sight breaks) as determined in consultation with BC Parks Conservation Specialists. Under the guidance of a Reclamation Specialist (or other qualified professional), planting crews will install the rooted stock plugs using standardized silviculture planting equipment and techniques. The rooted stock plugs will be installed at a specified density/distribution with the purpose of initiating an early ecological recovery trajectory that will, in time, emulate the adjacent undisturbed vegetation in form and function where not influenced by Trans Mountain's operations and maintenance procedures.

Where it is determined that ungulate species may damage (browse or up-root) newly installed deciduous plants within riparian zones, protection of the trees via chemical (*e.g.,* animal repellent [DeerGuard]) or mechanical (*e.g.,* tree shields) methods may be warranted at the time of installation.

Installation of Locally Sourced Dormant Woody Species Transplants

At pre-determined locations where vegetation is disturbed by construction, the use of plant transplants may be considered. The use of dormant woody transfers is a cost effective and efficient method of re-establishing vegetation to disturbed locations. Unlike salvaging and storing dormant woody material during construction, transfers are dug when dormant, where warranted, from a location adjacent to the reclamation site that contains select plant species of a suitable size (conifers < 45 cm in height, deciduous trees < 2 cm stem calliper at ground level or 90 cm in height). Where a donor plant community is located adjacent to a potential reclamation site outside of park boundaries, a survey of the donor plant community will be completed to determine the level of plant extraction that could be achieved without affecting the form and/or function of the donor plant community.

A permit for harvesting transplants from the adjacent plant community will be discussed with the appropriate personnel.

8.2.5 Nutrient Management on Disturbed Forested Areas

A slow-release nitrogen fertilizer is proposed for application on lands that contain woody debris and/or wood chips mixed into the salvaged and replaced root zone material or that have been placed on cleared and ungrubbed portions of the construction right-of-way. The nitrogen fertilizer will serve to adjust the carbon-nitrogen ratio in these carbon rich environments to a level that will be conducive to the establishment of seeded grass species and naturally regenerating vegetation.

To avoid deposition or leaching of applied nutrient into waterbodies, nitrogen fertilizer will not be applied within a 30 m buffer to wetlands, watercourses or lakes. In addition, the fertilizer application rate will vary based on the level of woody debris and/or wood chips encountered within or on the surface of the root zone material, the soil texture and the slope of the land adjacent to waterbodies to ensure nutrient movement is minimized.

8.2.6 Seeding of Native Grass Species

Seed mixes were developed in consultation with BC Parks and consist of species native to the park or areas within the vicinity of the park (Dwg. D-01 of the Draft Stage 2 Detailed Proposal). Seeding will be conducted as soon as practical following topsoil/root zone material replacement. Drill or broadcast seeding of native seed mixes or a grass cover crop species will be conducted on most of the right-of-way. Seed mixes will be sown at locations indicated on the Environmental Alignment Sheets, unless otherwise requested by the BC Parks Area Supervisor or Conservation Specialist.

8.2.7 Erosion and Sediment Control

Erosion and sediment control (ESC) measures will be implemented to: maintain soil conservation along the proposed right-of-way, preserve existing vegetation on the adjacent land use, reduce the risk of sedimentation of Bridal Creek during and following construction activities and to facilitate the establishment of permanent vegetation along the proposed disturbance.

General ESC Measures

- Woody vegetation located on TWS areas will be cleared and not grubbed where topsoil/root zone material salvage is not anticipated.
- Topsoil/root zone material will be stored on cleared/ungrubbed TWS areas adjacent to the proposed right-of-way.
- Subsoil will be stored on geotextile when placed over ungrubbed TWS areas.
- Topsoil/root zone material and grading material (subsoil) will be stored in separate piles so as not to admix.
- Following the replacement of trench and grade subsoil, recontour the area to match the adjacent landscape profile prior to topsoil/root zone material replacement. Avoid, to the extent feasible, mixing of subsoil and topsoil/root zone material during materials replacement.
- Install/re-establish coir logs, erosion control blanket or sediment fencing within the riparian area of Bridal Creek.
- Install a non-native annual or native perennial grass cover crop species in the riparian zone to minimize competition to regenerating and installed woody vegetation and a prescribed grass seed mix through broadcast or drill seeding methods on all other exposed soils. Ensure any seed mixes or cover crop species used are approved by BC Parks.

Specific ESC Measures

ESC measures that will be considered for use on the proposed construction right-of-way are described in the following subsections:

Coir Log, Erosion Control Blanket and Sediment Fence Installation

Coir logs composed of natural fibers are designed to reduce slope length and surface water velocities (Dwg B-02). Erosion control blankets prevent scour of surface soils, conserves soil moisture and promotes vegetation establishment (Dwg D-03). Sediment fencing filters sediment from surface water that has the potential to discharge into Bridal Creek (Dwg D-04). These measures should be installed following clearing and monitored and maintained following construction until vegetation establishment occurs.

Diversion Berms

Diversion berms are intended to reduce slope length and runoff velocities, and divert runoff into well-vegetated areas. Diversion berms will be designed with a suitable spacing, slope gradient and berm height to effectively convey overland water flow, originating on the construction disturbance, away from Bridal Creek and other waterbodies (Dwg. D-05).

Rollback

Trans Mountain will avoid the use of Douglas-fir and spruce for rollback within Bridal Veil Falls Provincial Park. Select tree species (*e.g.,* pine) felled during construction will be used in these locations as rollback, to the extent allowable, to provide erosion control and habitat enhancement. The woody material felled during construction will be used as rollback, within the Bridal Creek riparian zone and TWS area to provide erosion control and habitat enhancement. The woody rollback will provide microsites to aid in the re-establishment of woody vegetation and assist in the control of soil erosion along the proposed right-of-way where woody vegetation was cleared. To obtain material required for rollback, woody slash will be salvaged during construction clearing activities in suitable quantities to allow for the placement of rollback at select locations onto the construction right-of-way following topsoil/root zone material replacement (Dwg. D-06).

Grass Seeding

Native seed mixes have been developed and native perennial and non-native annual cover crop species selected for use on construction disturbances within Bridal Veil Falls Provincial Park. An appropriate native grass seed mix, native perennial or annual non-native cover crop will be sown (drill or broadcast seeded) along the disturbed areas following topsoil/root zone material replacement at an appropriate prescribed rate.

8.3 Specific Reclamation Issues

The biophysical features listed below warrant special consideration due to the difficulty in reclaiming and/or managing them. Specific reclamation and/or management plans will be developed from ongoing consultation with BC Parks personnel as well as field surveys.

8.3.1 Watercourses

Stabilization of the banks and slopes of Bridal Creek and riparian areas prior to and immediately following construction is critical to the restoration of the habitat at this watercourse. Mitigation measures have been developed to enhance the reclamation of Bridal Creek. These measures involve the installation of numerous bank and slope protecting structures including:

- log crib structures (Dwg. D-07 of the Draft Stage 2 Detailed Proposal);
- erosion control matting (Dwg D-03 of the Draft Stage 2 Detailed Proposal);
- revegetation grass rolls (Dwg. D-08 of the Draft Stage 2 Detailed Proposal);
- sediment fences (Dwg D-04 of the Draft Stage 2 Detailed Proposal);
- biodegradable coir geotextile wraps (Dwg. D-09 of the Draft Stage 2 Detailed Proposal);
- coniferous tree revetments (Dwg. D-10 of the Draft Stage 2 Detailed Proposal); and
- cobble or riprap armouring (Dwg. D-11 of the Draft Stage 2 Detailed Proposal).

In recognition of the old growth forest adjacent to Bridal Creek and the disturbance to watercourse bed, bank and riparian area that will be created during the crossing of this watercourse, reclamation of watercourse features will be completed as per the guidelines identified in the DFO Measures to Avoid Causing Harm to Fish and Fish Habitat.

A detailed riparian reclamation plan will be developed for Bridal Creek within Bridal Veil Falls Provincial Park, and will provide measures that contribute to the reclamation of watercourse banks and riparian areas disturbed by construction of the proposed Project (*i.e.,* erosion and sediment control measures and the planting of trees and shrubs).

8.3.2 Weed and Vegetation Management Plan

Management of weeds and problem vegetation is essential to maintaining the ecological integrity of Bridal Veil Falls Provincial Park during and after Project construction. Trans Mountain will use an integrated vegetation management (IVM) approach that includes non-chemical, cultural and chemical methods to control and reduce the spread of weeds and problem vegetation. The non-chemical, cultural or chemical treatment methods used will vary with life-form and mode of reproduction of the species targeted and the location and extent of the infestation. Non-chemical and cultural treatments include hand-pulling, cultivation, mowing, burning, mulching and active restoration of native plant communities. Chemical treatments include either selective herbicides (*i.e.*, target specific plant species) or non-selective herbicides (*i.e.*, target all vegetation).

Trans Mountain will actively cooperate with BC Parks and other stakeholders to implement an IVM approach to weed and problem vegetation management as outlined in KMC's Integrated Vegetation Management Plan and the Weed and Vegetation Management Plan provided in Section 14.0 in Appendix C of the Pipeline EPP. Accurate records of weed infestations, management measures conducted and the success of these measures will be maintained so that weed and vegetation management plans can be modified as necessary from year to year.

Specific weed and problem vegetation management measures for pre-construction, construction and post-construction are provided in the Weed and Vegetation Management Plan. Further measures involving monitoring and control measures following construction are provided in Dwg. D-12 of the Draft Stage 2 Detailed Proposal.

Detailed weed and problem vegetation reports will be developed for site-specific locations, as required, following a pre-construction weed survey (scheduled for spring 2015) and consultation with BC Parks Conservation Specialists. Weed and problem vegetation infestations and recommended mitigation measures will be incorporated into the Environmental Alignment Sheets.

8.3.3 Wildlife Movement, Mortality and Human Encounters

Measures to restore the effectiveness of wildlife movement corridors and that maintain biodiversity will be implemented during and after construction. These measures will include one or a combination of the following: using native plant species for restoration (Dwg. D-13 of the Draft Stage 2 Detailed Proposal); installing visual barriers along the right-of-way (Dwg. D-14 of the Draft Stage 2 Detailed Proposal); and the salvage and installation of wildlife habitat trees (Dwg. D-15 of the Draft Stage 2 Detailed Proposal).

DRAWINGS

LIST OF DRAWINGS

Drawing D-01	Seed Mix Detail – Finn Creek Provincial Park
Drawing D-02	Coir/Straw Log Installation
Drawing D-03	Erosion Control Matting/Blanket
Drawing D-04	Sediment Fence
Drawing D-05	Cross Ditches and Diversion Berms
Drawing D-06	Rollback
Drawing D-07	Cribwall Staked Logs
Drawing D-08	Streambank Protection - Grass Roll
Drawing D-09	Streambank Protection - Hedge Brush Layering
Drawing D-10	Streambank Protection – Coniferous Tree Revetment
Drawing D-11	Streambank Protection – Cobble and Riprap Armouring
Drawing D-12	Weed Control
Drawing D-13	Live Plant Salvage
Drawing D-14	Vegetation and Soil Berm - Line of Sight
Drawing D-15	Typical Wildlife Tree Enhancement Feature

CRITERIA FOR IMPLEMENTATION

Seed mixes (see tables below) will be installed at locations indicated on the Environmental Alignment Sheets, unless otherwise requested by BC Parks Area Supervisor or Conservation Specialists.

Notes:

1. Species cultivars, where applicable, will be determined at the time of procurement based on availability and suitability as determined by Trans Mountain.
2. Native seed species will be obtained from local genomes to the extent feasible.
3. All seed mix species must have Certificates of Analysis to allow for the determination of weed and undesirable species content, and germination for each species seed lot in the mix.
4. Certificates of Analysis for each seed mix species will be reviewed by Trans Mountain prior to purchase. Any seed lot with unacceptable weed contamination or viability will be rejected.
5. Seed mix species that are unavailable in sufficient quantity or quality at a reasonable cost as determined by Trans Mountain at the time of procurement will be eliminated from the mix and the proportions of other species in the mix increased.
6. Drill seeding will be used on all segments to be seeded with the exception of slopes which are too steep to safely operate the tractor and seed drill, areas too wet to access with a tractor and seed drill without causing rutting and poor seed placement, stony areas which could cause damage to the equipment or impede the ability of the drill to properly place the seed, and any other areas which cannot be feasibly reached with the seed drill.
7. Broadcast seeding will be used on lands where drill seeding cannot be conducted.
8. All seed drills and broadcast seeders will be calibrated for each seed mix using the manufacturer's recommended procedures; alternate calibration procedures may be used if approved by the Environmental Inspectors.
9. The seeding contractor will develop appropriate seeding procedures to ensure even distribution of all species in each seed mix and have these procedures approved by the Environmental Inspector. This may involve, but not be limited to:
   - using seed box agitators to prevent stratification of large and small seeds;
   - seeding large and small seed species from separate seed boxes, or in separate passes with the seeder; or
   - using an inert filler agent with the seed mix.
10. Seeding depth with seed drills will be 1-2 cm in fine textured soils and 1-3 cm in sandy soils.
11. Where site and safety conditions allow, broadcast seed will be harrowed into a depth of 1-3 cm, using standard agricultural harrows or other approved equipment. Harrowing will be conducted immediately following broadcasting. Steep slopes that cannot be safely harrowed will be hand raked, if feasible, to incorporate seed.
12. Only the salvaged or cultivated width of the construction right-of-way will be seeded with minimal overlap onto undisturbed areas. Swing-out passes will be made to seed scalped areas adjacent to the cultivated portion as needed.
13. Complete coverage of the stripped area will be ensured by using a sufficient number of passes. Damage to the native root mat adjacent to the disturbed portion of the construction right-of-way will be avoided.
14. Broadcast seeding will be delayed during high wind conditions, as directed by the Environmental Inspector.

SEED MIXES

Cover Crop
A cover crop is a fast-germinating and establishing annual/biennial or short-lived perennial grass species that is seeded to quickly stabilise topsoil, control erosion and limit weed growth while pre-disturbance vegetation reestablishes. Short-lived perennial grass cover crop species include slender/awned wheatgrass or Canada wild rye. Short-lived annual/biennial cover crop specie includes annual ryegrass. Broadcast short-lived perennial grass species seed at 10 kg/ha or 100 grams/100 m^2 and annual/biennial cover crop species at 8 kg/ha or 80 grams/100 m^2.

Seed Mixes – Bridal Veil Falls Provincial Park				
	Closed Coniferous - Moist		Riparian	
Biogeoclimatic Zone	Mix #1	%WT	Mix #2	%WT
coastal western hemlock	fringed brome	40	slender wheatgrass	75
	slender wheatgrass	20	rough hairgrass	25
	smooth wild rye	20		
	tufted hairgrass	10		
	fowl bluegrass	10	seeding rate	
			broadcast seed at 5 kg/ha	
	seeding rate			
	broadcast seed at 18 kg/ha			
	drill seed at 10 kg/ha			

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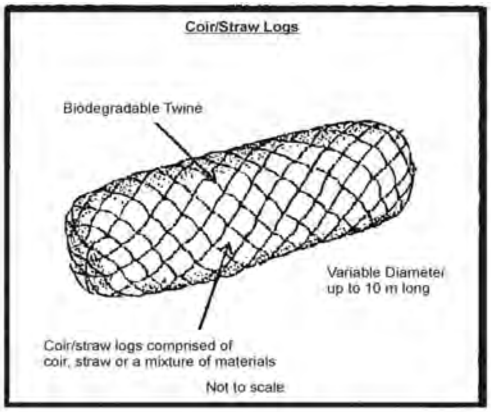
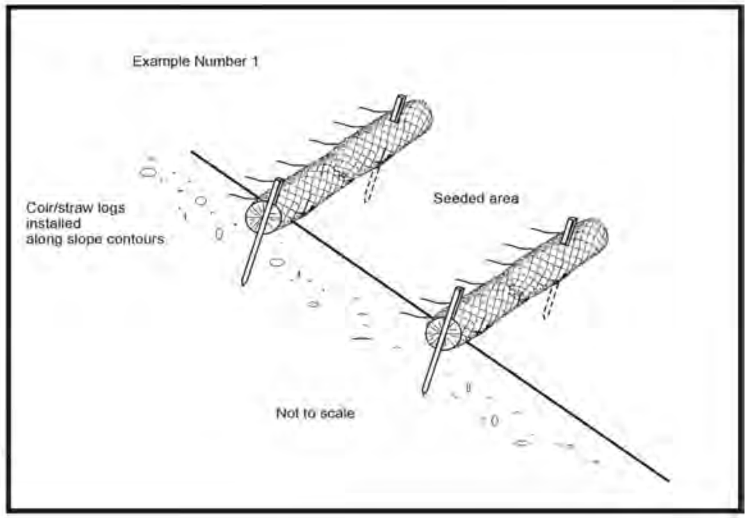
TRANS MOUNTAIN EXPANSION PROJECT

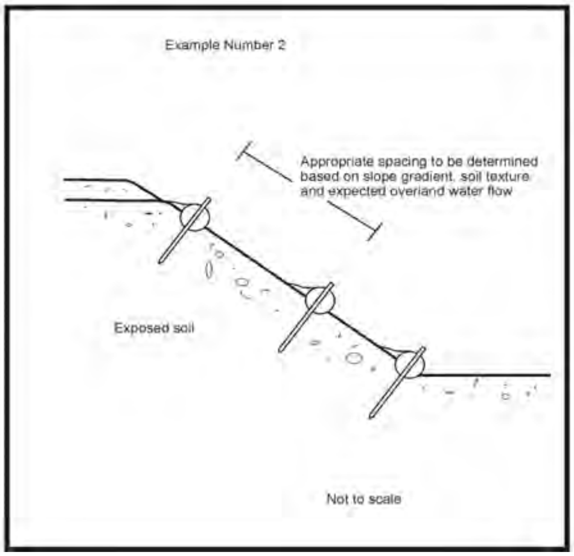
TRANSMOUNTAIN

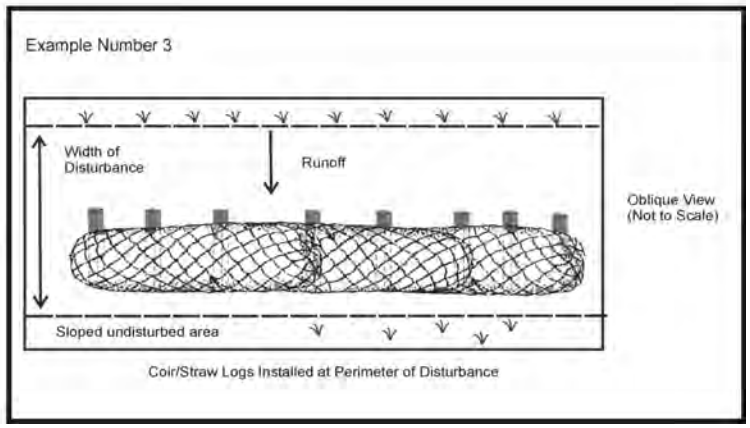
SEED MIXES

7894	August 2014	Drawing D-01









Notes:

1. Proper placement and design is critical and qualified specialists should be involved.
2. Install coir/straw logs in a shallow trench (~5-7.5 cm (2”-3”) deep), perpendicular to the direction of flow and across the entire width of the disturbance. Each end of the coir/staw log should be turned slightly up slope to help retain water and prevent flow along the outside of the coir/straw log.
3. Each coir/straw log should be secured into the ground by wooded stakes spaced every 0.9-1.2 m (3’-4’) across the length of the log. Stakes should be approximately 45 – 60 cm (18”-24”) in length and should be driven through the centre of the coir/straw log and into the ground with approximately 5 cm (2”) remaining above the coir/straw log. Stakes installed at each end of the coir/straw log should be placed approximately 5-15 cm (2”-6”) from the outer edge of the log.
4. When joining two coir/straw logs together, either tightly abut both ends or overlap each log approximately 15 cm (6”).
5. Store, move and install when dry.
6. Coir/straw logs may be seeded or dormant cuttings may be inserted.
7. Typical spacing is indicated below.

Slope Gradient (º)	Typical Spacing (approximate m (ft))
≥1:1	1.5 m (5’)
2:1<1:1	3.0 m (10’)
>4:1<2:1	5.2 m (17’)
6:1-4:1	7.6 m (25’)
<6:1	15.0 m (50’)

Adapted from CAPP *et al.* (2005)

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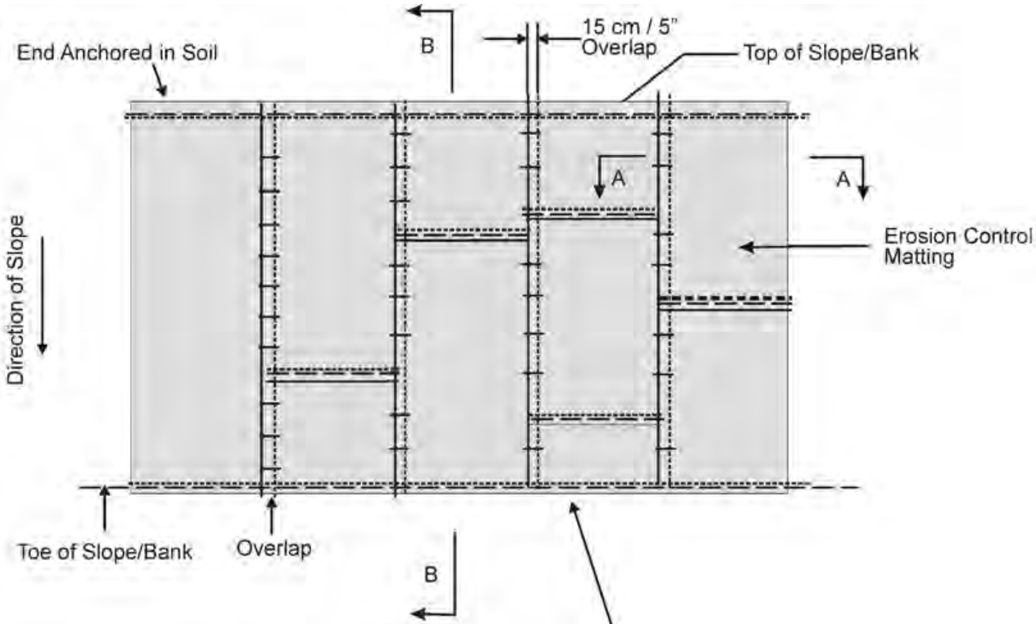
TRANS MOUNTAIN EXPANSION PROJECT

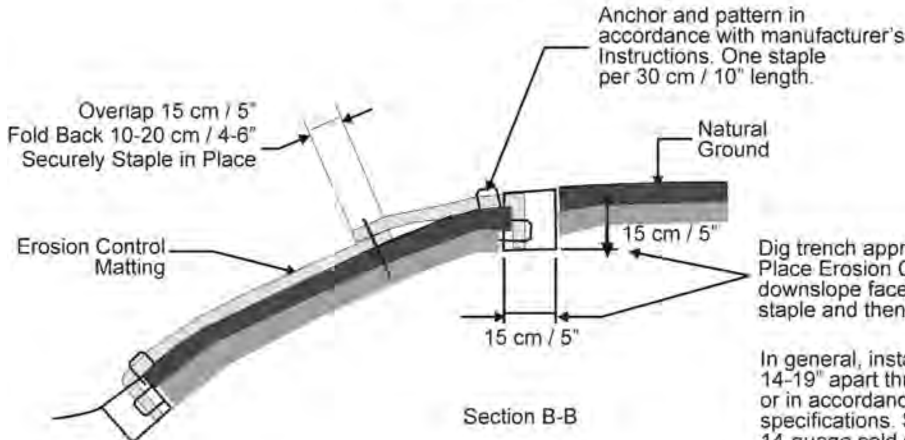
TRANSMOUNTAIN

COIR/STRAW LOG INSTALLATION

7894	August 2014	Drawing D-02

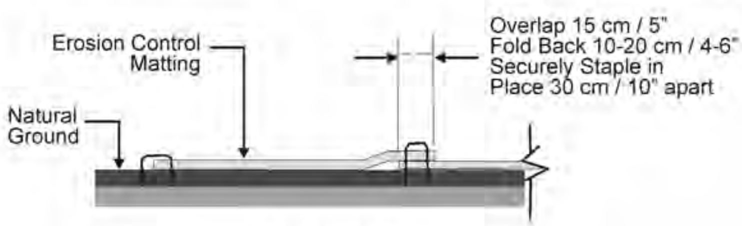


Plan View
(Not to Scale)



Section B-B

In general, install staples 45-60 cm / 14-19" apart throughout the matting, or in accordance with manufactures specifications. Staples shall be 14-guage cold drawn steel wire formed in a "U" shape not less than 30 cm / 10" length.



Section A-A

Note: When used at streambanks, erosion control matting should be secured to the bank using willow cuttings rather than staples.

Representation Only

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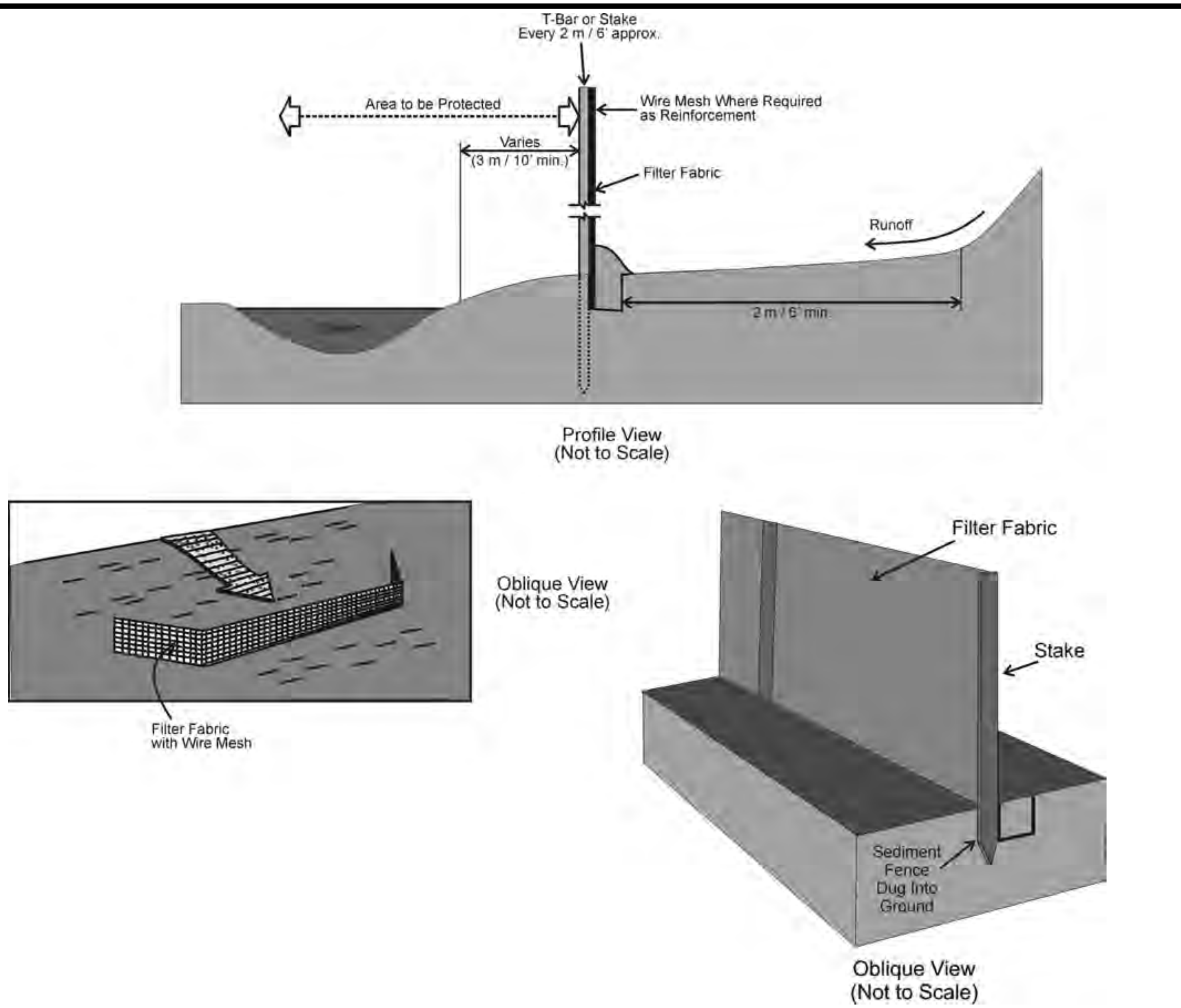
	EROSION CONTROL MATTING/BLANKET		
	7894	August 2014	Drawing D-03



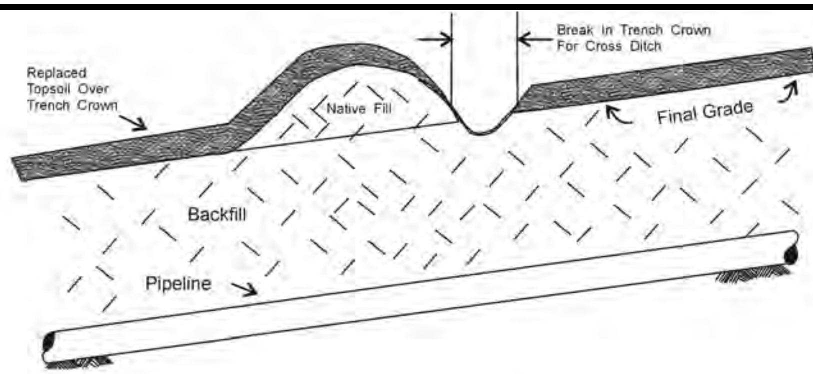
Representation Only

Notes:

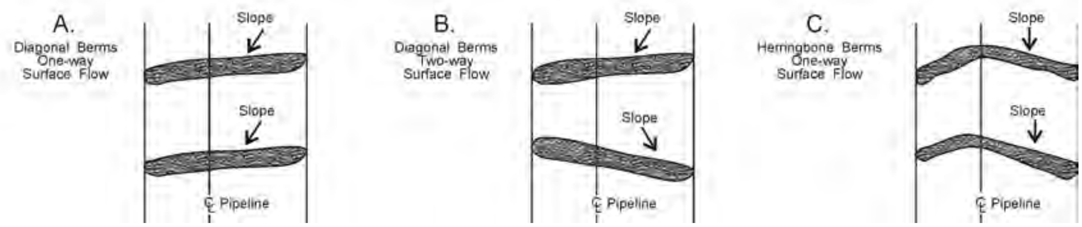
1. Watercourses that have moderate to high sensitivity of fish habitat and/or have steep approach slopes at the proposed crossings may need sediment fences during construction, as determined by Trans Mountain's Environmental Inspector(s).
2. Install sediment fences at the base of approach slopes to watercourses prior to clearing and grading using the method and materials above or other approved designs.
3. Ensure sediment fence is keyed into the substrate. Excavate a narrow trench, place the base of the sediment fence in the trench and place the fill back into the trench, securing the sediment fence in place.
4. Place sediment fences a minimum 2 m (6 feet), if feasible, from the toe of the slope in order to increase ponding volume.
5. Maintain sediment fences in place at the base of the approach slopes until revegetation of the construction right-of-way is complete.
6. In areas with frequent traffic, install two or more sediment fences in a staggered and overlapped configuration to allow vehicle passage without removal or opening of the sediment fence.
7. Ensure that sediment fences, if removed or damaged, are reinstalled or repaired prior to the end of the work day.
8. Install sediment fences, where warranted, to eliminate the flow of sediment from clean subsoil piles and disturbed areas into nearby wetlands.
9. Remove any sediment fences around wetlands that remain after the disturbed area is revegetated and the area is stable.

tera ENVIRONMENTAL CONSULTANTS	**TRANS MOUNTAIN EXPANSION PROJECT** TRANSMOUNTAIN		
	SEDIMENT FENCE		
	7894	August 2014	Drawing D-04

Profile
(Not to Scale)



Plan View
(Not to Scale)



Notes:

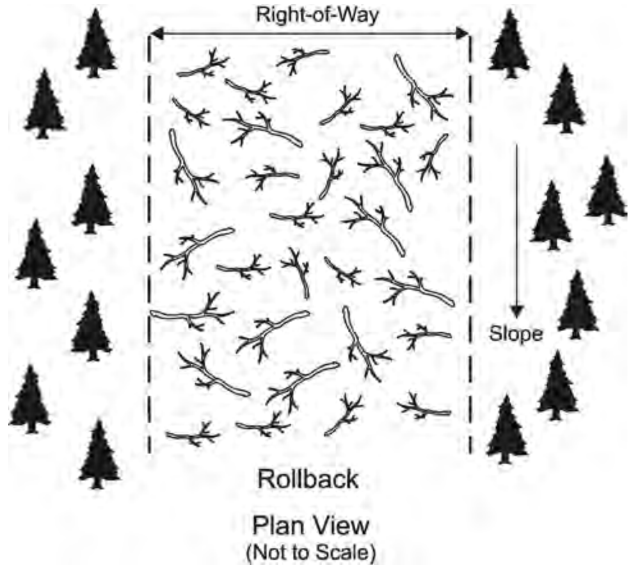
Representation Only

1. Install diversion berm and cross ditch on moderate and steep slopes on non-cultivated lands to divert surface water off the construction right-of-way. Install berms immediately downslope of trench breakers to collect seepage forced to the surface.
2. Skew berm across the construction right-of-way at downhill gradient of 5-10%.
3. Construct diversion berm of compacted native subsoils where extensive disturbance of the sod layer has occurred. Diversion berms should be constructed of timbers, imported logs or sandbags if disturbance of the sod layer is limited. Avoid use of organic material. Where native material is highly erodible, protect upslope of berm and base of cross ditch by burying a geotextile liner approximately 20 cm below the surface or armour upslope face of berm with earth-filled sand bags.
4. Typical diversion berm height and widths are approximately 0.75 m for summer construction and 1.0 m for winter construction. Trans Mountain shall inspect berms after heavy rains and the first spring following construction; replace or restore berms, if warranted.
5. Tie berms into existing berms on adjacent rights-of-way, where applicable.
6. Leave a break in trench crown immediately upslope of diagonal berm and cross ditch to allow passage of water across the construction right-of-way.
7. Use diagonal berms where direction of slope and surface water movement is oblique to construction right-of-way.
8. Use herringbone berm and cross ditch where direction of slope and surface water movement is parallel to construction right-of-way so runoff does not cross ditchline.
9. Determine location and direction of berm based on local topography and drainage patterns. Typical diversion berm spacing is indicated below.

Slope Gradient (º ;%)	Typical Spacing (m) Erosion Hazard*		
	High	Medium	Low
<7; <12	30-45	45-60	60 or more
7; 12	25	38	51
8; 14	22	33	44
9; 16	19	29	38
11; 19	16	24	32
14; 25	12	18	24
18; 33	9	14	18
27; 50	6	9	12

* High = fine sand and silts; medium = clays and coarse sands; low = rock or gravel.

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	CROSS DITCHES AND DIVERSION BERMS		
	7894	August 2014	Drawing D-05



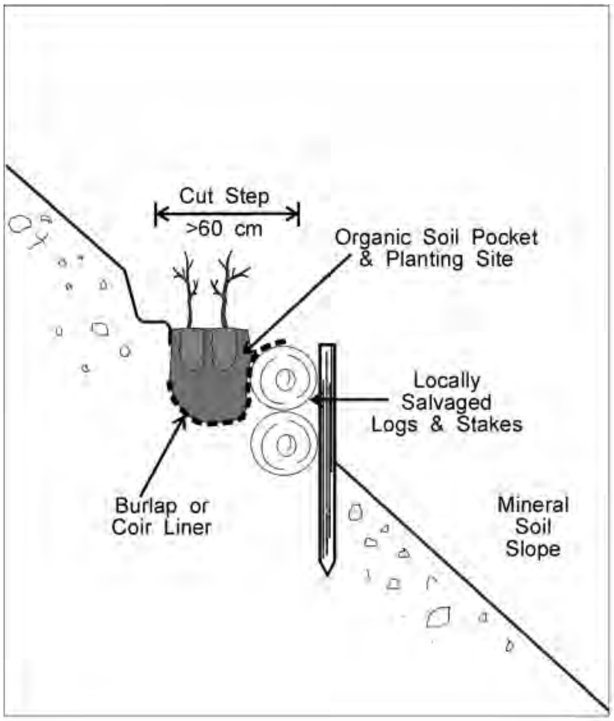
CRITERIA FOR IMPLEMENTATION

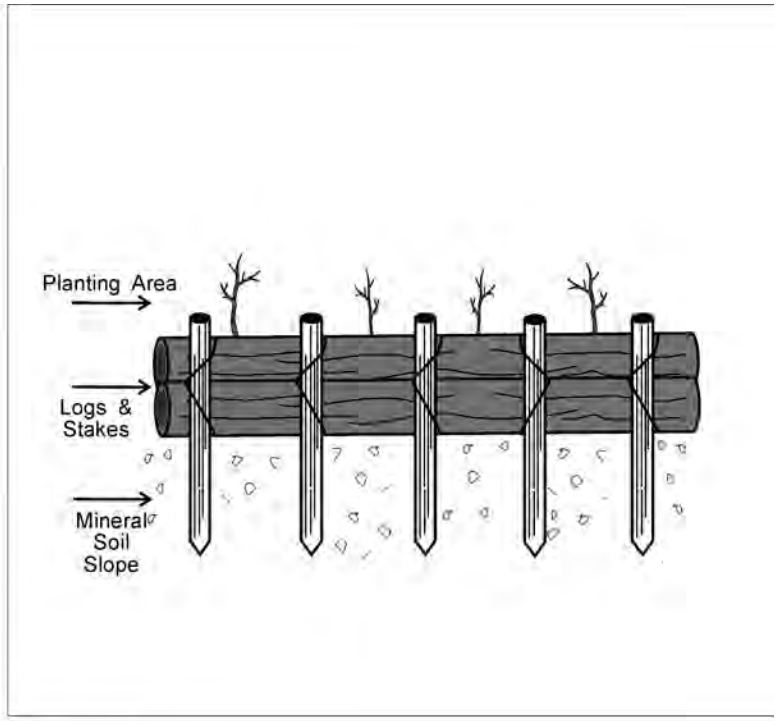
Slash and nonsalvageable timber may be used as rollback for erosion control where available and acceptable to the appropriate authority, as well as at strategic locations along the right-of-way for access control. Specific locations will be determined by Trans Mountain's Environmental Inspector(s) at the time of clearing. Do not use Douglas-fir for rollback.

Notes:

1. Retain slash and nonsalvageable timber, where required, for use as rollback.
2. Larger diameter slash (*e.g.,* 10 cm in diameter or larger) should be used for rollback intended for riparian area access control, plant micro-sites establishment or as soil erosion control.
3. The amount of timber retained for use as rollback will be determined by Trans Mountain's Construction Supervisor(s) in consultation with Trans Mountain's Environmental Inspector(s) and the appropriate authority. Store material for rollback along the edges of the right-of-way.
4. Walk down rollback with a dozer on steep slopes, if safe to do so.
5. Spread slash and nonsalvageable timber evenly over the right-of-way where access is a concern. Do not walk down rollback.
6. Leave gaps in the rollback at obvious wildlife trails.

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	ROLLBACK		
	7894	August 2014	Drawing D-06



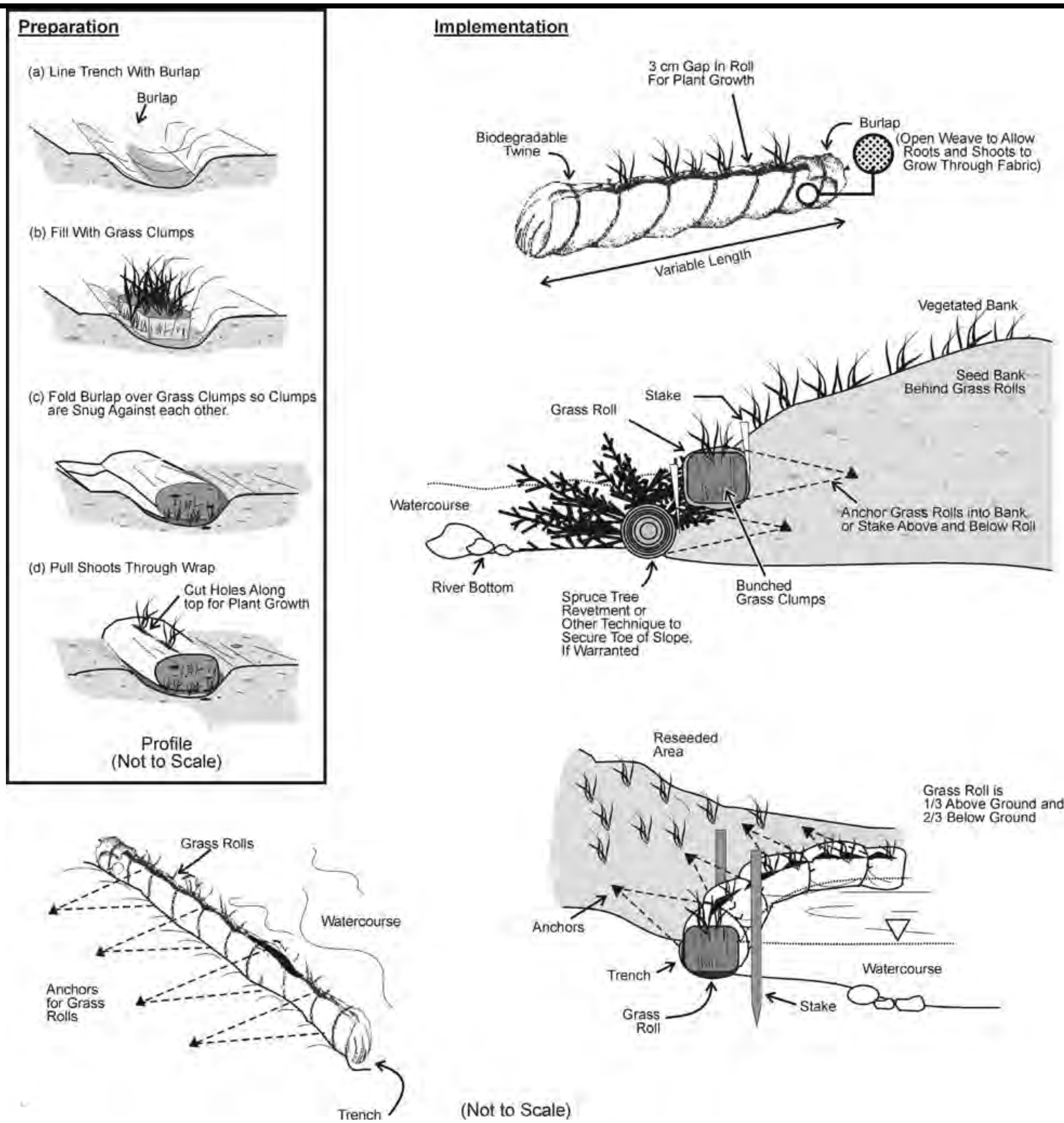


(Not to Scale)

At sites where erosion is a concern and where shrub plantings are required for reclamation, locally salvaged logs may be used to secure slopes and provide planting sites.

1. Sites where staked logs are to be installed will be selected by Trans Mountain's Environmental Inspector(s). When possible, sites will be selected prior to clearing and suitable local logs will be salvaged and stockpiled for later use.
2. Install staked logs during clean-up or reclamation phase. Where possible, use a backhoe to cut a step into the slope and push in a line of wood stakes. Note: take all necessary safety measures when working in proximity to pipeline.
3. With a qualified chainsaw operator, select and cut to fit suitable logs for horizontals. If necessary, the logs may be secured to the stakes using biodegradable rope.
4. Create a pocket behind the horizontally staked logs. The pocket can be used to install live shrub stakes and backfilled with topsoil/root zone material.
5. Where the planting pocket is required for rooted plugs or salvaged plantings, line the pocket with biodegradable fabric (burlap or coir). Bring the fabric over the top log. Fill the lined pocket with topsoil/root zone material or duff and tamp down. Install plants in pockets as directed by Trans Mountain's Environmental Inspector(s).

tera ENVIRONMENTAL CONSULTANTS	**TRANS MOUNTAIN EXPANSION PROJECT** TRANSMOUNTAIN	
	STAKED LOGS/LOG CRIBWALL FOR EROSION CONTROL	
7894	August 2014	Drawing D-07

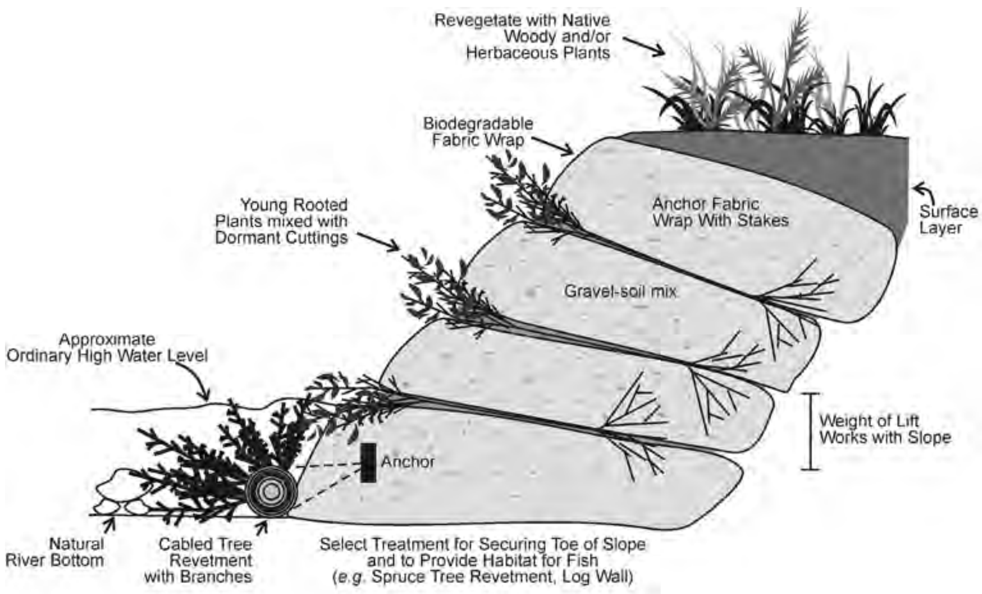


Notes:

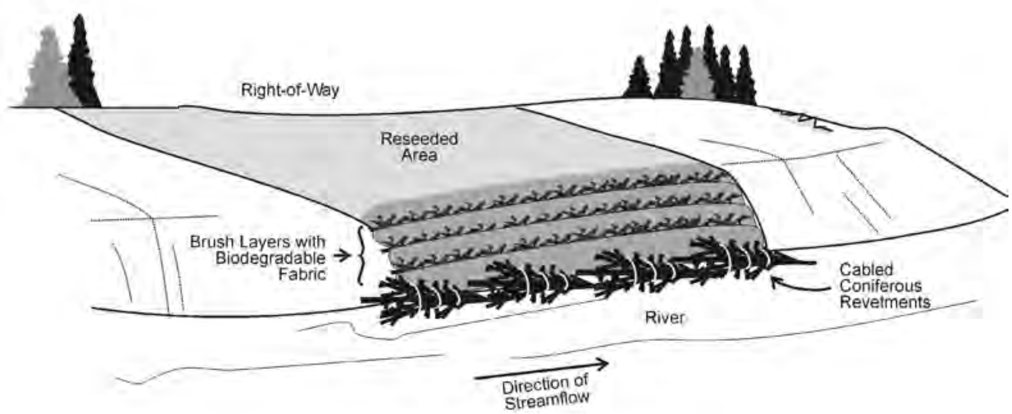
1. Proper placement and design is critical and qualified aquatics or reclamation resource specialists should be involved.
2. Excavate a shallow trench along the ordinary high level watermark parallel to the toe of the bank and line with burlap.
3. Install sod in the middle of the roll and wrap with burlap covers. Tie with twine and cut slits to expose sections of sod.
4. Stake or anchor firmly, ensuring up and downstream ends are secured to prevent washing out.

Adapted from CAPP *et al.* (2005)

tera ENVIRONMENTAL CONSULTANTS	**TRANS MOUNTAIN EXPANSION PROJECT** TRANSMOUNTAIN		
	STREAMBANK PROTECTION – GRASS ROLL		
	7894	August 2014	Drawing D-08



Profile
(Not to Scale)



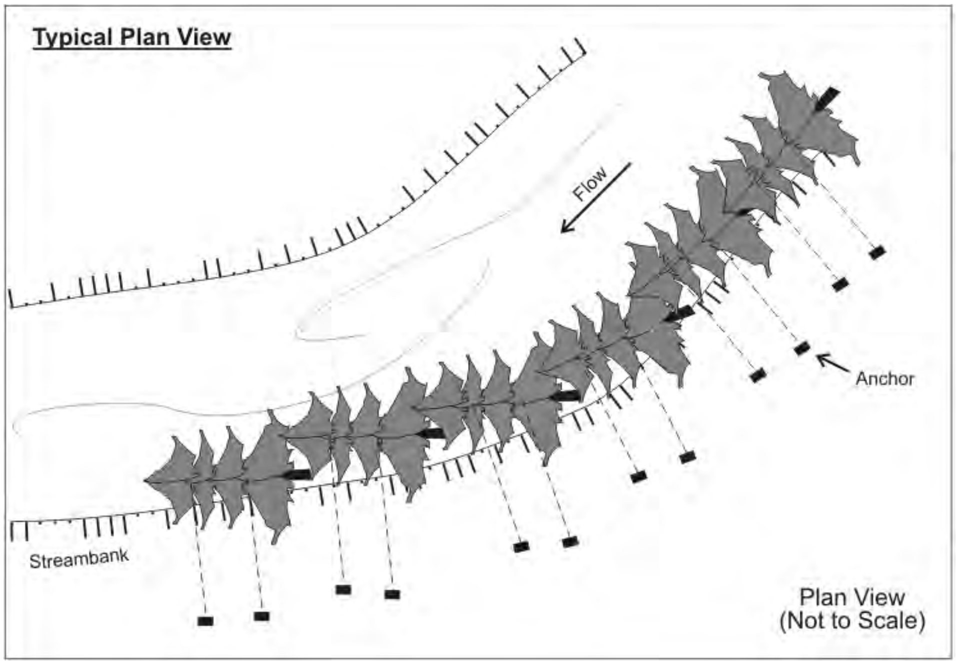
Oblique View
(Not to Scale)

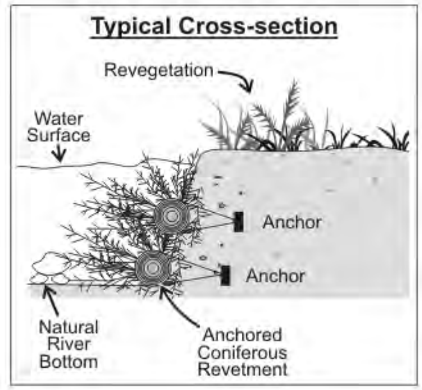
Notes:

1. Proper placement and design is critical and qualified specialists should be involved.
2. Secure the toe of the slope with appropriate technique (coniferous tree revetments, log wall, riprap, etc.).
3. Begin layering at the bottom of slope with first hedge/brush layer situated at the approximate ordinary high water level or lower. Select plant species suitable for site conditions.
4. To establish banks, install layers of soil filled biodegradable fabric (coir or equivalent) wraps. To make each layer, roll out the fabric parallel with the bank with one-third into the bank and two-thirds out (streamside). Form a step of soil approximately 30-40 cm (1-1.3 feet) high over the bank side fabric. Fold the stream side fabric over the soil step and firm into place.
5. Arrange locally salvaged live shrubs with roots (alder, rose ssp., etc.) with live stake material (willow, poplar, red osier dogwood) over the fabric wrap at 20 stems per metre, incorporate topsoil and firm into place.
6. Continue building layers of fabric soil wraps and live shrubs until original bank height is reached.
7. Use only dormant live shrub material. Keep transplants moist and install as soon as feasible following salvage. A mixture of plant species can mimic adjacent undisturbed vegetation.

Adapted from CAPP *et al.* (2005)

tera ENVIRONMENTAL CONSULTANTS	**TRANS MOUNTAIN EXPANSION PROJECT** TRANSMOUNTAIN	
	STREAMBANK PROTECTION – HEDGE/BRUSH LAYERING	
7894	August 2014	Drawing D-09



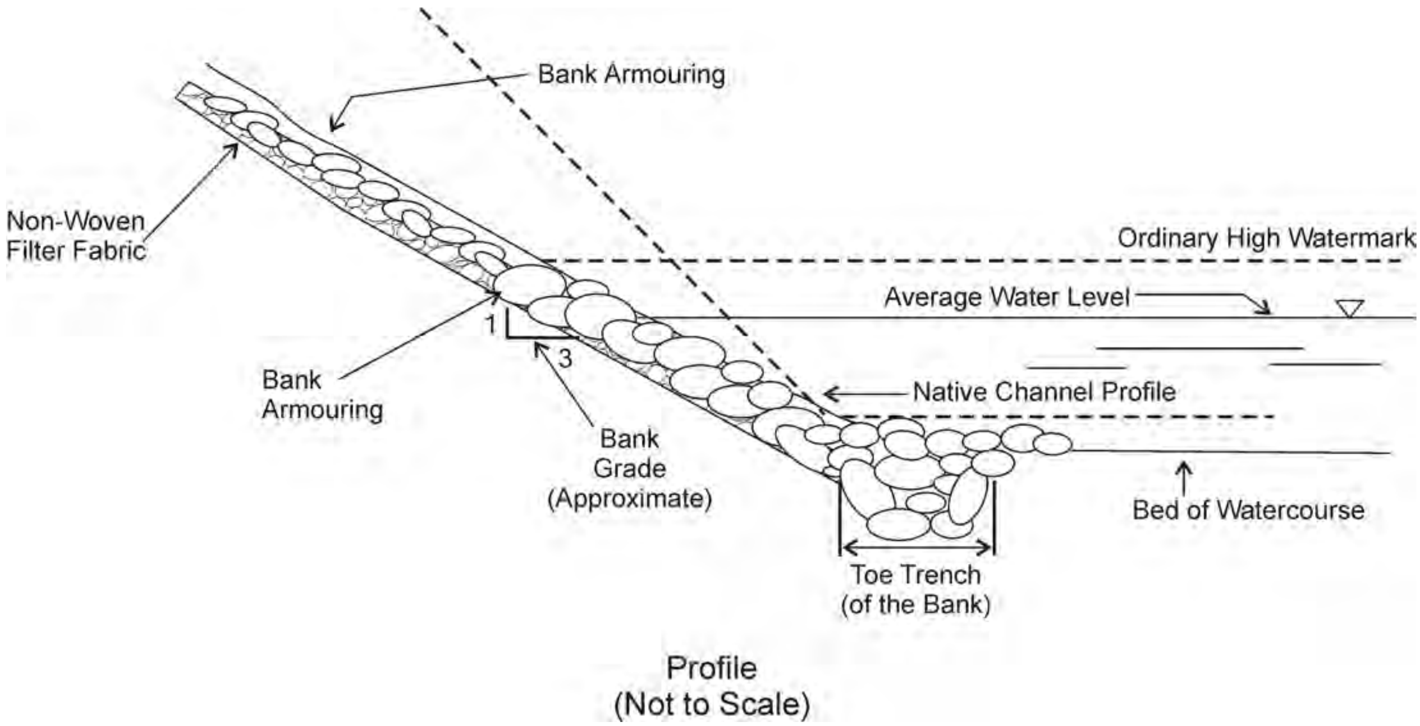


Notes:

1. Proper placement and design is critical and qualified specialists should be involved.
2. Select only good, sound, straight coniferous trees with adequate branches and a minimum length of 10 m.
3. Do not trim any branches and handle with care. Leave root ball intact if possible and transport the trees to the site with a minimum of handling to reduce damage to the branches. To the extent practical, remove soil material from the rootball before placing the tree instream. Place the trees lengthwise along or across the eroding bank to be protected beginning at the downstream end with the tips of the trees pointed in the downstream direction.
4. Begin assembly of the tree revetment at the downstream end and place tie back cable on the tree butt (largest end). Attach the cable to a suitable deadman or large armour rock with a drilled hole. Bury the anchor securely in the adjacent bank.
5. Place the butt of the next tree one-half the length of the previous tree or less upstream along the bank, so there is an overlap of the trees. If possible, cable the trees together in addition to cabling to an anchor buried in the bank.
6. Rock armour may be added along the toe of the slope, beneath the trees to reinforce the level of protection provided.
7. Maintenance, consisting of replacing severely damaged trees, will extend the life span.
8. Coniferous tree revetments also may be used as instream cover.

Adapted from CAPP *et al.* (2005)

tera ENVIRONMENTAL CONSULTANTS	**TRANS MOUNTAIN EXPANSION PROJECT** TRANSMOUNTAIN		
	STREAMBANK PROTECTION – CONIFEROUS TREE REVETMENT		
	7894	August 2014	Drawing D-10



Notes:

1. Proper placement and design is critical and qualified specialists (*i.e.*, hydrotechnical engineers) should be involved.
2. Remove all stumps, organic matter and work material, and grade/prepare banks to a maximum slope as directed by a geotechnical engineer (≥ 45º).
3. Construct toe trench to key in bottom of armour protection into the bed and bank of the watercourse bank or adopt thickened toe option.
4. Install non-woven filter fabric or gravel filter layer at the ordinary high water level and above where cobble or riprap bank armouring will be implemented.
5. Place cleaned cobble or riprap on slope to be protected such that a well-interlocked, smooth layer is produced.
6. Key in up and downstream ends of the armoured bank in a manner such that it will not be outflanked.
7. Cobble/riprap should extend 0.5 m (min) above design flood level. If design flood level is above the top of the bank, cobble/riprap should be placed to the top of the bank.
8. Cobble/riprap should be flush with bank adjacent to the right-of-way.
9. Cobble/riprap placement should not compromise bed elevation.

Adapted from CAPP *et al.* (2005).

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	STREAMBANK PROTECTION – COBBLE OR RIPRAP ARMOURING		
	7894	August 2014	Drawing D-11

CRITERIA FOR IMPLEMENTATION:

Management of weeds and non-native plant species is of paramount concern to Trans Mountain. The goal of non-native species management for the Trans Mountain Expansion Project is to prevent the introduction and spread of non-native plants to control them, to the extent feasible, along the existing TMPL system. Accurate records of weed infestations, control measures undertaken and the success of control measures will be maintained so that weed management and control plans can be modified as necessary to ensure an effective program of ongoing weed monitoring and control.

Following are measures to be implemented during the reclamation and post construction monitoring of the Trans Mountain Expansion Project.

1. All reclamation equipment shall arrive for project work in a clean condition to minimize the risk of weed introduction. Any equipment which arrives in a dirty condition will not be allowed to work until it has been cleaned off at a suitable location.
2. Equipment passing through areas identified as having a weed problem will be cleaned prior to continuing work on the right-of-way.
3. Equipment clean-off stations will be established by the main pipeline contractor under the direction of the Trans Mountain's Environmental Inspector(s). The preferred method of clean-off will be pressurized water, weather permitting.
4. Weed growth will be specifically monitored by personnel trained in weed identification walking the right-of-way and recording the density and species of all weeds observed. Weed monitoring will be conducted by teams in a timely manner so that weed control plans can be developed.
5. Monitoring will be conducted prior to, during and as per PCEM requirements.
6. Frequency of monitoring may be increased where: high potential for weeds of management concern was identified prior to, during or following construction. Weeds will generally be monitored in the spring when weed seedlings can be identified and subsequently controlled, if warranted. Additional weed monitoring in the late summer prior to setting seed will be conducted where high weed concerns exist or where spring surveys identify the need for follow-up.
7. Areas of poor plant cover will be reseeded and weed control measures applied as required.
8. The equipment cleaning station will be assessed in fall, late spring and mid-summer for at least three growing seasons following construction. Subsequent monitoring will be at least once per season, depending on weed issues identified during previous years. Weed species of concern that are identified at the sites will be treated. Manual removal of plants or chemical treatment will occur. If weeds are manually removed when in flower, the weed material will be disposed of in an approved land-fill facility.

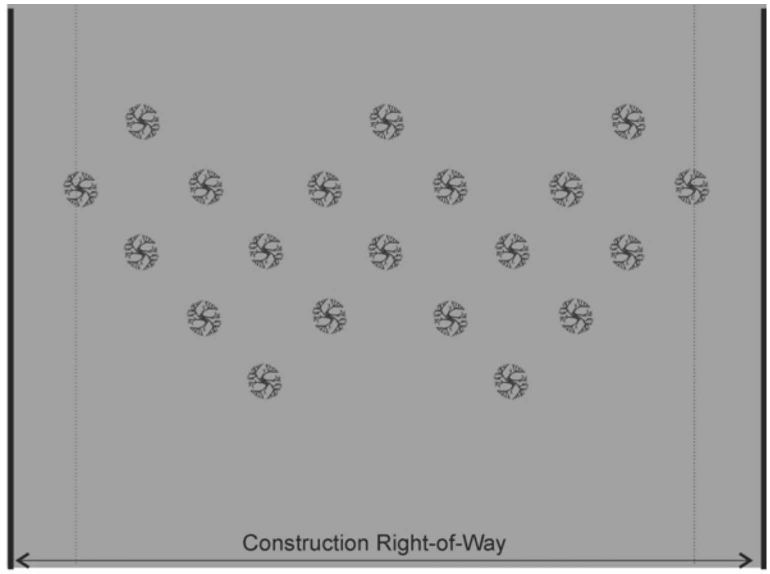
CRITERIA FOR IMPLEMENTATION

Live plant material salvage will generally be used for one of two reasons:

- salvage of shrubs with rootball; and
- salvage and transplant of rare plants.

All collection, salvage and transportation of live plant material will be conducted following approval by the appropriate regulatory authority.

Profile View
(Not to Scale)



Plan View
(Not to Scale)

Representation Only

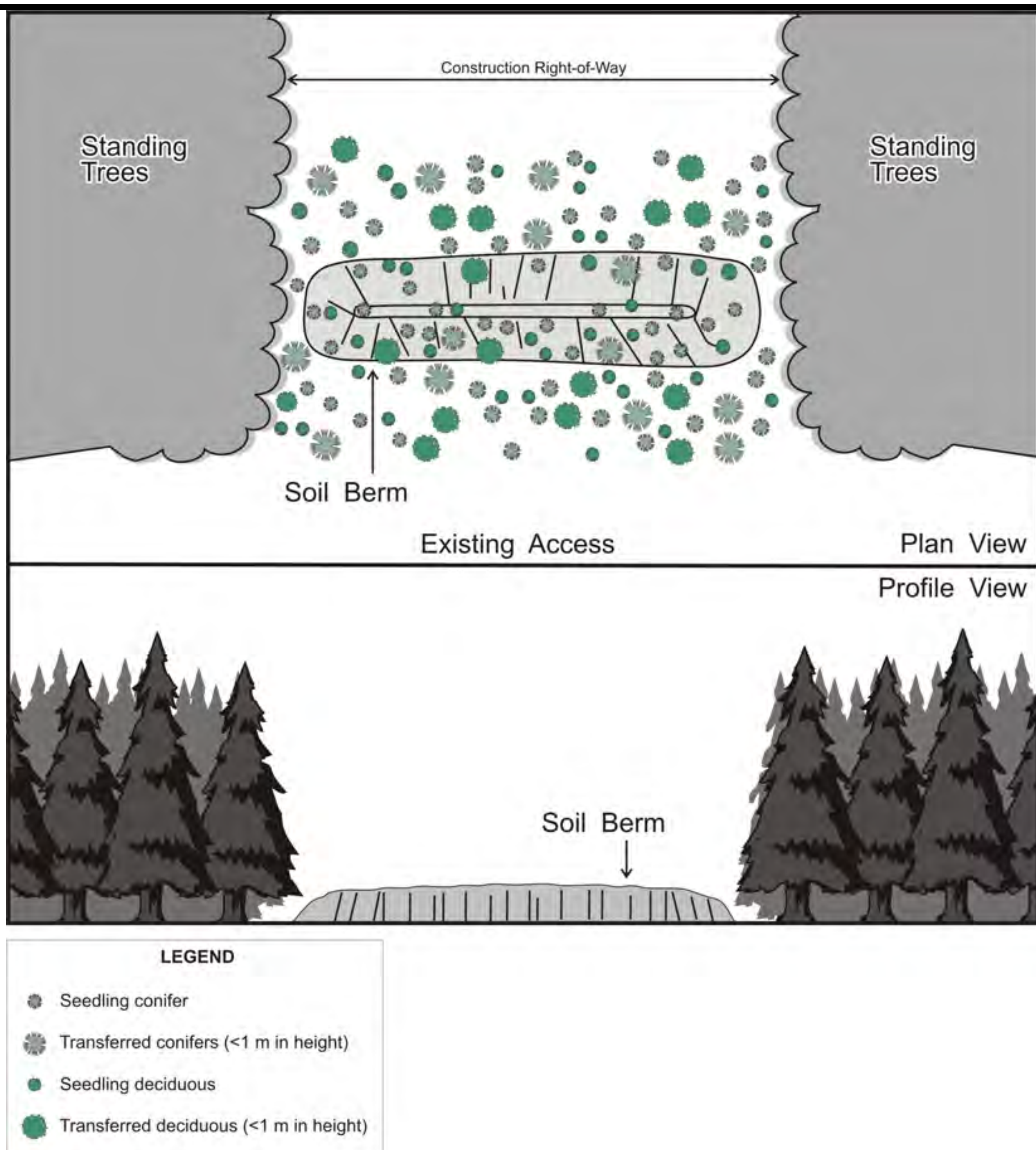
SALVAGE OF SHRUBS WITH ROOTBALL

Shrubs for salvage will be selected by a qualified botanist/biologist and flagged prior to construction activities in that area.

1. To the extent possible, shrub salvage will be conducted during dormancy (senescence to bud break).
2. Shrub salvage will be timed to minimize period between salvage and restoration planting.
3. Prior to salvage, prune back shrub top growth as instructed by a qualified botanist/biologist. Salvage shrubs using a backhoe. Remove as large a rootball as feasible.
4. Cover the rootball of the salvaged plants with burlap or geotextile. Keep the covered rootball slightly moist (but not saturated) until the plants are replanted.

RARE PLANTS

1. Rare plants located along the construction right-of-way that require transplanting will be identified by a qualified botanist/biologist and will be flagged prior to clearing.
2. A qualified botanist/biologist will select a suitable receiving site for the plant(s). Ideally, the receiving site should be adjacent to the construction right-of-way, in an area having a similar microsite to where the rare plant(s) had been growing.
3. Delay salvaging activities until immediately prior to construction. Cut back or prune plants to be salvaged as recommended by Trans Mountain's Environmental Inspector(s) in consultation with a qualified botanist/biologist. Salvage designated plants using a shovel or backhoe. Remove as large a rootball as feasible. Cover the rootball of the salvaged plants with burlap or geotextile. Keep the covered rootball slightly moist (but not saturated) until the plants are replanted.
4. Replant the salvaged plant(s) in the receiving site as soon as feasible following salvage.

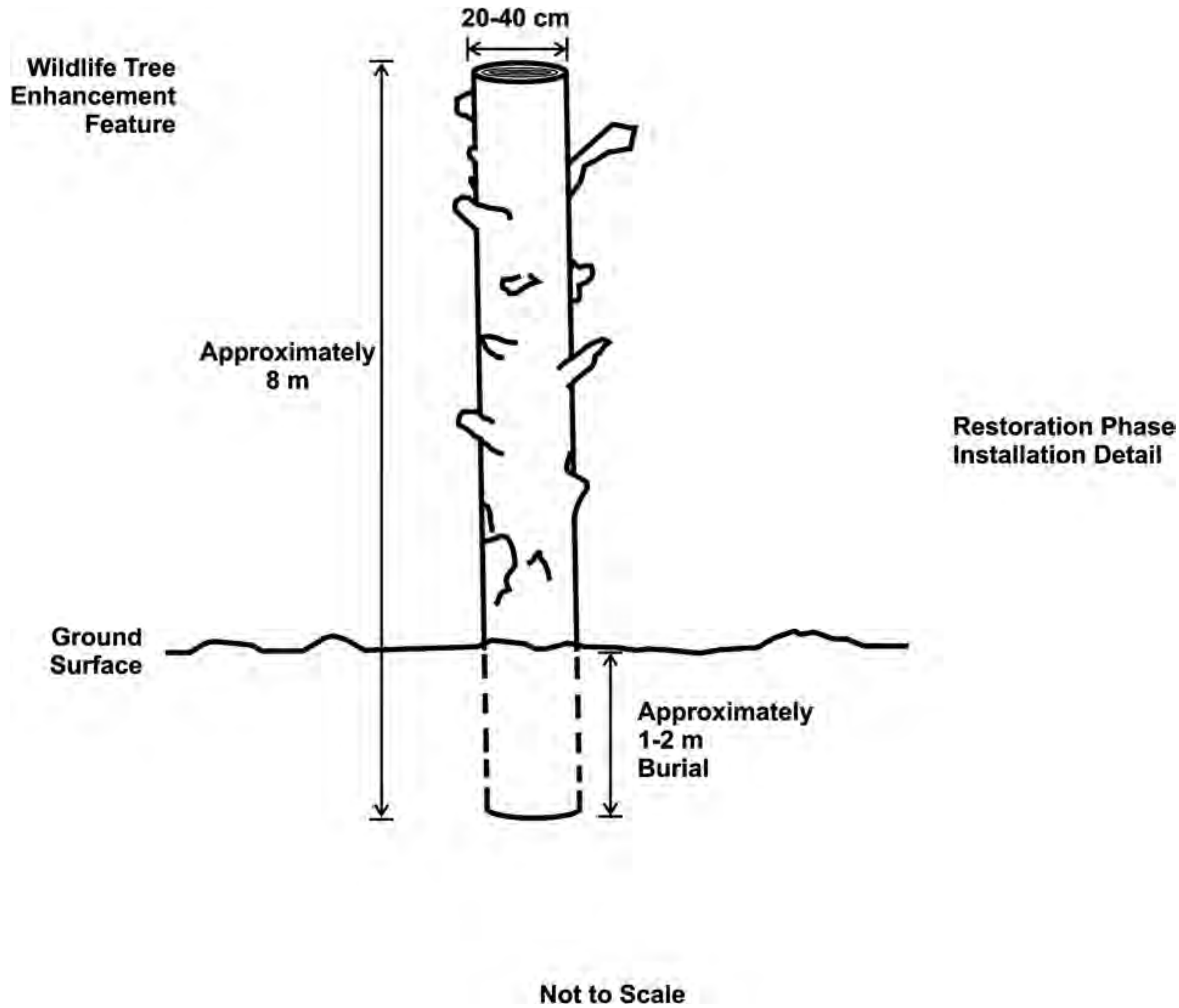


Representation Only

<u>Notes</u>:

1. Use subsoil to construct berm.
2. Locate berm across the entire width of the construction right-of-way.
3. Cover constructed berm with topsoil/root zone material.
4. Do not locate berm in drainages or depressions.
5. Ensure soil berm is of sufficient height to restrict line of sight down the construction right-of-way from existing access.
6. Plantings adjacent the berm on each side will be established no less than the width of the berm.
7. Plant suitable early and late seral plants together, adjacent, on the sides and top of the berm.
8. Transfer dormant, woody plant s <1 m in height from adjacent vegetated areas onto sides and adjacent areas of the berm.
9. Transfer dormant, woody plants at a density of 0.35 plant / m^2.
10. Plant seedling woody plants at a density of 1 plant / m^2.

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	VEGETATION AND SOIL BERM - LINE-OF-SIGHT BREAK		
	7894	August 2014	Drawing D-14



Notes:

1. Salvage and store sound deciduous or coniferous tree trunks at the edge of the cleared right-of-way for use as wildlife tree enhancement features.

2. Tree trunks should be delimbed, but can have 10-30 cm long branch remnants protruding from the trunk.

3. Approximate tree size: 20-40 cm diameter and 8 m long.

4. During restoration phase, the trunk will be “planted” to a depth of approximately 1-2 m in temporary workspace to serve as an artificial snag (wildlife tree).

5. Location of enhancement feature to be determined by Environmental Inspector.

tera ENVIRONMENTAL CONSULTANTS	TRANS MOUNTAIN EXPANSION PROJECT TRANSMOUNTAIN		
	TYPICAL WILDLIFE TREE ENHANCEMENT FEATURE		
	7894	August 2014	Drawing D-15

BC Parks - Alignment Sheets

ENVIRONMENTAL ALIGNMENT SHEET PACKAGE FOR THE BC PROVINCIAL PARKS CROSSED BY THE TRANS MOUNTAIN EXPANSION PROJECT

August 2014
7894

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ENVIRONMENTAL NOTES

GENERAL INFORMATION

The Environmental Alignment Sheets (EAS) provide information pertaining to the environmental and socio-economic setting above the Photomosaic. Potential environmental and socio-economic issues identified during Project planning, and their corresponding mitigation measures, are positioned below their respective location on the Photomosaic.

Discipline-specific Environmental Notes are included below the Photomosaic outlining mitigation measures as described in the Pipeline Environmental Protection Plan (Pipeline EPP) to be implemented during construction of the Project. The mitigation measures included on these Index Sheets do not include all of the potential mitigation measures that may be implemented. Consult the Pipeline EPP for additional protection measures as necessary. Pipeline EPP Section, Appendix and Construction Drawing references are provided in these Environmental Notes. Construction Drawings can be found in Appendix R of the Pipeline EPP.

ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING INFORMATION

Jurisdiction - Includes information regarding the regional or municipal jurisdictional authority of the land encountered along the narrowed pipeline corridor.

Land Ownership/Disposition - Indicates whether land is Private, Crown Land, or a mixture of Crown and Private Land (Mixed) and indicates Crown Land dispositions and other key land designations where applicable.

Land Use - Indicates the predominant land use at the time of survey.

Socio-Economic and Agricultural Considerations - Indicates select communities located within 5km of the corridor and select agricultural operations encountered along the narrowed pipeline corridor.

Heritage/Traditional Land Use - Indicates ranges (buffered) of known archeological concerns and areas with known Traditional Land Use values encountered along the narrowed pipeline corridor.

Wildlife and Wildlife Habitat - Identifies important wildlife habitat ranges and site-specific features encountered along the corridor and provincially identified habitat ranges.

Vegetation - Indicates rare plants, lichens and liverworts, and rare ecological communities encountered along the narrowed pipeline corridor.

Wetlands - Indicates the classification of the wetlands encountered along the narrowed pipeline corridor.

Fish Habitat Sensitivity - Indicates the fish sensitivity rating encountered along the corridor. Areas of high fish habitat sensitivity are assigned based on the quality of the habitat and the proposed instream construction work window.

Hydrology - Indicates watercourse and drainage crossings as well as the locations of shallow wells and shallow groundwater encountered along the narrowed pipeline corridor.

Soils Parent Material - Indicates parent material encountered along the narrowed pipeline corridor from which current soils have evolved.

POTENTIAL ENVIRONMENTAL ISSUES

Indicates where potential environmental and socio-economic issues or adverse effects may occur along the narrowed pipeline corridor as described in the Stage 2 Detailed Proposal. Additional information for each of the disciplines is provided in the Environmental Notes and in the Pipeline EPP.

Environmental Notes associated with potential environmental issues are arranged by discipline in the following categories:

Discipline	Note Prefix
Aquatics	AQ
Hydrology	HY
Soils	SO
Vegetation	VG
Wetlands	WT
Wildlife	WF

ENVIRONMENTAL PROTECTION

Construction Work Window - Identifies the allowable work window for site-specific environmental features.

Soil Handling - Indicates the recommended topsoil/root zone material depth to be salvaged as well as the topsoil/root zone material stripping procedure.

Soils - Identifies the locations where measures will be implemented to address wind and water erosion, compaction and rutting and trench instability.

Watercourse Crossing (Pipeline/Vehicle) Methods - Identifies locations with recommended pipeline and equipment crossing methods for watercourses, drainages and channels.

Forest Type - General locations where coniferous and deciduous salvageable timber is encountered along the eventual route will be provided in this band. Rollback areas will be identified for access control, wildlife movement and erosion control.

Vegetation - Identifies locations where measures will be implemented to mitigate impacts to rare plants, plant communities, lichens and liverworts.

Wildlife and Fish Habitat - Identifies locations where measures will be implemented to address concerns related to sensitive wildlife features, provincially identified wildlife ranges, and sensitive fish habitat.

Heritage/Traditional Land Use - Identifies locations where potential Heritage resource measures are being considered in ongoing discussions with applicable regulators and communities.

Socio-Economic and Agricultural Considerations - Identifies locations where measures may be implemented to address agricultural impacts encountered along the narrowed pipeline corridor.

Special Measures - Indicates site-specific measures to be implemented to address potential environmental issues.

GENERAL

Topsoil/Root Zone Material Depth: Salvage all available topsoil (min. 10 cm and max. 40 cm) and root zone material (min. 15-20 cm or 50% organic material and 50% mineral soil). Where soils are not readily distinguishable by colour, the Environmental Inspector(s) will provide direction based on an evaluation of soil texture and structure as well as the recommended depths noted on the EAS. Overstrip topsoils to a total depth at select locations with saline or sodic lower subsoils, or sands and gravels at depth which occurs on native grassland and/or areas of high wind erosion potential. Resource-specific mitigation measures have been identified for soils and are presented in Table 2 of the Index Sheets.

Soils Handling Procedures: Salvage topsoil from the entire construction right-of-way area (see Drawing 30 [Topsoil or Root Zone Material Salvage in Forest - Full Right-of-Way] and Drawing 35 [Topsoil Salvage on Agricultural Lands - Full Right-of-Way] provided in Appendix R of the Pipeline EPP) on all land uses during non-frozen conditions (Sections 7.0 and Section 8.0 of the Pipeline EPP). Exceptions where the salvage width is to be reduced include, but are not limited to, native grasslands, wetlands or rare plant sites.

Salvage topsoil from a blade width (Blade) centered over the trench (see Drawing 29 [Topsoil or Root Zone Material Salvage – Blade Width/Frozen] provided in Appendix R of the Pipeline EPP) on native grassland.

Construction Work Window: Abide by construction timing windows. For a complete list of Least Risk Timing Windows/Restricted Activity Periods associated with watercourses and wildlife features and habitat areas, see Appendices E to Q of the Pipeline EPP.

ENVIRONMENTAL NOTES

AQUATICS

AQ-Note 1: Sensitive Fish Habitat – Implement the appropriate measures outlined in Table 7.1.6-1 of the Stage 2 Detailed Proposal, Table 2 of the Index Sheets and Section 7.0 of the Pipeline EPP in areas with highly sensitive fish habitat.

AQ-Note 2: Vehicle Watercourse Crossing Methods: See Table 7.1.3-2 of the Stage 2 Detailed Proposal, Table 7 of the Index Sheets and Section 8.7 the Pipeline EPP for a complete list of recommended vehicle crossing methods for open water and frozen conditions and instream work windows.

AQ-Note 3: Pipeline Watercourse Crossing Methods: See Table 4, Table 7.1.3-2 of the Stage 2 Detailed Proposal, Table 2 of the Index Sheets and Section 8.7 and Appendix I of the Pipeline EPP for a complete list of pipeline crossing methods, including contingency crossing methods and instream work windows.

AQ-Note 4: Navigable Waters – Adhere to the notification measures provided in Section 4.0 of the Pipeline EPP for Navigable Watercourses. Notify recreational boaters of the hazards associated with instream construction in accordance with NEB requirements or approval conditions for navigable waters. Place warning signs (*e.g.*, Warning – Pipeline Construction Ahead) up and downstream of all navigable crossings.

HYDROLOGY

HY-Note 1: Shallow Groundwater – Adhere to the applicable mitigation measures found in Table 7.1.3-1 of the Stage 2 Detailed Proposal, Section 7.0 and Section 8.0 of the Pipeline EPP. Implement the appropriate site specific mitigation measures outlined in Appendix G of the Pipeline EPP.

SOILS

SO-Note 1: Erosion Control: Suspend soil handling operations if drifting or topsoil loss is evident. Implement erosion control measures outlined in Table 7.1.2-1 of the Stage 2 Detailed Proposal and Section 7.0 and Section 8.0 of the Pipeline EPP and in the Soil Erosion and Sediment Control Contingency Plan (Appendix B of the Pipeline EPP) at locations where wind or water erosion has been identified.

SO-Note 2: Compaction and Rutting: Work during dry and/or frozen soil conditions to ensure that there is sufficient frost or low soil moisture to allow construction to take place without causing excessive rutting or soil compaction. Implement measures outlined in Table 7.1.2-1 of the Stage 2 Detailed Proposal and Section 7.0 and Section 8.0 of the Pipeline EPP and in the Wet/Thawed Soils Contingency Plan (Appendix B of the Pipeline EPP) to reduce compaction and rutting of susceptible soils.

SO-Note 3: Unstable Trench: Store salvaged topsoil or root zone material at a sufficient distance from the trench so that topsoil or root zone material is not lost in the trench, if trench instability is anticipated. Back slope the trench walls until stable. Suspend trenching and salvage a wider area of topsoil/root zone material if the trench walls slough into the trench and the potential for topsoil/root zone material/subsoil mixing exists. Backslope the trench walls until stable. Equip backhoe with a swamp bucket, if practical, to avoid or reduce trench sloughing. Implement measures outlined in Table 7.1.2-1 of the Stage 2 Detailed Proposal.

WETLANDS

WT-Note 1: Wetland: Adhere to the Wetland Crossing Mitigation Measures found in Table 7.1.7-1 of the Stage 2 Detailed Proposal and Section 8.7.4 of the Pipeline EPP. A list of wetlands encountered along the narrowed pipeline corridor and associated mitigation measures is provided in Table 3 of the Index Sheets. Review the measures presented in the Water Crossing Construction Monitoring Management Plan (see Appendix C of the Pipeline EPP) where applicable.

WILDLIFE

WF-Note 1: Construction Timing: Implement the General Pipeline Construction Mitigation Measures found in Table 7.1.9-1of the Stage 2 Detailed Proposal and Section 7.0 of the Pipeline EPP. Adhere to the Least Risk Window applicable to site-specific wildlife habitat features when necessary. Notify the appropriate authorities if construction activities are scheduled to occur within timing windows.

VEGETATION

VG-Note 1: Rare Plant and Rare Ecological Communities: Adhere to the General Pipeline Construction Mitigation Measures found in Table 7.1.8-1 of the Stage 2 Detailed Proposal and Section 7.0 of the Pipeline EPP. Implement the appropriate site-specific mitigation measures related to known rare plants, rare lichens, rare liverworts and rare ecological communities of concern as identified in Table 4 of the Index Sheets. Follow the Rare Ecological Community and Rare Plant Population Management Plan (see Appendix C of the Pipeline EPP).

LEGEND/GLOSSARY

LAND TENURES

Land Tenure Type	Abbreviation
Environment, Conservation, & Recreation	ENV C&R
Trapper	TR
Protected Area (Parks & Rec)	PROT

TOPOGRAPHY CLASSES

Symbol	% Slope	Description
1	0-0.5	Level
2	0.5-2	Nearly Level
3	2-5	Very Gentle Slopes
4	6-9	Gentle Slopes
5	10-15	Moderate Slopes
6	16-30	Strong Slopes
7	31-45	Very Strong Slopes
8	46-70	Extreme Slopes
9	70-100	Steep Slopes
10	> 100	Very Steep Slopes

LAND USES

Land Use* (EAS Label if Applicable)	Description
Major Rivers (RIVER)	major watercourses encountered by the narrowed pipeline corridor
Native Grassland (NATIVE GRASSLAND)	land that supports native grassland vegetation
Treed (TREED)	areas that are treed (a description of tree species present is available in the site inspection list of the soils technical reports)

HYDROLOGY

Hydrological Feature (EAS Label If Applicable)	Description
Shallow Groundwater (SHALLOW GW)	locations along the narrowed pipeline corridor with increased potential to experience groundwater discharge in open excavations by intersecting the water table or comprising the integrity of a shallow confining unit

SOIL PHASES

Soil Phase	EAS Label	Description
Overlying gravel	/gv	soils that are gravelly at depth
Shallow	sh	soils that have an unconforming parent material within 1.0 m of the surface
Saline	sc	soils that have a saline lower subsoil

SOILS PARENT MATERIALS

Parent Material	EAS Label	Description
Colluvium	C	Colluvial deposits occur mostly on or at the base of steep slopes and consist of materials originating from nearby sources which have been re-deposited by the action of gravity. The deposits are usually loose, moderately to rapidly permeable and variable in depth to hard bedrock. Usual textures are gravelly sandy loam with a high proportion of stones and cobbles. They tend to be unstable and in some areas may still actively be accumulating. Topography is usually moderately to extremely sloping in areas of colluvium.
Fluvial	F	Most fluvial deposits occur on level to gently undulating floodplains but also occur near some of the smaller creeks and rivers. Textures range from sandy to silty in the surface and usually grade to sand at depths of 0.5 to 2 m. Most areas are affected by high groundwater tables and many areas are poorly drained. Periodic flooding during the winter months is common on these deposits.
Glaciofluvial	GF	Glaciofluvial deposits vary from gravelly to loamy sand to sand textured. Glaciofluvial deposits occur on undulating to gently rolling upland terraces but occasionally may also occur on steeply sloping terrain. Glaciofluvial sands and gravels are non-saline, non-sodic and non-calcareous.
Organic	O	Organic deposits form when the rate of organic accumulation exceeds the rate of decomposition. The peat is derived from accumulations of reeds, sedges, grasses and moss, in various stages of decomposition. In some areas a proportion of mineral material is mixed with the organic material which was usually carried in and deposited during flooding by adjacent watercourses.
Till	T	Till is usually moderately to very stony but can be exceedingly stony. Some of the till deposits may be gravelly in texture and sometimes hard consolidated bedrock occurs within a metre of the surface. The till is non-saline and non-sodic but can be moderately calcareous within 50 cm of the surface. Till deposits occur on undulating to extremely sloping terrain.

WETLANDS

Dominant Wetland Class	General Wetland Class Characteristics	Wetland Type (EAS Label If Applicable)	Description Of Wetland Type
Swamp	Tend to be mineral wetlands with the occasional peat veneer. The water table in these wetlands tends to be at or below the surface.	Broad leafed tree swamp (SWAMP)	Deciduous tree species (*e.g.*, paper birch, aspen) dominate the upper story of the vegetation community.
		Mixedwood treed swamp (SWAMP)	Deciduous and coniferous tree species (*e.g.*, paper birch, aspen, spruce) dominate the upper story of the vegetation community.
Marsh	Mineral wetlands with shallow water levels that can fluctuate quickly. Permanency of water also varies within this type of wetland.	Wet Meadow (MARSH)	Marshes with temporary water levels (often present for short periods of time in spring or following a large storm event).

VEGETATION

Species Name	EAS Label	Common Name
Artemisia tridentata/Pseudoroegneria spicata	ARTETRI	big sagebrush/bluebunch wheatgrass
Atriplex truncata	ATRITRU	Wedgescale orache
Festuca campestris – Psuedoroegneria spicata	FESCAM	rough fescue – bluebunch wheatgrass
Leymus cinereus	LEYMCIN	giant wildrye
ponderosa pine / bluebunch wheatgrass	PINUPON	Pinus ponderosa / Pseudoroegneria spicata
Populus tremuloides/Symphoricarpos albus/Poa pratensis	POPUTRE	Trembling aspen/common snowberry/Kentucky bluegrass
Psuedoroegneria spicata – Koeleria macrantha	PSEUSP	Bluebunch wheatgrass - junegrass
yrola elliptica	PYROELL	white wintergreen

FISH AND FISH HABITAT

Class	Description
S1A (fish-bearing large rivers)	mean channel width > 100 m
S1B (fish-bearing)	mean channel width > 20-100 m
S2 (fish-bearing)	mean channel width > 5-20 m
S3 (fish-bearing)	mean channel width 1.5-5 m
S4 (fish-bearing)	mean channel width < 1.5 m
S5 (nonfish-bearing)	mean channel width > 3 m
S6 (nonfish-bearing)	mean channel width ≤ 3 m
W	wetland
NCD	non-classified drainage
NVC	no visible channel

POTENTIAL ENVIORNMENTAL ISSUES

Biophysical Discipline	EAS Label	Description
Aquatics	WC (CLASS)	Watercourse Crossings (Class of the waterbody being crossed)
	FISH	Areas with highly sensitive fish habitat
	NAV WATERS	Navigable or potentially navigable waters
Hydrology	HYDRO	Shallow hydrological features of concern
Soils	WIND ER	Soils with textures susceptible to wind erosion
	WATER ER	Soils with textures in areas with topography that present a water erosion risk
	COMP/RUT	Soils with characteristics that make them prone to compaction and rutting
	UNST TRENCH	Areas with soils susceptible to trench instability when disturbed
Vegetation	RARE COMMUNITY	Rare ecological communities as identified by the BC Identified Wildlife program and the BC Conservation Data Centre (CDC)
	RARE PLANT	Rare plant species as identified by *SARA*, COSEWIC, the BC Identified Wildlife program and the BC CDC
Wetlands	WETLAND	Wetland encountered by the corridor
	NAV WATERS	Navigable or potentially navigable wetlands
	WILDLIFE AREA	Provincially identified wildlife areas with specific least risk window/timing restriction and mitigation requirements

TABLE 1

SUMMARY OF SOIL CHARACTERISTICS

Soil Symbol	Soil Name	RK/AK Start	RK/AK End	Soil Classification	Parent Material	Texture Class	Topsoil Depth Range (cm)	Colour Differentiation	Erosion Rating[2]		Susceptible to Compaction and Rutting	Susceptible to Trench Instability	Comments/Mitigation
									Wind	Water			
FINN CREEK PROVINCIAL PARK													
AV	Alluvium	638.8	638.9	orthic regosol and orthic humic regosol	fluvial	sandy loam-silty loam	0	fair	M-H	S		Yes	-variable textured material
GHT2	Ghita 2	638.9	639.4	typic mesisol	organic	organic	0	--	S	S	Yes	--	-underlying and silts and sands will be encountered at trench depth -salvage upper 40 cm of peat material
KKT2	Kwikoit 2	638.7	638.8	eluviated and orthic dystric brunisols	glaciofluvial	loamy sand-sand	0	--	H	S-H	--	Yes	--
NORTH THOMPSON RIVER PROVINCIAL PARK													
SES1	Struthers 1	725.6 725.9 727.7	725.8 726.7 727.9	eluviated and orthic eutric brunisols	glaciofluvial	gravelly sandy loam-loamy sand	0-20	fair	M-H	S-H	--	Yes	Gravelly material.
SES2	Struthers 2	726.7	727.6	eluviated and orthic eutric brunisols	glaciofluvial	loamy sand-sand	0-25	fair	H	S-H	--	Yes	Salvage upper 15-20 cm of material
SES2/gv	Struthers 2 overlying gravel	727.9	728.1	eluviated and orthic eutric brunisols	glaciofluvia	loamy sand-sand	0-24	fair	H	S	--	Yes	Gravel at 25-40 cm below the surface Overstrip to 25 cm
LAC DU BOIS GRASSLANDS PROTECTED AREA													
GLY1	Glossey 1	829.1 829.3	829.5 829.2	eluviated and orthic eutric brunisols	glaciofluvial	gravelly sandy loam-gravelly sand	0-14	poor-fair	H	S-H	--	Yes	Little or no topsoil in treed areas.
MQN	McQueen	829.5 833.7 834.2 835.1	833.1 834.1 834.6 836.2	orthic dark brown chernozem	till	loam-sandy loam	8-21	fair-good	M	S-H	--	--	--
shMQN	shallow McQueen	833.1	833.7	orthic dark brown chernozem	till	loam sandy loam	6-20	fair-good	M	H	--	--	--
RO	Rock	834.1	834.2	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]
scTNQ	Tranquille with a saline lower subsoil	836.2	836.5	orthic brown chernozem with a saline lower subsoil	til	loam to sandy loam textured till	13	poor-fair	M	M	--	--	These soils have been recommended to be overstripped to the 20-25 cm depth.
TNQ	Tranquille	836.5 842.5	836.9 843.9	orthic brown chernozem	till	loam-sandy loam	10-33	poor-fair	M	S-H	--	--	--
BRIDAL VEIL FALLS PROVINCIAL PARK													
KWY	Kenworthy	1078.0	1078.4	orthic sombric brunisol and orthic humo-ferric podzol	colluvium	sandy loam-loam to gravel	11-25	good	M	S	--	--	--

Sources: Mentiga Pedology Consultants Ltd. 2013b,c,d

Notes:
1 Soil units occur intermittently between listed RK locations.
2 Erosion Hazard Ratings: S = slight; M = moderate; and H = high.
3 Non applicable soil properties indicated by: N/A = not applicable.

TABLE 2

SUMMARY OF THE WATERCOURSE AND WATERBODY CROSSINGS ALONG THE NARROWED PIPELINE CORRIDOR IN BC PROVINCIAL PARKS

								Morphological Characteristics					Pipeline Crossing Method		Vehicle Crossing Method			
Watercourse Crossing ID	RK	Watercourse Name	Flow Regime	Class	UTM Coordinates	Fish Species Captured Observed (Previously Documented)	Sensitivity Rating	Flow (m^3/s)	Max/Mean Channel Width (m)	Mean Bank Height (m)	Provincial Instream Work Window (MoE and DFO)	Least Biological Risk Window Proposed	Recommended Primary	Recommended Contingency	Recommended Vehicle Method (Flowing)	Recommended Crossing Method (Dry/Frozen)	Navigability	Reclamation Notes[1]
FINN CREEK PROVINCIAL PARK																		
BC-201	638.8	Finn Creek	Perennial	S2	11U 340053E 5754392N	RB, BT (CH, CO, SK, RB, BT, MW, CCG, CAS)	High	1.46	31.00 / 18.70	0.90	July 22 – August 15	July 22 – August 15	Isolation with fish salvage and water quality monitoring	Open-cut with water quality monitoring inside timing window	Clear-span bridge	Clear-span bridge	Potentially Navigable	Comply with Federal and Provincial Legislation
BC-202	639.1	Unnamed Drainage	Seasonal	NCD	11U 340232E 5754152N	None (None)	Low	--	--	--	None	Open	Isolation if water present	Open-cut if dry or frozen to the bottom	Ramp and Culvert	Snow/icefill or other regulatory approved crossing method	None	B
NORTH THOMPSON RIVER PROVINCIAL PARK																		
BC-312	725.5	Clearwater River	Perennial	S1A	11U 702102E 5724656N	None (CCG, CH, CO, BT, LNC, MW, RB, RSC, SK)	High	71.83	115.20 / 105.15	1.71	August 7 – August 15	August 7 – August 15	Trenchless with water quality monitoring	Open-cut with water quality monitoring inside timing window	Access both banks	Access both banks	Navigable	Comply with Federal and Provincial Legislation
LAC DU BOIS GRASSLANDS PROTECTED AREA																		
BC-382	829.0	McQueen Creek	Intermittent	S6	11U 686885E 5633809N	None (None)	Low	0.004	2.12 / 1.71	0.27	None	Open	Isolation if water present	Open-cut if dry or frozen to the bottom	Ramp and Culvert	Snow/icefill or other regulatory approved crossing method	None	D
BC-383	831.2	Unnamed Drainage	Seasonal	NCD	10U 686962E 5631733N	None (None)	Low	--	--	--	None	Open	Isolation If water is present	Open-cut if dry or frozen to bottom	Ramp and Culvert	Ford	None	A
BC-384	831.8	Unnamed Drainage	--	NVD	10U 686979E 5631269N	None (None)	None	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	A
BC-385	832.3	Unnamed Drainage	--	NVD	10U 686786E 5630746N	None (None)	None	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	A
BC-386	832.3	Unnamed Drainage	--	NVD	10U 686776E 5630708N	None (None)	None	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	B
BC-387	833.2	Unnamed Drainage	--	NVD	10U 686477E 5629901N	None (None)	None	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	B
BC-388	833.6	Unnamed Drainage	--	NVD	10U 686331E 5629442N	None (None)	None	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	B
BC-389	834.1	Unnamed Drainage	--	NVD	10U 686193E 5629043N	None (None)	None	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	A
BC-390	834.4	Unnamed Drainage	--	NVD	10U 686094E 5628743N	None (None)	None	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	A
BC-391	834.4	Unnamed Drainage	--	NVD	10U 686079E 5628707N	None (None)	None	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	A
BC-392	835.0	Unnamed Drainage	--	NVD	10U 685885E 5628144N	None (None)	None	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	A
BC-393	835.1	Unnamed Drainage	--	NVD	10U 685834E 5628044N	None (None)	None	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	A
BC-394	835.5	Unnamed Drainage	--	NVD	10U 685732E 5627701N	None (None)	None	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	A
BC-395	835.9	Unnamed Drainage	--	NVD	10U 685608E 5627331N	None (None)	None	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	B
BC-396	836.2	Unnamed Drainage	Ephemeral	NCD	10U 685722E 5627066N	None (None)	Low	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	B
BC-397	836.7	Unnamed Drainage	Ephemeral	NCD	10U 685991E 5626603N	None (None)	Low	--	--	--	None	Open	Isolation if water is present	Open-cut if dry or frozen to the bottom	Ramp and Culvert	Snow/icefill or other regulatory approved crossing method	None	B
BC-398	837.0	Unnamed Drainage	Ephemeral	NCD	10U 685929E 5626322N	None (None)	Low	--	--	--	None	Open	Isolation if water is present	Open-cut if dry or frozen to the bottom	Ramp and Culvert	Snow/icefill or other regulatory approved crossing method	None	B
BC-410	842.3	Unnamed Drainage	--	NVD	10U 683328E 5622323N	None (None)	None	--	--	--	None	Open	Open-cut	Open-cut	Ford	Ford	None	A
BC-411	843.0	Unnamed Drainage	Ephemeral	NCD	10U 682903E 5622073N	None (None)	Low	--	--	--	None	Open	Isolation if water present	Open-cut if dry of frozen to the bottom	Ramp and Culvert	Snow/icefill or other regulatory approved crossing method	None	B
BRIDAL VEIL FALLS PROVINCIAL PARK																		
BC-706bPC1	1079.5	Bridal Creek	Perennial	S3	10U 591604E 5448817N	CO (CCT, CM, CO, CP, MW, PCC, RB, SB)	Low	0.09	- / 3.2	0.23	July 15 – August 15	Open	Isolation with water quality monitoring	--	Clear-span bridge	--	Class 3 Non-Navigable	D

Notes:

A Recontour bed and banks/approach slopes to pre-construction profiles and grades.

B Salvage dormant riparian vegetation along the trench line (and vehicle crossing locations, where grading is required), keep roots intact (*i.e.*, with a sufficient soil root-ball). Store salvaged dormant plants and plant material away from construction activities for replacement or installation during reclamation. Replace salvaged dormant riparian plants and plant material (stakes and brush) during reclamation (see Drawing [Shrub Staking and Transplanting] provided in Appendix R of the Pipeline EPP).

Install rooted stock shrubs/trees and/or dormant tree/shrub stakes/brush in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate vegetation recovery (see Drawing [Shrub Staking and Transplanting] and [Rooted Stock Selection and Installation] provided in Appendix R of Pipeline EPP).

D Recontour banks using salvaged bank material, and install erosion control blanket and/or coir logs as required (see Drawing [Erosion Control Matting/Blanket] and [Coir/Straw Log Installation] provided in Appendix R of the Pipeline EPP.

If required, install riprap below the ordinary high water level, keyed into bed and underlain with filter cloth or gravel layer.

Install coir soil wrap(s) about the OHWL (see Drawing [Streambank Protection – Hedge/Brush Layering] provided in Appendix R of the Pipeline EPP), or log crib structure made from natural logs may be used at the base of the bank (below the OHWL) if appropriate (may be a single log in height, typically a minimum of two logs are used) (see Drawing [Staked Logs/Log Cribwall for Erosion Control] provided in Appendix R of the Pipeline EPP).

Install rooted stock shrubs/trees and/or dormant shrub/tree stakes in disturbed riparian areas to stabilize soils, reduce sedimentation and accelerate woody vegetation recovery (see Drawing [Shrub Staking and Transplanting and [Rooted Stock Selection Installation] provided in Appendix R of the Pipeline EPP).

TABLE 3

MITIGATION MEASURES FOR WETLANDS ENCOUNTERED WITHIN THE NARROWED PIPELINE CORRIDOR

Start RK	End RK	Wetland Type	Legal Locations (LSD/PNG)	Area of Wetland Within Corridor (ha)	Length of Wetland Crossed by Corridor (km)	Regulatory Considerations	Reference to Potential Mitigation Measures
FINN CREEK PROVINCIAL PARK							
638.69	638.71	Flood Association (not a wetland)	a-7-K/82-M-14	0.3	0.02	N/A	General pipeline mitigation (Table 7.1.7-1 of the Stage 2 Detailed Proposal) Refer to Aquatics for watercourse mitigation (Table 2 of Index Sheets)
638.8	638.9	Mixedwood treed swamp	c-96-F/82-M-14	0.1	0.1	Submit for approval from BC OGC	Suite of wetland mitigation (Table 7.1.7-1 of the Stage 2 Detailed Proposal and Section 7.0 of the Pipeline EPP. As per the *Finn Creek Provincial Park Management Direction Statemen*t, 1999, a weed management plan will be implemented at all wetlands crossed within the park. Refer to Aquatics for watercourse mitigation (Table 7.1.3-2 of the Stage 2 Detailed Proposal and Section 7.0 of the Pipeline EPP)
LAC DU BOIS GRASSLANDS PROTECTED AREA							
831.17	831.37	Broad-leaf treed swamp	c-68-C/92-I-16	1.4	0.2	Submit for approval from BC OGC	Suite of wetland mitigation (Table 7.1.7-1 of the Stage 2 Detailed Proposal and Section 7.0 of the Pipeline EPP) As per the Lac Du Bois Management Plan, a weed management plan will be implemented at all wetlands crossed within the park
833.56	833.69	Wet Meadow	d-49-C/92-I-16 to a-49-C-92-I-16	0.3	0.1	Submit for approval from BC OGC	Suite of wetland mitigation (Table 7.1.7-1 of the Stage 2 Detailed Proposal and Section 7.0 of the Pipeline EPP) As per the Lac du Bois Management Plan, a weed management plan will be implemented at all wetlands crossed within the park
833.98	834.06	Wet Meadow	a-49-C/92-I-16 to c-39-C/92-I-16	0.4	0.1	Submit for approval from BC OGC	Suite of wetland mitigation (Table 7.1.7-1 of the Stage 2 Detailed Proposal and Section 7.0 of the Pipeline EPP) As per the Lac du Bois Management Plan, a weed management plan will be implemented at all wetlands crossed within the park
842.3	842.42	Wet Meadow	d-63-L/92-I-9	1.1	0.1	Submit for approval from BC OGC	Suite of wetland mitigation (Table 7.1.7-1 of the Stage 2 Detailed Proposal and Section 7.0 of the Pipeline EPP) As per the Lac du Bois Management Plan, a weed management plan will be implemented at all wetlands crossed within the park
843.27	843.33	Wet Meadow	b-63/L-92-I-9	0.3	0.1	Submit for approval from BC OGC	Suite of wetland mitigation (Table 7.1.7-1 of the Stage 2 Detailed Proposal and Section 7.0 of the Pipeline EPP) As per the Lac du Bois Management Plan, a weed management plan will be implemented at all wetlands crossed within the park

TABLE 4

MITIGATION MEASURES FOR RARE PLANT POPULATIONS AND RARE ECOLOGICAL COMMUNITIES ENCOUNTERED WITHIN THE NARROWED PIPELINE CORRIDOR

Start RK	End RK	Common Name	UTMs (10U)	Abundance and Distribution	Relation to the Narrowed Pipeline Corridor	Feature ID	Species Name (Rank)	Discussion	Recommended Mitigation		
									Planning Phase[C]	Construction Phase[D]	Post-Construction/ Operation Phase[E]
727.93	727.98	white wintergreen	701177 5723040	>100 plants throughout a 40 m x 12 m area	Occurs completely within the narrowed pipeline corridor immediately east of the existing pipeline ROW.	PYROELL177040	*Pyrola elliptica* (S2S3, Blue)	During the 2014 rare plant surveys, white wintergreen plants were observed on the existing pipeline ROW, suggesting that this species will be able to colonise on the proposed pipeline corridor. White wintergreen is known to propagate from seed (Huxley 1992). It is very sensitive to root disturbance and is also dependant on mycorhizal communities in the soil (Huxley 1992). By minimizing disturbance to the roots and mychorhizal soil communities Trans Mountain is confident that this population will regenerate following construction activities.	--	6, 10	13, 14
829.66	829.79	trembling aspen / common snowberry / Kentucky bluegrass	686729 5633259 686686 5633131	Community extends for approximately 110 m along the narrowed Pipeline Corridor	Across the entire narrowed pipeline corridor and extends off. Approximately half the community occurs to the west while a small patch occurs to the east of the narrowed pipeline corridor.	POPUTRE729259	*Populus tremuloides / Symphoricarpos albus / Poa pratensis* (S2, Red)	This community is an S2 red-listed community. Despite this, the component species are highly resilient. Therefore, walking down shrubs and avoiding grubbing will promote rapid regeneration of this community. Trembling aspen is a clonal species that propagates vegetatively. By leaving an uncleared patch on either side of the construction right-of-way this species should regenerate quickly. It is especially important to ensure that an uncleared area is left to the east, if feasible, where the community extends only slightly off of the narrowed pipeline corridor.	3	5, 6, 7, 8, 9, 10	13, 14
829.79	830.21	rough fescue - bluebunch wheatgrass	686686 5633131 686588 5632722	Community extends for approximately 400 m along the narrowed pipeline corridor	Across the entire narrowed pipeline corridor and extends beyond the narrowed pipeline corridor.	FESTCAM686131	*Festuca campestris - Pseudoroegneria spicata* (S2, Red)	Based on current knowledge of fescue conservation during construction, three main strategies are recommended to limit impacts to fescue grasslands: 1) reduce, to the extent feasible, construction-related disturbance to fescue grasslands; 2) where disturbance is unavoidable, implementing strategies to reintroduce rough fescue and bluebunch wheatgrass to the areas of disturbance; and 3) increase the potential for the reintroduced rough fescue and bluebunch wheatgrass to establish by reducing competition between these native grasses and invasive species. In all areas of fescue grassland, stripping and grading should be limited to the extent feasible. Trans Mountain is currently discussing a variety of propagation techniques for rough fescue that could implemented in Lac du Bois Grasslands Protected Area with BC Parks, the Grassland Conservation Council, Thompson Rivers University and Tannis Environmental.	1, 2, 3	4, 10, 11, 12	13, 14
831.37	831.42	giant wildrye Herbaceous Vegetation	6896987 5631616 687062 5631692 687004 5631657 687012 5631611	An approximately 70 m x 50 m patch and a second small patch to the east of the narrowed pipeline corridor	The 50 m x 70 m patch occurs on the west side of the narrowed pipeline corridor and extends off to the west. The second small patch is entirely to the east of the pipeline corridor.	LEYMCIN987616	*Leymus cinereus* (S2, Red)	Complete avoidance is the preferred mitigation to be employed for this community. This would involve moving the west boundary of the narrowed Pipeline Corridor approximately 20 m east. If avoidance is not feasible, seed collection and replanting while narrowing the extent feasible to minimize the impact to this community will be employed. According the USDA, the standard propagation technique for giant wildrye is through seed (Winslow 2002). Native seed collection from Lac du Bois Grasslands Protected Area will be implemented to preserve the genotype. This species is sensitive to competition from non-native invasive species (BC CDC 2014a) If deemed appropriate., a suitable cover crop of native short-lived perennial grass with be planted to increase the potential for reintroduction of giant wildrye to the areas of disturbance (see Section 8.0 of the Lac du Bois Tab of the Stage 2 Detailed Proposal for further details on when cover crops will be installed).	-- OR 1, 3	5 OR 5, 10, 11, 12	13, 14
831.53	831.56	bluebunch wheatgrass - junegrass	687037 5631522687 020 5631500	A single patch approximately 30 m long	Slightly off the narrowed pipeline corridor to the west	PSEUSPI966622	*Pseudoroegneria spicata - Koeleria macrantha* (S3, Blue)	Following selection of the narrowed pipeline corridor this community occurs slightly outside the potential area of disturbance. It is still recommended that the western boundary of the construction ROW be marked to avoid encroachment into this community.	--	4	13, 14
831.91	832.24	ponderosa pine / bluebunch wheatgrass	686895 5631171 686762 5630863	Community extends for approximately 350 m	Slightly off the narrowed pipeline corridor to the west	PINUPON895171	*Pinus ponderosa / Pseudoroegneria spicata* (S3, Blue)	Following selection of the narrowed pipeline corridor this community occurs slightly outside the potential area of disturbance. It is still recommended that the western boundary of the construction ROW be marked to avoid encroachment into this community.	--	4	13, 14
832.54	832.63	big sagebrush / bluebunch wheatgrass	686701 5630560 686705 5630467	Community extends approximately 100 m along the narrowed pipeline corridor	Across the entire narrowed pipeline corridor and extends beyond the narrowed pipeline corridor.	ARTETRI701560	*Artemisia tridentata / Pseudoroegneria spicata* (S2, Red)	The recommended mitigation will minimize disturbance to the roots of big sagebrush and preserve its seed bank. It is expected that big sagebrush will regenerate following construction activities. According to the USDA, bluebunch wheatgrass is best propagated by seed or by plugs (Skinner 2004a and Skinner 2004b). With the implementation of native seed collection, the community genotype will be maintained and good reestablishment within disturbed areas following construction is expected.	1, 2, 3	7, 8, 9, 10, 11, 12	13, 14
832.66	832.75	big sagebrush / bluebunch wheatgrass	686694 5630437 686623 5630369	Community extends approximately 100 m along the narrowed pipeline corridor	Across the entire narrowed pipeline corridor and extends beyond the narrowed pipeline corridor.	ARTETRI694437	*Artemisia tridentata / Pseudoroegneria spicata* (S2, Red)	See the discussion for ARTETRI701560.	1, 2, 3	7, 8, 9, 10, 11, 12	13, 14

TABLE 4 Cont'd

Start RK	End RK	Common Name	UTMs (10U)	Abundance and Distribution	Relation to the Narrowed Pipeline Corridor	Feature ID	Species Name (Rank)	Discussion	Recommended Mitigation: Planning Phase[C]	Recommended Mitigation: Construction Phase[D]	Recommended Mitigation: Post-Construction/ Operation Phase[E]
832.74	834.97	rough fescue - bluebunch wheatgrass	686701 5630560 685901 5628245	Community extends approximately 2.2 km along the narrowed pipeline corridor	Across the entire narrowed pipeline corridor and extends beyond the narrowed pipeline corridor.	FESTCAM623369	*Festuca campestris - Pseudoroegneria spicata* (S2, Red)	The area between RK 832.74 and RK 834.97 consists primarily of high quality native grassland. During the 2014 rare plant surveys, this community was observed to be a matrix of different rare ecological communities. While the boundaries of these communities are not distinct an effort has been made to separate them based on their component species for the purposes of providing appropriate mitigation. The area between RK 832.74 and RK 834.97 is described in the mitigation table as FESTCAM623369, PSEUSPI623369, ARTETRI582133, ARTETRI901245, ARTETRI180995, PINUPON111782, and ATRITRU312645. While some weedy areas occur within this portion of the narrowed pipeline corridor, mitigation is proposed for the entire 2.23 km. Please see FESTCAM686131 for a discussion of this community.	1, 2, 3	10, 11, 12	13, 14
832.74	832.97	bluebunch wheatgrass - junegrass	686623 5630369 686595 5630139	An approximately 300 m patch found within a larger grassland complex.	Across the entire narrowed pipeline corridor and extends beyond the narrowed pipeline corridor.	PSEUSPI623369	*Pseudoroegneria spicatata - Koeleria macrantha* (S3, Blue)	According to the USDA, bluebunch wheatgrass and junegrass are best propagated by seed or by plugs (Skinner 2004a, Skinner 2004b and Barner 2009). With the implementation of native seed collection, the community genotype will be maintained and good reestablishment within disturbed areas following construction is expected. This community is susceptible to being outcompeted by non-native invasive species (BC CDC 2014b If deemed appropriate., a suitable cover crop of native short-lived perennial grass with be planted to increase the potential for reintroduction of bluebunch wheatgrass to the areas of disturbance (see Section 8.0 of the Lac du Bois Tab of the Stage 2 Detailed Proposal for further details on when cover crops will be installed).	1, 2, 3	10, 11, 12	13, 14
832.98	833.20	big sagebrush / bluebunch wheatgrass	686582 5630133 686433 5629891	An approximately 300 m patch found within a larger grassland complex.	Across the entire narrowed pipeline corridor and extends beyond the narrowed pipeline corridor.	ARTETRI582133	*Artemisia tridentata / Pseudoroegneria spicata* (S2, Red)	See the discussion for ARTETRI701560 above.	1, 2, 3	7, 8, 9, 10, 11, 12	13, 14
833.62	--	wedgescale orache	686312 5629645	10 plants in a 94 m x 10 m patch.	Entirely off the narrowed pipeline corridor to the west.	ATRITRU312645	*Atriplex truncata* (S3, Blue)	Following selection of the narrowed pipeline corridor this community occurs outside the potential area of disturbance, confined to an alkaline flat off to the west. It is still recommended that the western boundary of the construction ROW be marked to avoid encroachment into this wetland and community.	--	4	--
833.67	834.18	big sagebrush / bluebunch wheatgrass	686180 5628995 686340 5629483	An approximately 600 m patch found within a larger grassland complex.	Across the entire narrowed pipeline corridor and extends beyond the narrowed pipeline corridor.	ARTETRI180995	*Artemisia tridentata / Pseudoroegneria spicata* (S2, Red)	See the discussion for ARTETRI701560 above	1, 2, 3	7, 8, 9, 10, 11, 12	13, 14
834.18	834.40	ponderosa pine / bluebunch wheatgrass	686111 5628782 686180 5628995	An approximately 300 m patch found within a larger grassland complex.	Across the entire narrowed pipeline corridor and extends beyond the narrowed pipeline corridor.	PINUPON111782	*Pinus ponderosa / Pseudoroegneria spicata* (S3, Blue)	Narrowing the area of disturbance will minimize the number of ponderosa pine trees cleared during construction. It is not possible to allow ponderosa pine trees to re-establish on the right-of-way during operations. Please see the discussion for PSEUSPI623369 for a discussion of mitigation for bluebunch wheatgrass.	1, 2, 3	7, 8, 9, 10, 11, 12	13, 14
834.60	834.97	big sagebrush / bluebunch wheatgrass	685901 5628245 686027 5628592	An approximately 450 m patch found within a larger grassland complex.	Across the entire narrowed pipeline corridor and extends beyond the narrowed pipeline corridor.	ARTETRI901245	*Artemisia tridentata / Pseudoroegneria spicata* (S2, Red)	See the discussion for ARTETRI701560 above.	1, 2, 3	7, 8, 9, 10, 11, 12	13, 14
834.42	834.98	ponderosa pine / bluebunch wheatgrass - rough fescue	685573 5627276 685790 5627803	Community extends approximately 700 m along the narrowed pipeline corridor.	Across the entire narrowed pipeline corridor and extends beyond the narrowed pipeline corridor.	PINUPON573276	*Pinus ponderosa / Pseudoroegneria spicata - Festuca campestris* (S2, Red)	Please see the discussion for PINUPON111782 and FESTCAM686131 above.	1, 2, 3	7, 8, 9, 10, 11, 12	13, 14
836.34	--	ponderosa pine / bluebunch wheatgrass - rough fescue	685761 5626693 685757 5626955	A small patch.	Slightly off the narrowed pipeline corridor to the west.	PINUPON930693	*Pinus ponderosa / Pseudoroegneria spicata - Festuca campestris* (S2, Red)	Following selection of the narrowed pipeline corridor this community occurs slightly outside the potential area of disturbance. It is still recommended that the western boundary of the construction ROW be marked to avoid encroachment into this community.	--	4	13, 14

Sources: BC CDC 2014c, NatureServe 2014a

Notes: A See the NatureServe website (NatureServe 2014b) for a definition of ranks.

B Information presented within the Resource-specific Mitigation Table is provided for the Narrowed pipeline corridor. When a construction right-of-way is chosen (to be located within the narrowed pipeline corridor) for the Project, only information pertaining to those features remaining within the boundaries of the construction right-of-way will be retained within the Resource-specific Mitigation Table for reference during construction.

C Mitigation measures recommended for implementation during the Planning Phase of the Project include:

1) Conduct native seed collection for use in revegetation efforts at the site (Dwg. C 04 of the Stage 2 Detailed Proposal);
2) Consider employing appropriate salvage, propogation and transplant technique for component species.
3) Consider delaying clearing to allow seed set and to limit drying of the soils.

D Mitigation measures recommended for implementation during the Construction Phase of the Project include:

4) Fence or clearly mark the site using flagging and inform all users of access restrictions in the vicinity of flagged or fenced sites.
5) Narrow down or reorient the area of disturbance and protect the site using fencing or clearly mark the site using flagging and inform all users of access restrictions in the vicinity of flagged or fenced sites (Dwg. C-05 of the Stage 2 Detailed Proposal).
6) Leave gaps in the topsoil/root zone material piles or subsoil piles to avoid the site.
7) Avoid or reduce clearing of trees or shrubs in vicinity of the site.
8) Reduce grubbing of roots within TWS areas, where feasible.
9) Mow or walk down rather than wholly remove shrubs, where feasible.
10) Use protective matting and/or snow during the winter (mark the area in case snow melts) to mat over the population or community where it occurs on the Project area, and other areas where topsoil/root zone material removal is not required, to protect vegetation from scraping and compacting (Dwg. C-06 of the Stage 2 Detailed Proposal).
11) If deemed appropriate, implement a suitable cover crop of native short-lived perennial grass during reseeding to reduce competition from non-native invasive species.
12) Install collected native seed and salvaged native plant species as detailed in the EPP and Environmental Alignment Sheets

E 13) Monitor effectiveness of implemented mitigation measures during rare plant Post-Construction Environmental Monitoring.
14) Avoid blanket use of herbicides within 30 m or between the ranges of UTM coordinates provided. Target spraying, wicking, mowing or hand-picking are acceptable weed control measures in proximity to rare plants and rare ecological communities and may be important to prevent competition with invasive plant species.

References

Barner, J. 2009. Propagation protocol for production of *Koeleria macrantha* (Ledeb.) Schult. seeds. Native Plant Network. Moscow, ID. Available online at: http://nativeplants.for.uidaho.edu/Network/ViewProtocols.aspx?ProtocolID=3785. Accessed: July 2014.

British Columbia Conservation Data Centre. 2014a. Conservation Status Report: *Leymus cinereus* Herbaceous Vegetation. BC Ministry of Environment. Website: http://a100.gov.bc.ca/pub/eswp/esr.do?id=20275. Accessed: July 2014.

British Columbia Conservation Data Centre. 2014b. Conservation Status Report: *Pseudoroegneria spicata* - *Koeleria macrantha*. BC Ministry of Environment. Website: http://a100.gov.bc.ca/pub/eswp/esr.do?id=20782. Accessed: July 2014.

British Columbia Conservation Data Centre. 2014c. BC Species and Ecosystems Explorer. Website: http://www.env.gov.bc.ca/atrisk/toolintro.html. Accessed: March 2014.

Huxley, A., M. Griffiths and M. Levy, Eds. 1999. The New Royal Horticultural Society Dictionary of Gardening. Macmillan, London, UK. 3000 pp.

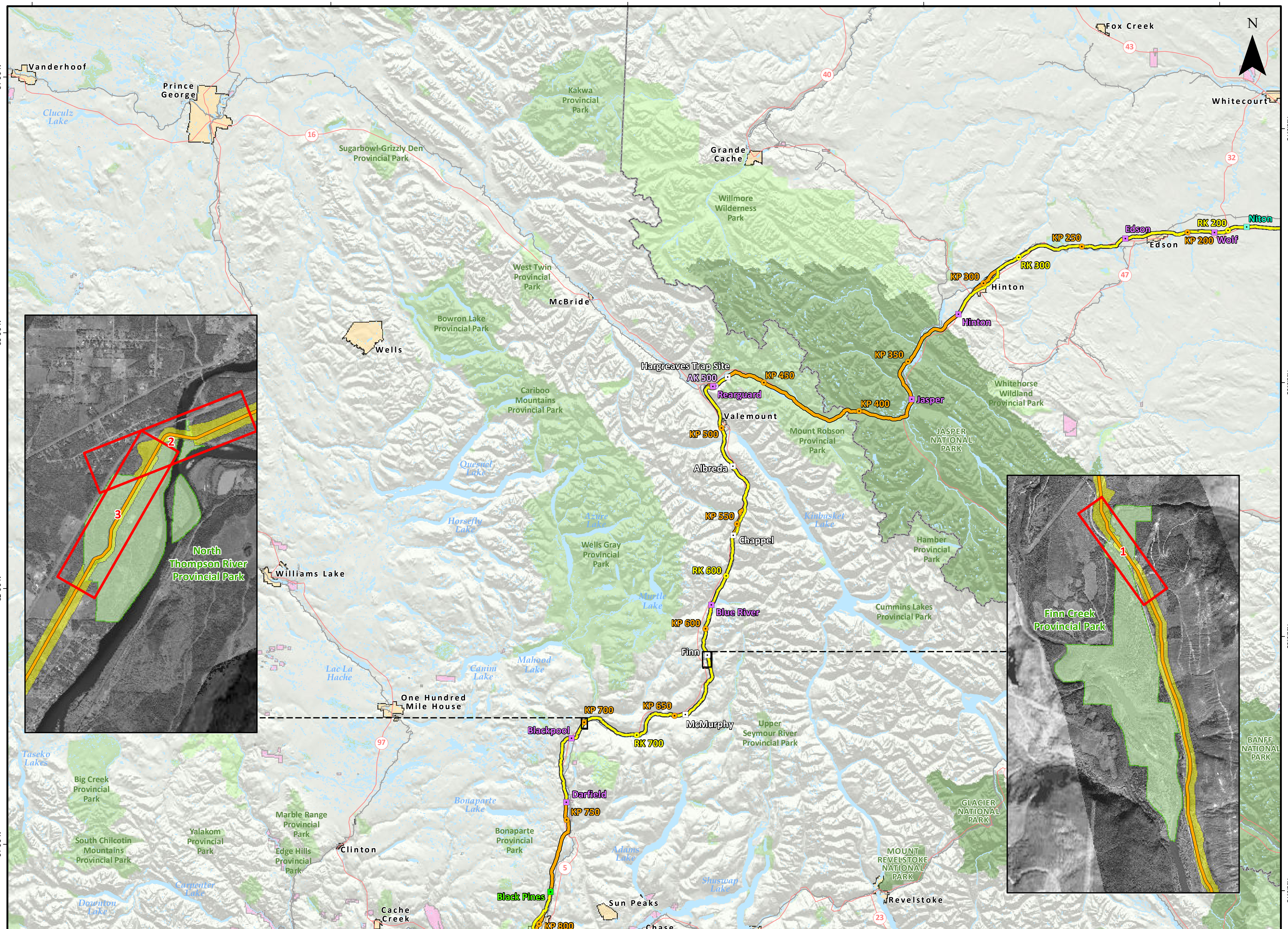
NatureServe. 2014a. NatureServe Explorer - An Online Encyclopedia of Life. Website: http://www.natureserve.org/explorer/index.htm. Accessed: March 2014.

NatureServe. 2014b. NatureServe Conservation Status. Website: http://www.natureserve.org/explorer/ranking.htm#global. Accessed: August 2014.

Skinner, D. 2004a. Propagation protocol for production of container *Pseudoroegneria spicata* (Pursh) A. Love *inermis* (Scribn & J.G. Sm.) A. Love plants. Native Plant Network. Moscow, ID. Available online at: http://nativeplants.for.uidaho.edu/Network/ViewProtocols.aspx?ProtocolID=2823. Accessed: July 2014.

Skinner, D. 2004b. Propagation protocol for production of *Pseudoroegneria spicata* (Pursh) A. Love *inerme* (*Whitmar*) (Scribn & J.G. Sm.) A. Love seeds. Native Plant Network. Moscow, ID. Available online at: http://nativeplants.for.uidaho.edu/Network/ViewProtocols.aspx?ProtocolID=2825. Accessed: July 2014.

Winslow, S.R. 2002. Propagation protocol for production of *Leymus cinereus* seeds. Native Plant Network. Moscow, ID. Available online at: http://nativeplants.for.uidaho.edu/Network/ViewProtocols.aspx?ProtocolID=1395. Accessed: July 2014.



TRANS MOUNTAIN

OVERVIEW
FINN CREEK PROVINCIAL PARK AND NORTH THOMPSON RIVER PROVINCIAL PARK

TRANS MOUNTAIN EXPANSION PROJECT

- City / Town
- Kilometre Post (KP)
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Revised Pipeline Corridor
- Terminal
- Pump Station (Pump Additions, Station Modifications and/or Scraper Facilities)
- New Pump Station (Proposed)
- Pump Station (Reactivated)
- Existing Pump Station
- Road
- Railway
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- National Park
- Provincial Park
- Natural Area / Provincial Recreation Area / Wilderness Provincial Park
- Provincial Boundary

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Projection: UTM Zone 11N.
Routing: Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor V10, provided by UPI, August 1st, 2014; Transportation: NRCan, 2012 & ESRI, 2005; Geopolitical Boundaries: AltaLIS, 2014 & IHS Inc., 2013; First Nation Lands: Government of Canada, 2014, AltaLIS, 2010 & IHS Inc., 2013; Hydrology: IHS Inc., 2004; Parks and Protected Areas: NRCan, 2014, AltaLIS, 2012, ATPR, 2012 & BC MFLNRO, 2008; Hillshade: TERA Environmental Consultants, 2008.

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Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER		PAGE
201407_MAP_TERA_EAS_00601_REV0_01		SHEET 1 OF 2
DATE	TERA REF.	REVISION
August 2014	7894	0
SCALE	PAGE SIZE	DISCIPLINE
1:1,600,000	11x17	PER
DRAWN	CHECKED	DESIGN
CMR	CAS	TGG

SCALE: 1:1,600,000

0 10 20 30 40 50 km

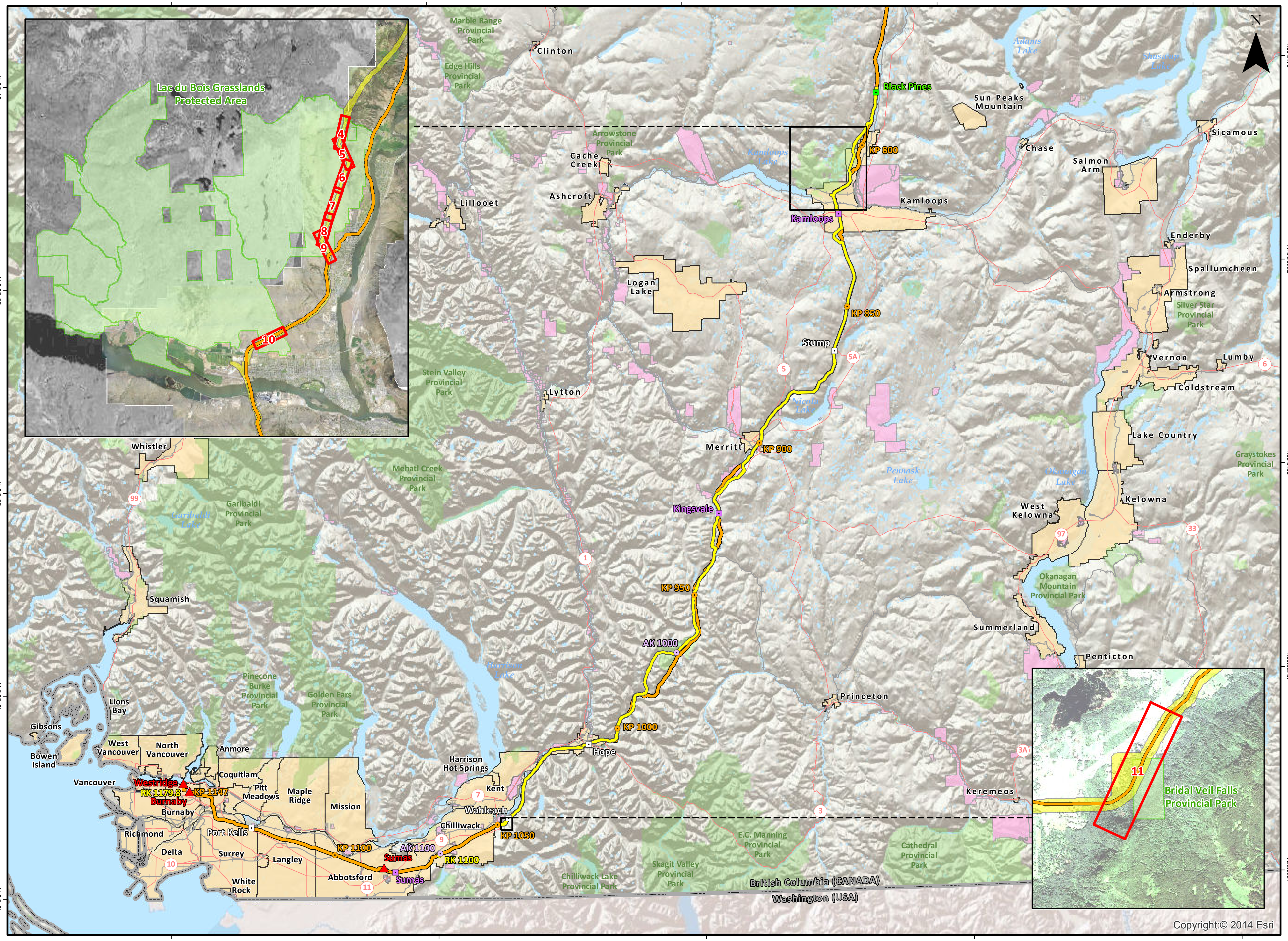
ALL LOCATIONS APPROXIMATE

201407_MAP_TERA_EAS_00601_Rev0_01.mxd

TRANS MOUNTAIN

OVERVIEW LAC DU BOIS GRASSLANDS PROTECTED AREA AND BRIDAL VEIL FALLS PROVINCIAL PARK

TRANS MOUNTAIN EXPANSION PROJECT



- City / Town
- Kilometre Post (KP)
- Reference Kilometre Post (RK)
- Alternate Kilometre Post (AK)
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Revised Pipeline Corridor
- Terminal
- Pump Station (Pump Additions, Station Modifications and/or Scraper Facilities)
- New Pump Station (Proposed)
- Pump Station (Reactivated)
- Existing Pump Station
- Road
- Railway
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- National Park
- Provincial Park
- Natural Area / Provincial Recreation Area / Wilderness Provincial Park
- Provincial Boundary

Projection: UTM Zone 10N.
Routing: Baseline TMPL Route Revision 0, provided by KMC, May 2012;Proposed Corridor V10, provided by UPI, August 1st, 2014; Transportation: NRCan, 2012 & ESRI, 2005; Geopolitical Boundaries: IHS Inc., 2013 & ESRI, 2005; First Nation Lands: Government of Canada, 2014, AltaLIS, 2010 & IHS Inc., 2013; Hydrology: IHS Inc., 2004 & ESRI, 2005; Parks and Protected Areas: NRCan, 2014, AltaLIS, 2012, ATPR, 2012 & BC MFLNRO, 2008; Hillshade: TERA Environmental Consultants, 2008 & ESRI, 2014.

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Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER 201407_MAP_TERA_EAS_00601_REV0_02		PAGE SHEET 2 OF 2
DATE August 2014	TERA REF. 7894	REVISION 0
SCALE 1:1,000,000	PAGE SIZE 11x17	DISCIPLINE PER
DRAWN CMR	CHECKED CAS	DESIGN TGG

SCALE: 1:1,000,000

0 10 20 30 40 km

ALL LOCATIONS APPROXIMATE

201407_MAP_TERA_EAS_00601_Rev0_02.mxd

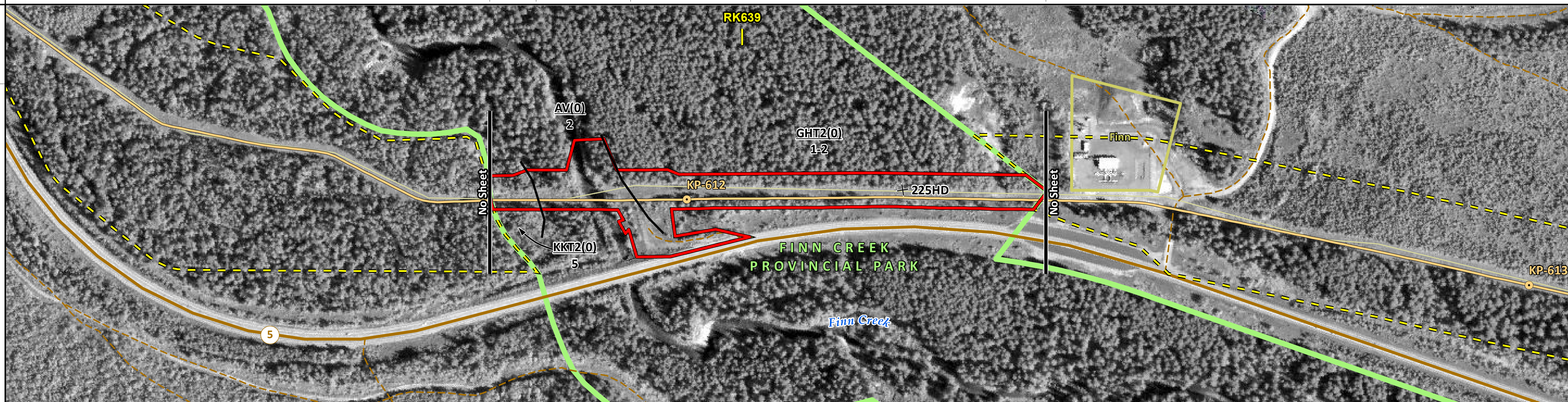
ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING INFORMATION

JURISDICTION	FINN CREEK PROVINCIAL PARK
LAND OWNERSHIP / DISPOSITION	CROWN TR0342T001 ENV C&R
LAND USE	TREED
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS	
HERITAGE / TRADITIONAL LAND USE	
WILDLIFE / WILDLIFE HABITAT	GROUNDHOG CARIBOU HERD RANGE
VEGETATION	
WETLANDS	SWAMP; FLOOD ASSOCIATION
FISH HABITAT SENSITIVITY	HIGH
HYDROLOGY	FINN CREEK; UNNAMED DRAINAGE; SHALLOW GW
SOILS PARENT MATERIAL	GF; F; O

11" X 17" MOSAIC SCALE 1:5,000
DATE OF IMAGERY: 2005-2012

N

- Reference Kilometre Post (RK)
- Kilometre Post (KP) (TMPL)
- Trans Mountain Pipeline (TMPL)
- Narrowed Pipeline Corridor
- Proposed Pipeline Corridor
- Trans Mountain Owned Land
- Soil Inspection
- Soil Sample
- Soil Break
- Other Existing Pipeline
- 1 Highway
- Paved Road
- Trail / Rough Road
- City / Town
- Indian Reserve
- Park / Protected Area



POTENTIAL ENVIRONMENTAL ISSUES	WETLAND; FISH; WETLAND; WC (NCD-W) WIND/WATER ER; WIND EROSION NAV WATERS / WC (S2) UNSTABLE TRENCH COMPACTION AND RUTTING HYDROLOGY WILDLIFE AREA

ENVIRONMENTAL PROTECTION

CONSTRUCTION WORK WINDOW		AQ-JULY 22 - AUGUST 15; AQ-OPEN
SOILS HANDLING	STRIPPING DEPTH (cm)	15-10; 40
	PROCEDURE	FULL ROW; REDUCE AS APPROPRIATE; N/A; FULL ROW; REDUCE AS APPROPRIATE
SOILS		SO-NOTE 1; SO-NOTE 3; SO-NOTE 1; SO-NOTE 3; SO-NOTE 2
WATERCOURSE CROSSINGS	PIPELINE	AQ-NOTE 3; AQ-NOTE 3
	VEHICLE	AQ-NOTE 2; AQ-NOTE 2
WETLANDS		WT-NOTE 1; WT-NOTE 1
FOREST TYPE (m^3/ha)		
VEGETATION		
WILDLIFE AND FISH HABITAT		WF-NOTE 5; AQ-NOTE 1
HERITAGE / TRADITIONAL LAND USE		
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS		
SPECIAL MEASURES		AQ-NOTE 4; HY-NOTE 1

TRANS MOUNTAIN

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Soils Description

- Soil Phase
- Soil Unit
- Depth of Topsoil (cm)

byKWY(10-15)
6 — Topographic Class

REFERENCES

Projection: NAD_1983_UTM_Zone_11N
Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor, provided by UPI, August 1st, 2014; Existing Infrastructure: IHS Inc., 2014; Transportation: BC MFLNRO 2012, NRCan 2012; Geopolitical Boundaries:BC MFLNRO 2007; First Nation Lands: Government of Canada 2014; Hydrology: BC FLNRO, 2008; Parks and Protected Areas: BC FLNRO, 2008; B/W & Colour Imagery 2008-2012: provided by KMC, 2013; 1:50,000 NTS Map © 2013 Department of Natural Resources Canada. All rights reserved.

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REVISION HISTORY

NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.
0	Aug 15, 2014	Stage 2 Park Permit Application	AJ	PS	GB

MAP NUMBER 201407_MAP_TERA_EAS_00601_REV0		PAGE SHEET 001 OF 011	ENVIRONMENTAL ALIGNMENT SHEETS TRANS MOUNTAIN EXPANSION PROJECT
DATE August 2014	TERA REF. 7894	REVISION 0	
SCALE 1:5,000	PAGE SIZE 11x17	DISCIPLINE EAS	FROM RK 638.7 / TO RK 639.4
DRAWN AJ	CHECKED PS	DESIGN TGG	0 50 100 150 200 250 m

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ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING INFORMATION

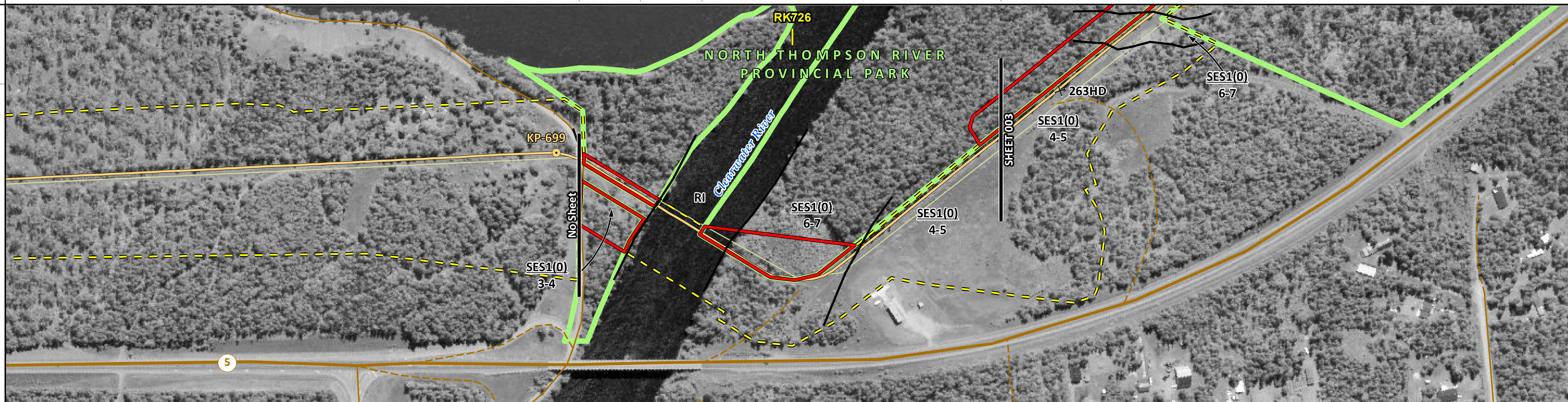
JURISDICTION: N THOMPSON RIVER PP | THOMPSON-NICOLA REGIONAL DISTRICT | N THOMPSON RIVER PP | THOMPSON-NICOLA REGIONAL DISTRICT

LAND OWNERSHIP / DISPOSITION	TR0340T006	CROWN	TR0339T001
LAND USE	TREED	RIVER	TREED
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS			
HERITAGE / TRADITIONAL LAND USE			
WILDLIFE / WILDLIFE HABITAT			
VEGETATION			
WETLANDS			
FISH HABITAT SENSITIVITY		HIGH	
HYDROLOGY		CLEARWATER RIVER	
SOILS PARENT MATERIAL	GF	N/A	GF

11" X 17" MOSAIC SCALE 1:5,000 DATE OF IMAGERY: 2005-2012

N

- Reference Kilometre Post (RK)
- Kilometre Post (KP) (TMPL)
- Trans Mountain Pipeline (TMPL)
- Narrowed Pipeline Corridor
- Proposed Pipeline Corridor
- Trans Mountain Owned Land
- Soil Inspection
- Soil Sample
- Soil Break
- Other Existing Pipeline
- Highway
- Paved Road
- Trail / Rough Road
- City / Town
- Indian Reserve
- Park / Protected Area



POTENTIAL ENVIRONMENTAL ISSUES

POTENTIAL ENVIRONMENTAL ISSUES	WIND EROSION UNSTABLE TRENCH	WC (S1A) FISH WATER EROSION	WIND/WATER ER UNSTABLE TRENCH

ENVIRONMENTAL PROTECTION

CONSTRUCTION WORK WINDOW		AQ-AUG 7 TO AUG 15	
SOILS HANDLING – STRIPPING DEPTH (cm)	15-20	N/A	15-20
SOILS HANDLING – PROCEDURE	FULL ROW; REDUCE AS APPROPRIATE	N/A	FULL ROW; REDUCE AS APPROPRIATE
SOILS	SO-NOTE 1 SO-NOTE 3		SO-NOTE 1 SO-NOTE 3
WATERCOURSE CROSSINGS – PIPELINE		AQ-NOTE 3	
WATERCOURSE CROSSINGS – VEHICLE		AQ-NOTE 2	
WETLANDS			
FOREST TYPE (m^3/ha)			
VEGETATION			
WILDLIFE AND FISH HABITAT		AQ-NOTE 1	
HERITAGE / TRADITIONAL LAND USE			
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS			
SPECIAL MEASURES			

TRANS MOUNTAIN

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Soils Description

Soil Phase
Soil Unit
Depth of Topsoil (cm)
byKWY(10-15)
6 — Topographic Class

REFERENCES

Projection: NAD_1983_UTM_Zone_10N
Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor, provided by UPI, August 1st, 2014; Existing Infrastructure: IHS Inc., 2014; Transportation: BC MFLNRO 2012, NRCan 2012; Geopolitical Boundaries:BC MFLNRO 2007; First Nation Lands: Government of Canada 2014; Hydrology: BC FLNRO, 2008; Parks and Protected Areas: BC FLNRO, 2008; B/W & Colour Imagery 2008-2012: provided by KMC, 2013; 1:50,000 NTS Map © 2013 Department of Natural Resources Canada. All rights reserved.

REVISION HISTORY

NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.
0	Aug 15, 2014	Stage 2 Park Permit Application	AJ	PS	GB

MAP NUMBER: 201407_MAP_TERA_EAS_00601_REV0		PAGE: SHEET 002 OF 011	ENVIRONMENTAL ALIGNMENT SHEETS
DATE: August 2014	TERA REF.: 7894	REVISION: 0	TRANS MOUNTAIN EXPANSION PROJECT
SCALE: 1:5,000	PAGE SIZE: 11x17	DISCIPLINE: EAS	FROM: RK 725.8 / TO: RK 726.5
DRAWN: AJ	CHECKED: PS	DESIGN: TGG	0 50 100 150 200 250 m

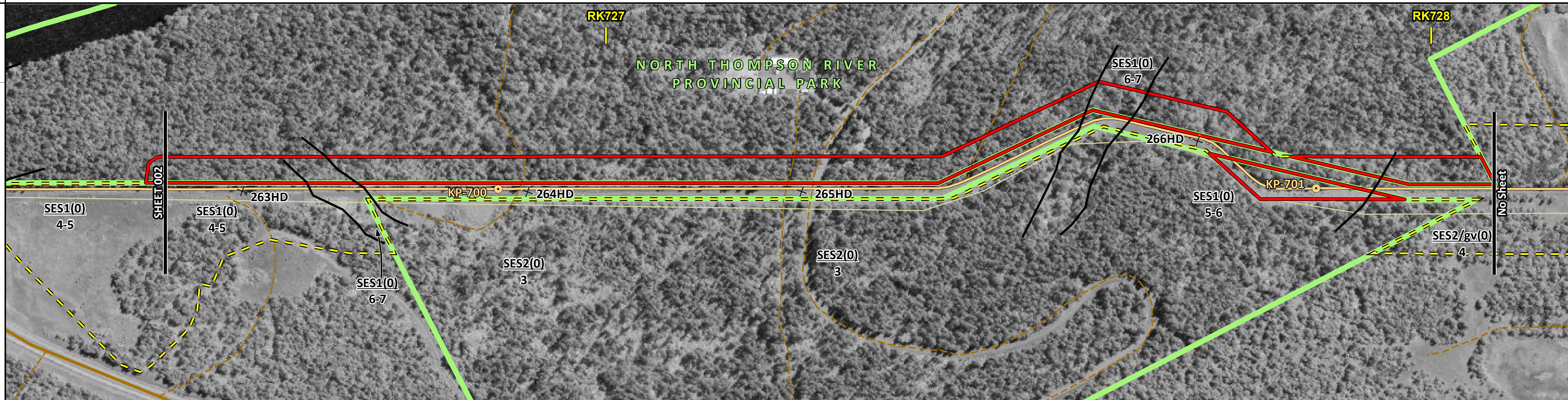
ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING INFORMATION

JURISDICTION	THOMPSON-NICOLA REGIONAL DISTRICT		N THOMPSON RIVER PP	THOMPSON-NICOLA REGIONAL DISTRICT
LAND OWNERSHIP / DISPOSITION	CROWN TR0339T001			
LAND USE	TREED			
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS				
HERITAGE / TRADITIONAL LAND USE				
WILDLIFE / WILDLIFE HABITAT				
VEGETATION				PYROELL177040
WETLANDS				
FISH HABITAT SENSITIVITY				
HYDROLOGY				
SOILS PARENT MATERIAL	GF			

11" X 17" MOSAIC SCALE 1:5,000
DATE OF IMAGERY: 2005-2012

N

- Reference Kilometre Post (RK)
- Kilometre Post (KP) (TMPL)
- Trans Mountain Pipeline (TMPL)
- Narrowed Pipeline Corridor
- Proposed Pipeline Corridor
- Trans Mountain Owned Land
- Soil Inspection
- Soil Sample
- Soil Break
- Other Existing Pipeline
- Highway
- Paved Road
- Trail / Rough Road
- City / Town
- Indian Reserve
- Park / Protected Area



POTENTIAL ENVIRONMENTAL ISSUES	WIND/WATER ER	WIND EROSION	WIND/WATER ER	RARE PLANT WIND EROSION	
	UNSTABLE TRENCH				

ENVIRONMENTAL PROTECTION

CONSTRUCTION WORK WINDOW					
SOILS HANDLING – STRIPPING DEPTH (cm)	15-20	15-20	15-20	25	
SOILS HANDLING – PROCEDURE	FULL ROW; REDUCE AS APPROPRIATE			OVERSTRIP	
SOILS	SO-NOTE 1 SO-NOTE 3				
WATERCOURSE CROSSINGS – PIPELINE					
WATERCOURSE CROSSINGS – VEHICLE					
WETLANDS					
FOREST TYPE (m^3/ha)					
VEGETATION				VEG-NOTE 1	
WILDLIFE AND FISH HABITAT					
HERITAGE / TRADITIONAL LAND USE					
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS					
SPECIAL MEASURES					

TRANS MOUNTAIN

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Soils Description

- Soil Phase
- Soil Unit
- Depth of Topsoil (cm)
- Topographic Class

byKWY(10-15)
6

REFERENCES

Projection: NAD_1983_UTM_Zone_10N
Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor, provided by UPI, August 1st, 2014; Existing Infrastructure: IHS Inc., 2014; Transportation: BC MFLNRO 2012, NRCan 2012; Geopolitical Boundaries:BC MFLNRO 2007; First Nation Lands: Government of Canada 2014; Hydrology: BC FLNRO, 2008; Parks and Protected Areas: BC FLNRO, 2008; B/W & Colour Imagery 2008-2012: provided by KMC, 2013; 1:50,000 NTS Map © 2013 Department of Natural Resources Canada. All rights reserved.

REVISION HISTORY

NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.
0	Aug 15, 2014	Stage 2 Park Permit Application	AJ	PS	GB

MAP NUMBER 201407_MAP_TERA_EAS_00601_REV0		PAGE SHEET 003 OF 011	ENVIRONMENTAL ALIGNMENT SHEETS TRANS MOUNTAIN EXPANSION PROJECT
DATE August 2014	TERA REF. 7894	REVISION 0	
SCALE 1:5,000	PAGE SIZE 11x17	DISCIPLINE EAS	FROM RK 726.5 / TO RK 728.1
DRAWN AJ	CHECKED PS	DESIGN TGG	0 50 100 150 200 250 m

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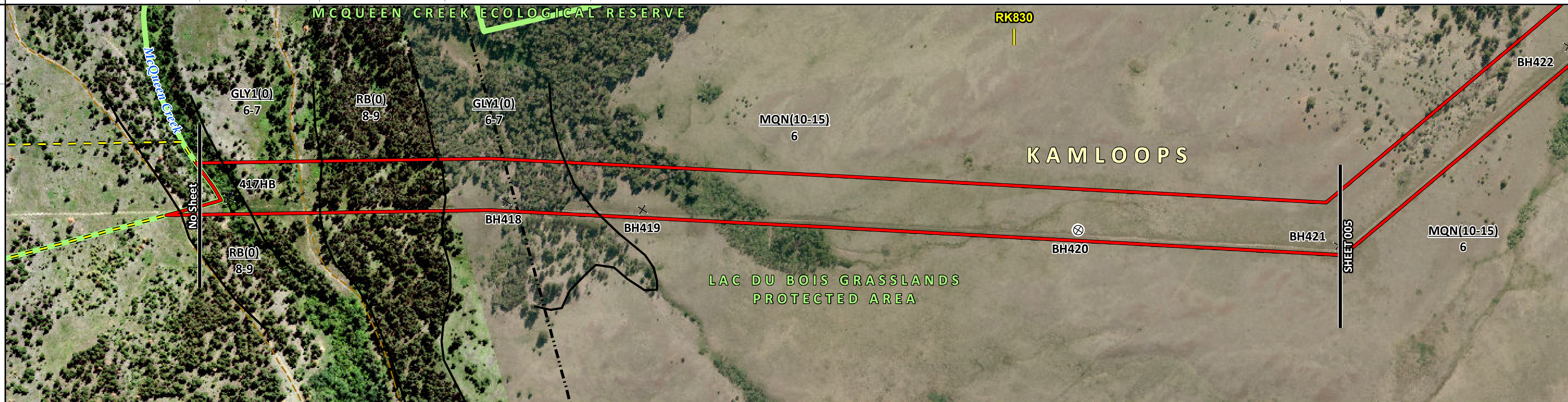
ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING INFORMATION

JURISDICTION	LAC DU BOIS GRASSLANDS PROTECTED AREA; LAC DU BOIS GRASSLANDS PROTECTED AREA; KAMLOOPS
LAND OWNERSHIP / DISPOSITION	CROWN TR0329T002
LAND USE	TREED; NATIVE GRASSLAND
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS	AGRICULTURAL LAND RESERVE; AGRICULTURAL LAND RESERVE
HERITAGE / TRADITIONAL LAND USE	
WILDLIFE / WILDLIFE HABITAT	
VEGETATION	POPUTRE729259; FESTCAM686131
WETLANDS	
FISH HABITAT SENSITIVITY	
HYDROLOGY	MCQUEEN CREEK
SOILS PARENT MATERIAL	N/A; GF; N/A; GF; T

11" X 17" MOSAIC SCALE 1:5,000
DATE OF IMAGERY: 2005-2012

N

- Reference Kilometre Post (RK)
- Kilometre Post (KP) (TMPL)
- Trans Mountain Pipeline (TMPL)
- Narrowed Pipeline Corridor
- Proposed Pipeline Corridor
- Trans Mountain Owned Land
- Soil Inspection
- Soil Sample
- Soil Break
- Other Existing Pipeline
- Highway
- Paved Road
- Trail / Rough Road
- City / Town
- Indian Reserve
- Park / Protected Area



POTENTIAL ENVIRONMENTAL ISSUES	WC (S6); NAV WATERS; WATER EROSION; WIND/WATER ER; WATER EROSION; UNSTABLE TRENCH; UNSTABLE TRENCH; RARE ECOLOGICAL COMMUNITIES; WIND/WATER ER

ENVIRONMENTAL PROTECTION

CONSTRUCTION WORK WINDOW		AQ-OPEN
SOILS HANDLING	STRIPPING DEPTH (cm)	15-20; 10-15
	PROCEDURE	BLADE WIDTH
SOILS		SO-NOTE 3; SO-NOTE 3; SO-NOTE 1
WATERCOURSE CROSSINGS	PIPELINE	AQ-NOTE 3
	VEHICLE	AQ-NOTE 2
WETLANDS		
FOREST TYPE (m^3/ha)		
VEGETATION		VEG-NOTE 1
WILDLIFE AND FISH HABITAT		
HERITAGE / TRADITIONAL LAND USE		
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS		
SPECIAL MEASURES		AQ-NOTE 4

TRANS MOUNTAIN

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Soils Description

byKWY(10-15)
6

Soil Phase
Soil Unit
Depth of Topsoil (cm)
Topographic Class

REFERENCES

Projection: NAD_1983_UTM_Zone_10N
Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor, provided by UPI, August 1st, 2014; Existing Infrastructure: IHS Inc., 2014; Transportation: BC MFLNRO 2012, NRCan 2012; Geopolitical Boundaries:BC MFLNRO 2007; First Nation Lands: Government of Canada 2014; Hydrology: BC FLNRO, 2008; Parks and Protected Areas: BC FLNRO, 2008; B/W & Colour Imagery 2008-2012: provided by KMC, 2013; 1:50,000 NTS Map © 2013 Department of Natural Resources Canada. All rights reserved.

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REVISION HISTORY

NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.
0	Aug 15, 2014	Stage 2 Park Permit Application	AJ	PS	GB

MAP NUMBER: 201407_MAP_TERA_EAS_00601_REV0		PAGE: SHEET 004 OF 011	ENVIRONMENTAL ALIGNMENT SHEETS
DATE: August 2014	TERA REF.: 7894	REVISION: 0	TRANS MOUNTAIN EXPANSION PROJECT
SCALE: 1:5,000	PAGE SIZE: 11x17	DISCIPLINE: EAS	FROM: RK 829.1 / TO: RK 830.4
DRAWN: AJ	CHECKED: PS	DESIGN: TGG	0 50 100 150 200 250 m

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ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING INFORMATION

JURISDICTION	LAC DU BOIS GRASSLANDS PROTECTED AREA; KAMLOOPS
LAND OWNERSHIP / DISPOSITION	CROWN TR0329T002
LAND USE	NATIVE GRASSLAND
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS	
HERITAGE / TRADITIONAL LAND USE	
WILDLIFE / WILDLIFE HABITAT	
VEGETATION	LEYMCIN987616
WETLANDS	SWAMP
FISH HABITAT SENSITIVITY	
HYDROLOGY	UNNAMED DRAINAGE
SOILS PARENT MATERIAL	T

11" X 17" MOSAIC SCALE 1:5,000
DATE OF IMAGERY: 2005-2012

N

- Reference Kilometre Post (RK)
- Kilometre Post (KP) (TMPL)
- Trans Mountain Pipeline (TMPL)
- Narrowed Pipeline Corridor
- Proposed Pipeline Corridor
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- Soil Sample
- Soil Break
- Other Existing Pipeline
- Highway
- Paved Road
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- Indian Reserve
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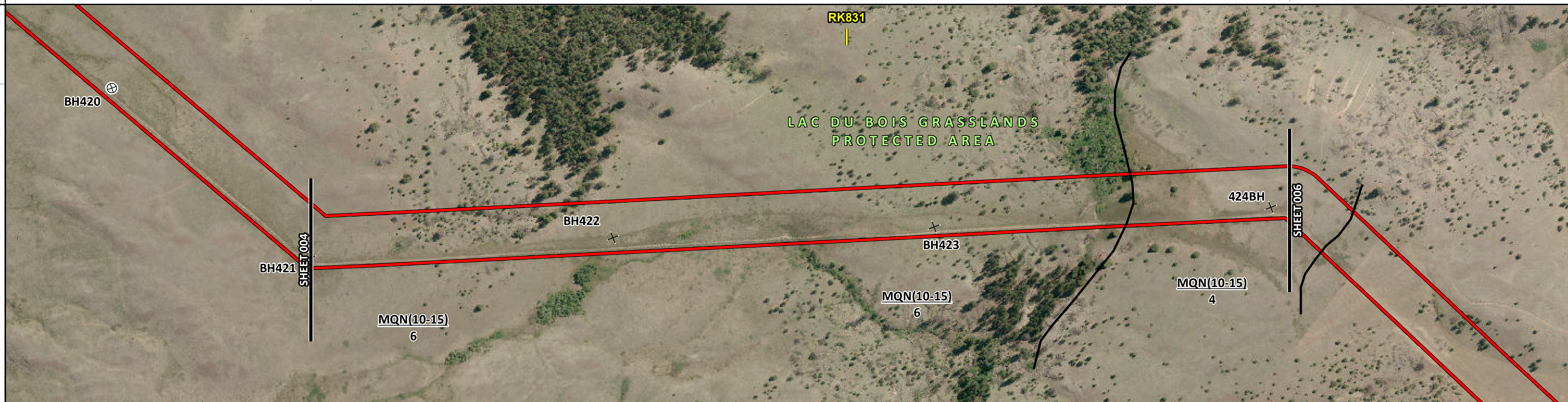

POTENTIAL ENVIRONMENTAL ISSUES	WIND/WATER ER; WC (NCD); RARE ECOLOGICAL COMMUNITY; WETLAND; WIND EROSION

ENVIRONMENTAL PROTECTION

CONSTRUCTION WORK WINDOW		AQ-OPEN
SOILS HANDLING	STRIPPING DEPTH (cm)	10-15
	PROCEDURE	BLADE WIDTH
SOILS		SO-NOTE 1
WATERCOURSE CROSSINGS	PIPELINE	AQ-NOTE 3
	VEHICLE	AQ-NOTE 2
WETLANDS		WT-NOTE 1
FOREST TYPE (m^3/ha)		
VEGETATION		VEG-NOTE 1
WILDLIFE AND FISH HABITAT		
HERITAGE / TRADITIONAL LAND USE		
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS		
SPECIAL MEASURES		

TRANS MOUNTAIN

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Soils Description

byKWY(10-15) — Soil Phase; Soil Unit; Depth of Topsoil (cm)
6 — Topographic Class

REFERENCES

Projection: NAD_1983_UTM_Zone_10N
Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor, provided by UPI, August 1st, 2014; Existing Infrastructure: IHS Inc., 2014; Transportation: BC MFLNRO 2012, NRCan 2012; Geopolitical Boundaries:BC MFLNRO 2007; First Nation Lands: Government of Canada 2014; Hydrology: BC FLNRO, 2008; Parks and Protected Areas: BC FLNRO, 2008; B/W & Colour Imagery 2008-2012: provided by KMC, 2013; 1:50,000 NTS Map © 2013 Department of Natural Resources Canada. All rights reserved.

REVISION HISTORY

NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.
0	Aug 15, 2014	Stage 2 Park Permit Application	AJ	PS	GB

MAP NUMBER 201407_MAP_TERA_EAS_00601_REV0		PAGE SHEET 005 OF 011	ENVIRONMENTAL ALIGNMENT SHEETS
DATE August 2014	TERA REF. 7894	REVISION 0	TRANS MOUNTAIN EXPANSION PROJECT
SCALE 1:5,000	PAGE SIZE 11x17	DISCIPLINE EAS	FROM RK 830.4 / TO RK 831.5
DRAWN AJ	CHECKED PS	DESIGN TGG	0 50 100 150 200 250 m

ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING INFORMATION

JURISDICTION	LAC DU BOIS GRASSLANDS PROTECTED AREA; KAMLOOPS
LAND OWNERSHIP / DISPOSITION	CROWN TR0329T002
LAND USE	NATIVE GRASSLAND
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS	
HERITAGE / TRADITIONAL LAND USE	
WILDLIFE / WILDLIFE HABITAT	
VEGETATION	PSEUSPI966622; PINUPON895171; ARTETRI701560; ARTETRI694437; FESTCAM623369; PSEUSPI623369; ARTETRI582133
WETLANDS	
FISH HABITAT SENSITIVITY	
HYDROLOGY	UNNAMED DRAINAGE; UNNAMED DRAINAGE; UNNAMED DRAINAGE
SOILS PARENT MATERIAL	T

11" X 17" MOSAIC SCALE 1:5,000
DATE OF IMAGERY: 2005-2012

N

- Reference Kilometre Post (RK)
- Kilometre Post (KP) (TMPL)
- Trans Mountain Pipeline (TMPL)
- Narrowed Pipeline Corridor
- Proposed Pipeline Corridor
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- Soil Sample
- Soil Break
- Other Existing Pipeline
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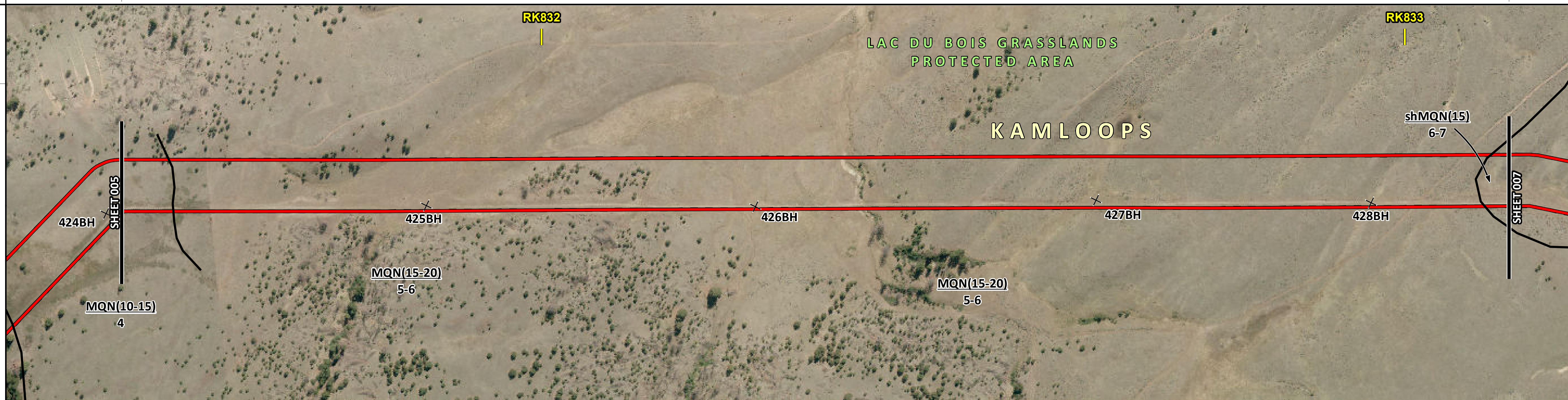
- Trail / Rough Road
- City / Town
- Indian Reserve
- Park / Protected Area



POTENTIAL ENVIRONMENTAL ISSUES

RARE ECOLOGICAL COMMUNITY; WC (NVC); RARE ECOLOGICAL COMMUNITY; WC (NVC); WC (NVC); RARE ECOLOGICAL COMMUNITY; RARE ECOLOGICAL COMMUNITIES

WIND EROSION; WIND/WATER ER

ENVIRONMENTAL PROTECTION

CONSTRUCTION WORK WINDOW		AQ-OPEN; AQ-OPEN; AQ-OPEN
SOILS HANDLING	STRIPPING DEPTH (cm)	10-15; 15-20; 15
	PROCEDURE	BLADE WIDTH
SOILS		SO-NOTE 1
WATERCOURSE CROSSINGS	PIPELINE	AQ-NOTE 3; AQ-NOTE 3; AQ-NOTE 3
	VEHICLE	AQ-NOTE 2; AQ-NOTE 2; AQ-NOTE 2
WETLANDS		
FOREST TYPE (m^3/ha)		
VEGETATION		VEG-NOTE 1; VEG-NOTE 1; VEG-NOTE 1; VEG-NOTE 1
WILDLIFE AND FISH HABITAT		
HERITAGE / TRADITIONAL LAND USE		
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS		
SPECIAL MEASURES		

TRANS MOUNTAIN

tera A CH2M HILL Company

Soils Description

byKWY(10-15) — Soil Phase; Soil Unit; Depth of Topsoil (cm)

6 — Topographic Class

REFERENCES

Projection: NAD_1983_UTM_Zone_10N

Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor, provided by UPI, August 1st, 2014; Existing Infrastructure: IHS Inc., 2014; Transportation: BC MFLNRO 2012, NRCan 2012; Geopolitical Boundaries:BC MFLNRO 2007; First Nation Lands: Government of Canada 2014; Hydrology: BC FLNRO, 2008; Parks and Protected Areas: BC FLNRO, 2008; B/W & Colour Imagery 2008-2012: provided by KMC, 2013; 1:50,000 NTS Map © 2013 Department of Natural Resources Canada. All rights reserved.

REVISION HISTORY

NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.
0	Aug 15, 2014	Stage 2 Park Permit Application	AJ	PS	GB

MAP NUMBER 201407_MAP_TERA_EAS_00601_REV0		PAGE SHEET 006 OF 011	ENVIRONMENTAL ALIGNMENT SHEETS
DATE August 2014	TERA REF. 7894	REVISION 0	TRANS MOUNTAIN EXPANSION PROJECT
SCALE 1:5,000	PAGE SIZE 11x17	DISCIPLINE EAS	FROM RK 831.5 / TO RK 833.1
DRAWN AJ	CHECKED PS	DESIGN TGG	0 50 100 150 200 250 m

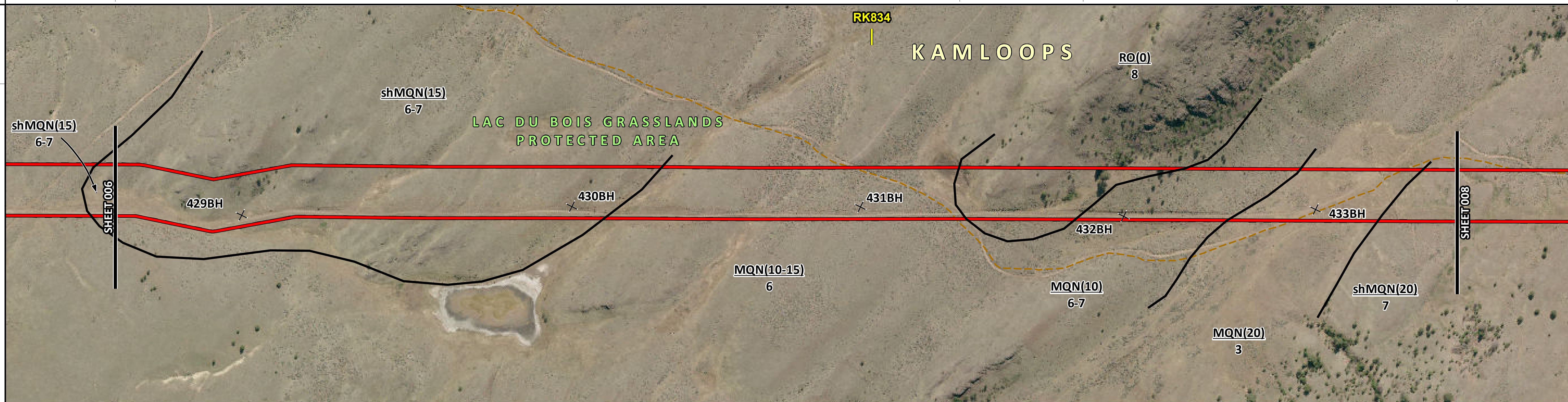
ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING INFORMATION

JURISDICTION	LAC DU BOIS GRASSLANDS PROTECTED AREA; KAMLOOPS
LAND OWNERSHIP / DISPOSITION	CROWN TR0329T002
LAND USE	NATIVE GRASSLAND
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS	AGRICULTURAL LAND RESERVE
HERITAGE / TRADITIONAL LAND USE	
WILDLIFE / WILDLIFE HABITAT	
VEGETATION	FESTCAM623369; ARTETRI582133; ATRITRU312645; ARTETRI180995; PINUPON111782; ARTETRI901245
WETLANDS	MARSH; MARSH
FISH HABITAT SENSITIVITY	
HYDROLOGY	UNNAMED DRAINAGE; UNNAMED DRAINAGE; UNNAMED DRAINAGE; UNNAMED DRAINAGE; UNNAMED DRAINAGE
SOILS PARENT MATERIAL	T; N/A; T

11" X 17" MOSAIC SCALE 1:5,000 DATE OF IMAGERY: 2005-2012

N

- Reference Kilometre Post (RK)
- Kilometre Post (KP) (TMPL)
- Trans Mountain Pipeline (TMPL)
- Narrowed Pipeline Corridor
- Proposed Pipeline Corridor
- Trans Mountain Owned Land
- Soil Inspection
- Soil Sample
- Soil Break
- Other Existing Pipeline
- Highway
- Paved Road
- Trail / Rough Road
- City / Town
- Indian Reserve
- Park / Protected Area



POTENTIAL ENVIRONMENTAL ISSUES	WC (NVC); WC (NVC); WC (NVC); WC (NVC); RARE ECOLOGICAL COMMUNITIES; WETLAND; WETLAND; WIND/WATER ER; WATER EROSION; WIND/WATER ER; WIND EROSION; WIND/WATER ER; WC (NVC); RARE PLANT

ENVIRONMENTAL PROTECTION

CONSTRUCTION WORK WINDOW		AQ-OPEN; AQ-OPEN; AQ-OPEN; AQ-OPEN; AQ-OPEN
SOILS HANDLING	STRIPPING DEPTH (cm)	15; 10-15; 15-20; 10; 20
	PROCEDURE	BLADE WIDTH
SOILS		SO-NOTE 1
WATERCOURSE CROSSINGS	PIPELINE	AQ-NOTE 3; AQ-NOTE 3; AQ-NOTE 3; AQ-NOTE 3; AQ-NOTE 3
	VEHICLE	AQ-NOTE 2; AQ-NOTE 2; AQ-NOTE 2; AQ-NOTE 2; AQ-NOTE 2
WETLANDS		WT-NOTE 1; WT-NOTE 1
FOREST TYPE (m^3/ha)		
VEGETATION		VEG-NOTE 1
WILDLIFE AND FISH HABITAT		
HERITAGE / TRADITIONAL LAND USE		
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS		
SPECIAL MEASURES		

TRANS MOUNTAIN

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Soils Description

Soil Phase
Soil Unit
Depth of Topsoil (cm)
byKWY(10-15)
6 Topographic Class

REFERENCES

Projection: NAD_1983_UTM_Zone_10N
Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor, provided by UPI, August 1st, 2014; Existing Infrastructure: IHS Inc., 2014; Transportation: BC MFLNRO 2012, NRCan 2012; Geopolitical Boundaries:BC MFLNRO 2007; First Nation Lands: Government of Canada 2014; Hydrology: BC FLNRO, 2008; Parks and Protected Areas: BC FLNRO, 2008; B/W & Colour Imagery 2008-2012: provided by KMC, 2013; 1:50,000 NTS Map © 2013 Department of Natural Resources Canada. All rights reserved.

REVISION HISTORY

NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.
0	Aug 15, 2014	Stage 2 Park Permit Application	AJ	PS	GB

MAP NUMBER: 201407_MAP_TERA_EAS_00601_REV0		PAGE: SHEET 007 OF 011	ENVIRONMENTAL ALIGNMENT SHEETS TRANS MOUNTAIN EXPANSION PROJECT
DATE: August 2014	TERA REF.: 7894	REVISION: 0	
SCALE: 1:5,000	PAGE SIZE: 11x17	DISCIPLINE: EAS	FROM: RK 833.1 / TO: RK 834.7
DRAWN: AJ	CHECKED: PS	DESIGN: TGG	0 50 100 150 200 250 m

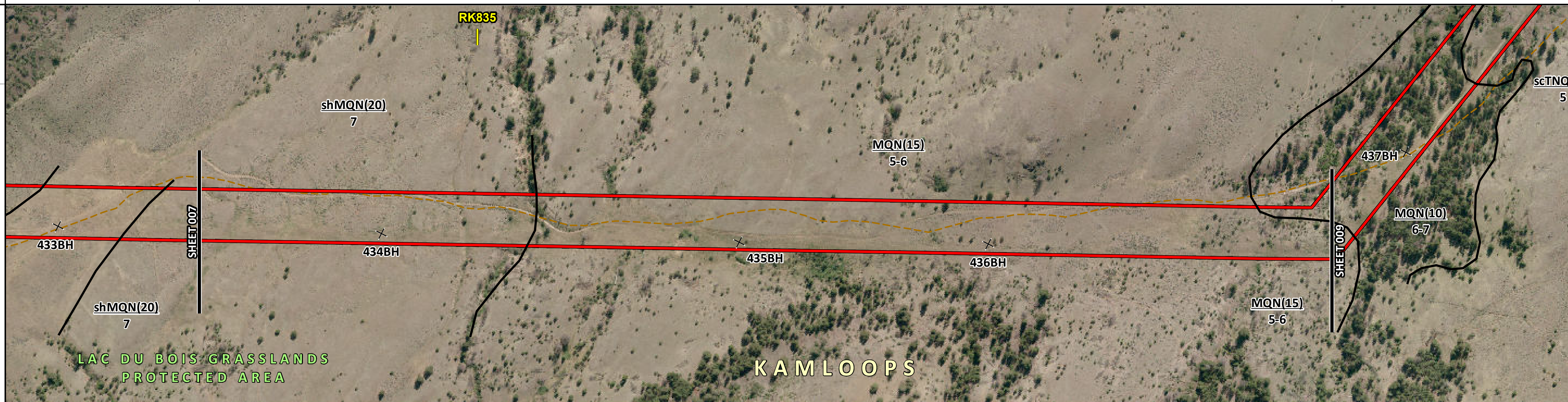
ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING INFORMATION

JURISDICTION	LAC DU BOIS GRASSLANDS PROTECTED AREA; KAMLOOPS
LAND OWNERSHIP / DISPOSITION	CROWN TR0329T002
LAND USE	NATIVE GRASSLAND
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS	AGRICULTURAL LAND RESERVE
HERITAGE / TRADITIONAL LAND USE	
WILDLIFE / WILDLIFE HABITAT	
VEGETATION	FESTCAM623369; ARTETRI901245; PINUPON573276
WETLANDS	
FISH HABITAT SENSITIVITY	
HYDROLOGY	UNNAMED DRAINAGE; UNNAMED DRAINAGE; UNNAMED DRAINAGE; UNNAMED DRAINAGE
SOILS PARENT MATERIAL	T

11" X 17" MOSAIC SCALE 1:5,000
DATE OF IMAGERY: 2005-2012

N

- Reference Kilometre Post (RK)
- Kilometre Post (KP) (TMPL)
- Trans Mountain Pipeline (TMPL)
- Narrowed Pipeline Corridor
- Proposed Pipeline Corridor
- Trans Mountain Owned Land
- Soil Inspection
- Soil Sample
- Soil Break
- Other Existing Pipeline
- Highway
- Paved Road
- Trail / Rough Road
- City / Town
- Indian Reserve
- Park / Protected Area



POTENTIAL ENVIRONMENTAL ISSUES	WC (NVC); WC (NVC); WC (NVC); WC (NVC); RARE ECOLOGICAL COMMUNITIES; RARE ECOLOGICAL COMMUNITY; WIND/WATER ER

ENVIRONMENTAL PROTECTION

CONSTRUCTION WORK WINDOW		AQ-OPEN; AQ-OPEN; AQ-OPEN; AQ-OPEN
SOILS HANDLING	STRIPPING DEPTH (cm)	20; 15
	PROCEDURE	BLADE WIDTH
SOILS		SO-NOTE 1
WATERCOURSE CROSSINGS	PIPELINE	AQ-NOTE 3; AQ-NOTE 3; AQ-NOTE 3; AQ-NOTE 3
	VEHICLE	AQ-NOTE 2; AQ-NOTE 2; AQ-NOTE 2; AQ-NOTE 2
WETLANDS		
FOREST TYPE (m^3/ha)		
VEGETATION		VEG-NOTE 1; VEG-NOTE 1
WILDLIFE AND FISH HABITAT		
HERITAGE / TRADITIONAL LAND USE		
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS		
SPECIAL MEASURES		

TRANS MOUNTAIN

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Soils Description

byKWY(10-15)
6

Soil Phase; Soil Unit; Depth of Topsoil (cm); Topographic Class

REFERENCES

Projection: NAD_1983_UTM_Zone_10N
Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor, provided by UPI, August 1st, 2014; Existing Infrastructure: IHS Inc., 2014; Transportation: BC MFLNRO 2012, NRCan 2012; Geopolitical Boundaries:BC MFLNRO 2007; First Nation Lands: Government of Canada 2014; Hydrology: BC FLNRO, 2008; Parks and Protected Areas: BC FLNRO, 2008; B/W & Colour Imagery 2008-2012: provided by KMC, 2013; 1:50,000 NTS Map © 2013 Department of Natural Resources Canada. All rights reserved.

REVISION HISTORY

NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.
0	Aug 15, 2014	Stage 2 Park Permit Application	AJ	PS	GB

MAP NUMBER	PAGE
201407_MAP_TERA_EAS_00601_REV0	SHEET 008 OF 011

DATE	TERA REF.	REVISION
August 2014	7894	0

SCALE	PAGE SIZE	DISCIPLINE
1:5,000	11x17	EAS

DRAWN	CHECKED	DESIGN
AJ	PS	TGG

ENVIRONMENTAL ALIGNMENT SHEETS
TRANS MOUNTAIN EXPANSION PROJECT

FROM	TO
RK 834.7	RK 836.0

0 50 100 150 200 250 m

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ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING INFORMATION

JURISDICTION	LAC DU BOIS GRASSLANDS PROTECTED AREA; KAMLOOPS
LAND OWNERSHIP / DISPOSITION	CROWN TR0329T002
LAND USE	NATIVE GRASSLAND; TREED; NATIVE GRASSLAND
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS	AGRICULTURAL LAND RESERVE
HERITAGE / TRADITIONAL LAND USE	
WILDLIFE / WILDLIFE HABITAT	
VEGETATION	PINUPON930693
WETLANDS	
FISH HABITAT SENSITIVITY	
HYDROLOGY	UNNAMED DRAINAGE; UNNAMED DRAINAGE
SOILS PARENT MATERIAL	T

11" X 17" MOSAIC SCALE 1:5,000
DATE OF IMAGERY: 2005-2012

- Reference Kilometre Post (RK)
- Kilometre Post (KP) (TMPL)
- Trans Mountain Pipeline (TMPL)
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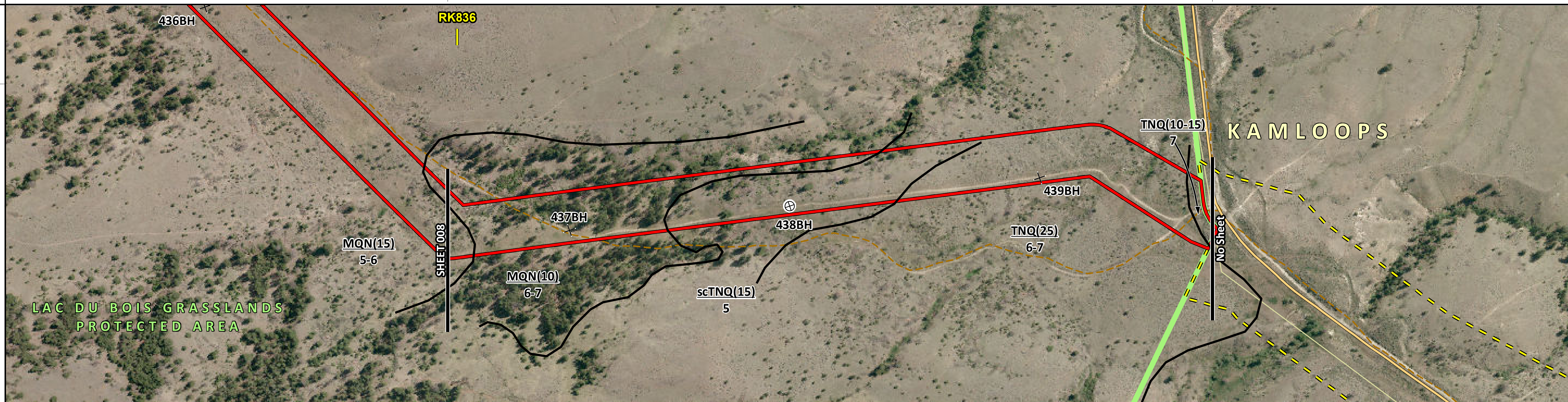
- Soil Inspection
- Soil Sample
- Soil Break
- Other Existing Pipeline
- Highway
- Paved Road
- Trail / Rough Road
- City / Town
- Indian Reserve
- Park / Protected Area



POTENTIAL ENVIRONMENTAL ISSUES	WC (NCD); RARE ECOLOGICAL COMMUNITY; WC (NCD); WIND/WATER ER

ENVIRONMENTAL PROTECTION

CONSTRUCTION WORK WINDOW		AQ-OPEN; AQ-OPEN
SOILS HANDLING	STRIPPING DEPTH (cm)	15; 10; 20-25; 25; 10-15
	PROCEDURE	BLADE WIDTH; OVERSTRIP; BLADE WIDTH
SOILS		SO-NOTE 1
WATERCOURSE CROSSINGS	PIPELINE	AQ-NOTE 3; AQ-NOTE 3
	VEHICLE	AQ-NOTE 2; AQ-NOTE 2
WETLANDS		
FOREST TYPE (m^3/ha)		
VEGETATION		VEG-NOTE 1
WILDLIFE AND FISH HABITAT		
HERITAGE / TRADITIONAL LAND USE		
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS		
SPECIAL MEASURES		

TRANS MOUNTAIN

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Soils Description

byKWY(10-15)
6

Soil Phase, Soil Unit, Depth of Topsoil (cm), Topographic Class

REFERENCES

Projection: NAD_1983_UTM_Zone_10N
Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor, provided by UPI, August 1st, 2014; Existing Infrastructure: IHS Inc., 2014; Transportation: BC MFLNRO 2012, NRCan 2012; Geopolitical Boundaries:BC MFLNRO 2007; First Nation Lands: Government of Canada 2014; Hydrology: BC FLNRO, 2008; Parks and Protected Areas: BC FLNRO, 2008; B/W & Colour Imagery 2008-2012: provided by KMC, 2013; 1:50,000 NTS Map © 2013 Department of Natural Resources Canada. All rights reserved.

REVISION HISTORY

NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.
0	Aug 15, 2014	Stage 2 Park Permit Application	AJ	PS	GB

MAP NUMBER: 201407_MAP_TERA_EAS_00601_REV0		PAGE: SHEET 009 OF 011	ENVIRONMENTAL ALIGNMENT SHEETS
DATE: August 2014	TERA REF.: 7894	REVISION: 0	TRANS MOUNTAIN EXPANSION PROJECT
SCALE: 1:5,000	PAGE SIZE: 11x17	DISCIPLINE: EAS	FROM: RK 836.0 / TO: RK 836.9
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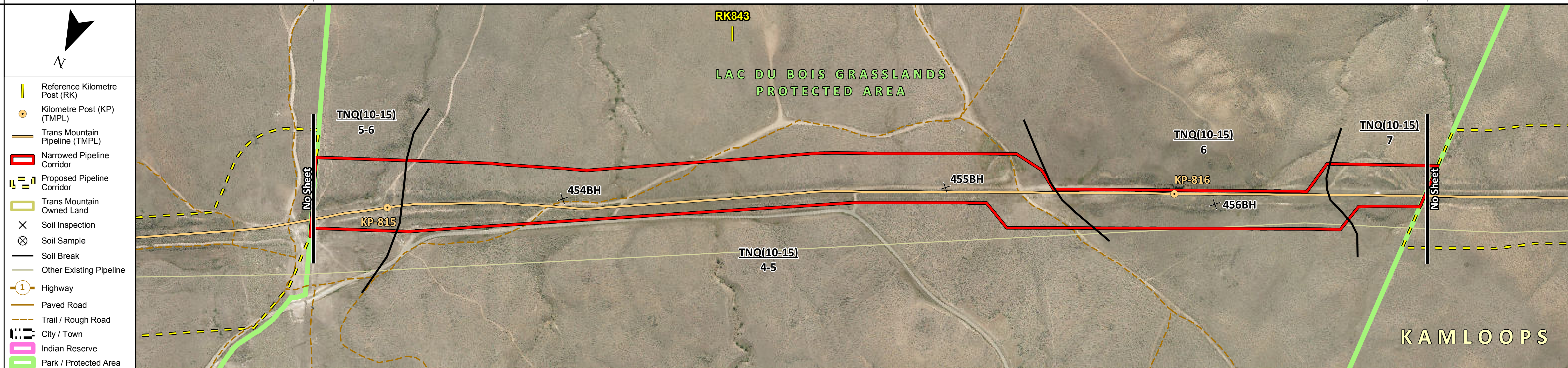
ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING INFORMATION	
JURISDICTION	LAC DU BOIS GRASSLANDS PROTECTED AREA; KAMLOOPS
LAND OWNERSHIP / DISPOSITION	CROWN TR0329T002 ENV C&R
LAND USE	NATIVE GRASSLAND
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS	
HERITAGE / TRADITIONAL LAND USE	
WILDLIFE / WILDLIFE HABITAT	
VEGETATION	
WETLANDS	MARSH
FISH HABITAT SENSITIVITY	
HYDROLOGY	UNNAMED DRAINAGE; UNNAMED DRAINAGE
SOILS PARENT MATERIAL	T

11" X 17" MOSAIC SCALE 1:5,000
DATE OF IMAGERY: 2005-2012



POTENTIAL ENVIRONMENTAL ISSUES	WC (NVC); WC (NCD); WETLAND; WIND/WATER ER

ENVIRONMENTAL PROTECTION		
CONSTRUCTION WORK WINDOW		AQ-OPEN; AQ-OPEN
SOILS HANDLING	STRIPPING DEPTH (cm)	10-15
SOILS HANDLING	PROCEDURE	BLADE WIDTH
SOILS		SO-NOTE 1
WATERCOURSE CROSSINGS	PIPELINE	AQ-NOTE 3; AQ-NOTE 3
WATERCOURSE CROSSINGS	VEHICLE	AQ-NOTE 2; AQ-NOTE 2
WETLANDS		WT-NOTE 1
FOREST TYPE (m^3/ha)		
VEGETATION		
WILDLIFE AND FISH HABITAT		
HERITAGE / TRADITIONAL LAND USE		
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS		
SPECIAL MEASURES		

TRANS MOUNTAIN

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Soils Description

byKWY(10-15) — Soil Phase; Soil Unit; Depth of Topsoil (cm)
6 — Topographic Class

REFERENCES

Projection: NAD_1983_UTM_Zone_10N
Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor, provided by UPI, August 1st, 2014; Existing Infrastructure: IHS Inc., 2014; Transportation: BC MFLNRO 2012, NRCan 2012; Geopolitical Boundaries:BC MFLNRO 2007; First Nation Lands: Government of Canada 2014; Hydrology: BC FLNRO, 2008; Parks and Protected Areas: BC FLNRO, 2008; B/W & Colour Imagery 2008-2012: provided by KMC, 2013; 1:50,000 NTS Map © 2013 Department of Natural Resources Canada. All rights reserved.

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REVISION HISTORY

NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.
0	Aug 15, 2014	Stage 2 Park Permit Application	AJ	PS	GB

MAP NUMBER: 201407_MAP_TERA_EAS_00601_REV0		PAGE: SHEET 010 OF 011	
DATE: August 2014	TERA REF.: 7894	REVISION: 0	
SCALE: 1:5,000	PAGE SIZE: 11x17	DISCIPLINE: EAS	FROM: RK 842.5 / TO: RK 843.9
DRAWN: AJ	CHECKED: PS	DESIGN: TGG	0 50 100 150 200 250 m

ENVIRONMENTAL ALIGNMENT SHEETS
TRANS MOUNTAIN EXPANSION PROJECT

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ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING INFORMATION

JURISDICTION	BRIDAL VEIL FALLS PROVINCIAL PARK
LAND OWNERSHIP / DISPOSITION	CROWN TR0203T004
LAND USE	TREED
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS	
HERITAGE / TRADITIONAL LAND USE	
WILDLIFE / WILDLIFE HABITAT	
VEGETATION	
WETLANDS	
FISH HABITAT SENSITIVITY	
HYDROLOGY	BRIDAL CREEK
SOILS PARENT MATERIAL	C

11" X 17" MOSAIC SCALE 1:5,000
DATE OF IMAGERY: 2005-2012

N

- Reference Kilometre Post (RK)
- Kilometre Post (KP) (TMPL)
- Trans Mountain Pipeline (TMPL)
- Narrowed Pipeline Corridor
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- Trans Mountain Owned Land
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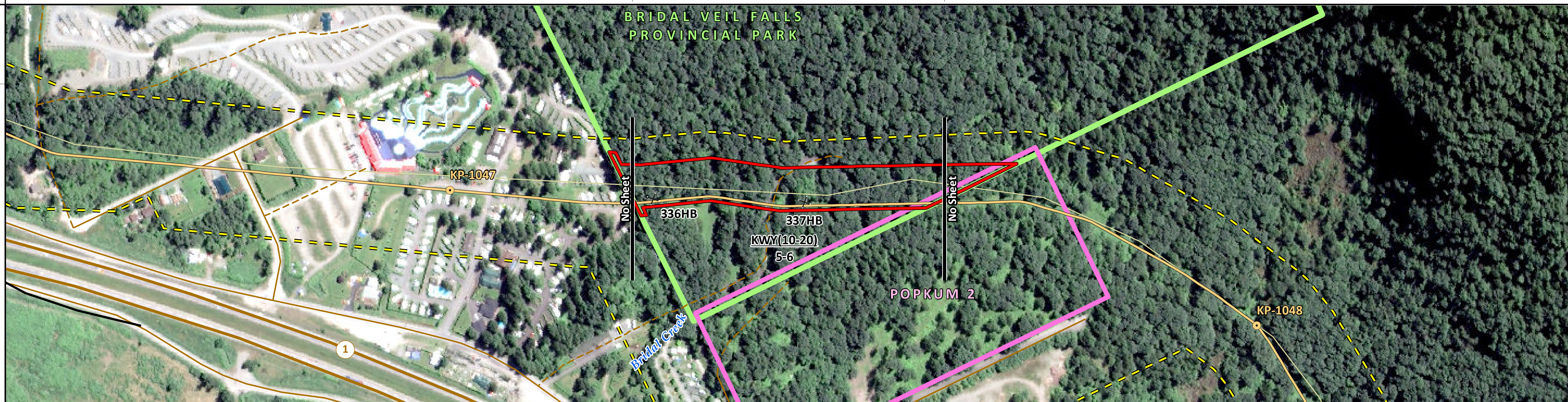

POTENTIAL ENVIRONMENTAL ISSUES	NAV WATERS WC (S3) WIND/WATER ER

ENVIRONMENTAL PROTECTION

CONSTRUCTION WORK WINDOW		AQ-OPEN
SOILS HANDLING	STRIPPING DEPTH (cm)	10-20
	PROCEDURE	FULL ROW; REDUCE AS APPROPRIATE
SOILS		SO-NOTE 1
WATERCOURSE CROSSINGS	PIPELINE	AQ-NOTE 3
	VEHICLE	AQ-NOTE 2
WETLANDS		
FOREST TYPE (m^3/ha)		
VEGETATION		
WILDLIFE AND FISH HABITAT		
HERITAGE / TRADITIONAL LAND USE		
SOCIO-ECONOMIC AND AGRICULTURAL CONSIDERATIONS		
SPECIAL MEASURES		AQ-NOTE 4

TRANS MOUNTAIN

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Soils Description

byKWY(10-15) — Soil Phase; Soil Unit; Depth of Topsoil (cm)
6 — Topographic Class

REFERENCES

Projection: NAD_1983_UTM_Zone_10N
Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor, provided by UPI, August 1st, 2014; Existing Infrastructure: IHS Inc., 2014; Transportation: BC MFLNRO 2012, NRCan 2012; Geopolitical Boundaries:BC MFLNRO 2007; First Nation Lands: Government of Canada 2014; Hydrology: BC FLNRO, 2008; Parks and Protected Areas: BC FLNRO, 2008; B/W & Colour Imagery 2008-2012: provided by KMC, 2013; 1:50,000 NTS Map © 2013 Department of Natural Resources Canada. All rights reserved.

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REVISION HISTORY

NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.
0	Aug 15, 2014	Stage 2 Park Permit Application	AJ	PS	GB

MAP NUMBER: 201407_MAP_TERA_EAS_00601_REV0		PAGE: SHEET 011 OF 011	ENVIRONMENTAL ALIGNMENT SHEETS		
DATE: August 2014	TERA REF.: 7894	REVISION: 0	TRANS MOUNTAIN EXPANSION PROJECT		
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Appendix A

APPENDIX A: PIPELINE ENVIRONMENTAL PROTECTION PLAN

REFER TO FILING ID: A56013

PART 5:

TRANS MOUNTAIN FOLLOW-UP RESPONSE TO CITY OF VANCOUVER IR NO. 1:
City of Vancouver F-IR No. 1.06.01f

Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
NEB Hearing Order OH-001-2014
Follow-Up Response to Information Request from City of Vancouver

F-IR 1.06 Natural Hazards

1.06.01 Landslide Risk

Reference:

i. Volume 5A, Section 7.1 0.2, *Potential Effects and Mitigation Measures* (A56004, A3S1 RO, p. 28)
ii. Volume 7, Section 3.1 .4 *Failure Frequency Estimating- Geohazards* (A56025, A3S4V5, p. 41)
iii. Auditor General of British Columbia. (2014). *Catastrophic Earthquake Preparedness*, Found online at http://WININ.bcauditor.com/pubs/2014/report15/catastrophic-earthquakepreparedness. Page 35.

Preamble:

Table 7.10-1 (A56004, A3S1 RO, p.129) indicates hazards for geotechnical risk. Climate change will likely result in increases in rainfall intensity and frequency of landslides and debris flows.

In Reference 'ii' the document states: "through data gathered from the Natural Hazard Management Program along the existing line over the last 20 years, on average one to two moderate sized debris flow events occur each year over the entire pipeline length and similarly an average of less than one landslide per year has been recorded. Over the 60 year history only a handful of these hazards have been of significant size to require intervention such as mitigation".

Reference 'iii' includes the BC Auditor General's report on the risk of catastrophic earthquakes in BC, including a number of different types of earthquakes that the region will inevitably experience. Any of these earthquakes could result in multiple debris flows or landslides along the pipeline.

Request:

f) Please describe for each of the "handful" of hazards identified the nature, size, and scope of the intervention.

Original Response:

f) Please see response to Nations IR No. 1.2.9b.

Trans Mountain's Follow-Up Commitment:

A response to this request will be filed in August 2014. (IR: Please describe for each of the handful of hazards identified the nature, size, and scope of the intervention.)

Commitment Response:

Please see Table 1.06.01f-1, which contains summary information requested in the IR for interventions undertaken in response to debris flow- and landslide-related events on the Trans Mountain Pipeline over its 60 plus years of operation. Repairs were developed in consultation with geotechnical engineering professionals, and others, as required.

TABLE 1.06.01F-1

Site Name	Hazard	Year Intervention Undertaken	Intervention Description
Lempriere Diversion, BC	Landslide	1957	Approximately 4.5 km of pipeline was relocated to avoid an area subject to frequent landslides.
Mad River Rock Slide, BC	Rock Slide	1974	Rock slide occurred on April 1, 1974 and debris deposited in ROW. Mitigation consisted of site inspection which indicated that the pipeline had over 1.5 m of cover in the slide area and wasn't damaged. No further action required.
KP 570.71, BC	Landslide	1975	A landslide occurred in the area and was deposited into a creek that crossed the Trans Mountain pipeline. The resulting stream erosion removed cover from the pipeline locally, no damage to the pipeline resulted. Mitigation consisted of re-establishing cover over the pipeline and removing debris from the stream channel.
Shale Hill Mudslide, BC	Landslide	1980	Landslide of fill slope caused by nearby highway construction. No impact to pipeline. Mitigation consisted of recontouring and revegetating the slope, ongoing monitoring for future movement.
Hope Debris Slide, BC	Debris flow	1990	Intense 1989 rainstorm caused a large debris torrent which resulted in significant scour of the pipeline right of way. Geotechnical investigation determined that construction of the four lane TransCanada highway resulted in a new 17 meter high cut slope which resulted in changed debris transport characteristics at the Trans Mountain right of way. Mitigation consisted of relocation of approximately 350 meters of pipeline.
French's Hill Diversion, BC	Landslide	1994	Slope developed water drainage problems resulting from construction of Yellowhead Highway in the 1970's. A drainage system was installed during Yellowhead Highway construction however by the mid 1980's the drainage system was in disrepair and not functioning properly. Approximately 600 meters of pipeline was relocated as a permanent mitigation.
Campbell Bennett Hill slope, BC	Debris flow	Prior to 1998	Mitigation consisted of extensive surface drainage works that were installed on the slope to stabilize. Regular monitoring continues to ensure no further issues.
Hope Creek Debris Flow, BC	Debris flow	2006	Pipeline was exposed and damaged in 1995 and 2002 by debris flows. Mitigated utilizing grouted rip-rap installed in the creek crossing in 2006 to protect the pipeline from further events of this type.
Messiter Debris Slide, BC	Debris flow	2008	Debris flow removed a portion of the right way on a slope above the North Thompson River. Mitigated by constructing rock buttress with drains in the gully invert.

PART 6:

TRANS MOUNTAIN FOLLOW-UP RESPONSE TO NATIONAL ENERGY BOARD IR NO. 2:

NEB F-IR No. 2.001, NEB F-IR No. 2.001 – Attachments 1 to 51

Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
NEB Hearing Order OH-001-2014
Follow-Up Response to Information Request from National Energy Board (NEB)

General

F-IR 2.001 Relief being sought

Reference:

A3S0Q7, Application Volume 1, Summary:

i) PDF page 27 of 113
ii) PDF pages 45 and 46 of 113

Preamble:

Reference i) indicates that Trans Mountain is applying to the Board pursuant to section 52 of Part III of the National Energy Board Act for a certificate of public convenience and necessity and related approvals for the Project.

Reference ii) provides an overview of the Project description, including the following components:

- installing new pipeline segments and reactivating existing lines that are currently maintained in a deactivated state;
- constructing pump stations;
- expanding existing terminals by adding new tanks and other infrastructure;
- constructing a new dock complex at the Westridge Marine Terminal;
- installing new mainline block valves; and
- adding new power lines under the jurisdiction of the appropriate provincial authorities.

Reference ii) also states that the Project will result in two continuous pipelines between Edmonton and Burnaby:

- Line 1 will have a sustainable capacity of 55,640 cubic metres (350,000 barrels) per day; and
- Line 2 will have a sustainable capacity of 85,850 cubic metres (540,000 barrels) per day.

The Board issued the original certificate of public convenience and necessity for the existing pipeline in August 1960 (OC-2). Since then, the Board has issued numerous legal instruments to construct and operate, modify, deactivate, and reactive parts of the pipeline system.

Request:

Please provide a detailed description of the relief that Trans Mountain is seeking in its Application, including, but not limited to:

a) the existing legal instruments Trans Mountain is seeking to amend or revoke, and the Project components applicable to each (provide a list and copies of all existing legal instruments referenced by Trans Mountain in its response);

b) any existing legal instruments that would remain in force and applicable to Lines 1 or 2 that Trans Mountain is not seeking to amend or revoke (provide a list and copies of all existing legal instruments referenced by Trans Mountain in its response); and

Response:

a) Trans Mountain is seeking to reactivate certain pipeline assets which are currently being maintained in a deactivated state. As detailed in the application, Trans Mountain is proposing to reactivate a 150 km NPS 24 pipeline segment from Hinton, AB, to Hargreaves, BC, and a 43 km NPS 24 pipeline segment from Darfield, BC, to Black Pines, BC. Trans Mountain is also proposing to reactive a pump station located at Niton, AB. Trans Mountain expects that it will file separate applications for the deactivation or decommissioning of existing assets that will not be required for the expanded pipeline system in due course.

   Trans Mountain is currently undertaking a search of its historical records and will file in August 2014 the requested list and copies of the existing legal instruments Trans Mountain is seeking to amend or revoke, and the Project components applicable to each.

b) Trans Mountain has been issued two certificates of public convenience and necessity since its inception. The first being OC-2 issued in August 1960 which provided for the original construction of the pipeline including two eighty kilometre pipeline loops (NEB IR No. 2.001b - Attachment 1) and the second being OC-49 issued in November 2006 which provided for the construction of the NPS36 Anchor Loop (NEB IR No. 2.001b – Attachment 2). Of the existing pipeline assets constructed pursuant to the reference certificates, Trans Mountain plans to utilize the Anchor Loop segment and the active NPS30 segment between Darfield, BC, and Black Pines, BC, on Line 2. The remaining segments will be used on Line 1 including the proposed reactivation of 150 km NPS 24 pipeline segment from Hinton, AB, to Hargreaves, BC, and a 43 km NPS 24 pipeline segment from Darfield, BC, to Black Pines, BC.

   Trans Mountain is not proposing to change the maximum operating limits for the existing active pipeline segments and therefore the existing licensing will remain in force.

   Trans Mountain is currently undertaking a search of its historical records and will file in August 2014 the requested list and copies of existing legal instruments that would remain in force and applicable to Lines 1 or 2 that Trans Mountain is not seeking to amend or revoke.

Summary of New Commitments:

- Trans Mountain will file in August 2014 the requested list and copies of existing legal instruments Trans Mountain is seeking to amend or revoke, and the Project components applicable to each.

Commitment Response:

Please refer to the NEB F-IR No. 2.001 - Attachment Summary for an inventory of legal instruments with respect to the existing pipeline, pump stations, and tanks.

NEB F-IR No. 2.001 - Attachment Summary

Trans Mountain Pipeline ULC
Trans Mountain Pipeline Expansion Project (OH-001-2014)
Follow Up Response to NEB Information Request No. 2.001
List of Legal Instruments - Pipe Segments

	Segment				NPS (inches)	Year Built	Current Status (Active /Deactivated)	NEB Certificate of Public Convenience and Necessity	NEB Reactivation/Deactivation Authorization	Current NEB Operating Authorization	NEB IR 2.001 Attachment Reference	Trans Mountain Expansion Project (Proposed Utilization)	
	Location		Kilometer Post										
	From	To	From	To								Line 1	Line 2
Edmonton to Edson (0-228.75)	Edmonton	Mainline Valve	0.0	64.0	24	1953	Active	AO-2-OC-2		MO-7-64	Attachment 1	Unchanged	
	Mainline Valve	Gainford	64.0	99.0						MO-6-78	Attachment 2	Unchanged	
	Gainford	Valve K117B	99.0	118.0						OPLO-T4-74-98	Attachment 3	Unchanged	
	Valve K117B	Valve K160	118.0	160.5						OPLO-T4-75-98	Attachment 4	Unchanged	
	Valve K160	Niton	160.5	173.4						OPLO-T4-15-99	Attachment 5	Unchanged	
	Niton	Line Flanges	173.4	211.5						OPLO-T4-16-99	Attachment 6	Unchanged	
	Line Flanges	Edson Pump Station	211.5	228.8						MO-19-78	Attachment 7	Unchanged	
Edson to Hinton (228.75-310.0)	Edson Pump Station	Hinton	228.8	310.0	24	1953	Deactivated	AO-2-OC-2	XO-T4-15-94 (Deactivate)	Deactivated	Attachment 8	Deactivated (Unchanged)	
	Edson Pump Station	Hinton	228.8	310.0	30	1957	Active	AO-2-OC-2	XO-T4-15-94 (Reactivate)	AO-OPLO-T4-2-94	Attachment 9	Unchanged	
Hinton to Hargreaves (310.0-468)	Hinton	Hargreaves	310.0	468.0	24	1953	Deactivated	AO-2-OC-2	MO-10-2010 (Deactivate)	Deactivated	Attachment 11	Reactivate	
	Hinton	Hinton Pump Station	310.0	317.7	30	2008	Active	AO-1-OC-49		OPLO-T099-01-2008	Attachment 10	Unchanged	
	Hinton Pump Station	AB/BC Border	317.7	406.5	36	2008	Active	AO-1-OC-49		OPLO-T099-01-2008	Attachment 10		Use on Line 2
	AB/BC Border	Hargreaves	406.5	461.0						OPLO-T099-03-2008	Attachment 12		Use on Line 2
Hargreaves to Darfield (468-742)	Valve K461A	Jackson Hill Line	461.0	479.6	24	1953	Active	AO-2-OC-2		OPLO-T4-76-98	Attachment 13	Unchanged	
	Jackson Hill Line Flanges	Albreda	479.6	519.1						OPLO-T4-17-99	Attachment 14	Unchanged	
	Albreda	Lot 3113	519.1	543.6						MO-9-83	Attachment 15	Unchanged	
	Lot 3113	Blue River	543.6	588.4						MO-3-82	Attachment 16	Unchanged	
	Blue River	Mainline Valve	588.4	624.7						MO-66-86	Attachmnet 17	Unchanged	
	Mainline Valve	McMurphy	624.7	644.6						MO-67-86	Attachment 18	Unchanged	
	McMurphy	Lemieux Creek Valve	644.6	722.0						MO-1-76	Attachment 19	Unchanged	
	Lemieux Creek Valve	Darfield	722.0	742.0						MO-54-78	Attachment 20	Unchanged	

Trans Mountain Pipeline ULC
Trans Mountain Pipeline Expansion Project (OH-001-2014)
Follow Up Response to NEB Information Request No. 2.001
List of Legal Instruments - Pipe Segments

	Segment				NPS (inches)	Year Built	Current Status (Active /Deactivated)	NEB Certificate of Public Convenience and Necessity	NEB Reactivation/Deactivation Authorization	Current NEB Operating Authorization	NEB IR 2.001 Attachment Reference	Trans Mountain Expansion Project (Proposed Utilization)	
	Location		Kilometer Post										
	From	To	From	To								Line 1	Line 2
Darfield to Kamloops (742-823)	Darfield	Black Pines	742.0	785.0	24	1953	Inactive	AO-2-OC-2	XO-T099-05-2004 (Deactivate)	Deactivated	Attachment 21	Reactivate	
	Black Pines	Kamloops	785.0	823.0	24	1953	Inactive	AO-2-OC-2	XO-T099-05-2004 (Deactivate)	Deactivated	Attachment 21	Deactivated (Unchanged)	
	Darfield	Black Pines	742.0	785.0	30	1957	Active	AO-2-OC-2	XO-T099-05-2004 (Reactivate)	OPLO-T099-04-2004	Attachment 22		Use on Line 2
	Black Pines	Kamloops	785.0	823.0	30	1957	Active	AO-2-OC-2	XO-T099-05-2004 (Reactivate)	OPLO-T099-04-2004	Attachment 22	Unchanged	
Kamloops to Sumas (823-1082)	Kamloops	Valve 831	823.0	832.4	24	1953	Active	AO-2-OC-2		OPLO-T4-27-98	Attachment 23	Unchanged	
	Valve 831	Flange Pair	832.4	840.7						OPLO-T4-28-98	Attachment 24	Unchanged	
	Flange Pair	Line Flanges	840.7	876.4						OPLO-T4-29-98	Attachment 25	Unchanged	
	Line Flanges	Brodie Valve (Juliet Creek)	876.4	936.4						AO-1-OPLO-T4-3-96	Attachment 26	Unchanged	
	Kingsvale	Juliet Creek Valve	925.8	950.1						OPLO-T099-01-2007	Attachment 27	Unchanged	
	Juliet Creek Valve	Unnamed Valve	950.1	983.9						AO-2-OC-2	Previously provided	Unchanged	
	Unnamed Valve	Unnamed Valve	983.9	988.3						MO-2-83	Attachment 28	Unchanged	
	Unnamed Valve	Hope	988.3	1010.7						MO-3-83	Attachment 29	Unchanged	
	Hope	Wahleach	1010.7	1045.9						MO-20-78	Attachment 30	Unchanged	
	Wahleach	Sumas Station	1045.9	1082.0						MO-52-78	Attachment 31	Unchanged	
Sumas to Border (0-8.5)	Sumas	Border	0.0	8.5	24	1953	Active	AO-2-OC-2		MO-15-73. MOP currently restricted to 80% by SO-T260-005-2013.	Attachment 32	Unchanged	
Sumas Transfer (1082)	Sumas Station	Sumas Tanks	1082.0	1085.7	20/24	1957	Active	AO-2-OC-2		AO-2-OC-2	Previously provided	Unchanged	
Sumas to Westridge (1082-1151.3)	Sumas Station	Bradner Valve M685	1082.0	1102.2	24	1953	Active	AO-2-OC-2		MO-7-78	Attachment 33	Unchanged	
	Bradner Valve M685	Burnaby	1102.2	1147.2						MO-8-78	Attachment 34	Unchanged	
	Burnaby	Westridge	1147.2	1151.3						AO-2-OC-2	Previously provided	Unchanged	
Westridge Marine Terminal	Westridge Marine Terminal		1151.3		Dock	1953	Active	AO-2-OC-2		AO-2-OC-2	Previously provided		

Trans Mountain Pipeline ULC
Trans Mountain Pipeline Expansion Project (OH-001-2014)
Follow Up Response to NEB Information Request No. 2.001
List of Legal Instruments - Mainline Pump Stations

Mainline Pump Station Location	Kilometer Post	No. of Mainline Pump Units	Power per unit (HP)	Year Built (Initially)	Current Status (Active / Deactivated)	Current NEB Authorization	NEB IR 2.001 Attachment Reference	Trans Mountain Expansion Project		
								Pump Unit Modifications	Proposed Pump Station Utilization	
									Line 1	Line 2
Edmonton	0.0	4	2,500	1953	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
Stoney Plain	49.5	2	5,000	2007	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
Gainford	99.0	3	2,000	1957	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
Chip Lake	147.0	2	5,000	2007	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
Niton	173.4	2	2,000	1957	Deactivated	Authorization sought to deactivate Niton station pursuant to Section 44 of the *National Energy Board Onshore Pipeline Regulations*. NEB authorization pending.		Reactivate		
Wolf	188.0	2	5,000	2008	Active	OPSO-T099-02-2008	Attachment 36	Unchanged		Move to Line 2
Edson	228.8	3	2,000	1953	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
Hinton	317.7	2	5,000	2007	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
Jasper	369.5	2	2,500	1957	Active	AO-2-T099-15-2005	Attachment 35	Unchanged	Relocate	
Rearguard	468.0	2	5,000	1994	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
Albreda	517.8	3	2,000	1957	Active	AO-2-T099-15-2005	Attachment 35	Deactivate		
Chappel	555.5	2	5,000	2008	Active	OPSO-T099-03-2008	Attachment 37	Unchanged		
Blue River	588.4	2	5,000	2007	Active	XO-T099-02-2007	Attachment 38	Add 1 x 5,000 HP Unit		Move to Line 2
Finn Creek	612.5	2	5,000	2007	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
McMurphy	645.0	2	2,000	1972	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
Blackpool	709.9	2	5,000	2007	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
Darfield	742.0	2	2,000	1988	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
Kamloops	822.9	2	2,500	1953	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
	822.9	4	2,000	1953	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
Stump Lake	862.7	2	5,000	2007	Active	AO-2-T099-15-2005	Attachment 35	Deactivate		
Kingsvale	925.8	3	2,500	1994	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		
Hope	1010.7	2	5,000	2007	Active	AO-2-T099-15-2005	Attachment 35	Deactivate		
Wahleach	1045.9	2	5,000	2007	Active	AO-2-T099-15-2005	Attachment 35	Deactivate		
Sumas	1082.0	4	2,000	1957	Active	AO-2-T099-15-2005	Attachment 35	Add 1 x 2,500 HP Unit		
Port Kells	1124.3	2	5,000	2007	Active	AO-2-T099-15-2005	Attachment 35	Unchanged		

Trans Mountain Pipeline ULC
Trans Mountain Pipeline Expansion Project (OH-001-2014)
Follow Up Response to NEB Information Request No. 2.001
List of Legal Instruments - Tanks

Location	Tank No.	Capacity (bbls)	Current Service	Year Built	Status	Current NEB Authorization	NEB IR 2.001 Attachment Reference
Edmonton	5	80,000	Refined Products	1953	Active	AO-2-OC-2	Previously provided
Edmonton	6	80,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Edmonton	7	80,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Edmonton	8	80,000	Refined Products	1953	Active	AO-2-OC-2	Previously provided
Edmonton	9	80,000	Refined Products	1965	Active	AO-2-OC-2	Previously provided
Edmonton	10	150,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Edmonton	11	150,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Edmonton	12	150,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Edmonton	13	150,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Edmonton	14	150,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Edmonton	15	150,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Edmonton	16	150,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Edmonton *	17	165,275	Crude	1990	Active	XO-2-89	Attachment 39
Edmonton	18	150,000	Refined Products	1957	Active	AO-2-OC-2	Previously provided
Edmonton	19	150,000	Refined Products	1957	Active	AO-2-OC-2	Previously provided
Edmonton	20	150,000	Crude	1987	Active	AO-2-OC-2	Previously provided
Edmonton	21	150,000	Crude	1987	Active	AO-2-OC-2	Previously provided
Edmonton	22	217,550	Crude	1989	Active	XO-1-88	Attachment 40
Edmonton	23	217,550	Crude	1989	Active	XO-1-88	Attachment 40
Edmonton	24	300,000	Crude	2013	Active	OPSO-T260-014-2013	Attachment 41
Edmonton	25	300,000	Crude	2013	Active	OPSO-T260-014-2013	Attachment 41
Edmonton	26	220,000	Crude	2014	Active	OPSO-T260-014-2014	Attachment 42
Edmonton	27	400,000	Crude	2014	Active	OPSO-T260-006-2014	Attachment 43
Edmonton	28	400,000	Crude	2014	Active	OPSO-T260-007-2014	Attachment 44
Edmonton	29	250,000	Crude	2014	Pending	In Service Date: October, 2014	LTO Pending
Edmonton	30	250,000	Crude	2014	Pending	In Service Date: October, 2014	LTO Pending
Edmonton	31	400,000	Crude	2013	Active	OPSO-T260-022-2013	Attachment 45
Edmonton	32	400,000	Crude	2013	Active	OPSO-T260-022-2013	Attachment 45

Trans Mountain Pipeline ULC
Trans Mountain Pipeline Expansion Project (OH-001-2014)
Follow Up Response to NEB Information Request No. 2.001
List of Legal Instruments - Tanks

Location	Tank No.	Capacity (bbls)	Current Service	Year Built	Status	Current NEB Authorization	NEB IR 2.001 Attachment Reference
Edmonton	33	300,000	Crude	2014	Active	OPSO-T260-018-2014	Attachment 46
Edmonton	34	400,000	Crude	2013	Active	OPSO-T260-022-2013	Attachment 45
Edmonton	35	400,000	Crude	2014	Active	OPSO-T260-007-2014	Attachment 44
Edmonton	36	400,000	Crude	2013	Active	OPSO-T260-020-2013	Attachment 47
Edmonton	37	300,000	Crude	2014	Pending	In Service Date: September, 2014	LTO Pending
Edmonton	38	300,000	Crude	2014	Active	OPSO-T260-022-2014	Attachment 48
Edmonton	39	300,000	Crude	2014	Pending	In Service Date: October, 2014	LTO Pending
Edson	41	80,000	Relief	1953	Active	AO-2-XO-T099-15-2005	Attachment 35
Edson	42	80,000	Out of service	1953	Inactive	MO-020-2014	Attachment 49
Edson	43	80,000	Out of service	1957	Inactive	MO-020-2014	Attachment 49
Edson	45	10,000	Out of service	1965	Inactive	MO-020-2014	Attachment 49
Edson	47	20,000	1999)	1956	Inactive	Not Applicable	
Albreda	53	10,000	Relief	2007	Active	AO-2-XO-T099-15-2005	Attachment 35
Blackpool	51	50,000	1999)	1953	Inactive	Not Applicable	
Blackpool	52	10,000	1999)	1953	Inactive	Not Applicable	
Kamloops	61	80,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Kamloops	62	80,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Kamloops	67	10,000	Relief	1964	Active	AO-2-OC-2	Previously provided
Kamloops	68	10,000	Relief	1986	Active		Previously provided
Hope	69	54,000	Relief	1953	Active	AO-2-OC-2	Previously provided
Hope	70	54,000	Relief	1953	Active	AO-2-OC-2	Previously provided
Burnaby	71	80,000	Iso-Octane	1953	Active	AO-2-OC-2	Previously provided
Burnaby	72	80,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Burnaby	73	80,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Burnaby	74	80,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Burnaby	81	150,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Burnaby	82	150,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Burnaby	83	150,000	Crude	1953	Active	AO-2-OC-2	Previously provided

Trans Mountain Pipeline ULC
Trans Mountain Pipeline Expansion Project (OH-001-2014)
Follow Up Response to NEB Information Request No. 2.001
List of Legal Instruments - Tanks

Location	Tank No.	Capacity (bbls)	Current Service	Year Built	Status	Current NEB Authorization	NEB IR 2.001 Attachment Reference
Burnaby	84	150,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Burnaby	85	150,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Burnaby	86	150,000	Crude	1953	Active	AO-2-OC-2	Previously provided
Burnaby	87	157,360	Crude	1988	Active	XO-1-88	Attachment 40
Burnaby	88	157,360	Crude	1988	Active	XO-1-88	Attachment 40
Burnaby	90	157,360	Crude	1988	Active	XO-1-88	Attachment 40
Burnaby	99	6,800	Relief	1989	Active	XOM-14-88	Attachment 50
Sumas	101	150,000	Crude	1957	Active	AO-2-OC-2	Previously provided
Sumas	102	150,000	Crude	1957	Active	AO-2-OC-2	Previously provided
Sumas	103	150,000	Crude	1957	Active	AO-2-OC-2	Previously provided
Sumas **	104	150,000	Crude	1971	Active	OPSO-4-30-71	Attachment 51
Sumas	121	54,000	Crude	1963	Active	AO-2-OC-2	Previously provided
Sumas	122	54,000	Crude	1963	Active	AO-2-OC-2	Previously provided

Notes:
* Original to construction and replaced in 1990

NEB F-IR 2.001 - Attachment 1

NATIONAL ENERGY BOARD — CANADA — OFFICE NATIONAL DE L'ÉNERGIE

ORDER NO. MO-7-64

IN THE MATTER OF the National Energy Board Act, and

IN THE MATTER OF an application made by Trans Mountain Oil Pipe Line Company respecting increases in the authorized maximum operating pressures of certain sections of its pipe line, filed with the Board under File No. 12-2-4-3.

B E F O R E:

I.N. McKinnon, Chairman	
R.D. Howland, Vice-Chairman	
H.L. Briggs, Member	Friday, the 13th day of November, 1964.
D.M. Fraser, Member	
Maurice Royer, Member	

UPON an application by Trans Mountain Oil Pipe Line Company (hereinafter called "the Applicant") for approval of increased maximum operating pressures for those sections of the Applicant's pipe line:

(i) extending from a point, known as Mile Post 0.0, situated in the South West Quarter of Section 5, Township 53, Range 23, West of the 4th Meridian, to a point, known as Mile Post 12.9, situated in the North West Quarter of Section 22, Township 52, Range 25, West of the 4th Meridian;

(ii) extending from a point, known as Mile Post 12.9, situated in the North West Quarter of Section 22, Township 52, Range 25, West of the 4th Meridian, to a point, known as Mile Post 39.5, situated in the South West Quarter of Section 10, Township 53, Range 2, West of the 5th Meridian;

(iii) extending from a point, known as Mile Post 61.6, situated in the North West Quarter of Section 13, Township 53, Range 6, West of the 5th Meridian, to a point, known as Mile Post 73.4, situated in the South West Quarter of Section 19, Township 53, Range 7, West of the 5th Meridian;

(iv) extending from a point, known as Mile Post 73.4, situated in the South West Quarter of Section 19, Township 53, Range 7, West of the 5th Meridian, to a point, known as Mile Post 99.5, situated in the North East Quarter of Section 26, Township 53, Range 12, West of the 5th Meridian; and

(v) extending from a point, known as Mile Post 107.5, situated in the South West Quarter of Section 34, Township 53, Range 13, West of the 5th Meridian, to a point, known as Mile Post 125.0, situated in the North East Quarter of Section 22, Township 53, Range 16, West of the 5th Meridian,

all in the Province of Alberta; and it appearing that the Board of Transport Commissioners for Canada authorized the Applicant to operate inter alia the aforesaid sections of its pipe line by its Order No. 82361, dated the 15th day of October, 1953; and the Board having been satisfied that the said sections of the Applicant's pipe line may safely be operated at increased maximum operating pressures; and upon reading the submissions of the Applicant, including the affidavit of its Chief Engineer John Sinclair Gray, filed,

IT IS ORDERED THAT the following maximum operating pressures for those sections of the Applicant's pipe line hereinbefore described, namely:

(i)	1178 psig
(ii)	1002 psig
(iii)	980 psig
(iv)	781 psig
(v)	797 psig

as set forth in Drawing No. B-A-8637, dated the 6th day of October, 1964, and Drawing No. R-A-8024, Revision 2, dated the 2nd day of October, 1964, copies of which are annexed to and form part of this Order, be and the same are hereby approved.

NATIONAL ENERGY BOARD

R. Dleat

Assistant Secretary

NATIONAL ENERGY BOARD
CANADA
Examined and certified to be a true copy of an order of the National Energy Board.

Gerley Hamilton

Secretary, National Energy Board
Canada
Ottawa NOV 16 1964 196

NEB F-IR 2.001 - Attachment 2

ORDER NO. MO-6-78

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. respecting the authorized maximum operating pressure of a certain portion of its existing pipeline, being a portion of its '24-inch diameter 'Main Line', in the Province of Alberta, filed with the Board under File No. 1800-T4-16.

B E F O R E the Board on Wednesday, the 15th day of March, 1978.

UPON an application by Trans Mountain Pipe Line Company Ltd., formerly known as Trans Mountain Oil Pipe Line Company, (hereinafter called "the Applicant"), dated the 31st day of August, 1977, for approval to operate a certain portion of its existing pipeline, being a portion of its '24-inch diameter 'Main Line', extending from a point designated 'M.P. 39.5', being (the downstream side of) an existing 'Main Line Valve', identified as 'M40', situated in part of the South West Quarter of Section 10, Township 53, Range 2, to a point designated 'M.P. 61.56', being (the upstream side of) an existing 'Main Line Valve', identified as '24G', located within the Applicant's existing 'Gainford Pump Station' site, situated in part of the North East Quarter of Section 13, Township 53, Range 6, all West of the 5th Meridian,

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in the Province of Alberta, at increased authorized maximum operating pressures; and it appearing that the Board of Transport Commissioners for Canada, now referred to as the Railway Transport Committee of the Canadian Transport Commission, by its Order No. 82361 dated the 15th day of October, 1953, authorized the Applicant to open for the 'transportation of crude oil' inter alia the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line'; and the Board having issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated the 19th day of August, 1960, as amended, respecting inter alia the portion of existing pipeline, being a portion of '24-inch diameter Main Line', referred to in this Order; and the Applicant having represented that it hydrostatically 're-tested' the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line'; and upon having read the submissions of the Applicant, including the Affidavit of Alwin Wilbert Samson, Chief Engineer of the Applicant, dated the 19th day of August, 1977, all filed; and the Board having been satisfied that the said portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter Main Line', may safely be operated at such maximum operating pressure as hereinafter referred to;

IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to operate for the transmission

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of oil that portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M.P. 39.5', being (the downstream side of) an existing 'Main Line Valve', identified as 'M40', situated in part of the South West Quarter of Section 10, Township 53, Range 2, to a point designated 'M.P. 61.56', being (the upstream side of) an existing 'Main Line Valve', identified as '24G', located within the Applicant's existing 'Gainford Pump Station' site, situated in part of the North East Quarter of Section 13, Township 53, Range 6, all West of the 5th Meridian, in the Province of Alberta, upon the following condition:

> The authorized maximum operating pressure of the portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter Main Line', respecting which this Order is issued, at the point designated 'M.P. 39.5', being (the downstream side of) an existing 'Main Line Valve', identified as 'M40', situated at the hereinbefore described location, shall be 1,058 psig.

NATIONAL ENERGY BOARD

for Brian H. Whittle
Secretary

NATIONAL ENERGY BOARD
CANADA
EXAMINED AND CERTIFIED TO BE A TRUE COPY OF AN ORDER OF THE NATIONAL ENERGY BOARD
DATED. MAY 26 1978
B.H. Whittle
SECRETARY, NATIONAL ENERGY BOARD, OTTAWA, CANADA

NEB F-IR 2.001 - Attachment 3

National Energy Board | Office national de l'énergie

ORDER OPLO-T4-74-98 THIS SUPERSEDES MO-7-64

IN THE MATTER OF the National Energy Board Act ("the Act") and the regulations made thereunder; and

IN THE MATTER OF an application, under section 47 of the Act, by Trans Mountain Pipe Line Company Ltd. ("TMPL"); filed with the Board under File No. 3400-T4-62.

BEFORE the Board on 30 November 1998.

WHEREAS the Board has received an application from TMPL, dated 10 November 1998, for an Order granting leave to open the portion of its pipeline system between km 99.437 and km 117.759 at the increased maximum operating pressures;

AND WHEREAS the Board has issued Certificate OC-2, dated 19 August 1960, as amended, respecting the pipeline facilities referred to in this Order;

AND WHEREAS the Board is satisfied that the pipeline facilities may be safely operated at the increased maximum operating pressures.

IT IS ORDERED THAT TMPL is granted leave to open the pipeline section between km 99.437 and km 117.759 for the transmission of oil at pressures not exceeding those shown for each location in Schedule "A", attached to and forming part of this Order.

NATIONAL ENERGY BOARD

Michel L. Mantha
Secretary

Canada

Schedule A
OPLO-T4-74-98

Trans Mountain Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 99.437 to km 117.759

km Post	Description	WT [mm]	Pipe Grade [MPa]	Pipe Elevation [m]	Current MOP [kPa]	Strength Test Pressure [kPa]	Strength Test % SMYS	Leak Test Pressure [kPa]	Leak Test % SMYS	New MOP [kPa]	Increase in MOP [kPa]	Increase in MOH [m]
East Test Section												
Test Point	Elevation of Test Trailer			786.2		8,596						
117.759	Valve K117B - Test Trailer Location	7.92	359	783.5	6,306	8,722						
Point of Maximum Stress in Test Section												
117.537	Approximate tie-in for 1986 work	7.92	359	724.6	6,797	9,300	99.8%					
99.437	Gainford Pump Station	7.92	359	765.5	6,457	8,899	95.5%	8,071	87%	7,119	663	79
100.000		7.92	359	755.0	6,544	9,002	96.6%	8,174	88%	7,202	658	79
100.532	CNR Crossing (cased)	7.92	359	748.0	6,611	9,071	97.3%	8,243	88%	7,257	646	77
100.927	Range Road #61	7.92	359	763.0	6,494	8,923	95.7%	8,095	87%	7,139	645	77
101.000		7.92	359	747.5	6,607	9,076	97.4%	8,248	88%	7,261	654	78
102.000		7.92	359	759.0	6,511	8,960	96.1%	8,135	87%	7,170	660	79
102.577	Range Road #62	7.92	359	763.0	6,477	8,923	95.7%	8,095	87%	7,139	662	79
103.000		7.92	359	753.5	6,557	9,017	96.7%	8,169	88%	7,213	657	79
104.000		7.92	359	746.0	6,619	9,090	97.5%	8,262	89%	7,272	653	78
105.000		7.92	359	751.5	6,573	9,036	96.9%	8,208	88%	7,229	656	79
106.000		7.92	359	754.5	6,548	9,007	96.6%	8,179	88%	7,206	657	79
107.000		7.92	359	766.5	6,448	8,889	95.4%	8,061	86%	7,111	663	80
107.474	Range Road #65	7.92	359	748.0	6,602	9,071	97.3%	8,243	88%	7,257	654	78
108.000		7.92	359	742.0	6,652	9,130	97.9%	8,302	89%	7,304	651	78
108.100		7.92	359	740.5	6,665	9,144	98.1%	8,316	89%	7,315	650	78
108.200		7.92	359	743.5	6,640	9,115	97.8%	8,287	89%	7,292	652	78
108.300		7.92	359	743.5	6,640	9,115	97.8%	8,287	89%	7,292	652	78
108.400		7.92	359	744.0	6,636	9,110	97.7%	8,282	89%	7,288	652	78
108.500		7.92	359	744.0	6,636	9,110	97.7%	8,282	89%	7,288	652	78
108.600		7.92	359	744.5	6,632	9,105	97.7%	8,277	89%	7,284	652	78
108.700		7.92	359	744.5	6,632	9,105	97.7%	8,277	89%	7,284	652	78
108.800		7.92	359	741.0	6,661	9,139	98.0%	8,311	89%	7,312	651	78
108.875	2nd lowest point in test (estimated) - Sturgeon Ck	7.92	359	734.3	6,717	9,205	98.7%	8,377	90%	7,364	647	78
108.900		7.92	359	738.5	6,682	9,164	98.3%	8,336	89%	7,301	650	78

Schedule A
OPLO-T4-74-98

Trans Mountain Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 99.437 to km 117.759

km Post	Description	WT [mm]	Pipe Grade [MPa]	Pipe Elevation [m]	Current MOP [kPa]	Strength Test Pressure [kPa]	Strength Test % SMYS	Leak Test Pressure [kPa]	Leak Test % SMYS	New MOP [kPa]	Increase In MOP [kPa]	Increase In MOH [m]
109.000		7.92	359	740.5	6,665	9,144	98.1%	8,316	89%	7,315	650	78
109.105	Range Road #70	7.92	359	746.2	6,617	9,088	97.5%	8,280	89%	7,271	653	78
110.000		7.92	359	772.0	6,402	8,835	94.8%	8,007	86%	7,068	666	80
110.762	Range Road #71	7.92	359	765.7	6,455	8,897	95.4%	8,069	87%	7,118	663	79
111.000		7.92	359	763.5	6,473	8,919	95.7%	8,091	87%	7,135	662	79
112.000		7.92	359	780.0	6,336	8,757	93.9%	7,929	85%	7,005	670	80
112.338	Range Road #72	7.92	359	779.5	6,340	8,762	94.0%	7,934	85%	7,009	670	80
113.000		7.92	359	787.0	6,277	8,688	93.2%	7,860	84%	6,951	673	81
114.000		7.92	359	784.0	6,302	8,716	93.5%	7,890	85%	6,974	672	81
114.027	Range Road #73	7.92	359	784.0	6,302	8,718	93.5%	7,890	85%	6,974	672	81
115.000		7.92	359	779.0	6,344	8,767	94.0%	7,939	85%	7,013	669	80
115.100	Temporary Haul Road	7.92	359	785.9	6,286	8,699	93.3%	7,871	84%	6,959	673	81
115.737	Highway #22	7.92	359	785.9	6,287	8,699	93.3%	7,871	84%	6,960	673	81
116.000	Highest point in test section	7.92	359	789.0	6,261	8,669	93.0%	7,841	84%	6,935	674	81
116.108	Entwistle: 3rd Street	7.92	359	787.5	6,273	8,683	93.1%	7,855	84%	6,947	674	81
116.350	Entwistle: 2nd Street	7.92	359	780.0	6,306	8,757	93.9%	7,929	85%	7,005	670	80
116.852	Entwistle: 55th Street	7.92	359	778.5	6,348	8,772	94.1%	7,944	85%	7,017	669	80
117.000		7.92	359	774.0	6,386	8,816	94.6%	7,988	86%	7,053	667	80
117.337	Valve K117A, grade & w.t. change	12.70	289	729.1	6,760	9,256	76.9%	8,428	70%	7,405	645	77
117.341	Assumed tie-in for '96 work (based on BBT report)	12.70	359	730.1	6,752	9,246	61.9%	8,418	56%	7,397	645	77
117.347		12.70	359	729.1	6,760	9,256	61.9%	8,428	56%	7,405	645	77
117.357		12.70	359	728.7	6,763	9,260	61.9%	8,432	56%	7,408	645	77
117.362	Side Bend	12.70	359	728.4	6,766	9,263	62.0%	8,435	56%	7,410	645	77
117.367		12.70	359	727.9	6,770	9,268	62.0%	8,440	56%	7,414	644	77
117.377		12.70	359	723.7	6,805	9,309	62.3%	8,481	57%	7,447	642	77
117.387		12.70	359	719.8	6,837	9,347	62.5%	8,519	57%	7,478	640	77
117.397		12.70	359	719.0	6,844	9,355	62.6%	8,527	57%	7,484	640	77
117.407		12.70	359	719.0	6,844	9,355	62.6%	8,527	57%	7,484	640	77
117.417	NE bank of Pembina River	12.70	359	719.1	6,843	9,354	62.6%	8,526	57%	7,483	640	77
117.427		12.70	359	719.1	6,843	9,354	62.6%	8,526	57%	7,483	640	77
117.437	Lowest point in test section	12.70	359	719.0	6,844	9,355	62.6%	8,527	57%	7,484	640	77
117.447		12.70	359	719.1	6,843	9,354	62.6%	8,528	57%	7,483	640	77

Schedule A
OPLO-T4-74-98

Trans Mountain Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 99.437 to km 117.759

km Post	Description	WT	Pipe Grade	Pipe Elevation	Current MOP	Strength Test		Leak Test		New	Increase In	
						Pressure	% SMYS	Pressure	% SMYS	MOP	MOP	MOH
		[mm]	[MPa]	[m]	[kPa]	[kPa]		[kPa]		[kPa]	[kPa]	[m]
117.457		12.70	359	719.1	6,843	9,354	62.6%	8,526	57%	7,483	640	77
117.467		12.70	359	719.3	6,842	9,352	62.6%	8,524	57%	7,482	640	77
117.477		12.70	359	719.5	6,840	9,350	62.5%	8,522	57%	7,480	640	77
117.487		12.70	359	719.6	6,839	9,349	62.5%	8,521	57%	7,479	640	77
117.489	SW bank of Pembina River	12.70	359	719.7	6,838	9,348	62.5%	8,520	57%	7,479	640	77
117.497		12.70	359	720.0	6,836	9,345	62.5%	8,517	57%	7,476	640	77
117.507		12.70	359	722.2	6,817	9,324	62.4%	8,496	57%	7,459	642	77
117.517		12.70	359	724.2	6,801	9,304	62.2%	8,476	57%	7,443	643	77
117.527		7.92	359	724.6	6,797	9,300	99.8%	8,472	91%	7,440	643	77
117.537	Approximate tie-in for 1986 work	7.92	359	724.6	6,797	9,300	99.8%	8,472	91%	7,440	643	77
117.547		7.92	359	725.2	6,792	9,294	99.7%	8,466	91%	7,435	643	77
117.557		7.92	359	725.9	6,787	9,287	99.6%	8,459	91%	7,430	643	77
117.567		7.92	359	726.8	6,779	9,279	99.5%	8,451	91%	7,423	644	77
117.570	Side Bend	7.92	359	726.8	6,779	9,279	99.5%	8,451	91%	7,423	644	77
117.578		7.92	359	726.8	6,779	9,279	99.5%	8,451	91%	7,423	644	77
117.759	Valve K117B - Test Trailer Location	7.92	359	783.5	8,306	8,722	93.6%	7,894	85%	6,978	672	81
	High Point			789.0								
	Low Point			719.0								

NEB F-IR 2.001 - Attachment 4

National Energy Board | Office national de l'énergie

ORDER OPLO-T4-75-98 - THIS SUPERSEDES MO-7-64

IN THE MATTER OF the National Energy Board Act ("the Act") and the regulations made thereunder; and

IN THE MATTER OF an application, under section and 47 of the Act, by Trans Mountain Pipe Line Company Ltd. ("TMPL"); filed with the Board under File No. 3400-T4-62.

BEFORE the Board on 30 November 1998.

WHEREAS the Board has received an application from TMPL, dated 10 November1998, for an Order granting leave to open the portion of its pipeline system between km 117.759 and km160.548 at the increased maximum operating pressures;

AND WHEREAS the Board has issued Certificate OC-2, dated 19 August 1960, as amended, respecting the pipeline facilities referred to in this Order;

AND WHEREAS the Board is satisfied that the pipeline facilities may be safely operated at the increased maximum operating pressures.

IT IS ORDERED THAT TMPL is granted leave to open the pipeline section between km117.759 and km160.548 for the transmission of oil at pressures not exceeding those shown for each location in Schedule "A", attached to and forming part of this Order.

NATIONAL ENERGY BOARD

Michel L. Mantha
Secretary

Canada

Schedule A
OPLO-T4-75-98

Trans Mountain Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 117.759 to km 160.548

km Post	Description	WT [mm]	Pipe Grade [MPa]	Pipe Elevation [m]	Current MOP [kPa]	Strength Test Pressure [kPa]	Strength Test % SMYS	Leak Test Pressure [kPa]	Leak Test % SMYS	New MOP [kPa]	Increase in MOP [kPa]	Increase in MOH [m]
West Test Section												
Test Point	Elevation of Test Trailer			786.4		7,600						
117.759	Valve K117B - Test Trailer Location	7.92	359	783.5	5,529	7,628						
Point of Maximum Stress in Test Section												
146.225	2nd lowest point in test section - Minor Ck. crossing	6.35	359	801.0	5,303	7,457	99.8%					
117.759	Valve K117B - Test Trailer Location	7.92	359	783.5	5,529	7,628	81.8%	6,943	74%	6,103	573	69
118.000		7.92	359	783.5	5,529	7,628	81.8%	6,943	74%	6,103	573	69
118.404	Reno Road	7.92	359	787.0	5,500	7,594	81.5%	6,909	74%	6,075	575	69
118.743	w.t. change (7.93 to 7.14)	7.14	359	785.0	5,517	7,614	90.6%	6,929	82%	6,091	574	69
119.000	Lowest point in test section	7.14	359	778.5	5,571	7,677	91.4%	6,992	83%	6,142	571	68
119.274	Range Road #80	7.14	359	775.8	5,593	7,704	91.7%	7,019	84%	6,163	570	68
120.000		7.14	359	784.5	5,521	7,619	90.7%	6,934	83%	6,095	574	69
120.907	Range Road #81	7.14	359	796.0	5,425	7,506	89.3%	6,821	81%	6,005	580	70
121.000		7.14	359	795.5	5,429	7,511	89.4%	6,826	81%	6,009	579	69
122.000		7.14	359	794.0	5,442	7,525	89.6%	6,840	81%	6,020	579	69
122.552	Range Road #82	7.14	359	788.7	5,466	7,577	90.2%	6,892	82%	6,062	576	69
123.000		7.14	359	788.5	5,488	7,579	90.2%	6,894	82%	6,064	576	69
124.000		7.14	359	787.5	5,498	7,589	90.3%	6,904	82%	6,071	575	69
124.189	Range Road #83	7.14	359	788.5	5,504	7,599	90.5%	6,914	82%	6,079	575	69
125.000		7.14	359	783.5	5,529	7,628	90.8%	6,943	83%	6,103	573	69
125.800	Range Road #84	7.14	359	790.3	5,473	7,562	90.0%	6,877	82%	6,050	577	69
126.000		7.14	359	792.5	5,454	7,540	89.8%	6,855	82%	6,032	578	69
127.000		7.14	359	798.5	5,404	7,481	89.1%	6,796	81%	5,985	581	70
127.280	Range Road #85	7.14	359	792.5	5,454	7,540	89.8%	6,855	82%	6,032	578	69
128.000		7.14	359	795.0	5,433	7,516	89.5%	6,831	81%	6,013	579	69
129.000		7.14	359	806.5	5,337	7,403	88.1%	6,718	80%	5,922	585	70
129.103	Range Road #90	7.14	359	807.7	5,327	7,391	88.0%	6,706	80%	5,913	585	70
130.000		7.14	359	814.5	5,271	7,324	87.2%	6,639	79%	5,859	589	71
130.715	Range Road #91	7.14	359	826.0	5,175	7,212	85.8%	6,527	78%	5,769	594	71
131.000		7.14	359	825.5	5,179	7,216	85.9%	6,531	78%	5,773	594	71
132.000		7.14	359	824.5	5,187	7,226	86.0%	6,541	78%	5,781	594	71
132.367	Range Road #92	7.14	359	823.2	5,198	7,239	86.2%	6,554	78%	5,791	593	71
133.000		7.14	359	815.0	5,267	7,319	87.1%	6,634	79%	5,856	589	71
133.997	Range Road #93	7.14	359	801.7	5,377	7,450	88.7%	6,765	81%	5,960	582	70
134.000		7.14	359	802.5	5,371	7,442	88.6%	6,757	80%	5,954	583	70
135.000		7.14	359	811.0	5,300	7,359	87.6%	6,674	79%	5,887	587	70
135.640	Range Road #94	7.14	359	837.5	5,079	7,099	84.5%	6,414	76%	5,679	600	72
136.000	Highest point in test section	7.14	359	847.5	4,996	7,001	83.3%	6,316	75%	5,600	605	73

Schedule A
OPLO-T4-75-98

Trans Mountain Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 117.759 to km 160.548

km Post	Description	W/T [mm]	Pipe Grade [MPa]	Pipe Elevation [m]	Current MOP [kPa]	Strength Test Pressure [kPa]	Strength Test % SMYS	Leak Test Pressure [kPa]	Leak Test % SMYS	New MOP [kPa]	Increase in MOP [kPa]	Increase in MOH [m]
137.000		7.14	359	832.5	5,121	7,148	85.1%	6,463	77%	5,718	596	72
137.309	Range Road #95	7.14	359	831.0	5,133	7,162	85.3%	6,477	77%	5,730	597	72
137.820		7.14	359	827.0	5,167	7,202	85.7%	6,517	78%	5,761	595	71
138.000		7.14	359	818.5	5,237	7,285	86.7%	6,600	79%	5,828	591	71
139.000		7.14	359	805.0	5,350	7,418	88.3%	6,733	80%	5,934	584	70
139.100	2nd lowest point in test section - Minor Ck. crossing	7.14	359	801.0	5,383	7,457	88.8%	6,772	81%	5,965	582	70
140.000		7.14	359	806.5	5,337	7,403	88.1%	6,718	80%	5,922	585	70
140.575	Range Road #101	7.14	359	809.3	5,314	7,376	87.8%	6,691	80%	5,901	586	70
141.000		7.14	359	814.5	5,271	7,324	87.2%	6,639	79%	5,859	589	71
141.182	w.t change (from 7.14 to 6.35)	6.35	359	812.0	5,292	7,349	98.3%	6,664	89%	5,879	587	70
142.000		6.35	359	812.5	5,287	7,344	98.3%	6,659	89%	5,875	588	70
142.226	Range Road #102	6.35	359	825.2	5,181	7,219	96.6%	6,534	87%	5,775	594	71
143.000		6.35	359	826.0	5,175	7,212	96.5%	6,527	87%	5,769	594	71
143.857	Range Road #103	6.35	359	821.9	5,209	7,252	97.0%	6,567	88%	5,801	592	71
144.000		6.35	359	820.5	5,221	7,265	97.2%	6,580	88%	5,812	592	71
145.000		6.35	359	818.5	5,237	7,285	97.5%	6,600	88%	5,828	591	71
145.534	Highway #753 Crossing	6.35	359	810.0	5,309	7,369	98.6%	6,684	89%	5,895	586	70
146.000		6.35	359	806.5	5,337	7,403	99.0%	6,718	90%	5,922	585	70
146.225	2nd lowest point in test section - Minor Ck. crossing	6.35	359	801.0	5,383	7,457	99.8%	6,772	91%	5,965	582	70
147.000		6.35	359	823.5	5,196	7,236	96.8%	6,551	88%	5,789	593	71
147.157	Range Road #105	6.35	359	820.1	5,224	7,269	97.3%	6,584	88%	5,815	591	71
148.000		6.35	359	818.5	5,237	7,285	97.5%	6,600	88%	5,828	591	71
148.805	Range Road #110	6.35	359	823.3	5,197	7,238	96.8%	6,553	88%	5,790	593	71
149.000		6.35	359	832.0	5,125	7,153	95.7%	6,468	87%	5,722	597	72
150.000		6.35	359	835.0	5,100	7,123	95.3%	6,438	86%	5,699	599	72
150.425	Range Road #111	6.35	359	819.2	5,231	7,278	97.4%	6,593	88%	5,822	591	71
151.000		6.35	359	842.0	5,041	7,055	94.4%	6,370	85%	5,644	602	72
152.000		6.35	359	837.5	5,079	7,099	95.0%	6,414	86%	5,679	600	72
152.047	Range Road #112	6.35	359	835.2	5,098	7,122	95.3%	6,437	86%	5,697	599	72
153.000		6.35	359	832.0	5,125	7,153	95.7%	6,468	87%	5,722	597	72
153.698	Range Road #113	6.35	359	837.3	5,081	7,101	95.0%	6,416	86%	5,681	600	72
154.000		6.35	359	828.0	5,158	7,192	96.2%	6,507	87%	5,754	595	71
155.000		6.35	359	828.5	5,154	7,187	96.2%	6,502	87%	5,750	596	71
155.350	Range Road #114	6.35	359	825.0	5,183	7,221	96.6%	6,536	87%	5,777	594	71
156.000		6.35	359	831.0	5,133	7,162	95.8%	6,477	87%	5,730	597	72

Schedule A
OPLO-T4-75-98

Trans Mountain Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 117.759 to km 160.548

km Post	Description	WT	Pipe Grade	Pipe Elevation	Current MOP	Strength Test		Leak Test		New	Increase in	
						Pressure	% SMYS	Pressure	% SMYS	MOP	MOP	MOH
		[mm]	[MPa]	[m]	[kPa]	[kPa]		[kPa]		[kPa]	[kPa]	[m]
156.977	Range Road #115	6.35	359	828.5	5,154	7,187	90.2%	6,502	87%	5,760	598	71
157.000		6.35	359	837.2	5,081	7,102	95.0%	6,417	88%	5,681	600	72
158.000		6.35	359	835.5	5,096	7,118	95.2%	6,430	86%	5,695	599	72
158.600	Range Road #120	6.35	359	832.0	5,125	7,153	95.7%	6,468	87%	5,722	597	72
159.000		6.35	359	831.5	5,129	7,158	95.8%	6,473	87%	5,726	597	72
160.000		6.35	359	835.5	5,096	7,118	95.2%	6,433	86%	5,695	599	72
160.242	Range Road #121	6.35	359	837.0	5,083	7,104	95.0%	6,419	86%	5,683	600	72
160.548	Valve K160	6.35	359	831.5	5,129	7,158	95.8%	6,473	87%	5,726	597	72
	High Point			847.5			99.8%					
	Low Point			775.8			81.5%					

NEB F-IR 2.001 - Attachment 5

National Energy Board | Office national de l'énergie

ORDER OPLO-T4-15-99

IN THE MATTER OF the National Energy Board Act (the Act) and the regulations made thereunder; and

IN THE MATTER OF an application, under section 47 of the Act, by Trans Mountain Pipe Line Company Ltd. (TMPL), filed with the Board under File 3400-T4-67.

BEFORE the Board on 3 September 1999.

WHEREAS the Board has received letters from TMPL, dated 18 August 1999 and 1 September 1999 for an Order granting leave to open the portion of its pipeline system between km 160.548 and km 173.384 at the increased maximum operating pressures;

AND WHEREAS the Board has issued Certificate OC-2, dated 19 August 1960, as amended, respecting the pipeline facilities referred to in this Order;

AND WHEREAS the Board is satisfied that the pipeline facilities may be safely operated at the increased maximum operating pressures;

IT IS ORDERED THAT TMPL is granted leave to open the pipeline section between km 160.548 and km 173.348 for the transmission oil at pressures not exceeding those shown for each location in Schedule A, attached to and forming part of this Order.

NATIONAL ENERGY BOARD

Michel L. Mantha
Secretary

Schedule A
OPLO-T4-15-99

Trans Mountain Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 160.548 to 173.384

km Post	Description	WT	Pipe Grade	Pipe Elevation (Roll dwgs)	Strength Test		Leak Test		New	Increase In	
					Pressure	% SMYS	Pressure	% SMYS	MOP	MOP	MOH
		[mm]	[MPa]	[m]	[kPa]		[kPa]		[kPa]	[kPa]	[m]
160.548	Valve K160	6.35	359	831.0	7,451	99.7%	6,704	90%	5,961	17	2
160.875	Beaver flood area-Pt of max stress, Lowest Pt In S	6.35	359	827.5	7,486	100.1%	6,738	90%	5,988	15	2
161.000		6.35	359	830.5	7,456	99.8%	6,709	90%	5,965	17	2
161.500		6.35	359	834.5	7,417	99.2%	6,670	89%	5,933	19	2
161.875	Range Road 121 (undeveloped)	6.35	359	836.0	7,402	99.0%	6,655	89%	5,922	20	2
161.906		6.35	359	835.7	7,404	99.1%	6,657	89%	5,924	19	2
162.000		6.35	359	836.0	7,402	99.0%	6,655	89%	5,922	20	2
162.500		6.35	359	835.0	7,412	99.2%	6,665	89%	5,929	19	2
162.769	Magnetic Marker 102	6.35	359	833.0	7,431	99.4%	6,684	89%	5,945	18	2
162.780	Road	6.35	359	833.5	7,428	99.4%	6,679	89%	5,941	18	2
162.869		6.35	359	832.5	7,436	99.5%	6,689	89%	5,949	18	2
162.987	Bruce Creek	6.35	359	831.0	7,451	99.7%	6,704	90%	5,961	17	2
163.000		6.35	359	831.5	7,446	99.6%	6,699	90%	5,957	17	2
163.512	Range Road 123 (undeveloped)	6.35	359	835.5	7,407	99.1%	6,660	89%	5,925	19	2
164.000		6.35	359	838.5	7,377	98.7%	6,630	89%	5,902	21	2
164.308		6.35	359	841.4	7,349	98.3%	6,602	88%	5,879	22	3
164.500		6.35	359	843.0	7,333	98.1%	6,586	88%	5,867	23	3
165.000		6.35	359	847.5	7,289	97.5%	6,542	88%	5,831	25	3
165.131	Range Road 124 (undeveloped)	6.35	359	849.0	7,274	97.3%	6,527	87%	5,819	26	3
165.500		6.35	359	849.5	7,269	97.3%	6,522	87%	5,816	26	3
165.563		6.35	359	849.7	7,268	97.2%	6,521	87%	5,814	26	3
166.000		6.35	359	848.5	7,279	97.4%	6,532	87%	5,823	26	3
166.500		6.35	359	847.5	7,289	97.5%	6,542	88%	5,831	25	3
166.768	Range Road 125	6.35	359	845.2	7,312	97.8%	6,565	88%	5,849	24	3
167.000		6.35	359	844.5	7,319	97.9%	6,572	88%	5,855	24	3
167.251	Change w.t.	11.13	330	842.0	7,343	61.0%	6,596	55%	5,874	22	3
167.280	Lobstick Creek	11.13	330	838.0	7,382	61.3%	6,635	55%	5,906	21	2
167.309	Change w.t.	6.35	359	842.5	7,338	98.2%	6,591	88%	5,871	23	3
167.500		6.35	359	845.5	7,309	97.8%	6,562	88%	5,847	24	3
167.733		6.35	359	846.6	7,298	97.6%	6,551	88%	5,838	25	3
168.000		6.35	359	847.5	7,289	97.5%	6,542	88%	5,831	25	3
168.442	Range Road 130	6.35	359	849.2	7,273	97.3%	6,526	87%	5,818	26	3
168.500		6.35	359	849.5	7,269	97.3%	6,522	87%	5,816	26	3
169.015	Highway 16	6.35	359	850.6	7,258	97.1%	6,511	87%	5,807	27	3
169.500		6.35	359	849.5	7,269	97.3%	6,522	87%	5,816	26	3
170.000		6.35	359	851.0	7,255	97.1%	6,508	87%	5,804	27	3
170.183	Range Road 131	6.35	359	852.2	7,243	96.9%	6,496	87%	5,794	28	3
170.500		6.35	359	853.0	7,235	96.8%	6,488	87%	5,788	28	3
170.875	Un-named Creek	6.35	359	851.5	7,250	97.0%	6,503	87%	5,800	27	3
171.000		6.35	359	851.5	7,250	97.0%	6,503	87%	5,800	27	3
171.815	Range Road 132 (undeveloped)	6.35	359	854.0	7,225	96.7%	6,478	87%	5,780	28	3
171.830	Access road	6.35	359	854.6	7,220	96.6%	6,473	87%	5,776	29	3
172.000		6.35	359	855.0	7,216	96.5%	6,469	87%	5,772	29	3
172.500		6.35	359	858.0	7,186	96.1%	6,439	86%	5,749	30	4
173.000	Highest Point In Test Section	6.35	359	863.0	7,137	95.5%	6,390	85%	5,710	33	4
173.384	Niton Station Valve 24G - Test monitoring site	6.35	359	861.7	7,150	95.7%	6,403	86%	5,720	32	4

NEB F-IR 2.001 - Attachment 6

National Energy Board | Office national de l'énergie

ORDER OPLO-T4-16-99

IN THE MATTER OF the National Energy Board Act (the Act) and the regulations made thereunder; and

IN THE MATTER OF an application, under section 47 of the Act, by Trans Mountain Pipe Line Company Ltd. (TMPL), filed with the Board under File 3400-T4-67.

BEFORE the Board on 3 September 1999.

WHEREAS the Board has received letters from TMPL, dated 18 August 1999 and 1 September1999 for an Order granting leave to open the portion of its pipeline system between km 173.384 and km 211.510 at the increased maximum operating pressures;

AND WHEREAS the Board has issued Certificate OC-2, dated 19 August 1960, as amended, respecting the pipeline facilities referred to in this Order;

AND WHEREAS the Board is satisfied that the pipeline facilities may be safely operated at the increased maximum operating pressures;

IT IS ORDERED THAT TMPL is granted leave to open the pipeline section between km 173.384 and km 211.510 for the transmission oil at pressures not exceeding those shown for each location in Schedule A, attached to and forming part of this Order.

NATIONAL ENERGY BOARD

Michel L. Mantha
Secretary

Schedule A
OPLO-T4-16-99

Trans Mountain Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 173.384 to 211.510

km Post	Description	WT [mm]	Pipe Grade [MPa]	Pipe Elevation (Roll dwgs) [m]	Strength Test Pressure [kPa]	Strength Test % SMYS	Leak Test Pressure [kPa]	Leak Test % SMYS	New MOP [kPa]	Increase in MOP [kPa]	Increase in MOH [m]
173.384	Niton Station Valve 24G - Test monitoring site	6.35	359	861.7	7,368	98.5%	6,701	90%	5,892	27	3
173.430	Range Road 133	6.35	359	861.5	7,367	98.6%	6,702	90%	5,894	27	3
173.500		6.35	359	861.0	7,372	98.6%	6,707	90%	5,898	27	3
174.000		6.35	359	861.5	7,367	98.6%	6,702	90%	5,894	27	3
174.280	Gravel Road (N.U.L. Compressor Stn.)	6.35	359	861.2	7,371	98.6%	6,706	90%	5,898	27	3
174.500		6.35	359	858.0	7,402	99.0%	6,737	90%	5,921	25	3
174.932	Grade & w.t. change	11.13	330	847.0	7,509	62.4%	6,844	57%	6,008	20	2
174.970	Carrot Creek - Lowest Point in Test Section	11.13	330	845.5	7,524	62.5%	6,859	57%	6,019	19	2
175.008	Grade & w.t. change	6.35	359	851.0	7,470	99.9%	6,805	91%	5,976	22	3
175.080	Range Road 134	6.35	359	853.3	7,448	99.6%	6,783	91%	5,958	23	3
175.400		6.35	359	857.0	7,411	99.2%	6,746	90%	5,929	25	3
175.500		6.35	359	858.0	7,402	99.0%	6,737	90%	5,921	25	3
175.670	Driveway (Nova Stn.)	6.35	359	854.5	7,436	99.5%	6,771	91%	5,949	23	3
175.866		6.35	359	861.2	7,370	98.6%	6,705	90%	5,896	27	3
175.960	Driveway	6.35	359	862.0	7,362	98.5%	6,697	90%	5,890	27	3
176.000		6.35	359	863.0	7,352	98.4%	6,687	89%	5,882	28	3
176.190	Driveway	6.35	359	863.0	7,352	98.4%	6,687	89%	5,882	19	2
176.500	Wayside Campsite	6.35	359	863.0	7,352	98.4%	6,687	89%	5,882	28	3
176.893	Range Road 135 (undeveloped)	6.35	359	863.0	7,352	98.4%	6,687	89%	5,882	28	3
177.000		6.35	359	863.5	7,347	98.3%	6,682	89%	5,878	28	3
177.200	Jaydel Farm Yard	6.35	359	865.0	7,333	98.1%	6,668	89%	5,866	20	2
177.500		6.35	359	865.0	7,333	98.1%	6,668	89%	5,866	29	3
178.000		6.35	359	864.0	7,343	98.2%	6,678	89%	5,874	28	3
178.325	Range Road 140	6.35	359	877.0	7,215	96.5%	6,550	88%	5,772	34	4
178.500		6.35	359	875.5	7,229	96.7%	6,564	88%	5,784	34	4
179.000		6.35	359	873.0	7,254	97.1%	6,589	88%	5,804	32	4
179.148		6.35	359	878.5	7,200	96.3%	6,535	87%	5,760	35	4
179.500		6.35	359	883.7	7,149	95.6%	6,484	87%	5,719	38	5
180.023	Range Road 141	6.35	359	893.0	7,058	94.4%	6,393	86%	5,647	42	5
180.500		6.35	359	881.6	7,170	95.9%	6,505	87%	5,736	37	4
181.000		6.35	359	867.5	7,308	97.8%	6,643	89%	5,847	30	4
181.400		6.35	359	868.5	7,299	97.6%	6,634	89%	5,839	30	4
181.500		6.35	359	865.0	7,333	98.1%	6,668	89%	5,866	29	3
181.930	Highway 32	6.35	359	866.0	7,323	98.0%	6,658	89%	5,858	29	3
182.052		6.35	359	867.0	7,313	97.8%	6,648	89%	5,851	29	4
182.500		6.35	359	866.6	7,298	97.6%	6,633	89%	5,838	30	4
183.000		6.35	359	871.5	7,269	97.3%	6,604	88%	5,815	32	4
183.500		6.35	359	872.5	7,259	97.1%	6,594	88%	5,807	32	4
183.680	Driveway	6.35	359	871.5	7,269	97.3%	6,604	88%	5,815	32	4
183.700	Range Road 143 (undeveloped)	6.35	359	871.0	7,274	97.3%	6,609	88%	5,819	31	4
184.000		6.35	359	870.0	7,284	97.5%	6,619	89%	5,827	31	4
184.390	Road	6.35	359	864.0	7,343	98.2%	6,678	89%	5,874	28	3
184.450	Un-named Creek	6.35	359	860.0	7,382	98.8%	6,717	90%	5,906	26	3
184.500		6.35	359	861.0	7,372	98.6%	6,707	90%	5,898	27	3
185.000		6.35	359	868.5	7,299	97.6%	6,634	89%	5,839	30	4
185.330	Range Road 144 (undeveloped)	6.35	359	870.0	7,284	97.5%	6,619	89%	5,827	31	4
185.500		6.35	359	871.0	7,274	97.3%	6,609	88%	5,819	31	4
186.000		6.35	359	869.5	7,289	97.5%	6,624	89%	5,831	31	4
186.500		6.35	359	873.0	7,254	97.1%	6,589	88%	5,804	32	4
186.980	Range Road 145 (undeveloped) / Access Road	6.35	359	877.0	7,215	96.5%	6,550	88%	5,772	34	4
187.000		6.35	359	877.5	7,210	96.5%	6,545	88%	5,768	35	4
187.500		6.35	359	873.5	7,249	97.0%	6,584	88%	5,800	33	4
188.000		6.35	359	876.0	7,225	96.7%	6,560	88%	5,780	34	4
188.500		6.35	359	876.0	7,225	96.7%	6,560	88%	5,780	34	4
188.585	Range Road 150	6.35	359	876.5	7,220	96.6%	6,555	88%	5,776	34	4
188.613		6.35	359	875.5	7,230	96.7%	6,565	88%	5,784	34	4
188.890	January Creek	6.35	359	872.0	7,264	97.2%	6,599	88%	5,811	32	4
189.000		6.35	359	874.0	7,245	96.9%	6,580	88%	5,796	33	4
189.500		6.35	359	883.5	7,151	95.7%	6,486	87%	5,721	38	5
189.950	Township Road 534	6.35	359	892.0	7,068	94.6%	6,403	86%	5,654	42	5
190.000		6.35	359	892.0	7,068	94.6%	6,403	86%	5,654	42	5
190.326	Range Road 151	6.35	359	888.5	7,102	95.0%	6,437	86%	5,682	40	5

Schedule A
OPLO-T4-16-99

Trans Mountain Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 173.384 to 211.510

km Post	Description	WT [mm]	Pipe Grade [MPa]	Pipe Elevation (Roll dwgs) [m]	Strength Test Pressure [kPa]	Strength Test % SMYS	Leak Test Pressure [kPa]	Leak Test % SMYS	New MOP [kPa]	Increase in MOP [kPa]	Increase in MOH [m]
190.500		6.35	359	889.0	7,097	95.0%	6,432	86%	5,678	40	5
190.815	Driveway	6.35	359	893.5	7,053	94.4%	6,388	85%	5,643	42	5
191.000		6.35	359	896.0	7,029	94.0%	6,364	85%	5,623	44	5
191.500		6.35	359	903.0	6,960	93.1%	6,295	84%	5,568	47	6
191.951	Range Road 152	6.35	359	911.5	6,877	92.0%	6,212	83%	5,501	51	6
192.000		6.35	359	912.0	6,872	91.9%	6,207	83%	5,497	52	6
192.440	Driveway	6.35	359	919.0	6,803	91.0%	6,138	82%	5,443	55	7
192.500		6.35	359	920.0	6,793	90.9%	6,128	82%	5,435	55	7
193.000		6.35	359	927.5	6,720	89.9%	6,055	81%	5,376	59	7
193.500		6.35	359	926.5	6,730	90.0%	6,065	81%	5,384	59	7
193.614	Range Road 153	6.35	359	923.0	6,764	90.5%	6,099	82%	5,411	57	7
194.000		6.35	359	928.5	6,710	89.8%	6,045	81%	5,368	60	7
194.500		6.35	359	927.0	6,725	90.0%	6,060	81%	5,380	59	7
195.000		6.35	359	931.5	6,681	89.4%	6,016	80%	5,344	61	7
195.230	Range Road 154	6.35	359	934.0	6,656	89.1%	5,991	80%	5,325	62	7
195.500		6.35	359	935.5	6,641	88.9%	5,976	80%	5,313	63	8
196.000		6.35	359	935.5	6,641	88.9%	5,976	80%	5,313	63	8
196.180	Poplar Crescent	6.35	359	940.0	6,597	88.3%	5,932	79%	5,278	65	8
196.500		6.35	359	943.0	6,568	87.9%	5,903	79%	5,254	67	8
196.861	R.R. 155 - Highest Point in Test Section	6.35	359	947.5	6,523	87.3%	5,858	78%	5,219	69	8
197.000		6.35	359	946.0	6,538	87.5%	5,873	79%	5,231	68	8
197.112	Driveway	6.35	359	946.0	6,538	87.5%	5,873	79%	5,231	68	8
197.500		6.35	359	944.0	6,558	87.7%	5,893	79%	5,246	67	8
198.000		6.35	359	931.0	6,685	89.4%	6,020	81%	5,348	61	7
198.500	Range Road 160	6.35	359	932.2	6,674	89.3%	6,009	80%	5,339	61	7
199.000		6.35	359	919.0	6,803	91.0%	6,138	82%	5,443	55	7
199.292		6.35	359	922.5	6,769	90.6%	6,104	82%	5,415	57	7
199.930	Township Road 534	6.35	359	911.0	6,882	92.1%	6,217	83%	5,505	51	6
200.000		6.35	359	910.0	6,891	92.2%	6,226	83%	5,513	51	6
200.379	Range Road 161	6.35	359	905.8	6,933	92.8%	6,268	84%	5,546	49	6
200.500		6.35	359	906.0	6,931	92.7%	6,266	84%	5,545	49	6
200.800		6.35	359	920.0	6,793	90.9%	6,128	82%	5,435	55	7
201.000		6.35	359	911.0	6,882	92.1%	6,217	83%	5,505	51	6
201.174		6.35	359	900.4	6,985	93.5%	6,320	85%	5,588	48	6
201.500		6.35	359	895.0	7,039	94.2%	6,374	85%	5,631	43	5
201.834	**Valve K202**	6.35	359	893.0	7,058	94.4%	6,393	85%	5,647	42	5
202.000		6.35	359	882.0	7,166	95.9%	6,501	87%	5,733	37	4
202.050	Range Road 162 (undeveloped)	6.35	359	877.0	7,215	96.5%	6,550	88%	5,772	34	4
202.115	Grade & w.t. change	12.70	289	876.0	7,225	61.0%	6,560	55%	5,780	34	4
202.150	Wolf Creek	12.70	289	873.0	7,254	61.2%	6,589	56%	5,804	32	4
202.203	Grade & w.t. change	6.35	359	876.0	7,225	96.7%	6,560	88%	5,780	34	4
202.500		6.35	359	878.0	7,225	96.7%	6,560	88%	5,780	34	4
202.730	Road	6.35	359	891.5	7,073	94.6%	6,408	86%	5,658	42	5
202.939		6.35	359	893.9	7,049	94.3%	6,384	85%	5,640	43	5
203.000		6.35	359	895.0	7,039	94.2%	6,374	85%	5,631	43	5
203.500		6.35	359	894.0	7,048	94.3%	6,383	85%	5,639	43	5
203.700	Range Road 163 (undeveloped)	6.35	359	894.5	7,043	94.2%	6,378	85%	5,635	43	5
203.712		6.35	359	894.7	7,042	94.2%	6,377	85%	5,633	43	5
204.000		6.35	359	896.5	7,024	94.0%	6,359	85%	5,619	44	5
204.500		6.35	359	898.5	7,004	93.7%	6,339	85%	5,603	45	5
204.699		6.35	359	896.4	7,025	94.0%	6,360	85%	5,620	44	5
205.000		6.35	359	894.5	7,043	94.2%	6,378	85%	5,636	43	5
205.270	**Valve K205, McLeod River East**	6.35	359	896.4	7,025	94.0%	6,360	85%	5,620	44	5
205.280	Range Road 164	6.35	359	896.4	7,025	94.0%	6,360	85%	5,620	44	5
205.475	Grade & w.t. change	12.70	289	851.0	7,470	63.1%	6,805	57%	5,976	22	3
205.500		12.70	289	848.5	7,485	63.2%	6,820	58%	5,988	21	3
205.550	McLeod River	12.70	289	845.0	7,529	63.6%	6,864	58%	6,023	19	2
205.710		12.70	289	855.0	7,431	62.7%	6,766	57%	5,945	24	3
205.755	**Valve K206, McLeod R.West, Gr. & w.t. change**	7.92	359	855.8	7,423	79.6%	6,758	72%	5,938	24	3
205.760	Grade & w.t. change	6.35	359	857.0	7,411	99.2%	6,746	90%	5,929	25	3
206.000		6.35	359	891.0	7,078	94.7%	6,413	86%	5,662	41	5
206.175	Road Plan 221 YJ	6.35	359	889.0	7,097	95.0%	6,432	86%	5,678	40	5
206.500		6.35	359	890.5	7,083	94.8%	6,418	86%	5,666	41	5
207.000		6.35	359	890.0	7,088	94.8%	6,423	86%	5,670	41	5

Schedule A
OPLO-T4-16-99

Trans Mountain Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 173.384 to 211.510

km Post	Description	WT [mm]	Pipe Grade [MPa]	Pipe Elevation (Roll dwgs) [m]	Strength Test Pressure [kPa]	Strength Test % SMYS	Leak Test Pressure [kPa]	Leak Test % SMYS	New MOP [kPa]	Increase in MOP [kPa]	Increase in MOH [m]
207.187	Range Road 165	6.35	359	889.6	7,090	94.9%	6,426	86%	5,672	41	5
207.500		6.35	359	890.0	7,088	94.8%	6,423	86%	5,670	41	5
208.000		6.35	359	888.5	7,102	95.0%	6,437	86%	5,682	40	5
208.500		6.35	359	888.5	7,102	95.0%	6,437	86%	5,682	40	5
208.850	Range Road 170 (undeveloped)	6.35	359	889.7	7,091	94.9%	6,426	86%	5,673	41	5
209.000		6.35	359	890.0	7,088	94.8%	6,423	86%	5,670	41	5
209.080	Farm access road	6.35	359	890.0	7,088	94.8%	6,423	86%	5,670	41	5
209.230	Un-named Creek	6.35	359	878.5	7,200	96.3%	6,535	87%	5,760	35	4
209.231		6.35	359	878.5	7,200	96.3%	6,535	87%	5,760	35	4
209.500		6.35	359	892.5	7,063	94.5%	6,398	86%	5,650	42	5
209.818		6.35	359	895.8	7,031	94.1%	6,366	85%	5,625	44	5
209.834	CNR Rail Crossing (cased)	6.35	359	895.8	7,031	94.1%	6,366	85%	5,625	35	4
210.000		6.35	359	899.0	6,999	93.6%	6,334	85%	5,599	45	5
210.510	Range Road 171 (26th Street)	6.35	359	910.0	6,891	92.2%	6,226	83%	5,513	51	6
211.000		6.35	359	927.0	6,725	90.0%	6,060	81%	5,380	59	7
211.510	Line Flanges	6.35	359	941.0	6,587	88.1%	5,922	79%	5,270	66	8

NEB F-IR 2.001 - Attachment 7

ORDER NO. MO-19-78

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. _inter alia_ respecting the authorized maximum operating pressure of a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', in the Province of Alberta, filed with the Board under File No. 1800-T4-18.

B E F O R E the Board on Wednesday, the 31st day of May, 1978.

UPON an application by Trans Mountain Pipe Line Company Ltd., formerly known as Trans Mountain Oil Pipe Line Company, (hereinafter called "the Applicant"), submitted under a letter dated the 15th day of May, 1978, _inter alia_ for approval to operate a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M.P. 131.2', being a point in part of the North West Quarter of Section 23, Township 53, Range 17, to a point designated 'M.P. 141.9', being (the upstream side of) an existing 'Main Line Valve', identified as '24B', located within the Applicant's existing 'Edson Pump Station' site, situated in parts of the West Half of

...2

Section 18, Township 53, Range 18, all West of the 5th Meridian, in the Province of Alberta, at increased authorized maximum operating pressures; and it appearing that the Board of Transport Commissioners for Canada, now referred to as the Railway Transport Committee of the Canadian Transport Commission, by Order No. 82361, dated the 15th day of October, 1953, authorized the Applicant to open for the 'transportation of crude oil' inter alia the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line';

AND the Board having issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated the 19th day of August, 1960, as amended, respecting inter alia the portion of existing pipeline, being a portion of '24-inch diameter Main Line', referred to in this Order; and the Applicant having represented that it hydrostatically 're-tested' the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line'; and upon having read the submissions of the Applicant, including the Affidavit of Alwin Wilbert Samson, Chief Engineer of the Applicant, dated the 12th day of May, 1978, all filed; and the Board having been satisfied that the said portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter Main Line', may safely be operated at such maximum operating pressure as hereinafter referred to;

...3

IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to operate for the transmission of oil that portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M.P. 131.2', being a point in part of the North West Quarter of Section 23, Township 53, Range 17, to a point designated 'M.P. 141.9', being (the upstream side of) an existing 'Main Line Valve', identified as '24B', located within the Applicant's existing 'Edson Pump Station' site, situated in parts of the West Half of Section 18, Township 53, Range 18, all West of the 5th Meridian, in the Province of Alberta, upon the following condition:

> The authorized maximum operating pressure of the portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter Main Line', respecting which this Order is issued, at the point designated 'M.P. 131.2', situated at the hereinbefore described location, shall be 845 psig.

NATIONAL ENERGY BOARD

NATIONAL ENERGY BOARD
CANADA
EXAMINED AND CERTIFIED TO BE A TRUE COPY OF AN ORDER OF THE NATIONAL ENERGY BOARD.
DATED. AUG - 1 1978

B.H. Whittle

SECRETARY, NATIONAL ENERGY BOARD, OTTAWA, CANADA

Brian H. Whittle
Secretary

NEB F-IR 2.001 - Attachment 8

National Energy Board

CANADA

Office national de l'énergie

ORDER XO-T4-15-94

IN THE MATTER OF the *National Energy Board Act* ("the Act") and the regulations made thereunder; and

IN THE MATTER OF an application, pursuant to section 58 of the Act, by Trans Mountain Pipe Line Company Ltd. ("TMPL"); filed with the Board under File No. 3400-T004-36.

B E F O R E the Board on 12 April 1994.

WHEREAS the Board has received an application by TMPL dated 29 October 1993 respecting certain modifications and facilities to be added to its pipeline system, known as the Stage 2 Expansion Project;

AND WHEREAS the Board has conducted the written public hearing OHW-1-93 to consider the Stage 2 Expansion Project;

AND WHEREAS pursuant to the *Environmental Assessment and Review Process Guidelines Order* ("EARP Guidelines Order"), the Board has performed an environmental screening and has considered the information submitted during these proceedings;

AND WHEREAS the Board has determined, pursuant to paragraph 12(c) of the EARP Guidelines Order, that the potentially adverse environmental effects, including the social effects directly related to those environmental effects, which may be caused by the Stage 2 Expansion Project are insignificant or mitigable with known technology and public concern, including that submitted by Parks Canada, about the Stage 2 Expansion Project does not warrant referral for a panel review;

AND WHEREAS the Board has examined the application and considers it to be in the public interest to grant the relief requested therein with respect to the project referred to above;

IT IS ORDERED THAT the Edson-Hinton Loop Reactivation (Job 3197) is exempt from the provisions of paragraph 30(1)(a), subsection 30(2) and section 31 of the Act, and that TMPL shall submit to the Board and obtain Board approval for the hydrostatic testing plan for the 762 mm outside diameter (NPS 30) Edson to Hinton pipeline loop;

..2

IT IS FURTHER ORDERED that the Stage 2 Expansion Project as described in Schedule A attached to and forming part of this Order, with the exception of the Edson-Hinton Loop Reactivation (Job 3197), is exempt from the provisions of sections 30, 31 and 47 of the Act, and all projects described in Schedule A are subject to the following conditions:

1. Unless the Board otherwise directs, TMPL shall:

    (a) prior to the commencement of Stage 2 Expansion Project, file with the Board copies of all federal and provincial permits or authorizations which contain environmental conditions;

    (b) during construction of the Stage 2 Expansion Project, maintain a file in the construction office(s) containing such permits and authorizations together with all permits subsequently obtained, copies of which shall be filed with the Board;

2. Unless the Board otherwise directs, prior to the commencement of the construction of the Hinton Scraper Traps (Job 3198), TMPL shall advise the Board when the amended lease agreement at the Hinton site is obtained from the Alberta Department of Environmental Protection, Land, and Forest Services; and

3. Unless the Board otherwise directs prior to 31 December 1995, this Order shall expire on 31 December 1995 unless the construction or installation with respect to the Stage 2 Expansion Project has commenced by that date.

NATIONAL ENERGY BOARD

KM

for J.S. Richardson
Secretary

XO-T4-15-94

NEB F-IR 2.001 - Attachment 9

National Energy Board | Office national de l'énergie

CANADA

ORDER AO-1-OPLO-T4-2-94

IN THE MATTER OF the *National Energy Board Act* ("the Act") and the regulations made thereunder; and

IN THE MATTER OF an application, pursuant to section 21 of the Act, by Trans Mountain Pipe Line Company Ltd. ("Trans Mountain"); filed with the Board under File 3400-T4-36.

BEFORE the Board on 7 March 1995.

WHEREAS Order OPLO-T4-2-94, dated 29 August 1994, granted leave to open 81.11 km of 762 mm OD pipeline between km 228.37 and km 309.48 of Trans Mountain's system, known as the Edson to Hinton Loop, in the province of Alberta, at a maximum operating pressure ("MOP") of 5970 kPa;

AND WHEREAS the Board has received an application dated 22 February 1995 requesting an amendment to Order OPLO-T4-2-94 which would authorize the operation of the Edson to Hinton Loop at pressures which are higher than presently authorized;

AND WHEREAS the Board has considered the request and is satisfied that the pipeline at the Edson Pump Station may be safely operated at 6872 kPa, while not exceeding the MOP for the points of maximum stress located at km 252.17 and km 288.80;

IT IS ORDERED THAT Trans Mountain is granted leave to open for the transmission of oil the Edson to Hinton Loop at a MOP of 6872 kPa at the Edson Pump Station, while not exceeding 5970 kPa at km 252.17 ~~and km 288.80.~~

NATIONAL ENERGY BOARD

J.S. Richardson
Secretary

NEB F-IR 2.001 - Attachment 10

NEB/ONE

National Energy Board | Office national de l'énergie

ORDER OPLO-T099-01-2008

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Trans Mountain Pipeline Inc. (TMPI) for an Order pursuant to section 47 of the Act filed with the National Energy Board under File OF-Fac-Oil-T099-2006-01.

BEFORE the Board on 15 April 2008.

WHEREAS TMPI has filed an application dated 8 April 2008 for Leave to Open a portion of the TMX Anchor Loop Pipeline running from Hinton, AB (KL 310.0) to the Alberta – British Columbia border (KL 406.5) and those facilities associated with the operation of that portion of the pipeline.

AND WHEREAS the Board has issued Certificate of Public Convenience and Necessity OC-49, the effect of which was to permit the construction of a pipeline loop and associated facilities extending from Hinton, Alberta to a location near Rearguard, British Columbia;

IT IS ORDERED THAT TMPI is granted Leave to Open the portion of the TMX Anchor Loop Pipeline running from Hinton, AB (KL 310.0) to the Alberta – British Columbia border (KL 406.5) and those facilities associated with the operation of that portion of the pipeline for the transmission of low vapour pressure refined petroleum products at the maximum operating pressures outlined in Schedule A (attached).

NATIONAL ENERGY BOARD

Claudine Dutil-Berry
Secretary of the Board

Canada

ORDER OPLO-T099-01-2008

SCHEDULE A

Mainline Pipe	
Pipe Section	MOP (kPa)
KL 310.0 to KL 323.5	9930
KL 323.5 to KL 345.2	10875
KL 345.2 to KL 406.5	9930

Facility Lines			
Test No.	Test Description	Drawing No.	Recommended MOP (kPa)
Hinton Tie-In	Hinton Pump Station Tie-in	n/a	9930
1	Scraper Trap Lines	01-12211--C1A01-HS00-GS2000	9930
2	Drain Lines	01-12211--C1A01-HS00-GS2000	1875
3	Pump Station and Temporary Crossover Lines	01-12211-C1A01-YH00-GS1005 and 01-12211-C1A01-JA00-GS1002	9930
4	Pump Station and Temporary Crossover Lines	01-12211-C1A01-YH00-GS1005 and 01-12211-C1A01-JA00-GS1002	9768
5	Scraper Trap Lines	01-12211--C1A01-HS00-GS2000	9930
6	Scraper Trap Lines	01-12211--C1A01-HS00-GS2000	9930

NEB F-IR 2.001 - Attachment 11

ORDER MO-10-2010

IN THE MATTER OF the *National Energy Board Act* (NEB Act) and the regulations made thereunder; and

IN THE MATTER OF an application made by Trans Mountain Pipelines ULC (Trans Mountain or the Company), pursuant to section 44 of the *Onshore Pipeline Regulations, 1999* (OPR-99), dated 29 March 2010, filed with the National Energy Board under File OF-Fac-Oil-T260-2010-01 01.

BEFORE the Board on 4 August 2010.

WHEREAS the Board received an application from Trans Mountain, pursuant to section 44 of the OPR-99, dated 29 March 2010, to deactivate a 24 inch pipeline from KP 310 to KP 468 (the Project);

AND WHEREAS, the Board approved the construction of the pipeline pursuant to Certificate OC-49 issued on 30 November 2006;

AND WHEREAS the information about the Project is set out in Schedule A;

AND WHEREAS the Board has considered environmental matters related to the Project pursuant to Part III of the NEB Act;

AND WHEREAS the Board has determined the Project is not subject to an environmental assessment pursuant to the *Canadian Environmental Assessment Act*;

AND WHEREAS the Board has examined the application and considers it to be in the public interest to grant the relief requested;

IT IS ORDERED that, pursuant to section 44 of the OPR-99, that the applied-for Project is approved subject to the following conditions:

1. Trans Mountain shall comply with all of the conditions contained in this Order unless the Board otherwise directs.

.../2

2. Trans Mountain shall cause the approved Project to be deactivated and maintained in accordance with the specifications, standards and other information referred to in its application.

3. Trans Mountain shall implement or cause to be implemented all of the polices, practices, programs, mitigation measures, recommendations and procedures for the protection of the environment included in or referred to in the application or in related submissions.

4. Within 30 days of the date that the approved Project is completed, Trans Mountain shall file with the Board a confirmation, by an officer of the company, that the approved Project was completed in compliance with all applicable conditions in this Order. If compliance with any of these conditions cannot be confirmed, the officer of the company shall file with the Board details as to why compliance cannot be confirmed. The filing required by this condition shall include a statement confirming that the signatory to the filing is an officer of the company

5. Unless the Board otherwise directs prior to 4 August 2011, this Order shall expire on 4 August 2011 unless the Project has commenced by that date.

NATIONAL ENERGY BOARD

AnneMarie Erickson

Anne-Marie Erickson
Secretary of the Board

SCHEDULE A
National Energy Board MO-10-2010

Trans Mountain Pipeline ULC

Application dated 29 March 2010
for deactivation of a portion of the Trans Mountain Pipeline System
Pursuant to section 44 of the *Onshore Pipeline Regulations, 1999*
NEB File OF-Fac-Oil-T260-2010-01 01

Pipeline Specifications

Facility Name	Trans Mountain Pipeline System
Facility Status	Deactivated
Location (endpoints)	KP 310 to KP 468
Product Contained	Nitrogen
Maintenance Pressure	350 kPa (KP 310 to KP 369); 650 kPa (KP 369 to KP 406); 336 kPa (KP 406 to KP 468); minimum maintenance pressure 100 kPa in all sections
State of Deactivation	Purged, cleaned, physically isolated
Maintenance Status	Cathodic protection maintained, damage prevention and monitoring programs to continue
Outside Diameter	NPS 24
Wall Thickness	
Grade	
External Coating Type	

NEB F-IR 2.001 - Attachment 12

National Energy Board

Office national de l'énergie

ORDER OPLO-T099-03-2008

IN THE MATTER OF the *National Energy Board Act* (Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Trans Mountain Pipeline Inc. (TMPI) for an Order pursuant to section 47 of the Act filed with the National Energy Board under File OF-Fac-Oil-T099-2006-01.

BEFORE the Board on 20 October 2008.

WHEREAS TMPI has filed an application dated 10 October 2008 for leave to open a portion of the TMX Anchor Loop Pipeline running from the Alberta – British Columbia border (KL 406.5) to Rearguard, BC (KL 468.0) and those facilities associated with the operation of that portion of the pipeline.

AND WHEREAS the Board has issued Certificate of Public Convenience and Necessity OC-49, the effect of which was to permit the construction of a pipeline loop and associated facilities extending from Hinton, Alberta to a location near Rearguard, British Columbia;

IT IS ORDERED THAT TMPI is granted Leave to Open the portion of the TMX Anchor Loop Pipeline running from Alberta – British Columbia border (KL 406.5) to Rearguard, BC (KL 468.0) and those facilities associated with the operation of that portion of the pipeline for the transmission of low vapour pressure refined petroleum products at the maximum operating pressure of 9930 kPa.

NATIONAL ENERGY BOARD

Claudine Dutil-Berry
Secretary of the Board

Canada

NEB F-IR 2.001 - Attachment 13

National Energy Board | Office national de l'énergie

ORDER OPLO-T4-76-98 THIS SUPERSEDES MO-16-66

IN THE MATTER OF the National Energy Board Act ("the Act") and the regulations made thereunder; and

IN THE MATTER OF an application, under section and 47 of the Act, by Trans Mountain Pipe Line Company Ltd. ("TMPL"); filed with the Board under File No. 3400-T4-62.

BEFORE the Board on 30 November 1998.

WHEREAS the Board has received an application from TMPL, dated 10 November 1998, for an Order granting leave to open the portion of its pipeline system between km 461.041 and km 479.590 at the increased maximum operating pressures;

AND WHEREAS the Board has issued Certificate OC-2, dated 19 August 1960, as amended, respecting the pipeline facilities referred to in this Order;

AND WHEREAS the Board is satisfied that the pipeline facilities may be safely operated at the increased maximum operating pressures.

IT IS ORDERED THAT TMPL is granted leave to open the pipeline section between km 461.041 and km 479.590 for the transmission of oil at pressures not exceeding those shown for each location in Schedule "A", attached to and forming part of this Order.

NATIONAL ENERGY BOARD

Michel L. Mantha
Secretary

Canada

Schedule A
OPLO-T4-76-98

Trans Canada Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 461.041 to km 479.590

km Post	Description	WT [mm]	Pipe Grade [MPa]	Elevation (Roll dwgs) [m]	Current MOP [kPa]	Strength Test Pressure [kPa]	Strength Test % SMYS	Leak Test Pressure [kPa]	Leak Test % SMYS	New MOP [kPa]	Increase in MOP [kPa]	Increase in MOH [m]
Test Section:												
Test Point	Elevation of Test Trailer:			927.4		7,735						
461.041	Valve K461A - Setup Location	7.92	359	924.5	5,436	7,763						
Point of Maximum Stress in Test Section		7.92	359	766.5	6,753	9,313	99.9%	8,619	92%	7,451		
477.650												
461.041	Valve K461A - Setup Location	7.92	359	924.5	5,436	7,763	83.3%	7,069	76%	6,211	775	93
461.142	Grade & w.t. change (from 359/7.92 to 289/12.7)	12.70	289	913.0	5,532	7,876	65.5%	7,182	60%	6,301	769	92
461.210	East edge Fraser River	12.70	289	894.0	5,690	8,063	67.0%	7,369	61%	6,450	760	91
461.250	Centre-line Fraser River #7 Crossing	12.70	289	894.0	5,690	8,063	67.0%	7,369	61%	6,450	760	91
461.300	West edge Fraser River	12.70	289	894.0	5,690	8,063	67.0%	7,369	61%	6,450	760	91
461.332	Grade & w.t. change (from 289/12.7 to 359/7.92)	7.92	359	902.0	5,623	7,984	85.6%	7,290	78%	6,387	764	92
461.377	Valve K461B - West side Fraser R #7 Crossing	7.92	359	908.0	5,573	7,925	85.0%	7,231	78%	6,340	767	92
462.000		7.92	359	947.5	5,244	7,538	80.9%	6,844	73%	6,030	786	94
462.247		7.92	359	923.0	5,457	7,778	83.4%	7,084	76%	6,223	766	92
463.000		7.92	359	907.5	5,578	7,930	85.1%	7,236	78%	6,344	767	92
464.000		7.92	359	887.5	5,744	8,126	87.2%	7,432	80%	6,501	757	91
464.800	Gravel access road to Mt. Robson Ranch	7.92	359	848.5	6,070	8,509	91.3%	7,815	84%	6,807	738	88
465.000		7.92	359	841.5	6,128	8,578	92.0%	7,884	85%	6,862	734	88
466.000		7.92	359	887.0	5,749	8,131	87.2%	7,437	80%	6,505	756	91
466.200	Gravel access road to Mt. Robson Ranch	7.92	359	870.0	5,890	8,298	89.0%	7,604	82%	6,638	748	90
467.000		7.92	359	892.5	5,703	8,077	86.6%	7,383	79%	6,462	759	91
468.000		7.92	359	864.0	5,940	8,357	89.6%	7,663	82%	6,688	745	89
468.909		7.92	359	827.5	6,253	8,715	93.5%	8,021	86%	6,972	719	86
469.000		7.92	359	828.0	6,241	8,710	93.4%	8,016	86%	6,968	728	87
470.000		7.92	359	856.5	6,003	8,431	90.4%	7,737	83%	6,744	742	89
471.000		7.92	359	829.0	6,232	8,700	93.3%	8,008	86%	6,960	728	87
472.000		7.92	359	840.5	6,136	8,587	92.1%	7,893	85%	6,870	734	88
473.000		7.92	359	845.0	6,099	8,543	91.6%	7,849	84%	6,835	736	88
473.902		7.92	359	796.0	6,507	9,024	96.8%	8,330	89%	7,219	712	85
474.000		7.92	359	798.0	6,491	9,004	96.6%	8,310	89%	7,204	713	85
475.000		7.92	359	808.5	6,403	8,901	95.5%	8,207	88%	7,121	718	86
475.284	Valve K475A - East side Fraser R #8 Crossing	7.92	359	782.5	6,620	9,158	98.2%	8,462	91%	7,325	705	85
475.284	Grade & w.t. change (from 359/7.92 to 289/12.7)	12.70	289	782.5	6,620	9,156	76.1%	8,462	70%	7,325	705	85
475.325	East edge Fraser River	12.70	289	779.5	6,645	9,186	76.3%	8,492	71%	7,349	704	84
475.350	Centre-line Fraser River #8 Crossing	12.70	289	779.5	6,645	9,186	76.3%	8,492	71%	7,349	704	84
475.395	West edge Fraser River	12.70	289	779.5	6,645	9,186	76.3%	8,492	71%	7,349	704	84

Schedule A
OPLO-T4-76-98

Trans Canada Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 461.041 to km 479.590

km Post	Description	WT [mm]	Pipe Grade [MPa]	Elevation (Roll dwgs) [m]	Current MOP [kPa]	Strength Test Pressure [kPa]	Strength Test % SMYS	Leak Test Pressure [kPa]	Leak Test % SMYS	New MOP [kPa]	Increase in MOP [kPa]	Increase in MOH [m]
475.429	Grade & w.t. change (from 289/12.7 to 359/7.92)	7.92	359	789.0	6,566	9,093	97.5%	8,399	90%	7,274	708	85
475.463	Valve K475B - West side Fraser R #8 Crossing	7.92	359	790.0	6,557	9,063	97.4%	8,389	90%	7,266	709	85
476.000		7.92	359	798.6	6,503	9,019	96.7%	8,325	89%	7,215	712	85
476.040		7.92	359	795.5	6,512	9,029	98.9%	8,335	89%	7,223	712	85
476.190		7.92	359	794.0	6,524	9,044	97.0%	8,350	90%	7,235	711	85
476.700	Gravel road access to valve K477A	7.92	359	814.0	6,368	8,847	94.9%	8,153	87%	7,078	712	85
477.000		7.92	359	791.5	6,545	9,068	97.3%	8,374	90%	7,255	710	85
477.088	Vavle K477A - East side of Fraser #9 Crossing	7.92	359	782.5	6,620	9,156	98.2%	8,462	91%	7,325	705	85
477.100		7.92	359	782.0	6,624	9,161	98.3%	8,467	91%	7,329	705	85
477.122	Grade & w.t. change (from 359/7.92 to 289/12.7)	12.70	289	781.5	6,628	9,166	76.2%	8,472	70%	7,333	705	85
477.195	East edge Fraser River - Lowest Point in Test Section	12.70	289	763.8	6,776	9,340	77.6%	8,646	72%	7,472	696	83
477.220	Centre-line Fraser River #9 Crossing	12.70	289	764.2	6,773	9,336	77.6%	8,642	72%	7,469	696	83
477.250	West edge Fraser River	12.70	289	764.6	6,770	9,332	77.6%	8,638	72%	7,466	696	84
477.290	Grade & w.t. change (from 289/12.7 to 359/7.92)	7.92	359	773.0	6,699	9,250	99.2%	8,556	92%	7,400	701	84
477.299	Valve K477B - West side of Fraser #9 Crossing	7.92	359	774.0	6,691	9,240	99.1%	8,546	92%	7,392	701	84
477.650		7.92	359	766.5	6,753	9,313	99.9%	8,619	92%	7,451	697	84
477.890		7.92	359	778.5	6,653	9,196	98.6%	8,502	91%	7,357	703	84
478.000		7.92	359	788.0	6,574	9,103	97.6%	8,409	90%	7,282	708	85
478.070		7.92	359	793.0	6,532	9,053	97.1%	8,359	90%	7,243	710	85
478.250		7.92	358	788.5	6,570	9,098	97.6%	8,404	90%	7,278	708	85
478.300	CNR rail crosssing (cased)	7.92	359	795.0	6,524	9,034	96.9%	8,340	89%	7,227	703	84
478.580	CNR rail crosssing (cased)	7.92	359	806.0	6,441	8,926	95.7%	8,232	88%	7,141	700	84
479.000		7.92	359	953.5	5,194	7,479	80.2%	6,785	73%	5,983	789	95
479.590	Flge Pair at Jackman Hill - Highest Point in Test Section			1,040.0	4,473	6,630	71.1%	5,936	64%	5,304	832	100
	High Point			1,040.0								
	Low Point			763.8								

NEB F-IR 2.001 - Attachment 14

National Energy Board | Office national de l'énergie

ORDER OPLO-T4-17-99

IN THE MATTER OF the National Energy Board Act (the Act) and the regulations made thereunder; and

IN THE MATTER OF an application, under section 47 of the Act, by Trans Mountain Pipe Line Company Ltd. (TMPL), filed with the Board under File 3400-T4-68.

BEFORE the Board on 3 September 1999.

WHEREAS the Board has received letters from TMPL, dated 18 August 1999 and 1 September 1999 for an Order granting leave to open the portion of its pipeline system between km 479.582 and km 519.077 at the increased maximum operating pressures;

AND WHEREAS the Board has issued Certificate OC-2, dated 19 August 1960, as amended, respecting the pipeline facilities referred to in this Order;

AND WHEREAS the Board is satisfied that the pipeline facilities may be safely operated at the increased maximum operating pressures;

IT IS ORDERED THAT TMPL is granted leave to open the pipeline section between km 479.582 and km 519.077 for the transmission oil at pressures not exceeding those shown for each location in Schedule A, attached to and forming part of this Order.

NATIONAL ENERGY BOARD

Michel L. Mantha
Secretary

Canada

Schedule A
OPLO-T4-17-99

Trans Mountain Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 479.582 to 519.077

km Post	Description	WT [mm]	Pipe Grade [MPa]	Pipe Elevation (Roll dwgs) [m]	Strength Test Pressure [kPa]	Strength Test % SMYS	Leak Test Pressure [kPa]	Leak Test % SMYS	New MOP [kPa]	Increase in MOP [kPa]	Increase in MOH [m]
479.582	Jackman Hill Line Flanges - Highest Point	7.92	359	1,039.6	6,667	71.5%	5,999	64%	5,333	-44	-5
480.000		7.92	359	951.0	7,535	80.8%	6,887	74%	6,028	-44	-5
480.370		7.92	359	925.0	7,790	83.6%	7,122	76%	6,232	-44	-5
480.500		7.92	359	903.5	8,001	85.8%	7,333	79%	6,401	-44	-5
480.965	TMPL Access Road	7.92	359	873.0	8,300	89.0%	7,632	82%	6,640	-44	-5
480.993	CNR Crossing	7.92	359	865.0	8,379	89.9%	7,711	83%	6,703	-17	-2
480.998	CNR Crossing	7.92	359	865.0	8,379	89.9%	7,711	83%	6,703	-17	-2
481.000		7.92	359	854.0	8,389	90.0%	7,721	83%	6,711	-9	-1
481.020	Road	7.92	359	856.0	8,467	90.8%	7,799	84%	6,774	54	6
481.390	Road	7.92	359	815.0	8,869	95.1%	8,201	88%	7,096	378	45
481.500		7.92	359	813.0	8,889	95.4%	8,221	88%	7,111	391	47
482.000		7.92	359	823.5	8,786	94.2%	8,118	87%	7,029	309	37
482.125	Road	7.92	359	815.0	8,869	95.1%	8,201	88%	7,098	378	45
482.370		7.92	359	807.5	8,943	95.9%	8,275	89%	7,154	434	52
482.500		7.92	359	808.0	8,958	96.1%	8,290	89%	7,166	446	54
482.994	Road	7.92	359	797.5	9,041	97.0%	8,373	90%	7,233	513	62
483.000		7.92	359	798.0	9,036	96.9%	8,368	90%	7,229	509	61
483.500		7.92	359	799.0	9,028	96.8%	8,358	90%	7,221	501	60
483.920	Jackman Road	7.92	359	792.0	9,095	97.6%	8,427	90%	7,276	556	67
484.000		7.92	359	790.0	9,115	97.8%	8,447	91%	7,292	572	69
484.370		7.92	359	787.5	9,139	98.0%	8,471	91%	7,311	591	71
484.500		7.92	359	788.5	9,129	97.9%	8,461	91%	7,304	584	70
484.780	Road	7.92	359	788.5	9,129	97.9%	8,461	91%	7,304	584	70
485.000		7.92	359	788.0	9,134	98.0%	8,466	91%	7,307	587	70
485.500		7.92	359	791.0	9,105	97.7%	8,437	91%	7,284	564	68
486.000	Un-named Creek	7.92	359	783.0	9,183	98.5%	8,515	91%	7,347	627	75
486.001		7.92	359	783.0	9,183	98.5%	8,515	91%	7,347	627	75
486.370		7.92	359	788.0	9,134	98.0%	8,466	91%	7,307	587	70
486.483	Driveway	7.92	359	789.0	9,124	97.9%	8,456	91%	7,300	580	70
486.500		7.92	359	786.5	9,149	98.1%	8,481	91%	7,319	599	72
487.000		7.92	359	789.0	9,124	97.9%	8,456	91%	7,300	580	70
487.500		7.92	359	811.5	8,904	95.5%	8,236	88%	7,123	403	48
487.900	Hogan Creek	7.92	359	806.0	8,958	96.1%	8,290	89%	7,166	446	54
488.000		7.92	359	810.0	8,918	95.7%	8,250	89%	7,135	415	50
488.370		7.92	359	808.0	8,938	95.9%	8,270	89%	7,150	431	52
488.500		7.92	359	801.0	9,007	96.6%	8,339	89%	7,205	485	58
489.000		7.92	359	795.0	9,066	97.2%	8,398	90%	7,252	533	64
489.710	Teepee Creek	7.92	359	798.5	9,031	96.9%	8,363	90%	7,225	505	61
489.730	Road	7.92	359	801.0	9,007	96.6%	8,339	89%	7,205	485	58
490.000		7.92	359	807.0	8,948	96.0%	8,280	89%	7,158	438	53
490.280	Road	7.92	359	807.0	8,948	96.0%	8,280	89%	7,158	438	53
490.370		7.92	359	807.0	8,948	96.0%	8,280	89%	7,158	438	53
490.500		7.92	359	803.5	8,982	96.4%	8,314	89%	7,186	466	56
490.680	Tinsley Pit Access Road	7.92	359	803.5	8,982	96.4%	8,314	89%	7,186	466	56
491.000		7.92	359	795.0	9,066	97.2%	8,398	90%	7,252	533	64
491.200	Crooked Creek	7.92	359	789.0	9,124	97.9%	8,456	91%	7,300	580	70
491.500		7.92	359	792.0	9,095	97.6%	8,427	90%	7,276	556	67
491.505	Old N. Thompson Hwy	7.92	359	792.0	9,095	97.6%	8,427	90%	7,276	556	67
491.540	Un-named Creek	7.92	359	790.0	9,115	97.8%	8,447	91%	7,292	572	69
491.663	Rail Spur	7.92	359	790.0	9,115	97.8%	8,447	91%	7,292	572	69
491.714	Rail Spur	7.92	359	790.0	9,115	97.8%	8,447	91%	7,292	572	69
491.846	Access Road	7.92	359	794.0	9,075	97.4%	8,407	90%	7,260	540	65
492.000		7.92	359	790.0	9,115	97.8%	8,447	91%	7,292	572	69
492.230	Un-named Creek	7.92	359	786.5	9,149	98.1%	8,481	91%	7,319	599	72
492.370		7.92	359	787.0	9,144	98.1%	8,476	91%	7,315	595	71
492.475	Un-named Creek	7.92	359	782.5	9,188	98.6%	8,520	91%	7,351	631	76
492.500		7.92	359	785.0	9,164	98.3%	8,496	91%	7,331	611	73
492.565	Un-named Creek	7.92	359	781.0	9,203	98.7%	8,535	92%	7,362	642	77
492.889		7.92	359	797.4	9,042	97.0%	8,374	90%	7,234	514	62
493.000		7.92	359	786.5	9,149	98.1%	8,481	91%	7,319	599	72
493.130	Road	7.92	359	787.0	9,144	98.1%	8,476	91%	7,315	595	71
493.500		7.92	359	786.5	9,149	98.1%	8,481	91%	7,319	599	72
493.931		7.92	359	771.2	9,299	99.8%	8,631	93%	7,439	719	86
494.000		7.92	359	771.5	9,296	99.7%	8,628	93%	7,437	717	86
494.100		7.92	359	773.0	9,281	99.6%	8,613	92%	7,425	705	85
494.200	Bush Road	7.92	359	772.0	9,291	99.7%	8,623	93%	7,433	713	86
494.370		7.92	359	787.0	9,144	98.1%	8,476	91%	7,315	595	71
494.500		7.92	359	787.0	9,144	98.1%	8,476	91%	7,315	595	71
494.935		7.92	359	784.0	9,174	98.4%	8,506	91%	7,339	619	74
495.000		7.92	359	788.5	9,129	97.9%	8,461	91%	7,304	584	70

Schedule A
OPLO-T4-17-99

Trans Mountain Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 479.582 to 519.077

km Post	Description	WT [mm]	Pipe Grade [MPa]	Pipe Elevation (Roll dwgs) [m]	Strength Test Pressure [kPa]	Strength Test % SMYS	Leak Test Pressure [kPa]	Leak Test % SMYS	New MOP [kPa]	Increase in MOP [kPa]	Increase in MOH [m]
495.190	Road	7.92	359	789.0	9,124	97.9%	8,456	91%	7,299	579	69
495.275		7.92	359	783.5	9,178	98.5%	8,510	91%	7,343	623	75
495.380	Bush Road	7.92	359	789.0	9,124	97.9%	8,456	91%	7,300	580	70
495.500		7.92	359	786.0	9,154	98.2%	8,486	91%	7,323	603	72
495.802	North Thompson Hwy	7.92	359	786.0	9,154	98.2%	8,486	91%	7,323	603	72
496.000		7.92	359	787.0	9,144	98.1%	8,476	91%	7,315	595	71
496.370		7.92	359	776.0	9,252	99.2%	8,584	92%	7,402	682	82
496.440	Swift Creek	7.92	359	772.5	9,286	99.6%	8,618	92%	7,429	709	85
496.500		7.92	359	773.5	9,277	99.5%	8,609	92%	7,421	701	84
497.000		7.92	359	786.5	9,149	98.1%	8,481	91%	7,319	599	72
497.060	Pine Road	7.92	359	786.0	9,154	98.2%	8,486	91%	7,323	603	72
497.077		7.92	359	786.7	9,147	98.1%	8,479	91%	7,318	598	72
497.500		7.92	359	786.5	9,149	98.1%	8,481	91%	7,319	599	72
497.760	Cranberry Lake Road	7.92	359	786.7	9,147	98.1%	8,479	91%	7,317	597	72
498.000		7.92	359	787.0	9,144	98.1%	8,476	91%	7,315	595	71
498.370		7.92	359	787.0	9,144	98.1%	8,476	91%	7,315	595	71
498.500		7.92	359	787.5	9,139	98.0%	8,471	91%	7,311	591	71
498.675	Road	7.92	359	788.0	9,134	98.0%	8,466	91%	7,307	587	70
499.000		7.92	359	788.0	9,134	98.0%	8,466	91%	7,307	587	70
499.500		7.92	359	787.0	9,144	98.1%	8,476	91%	7,315	595	71
500.000		7.92	359	788.5	9,129	97.9%	8,461	91%	7,304	584	70
500.100	Private Road (Virgo)	7.92	359	795.5	9,061	97.2%	8,393	90%	7,249	529	63
500.155		7.92	359	795.6	9,060	97.2%	8,392	90%	7,248	528	63
500.370		7.92	359	806.0	8,958	96.1%	8,290	89%	7,166	446	54
500.500		7.92	359	808.0	8,938	95.9%	8,270	89%	7,150	431	52
500.775	Cranberry Lake Road	7.92	359	810.5	8,914	95.6%	8,246	88%	7,131	411	49
501.000		7.92	359	810.0	8,918	95.7%	8,250	89%	7,135	415	50
501.500		7.92	359	822.5	8,796	94.4%	8,128	87%	7,037	317	38
501.535	Road	7.92	359	822.0	8,801	94.4%	8,133	87%	7,041	321	38
501.876	Cedarside Road	7.92	359	819.0	8,830	94.7%	8,162	88%	7,064	344	41
501.880	Road	7.92	359	820.0	8,820	94.6%	8,152	87%	7,056	336	40
502.000		7.92	359	821.0	8,811	94.5%	8,143	87%	7,048	329	39
502.370		7.92	359	826.0	8,762	94.0%	8,094	87%	7,009	289	35
502.442		7.92	359	826.7	8,755	93.9%	8,087	87%	7,004	284	34
502.500		7.92	359	827.0	8,752	93.9%	8,084	87%	7,001	281	34
502.917	Private Road	7.92	359	830.5	8,718	93.5%	8,050	86%	6,974	254	30
503.000		7.92	359	830.0	8,722	93.6%	8,054	86%	6,978	258	31
503.325	CNR Crossing	7.92	359	811.5	8,904	95.5%	8,236	88%	7,123	403	48
503.518	North Thompson Hwy, (min elevation, pt of max stress)	7.92	359	768.2	9,328	100.1%	8,660	93%	7,463	745	89
503.519		7.92	359	768.2	9,329	100.1%	8,661	93%	7,463	745	89
504.000	Lowest Point in Test Section	7.92	359	771.0	9,301	99.8%	8,633	93%	7,441	721	86
504.234	Griffins Road	7.92	359	773.8	9,274	99.5%	8,606	92%	7,419	699	84
504.370		7.92	359	776.0	9,252	99.2%	8,584	92%	7,402	682	82
504.500		7.92	359	777.0	9,242	99.1%	8,574	92%	7,394	674	81
505.000		7.92	359	780.0	9,213	98.8%	8,545	92%	7,370	650	78
505.082	Grade & w.t. change	12.70	289	780.0	9,213	76.6%	8,545	71%	7,370	-44	-5
505.103		12.70	289	778.8	9,225	76.7%	8,557	71%	7,380	-44	-5
505.125	Canoe River	12.70	289	780.0	9,213	76.6%	8,545	71%	7,370	-44	-5
505.168	Grade & w.t. change	7.92	359	781.0	9,203	98.7%	8,535	92%	7,362	642	77
505.253	Grade & w.t. change	12.70	289	781.0	9,203	76.5%	8,535	71%	7,362	-44	-5
505.255	**Valve K504, Canoe R-Test Monitoring Site**	12.70	289	779.5	9,217	76.6%	8,549	71%	7,374	-45	-5
505.258	Grade & w.t. change	7.92	359	781.0	9,203	98.7%	8,535	92%	7,362	642	77
505.377	Everards Road	7.92	359	780.0	9,213	98.8%	8,545	92%	7,370	650	78
505.704	Sunnyview Road	7.92	359	778.6	9,227	99.0%	8,559	92%	7,382	662	79
505.879	Road	7.92	359	780.5	9,208	98.8%	8,540	92%	7,366	646	78
506.000		7.92	359	781.5	9,198	98.7%	8,530	92%	7,358	639	77
506.370		7.92	359	782.0	9,193	98.6%	8,525	91%	7,355	635	76
506.500		7.92	359	781.5	9,198	98.7%	8,530	92%	7,358	639	77
507.000		7.92	359	786.0	9,154	98.2%	8,486	91%	7,323	603	72
507.437	Road & Fibre Optic Crossing	7.92	359	786.0	9,154	98.2%	8,486	91%	7,323	603	72
507.500		7.92	359	786.0	9,154	98.2%	8,486	91%	7,323	603	72
508.000		7.92	359	789.0	9,124	97.9%	8,456	91%	7,300	580	70
508.254	Camp Creek #1	7.92	359	785.0	9,163	98.3%	8,495	91%	7,331	611	73
508.315	Road	7.92	359	787.6	9,139	98.0%	8,471	91%	7,311	591	71
508.370		7.92	359	788.0	9,134	98.0%	8,466	91%	7,307	587	70
509.000		7.92	359	793.0	9,085	97.5%	8,417	90%	7,268	548	66
509.125	Camp Creek Recreation Road	7.92	359	794.0	9,075	97.4%	8,407	90%	7,260	540	65
509.500		7.92	359	794.0	9,075	97.4%	8,407	90%	7,260	540	65
509.822	Road	7.92	359	796.5	9,051	97.1%	8,383	90%	7,241	521	62
510.000		7.92	359	795.0	9,066	97.2%	8,398	90%	7,252	533	64
510.133	Road	7.92	359	794.0	9,075	97.4%	8,407	90%	7,260	540	65
510.370		7.92	359	800.0	9,017	96.7%	8,349	90%	7,213	493	59

Schedule A
OPLO-T4-17-99

Trans Mountain Pipe Line Company Ltd.
Maximum Operating Pressures
Pipeline Section km 479.582 to 519.077

km Post	Description	WT [mm]	Pipe Grade [MPa]	Pipe Elevation (Roll dwgs) [m]	Strength Test Pressure [kPa]	Strength Test % SMYS	Leak Test Pressure [kPa]	Leak Test % SMYS	New MOP [kPa]	Increase in MOP [kPa]	Increase in MOH [m]
510.500		7.92	359	800.0	9,017	96.7%	8,349	90%	7,213	493	59
510.692	Road	7.92	359	799.4	9,023	96.8%	8,355	90%	7,218	498	60
510.850	Old N. Thompson Hwy	7.92	359	801.0	9,007	96.6%	8,339	89%	7,205	485	58
511.000	Run-off Creek	7.92	359	801.5	9,002	96.6%	8,334	89%	7,201	482	58
511.386	Road	7.92	359	822.5	8,796	94.4%	8,128	87%	7,037	317	38
511.500		7.92	359	825.0	8,771	94.1%	8,103	87%	7,017	287	36
511.525	Run-off Creek	7.92	359	821.0	8,811	94.5%	8,143	87%	7,048	329	39
512.000		7.92	359	826.0	8,771	94.1%	8,103	87%	7,017	297	36
512.050	Run-off Creek	7.92	359	823.0	8,791	94.3%	8,123	87%	7,033	313	38
512.130	Run-off Creek	7.92	359	822.0	8,801	94.4%	8,133	87%	7,041	321	38
512.370		7.92	359	825.0	8,771	94.1%	8,103	87%	7,017	297	36
512.500		7.92	359	823.5	8,786	94.2%	8,118	87%	7,029	309	37
512.638	Road	7.92	359	827.0	8,752	93.9%	8,084	87%	7,001	281	34
513.000		7.92	359	837.0	8,654	92.8%	7,986	86%	6,923	203	24
513.356	Road	7.92	359	825.0	8,771	94.1%	8,103	87%	7,017	297	36
513.500		7.92	359	810.0	8,918	95.7%	8,250	89%	7,135	415	50
514.000		7.92	359	829.0	8,732	93.7%	8,064	87%	6,986	266	32
514.200	Jalink Creek	7.92	359	830.0	8,722	93.6%	8,054	86%	6,978	258	31
514.375	Run-off Creek	7.92	359	834.0	8,683	93.1%	8,015	86%	6,946	226	27
514.500		7.92	359	872.5	8,305	89.1%	7,637	82%	6,644	-44	-5
515.000		7.92	359	865.0	8,379	89.9%	7,711	83%	6,703	-17	-2
515.263	Crystal Creek	7.92	359	860.0	8,428	90.4%	7,760	83%	6,742	22	3
515.500		7.92	359	865.0	8,379	89.9%	7,711	83%	6,703	-17	-2
515.720	Run-off Creek	7.92	359	855.0	8,477	90.9%	7,809	84%	6,782	62	7
516.000		7.92	359	851.5	8,511	91.3%	7,843	84%	6,809	89	11
516.350	Road	7.92	359	854.0	8,487	91.0%	7,819	84%	6,789	70	8
516.500		7.92	359	846.0	8,546	91.7%	7,878	85%	6,837	117	14
516.640	Urquhart Creek	7.92	359	840.0	8,624	92.5%	7,956	85%	6,899	179	22
517.000		7.92	359	867.5	8,354	89.6%	7,686	82%	6,684	-36	-4
517.500		7.92	359	877.0	8,261	88.6%	7,593	81%	6,609	-44	-5
517.635	Run-off Creek	7.92	359	883.0	8,202	88.0%	7,534	81%	6,582	-44	-5
518.000		7.92	359	859.0	8,438	90.5%	7,770	83%	6,750	30	4
518.370		7.92	359	874.0	8,291	88.9%	7,623	82%	6,632	-44	-5
518.480	Road	7.92	359	878.0	8,251	88.5%	7,583	81%	6,601	-44	-5
518.500		7.92	359	879.0	8,242	88.4%	7,574	81%	6,593	-44	-5
518.605	Gunn Creek	7.92	359	882.5	8,207	88.0%	7,539	81%	6,566	-44	-5
518.720	Run-off Creek	7.92	359	884.0	8,193	87.9%	7,525	81%	6,554	-44	-5
518.850	Road	7.92	359	885.0	8,183	87.8%	7,515	81%	6,546	-44	-5
519.000		7.92	359	887.5	8,158	87.5%	7,490	80%	6,527	-44	-5
519.077	Albreda Station Valve 24G	7.92	359	892.5	8,109	87.0%	7,441	80%	6,487	-44	-5

NEB F-IR 2.001 - Attachment 15

NATIONAL ENERGY BOARD

CANADA

OFFICE NATIONAL DE L'ÉNERGIE

ORDER NO. MO-9-83

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. (hereinafter called "the Applicant"), dated 28 November 1983, for an Order granting leave to increase the authorized maximum operating pressure of its 610 mm diameter pipeline from a designated kilometre 518.72 to a point designated kilometer 543.64, in the Province of British Columbia, filed with the Board under File No. 1800-T4-24.

B E F O R E the Board on 20 December 1983.

WHEREAS the Board has considered the said application and the Affidavit of Thomas Harry Woodman, Professional Engineer of the Applicant, dated 7 November 1983;

AND WHEREAS the Board has issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated the 19th day of August, 1960, as amended, respecting the pipeline referred to in this Order;

AND WHEREAS the Board is satisfied that the said pipeline may safely be operated at pressures not exceeding those hereinafter referred to;

IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to operate for the transmission of oil its 610 mm diameter pipeline from a point designated kilometre 518.72 to a point designated kilometre 543.64, in the Province of British Columbia, at pressures not exceeding those shown for each location in Schedule "A", attached to and forming part of this Order.

NATIONAL ENERGY BOARD
CANADA
EXAMINED AND CERTIFIED TO BE A TRUE COPY OF AN ORDER OF THE NATIONAL ENERGY BOARD.
DATED: JAN - 9 1984

G. Yorke Slader

SECRETARY, NATIONAL ENERGY BOARD, OTTAWA, CANADA

NATIONAL ENERGY BOARD

G. Yorke Slader
Secretary

SCHEDULE "A"

PIPE STRENGTH PROFILE
Test Section 518.72

Tab 4b

km	Wall Thickness mm	Ground Elev. m	Meters of Water: Test Elev.	Test Head	72% SMYS	80% Test Head	M.A.O.P.: kPa	Elev. Meter of Water	Elev. Meter of Oil Density 850 kg/m^3	Remarks
518.72	7.92	893.0	1686.3	793.7	685.8	635.0	6225	1527.6	1639.6	Upstream end valve 24G Albreda Station test site.
520.0	7.92	873.5	1686.3	812.8	685.8	650.2	6375	1523.7	1638.5	
522.0	7.92	884.2	1686.3	802.1	685.8	641.7	6290	1525.9	1639.1	
524.0	7.92	889.7	1686.3	796.6	685.8	637.3	6245	1527.0	1639.4	
526.0	7.92	863.8	1686.3	822.5	685.8	658.0	6450	1521.8	1637.9	
526.4	7.92	908.5	1686.3	777.8	685.8	622.2	6100	1530.7	1640.5	Maximum elev. point of min. pipe stress
528.0	7.92	881.8	1686.3	804.5	685.8	643.6	6310	1525.4	1639.0	
530.0	7.92	836.8	1686.3	849.5	685.8	679.6	6660	1516.4	1636.3	
532.0	7.92	835.7	1686.3	850.6	685.8	680.5	6670	1516.2	1636.3	
534.0	7.92	812.4	1686.3	873.9	685.8	699.1	6720	1498.2	1619.2	
536.0	7.92	803.5	1686.3	882.8	685.8	706.2	6720	1489.3	1610.3	
538.0	7.92	765.8	1686.3	920.5	685.8	736.4	6720	1415.6	1572.6	
540.0	7.92	751.1	1686.3	935.2	685.8	748.2	6720	1436.9	1557.9	
542.0	7.92	736.5	1686.3	949.8	685.8	759.8	6720	1422.3	1543.3	
543.64	7.92	733.7	1686.3	952.6	685.8	762.1	6720	1419.5	1540.5	Downstream end N. Thompson Valve M544 min. elev. point of max. pipe stress

NEB F-IR 2.001 - Attachment 16

NATIONAL ENERGY BOARD

CANADA

OFFICE NATIONAL DE L'ÉNERGIE

ORDER NO. MO-3-82

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. (hereinafter called "the Applicant"), dated the 17th day of November, 1981, for an Order granting leave to increase the authorized maximum operating pressure of its 610 mm diameter pipeline from a point designated kilometre 543.64 to a point designated kilometre 588.36, in the Province of British Columbia, filed with the Board under File No. 1800-T4-25.

B E F O R E the Board on Wednesday, the 27th day of January, 1982.

WHEREAS the Board has considered the said application and the Affidavit of Alwin Wilbert Samson, Professional Engineer of the Applicant, dated the 17th day of November, 1981;

AND WHEREAS the Board has issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated the 19th day of August, 1960, as amended, respecting the pipeline referred to in this Order;

AND WHEREAS the Board is satisfied that the said pipeline may safely be operated at pressures not exceeding those hereinafter referred to;

IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to operate for the transmission of oil its 610 mm diameter pipeline from a point designated kilometre 543.64, situated in part of Lot 3113, to a point designated kilometre 588.36, in the Applicant's Blue River Pump Station site, situated in part of Lot 1, Plan 6489, District Lot 3278, all in Kamloops Division, Yale District, Province of British Columbia, at pressures not exceeding those shown for each location in Schedule "A", attached to and forming part of this Order.

NATIONAL ENERGY BOARD

G. Yorke Slader
Secretary

NATIONAL ENERGY BOARD
CANADA
EXAMINED AND CERTIFIED TO BE A TRUE COPY OF AN ORDER OF THE NATIONAL ENERGY BOARD.
DATED: FEB FEV 24 1982

G. Yorke Slader

SECRETARY, NATIONAL ENERGY BOARD, OTTAWA, CANADA

EJL
AWS
GFF

Schedule "A"

PIPE STRENGTH PROFILE
Test Section 543.64

km	Wall Thick-ness mm	Ground Elev. m	Meters of Water: Test Elev.	Meters of Water: Test Head	Meters of Water: 72% SMYS	Meters of Water: 80% Test Head	M.A.O.P.: kPa	M.A.O.P.: Elev. Meter of Water	M.A.O.P.: Elev. Meter of Oil Density 850 kg/m³	REMARKS
543.64	12.70	731.3	1627	895.7	970.7	716.6	7020	1447.9	1574.4	Upstream end. Valve M544
544.0	8.74	733.0	1627	894.0	754.4	715.2	7010	1448.2	1574.4	
546.0	7.92	736.1	1627	890.9	685.8	712.7	6720	1421.9	1542.9	
548.0	7.92	738.5	1627	888.5	685.8	710.8	6720	1424.3	1545.3	
550.0	7.92	760	1627	867.0	685.8	693.6	6720	1445.8	1566.8	
552.0	7.92	725.4	1627	901.6	685.8	721.3	6720	1411.2	1532.2	
554.0	7.92	731.5	1627	895.5	685.8	716.4	6720	1417.3	1538.3	
556.0	7.92	696.5	1627	930.5	685.8	744.4	6720	1382.3	1503.3	
558.0	7.92	725.4	1627	901.6	685.8	721.3	6720	1411.2	1532.2	
560.0	7.92	786.4	1627	840.6	685.8	672.5	6590	1458.9	1577.6	
562.0	7.92	743.7	1627	883.3	685.8	706.6	6720	1429.5	1550.5	
564.0	7.92	760	1627	867	685.8	693.6	6720	1445.8	1566.8	
566.0	7.92	705	1627	922	685.8	737.6	6720	1390.8	1511.8	
568.0	7.92	830	1627	797	685.8	637.6	6250	1467.6	1580.1	
568.66	7.92	866.5	1627	760.5	685.8	608.4	5960	1474.9	1582.3	Maximum elevation Point of minimum pipe stress
570	7.92	736	1627	891	685.8	712.8	6720 (6724)	1421.8	1542.8	
572	7.92	751	1627	876	685.8	700.8	6720 (6724)	1436.8	1557.8	
574	7.92	695	1627	932	685.8	745.6	6720 (6724)	1380.8	1501.8	
576	7.92	732	1627	895	685.8	716	6720	1417.8	1538.8	
578	7.92	754	1627	873	685.8	698.4	6720	1439.8	1560.8	
580	7.92	739	1627	888	685.8	710.4	6720	1424.8	1545.8	
582	7.92	684.3	1627	942.7	685.8	754.2	6720 (6724)	1370.1	1491.1	
584	7.92	682.8	1627	944.2	685.8	755.4	6720	1368.6	1489.6	
586.0	7.92	679.7	1627	947.3	685.8	757.8	6720	1365.5	1486.5	
587.5	7.92	675.1	1627	951.9	685.8	761.8	6720	1360.9	1481.9	Minimum elevation Point of maximum pipe stress.
588.0	7.92	678.2	1627	948.8	685.8	759.0	6720	1364	1485.0	
588.36	7.92	682.8	1627	944.2	685.8	755.4	6720	1368.6	1489.6	Downstream end Test site. Blue River Scraper trap

NEB F-IR 2.001 - Attachment 17

NATIONAL ENERGY BOARD

CANADA

OFFICE NATIONAL DE L'ÉNERGIE

ORDER NO. MO-66-86

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. (hereinafter called "the Applicant"), dated 3 December 1986, for an Order granting leave to increase the authorized maximum operating pressure of its 610 mm diameter pipeline from a point designated kilometre 588.36 to a point designated kilometre 624.71, in the Province of British Columbia, filed with the Board under File No. 1800-T4-34.

B E F O R E the Board on 23 December 1986.

WHEREAS the Board has considered the said application and the Affidavit of Arthur Donald Meyer, Professional Engineer of the Applicant, dated 3 December 1986;

AND WHEREAS the Board has issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated 19 August 1960, as amended, respecting the pipeline referred to in this Order;

AND WHEREAS the Board is satisfied that the said pipeline may safely be operated at pressures not exceeding those hereinafter referred to;

IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to operate for the transmission of oil its 610 mm diameter pipeline from a point designated kilometre 588.36 to a point designated kilometre 624.71, in the Province of British Columbia, at pressures not exceeding those shown for each location in Schedule "A", attached to and forming part of this Order.

NATIONAL ENERGY BOARD

L. Alylord

for J.S. Klenavic
Secretary

SCHEDULE "A"

Retest Section 588.36

km Post	Pipe Wall mm	Ground Elevation m	MOP kPa
588.36	7.92	684.0	6475
590.00	7.92	680.2	6505
592.00	7.92	683.8	6476
593.80	7.92	667.4	6605
593.80	12.70	667.4	6605
594.00	12.70	665.9	6617
594.06	12.70	666.1	6615
594.06	7.92	666.1	6615
596.00	7.92	673.9	6554
598.00	7.92	676.2	6536
598.59	7.92	669.6	6588
598.59	12.70	669.6	6588
598.67	12.70	672.6	6564
598.67	7.92	672.6	6564
600.00	7.92	666.6	6611
602.00	7.92	667.5	6604
604.00	7.92	656.3	6692
606.00	7.92	660.8	6657
608.00	7.92	639.8	6712
609.27	7.92	770.2	5798
609.60	12.70	724.7	6155
609.71	12.70	722.2	6175
609.71	7.92	722.2	6175
610.00	7.92	706.6	6297
612.00	7.92	631.2	6712
614.00	7.92	586.2	6712
616.00	7.92	579.6	6712
618.00	7.92	580.4	6712
620.00	7.92	581.1	6712
622.00	7.92	580.0	6712
624.00	7.92	580.0	6712
624.44	7.92	576.2	6712
624.50	12.70	576.2	7320
624.70	12.70	576.5	7318
624.71	7.92	576.5	6712

NEB F-IR 2.001 - Attachment 18

NATIONAL ENERGY BOARD

OFFICE NATIONAL DE L'ÉNERGIE

CANADA

ORDER NO. MO-67-86

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. (hereinafter called "the Applicant"), dated 3 December 1986, for an Order granting leave to increase the authorized maximum operating pressure of its 610 mm diameter pipeline from a point designated kilometre 624.71 to a point designated kilometre 644.60, in the Province of British Columbia, filed with the Board under File No. 1800-T4-34.

B E F O R E the Board on 23 December 1986.

WHEREAS the Board has considered the said application and the Affidavit of Arthur Donald Meyer, Professional Engineer of the Applicant, dated 3 December 1986;

AND WHEREAS THE Board has issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated 19 August 1960, as amended, respecting the pipeline referred to in this Order;

AND WHEREAS the Board is satisfied that the said pipeline may safely be operated at pressures not exceeding those hereinafter referred to;

IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to operate for the transmission of oil its 610 mm diameter pipeline from a point designated kilometre 624.71 to a point designated kilometre 644.60, in the Province of British Columbia, at pressures not exceeding those shown for each location in Schedule "A", attached to and forming part of this Order.

NATIONAL ENERGY BOARD

R. Alford

for J.S. Klenavic
Secretary

SCHEDULE "A"

Retest Section 624.71

km Post	Pipe Wall mm	Ground Elevation m	MOP kPa
624.71	7.92	576.5	6712
626.00	7.92	584.1	6712
628.00	7.92	584.0	6712
630.00	7.92	583.7	6712
632.00	7.92	581.0	6712
634.00	7.92	575.4	6712
636.00	7.92	594.5	6712
638.00	7.92	626.5	6712
638.46	7.92	666.4	6613
640.00	7.92	595.5	6712
642.00	7.92	574.7	6712
644.01	7.92	558.7	6712
644.60	7.92	577.9	6712

NEB F-IR 2.001 - Attachment 19

ORDER NO. MO-1-76

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. respecting the authorized maximum operating pressure of a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', in the Province of British Columbia, filed with the Board under File No. 1800-T4-13.

B E F O R E the Board on Tuesday, the 13th day of January, 1976

UPON an application by Trans Mountain Pipe Line Company Ltd., formerly known as Trans Mountain Oil Pipe Line Company, (hereinafter called "the Applicant"), dated the 30th day of December, 1975, for approval to operate a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M/P 400.5', being a point within its existing 'McMurphy Pump Station' site, situated in part of District Lot 2956^F, to a point designated 'M/P 448.7', being (the upstream side of) an existing 'Main Line Valve', referred to as 'Lemieux Creek Valve', situated in part of District Lot 2063, all in the Kamloops Division, Yale District, in the Province of British Columbia, at increased maximum operating pressures; and it appearing that the Board of

...2

Transport Commissioners for Canada, now referred to as the Railway Transport Committee of the Canadian Transport Commission, by its Order No. 82361, dated the 15th day of October, 1953, authorized the Applicant to open for the 'transportation of crude oil' _inter alia_ the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line'; and the Board having issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated the 19th day of August, 1960, as amended, respecting _inter alia_ the portion of existing pipeline, being a portion of '24-inch diameter Main Line', referred to in this Order; and the Applicant having represented that it hydrostatically 're-tested' the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line'; and upon having read the submissions of the Applicant, including an Affidavit of Alwin Wilbert Samson, Chief Engineer of the Applicant, dated the 30th day of December, 1975, all filed; and the Board having been satisfied that the said portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter Main Line', may safely be operated at such maximum operating pressures as hereinafter referred to;

IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to operate for the transmission of oil that portion of its existing pipeline, being a portion

...3

of its '24-inch diameter Main Line', extending from a point designated 'M/P 400.5', being a point within its existing 'McMurphy Pump Station' site, situated in part of District Lot 2956F, to a point designated 'M/P 448.7', being (the upstream side of) an existing 'Main Line Valve', referred to as 'Lemieux Creek Valve', situated in part of District Lot 2063, all in the Kamloops Division, Yale District, in the Province of British Columbia, upon the following condition:

> The authorized maximum operating pressure of the portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter Main Line', respecting which this Order is issued, at the point designated
>
> (i) 'M/P 400.5', being a point on the discharge side of the said existing 'McMurphy Pump Station', situated at the hereinbefore described location, shall be 1,008 psig,
>
> (ii) 'M/P 418.1', being (the downstream side of) an existing 'Main Line Valve', referred to as 'Vavenby Valve', situated in part of District Lot 2577, Kamloops Division, Yale District, in the Province of British Columbia, shall be 958 psig, and

...4

(iii) 'M/P 440.9' (formerly referred to as 'M/P 439.5'), being a point on the discharge side of the Applicant's existing 'Blackpool Pump Station', situated in parts of Lot 1, Plan 6161 of District Lot 1640 and District Lot 5437, all in the Kamloops Division, Yale District, in the said Province, shall be 1,076 psig.

NATIONAL ENERGY BOARD

for Robert A. Stead
Secretary

NATIONAL ENERGY BOARD
CANADA
EXAMINED AND CERTIFIED TO BE A TRUE COPY OF AN ORDER OF THE NATIONAL ENERGY BOARD.
DATED: MAY - 5 1976

B.H. Whittle

ACTING SECRETARY, NATIONAL ENERGY BOARD, OTTAWA, CANADA

NEB F-IR 2.001 - Attachment 20

NATIONAL ENERGY BOARD

CANADA

OFFICE NATIONAL DE L'ÉNERGIE

ORDER NO. MO-54-78

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. respecting the authorized maximum operating pressure of a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', in the Province of British Columbia, filed with the Board under File No. 1800-T4-20.

B E F O R E the Board on Friday the 17th day of November 1978.

UPON an application by Trans Mountain Pipe Line Company Ltd., formerly known as Trans Mountain Oil Pipe Line Company, (hereinafter called "the Applicant"), dated the 5th day of September, 1978, for approval to operate a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M.P. 448.7', being (the downstream side of) an existing 'Main Line Valve', identified as 'M448', also referred to as 'Lemieux Creek Valve', situated in part of District Lot 2036, to a point designated 'M.P. 479.0', being (the upstream side of) an existing 'Main Line Valve', identified as 'M479' situated in part of District Lot 1688, all in Kamloops Division, Yale District, in the Province of British Columbia, at increased authorized maximum operating pressures; and it appearing that the Board of Transport Commissioners for Canada, now referred to as the Railway Transport Committee of the Canadian Transport Commission, by Order No. 82361, dated the 15th day of October, 1953, authorized the Applicant to open for the 'transportation of crude oil' inter alia the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line';

AND the Board having issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated the 19th day of August, 1960, as amended, respecting inter alia the portion of existing pipeline, being a portion of '24-inch diameter Main Line', referred to in this Order; and the Applicant having represented that it hydrostatically 're-tested' the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line'; and upon having read the submissions of the Applicant, including the Affidavit of Alwin Wilbert Samson, Chief Engineer of the Applicant, dated the 5th day of September, 1978, all filed; and the Board having been satisfied that the said portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter Main Line', may safely be operated at such maximum operating

...3

pressures as hereinafter referred to;

IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to operate for the transmission of oil that portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M.P. 448.7', being (the downstream side of) an existing 'Main Line Valve', identified as 'M448', also referred to as 'Lemieux Creek Valve', situated in part of District Lot 2036, to a point designated 'M.P. 479.0', being (the upstream side of) an existing 'Main Line Valve', identified as 'M479', situated in part of District Lot 1688, all in Kamloops Division, Yale District, in the Province of British Columbia, upon the following conditions:

(1) The authorized maximum operating pressure of the portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter Main Line', respecting which this Order is issued, at the point designated 'M.P. 448.7', being (the downstream side of) an existing 'Main Line Valve' identified as 'M448', situated at the hereinbefore described location shall be 975 psig.

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(2) The authorized maximum operating pressure at any given point on the portion of the Applicant's existing pipeline between the said point designated 'M.P. 448.7', being (the downstream side of) an existing 'Main Line Valve' identified as 'M448' and the point designated 'M.P. 479.0', being (the upstream side of) an existing 'Main Line Valve' identified as 'M479', situated at the hereinbefore described locations, shall be the lesser of:

(i) 80% of the test pressure experienced at that point on the pipeline during the hydrostatic test as described in the application for higher operating pressures, or

(ii) a pressure which causes a circumferential stress in the pipe of 72% of the Specified Minimum Yield

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Stress of the pipe material

at that point.

NATIONAL ENERGY BOARD

G. Yorke Slader

for Brian H. Whittle
Secretary

NATIONAL ENERGY BOARD
CANADA
EXAMINED AND CERTIFIED TO BE A TRUE COPY
OF AN ORDER OF THE NATIONAL ENERGY
BOARD.
DATED. MAY 11 1979

B.H. Whittle

SECRETARY, NATIONAL ENERGY
BOARD, OTTAWA, CANADA

NEB F-IR 2.001 - Attachment 21

ORDER XO-T099-05-2004

IN THE MATTER OF the *National Energy Board Act* (the NEB Act) and the regulations made thereunder; and

IN THE MATTER OF an application, pursuant to section 58 of the *National Energy Board Act* and sections 44 and 45 of the *Onshore Pipeline Regulations, 1999*, by Terasen Pipelines (Trans Mountain) Inc., filed with the National Energy Board under File 3400-T099-7;

BEFORE the Board on 29 April 2004.

WHEREAS the Board has received an application made pursuant to section 58 of the NEB Act and sections 44 and 45 of the OPR-99 by Terasen dated 5 January 2004 for approval of the Trans Mountain capacity upgrade program as described on Schedule A attached to and forming part of this Order (the Project):

AND WHEREAS the work listed in Schedule A will cost an estimated $17 million;

AND WHEREAS the Board determined that the Project is not included in the *Exclusion List Regulations* of the *Canadian Environmental Assessment Act* (CEA Act), and, therefore, is subject to an environmental assessment under the CEA Act;

AND WHEREAS pursuant to the CEA Act, the Board has considered the information submitted by Terasen and performed an environmental screening;

AND WHEREAS the Board has determined, pursuant to paragraph 20(1)(a) of the CEA Act that, taking into account the implementation of Terasen's proposed mitigative measures and those set out in the attached conditions, the Project is not likely to cause significant adverse environmental effects;

AND WHEREAS the Board has examined the Project and considers it to be in the public interest to grant the relief described herein;

.../2

IT IS ORDERED that the Trans Mountain capacity upgrade program is exempt from the provisions of sections 30(1)(a), 30(2) and section 31 of the NEB Act, subject to the following conditions:

1. Terasen shall implement or cause to be implemented all of the policies, practices, mitigative measures, recommendations and procedures for the protection of the environment referred to in its application and related correspondence.

2 Terasen shall cause the approved facilities to be designed, manufactured, located, constructed and installed in accordance with those specifications, drawings and other information or data set forth in its application and related correspondence.

3. Terasen shall file with the Board, at least 10 days prior to the commencement of the repair work on the NPS30 Darfield - Kamloops pipeline segment, a detailed activity schedule identifying major repair activities and shall notify the Board of any modifications to the schedule as they occur.

4. Terasen shall consult with a qualified biologist to identify potential species at risk located near proposed cutout locations. Terasen shall file with the Board prior to construction activities:
   i) evidence to demonstrate that this consultation has occurred;
   ii) the results of the consultation; and
   iii) mitigative strategies to protect any identified species at risk.

5. Terasen shall submit a separate section 58 application to the Board for any work that would be required within 30 metres of a watercourse or wetland.

6. Terasen shall complete an environmental assessment of all cutout locations on the NPS30 pipeline loop. Should any of the locations require special environmental procedures or mitigation not already provided in Company manuals, Terasen shall notify the Board prior to conducting any work.

7. Terasen shall offer to hold an information sharing session with the North Thompson, Kamloops and Whispering Pines / Clinton Indian Bands, in the vicinity of the Project, to discuss the EIA Report, including potential impacts on traditional use, and safety issues. After the information session, Terasen shall file with the Board, 30 days prior to any construction activities associated with the reactivation of the existing NPS30 pipeline loop between Darfield and Kamloops:

.../3

i) a report on any issues and concerns raised at the information sharing session, and
ii) how they will be addressed; and
iii) for approval, any mitigation measures it proposes to address the issues and concerns. in i) that result in changes to the Project.

8. Within 30 days of the date that the approved facilities are placed in service or of the date that the last order was issued for leave to open, Terasen shall file with the Board a confirmation, by an officer of the company, that the approved facilities were completed and constructed in compliance with all applicable conditions in this order. If compliance with any of these conditions cannot be confirmed, the officer of the company shall file with the Board details as to why compliance cannot be confirmed.

9. Unless the Board otherwise directs prior to 31 December 2005, this Order shall expire on 31 December 2005, unless work on the Project has commenced by that date.

NATIONAL ENERGY BOARD

Michel L. Mantha
Secretary

Schedule A
National Energy Board XO-T099-05-2004

Terasen Pipelines (Trans Mountain) Inc.
Application dated 5 January 2004 for Trans Mountain Capcity Upgrade Project

Projects Assessed Pursuant to the NEB Act

Construction Type	Facility Type	Name of Facility	Location of Facility	Pump Power
upgrade Tank line		Edmonton Terminal	Edmonton, AB	n/a
upgrade crude booster pumps		Edmonton Terminal	Edmonton, AB	400 Hp
power upgrade		Edmonton Terminal	Edmonton, AB	n/a
motor replacement transformer upgrade	pump station	Gainford Station	Alberta	2000 Hp
motor piping and electrical upgrade	pump station	Edson Station	Alberta	2000 Hp
motor replacement	pump station	Albreda Station	British Columbia	2000 Hp
motor replacement piping modifications	pump station	Darfield Station	British Columbia	2000 Hp
piping modifications	pump station	Kamloops Station	British Columbia	n/a
tank modifications	terminal	Burnaby Terminal	Burnaby, BC	n/a

National Energy Board | Office national de l'énergie

ENVIRONMENTAL SCREENING REPORT

SCREENING SUMMARY

Terasen Pipelines (Trans Mountain) Inc. applied to the National Energy Board pursuant to section 58 of the *National Energy Board Act* to increase capacity along the Trans Mountain Pipeline System. The proposed upgrades and modifications to existing facilities include: the reactivation of the existing 30 inch pipeline loop between Darfield and Kamloops and the deactivation of the parallel portion of the existing 24 inch mainline; upgrades to pumps, motors and electrical power supply at the Edmonton Terminal and Gainford, Edson, Albreda and Darfield stations; upgrades to Tank 23 feeder line at Edmonton Terminal and modifications to Tanks 88 and 90 at Burnaby Terminal (the Project). The environmental components with the potential to be adversely affected include noise, soil, air, wildlife and vegetation. The Board has examined Teresen's proposed mitigative measures in relation to these components and determined the measures were adequate.

The Board is of the view that, taking into account the implementation of the companies proposed environmental procedures and mitigative measures, and those set out in the proposed conditions, the Project is not likely to cause significant adverse environmental effects. This represents a determination pursuant to paragraph 20(1) (a) of the *Canadian Environmental Assessment Act.*

PROJECT IDENTIFICATION

Project Title:	Trans Mountain Capacity Upgrade Program
Physical Work/Activity:	Construction
Project Location:	Edmonton Terminal, Gainford, Edson, Albreda, Darfield and Kamloops Stations
Applicant Name:	Terasen Pipelines (Trans Mountain) Inc. (Terasen)
Application Date:	5 January 2004
NEB[1] File No.:	3000-T099-7
CEA Act[2] Registration Date:	19 January 2004
CEA Registry Ref. Number:	04-01-709
CEA Act Law List Trigger:	Section 58(1) *National Energy Board Act* (NEB Act). The reactivation/deactivation although not a CEA Act trigger was screened collectively with the section 58 as they are interconnected.
CEA Act Determination Date:	30 April 2004

1 NEB or the Board (National Energy Board)
2 CEA Act (*Canadian Environmental Assessment Act*)

Canada

1.0 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

Scope of the Project

Physical Work and/or Activity	Description
Construction Phase (Summer construction starting in 2004)	
➢ Booster pump motor upgrade, piping and power upgrades at Edmonton Terminal	▪ Construction/installation would be undertaken on previously disturbed, bermed, lined and fenced land within the Edmonton Terminal. ▪ No grading or soil handling would be required.
➢ Upgrades to pumps, motors and electrical power supply at the Edmonton Terminal and Gainford, Edson, Albreda and Darfield stations	▪ Access to the proposed pump stations would be via existing roads. ▪ Installation of pumps and associated infrastructure. ▪ No new lands required.
➢ Modifications to tanks 88 and 90 at the Burnaby Terminal to reduce heel volumes	▪ Excavation of fill and drain lines under the floor, relocation of protruding appurtenances, removing mixers and installing an alternative mixing system. ▪ All work would occur within tank farm property.
➢ Reactivation of an existing 30 inch loop and deactivation of the parallel 24 inch mainline from Kamloops to Darfield with associated modifications to station piping at the Kamloops station	▪ Reactivation would require the execution of an integrity assurance program to determine locations for potential pipeline replacements (cutouts). ▪ Nitrogen currently within the pipeline would be vented to the atmosphere and the pipeline would be tested for integrity using an inline inspection program followed by hydrostatic testing. ▪ All work would take place on an existing disturbed right-of-way ▪ Standard mainline excavation, backfill and compaction procedures would be implemented at these sites. ▪ The 30 inch loop would be tied-in to the existing containment building at the Kamloops Station and a receiving barrel would be installed. ▪ No new lands are required.
➢ Installation of scraper traps at Darfield to Kamloops stations	▪ Scraper traps to accommodate the transition from 24 inch pipeline to 30 inch pipeline would be installed within the existing Terasen pump stations boundaries at both Darfield and Kamloops.
Operation Phase	

Physical Work and/or Activity	Description
➢ Facility operation and maintenance	▪ The design noise level of the proposed higher capacity pumps and motor units would not exceed 85 dBA at a distance of one meter from the motor casing. ▪ Terasen would conduct noise level surveys around these sites to ensure that no applicable laws or regulations pertaining to noise intensity are being violated. ▪ Erosion control procedures would be implemented as required at the cutout locations and monitored to ensure successful reclamation of disturbed sites.
Abandonment Phase	
➢ No details were provided	▪ Terasen would be required to apply to the Board prior to abandoning the pipeline or any section of it.

Scope of the Factors that were Considered

The factors considered within the scope of this Environmental Screening Report are those set out in subsection 16 (1) of the CEAA and are examined in this report.

2.0 DESCRIPTION OF THE ENVIRONMENTAL AND SOCIO-ECONOMIC ENVIRONMENT

2.1 Edmonton Terminal:

- The site is zoned for Industrial use
- Previously disturbed land within existing bermed and fenced area
- The Terminal site is located in Strathcona County immediately adjacent to the cities of Edmonton and Sherwood Park
- The population of the socio-economic study area is estimated to be 900,000

2.2 Gainford Pump Station:

- Restricted to existing facility boundaries
- The site is approximately 12 km west of Wabamun in the County of Parkland Alberta
- A number of small villages and hamlets are within the Gainford station area including Gainford, Duffield, Wabamun, Evansburg, and Seba Beach
- The population of the socio-economic study area is estimated to be 27,000
- The Gainford study area includes members of the Paul First Nation. Two of the three reserve sites are located in the study area, including the largest site which is located near Duffield, approximately 40 km south east of the Gainford pump station. The Paul First Nation has 1,625 registered members, of which 1,032 are living on the three Paul First Nation reserves.

2.3 Edson Pump Station:

- Restricted to existing facility boundaries
- The pump station is located approximately 15 km west of Edson, Alberta

- The population of the socio-economic study area is estimated to be 17,000

2.4 Albreda Pump Station:

- Restricted to existing facility boundaries
- Located immediately adjacent to the Yellowhead highway (Hwy # 15) approximately 3 kms northeast of Albreda B.C.
- The Village of Valemount is 15 km north of the Albreda Pump Station
- The population of the socio-economic study area is estimated to be 1,500

2.5 Darfield Pump Station:

- Restricted to existing facility boundaries
- Located just off the Yellowhead highway (Hwy #15) approximately 15 km north of the Improvement District of Barriere.
- The Improvement District of Barriere is the largest community in the area, with a population of 3,460
- The study area includes the Whispering Pines / Clinton and North Thompson First Nations
- The Whispering Pines / Clinton First Nation has two reserve sites and 46 registered members were living on the Whispering Pines reserves as of October 2003. The existing pipeline right-of-way currently traverses the Whispering Pines / Clinton First Nations reserve.
- The North Thompson First Nation has five reserve sites and 215 members are listed as living on reserve. There are 22 members listed living at the Louis Creek reserve located approximately 55 km north of Kamloops.

2.6 Kamloops Pump Station

- Restricted to existing facility boundaries
- The population of the socio-economic study area is estimated to be 90,000
- The Kamloops study area includes the Kamloops Indian Band reserve located immediately adjacent to the city of Kamloops. The Kamloops First Nation has a membership of 860 members and a total reserve area of 33,500 acres. The existing pipeline right-of-way currently traverses the Kamloops Indian Band reserve.

3.0 CONSULTATION

3.1 Consultation carried out by Terasen

Terasen submitted that an early public notification (EPN) program was implemented to ensure that interested parties had access to relevant, clear and timely information on the proposed project and to identify and respond to any questions or concerns. The EPN consisted of public, landowner and stakeholder consultation, along with regulatory and government consultation through various means including:

- Distribution of a cover letter and project fact sheets to all interested parties
- All letters included an offer to meet in person to discuss the project and contact details were provided including a toll free telephone number and email address
- A website was created specifically for the project
- Information ads were placed in the community newspapers service areas where the proposed work is to take place.

3.2 Consultation between Terasen and First Nations

In determining which Aboriginal groups to contact, Terasen considered the location of reserve lands of Aboriginal groups in proximity to the Project areas. Terasen contacted the North Thompson Indian Band, the Kamloops Indian Band and the Whispering Pines / Clinton Indian Band in respect of the Project application.

Representatives from Terasen met with the Chief and Council of Whispering Pines / Clinton Indian Band at the Band reserve on 11 March, 2003 in the context of a broader information sharing process. At this meeting, Terasen reviewed, in general terms, its plans to upgrade the capacity of the Trans Mountain system, and consequent application to the Board. At a subsequent meeting on 23 April, 2003, Terasen tabled a copy of its formal Capacity Upgrade Project pamphlet, and discussed the proposed timeline for filing the application with the Board. Terasen met again with the Aboriginal groups on 6 May and 2 June, 2003. All three Aboriginal groups were included in the stakeholder mail-out of 6 May, 2003.

Aside from the Project information, a number of other issues were discussed in the course of four meetings that were not part of the Early Public Notification Program. Specific issues or concerns raised by these Aboriginal groups that relate to the Projects are environmental impacts, economic opportunities, safety and the status of the pipeline easement.

A copy of the application was sent to the Whispering Pines / Clinton Indian Band, North Thompson and Kamloops Indian Bands in mid-January 2004. The potential remaining issues were described in the application as: initiation of an information sharing session on the EIA Report; and the possibility of holding a presentation on hydrotesting and safety issues related to the reactivation of the Darfield loop.

Terasen stated in its 27 February 2004 letter to the Board that none of the Bands have identified to the Company any remaining issues or concerns related to the project. By phone conversation with Board Counsel on 14 April 2004, Terasen confirmed that it had not met with the Bands since filing its 27 February response and did not have any meetings with the Band scheduled.

3.3 Consultation with other Federal Authorities pursuant to the CEA Act

Based on an assessment of the type and location of the project, the Board, pursuant to the Federal Coordination Regulations sent a notification letter to Health Canada, Indian Northern Affairs Canada (INAC) and Environment Canada. The Board received comments from Environment Canada regarding migratory birds and species at risk. The Board also received comments from INAC requesting that they be kept informed of project activities that occur on reserve land and recommended that Terasen continue to discuss the Capacity Upgrade Program with First Nations who may be impacted by the project.

4.0 ENVIRONMENTAL EFFECTS ANALYSIS

4.1 Baseline Information and Sources

The Board's analysis is based on the information in the Application and sources referenced in Appendix A.

4.2 Methodology of the Board's Environmental Assessment

In assessing the environmental effects of the Project the Board used an issue-based approach. In its analysis the Board identified interactions expected to occur between the proposed Project activities and the surrounding environmental components. If there were no expected project interactions with an environmental component then no further examination was deemed necessary (Table 4.3.1).

Further analysis was conducted for project-environment interactions that could result in negative effects or where the interactions or effects were uncertain (Table 4.4.1). As well, environmental effects of accidents or malfunctions that may occur in connection to the project were considered. The Applicant's proposed mitigative measures and environmental-protection procedures were examined to assess the potential for any residual adverse environmental effects.

4.3 Project – Environment Interactions

Table 4.3.1 Interaction Matrix

Environmental Component		Project Interaction (Y/N/U)	Probable Effect (Pos/Neg/0/U)	Description of Interaction (How, When, Where Likely to Occur)
Physical	Surface Water	N		• All construction activities at the pump stations would be confined to station boundaries and there are no waterbodies within 30 metres of the proposed construction at the stations • The locations of the cutouts are unknown at this time
	Air Quality	Y	Neg	• Emissions from the storage tanks at the Burnaby Terminal and at the Westridge Dock • Air emissions from equipment and vehicles during construction
	Soils	Y	Neg	• Construction activities such as excavating, grading and soil handling at the cutout locations • Construction would require the movement of heavy equipment which could result in soil degradation and rutting
	Terrain	N		
	Effects of Environ. on Project	N		
Biological	Vegetation	Y	Neg	• Removal of vegetation during construction activities • Potential loss of rare plant species
	Terrestrial Fauna	Y	Neg	• Displacement of wildlife during construction • Direct wildlife mortality during construction
	Terrestrial Habitat	U	Neg	• Potential for cutouts to be located near or in areas of habitat
	Wetlands	U	Neg	• Potential for cutouts to be located near or in wetlands
	Aquatic Fauna	U	Neg	• Potential for cutouts to be located near or in waterbodies
	Aquatic Habitat	U	Neg	• Potential for cutouts to be located near or in waterbodies
	Species at Risk	U	Neg	• Potential for cutouts to be located near or around species at risk

Social	Heritage Resources	U	Neg	• Construction activities could result in the loss of or damage to, previously unidentified heritage resources
	Human Health	Y	Neg	• Terasen would vent the nitrogen currently in the pipeline to the atmosphere • Air emissions generated from equipment and vehicles involved in the various construction activities are discussed under the air quality section
	Land Use	U	Neg	• Construction activities associated with the reactivation of the existing pipeline could impact land use in the area
	Noise/Aesthetics	Y	Neg	• A short-term increase in noise levels associated with the proposed construction activity would occur as the result of construction vehicle movement and construction activities • Noise would be generated by the operation of the pump stations
	Socio-economic	N		
	Traditional Use	N		• The pump station upgrades would occur with existing fenced facilities and no traditional uses would be impacted • Any ground disturbances associated with the reactivation would be minimal and located within the previously disturbed right-of-way • The summer construction season would not overlap with the winter trapping season so no additional disturbance or conflict with trappers is forecast • Terasen discussed the Project with the three Aboriginal Bands at four separate meetings and no impacts on current traditional uses or resources were identified

Legend: Y (yes); N (no); U (uncertain); Pos (positive); Neg (negative); 0 (neutral)

4.4 Project Interactions that May Result in Residual Adverse Environmental Effects

Table 4.4.1: Environmental-Effects Matrix

Environmental Component	Predicted Negative or Uncertain Effects	Applicant Mitigation (Y/N)	Residual Adverse Effect (Y/N/U)	Explanatory Notes
Air Quality	Air emissions from the storage tanks at the Burnaby Terminal and the additional tanker loadings required at Westridge Dock Vehicle and equipment emissions and dust during construction.	Y	N	• The tank modifications are expected to generate additional hydrocarbon emissions during the tank cleaning and venting. Terasen would use a portable emission control device (e.g., a portable incinerator) to control this emission discharge. • Improvements to the tanker loading facilities at the Westridge Dock including scrubber systems and a vapour control unit have been installed to remove most of the odour causing sulphur compounds from the fugitive emissions. • To reduce vehicle emissions, equipment would be kept in good working order and operated efficiently. Impacts would be short term, highly localized and with no measurable cumulative or long term impacts.

Soils	Soil disturbance would occur where the pipeline cutouts occur. Removal of vegetation during construction activities	Y	N	• Standard procedures including stripping topsoil, stockpiling the topsoil and subsoil separately and monitoring soil horizons for rutting and compaction under wet conditions would be used. In addition, erosion control procedures would be implemented where required. • Following the completion of the pipeline inspection, subsoil and topsoil would be replaced and the disturbed sites would be re-vegetated.
Vegetation	Potential loss of rare plants species	Y	N	• Work would be confined to existing right-of-way boundaries. • A qualified biologist would assess the cutout locations for species at risk. • Terasen would conduct an environmental assessment of all cutout locations.
Terrestrial Fauna and Habitat	Displacement of wildlife during construction	Y	N	• Construction activities would take place within existing right-of-way or within station boundaries. • A qualified biologist would assess the cutout locations for species at risk. • Terasen would conduct an environmental assessment of all cutout locations. • The proposed activities would be short term in duration
Wetlands	Potential for alteration of wetlands	Y	N	• A qualified biologist would assess the cutout locations for species at risk. • Terasen would conduct an environmental assessment of all cutout locations.
Aquatic Fauna and Habitat	Potential for impacts to waterbodies	Y	N	• A qualified biologist would assess the cutout locations for species at risk. • Terasen would conduct an environmental assessment of all cutout locations.
Species at Risk	Potential for cutouts to be located near or around Species at Risk	Y	N	• A qualified biologist would assess the cutout locations for species at risk. • Terasen would conduct an environmental assessment of all cutout locations.
Heritage Resources	Potential for loss of, or damage to, a previously unidentified heritage site or artifacts during construction activities associated with the reactivation	Y	N	• The previously disturbed right-of-way is not expected to contain any historical or archaeological resources • Activities would be restricted to an already disturbed easement • If a previously undisturbed site becomes exposed during excavation, Terasen would halt the activity at that site until a qualified archaeologist has had an opportunity to review the site and recommend mitigation measures.
Human Health	Air emissions from venting the pipeline	Y	N	• The nitrogen currently in the pipeline will be vented to the atmosphere on the Right of Way • Local residents, and police if necessary, will be advised in advance of the venting locations • This activity is short term in duration and highly localized, with no measurable or cumulative or long term impacts.

Land use	Construction activities associated with the reactivation could conflict with other land use activities along the right-of-way	Y	N	• Project activities would be highly localized and short-term in duration • Terasen would notify stakeholders in advance to ensure that project activities would not conflict with other land use activities along the right-of-way • Where scheduling / land use concerns arise, Terasen would work with the stakeholder to try and resolve the issue
Noise / Aesthetics	Potential disturbance to local residents	N	N	• The current sound level as measure by the motor manufacturer at 1m from the casing of the 1500HP Motors is approximately 85dBA • The sound level specified by the vendor of the new 2000HP motors at 1 m from the casing is 85dBA • Subsequent to the commissioning of the new facilities, Terasen would conduct noise level surveys around the pump stations to ensure that no applicable laws or regulations pertaining to noise intensity are being violated
Accidents and Malfunctions	Spills during construction and operation	Y	N	• Terasen's Emergency Response Plans has been filed with the Board (updated 2000) • Marine spill response equipment is maintained at the Westridge Dock to minimize environmental impacts in the event of a petroleum release at this facility.

Legend: Y (yes); N (no); U (uncertain)

4.5 Evaluation of the Appropriateness for a Follow-up Program

The project and its associated activities are routine in nature. The predicted effects of the project are well understood and based on past project of similar nature in a similar environment. For these reasons, the Board is of the view that a follow-up program would not be appropriate for this project.

5.0 BOARD CONCLUSION

The Board examined all of the environmental information as described in the application or referenced in this Environmental Screening Report in making its conclusion. The Board is of the view that Terasen should implement all of the policies, practices, mitigative measures, recommendations, and procedures for the protection of the environment referred to in its application and that a condition to that effect should be required. This proposed conditions are listed in section 5.1.

The Board is of the view that if Terasen' environmental protection procedures and mitigative measures are implemented, including those agreed to by other regulatory agencies, as well as any conditions imposed by the Board in any order that may be granted, the proposed Project is not likely to cause significant adverse environmental effects.

5.1 Proposed Conditions

a) Terasen shall implement or cause to be implemented all the policies, practices, recommendations and procedures for the protection of the environment included in or referred to in its application or subsequent filings.

b) Terasen shall complete an environmental assessment of all cutout locations on the NPS 30 loop and notify the Board prior to conducting any work that requires special environmental procedures or mitigation not already provided in Company manuals.

c) Terasen shall submit a separate section 58 application to the Board for approval for any work that would be required within 30 metres of a watercourse or wetland.

d) Terasen shall consult with a qualified biologist to identify potential species at risk located near proposed cutout locations. Terasen shall file with the Board prior to construction activities;
    i) evidence to demonstrate that this consultation has occurred;
    ii) the results of the consultation; and
    iii) mitigative strategies to protect any identified species at risk.

6.0 CEA ACT DETERMINATION

The Board is of the view that, taking into account the implementation of the proposed environmental procedures and mitigative measures, and those set out in the above-noted conditions, the Project is not likely to cause significant adverse environmental effects. This represents a determination pursuant to paragraph 20(1) (a) of the CEA Act.

This Environmental Screening Report and the CEA Act determination were approved by the Board on the date as specified on page one of this report.

7.0 AGENCY CONTACT

Michel L. Mantha
Secretary
National Energy Board
444 Seventh Avenue S.W.
Calgary, Alberta T2P 0X8
Facsimile: (403) 292-5503

APPENDIX A: INFORMATION SOURCES

Reference No.	Title/Type of Document/Date
1	2003 Section 58 Application and Environmental Impact Assessment- Terasen Capacity Upgrade Project
2	Terasen's Emergency Response Plans (updated 2000)
3	Information Request No. 1 Response dated 30 March 2004.
4	Environmental Standards and Guidelines for Erosion and Sedimentation Control (March 2000)
5	Trans Mountain Pipe Line Company Ltd. Environmental Standards and Guidelines for Work in-and-about a Stream (March 2000)

NEB F-IR 2.001 - Attachment 22

National Energy Board

Office national de l'énergie

ORDER OPLO-T099-04-2004

IN THE MATTER OF the *National Energy Board Act* and the regulations made thereunder, and

IN THE MATTER OF an application by Terasen Pipelines (Trans Mountain) Inc. ("TPTM") for an Order pursuant to section 47 of the Act filed with the National Energy Board under File 3400-T099-7.

BEFORE the Board on 22 September 2004.

WHEREAS TPTM has filed an application dated 16 September 2004 for leave to open the NPS30 Loop between the Darfield and Kamloops Stations (NPS30 Loop);

AND WHEREAS the Board has issued Order XO-T099-5-2004, the effect of which was to permit the work associated with the reactivation of the NPS30 Loop;

AND WHEREAS the Board has examined the application and is satisfied that the NPS30 Loop may be safely opened for the transmission of low vapour pressure hydrocarbons;

IT IS ORDERED THAT TPTM is granted Leave to Open the NPS30 Loop at the maximum operating pressures (MOP) as specified in Tables A-1, A-2 and A-3 of its leave to open application.

Schedule A (attached) sets out the MOP for certain specific points of the NPS30 Loop.

NATIONAL ENERGY BOARD

Michel L. Mantha
Secretary

Canadä

ORDER OPLO-T099-04-2004

SCHEDULE A

Test Section Number	Description	MOP kPa	
1	Start point (km post: 741.988)	8148	
	Highest point (km post:	5313	
	Lowest points (km posts: 754.108/.120/.928)	8233	Point of max stress
	End Point (km post: 758.742)	5313	
2	Start point (km post: 758.754)	3659	
	Highest point (km post:	3659	
	Lowest point (km post:	6767	This isn't the point of max stress
	End Point (km post: 784.905)	6534	
3	Start point (km post: 784.917)	5419	
	Highest point (km post:	2655	
	Lowest points (km posts: 818.706,	5830	This isn't the point of maximum stress
	End Point (km post: 823.004)	2811	

NEB F-IR 2.001 - Attachment 23

National Energy Board | Office national de l'énergie

ORDER OPLO-T4-27-98

IN THE MATTER OF the National Energy Board Act ("the Act") and the regulations made thereunder; and

IN THE MATTER OF an application, under sections 21 and 47 of the Act, by Trans Mountain Pipe Line Company Ltd. ("TMPL"); filed with the Board under File 3400-T4-57.

BEFORE the Board on 19 March 1998.

WHEREAS the Board has received an application from TMPL, dated 16 March 1998, for an Order granting leave to open the portion of its pipeline system between km 822.9 and km 832.4 at the increased maximum operating pressures;

AND WHEREAS the Board has issued Certificate OC-2, dated 19 August 1960, as amended, respecting the pipeline facilities referred to in this Order;

AND WHEREAS the Board is satisfied that the pipeline facilities may be safely operated at the increased maximum operating pressures.

IT IS ORDERED THAT TMPL is granted leave to open the pipeline section between km 822.9 and km 832.4 for the transmission oil at pressures not exceeding those shown for each location in Schedule "A", attached to and forming part of this Order.

NATIONAL ENERGY BOARD

Michel L. Mantha
Secretary

Schedule "A"

Trans Mountain Pipe Line
Maximum Operating Pressures
Pipeline Section Km 822.9 to 832.4

KM Post	Description	WT (mm)	Pipe Grade (MPa)	Elevation (m)	Pre-test MOH @ 0.85 SG (m)	Pre-test MOP (KPa)	Strength Test Pressure (Kpa)	% SMYS	Leak Test Pressure (Kpa)	Leak Test Pressure as % of New MOP	Strength Test Pressure x 0.80 (KPa)	Design Pressure (KPa)	New MOP (KPa)	New Head @.85 SG (m)	New MOH @ 0.85 SG (m)	Increase in MOP (kPa)	Increase in MOH (m)
822.90	Kamloops Station	12.70	317	725.1	1,924.5	10,001	12,809	97%	11,754	115%	10,247	10,567	10,247	1228.9	**1954.0**	246	29.5
823.0		12.70	317	723.6	1,924.5	10,014	12,823	97%	11,768	115%	10,258	10,567	10,258	1230.2	**1953.8**	244	29.3
823.1	24Q (Test Point)	12.70	317	727.0	1,924.5	9,985	12,790 *	97%	11,735 *	115%	10,232	10,567	10,232	1227.1	**1954.1**	247	29.6
823.5		12.70	317	790.5	1,924.5	9,456	12,167	92%	11,112	114%	9,734	10,567	9,734	1167.4	**1957.9**	278	33.4
824.0		12.70	317	839.0	1,924.5	9,051	11,691	89%	10,636	114%	9,353	10,567	9,353	1121.7	**1960.7**	302	36.2
824.4	w.t. change	9.52	359	909.6	1,924.5	8,463	10,999	98%	9,944	113%	8,799	8,970	8,799	1055.2	**1964.8**	336	40.3
824.5		9.52	359	910.5	1,924.5	8,455	10,990	98%	9,935	113%	8,792	8,970	8,792	1054.4	**1964.9**	337	40.4
825.0		9.52	359	927.0	1,924.5	8,318	10,828	97%	9,773	113%	8,662	8,970	8,662	1038.8	**1965.8**	344	41.3
825.5		9.52	359	949.5	1,924.5	8,130	10,607	95%	9,552	113%	8,486	8,970	8,486	1017.7	**1967.2**	356	42.7
826.0		9.52	359	966.5	1,924.5	7,988	10,441	93%	9,386	112%	8,353	8,970	8,353	1001.7	**1968.2**	365	43.7
826.5		9.52	359	957.5	1,924.5	8,063	10,529	94%	9,474	112%	8,423	8,970	8,423	1010.1	**1967.6**	360	43.1
827.0		9.52	359	957.5	1,924.5	8,063	10,529	94%	9,474	112%	8,423	8,970	8,423	1010.1	**1967.6**	360	43.1
827.5		9.52	359	964.0	1,924.5	8,009	10,465	93%	9,410	112%	8,372	8,970	8,372	1004.0	**1968.0**	363	43.5
828.0		9.52	359	950.0	1,924.5	8,126	10,602	95%	9,547	113%	8,482	8,970	8,482	1017.2	**1967.2**	356	42.7
828.5		9.52	359	993.5	1,924.5	7,763	10,176	91%	9,121	112%	8,141	8,970	8,141	976.3	**1969.8**	378	45.3
829.0		9.52	359	912.5	1,924.5	8,439	10,970	98%	9,915	113%	8,776	8,970	8,776	1052.5	**1965.0**	337	40.5
829.5		9.52	359	896.5	1,924.5	8,572	11,127	99%	10,072	113%	8,902	8,970	8,902	1067.6	**1964.1**	330	39.6
830.0		9.52	359	892.5	1,924.5	8,605	11,166	100%	10,111	113%	8,933	8,970	8,933	1071.3	**1963.8**	328	39.3
830.15	low point (due to Afton reloc'n)	9.52	359	888.0	1,925.5	8,651	11,211	100%	10,156	113%	8,969	8,970	8,969	1075.6	**1963.6**	318	38.1
830.5		9.52	359	906.5	1,924.5	8,489	11,029	98%	9,974	113%	8,823	8,970	8,823	1058.1	**1964.6**	334	40.1
831.0		9.52	359	938.0	1,924.5	8,226	10,720	96%	9,665	113%	8,576	8,970	8,576	1028.5	**1966.5**	350	42.0
831.2		9.52	359	957.5	1,924.5	8,063	10,529	94%	9,474	112%	8,423	8,970	8,423	1010.1	**1967.6**	360	43.1
831.5		9.52	359	977.5	1,924.5	7,897	10,333	92%	9,278	112%	8,266	8,970	8,266	991.3	**1968.8**	369	44.3
832.0		9.52	359	960.0	1,924.5	8,042	10,504	94%	9,449	112%	8,403	8,970	8,403	1007.7	**1967.7**	361	43.2
832.15	local low point	9.52	359	953.0	1,925.5	8,109	10,573	94%	9,518	113%	8,458	8,970	8,458	1014.3	**1967.3**	349	41.8
832.4	Valve K831(End of test Section) high point	9.52	359	994.1	1,924.5	7,758	10,170	91%	9,115	112%	8,136	8,970	8,136	975.7	**1969.8**	378	45.3

OPLO-T4-27-98

NEB F-IR 2.001 - Attachment 24

National Energy Board | Office national de l'énergie

ORDER OPLO-T4-28-98

IN THE MATTER OF the National Energy Board Act ("the Act") and the regulations made thereunder; and

IN THE MATTER OF an application, under sections 21 and 47 of the Act, by Trans Mountain Pipe Line Company Ltd. ("TMPL"); filed with the Board under File 3400-T4-57.

BEFORE the Board on 19 March 1998.

WHEREAS the Board has received an application from TMPL, dated 16 March 1998, for an Order granting leave to open the portion of its pipeline system between km 832.4 and km 840.7 at the increased maximum operating pressures;

AND WHEREAS the Board has issued Certificate OC-2, dated 19 August 1960, as amended, respecting the pipeline facilities referred to in this Order;

AND WHEREAS the Board is satisfied that the pipeline facilities may be safely operated at the increased maximum operating pressures.

IT IS ORDERED THAT TMPL is granted leave to open the pipeline section between km 832.4 and km 840.7 for the transmission oil at pressures not exceeding those shown for each location in Schedule "A", attached to and forming part of this Order.

NATIONAL ENERGY BOARD

Michel L. Mantha
Secretary

Schedule "A"

Trans Mountain Pipe Line
Maximum Operating Pressures
Pipeline Section Km 832.4 to 840.7

KM Post	Description	WT (mm)	Pipe Grade (MPa)	Elevation (m)	Pre-test MOH @ 0.85 SG (m)	Pre-test MOP (KPa)	Strength Test Pressure (Kpa)	% SMYS	Leak Test Pressure (Kpa)	Leak Test Pressure as % of New MOP	Strength Test Pressure x 0.80 (KPa)	Design Pressure (KPa)	New MOP (KPa)	New Head @ .85 SG (m)	New MOH @ 0.85 SG (m)	Increase in MOP (kPa)	Increase in MOH (m)
832.4	Valve K831/w.t. change	7.92	359	994.1	1,854.0	7,170	9,231	99%	8,511	115%	7,385	7,463	7,385	885.7	**1879.8**	215	25.8
832.5		7.92	359	994.0	1,854.0	7,171	9,232	99%	8,512	115%	7,386	7,463	7,386	885.8	**1879.8**	215	25.8
832.63	low point	7.92	359	984.0	1,854.0	7,254	9,330	100%	8,610	115%	7,464	7,463	7,463	895.0	**1879.0**	209	25.0
833.0		7.92	359	1,018.0	1,854.0	6,971	8,996	96%	8,276	115%	7,197	7,463	7,197	863.1	**1881.1**	226	27.1
833.5		7.92	359	1,034.0	1,854.0	6,838	8,839	95%	8,119	115%	7,071	7,463	7,071	848.0	**1882.0**	233	28.0
834.0		7.92	359	1,080.0	1,854.0	6,454	8,388	90%	7,668	114%	6,710	7,463	6,710	804.7	**1884.7**	256	30.7
834.5		7.92	359	1,095.0	1,854.0	6,329	8,241	88%	7,521	114%	6,593	7,463	6,593	790.7	**1885.7**	264	31.7
835.0		7.92	359	1,092.0	1,854.0	6,354	8,270	89%	7,550	114%	6,616	7,463	6,616	793.4	**1885.4**	262	31.4
835.5		7.92	359	1,058.0	1,854.0	6,637	8,604	92%	7,884	115%	6,883	7,463	6,883	825.4	**1883.4**	246	29.4
836.0		7.92	359	1,091.0	1,854.0	6,362	8,280	89%	7,560	114%	6,624	7,463	6,624	794.4	**1885.4**	262	31.4
836.5		7.92	359	1,126.5	1,854.0	6,066	7,932	85%	7,212	114%	6,346	7,463	6,346	761.0	**1887.5**	280	33.5
837.0		7.92	359	1,166.0	1,854.0	5,737	7,544	81%	6,824	113%	6,035	7,463	6,035	723.8	**1889.8**	298	35.8
837.5		7.92	359	1,171.5	1,854.0	5,691	7,490	80%	6,770	113%	5,992	7,463	5,992	718.6	**1890.1**	301	36.1
838.0		7.92	359	1,205.0	1,854.0	5,412	7,162	77%	6,442	112%	5,730	7,463	5,730	687.2	**1892.2**	318	38.2
838.5		7.92	359	1,198.0	1,854.0	5,470	7,230	77%	6,510	113%	5,784	7,463	5,784	693.6	**1891.6**	314	37.6
838.8		7.92	359	1,172.5	1,854.0	5,683	7,481	80%	6,761	113%	5,985	7,463	5,985	717.8	**1890.3**	302	36.3
839.0		7.92	359	1,217.5	1,854.0	5,307	7,039	75%	6,319	112%	5,631	7,463	5,631	675.3	**1892.8**	324	38.8
839.12	high point	7.92	359	1,222.5	1,854.0	5,266	6,990	75%	6,270	112%	5,592	7,463	5,592	670.6	**1893.1**	326	39.1
839.5		7.92	359	1,214.0	1,854.0	5,337	7,073	76%	6,353	112%	5,658	7,463	5,658	678.5	**1892.5**	321	38.5
840.0		7.92	359	1,215.0	1,854.0	5,328	7,064	76%	6,344	112%	5,651	7,463	5,651	677.7	**1892.7**	323	38.7
840.5		7.92	359	1,216.0	1,854.0	5,320	7,054	76%	6,334	112%	5,643	7,463	5,643	676.7	**1892.7**	323	38.7
840.7	Flange Pair (Test Point)	7.92	359	1,222.5	1,854.0	5,266	6,990 *	75%	6,270 *	112%	5,592	7,463	5,592	670.6	**1893.1**	326	39.1

NEB F-IR 2.001 - Attachment 25

National Energy Board | Office national de l'énergie

ORDER OPLO-T4-29-98

IN THE MATTER OF the National Energy Board Act ("the Act") and the regulations made thereunder; and

IN THE MATTER OF an application, under sections 21 and 47 of the Act, by Trans Mountain Pipe Line Company Ltd. ("TMPL"); filed with the Board under File 3400-T4-57.

BEFORE the Board on 19 March 1998.

WHEREAS the Board has received an application from TMPL, dated 16 March 1998, for an Order granting leave to open the portion of its pipeline system between km 840.7 and km 876.4 at the increased maximum operating pressures;

AND WHEREAS the Board has issued Certificate OC-2, dated 19 August 1960, as amended, respecting the pipeline facilities referred to in this Order;

AND WHEREAS the Board is satisfied that the pipeline facilities may be safely operated at the increased maximum operating pressures.

IT IS ORDERED THAT TMPL is granted leave to open the pipeline section between km 840.7 and km 876.4 for the transmission oil at pressures not exceeding those shown for each location in Schedule "A", attached to and forming part of this Order.

NATIONAL ENERGY BOARD

Michel L. Mantha
Secretary

Schedule "A"

Trans Mountain Pipe Line
Maximum Operating Pressures
Pipeline Section Km 840.7 to 876.4

KM Post	Description	WT (mm)	Pipe Grade (MPa)	Elevation (m)	Pre-test MOH @ 0.85 SG (m)	Pre-test MOP (KPa)	Strength Test Pressure (Kpa)	% SMYS	Leak Test Pressure (Kpa)	Leak Test Pressure as % of New MOP	Strength Test Pressure x 0.80 (KPa)	Design Pressure (KPa)	New MOP (KPa)	New Head @.85 SG (m)	New MOH @ 0.85 SG (m)	Increase in MOP (kPa)	Increase in MOH (m)
840.7	Flange Pair (Test Point)	7.92	359	1,222.5	1,792.0	4,749	5,900 *	63%	5,279 *	112%	4,720	7,463	4,720	566.0	1788.5	-29	-3.5
841.0	high point	7.92	359	1,218.0	1,791.8	4,784	5,944	64%	5,323	112%	4,755	7,463	4,755	570.2	1788.2	-29	-3.6
841.5		7.92	359	1,203.0	1,791.4	4,906	6,091	65%	5,470	112%	4,873	7,463	4,873	584.4	1787.4	-33	-4.0
842.0		7.92	359	1,193.5	1,791.0	4,982	6,184	66%	5,563	112%	4,947	7,463	4,947	593.3	1786.8	-35	-4.2
842.5		7.92	359	1,202.5	1,790.6	4,904	6,096	65%	5,475	112%	4,877	7,463	4,877	584.9	1787.4	-27	-3.2
843.0		7.92	359	1,202.0	1,790.2	4,904	6,101	65%	5,480	112%	4,881	7,463	4,881	585.4	1787.4	-23	-2.8
843.5		7.92	359	1,182.0	1,789.8	5,068	6,297	67%	5,676	113%	5,038	7,463	5,038	604.2	1786.2	-30	-3.6
844.0		7.92	359	1,178.0	1,789.4	5,098	6,337	68%	5,716	113%	5,070	7,463	5,070	608.0	1786.0	-28	-3.4
844.5		7.92	359	1,154.0	1,789.0	5,295	6,572	70%	5,951	113%	5,258	7,463	5,258	630.6	1784.6	-37	-4.4
845.0		7.92	359	1,153.0	1,788.6	5,300	6,582	71%	5,961	113%	5,266	7,463	5,266	631.5	1784.5	-34	-4.1
845.5		7.92	359	1,179.0	1,788.2	5,080	6,327	68%	5,706	113%	5,062	7,463	5,062	607.1	1786.1	-18	-2.1
846.0		7.92	359	1,180.0	1,787.8	5,068	6,317	68%	5,696	113%	5,054	7,463	5,054	606.1	1786.1	-14	-1.7
846.5		7.92	359	1,166.0	1,787.4	5,181	6,454	69%	5,833	113%	5,163	7,463	5,163	619.2	1785.2	-18	-2.2
847.0		7.92	359	1,169.0	1,787.0	5,153	6,425	69%	5,804	113%	5,140	7,463	5,140	616.4	1785.4	-13	-1.6
847.5		7.92	359	1,166.0	1,786.6	5,175	6,454	69%	5,833	113%	5,163	7,463	5,163	619.2	1785.2	-12	-1.4
848.0		7.92	359	1,165.0	1,786.2	5,180	6,464	69%	5,843	113%	5,171	7,463	5,171	620.1	1785.1	-9	-1.1
848.5		7.92	359	1,123.0	1,785.8	5,527	6,876	74%	6,255	114%	5,501	7,463	5,501	659.7	1782.7	-26	-3.1
849.0		7.92	359	1,110.0	1,785.4	5,632	7,004	75%	6,383	114%	5,603	7,463	5,603	671.9	1781.9	-29	-3.5
849.5		7.92	359	1,107.0	1,785.0	5,653	7,033	75%	6,412	114%	5,626	7,463	5,626	674.7	1781.7	-27	-3.3
850.0		7.92	359	1,084.0	1,784.6	5,842	7,259	78%	6,638	114%	5,807	7,463	5,807	696.4	1780.4	-35	-4.2
850.5		7.92	359	1,103.5	1,784.2	5,676	7,067	76%	6,446	114%	5,654	7,463	5,654	678.1	1781.6	-22	-2.6
851.0		7.92	359	1,117.0	1,783.8	5,560	6,935	74%	6,314	114%	5,548	7,463	5,548	665.3	1782.3	-12	-1.5
851.5		7.92	359	1,161.5	1,783.4	5,186	6,498	70%	5,877	113%	5,198	7,463	5,198	623.4	1784.9	12	1.5
852.0		7.92	359	1,161.0	1,783.0	5,186	6,503	70%	5,882	113%	5,202	7,463	5,202	623.9	1784.9	16	1.9
852.5		7.92	359	1,165.0	1,782.6	5,150	6,464	69%	5,843	113%	5,171	7,463	5,171	620.1	1785.1	21	2.5
853.0		7.92	359	1,139.5	1,782.2	5,359	6,714	72%	6,093	113%	5,371	7,463	5,371	644.1	1783.6	12	1.4
853.5		7.92	359	1,097.0	1,781.8	5,710	7,131	76%	6,510	114%	5,705	7,463	5,705	684.2	1781.2	-5	-0.6
854.0		7.92	359	1,087.0	1,781.4	5,790	7,229	77%	6,608	114%	5,783 .	7,463	5,783	693.5	1780.5	-7	-0.9
854.5		7.92	359	1,079.0	1,781.0	5,854	7,308	78%	6,687	114%	5,846	7,463	5,846	701.1	1780.1	-8	-0.9
855.0		7.92	359	1,052.5	1,780.6	6,071	7,568	81%	6,947	115%	6,054	7,463	6,054	726.0	1778.5	-17	-2.1
855.5		7.92	359	1,040.0	1,780.2	6,172	7,690	82%	7,069	115%	6,152	7,463	6,152	737.8	1777.8	-20	-2.4
856.0		7.92	359	1,011.5	1,779.8	6,407	7,970	85%	7,349	115%	6,376	7,463	6,376	764.6	1776.1	-31	-3.7
856.5		7.92	359	988.0	1,779.4	6,599	8,200	88%	7,579	116%	6,560	7,463	6,560	786.7	1774.7	-39	-4.7
857.0		7.92	359	952.0	1,779.0	6,896	8,554	92%	7,933	116%	6,843	7,463	6,843	820.7	1772.7	-53	-6.3
857.5		7.92	359	941.5	1,778.6	6,980	8,657	93%	8,036	116%	6,926	7,463	6,926	830.6	1772.1	-54	-6.5
858.0		7.92	359	956.0	1,778.2	6,856	8,514	91%	7,893	116%	6,811	7,463	6,811	816.8	1772.8	-45	-5.4
858.5		7.92	359	977.5	1,777.8	6,673	8,303	89%	7,682	116%	6,642	7,463	6,642	796.5	1774.0	-31	-3.8
859.0		7.92	359	974.0	1,777.4	6,699	8,338	89%	7,717	116%	6,670	7,463	6,670	799.9	1773.9	-29	-3.5
859.5		7.92	359	1,014.0	1,777.0	6,362	7,945	85%	7,324	115%	6,356	7,463	6,356	762.2	1776.2	-6	-0.8
860.0		7.92	359	1,055.0	1,776.6	6,017	7,543	81%	6,922	115%	6,034	7,463	6,034	723.6	1778.6	17	2.0
860.5		7.92	359	987.5	1,776.2	6,577	8,205	88%	7,584	116%	6,564	7,463	6,564	787.2	1774.7	-13	-1.5
861.0		7.92	359	981.5	1,775.8	6,623	8,264	89%	7,643	116%	6,611	7,463	6,611	792.8	1774.3	-12	-1.5

OPLO-T4-29-98

(continued next page)

Schedule "A" Continued

Trans Mountain Pipe Line
Maximum Operating Pressures
Pipeline Section Km 840.7 to 876.4

KM Post	Description	WT (mm)	Pipe Grade (MPa)	Elevation (m)	Pre-test MOH @ 0.85 SG (m)	Pre-test MOP (KPa)	Strength Test Pressure (Kpa)	% SMYS	Leak Test Pressure (Kpa)	Leak Test Pressure as % of New MOP	Strength Test Pressure x 0.80 (KPa)	Design Pressure (KPa)	New MOP (KPa)	New Head @ .85 SG (m)	New MOH @ 0.85 SG (m)	Increase in MOP (kPa)	Increase in MOH (m)
861.5		7.92	359	930.0	1,775.4	7,050	8,769	94%	8,148	116%	7,015	7,463	7,015	841.3	1771.3	-35	-4.1
861.6	w.t. change	7.92	359	898.6	1,775.3	7,311	9,077	97%	8,456	116%	7,262	7,463	7,262	870.9	1769.5	-49	-5.8
862.0		9.52	359	873.5	1,775.0	7,517	9,324	83%	8,703	117%	7,459	8,970	7,459	894.5	1768.0	-58	-7.0
862.5		9.52	359	846.0	1,774.6	7,743	9,593	86%	8,972	117%	7,674	8,970	7,674	920.3	1766.3	-69	-8.3
863.0		9.52	359	827.5	1,774.2	7,894	9,775	87%	9,154	117%	7,820	8,970	7,820	937.8	1765.3	-74	-8.9
863.3		9.52	359	800.0	1,774.0	8,122	10,045	90%	9,424	117%	8,036	8,970	8,036	963.7	1763.7	-86	-10.3
863.5		9.52	359	833.0	1,773.8	7,845	9,721	87%	9,100	117%	7,777	8,970	7,777	932.7	1765.7	-68	-8.1
864.0		9.52	359	828.5	1,773.4	7,879	9,765	87%	9,144	117%	7,812	8,970	7,812	936.9	1765.4	-67	-8.0
864.5		9.52	359	792.0	1,773.0	8,180	10,123	90%	9,502	117%	8,098	8,970	8,098	971.2	1763.2	-82	-9.8
865.0		9.52	359	770.5	1,772.6	8,356	10,334	92%	9,713	117%	8,267	8,970	8,267	991.4	1761.9	-89	-10.7
865.5		9.52	359	767.5	1,772.2	8,378	10,364	92%	9,743	118%	8,291	8,970	8,291	994.3	1761.8	-87	-10.4
866.0		9.52	359	756.0	1,771.8	8,471	10,476	93%	9,855	118%	8,381	8,970	8,381	1005.1	1761.1	-90	-10.7
866.5		9.52	359	737.5	1,771.4	8,621	10,658	95%	10,037	118%	8,526	8,970	8,526	1022.5	1760.0	-95	-11.4
867.0		9.52	359	742.5	1,771.0	8,576	10,609	95%	9,988	118%	8,487	8,970	8,487	1017.8	1760.3	-89	-10.7
867.5		9.52	359	737.0	1,770.6	8,619	10,663	95%	10,042	118%	8,530	8,970	8,530	1023.0	1760.0	-89	-10.6
868.0		9.52	359	734.0	1,770.2	8,641	10,692	95%	10,071	118%	8,554	8,970	8,554	1025.8	1759.8	-87	-10.4
868.1	Valve K867	9.52	359	734.0	1,770.2	8,640	10,692	95%	10,071	118%	8,554	8,970	8,554	1025.8	1759.8	-86	-10.4
868.35	low point	9.52	359	720.0	1,770.0	8,755	10,830	97%	10,209	118%	8,664	8,970	8,664	1039.0	1759.0	-91	-11.0
868.5		9.52	359	726.0	1,769.8	8,704	10,771	96%	10,150	118%	8,617	8,970	8,617	1033.4	1759.4	-87	-10.4
868.8		9.52	359	736.0	1,769.6	8,619	10,673	95%	10,052	118%	8,538	8,970	8,538	1023.9	1759.9	-81	-9.7
868.9		9.52	359	767.0	1,769.5	8,360	10,368	92%	9,747	118%	8,294	8,970	8,294	994.7	1761.7	-66	-7.8
869.0		9.52	359	789.0	1,771.2	8,190	10,153	91%	9,532	117%	8,122	8,970	8,122	974.0	1763.0	-68	-8.2
869.3	w.t. change	7.92	359	872.9	1,771.7	7,495	9,330	100%	8,709	117%	7,464	7,463	7,463	895.0	1767.9	-32	-3.8
869.5		7.92	359	922.0	1,772.1	7,088	8,848	95%	8,227	116%	7,078	7,463	7,078	848.8	1770.8	-10	-1.3
870.0		7.92	359	1,003.5	1,773.0	6,417	8,048	86%	7,427	115%	6,438	7,463	6,438	772.1	1775.6	21	2.6
870.5		7.92	359	984.0	1,773.9	6,587	8,240	88%	7,619	116%	6,592	7,463	6,592	790.5	1774.5	5	0.6
871.0		7.92	359	1,015.0	1,774.9	6,336	7,936	85%	7,315	115%	6,349	7,463	6,349	761.4	1776.4	13	1.5
871.5		7.92	359	1,047.5	1,775.8	6,073	7,617	82%	6,996	115%	6,094	7,463	6,094	730.8	1778.3	21	2.5
872.0		7.92	359	1,046.0	1,776.7	6,093	7,631	82%	7,010	115%	6,105	7,463	6,105	732.1	1778.1	12	1.4
872.5		7.92	359	1,080.0	1,777.6	5,817	7,298	78%	6,677	114%	5,838	7,463	5,838	700.1	1780.1	21	2.5
873.0		7.92	359	1,109.5	1,778.6	5,579	7,009	75%	6,388	114%	5,607	7,463	5,607	672.4	1781.9	28	3.3
873.5		7.92	359	1,130.0	1,779.5	5,416	6,807	73%	6,186	114%	5,446	7,463	5,446	653.1	1783.1	30	3.6
873.7		7.92	359	1,106.5	1,779.9	5,615	7,038	75%	6,417	114%	5,630	7,463	5,630	675.2	1781.7	15	1.8
874.0		7.92	359	1,141.0	1,780.4	5,332	6,700	72%	6,079	113%	5,360	7,463	5,360	642.8	1783.8	28	3.4
874.5		7.92	359	1,182.5	1,781.4	4,994	6,292	67%	5,671	113%	5,034	7,463	5,034	603.7	1786.2	40	4.8
875.0		7.92	359	1,161.0	1,782.3	5,181	6,503	70%	5,882	113%	5,202	7,463	5,202	623.9	1784.9	21	2.6
875.5		7.92	359	1,154.5	1,783.2	5,242	6,567	70%	5,946	113%	5,254	7,463	5,254	630.1	1784.6	12	1.4
876.0		7.92	359	1,175.0	1,784.1	5,079	6,366	68%	5,745	113%	5,093	7,463	5,093	610.8	1785.8	14	1.7
876.4	Flange Pair	7.92	359	1,202.5	1,785.0	4,857	6,096	65%	5,475	112%	4,877	7,463	4,877	584.9	1787.4	20	2.4

NEB F-IR 2.001 - Attachment 26

National Energy Board | Office national de l'énergie

CANADA

ORDER AO-1-OPLO-T4-3-96

IN THE MATTER OF the *National Energy Board Act* ("the Act") and the regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipeline Company Ltd. ("Trans Mountain") pursuant to section 47 of the Act for leave to open a portion of its pipeline system, filed with the Board under File No. 3200-T4-49.

B E F O R E the Board on 5 February 1997.

WHEREAS on 20 December 1996 the Board issued Order OPLO-T4-3-96, granting Trans Mountain leave to open the portion of its pipeline system between km 876.36 and km 936.41 at a maximum operating pressure of 8 958 kPa;

AND WHEREAS due to varying elevations along the line it would be more appropriate to specify the MOP at particular points along the line;

AND WHEREAS pursuant to s. 21(1) of the Act the Board may review, vary or rescind any order made by it;

IT IS ORDERED THAT the maximum operating pressures set out in Schedule A to this order shall apply to that portion of Trans Mountain's pipeline system between km 876.36 and km 936.41 and that Order OPLO-T4-3-96 is amended accordingly.

NATIONAL ENERGY BOARD

M. L. Mantha
A/Secretary

Schedule "A"

Trans Mountain Pipeline Company Ltd.
dated 4 February 1997

Maximum Operating Pressure - km 876.36 to 936.41

km Post	Description	Pipe Wall (mm)	Elevation (m)	MOP (kPa)
	North Test Section - km 876.36 to 898.71			
876.36	Line Flanges	7.92	1,202.50	4,190
880.00		7.92	1,112.00	4,901
887.66	WT Change (7.92 to 9.52)	7.92	793.00	7,404
898.31	WT Change (9.52 to 12.7)	9.52	595.00	8,958
898.50	HW Pipe under Nicola River	12.70	595.00	8,958
898.66	WT Change (12.7 to 9.52)	9.52	595.00	8,958
898.71	Upstream of Valve K898 (closed for test)	9.52	603.20	8,894
	South Test Section - km 898.71 to 936.41			
898.71	Downstream of Valve K898 (closed for test)	9.52	603.20	8,105
903.86	WT Change (9.52 to 7.92)	7.92	741.14	7,020
913.26	Low Point	7.92	686.00	7,455
924.82		7.92	882.00	5,917
934.65	High Point	7.92	1,056.00	4,551
936.41	Brodie Valve K935	7.92	998.50	5,002

NEB F-IR 2.001 - Attachment 27

National Energy Board | Office national de l'énergie

ORDER OPLO-T099-01-2007

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Terasen Pipelines (Trans Mountain) Inc. ("Terasen") for an Order pursuant to section 47 of the Act filed with the National Energy Board under File AFP-TTM 2005-001 (3400-T099-13).

BEFORE the Board on 5 April 2007.

WHEREAS Terasen has filed an application pursuant to section 47 of the Act for leave to open the Mainline Section between the Kingsvale Pump Station and the Juliet Creek Valve (Mainline Section), dated 8 March 2007;

AND WHEREAS the Board has issued Order XO-T099-15-2005 and Amending Orders AO-1-XO-T099-15-2005 and AO-2-XO-T099-15-2005, the effects of which were to permit the construction of the Trans Mountain Pump Station Expansion Project, part of which involved the increase in the maximum operating pressure (MOP) of the Mainline Section;

AND WHEREAS the Board has examined the application and is satisfied that the Mainline Section may be safely opened at the increased MOP for the transmission of oil; and

IT IS ORDERED THAT Terasen is granted Leave to Open the Mainline Section at the increased maximum operating pressures as specified in its leave to open application.

Schedule A (attached) sets out the increased MOP for certain specific points of the Mainline Section.

NATIONAL ENERGY BOARD

David Young
Acting Secretary

Canada

Schedule A
National Energy Board Order OPLO-T099-01-2007

Test Section	Description	New MOP kPa
North	Highest point (KP 934.66)	5502
	Lowest point (KP 928.10)	7448
	Test point (KP 936.34)	5946
South	Highest point (KP 937.06)	6401
	Lowest point (KP 938.64)	7430
	Test Point (KP 936.44)	6728

NEB F-IR 2.001 - Attachment 28

NATIONAL ENERGY BOARD

OFFICE NATIONAL DE L'ÉNERGIE

CANADA

ORDER NO. MO-2-83

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. (hereinafter called "the Applicant"), dated 20 August 1982, received by the Board with the Applicant's letter dated 11 March 1983, for an Order granting leave to increase the authorized maximum operating pressure of its 610 mm diameter pipeline from a point designated kilometre 983.86 to a point designated kilometre 988.34, in the Province of British Columbia, filed with the Board under File No. 1800-T4-26.

B E F O R E the Board on Wednesday, the 23rd day of March 1983.

WHEREAS the Board has considered the said application and the Affidavit of Thomas Harry Woodman, Professional Engineer of the Applicant, dated 20 August 1982;

AND WHEREAS the Board has issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated 19 August 1960, as amended, respecting the pipeline referred to in this Order;

AND WHEREAS the Board is satisfied that the said pipeline may safely be operated at pressures not exceeding those hereinafter referred to;

IT IS ORDERED THAT leave is granted to the Applicant to operate for the transmission of oil its 610 mm diameter pipeline from a point designated kilometre 983.86 to a point designated kilometre 988.34, in the Province of British Columbia, at pressures not exceeding those shown for each location in Schedule "A", attached to and forming part of this Order.

NATIONAL ENERGY BOARD

B. Jolicoeur
for G. Yorke Slader
Secretary

NATIONAL ENERGY BOARD CANADA
EXAMINED AND CERTIFIED TO BE A TRUE COPY OF AN ORDER OF THE NATIONAL ENERGY BOARD.
DATED: APR 21 1983 AVR

G. Yorke Slader
SECRETARY, NATIONAL ENERGY BOARD, OTTAWA, CANADA

Schedule "A"

PIPE STRENGTH PROFILE
Test Section 983.86

km	Wall Thickness mm	Ground Elev. m	Meters of Water: Test Elev.	Test Head	72% SMYS Head	80% Test Head	Requested M.A.O.P. kPa	Elev. Meter of Water	Elev. Meter of Oil Density 850 kg/m³	REMARKS
983.86	7.92	595.88	1337.5	741.62	685.8	593.3	5815	1189.2	1293.9	Upstream end. Maximum elevation and point of minimum pipe stress.
984.0	7.92	593.45	1337.5	744.05	685.8	594.24	5835	1188.7	1293.7	
986.0	7.92	417.27	1337.5	920.23	685.8	736.18	6720	1130.1	1224.1	
988.0	7.92	395.33	1337.5	942.17	685.8	753.74	6720	1081.1	1202.2	
988.34	7.92	384.96	1337.5	952.54	685.8	762.0	6720	1070.8	1191.8	Test site. Downstream end. Minimum elevation and point of maximum pipe stress.

NEB F-IR 2.001 - Attachment 29

NATIONAL ENERGY BOARD

CANADA

OFFICE NATIONAL DE L'ÉNERGIE

ORDER NO. MO-3-83

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. (hereinafter called "the Applicant"), dated 20 August 1982, received by the Board with the Applicant's letter dated 11 March 1983, for an Order granting leave to increase the authorized maximum operating pressure of its 610 mm diameter pipeline from a point designated kilometre 988.34 to a point designated kilometre 1010.67, in the Province of British Columbia, filed with the Board under File No. 1800-T4-27.

B E F O R E the Board on Wednesday, the 23rd day of March 1983.

WHEREAS the Board has considered the said application and the Affidavit of Thomas Harry Woodman, Professional Engineer of the Applicant, dated 20 August 1982;

AND WHEREAS the Board has issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated 19 August 1960, as amended, respecting the pipeline referred to in this Order;

AND WHEREAS the Board is satisfied that the said pipeline may safely be operated at pressures not exceeding those hereinafter referred to;

IT IS ORDERED THAT leave is granted to the Applicant to operate for the transmission of oil its 610 mm diameter pipeline from a point designated kilometre 988.34 to a point designated kilometre 1010.67, in the Province of British Columbia, at pressures not exceeding those shown for each location in Schedule "A", attached to and forming part of this Order.

NATIONAL ENERGY BOARD

B. Jolicoeur

G. Yorke Slader
Secretary

NATIONAL ENERGY BOARD
CANADA

EXAMINED AND CERTIFIED TO BE A TRUE COPY OF AN ORDER OF THE NATIONAL ENERGY BOARD.

DATED: APR AVR 21 1983

G. Yorke Slader

SECRETARY, NATIONAL ENERGY BOARD, OTTAWA, CANADA

Schedule "A"

PIPE STRENGTH PROFILE
Test Section 988.34

km	Wall Thick-ness mm	Ground Elev. m	Meters of Water: Test Elev.	Meters of Water: Test Head	Meters of Water: 72% SMYS Head	Meters of Water: 80% Test Head	Requested M.A.O.P. kPa	Requested M.A.O.P. Elev. Meter of Water	Requested M.A.O.P. Elev. Meter of Oil Density 850 kg/m^3	REMARKS
988.34	7.92	384.96	1158.5	773.54	685.8	681.83	6065	1003.8	1113.0	Test site. Upstream end. Maximum elevation and point of minimum pipe stress.
990	7.92	365.15	1158.5	793.35	685.8	634.68	6220	999.8	1111.8	
992	7.92	331.0	1158.5	827.5	685.8	662.0	6490	993.0	1109.8	
994	7.92	299.9	1158.5	858.6	685.8	686.88	6720	985.7	1106.7	
996	7.92	270	1158.5	888.5	685.8	710.8	6720	955.8	1076.8	
998	7.92	248.4	1158.5	910.1	685.8	728.08	6720	934.2	1055.2	
1000	7.92	230.4	1158.5	928.1	685.8	742.48	6720	916.2	1037.2	
1002	7.92	208.8	1158.5	949.7	685.8	759.76	6720	894.6	1015.6	
1002.77	7.92	206.0	1158.5	952.5	685.8	762.0	6720	891.8	1012.8	Point of maximum pipe stress and change in pipe wall thickness.
1002.77	9.52	206.0	1158.5	952.5	822.96	762.0	7470	968.0	1102.5	
1004	9.52	230.1	1158.5	928.4	822.96	742.72	7280	972.8	1103.9	
1006	9.52	231.6	1158.5	926.9	822.96	741.52	7270	973.1	1104.0	
1008	9.52	97.5	1158.5	1061.0	822.96	848.8	8065	920.5	1065.7	
1010	9.52	62.5	1158.5	1096.0	822.96	876.8	8065	885.5	1030.7	
1010.67	9.52	76.2	1158.5	1082.3	822.96	865.84	8065	899.2	1044.4	Downstream end of test section.

NEB F-IR 2.001 - Attachment 30

NATIONAL ENERGY BOARD　　　CANADA　　　OFFICE NATIONAL DE L'ÉNERGIE

ORDER NO. MO-20-78

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. inter alia respecting the authorized maximum operating pressure of a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', in the Province of British Columbia, filed with the Board under File No. 1800-T4-19.

B E F O R E the Board on Wednesday, the 31st day of May, 1978.

UPON an application by Trans Mountain Pipe Line Company Ltd., formerly known as Trans Mountain Oil Pipe Line Company, (hereinafter called "the Applicant"), submitted under a letter dated the 15th day of May, 1978, inter alia for approval to operate a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M.P. 628.0', being (the downstream side of) an existing 'Main Line Valve', identified as 'M628H', located within the Applicant's existing 'Hope Pressure Relief Station' site, situated in part of District Lot 3 and in part of District Lot 2, both

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CC ENG.

OPERATIONS.

in Group 1, Yale Division, Yale District, Kamloops Land Registration District, to a point designated 'M.P. 649.3', being (the upstream side of) an existing 'Main Line Valve', identified as '24G', located within the Applicant's existing 'Wahleach Pump Station' site, situated in part of the Fractional South East Quarter of Section 8, Township 3, Range 28, West of the 6th Meridian, New Westminster District, all in the Province of British Columbia, at increased authorized maximum operating pressures; and it appearing that the Board of Transport Commissioners for Canada, now referred to as the Railway Transport Committee of the Canadian Transport Commission, by Order No. 82361, dated the 15th day of October, 1953, authorized the Applicant to open for the 'transportation of crude oil' inter alia the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line';

AND the Board having issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated the 19th day of August, 1960, as amended, respecting inter alia the portion of existing pipeline, being a portion of '24-inch diameter Main Line', referred to in this Order; and the Board having further issued to the Applicant Order No. MO-16-66, dated the 9th day of June, 1966, approving inter alia certain specified maximum operating pressures respecting a certain part of the portion of existing pipeline,

...3

being the portion of '24-inch diameter Main Line', referred to herein, as more particularly set forth under paragraph (iv) of said Order No. MO-16-66; and the Applicant having represented that it hydrostatically 're-tested' the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line'; and upon having read the submissions of the Applicant, including the Affidavit of Alwin Wilbert Samson, Chief Engineer of the Applicant, dated the 12th day of May, 1978, all filed; and the Board having been satisfied that the said portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter Main Line', may safely be operated at such maximum operating pressure as hereinafter referred to;

IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to operate for the transmission of oil that portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M.P. 628.0', being (the downstream side of) an existing 'Main Line Valve', identified as 'M628H', located within the Applicant's existing 'Hope Pressure Relief Station' site, situated in part of District Lot 3 and in part of District Lot 2, both in Group 1, Yale Division, Yale District, Kamloops Land Registration District, to a point designated 'M.P. 649.3', being (the upstream side of) an existing 'Main Line Valve', identified as '24G', located within the Applicant's existing 'Wahleach Pump Station' site,

...4

situated in part of the Fractional South East Quarter of Section 8, Township 3, Range 28, West of the 6th Meridian, New Westminster District, all in the Province of British Columbia, upon the following condition:

> The authorized maximum operating pressure of the portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter Main Line', respecting which this Order is issued, at the point designated 'M.P. 628.0', being (the downstream side of) an existing 'Main Line Valve', identified as 'M628H', situated at the hereinbefore described location, shall be 1,023 psig.

NATIONAL ENERGY BOARD

Brian H. Whittle
Secretary

NATIONAL ENERGY BOARD
CANADA
EXAMINED AND CERTIFIED TO BE A TRUE COPY OF AN ORDER OF THE NATIONAL ENERGY BOARD.
DATED. AUG - 1 1978

B.H. Whittle
SECRETARY, NATIONAL ENERGY BOARD, OTTAWA, CANADA

NEB F-IR 2.001 - Attachment 31

NATIONAL ENERGY BOARD

CANADA

OFFICE NATIONAL DE L'ÉNERGIE

ORDER NO. MO-52-78

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. respecting the authorized maximum operating pressure of a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', in the Province of British Columbia, filed with the Board under File No. 1800-T4-19.

B E F O R E the Board on Friday the 17th day of November 1978.

UPON an application by Trans Mountain Pipe Line Company Ltd., formerly known as Trans Mountain Oil Pipe Line Company, (hereinafter called "the Applicant"), dated the 8th day of September, 1978, for approval to operate a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M.P. 649.3', being a point within the Applicant's existing 'Wahleach Pump Station' site, situated in Parcel "D", Reference Plan 42094 of the Fractional South East Quarter of Section 8, Township 3, Range 28, West of the 6th Meridian, to a point designated 'M.P. 671.7', being a point within the Applicant's existing 'Sumas Pump Station' site, situated

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in Parcel "A", Reference Plan 13382 of Lot 1 of part of District Lot 226, Group 2, all in the New Westminster District, in the Province of British Columbia, at increased authorized maximum operating pressures; and it appearing that the Board of Transport Commissioners for Canada, now referred to as the Railway Transport Committee of the Canadian Transport Commission, by Order No. 82361, dated the 15th day of October, 1953, authorized the Applicant to open for the 'transportation of crude oil' inter alia the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line';

AND the Board having issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated the 19th day of August, 1960, as amended, respecting inter alia the portion of existing pipeline, being a portion of '24-inch diameter Main Line', referred to in this Order; and the Applicant having represented that it hydrostatically 're-tested' the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line'; and upon having read the submissions of the Applicant, including the Affidavit of Alwin Wilbert Samson, Chief Engineer of the Applicant, dated the 8th day of September, 1978, all filed; and the Board having been satisfied that the said portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter Main Line', may safely be operated at such maximum operating pressures as hereinafter referred to;

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IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to operate for the transmission of oil that portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M.P. 649.3', being a point within the Applicant's existing 'Wahleach Pump Station' site, situated in Parcel "D", Reference Plan 42094 of the Fractional South East Quarter of Section 8, Township 3, Range 28, West of the 6th Meridian, to a point designated 'M.P. 671.7', being a point within the Applicant's existing 'Sumas Pump Station' site, situated in Parcel "A", Reference Plan 13382 of Lot 1 of part of District Lot 226, Group 2, all in the New Westminster District, in the Province of British Columbia, upon the following conditions:

(1) The authorized maximum operating pressure of the portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter Main Line', respecting which this Order is issued, at the point designated 'M.P. 649.3', being a point on the discharge side of the said existing 'Wahleach Pump Station', situated at the hereinbefore described location, shall be 975 psig.

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(2) The authorized maximum operating pressure at any given point on the portion of the Applicant's existing pipeline between the said point designated 'M.P. 649.3' within the Applicant's said existing 'Wahleach Pump Station' and the point designated 'M.P. 671.1', being a point at the suction side within the Applicant's said existing 'Sumas Pump Station' at the herein-before described locations, shall be the lesser of:

(i) 80% of the test pressure experienced at that point on the pipeline during the hydrostatic test as described in the application for higher operating pressures, or

(ii) a pressure which causes a circumferential stress in the pipe of 72% of the Specified Minimum Yield

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Stress of the pipe material

at that point.

NATIONAL ENERGY BOARD

L. Yorke Slader

for Brian H. Whittle
Secretary

NATIONAL ENERGY BOARD
CANADA
EXAMINED AND CERTIFIED TO BE A TRUE COPY OF AN ORDER OF THE NATIONAL ENERGY BOARD.
DATED. MAY 11 1979

B.H. Whittle

SECRETARY, NATIONAL ENERGY BOARD, OTTAWA, CANADA

NEB F-IR 2.001 - Attachment 32

NATIONAL ENERGY BOARD

CANADA

OFFICE NATIONAL DE L'ÉNERGIE

ORDER NO. MO-15-73

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. respecting the authorized maximum operating pressure of a certain portion of its existing pipeline, referred to as 'Sumas Branch Line', in the Province of British Columbia, filed with the Board under File No. 1800-T4-12.

B E F O R E the Board on Wednesday, the 1st day of August, 1973.

UPON an application by Trans Mountain Pipe Line Company Ltd., formerly known as Trans Mountain Oil Pipe Line Company, (hereinafter called "the Applicant"), dated the 16th day of July, 1973, for approval to operate a certain portion of its existing pipeline, referred to as 'Sumas Branch Line', extending from a point within its existing 'Sumas Pump Station' site, situated in part of District Lot 226, Group 2, to a point on the International Boundary Line between Canada and the United States of America being a point in the South limit of the North West Quarter of Section 6, Township 19, all in the Municipality

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of Sumas, New Westminster District, in the Province of British Columbia, at an increased maximum operating pressure; and it appearing that the Board of Transport Commissioners for Canada, now referred to as the Railway Transport Committee of the Canadian Transport Commission, by its Order No. 84426, dated the 27th day of August, 1954, authorized the Applicant to open for the transportation of oil the said portion of existing pipeline, referred to as 'Sumas Branch Line'; and the Board having issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated the 19th day of August, 1960, as amended, respecting inter alia the said portion of existing pipeline, referred to as 'Sumas Branch Line'; and the Applicant having represented that it hydrostatically 're-tested' the said portion of existing pipeline, referred to as 'Sumas Branch Line'; and upon reading the submissions of the Applicant, including the Affidavit of Alwin Wilbert Samson, Chief Engineer of the Applicant, dated the 16th day of July, 1973, all filed; and the Board having been satisfied that the said portion of the Applicant's existing pipeline, referred to as 'Sumas Branch Line', may safely be operated at such maximum operating pressure hereinafter referred to;

IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to operate for the transmission

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of oil that portion of its existing pipeline, referred to as 'Sumas Branch Line', extending from a point within its existing 'Sumas Pump Station' site, situated in part of District Lot 226, Group 2, to a point on the International Boundary Line between Canada and the United States of America being a point in the South limit of the North West Quarter of Section 6, Township 19, all in the Municipality of Sumas, New Westminster District, in the Province of British Columbia, upon the following condition:

> The authorized maximum operating pressure of the portion of the Applicant's existing pipeline, referred to as 'Sumas Branch Line', respecting which this Order is issued, at the point designated 'M.P. 0.0', being a point on the discharge side of the said existing 'Sumas Pump Station', at the hereinbefore described location, shall be 960 psig.

NATIONAL ENERGY BOARD

Robert A. Stead,
Secretary.

NEB F-IR 2.001 - Attachment 33

NATIONAL ENERGY BOARD CANADA **OFFICE NATIONAL DE L'ÉNERGIE**

ORDER NO. MO-7-78

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. inter alia respecting the authorized maximum operating pressure of a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', in the Province of British Columbia, filed with the Board under File No. 1800-T4-17.

B E F O R E the Board on Wednesday, the 15th day of March, 1978.

UPON an application by Trans Mountain Pipe Line Company Ltd., formerly known as Trans Mountain Oil Pipe Line Company, (hereinafter called "the Applicant"), dated the 31st day of August, 1977, inter alia for approval to operate a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M.P. 671.7', being a point within the Applicant's existing 'Sumas Pump Station' site, situated in Parcel "A", Reference Plan 13382, of Lot 1 of part of District Lot 225 and part of District Lot 226, both Group 2, and of the South West Quarter of Section 27, Township 19, formerly in the Municipality of Sumas, now in the District of Abbotsford, to a point designated 'M.P. 685.31', being (the upstream side of) an existing 'Main Line Valve', identified as 'Bradner Valve M 685', situated in part of Lot 15, Plan 3879, of the South East Quarter of Section 16, Township 14, in the Municipality of Matsqui, all in the New Westminster District, in the Province of British Columbia, at increased maximum operating pressures; and it appearing that the Board of Transport Commissioners for Canada, now referred to as the Railway Transport Committee of the Canadian Transport Commission, by its Order No. 82361, dated the 15th day of October, 1953, authorized the Applicant to open for the 'transportation of crude oil' inter alia the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line'; and the Board having issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated the 19th day of August, 1960, as amended, respecting inter alia the portion of existing pipeline, being a portion of '24-inch diameter Main Line', referred to in this Order; and the Applicant having represented that it hydrostatically 're-tested' the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line'; and upon having read the submissions of the Applicant, including the Affidavit of Alwin Wilbert Samson, Chief Engineer of the Applicant, dated the 19th day of August, 1977, all filed; and the

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Board having been satisfied that the said portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter Main Line', may safely be operated at such maximum operating pressure as hereinafter referred to;

IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to operate for the transmission of oil that portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M.P. 671.7', being a point within the Applicant's existing 'Sumas Pump Station' site, situated in Parcel "A", Reference Plan 13382, of Lot 1 of part of District Lot 225 and part of District Lot 226, both Group 2, and of the South West Quarter of Section 27, Township 19, formerly in the Municipality of Sumas, now in the District of Abbotsford, to a point designated 'M.P. 685.31', being (the upstream side of) an existing 'Main Line Valve', identified as 'Bradner Valve M 685', situated in part of Lot 15, Plan 3879, of the South East Quarter of Section 16, Township 14, in the Municipality of Matsqui, all in the New Westminster District, in the Province of British Columbia, upon the following condition:

> The authorized maximum operating pressure of the portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter 'Main Line', respecting which this

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Order is issued, at the point designated 'M.P. 671.7', being a point on the discharge side of the said existing 'Sumas Pump Station', situated at the hereinbefore described location, shall be 980 psig.

NATIONAL ENERGY BOARD

for Brian H. Whittle
Secretary

NATIONAL ENERGY BOARD
CANADA
EXAMINED AND CERTIFIED TO BE A TRUE COPY OF AN ORDER OF THE NATIONAL ENERGY BOARD.
DATED. MAY 26 1978

B.H. Whittle

SECRETARY, NATIONAL ENERGY BOARD, OTTAWA, CANADA

NEB F-IR 2.001 - Attachment 34

NATIONAL ENERGY BOARD

OFFICE NATIONAL DE L'ÉNERGIE

CANADA

ORDER NO. MO-8-78

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Pipe Line Company Ltd. inter alia respecting the authorized maximum operating pressure of a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', in the Province of British Columbia, filed with the Board under File No. 1800-T4-17.

B E F O R E the Board on Wednesday, the 15th day of March, 1978.

UPON an application by Trans Mountain Pipe Line Company Ltd., formerly known as Trans Mountain Oil Pipe Line Company, (hereinafter called "the Applicant"), dated the 31st day of August, 1977, inter alia for approval to operate a certain portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M.P. 685.31', being (the downstream side of) an existing 'Main Line Valve', identified as 'Bradner Valve M 685', situated in part of Lot 15, Plan 3879, of the South East Quarter of Section 16, Township 14, in the Municipality of Matsqui, to a point designated 'M.P. 712.293',

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being a point within the Applicant's existing 'Burnaby Tank Farm and Terminal' site, situated in Block "C" of District Lot 141, District Lot 142, District Lot 143 and District Lot 144, all Group 1, Plan 17387, in the Municipality of Burnaby, all in the New Westminster District, in the Province of British Columbia, at increased maximum operating pressures; and it appearing that the Board of Transport Commissioners for Canada, now referred to as the Railway Transport Committee of the Canadian Transport Commission, by its Order No. 82361, dated the 15th day of October, 1953, authorized the Applicant to open for the 'transportation of crude oil' inter alia the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line'; and the Board having issued to the Applicant Certificate of Public Convenience and Necessity No. OC-2, dated the 19th day of August, 1960, as amended, respecting inter alia the portion of existing pipeline, being a portion of '24-inch diameter Main Line', referred to in this Order; and the Applicant having represented that it hydrostatically 're-tested' the said portion of existing pipeline, being a portion of its '24-inch diameter Main Line'; and upon having read the submissions of the Applicant, including the Affidavit of Alwin Wilbert Samson, Chief Engineer of the Applicant, dated the 19th day of August, 1977, all filed; and the Board having been satisfied that the said portion of the Applicant's existing pipeline,

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being a portion of its '24-inch diameter Main Line', may safely be operated at such operating pressure as hereinafter referred to;

IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to operate for the transmission of oil that portion of its existing pipeline, being a portion of its '24-inch diameter Main Line', extending from a point designated 'M.P. 685.31', being (the downstream side of) an existing 'Main Line Valve', identified as 'Bradner Valve M 685', situated in part of Lot 15, Plan 3879, of the South East Quarter of Section 16, Township 14, in the Municipality of Matsqui, to a point designated 'M.P. 712.293', being a point within the Applicant's existing 'Burnaby Tank Farm and Terminal' site, situated in Block "C" of District Lot 141, District Lot 142, District Lot 143 and District Lot 144, all Group 1, Plan 17387, in the Municipality of Burnaby, all in the New Westminster District, in the Province of British Columbia, upon the following condition:

> The authorized maximum operating pressure of the portion of the Applicant's existing pipeline, being a portion of its '24-inch diameter 'Main Line', respecting which this Order is issued, at the point designated 'M.P. 685.31', being (the downstream side of) an existing 'Main Line Valve', identified as 'Bradner Valve M 685',

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situated at the hereinbefore described location, shall be 610 psig.

NATIONAL ENERGY BOARD

Brian H. Whittle
Secretary

NATIONAL ENERGY BOARD
CANADA
EXAMINED AND CERTIFIED TO BE A TRUE COPY
OF THE ORDER OF THE NATIONAL ENERGY
BOARD.
DATED. MAY 2 6 1978

SECRETARY, NATIONAL ENERGY
BOARD, OTTAWA, CANADA

NEB F-IR 2.001 - Attachment 35

National Energy Board

Office national de l'énergie

ORDER AO-2-XO-T099-15-2005

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Terasen Pipelines (Trans Mountain) Inc. (Terasen), pursuant to subsection 21(1) of the Act, filed with the National Energy Board under File AFP-TTM 2005-001 (3400-T099-13).

BEFORE the Board on 5 April 2007.

WHEREAS the Board received an application from Terasen dated 12 July 2005 for the Trans Mountain Pump Station Expansion Project (the Project);

AND WHEREAS the Board approved the Project pursuant to Order XO-T099-15-2005 on 9 November 2005, and Amending Order AO-1-XO-T099-15-2005 dated 3 February 2006;

AND WHEREAS the Board received an application by Terasen dated 28 March 2007 to amend Condition 12 of Order XO-T099-15-2005 to extend the timeline to file its weed management plan;

AND WHEREAS nothing in this order alters Terasen's obligations to comply with existing conditions contained in Order XO-T099-15-2005 dated 9 November 2005 and Amending Order AO-1-XO-T099-15-2005 dated 3 February 2006;

AND WHEREAS the Board has examined the application and considers it to be in the public interest to grant the relief requested;

IT IS ORDERED that, pursuant to subsection 21(1) of the Act, the wording of Condition 12 of Order XO-T099-15-2005 is hereby amended and follows:

Condition 12:
"Unless the Board otherwise directs, Terasen shall file with the Board a revised weed management plan for approval by 30 April 2007. This is to describe Terasen's long term weed monitoring and control procedures, decision criteria and accountabilities for the operations phase of the facilities as well as for the immediate post-construction project reclamation period."

NATIONAL ENERGY BOARD

David Young
Acting Secretary

Canada

ORDER AO-1-XO-T099-15-2005

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder; and

IN THE MATTER OF an application by Terasen Pipelines (Trans Mountain) Inc. (Terasen), pursuant to subsection 21(1) of the Act, filed with the National Energy Board under File 3400-T099-13.

BEFORE the Board on 3 February 2006.

WHEREAS the Board received an application from Terasen dated 12 July 2005 for the Trans Mountain Pump Station Expansion Project (the Project);

AND WHEREAS the Board approved the Project pursuant to Order XO-T099-15-2005 on 9 November 2005;

AND WHEREAS the Board received an application by Terasen dated 21 December 2005 pursuant to subsection 21(1) of the Act to amend Schedule A of Order XO-T099-15-2005;

AND WHEREAS nothing in this order alters Terasen's obligations to comply with the conditions contained in Order XO-T099-15-2005 dated 9 November 2005, except that Terasen is no longer required to comply with Condition 4 of the aforementioned order;

AND WHEREAS information on the proposed projects is set out as detailed in Schedule A attached to and forming part of this Order;

AND WHEREAS the Board has examined the application and considers it to be in the public interest to grant the relief requested;

IT IS ORDERED that, pursuant to subsection 21(1) of the Act, Schedule A of Order XO-T099-15-2005 is amended to replace the proposed Merritt Pump Station with additional upgrades to the Kingsvale Pump Station.

NATIONAL ENERGY BOARD

Michel L. Mantha
Secretary

Attachment: Schedule A

Schedule A

Terasen Pipelines (Trans Mountain) Inc. (Terasen)

Application dated 21 December 2005 to Amend Order XO-T099-15-2005

NEB File 3400-T099-13-1

	Name of Facility	Type of Facility	Location of Facility	New Construction	Modification	Pump Power
Alberta	Edmonton Terminal	Terminal	Within Sherwood Park and adjacent to the City of Edmonton (Km Post 0)	N/A	• rebowl booster pumps • replace relief valve and piping • replace existing pump motors • change-out pump impellers and diffusers • upgrade of motor bases and transformer	• electric (1,875 kW x4)
	K19	Valve Site	Km Post 20	• surge by-pass relief	N/A	N/A
	K21	Valve Site	Km Post 21	• surge by-pass relief	N/A	N/A
	Stoney Plain Station	Pump Station	100 m north of Stony Plain (Km Post 49.5)	• pump station on existing land	N/A	• electric (3,730 kW x2)
	Gainford Station	Pump Station	South of Gainford (Km Post 99.4)	• surge by-pass relief	• modification of pump internals • upgrade control valve	N/A
	Chip Lake Station	Pump Station	16 km west of Wildwood (Km Post 147.1)	• pump station on new land	N/A	• electric (3,730 kW x2)
	Niton Station	Pump Station	South of Niton (Km Post 173.4)	N/A	• modification of pump internals • upgrade control valve	N/A
	Edson Station	Pump Station	North of Edson (Km Post 228.7)	• surge relief system to tank	• modification of pump internals • upgrade control valve	N/A

Schedule A

	Name of Facility	Type of Facility	Location of Facility	New Construction	Modification	Pump Power
					• upgrade existing 80,000 bbl tank	
	Hinton Station	Pump Station	12 Km southwest of Town of Hinton (Km Post 317.7)	• pump station on existing land	N/A	• electric (3,730 kW x2)
	Jasper Station	Pump Station	Jasper National Park (Km Post 369.5)	• surge by-pass relief	• modification of pump internals	N/A
British Columbia	Rearguard Station	Pump Station	20 Km northeast of Valemount (Km Post 476.8)	• pump station on existing land	N/A	• electric (3,730 kW x2)
	Albreda Station	Pump Station	South of Valemount (Km Post 519.1)	• 10,000 bbl relief tank and piping	• modification of pump internals • upgrade control valve	N/A
	Finn Creek Station	Pump Station	12 km south of Blue River (Km Post 612.5)	• pump station on new land	N/A	• electric (3,730 kW x2)
	McMurphy Station	Pump Station	Southwest to Blue River (Km Post 645)	• surge by-pass relief	• modification of pump internals • upgrade control valve	•
	Blackpool Station	Pump Station	11km south of Clearwater (Km Post 709.9)	• pump station on existing land	N/A	• electric (3,730 kW x2)
	Darfield Station	Pump Station	East of Darfield (Km Post 742)	N/A	• modification of pump internals • upgrade control valve	N/A
	Kamloops Petrocan Take-off (K818)	Valve Site	Km Post 817.4	• surge by-pass relief	N/A	N/A
	Kamloops Station	Pump Station	Within Kamloops (Km Post 822.0)	• surge by-pass relief	• replace existing pump motors (2 units) • replace booster pump • change-out pump impellers and diffusers	• electric (1,875 kW x2)

Schedule A

Name of Facility	Type of Facility	Location of Facility	New Construction	Modification	Pump Power
				• upgrade of motor bases and transformer	
Stump Station	Pump Station	40 km south of Kamloops (Km Post 862.7)	• pump station on new land	N/A	• electric (3,730 kW x2)
Kingsvale Station	Pump Station	24 km south of Merrit (Km Post 924.8)	• motor and pump • surge by-pass relief • spare pump unit	• modification of pump internals • replace pump controller	• electric (1,875 kW x2)
Hope Pressure Relief Station	Pump Station	Within the limits of the District of Hope (Km Post 1011.8)	• pump station on existing land	N/A	• electric (3,730 kW x2)
Wahleach Station	Pump Station	16.5 km northeast of Chilliwack (Km Post 1045.9)	• pump station on existing land	N/A	• electric (3,730 kW x2)
Sumas Station	Pump Station	South of Sumas (Km Post 1082)	• actuator for valve 24M • surge by-pass relief	• replace existing control valve • modification of pump internals • upgrade 2 control valves	N/A
Port Kells Station	Pump Station	Located within Surrey city limits (Km Post 1124.3)	• pump station on new land		• electric (3,730 kW x2)

NEB F-IR 2.001 - Attachment 36

National Energy Board — Office national de l'énergie

ORDER OPSO-T099-02-2008

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Kinder Morgan Canada Inc. (KMC) for an Order pursuant to section 47 of the Act filed with the National Energy Board under File 3200-T099-2.

BEFORE the Board on 25 March 2008.

WHEREAS KMC has filed an application dated 14 March 2008 for Leave to Open Wolf Pump Station located near Edson, Alberta;

AND WHEREAS the Board has issued Certificate of Public Convenience and Necessity OC-49, the effect of which was to permit the construction of a pipeline loop and associated facilities extending from Hinton, Alberta to a location near Rearguard, British Columbia;

IT IS ORDERED THAT KMC is granted Leave to Open the station piping at Wolf pump station for the transmission of low vapour pressure refined petroleum products at the maximum operating pressures outlined in Schedule A (attached).

NATIONAL ENERGY BOARD

Claudine Dutil-Berry
Secretary of the Board

Canada

ORDER OPSO-T099-02-2008

SCHEDULE A

Wolf Pump Station			
Test No.	Test Description	Drawing No.	MOP (kPa)
1	Sump Tank Riser NPS 4	01-12211-C1A01-WL-GS1004	1878
8	Station Piping NPS 20	01-12211-C1A01-WL-GS1000	9930
9	Station Piping NPS 2	01-12211-C1A01-WL-GS1004	9930
11	Station Piping NPS 24	01-12211-C1A01-WL-GS1000	9930
	Station Piping NPS 20	01-12211-C1A01-WL-GS1000	9930
13	Station Piping NPS 20	01-12211-C1A01-WL-GS1000	9930
14	Station Piping NPS 4	01-12211-C1A01-WL-GS1004	1895
15	Station Piping NPS 20	01-12211-C1A01-WL-GS1000	9927
16	Station Piping NPS 20	01-12211-C1A01-WL-GS1004	9930
19	Station Piping NPS 20	01-12211-C1A01-WL-GS1000	9930
20	Station Piping NPS 20	01-12211-C1A01-WL-GS1000	9930
21	Station Piping NPS 20	01-12211-C1A01-WL-GS1000	9930
24	Station Piping NPS 20	01-12211-C1A01-WL-GS1000	9930
25	Station Piping NPS 20	01-12211-C1A01-WL-GS1000	9930
27	Station Piping NPS 20	01-12211-C1A01-WL-GS1000	9930
29	Station Piping NPS 1	01-12211-C1A01-WL-GS1002	862
30	Station Piping NPS 20	01-12211-C1A01-WL-GS1000	9930
31	Station Piping NPS 20	01-12211-C1A01-WL-GS1000	9930
FT - 01	Station Piping NPS 24	01-12211-C1A01-WL-GS1000	9930
	Station Piping NPS 20	01-12211-C1A01-WL-GS1000	9930

NEB F-IR 2.001 - Attachment 37

National Energy Board | Office national de l'énergie

ORDER OPSO-T099-03-2008

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Kinder Morgan Canada Inc. (KMC) for an Order pursuant to section 47 of the Act filed with the National Energy Board under File 3200-T099-2.

BEFORE the Board on 25 March 2008.

WHEREAS KMC has filed an application dated 14 March 2008 for Leave to Open Chappel Pump Station located near Blue River, British Columbia;

AND WHEREAS the Board has issued Certificate of Public Convenience and Necessity OC-49, the effect of which was to permit the construction of a pipeline loop and associated facilities extending from Hinton, Alberta to a location near Rearguard, British Columbia;

IT IS ORDERED THAT KMC is granted Leave to Open the station piping at Chappel pump station for the transmission of low vapour pressure refined petroleum products at the maximum operating pressures outlined in Schedule A (attached).

NATIONAL ENERGY BOARD

Claudine Dutil-Berry
Secretary of the Board

Canada

ORDER OPSO-T099-03-2008

SCHEDULE A

Chappel Pump Station			
Test No.	Test Description	Drawing No.	MOP
4	Station Piping NPS 4	01-12211-C1A01-CP-GS1004	1895
5	Station Piping NPS 2	01-12211-C1A01-CP-GS1004	9930
6	Station Piping NPS 4	01-12211-C1A01-CP-GS1004	1895
	Station Piping NPS 2	01-12211-C1A01-CP-GS1004	1895
8	Station Piping NPS 20	01-12211-C1A01-CP-GS1000	9930
10	Station Piping NPS 24	01-12211-C1A01-CP-GS1000	9907
	Station Piping NPS 20	01-12211-C1A01-CP-GS1000	9907
12	Station Piping NPS 20	01-12211-C1A01-CP-GS1000	9928
15	Station Piping NPS 20	01-12211-C1A01-CP-GS1000	9927
16	Station Piping NPS 20	01-12211-C1A01-CP-GS1000	9930
17	Station Piping NPS 20	01-12211-C1A01-CP-GS1000	9930
18	Station Piping NPS 20	01-12211-C1A01-CP-GS1004	9930
23	Station Piping NPS 20	01-12211-C1A01-CP-GS1004	9928
24	Station Piping NPS 20	01-12211-C1A01-CP-GS1000	9930
26	Station Piping NPS 20	01-12211-C1A01-CP-GS1000	9930
27	Station Piping NPS 20	01-12211-C1A01-CP-GS1000	9930
28	Station Piping NPS 20	01-12211-C1A01-CP-GS1000	9930
29	Station Piping NPS 1	01-12211-C1A01-CP-GS1002	862
30	Station Piping NPS 20	01-12211-C1A01-CP-GS1000	9930
HT - 01	Station Piping NPS 24	01-12211-C1A01-CP-GS1000	9930
	Station Piping NPS 20	01-12211-C1A01-CP-GS1000	9930

NEB F-IR 2.001 - Attachment 38

ORDER XO-T099-04-2007

IN THE MATTER OF the *National Energy Board Act* (Act) and the regulations made thereunder; and

IN THE MATTER OF an application pursuant to section 58 of the Act, dated 9 March 2007, by Terasen Inc. (Terasen), filed with the National Energy Board under File OF-Fac-Oil-T099-2007-01 01.

BEFORE the Board on 27 April 2007.

WHEREAS Terasen filed an application dated 9 March 2007 and subsequent filings dated 30 March 2007 and 13 April 2007, pursuant to section 58 of the Act, in respect of the construction of the Blue River Pump Station Project (the Project) in British Columbia, at an estimated total capital cost of $22,600,000.

AND WHEREAS information about the Project is set out in Schedule A;

AND WHEREAS, pursuant to the *Canadian Environmental Assessment Act* (CEA Act), the Board has considered the information submitted by Terasen and has performed an environmental screening of the Project;

AND WHEREAS the Board has determined, pursuant to paragraph 20(1)(a) of the CEA Act that, taking into account the implementation of Terasen's proposed mitigative measures and those set out in the attached conditions, the Project is not likely to cause significant adverse environmental effects;

AND WHEREAS the Board has examined the application and considers it to be in the public interest to grant the relief requested;

IT IS ORDERED that, pursuant to section 58 of the Act, the Project is exempt from the provisions of paragraph 30(1)(a), 31 and 47 of the Act, subject to the following conditions:

1. Terasen shall cause the approved Project to be designed, located, constructed, installed, and operated in accordance with the specifications, standards and other information referred to in its application or as otherwise agreed to during questioning or in its related submissions.

…/2

2. Terasen shall implement or cause to be implemented all of the policies, practices, programs, mitigation measures, recommendations and procedures for the protection of the environment included in or referred to in its application or as otherwise agreed to during questioning or in its related submissions.

3. Terasen shall file with the Board the following manuals:

a) Construction Safety Manual	14 days prior to construction;
b) Operation & Maintenance Manual	14 days prior to operation; and
c) An updated Emergency Procedures Manual	14 days prior to operation.

4. Within 30 days of the date that the approved Project is placed in service, Terasen shall file with the Board a confirmation, by an officer of the company, that the Project was completed and constructed in compliance with all applicable conditions in this Order. If compliance with any of these conditions cannot be confirmed, the officer of the company shall file with the Board details as to why compliance cannot be confirmed. The filing required by this condition shall include a statement confirming that the signatory to the filing is an officer of the company.

5. Unless the Board otherwise directs prior to 27 April 2008**,** this Order shall expire on 27 April 2008, unless construction in respect of the Project has commenced by that date.

NATIONAL ENERGY BOARD

for David Young
Acting Secretary

Attachment (Schedule A)

SCHEDULE A
National Energy Board XO-T099-04-2007

Terasen Inc. (Terasen)

Application dated 9 March 2007 for the
Blue River Pump Station Project
NEB File OF-Fac-Oil-T099-2007-01 01

Facilities Specifications

Construction Type	New
Facility Type	Mainline Pump Station (2 Pumps)
Location	KP 588.9 - Lot 1 District Lot 3278 Kamloops Division Yale District Plan 6489, BC
Pump Type	Horizontal Single Impeller
Pump Power	3,730 kW (5,000 hp) ea. Electric
Control	Variable Frequency Drive
Associated Facilities	Pump Building, Electrical Building, Electric Substation, Operator Building, Sump Tank and Tie-in and Auxiliary Piping
Maximum Allowable Operating Pressure	9,930 kPa

NEB F-IR 2.001 - Attachment 39

ORDER NO. XO-2-89

IN THE MATTER OF the *National Energy Board Act* ("the Act") and the regulations made thereunder; and

IN THE MATTER OF an application, pursuant to section 58 of the Act, by Trans Mountain Pipe Line Company Ltd. ("Trans Mountain") for exemption from the provisions of certain sections of the Act for facilities to be added to its pipeline system; filed with the Board under File No. 1755-T4-29.

B E F O R E the Board on 20 July 1989.

WHEREAS the Board has examined the application, together with correspondence dated 29 June 1989, and considers it to be in the public interest to grant part of the relief requested therein;

IT IS ORDERED THAT, pursuant to section 58 of the Act, the replacement of Tank 17 at Trans Mountain's Edmonton Terminal, as more particularly described in the application, is exempted from the provisions of paragraph 30(1)(a), subsection 30(2), and section 31 of the Act, upon the following condition:

1. Trans Mountain shall cause the construction and installation of the facilities exempted by this Order to be commenced on or before 31 December 1990.

NATIONAL ENERGY BOARD

Louise Meagher

Louise Meagher
Secretary

NEB F-IR 2.001 - Attachment 40

ORDER NO. XO-1-88

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application, pursuant to Section 49 of the National Energy Board Act (the Act), by Trans Mountain Pipe Line Company Ltd. (Trans Mountain), dated 21 September 1987, for exemption from the provisions of certain sections of the Act for facilities to be added to its pipeline system, filed with the Board under File No. 1755-T4-25.

B E F O R E

R. Priddle
Presiding Member

W.G. Stewart
Member

on the
18th day of July 1988

A.B. Gilmour
Member

WHEREAS, by application dated 21 September 1987, Trans Mountain applied to the Board for, inter alia, certain Orders under Part III of the Act;

AND WHEREAS the Board heard evidence and submissions of Trans Mountain and all intervenors, with respect to the application, at a public hearing held pursuant to Order OH-1-87, as amended;

AND WHEREAS Trans Mountain has demonstrated that the proposed Stage 1 pumping, tankage and pipeline facilities are required to transport crude oil and refined products in its system;

AND WHEREAS the Board has found that the proposed Stage 1 facilities are in the public interest;

IT IS ORDERED THAT pursuant to section 49 of the Act, the Stage 1 facilities described in Schedule "A" attached to and forming part of this Order, are exempt from the provisions of paragraph 26(1)(a), subsection 26(2) and section 27 of the Act upon the following conditions:

1. Prior to commencement of construction, Trans Mountain shall:

   (i) submit for Board approval the final design and configuration of the pipeline facilities where such differ from those submitted in the application, and

   (ii) provide the Board with a detailed construction schedule or schedules identifying major construction activities;

2. Prior to commencement of construction of the three domed storage tanks at Burnaby Terminal, Trans Mountain shall provide the Board with:

   (i) design drawings and specifications for the tanks, containment dikes and vapour-recovery systems, and

   (ii) a site-specific quantitative analysis demonstrating that the tanks will conform with the seismic design criteria of the latest edition of the API Standard 650 <u>Welded Steel Tanks for Oil Storage</u>;

3. Trans Mountain shall cause the construction and installation of the Stage 1 facilities described in Schedule "A" to be commenced before 31 December 1989;

4. During construction, Trans Mountain shall file:

   (i) monthly construction cost reports providing a breakdown, by location and facility, of costs incurred during that month, the percentage completion of each activity and an update of projected costs to complete the project,

   (ii) monthly construction progress reports, and

   (iii) updated construction schedules, if any significant changes to the schedules provided pursuant to subsection 1(ii) occur;

.../3

5. During the construction of the three storage tanks at Burnaby, Trans Mountain shall file, twice each month, reports detailing the observed concentrations of suspended solids in any waters discharged from the terminal property. Should those observed concentrations exceed the range of 10-20 parts per million, Trans Mountain shall also provide a description of the mitigative measures used to reduce the level of suspended solids, including observations on the effectiveness of those measures;

6. Trans Mountain shall submit, by 31 October 1988, to the Board and all interested parties pursuant to AO-1-OH-1-87, a contingency planning manual which includes Trans Mountain's plans and procedures for dealing with major emergencies at the Burnaby and Westridge terminals;

7. Prior to applying for leave to open the three new storage tanks at Burnaby, Trans Mountain shall submit:

   (i) a report detailing its final procedures for the disposal of waste scrubbing liquors and sludges, and

   (ii) a report outlining the air-monitoring program which is to be funded by Trans Mountain and carried out by a separate party;

8. Trans Mountain shall, to the fullest extent possible, schedule operations at the Burnaby Terminal so that the most odorous crude oils are stored only in those storage tanks equipped with vapour-recovery systems;

9. During the operation of the three new storage tanks at Burnaby, Trans Mountain shall, unless otherwise directed by the Board, submit twice each year:

   (i) a report summarizing the results of its air-monitoring program, including information on H_2S and mercaptan levels for both the Burnaby and Westridge Terminals, and

   (ii) a report summarizing the results of noise level monitoring at the Burnaby Terminal. The monitoring should be carried out in accordance with the requirements of CSA Standard Z107.53-M1982 <u>Procedure for Performing a Survey of Sound Due to Industrial, Institutional, or Commercial Activities</u>; and

.../4

10. (i) Trans Mountain shall file with the Board a post-construction environmental report within six months of the date that the Board grants leave to open the last of the Stage 1 facilities,

(ii) The post-construction environmental report referred to in subsection 10(i) shall set out the environmental issues that have arisen up to the date on which the report is filed and shall:

(a) indicate the issues resolved and those unresolved, and

(b) describe the measures Trans Mountain proposes to take in respect of the unresolved issues; and

(iii) Trans Mountain shall file with the Board, on or before the 31 December that follows each of the first two complete growing seasons after the post-construction environmental report referred to in subsection 10(i) is filed:

(a) a list of the environmental issues indicated as unresolved in the report referred to in subsection 10(i) and any that have arisen since the report was filed, and

(b) a description of the measures Trans Mountain proposes to take in respect of any unresolved environmental issues.

NATIONAL ENERGY BOARD

J.S. Klenavic
Secretary

Attachment: Schedule "A"

SCHEDULE "A"

TRANS MOUNTAIN SECTION 49 APPLICATION

STAGE 1 FACILITIES

	Estimated Expenditure
Add one 1 120 kW pump unit and replace three pumps, Edmonton	$ 1,609,000
Two 31 700 m^3 tanks, Edmonton	12,201,400
Booster pumps, feeder lines, metering legs and manifolding, Edmonton	3,939,700
Add one 1 120 kW pump unit and replace two pumps, Gainford	518,100
New pump station with three 1 120 kW units, Niton	5,428,600
Replace three pumps, Edson	562,900
Add one diesel unit, Jasper	2,725,200
New pump station with three 1 120 kW units, Albreda	6,297,000
New residence, Blue River	179,200
Add one 1 120 kW pump unit, replace one pump and convert station to remote control, Darfield	4,778,700
Replace one 1 120 kW motor with 1 500 kW motor and replace one pump, Kamloops	719,600
Add one 1 500 kW pump unit and replace two pumps, Sumas	1,372,500
Three 23 700 m^3 tanks with vapour recovery systems, Burnaby	16,062,200
Manifold connections, Burnaby	508,400
TOTAL	$ 56,902,500

NEB F-IR 2.001 - Attachment 41

National Energy Board

Office national de l'énergie

File OF-Fac-Oil-T246-2007-03 06
18 September 2013

Ali Jakubec
Regulatory Compliance Lead, Regulatory Affairs
Kinder Morgan Canada Inc.
2700, 300 – 5th Avenue SW
Calgary, AB T2P 5J2
Facsimile 403-514-6622

Dear Ms. Jakubec:

Trans Mountain Pipeline ULC (Trans Mountain) Section 47 Application dated 5 September 2013 for Partial Leave to Open the Edmonton Terminal Expansion Project

The National Energy Board, having considered the above-referenced application, has issued Order OPSO-T260-014-2013 granting leave to open Tanks 24 and 25; the manifold; two of four booster pumps; meters; associated tank lines; remote impoundment; secondary containment; and fire suppression equipment of the Edmonton Terminal Expansion Project. A copy of the Order is attached.

Yours truly,

Sheri Young

Sheri Young
Secretary of the Board

Attachment

444 Seventh Avenue SW
Calgary, Alberta T2P 0X8

444, Septième Avenue S.-O.
Calgary (Alberta) T2P 0X8

Canada

Telephone/Téléphone : 403-292-4800
Facsimile/Télécopieur : 403-292-5503
http://www.neb-one.gc.ca
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Facsimile/Télécopieur : 1-877-288-8803

National Energy Board

Office national de l'énergie

ORDER OPSO-T260-014-2013

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Trans Mountain Pipeline ULC (Trans Mountain) for an Order pursuant to section 47 of the Act filed with the National Energy Board (the Board) under File OF-Fac-Oil-T246-2007-03 06.

BEFORE the Board on 18 September 2013.

WHEREAS Trans Mountain has filed an application dated 5 September 2013 for leave to open Tanks 24 and 25; the manifold; two of four booster pumps; meters; associated tank lines; remote impoundment; secondary containment; and fire suppression equipment as part of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has issued Order XO-T246-04-2008 as amended, the effect of which was to permit the construction of the of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has examined the application and is satisfied that Tanks 24 and 25; the manifold; two of four booster pumps; meters; associated tank lines; remote impoundment; secondary containment; and fire suppression equipment as part of the Edmonton Terminal Expansion Project may be safely opened for the storage and transmission of oil;

IT IS ORDERED THAT Trans Mountain is granted leave to open Tanks 24 and 25; the manifold; two of four booster pumps; meters; associated tank lines; remote impoundment; secondary containment; and fire suppression equipment as part of the Edmonton Terminal Expansion Project at a maximum operating pressure of 1900 kPa.

NATIONAL ENERGY BOARD

Sheri Young

Sheri Young
Secretary of the Board

Canada

NEB F-IR 2.001 - Attachment 42

National Energy Board

Office national de l'énergie

File OF-Fac-Oil-T246-2007-03 06
15 May 2014

Ms. Ali Jakubec
Regulatory Compliance Lead, Regulatory Affairs
Kinder Morgan Canada Inc.
2700, 300 – 5th Avenue SW
Calgary, AB T2P 5J2
Facsimile 403-514-6622

Dear Ms. Jakubec:

Trans Mountain Pipeline ULC (Trans Mountain)
Section 47 Application dated 7 May 2014 for Partial Leave to Open the Edmonton Terminal Expansion Project

The National Energy Board, having considered the above-referenced application, has issued Order OPSO-T246-014-2014 granting leave to open Tank 26 and related facilities of the Edmonton Terminal Expansion Project. A copy of the Order is attached.

Yours truly,

Sheri Young

Sheri Young
Secretary of the Board

Attachment

National Energy Board | Office national de l'énergie

ORDER OPSO-T246-014-2014

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Trans Mountain Pipeline ULC (Trans Mountain) for an Order pursuant to section 47 of the Act filed with the National Energy Board (the Board) under File OF-Fac-Oil-T246-2007-03 06.

BEFORE the Board on 15 May 2014.

WHEREAS Trans Mountain has filed an application dated 7 May 2014 for leave to open the Tank 26 and related facilities as part of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has issued Order XO-T246-04-2008 as amended, the effect of which was to permit the construction of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has examined the application and is satisfied that Tank 26 and related facilities as part of the Edmonton Terminal Expansion Project may be safely opened for the storage and transmission of oil;

IT IS ORDERED THAT Trans Mountain is granted leave to open Tank 26 and related facilities as part of the Edmonton Terminal Expansion Project at a maximum operating pressure of 1900 kPa.

NATIONAL ENERGY BOARD

Sheri Young

Sheri Young
Secretary of the Board

Canada

NEB F-IR 2.001 - Attachment 43

National Energy Board
Office national de l'énergie

File OF-Fac-Oil-T246-2007-03 06
21 January 2014

Ms. Ali Jakubec
Regulatory Compliance Lead, Regulatory Affairs
Kinder Morgan Canada Inc.
2700, 300 – 5th Avenue SW
Calgary, AB   T2P 5J2
Facsimile 403-514-6622

Dear Ms. Jakubec:

Trans Mountain Pipeline ULC (Trans Mountain) Section 47 Application dated 10 January 2014 for Partial Leave to Open the Edmonton Terminal Expansion Project

The National Energy Board, having considered the above-referenced application, has issued Order OPSO-T260-006-2014 granting leave to open Tank 27and related facilities of the Edmonton Terminal Expansion Project. A copy of the Order is attached.

Yours truly,

Sheri Young
Secretary of the Board

Attachment

National Energy Board

Office national de l'énergie

ORDER OPSO-T246-006-2014

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Trans Mountain Pipeline ULC (Trans Mountain) for an Order pursuant to section 47 of the Act filed with the National Energy Board (the Board) under File OF-Fac-Oil-T246-2007-03 06.

BEFORE the Board on 21 January 2014.

WHEREAS Trans Mountain has filed an application dated 10 January 2014 for leave to open the Tank 27 and related facilities as part of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has issued Order XO-T246-04-2008 as amended, the effect of which was to permit the construction of the of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has examined the application and is satisfied that Tank 27 and related facilities as part of the Edmonton Terminal Expansion Project may be safely opened for the storage and transmission of oil;

IT IS ORDERED THAT Trans Mountain is granted leave to open Tank 27 and related facilities as part of the Edmonton Terminal Expansion Project at a maximum operating pressure of 1379 and 1900 kPa.

NATIONAL ENERGY BOARD

Sheri Young

Sheri Young
Secretary of the Board

Canada

NEB F-IR 2.001 - Attachment 44

File OF-Fac-Oil-T246-2007-03 06
29 January 2014

Ms. Ali Jakubec
Regulatory Compliance Lead, Regulatory Affairs
Kinder Morgan Canada Inc.
2700, 300 – 5th Avenue SW
Calgary, AB T2P 5J2
Facsimile 403-514-6622

Dear Ms. Jakubec:

Trans Mountain Pipeline ULC (Trans Mountain) Section 47 Application dated 21 January 2014 for Partial Leave to Open the Edmonton Terminal Expansion Project

The National Energy Board, having considered the above-referenced application, has issued Order OPSO-T260-007-2014 granting leave to open Tanks 28 and 35 and related facilities of the Edmonton Terminal Expansion Project. A copy of the Order is attached.

Yours truly,

for

Sheri Young
Secretary of the Board

Attachment

National Energy Board

Office national de l'énergie

ORDER OPSO-T260-007-2014

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Trans Mountain Pipeline ULC (Trans Mountain) for an Order pursuant to section 47 of the Act filed with the National Energy Board (the Board) under File OF-Fac-Oil-T246-2007-03 06.

BEFORE the Board on 29 January 2014.

WHEREAS Trans Mountain has filed an application dated 21 January 2014 for leave to open Tanks 28 and 35 and related facilities as part of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has issued Order XO-T246-04-2008 as amended, the effect of which was to permit the construction of the of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has examined the application and is satisfied that Tanks 28 and 35 and related facilities as part of the Edmonton Terminal Expansion Project may be safely opened for the storage and transmission of oil;

IT IS ORDERED THAT Trans Mountain is granted leave to open Tanks 28 and 35 and related facilities as part of the Edmonton Terminal Expansion Project at a maximum operating pressure of 1379 kPa and 1900 kPa.

NATIONAL ENERGY BOARD

for
Sheri Young
Secretary of the Board

Canada

NEB F-IR 2.001 - Attachment 45

File OF-Fac-Oil-T246-2007-03 06
18 November 2013

Ms. Ali Jakubec
Regulatory Compliance Lead, Regulatory Affairs
Kinder Morgan Canada Inc.
2700, 300 – 5th Avenue SW
Calgary, AB T2P 5J2
Facsimile 403-514-6622

Dear Ms. Jakubec:

Trans Mountain Pipeline ULC (Trans Mountain) Section 47 Application dated 4 November 2013 for Partial Leave to Open the Edmonton Terminal Expansion Project

The National Energy Board, having considered the above-referenced application, has issued Order OPSO-T246-022-2013 granting leave to open Tanks 31, 32, 34, and tank specific process and fire water piping as part of the Edmonton Terminal Expansion Project. A copy of the Order is attached.

Yours truly,

for
Sheri Young
Secretary of the Board

Attachment

National Energy Board | Office national de l'énergie

ORDER OPSO-T246-022-2013

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Trans Mountain Pipeline ULC (Trans Mountain) for an Order pursuant to section 47 of the Act filed with the National Energy Board (the Board) under File OF-Fac-Oil-T246-2007-03 06.

BEFORE the Board on 18 November 2013.

WHEREAS Trans Mountain has filed an application dated 4 November 2013 for leave to open Tanks 31, 32, 34, and tank specific process and fire water piping as part of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has issued Order XO-T246-04-2008 as amended, the effect of which was to permit the construction of the of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has examined the application and is satisfied that Tanks 31, 32, 34, and tank specific process and fire water piping as part of the Edmonton Terminal Expansion Project may be safely opened for the storage and transmission of oil;

IT IS ORDERED THAT Trans Mountain is granted leave to open Tanks 31, 32, 34, and tank specific process and fire water piping as part of the Edmonton Terminal Expansion Project at a maximum operating pressure of 1900 kPa.

NATIONAL ENERGY BOARD

for

Sheri Young
Secretary of the Board

Canada

NEB F-IR 2.001 - Attachment 46

National Energy Board

Office national de l'énergie

File OF-Fac-Oil-T246-2007-03 06
11 July 2014

Ms. Megan Sartore
Regulatory Compliance Lead, Regulatory Affairs
Kinder Morgan Canada Inc.
2700, 300 – 5th Avenue SW
Calgary, AB   T2P 5J2
Facsimile 403-514-6622

Dear Ms. Sartore:

Trans Mountain Pipeline ULC (Trans Mountain) Section 47 Application dated 3 July 2014 for Partial Leave to Open the Edmonton Terminal Expansion Project

The National Energy Board, having considered the above-referenced application, has issued Order OPSO-T260-018-2014 granting leave to open Tank 33 and related facilities of the Edmonton Terminal Expansion Project. A copy of the Order is attached.

Yours truly,

Original signed by

Sheri Young
Secretary of the Board

Attachment

National Energy Board | Office national de l'énergie

ORDER OPSO-T260-018-2014

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Trans Mountain Pipeline ULC (Trans Mountain) for an Order pursuant to section 47 of the Act filed with the National Energy Board (the Board) under File OF-Fac-Oil-T246-2007-03 06.

BEFORE the Board on 11 July 2014.

WHEREAS Trans Mountain has filed an application dated 3 July 2014 for leave to open Tank 33 and related facilities as part of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has issued Order XO-T246-04-2008 as amended, the effect of which was to permit the construction of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has examined the application and is satisfied that Tank 33 and related facilities as part of the Edmonton Terminal Expansion Project may be safely opened for the storage and transmission of oil;

IT IS ORDERED THAT Trans Mountain is granted leave to open Tank 33 and related facilities as part of the Edmonton Terminal Expansion Project at a maximum operating pressure of 1900 kPa.

NATIONAL ENERGY BOARD

Original signed by

Sheri Young
Secretary of the Board

Canada

NEB F-IR 2.001 - Attachment 47

National Energy Board

Office national de l'énergie

File OF-Fac-Oil-T246-2007-03 06
15 October 2013

Ali Jakubec
Regulatory Compliance Lead, Regulatory Affairs
Kinder Morgan Canada Inc.
2700, 300 – 5th Avenue SW
Calgary, AB T2P 5J2
Facsimile 403-514-6622

Dear Ms. Jakubec:

Trans Mountain Pipeline ULC (Trans Mountain) Section 47 Application dated 7 October 2013 for Partial Leave to Open the Edmonton Terminal Expansion Project

The National Energy Board, having considered the above-referenced application, has issued Order OPSO-T260-020-2013 granting leave to open Tank 36, booster pumps (BP-52 and BP-53) and related facilities of the Edmonton Terminal Expansion Project. A copy of the Order is attached.

Yours truly,

Sheri Young

Sheri Young
Secretary of the Board

Attachment

National Energy Board | Office national de l'énergie

ORDER OPSO-T260-020-2013

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Trans Mountain Pipeline ULC (Trans Mountain) for an Order pursuant to section 47 of the Act filed with the National Energy Board (the Board) under File OF-Fac-Oil-T246-2007-03 06.

BEFORE the Board on 15 October 2013.

WHEREAS Trans Mountain has filed an application dated 7 October 2013 for leave to open Tank 36, booster pumps (BP-52 and BP-53) and related facilities as part of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has issued Order XO-T246-04-2008 as amended, the effect of which was to permit the construction of the of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has examined the application and is satisfied that Tank 36, booster pumps (BP-52 and BP-53) and related facilities as part of the Edmonton Terminal Expansion Project may be safely opened for the storage and transmission of oil;

IT IS ORDERED THAT Trans Mountain is granted leave to open Tank 36, booster pumps (BP-52 and BP-53) and related facilities as part of the Edmonton Terminal Expansion Project at a maximum operating pressure of 1900 kPa.

NATIONAL ENERGY BOARD

Sheri Young

Sheri Young
Secretary of the Board

Canada

NEB F-IR 2.001 - Attachment 48

File OF-Fac-Oil-T246-2007-03 06
8 August 2014

Ms. Megan Sartore
Regulatory Compliance Lead, Regulatory Affairs
Kinder Morgan Canada Inc.
2700, 300 – 5th Avenue SW
Calgary, AB T2P 5J2
Facsimile 403-514-6622

Dear Ms. Sartore:

Trans Mountain Pipeline ULC (Trans Mountain) Section 47 Application dated 31 July 2014 for Partial Leave to Open the Edmonton Terminal Expansion Project

The National Energy Board, having considered the above-referenced application, has issued Order OPSO-T260-022-2014 granting leave to open Tank 38 and process piping for Tanks 37, 38, and 39 as part of the Edmonton Terminal Expansion Project. A copy of the Order is attached.

Yours truly,

Original signed by L. George for

Sheri Young
Secretary of the Board

Attachment

National Energy Board | Office national de l'énergie

ORDER OPSO-T260-022-2014

IN THE MATTER OF the *National Energy Board Act* (the Act) and the regulations made thereunder, and

IN THE MATTER OF an application by Trans Mountain Pipeline ULC (Trans Mountain) for an Order pursuant to section 47 of the Act filed with the National Energy Board (the Board) under File OF-Fac-Oil-T246-2007-03 06.

BEFORE the Board on 8 August 2014.

WHEREAS Trans Mountain has filed an application dated 31 July 2014 for leave to open Tank 38 and process piping for Tanks 37, 38, and 39 as part of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has issued Order XO-T246-04-2008 as amended, the effect of which was to permit the construction of the Edmonton Terminal Expansion Project;

AND WHEREAS the Board has examined the application and is satisfied that Tank 38 and process piping for Tanks 37, 38, and 39 as part of the Edmonton Terminal Expansion Project may be safely opened for the storage and transmission of oil;

IT IS ORDERED THAT Trans Mountain is granted leave to open Tank 38 and process piping for Tanks 37, 38 and 39 as part of the Edmonton Terminal Expansion Project at a maximum operating pressure of 1900 kPa.

NATIONAL ENERGY BOARD

Original signed by L. George for

Sheri Young
Secretary of the Board

NEB F-IR 2.001 - Attachment 49

File OF-Fac-Oil-T260-2014-01
13 May 2014

Ms. Ali Jakubec
Regulatory Affairs
Kinder Morgan Canada Inc
2700, 300 – 5th Avenue SW
Calgary, AB T2P 5J2
Facsimile 403-514-6622

Dear Ms. Jakubec:

Kinder Morgan Canada Inc. on behalf of Trans Mountain Pipeline ULC (Trans Mountain) - Application to Decommission Facilities at Edson Pump Station (Project) under section 45.1 of the *National Energy Board Onshore Pipeline Regulations (OPR)*

The National Energy Board has considered Trans Mountain's application, dated 26 February 2014.

The Board is satisfied that the protection of the environment and public safety have been adequately addressed by Trans Mountain.

The Board has issued Order MO-020-2014 (Order) pursuant to section 45.1 of the OPR, approving the Project. A copy of the Order and its Schedule A, which together outline the specifics of the Project as approved, is attached.

The Board directs Trans Mountain to serve a copy of this letter, the attached Order and its Schedule A on all interested parties.

Yours truly,

Sheri Young

Sheri Young
Secretary of the Board

Attachment

ORDER MO-020-2014

IN THE MATTER OF the *National Energy Board Act* (NEB Act) and the regulations made thereunder; and

IN THE MATTER OF an application made by Kinder Morgan Canada Inc. on behalf of Trans Mountain ULC (Trans Mountain), pursuant to section 45.1 of the *National Energy Board Onshore Pipeline Regulations* (OPR), dated 26 February 2014, filed with the National Energy Board (Board) under File Of-Fac-Oil-T260-2014-01.

BEFORE the Board on 13 May 2014.

WHEREAS the Board received an application from Trans Mountain, pursuant to section 45.1 of the OPR, dated 26 February 2014, to decommission the Edson Pump Station Facilities (Project);

AND WHEREAS the information about the Project is set out in Schedule A, attached to and forming part of this Order;

AND WHEREAS the Board has had regard to all considerations that are directly related to the Project and relevant, including environmental matters;

AND WHEREAS the Board has examined the application and considers it to be in the public interest to grant the relief requested by Trans Mountain;

IT IS ORDERED that, pursuant to section 45.1 of the OPR, the applied-for Project, as specified in Schedule A, is approved subject to the following conditions:

1. Trans Mountain shall comply with all of the conditions contained in this Order unless the Board otherwise directs.

2. Trans Mountain shall decommission and maintain the Edson Pump Station in accordance with the specifications, standards, commitments made and other information referred to in its application or in its related submissions.

3. Trans Mountain shall implement or cause to be implemented all of the policies, practices, programs, mitigation measures, recommendations, procedures and its commitments for the protection of the environment included in or referred to in its application or in its related submissions.

…/2

4. Within 30 days of this Order, Trans Mountain shall file with the Board a confirmation that the Project was completed in compliance with all applicable conditions in this Order. If compliance with any of these conditions cannot be confirmed, Trans Mountain shall file with the Board details as to why compliance cannot be confirmed. The filing required by this condition shall include a statement confirming that the signatory to the filing is an officer of Trans Mountain.

NATIONAL ENERGY BOARD

Sheri Young
Secretary of the Board

SCHEDULE A

National Energy Board MO-020-2014

Trans Mountain Pipeline ULC
Application dated 26 February 2014.
assessed pursuant to 45.1 of the *Onshore Pipeline Regulation*

Edson Pump Station
File OF-Fac-Oil-T260-2014-01

Facilities Specifications – Edson Pump Station Piping

Project Type	Decommissioning
Facility Type	Pipe segments
Location	Edson Pump Station, AB
Description	• 2 x 421 m NPS 3, CCS Edson Condensate Lines. • 2 x 104 m NPS 12, Peace Pipe. • 100 m NPS 6, Windfall. • 45 m NPS 6, Gaso. • 222 m NPS 20, Tank 42 Tank Line. • 123 m NPS 20, Tank 43 Tank Line. • 128 m NPS 24, Tank 45 Tank Line.
Buried	Yes

Facilities Specifications – Tank 42

Project Type	Decommission
Location (endpoints)	Edson Pump Station, AB
Approximate Capacity	80,000 bbl
Description	Above ground storage tank Internal floating roof

SCHEDULE A (continued)

National Energy Board MO-020-2014
Trans Mountain Pipeline ULC
Application dated 26 February 2014.
assessed pursuant to 45.1 of the *Onshore Pipeline Regulation*

Edson Pump Station
File OF-Fac-Oil-T260-2014-01

Facilities Specifications – Tank 45

Project Type	Decommission
Location (endpoints)	Edson Pump Station, AB
Approximate Capacity	10,000 bbl
Description	Above ground storage tank Fixed cone roof

Facilities Specifications – Tank 43

Project Type	Decommission
Location (endpoints)	Edson Pump Station, AB
Approximate Capacity	80,000 bbl
Description	Above ground storage tank Fixed cone roof

NEB F-IR 2.001 - Attachment 50

National Energy Board | Office national de l'énergie

CANADA

ORDER NO. XOM-14-88

IN THE MATTER OF the National Energy Board Act ("the Act") and the Regulations made thereunder; and

IN THE MATTER OF an application, pursuant to Part III of the Act, by Trans Mountain Pipe Line Company Ltd., ("the Applicant"), dated 7 October 1988, respecting certain facilities to be added to its pipeline system; filed with the Board under file No. 1755-T4-29.

B E F O R E the Board on 14 December 1988.

WHEREAS the Board has considered the said application and considers it to be in the public interest to grant the relief requested therein;

IT IS THEREFORE ORDERED THAT pursuant to section 58 of the Act, the projects described in Schedule "A" attached to and forming part of this Order, are exempt from the provisions of sections 30, 31 and 47 of the Act, upon the following condition:

The Applicant shall cause the construction and installation of the projects as set forth in Schedule "A" to be commenced on or before 31 December 1989.

NATIONAL ENERGY BOARD

Louise Meagher
Secretary

SCHEDULE "A"

TRANS MOUNTAIN 1989 SECTION 49 APPLICATION

	Type of Project	Estimated Expenditure	Overrun Allowance	Total
1.0	Trunk and Feeder Lines	725,300	72,530	797,830
2.0	Station Equipment	3,442,400	344,240	3,786,640
3.0	Buildings, Roads & Grounds	1,764,400	176,440	1,940,840
4.0	Tanks	2,890,400	289,040	3,179,440
5.0	Central Pipeline Control & Data Processing System	1,257,000	125,700	1,382,700
6.0	Work Equipment, Safety Equipment & Oil Spill Equipment	955,800	95,580	1,051,380
7.0	Communication System	167,600	16,760	184,360
8.0	Office Furniture & Equipment and Audiovisuals	334,300	33,430	367,730
		$11,537,200	$1,153,720	12,690,920
	Contingencies			250,000
				$12,940,920

SCHEDULE "A"

1989 SECTION 49 APPLICATION

Project Number	Type of Project	TMPL Estimated Expenditure
TRUNK AND FEEDER LINES		
810-812	Three Mainline Cut-outs	210,000
813	Valve Automation, Fraser River	302,000
814	Removal of Valve Assembly, Sumas	83,900
815	Two Valve Bypasses, McLeod River	46,500
816	Mainline Valve Culverts, Blue River	10,900
817-820	Rectifiers and Ground Bed Replacements	72,000
		$725,300
PUMP STATION AND TANK TERMINAL PROJECTS		
Edmonton		
821	Replace Nine Meters	288,500
822	Electrical Service for Tank Mixers	181,000
823	Install 152 mm Meter	104,500
824	Modify Oily Water Pit	87,600
825	Fire Detection System	14,900
826	Portable Electrical Panels	6,300
827	Storage Area Lighting	4,000
828	Fencing	3,200
855	Water Retention Works	164,700
856	Pave Road	55,700
857	Modify Main Gate	22,600
858	Retaining Wall	9,100
859	Lighting and Landscaping	8,300
860	Warehouse Shelving	6,200
861	Fume Hood in Laboratory	5,000
862	Storage Building Door	3,600
896-898	Capital Repairs to Three Tanks	2,202,900
899	Catwalks for Four Tanks	136,600
900	Asphalt Spray on Dykes	55,700
901	Gauge Platforms	41,300
902	Replace Fire Wall Valves	11,200
903	Replace Tank Gauges	9,100
Gainford		
863	Pave Parking Area	10,700
904	Paint Logo on Tank 31	5,300

Edson

829	Facilities For Remote Control	270,300
830	Automatic Proportional Samplers	69,700
831	Control Console	150,800
832	Intruder Alarms	24,800
833	Instrument Enclosures	7,300
834, 864	Fencing	82,900
865	Relocate Main Gate	12,000
866	Upgrade Garage	7,200
867	Scraper Trap Roof	5,000
868	Replace Sidewalks	4,000
905	Paint Logo on Tank 41	10,000

Jasper

835	Instrument Enclosure	3,700
836	Fencing	1,600
837	Modify Scraper Trap Pit	4,200
869	Electric Security Gate	16,000
894	Fireplace Inserts in Houses	7,000
895	Sidewalks	5,000

Blue River PLM

838	Power Distribution Centre	2,100

McMurphy

839	Wedge Meter	65,000

Kamloops

840	Metering System with Prover	1,390,000
841	Booster Pump	222,100
842	Wedge Meters	83,800
843	Scraper Cleaning Facility	26,500
844, 845	Lighting	6,900
846	Annunciator Panel	1,600
870	Garage	29,500
871	Fencing	24,500
872	Upgrade Division Office	18,500
873	Control Room Renovations	20,000
874	Extend Sprinkling System	5,000
875	Retaining Wall	3,500
876	Pavement	3,100
906	Asphalt Spray on Dykes	14,500

Hope PLM

877	Equipment Shed	105,000
878	Fencing	23,000

Sumas

847	Pump Platform	102,300
848	Back-Up Generator	72,400
849	Ground Bed	12,000
879, 881	Fencing	36,000
880	Upgrade Building	19,800

Burnaby

850	Back-Up Generator	152,700
851	Air Compressor	52,000
852	Sampler Probes	9,000
853	Rectifier	5,000
882	Concrete Oil Trap	30,000
883	Security Gate	25,000
884	Security Building	10,000
885	Extend Maintenance Shop	5,000
886	Landscaping	95,300
907	Replace Relief Tank	278,800
908	Two Tank Mixers	30,000
909	Gauge Pole Roof Seals	10,000
910	Tank Bottom Transfer System	81,000

Westridge

854	Control Valve Bypass	15,000
887	Access Road	31,400
888	Upgrade Dock	716,200
889	Increase Berth Depth	97,400
890	Sump Piping	15,000

General

891, 892	Refined Product Sampling Buildings	14,000
893	Fencing	13,800
911	Asphalt Spray	4,000
		$8,097,200

CENTRAL PIPELINE CONTROL AND DATA PROCESSING

912	Replace Leak Detection Computer	171,000
913	Trainer/Simulator Model	252,000
914	Remote Terminal Units	80,000
915	Local Operator Interface System	48,500
916	Control System Software	40,000
917	LOI Console	30,000
918	Leak Detection Enhancements	24,000
919	Data Analyzer	20,000
920	PLC Computer and Printer	10,500
921, 922	Telemetry, Carolin and Valemont	34,600
923, 924	Data Cartridge Recorders	11,800
925	PLC Terminal	8,500
926	Highway Analysis Software	5,400
927	15 Computer Terminals	86,000
928, 929	Multi-User Terminals	81,000
930	Local Area Network Expansion	27,800
931	Expand Memory, MV10000	21,000
932	Desk Top Publishing	15,500
933	Portable Terminal	7,000
934	Two Printers	13,000
935	CAD Workstation	12,300
936	Local-Bus Asynchronous Controller	4,400
937	Back-Up Magnetic Tape System	23,000
938	Accounting Software	80,000
939	Financial Software	26,600
940	Financial Models	30,800
941	Job Evaluation Project	23,500
942	Electronic Office Development	22,000
943	Software for Report Writing	19,500
944	Vehicle Maintenance Software	10,500
945	Business Graphics Software	8,900
946	Sample Analysis Software	4,900
		$1,257,000

WORK EQUIPMENT AND OIL SPILL EQUIPMENT

947,980	Two Fork Lifts	52,600
948	Centrifuge Heater	11,800
949	Portable Heater	6,600
950	Hot Tap Machine	4,500
951, 952	Two Current Calibrators	8,800
953	Pneumatic Test Bench	4,000
954	PD Pump	3,500
955	Chart Recorder	3,000
956, 971	Decade Boxes	5,500
957	Air-Driven Pump	2,700

958	Hy-Press Tool	2,500
959, 960, 973	Four Generator Sets	6,000
961	Chain Hoist	1,500
962	Calibration Kit	1,000
963	Water Pump	1,000
964, 978	Two Backhoes	161,900
965	Heavy Equipment Trailer	56,300
966, 984	Impact Tools	10,300
967	Thickness Tester	6,000
968, 983	Two Line Locators	10,000
969, 981	Hot Water Washers	8,800
970, 975, 992	Three Calibrators	10,000
972, 981	Air Compressors	22,500
974	Radial Arm Saw	1,300
976	Vacuum Pump	1,200
977	Multimeter	1,200
979	Landscaping Tractor	60,000
982	Lathe	6,000
985	Tap and Die Set	1,700
986, 987	Two Drain Down Devices	39,000
988	Temperature, Pressure Recorders	18,800
989	Holiday Detector	2,900
990	Blast Cleaner	4,800
993, 994	Fire Extinguishers	8,000
995	Air Pack	2,000
101	Oil Skimmer	23,100
102	Purchase 21 Vehicles	385,000
		$955,800

COMMUNICATIONS SYSTEM

103	Improve Radio System	77,200
104	Replace 10 Radios	32,700
105	VHF Radio	9,200
106	Communication Cable	3,000
107	Upgrade Office Telephone System	44,000
108	Radio Set for Petro Canada	1,500
		$167,600

OFFICE FURNITURE AND EQUIPMENT

120	Leasehold Improvements	157,500
121	Card Reader Access	24,000
140	Community Outreach Audiovisual	40,000
141	Safety Audiovisual	25,000
	Sundry Items Under $10,000	87,800
		$334,300

NEB F-IR 2.001 - Attachment 51

NATIONAL ENERGY BOARD — CANADA — OFFICE NATIONAL DE L'ÉNERGIE

ORDER NO. OPSO-4-30-71

IN THE MATTER OF the National Energy Board Act and the Regulations made thereunder; and

IN THE MATTER OF an application by Trans Mountain Oil Pipe Line Company for an Order granting leave to open for the transmission of oil certain additional pipe line, being certain additional storage facilities and other works connected therewith, at its existing 'Sumas Tank Farm', situated in parts of the West Half of Section 32, Township 19, Municipality of Sumas, New Westminster District, in the Province of British Columbia, filed with the Board under File No. 12-2-4-S10.

B E F O R E the Board on Thursday, the 30th day of December, 1971.

UPON an application by Trans Mountain Oil Pipe Line Company (hereinafter called "the Applicant"), and upon reading the Affidavit of Alwin Wilbert Samson, Chief Engineer of the Applicant, dated the 13th day of December, 1971, and other submissions of the Applicant, filed; and the Board having issued to the Applicant Order No. OPS-4-34-71, dated the 23rd day of December, 1971, in respect of the additional pipe line respecting which this application is made; and the Board having been satisfied that the said additional storage facilities and other works connected therewith, may safely be opened for the

Copy to A W Samson

... 2

transmission of oil;

IT IS ORDERED THAT leave be and it is hereby granted to the Applicant to open for the transmission of oil the said additional pipe line, being one 150,000 barrel storage tank, designated 'NEW TANK TM # 104', and other works connected therewith, at its existing 'Sumas Tank Farm', situated at the hereinbefore described location, all of which additional pipe line is shown inter alia on Drawing No. B-L-7480R, REV. 12, date stamped '23 DEC 1971', on deposit with the Board under File No. 12-2-4-S10.

NATIONAL ENERGY BOARD

for Robert A. Stead,
Secretary.

PART 7:

TRANS MOUNTAIN FOLLOW-UP RESPONSE TO NEB IR No. 1

NEB F-IR No. 1.80, NEB F-IR No. 1.80 – Attachment 1

Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
NEB Hearing Order OH-001-2014
Follow-Up Response to Information Request from
National Energy Board (NEB)

Engineering

F-IR 1.80 Watercourse Crossing Methods – Horizontal Directional Drill

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering:

i) PDF page 43 of 110
ii) PDF page 46 of 110
iii) CSA Z662-11, Clause 6.2.11

Preamble:

Reference i) states that:

- extensive geotechnical investigations are required to determine the feasibility of using horizontal directional drilling at selected water course crossings;
- bored crossings may be used in some instances and are typically limited to 100 m in length;
- a contingency isolated or open cut crossing method would be developed for use if the horizontal directional drilling method is determined to be not feasible, or if it is unsuccessful;
- micro-tunnelling will be considered for watercourse crossings where a horizontal directional drilling crossing is not feasible, and where fisheries and other considerations preclude a trenched crossing; and
- tunnelling and aerial crossings are also discussed briefly in the Project application, although no locations have been identified for their use. Trans Mountain stated that the need for tunnels would be determined during the detailed engineering and design phase.

Reference ii) states that 84 watercourse crossings were evaluated for the technical feasibility of using horizontal directional drilling. It also states that one or two boreholes were drilled where permits were received, and that geophysical surveys were completed for about half of the crossings evaluated. Horizontal directional drilling feasibility assessments will be submitted in the second quarter of 2014 and additional geotechnical and geophysical investigations will be carried out during the detailed engineering and design phase. Trans Mountain submits that early assessments indicate that the horizontal directional drilling crossing technique may be feasible for 21 major watercourses.

Reference iii) establishes the requirements for installing piping with horizontal directional drilling.

Request:

Please provide:

a) an indication of whether tunnelling and aerial crossings are currently being considered and, if so, at what locations;

b) a preliminary feasibility report for each proposed horizontal directional drilling crossing detailing the assessment that was completed to determine that horizontal directional drilling could be successfully completed;

c) a description of the contingency plan to be followed at each crossing if the horizontal directional drilling is not successful;

d) a horizontal directional drilling execution plan according to Reference iii); and

e) an indication of when final horizontal directional drilling technical feasibility studies will be available for all crossings where horizontal directional drilling would be attempted.

Response:

a) Tunnelling and aerial crossings for watercourse crossings are currently not being considered.

b) Trans Mountain will provide to the NEB feasibility reports for the horizontal directional drill (HDD) of five watercourse crossings by June 16, 2014.

c) Trans Mountain will provide to the NEB a contingency plan for each watercourse crossing where an HDD will be attempted, along with the feasibility reports referenced in NEB IR No. 1.80b, by June 16, 2014.

d) During the detailed engineering and design phase, Trans Mountain will develop a horizontal direction drill specification and provide it to the NEB by September 30, 2014. An HDD execution plan is generally crossing specific and will not be available until just prior to construction of the crossing.

e) Trans Mountain plans to undertake field geotechnical investigations in summer/fall 2014 for the remaining 16 of 21 watercourse crossings where horizontal direction drills (HDDs) are currently being contemplated. The feasibility reports for watercourse crossings determined to be feasible using HDD will be provided to the NEB as they are completed, with the final one to be submitted prior to the end of Q1 2015.

   Trans Mountain may identify additional watercourse crossings during the detailed engineering and design phase of the Project that will be installed using trenchless methods. In those cases, the feasibility reports will be completed and provided to the NEB 60 days prior to the commencement of construction of each crossing.

Summary of New Commitments:

- Trans Mountain will provide to the NEB feasibility reports for the horizontal directional drill of five watercourse crossings, by June 16, 2014.
- Trans Mountain will provide to the NEB a contingency plan for each watercourse crossing where a horizontal directional drill will be attempted, along with the feasibility reports referenced in NEB IR No. 1.80b, by June 16, 2014.
- During the detailed engineering and design phase, Trans Mountain will develop a horizontal direction drill specification and provide it to the NEB by September 30, 2014.
- Trans Mountain will provide to the NEB feasibility reports for the remaining 16 of 21 watercourse crossings where horizontal directional drills are currently being contemplated as they are completed, with final one to be submitted prior to the end of Q1 2015.
- Trans Mountain may identify additional watercourse crossings during the detailed engineering and design phase of the Project that will be installed using trenchless methods. In those cases, the feasibility reports will be completed and provided to the NEB 60 days prior to the commencement of construction of each crossing.

Commitment Response:

Please refer to NEB F-IR 1.80 - Attachment 1 for a draft horizontal directional drill specification. This specification will be further refined during the detailed engineering and design phase of the Project.

NEB F-IR No. 1.80 – Attachment 1

KINDER MORGAN CANADA INC.

TRANS MOUNTAIN PIPELINE L.P.
EXPANSION PROJECT SPECIFICATION

HORIZONTAL DIRECTIONAL DRILL CONSTRUCTION SPECIFICATION

TMEP-MP3121, Revision B, September 2, 2014

REVISION INDEX					
Rev No.	Prepared by/ Date	Reviewed by/ Date	Approved by/ Date	Pages Revised	Remarks
A	Peter Liang 2014-08-22	J. Murphy B. Osorio, J. Fry R. Fletcher 2014-08-27			Issued for Review
B	R. Fletcher 2014-09-02	G. Toth, A. Dmitrienko 2014-09-02		1,3,6	Issued for Review

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1. GENERAL

This HDD specification is directed primarily to the technical requirements necessary to the planning, execution, and clean-up for HDD pipeline crossings in support of the TMEP. This specification shall be considered complementary to all other contract requirements including general conditions, special conditions, and environmental and safety requirements. While referenced in the specification, Environmental requirements will be in accordance with all requirements identified in the Environmental Protection Plan, and in particular the requirements of the Drilling Mud Release Contingency Plan, Section 3, Appendix B.

The Contractor shall use this Specification for Horizontal Directional Drill (HDD) crossings that have a specific design drawing and have been approved by the Owner. The Contractor shall choose the appropriate equipment to complete the Work according to this Specification, site conditions, geotechnical information of the area, and environmental requirements for the Work.

Contractor shall complete the Work in accordance the requirements of the Contractor-submitted and the Owner-approved HDD Work plan procedure and schedule (WPPS), the contract documents and any applicable codes, standards and regulations related to the material, equipment and personnel.

Contractor shall control and manage all surface runoff from the worksite to ensure any deleterious substances are not deposited on surrounding land. Silt fence, berms, or other measures shall be taken to ensure controlled migration of water, drilling fluid, or other fluids.

The Owner and/or the Owner's representative shall have access to the equipment and documentation of Contractor at all times.

At the completion of the drill, Contractor shall remove all materials such as rig anchoring system, sandbags, gravel, geotextile and any other materials from the site

2. TERMS CONTAINED IN THIS SPECIFICATION

2.1 Glossary

2.1.1 Table 1 defines the terms used in this specification.

TABLE 1: GLOSSARY

Term	Definition
Authorities having jurisdiction	Federal or provincial regulatory bodies that are enacted to regulate those activities that occur on the project site.
Azimuth	The angle at which the downhole probe is projecting in the horizontal plane at a particular downhole survey point (magnetic north corresponds to zero degrees).
Contractor	An entity providing specific services under a contract.
Inspection	The observation and recording of HDD equipment, personnel and activities, and their adherence to the specifications and good drilling practices.
Joint	One section of drill pipe (typically between 8 and 10 m in length.)
Legislative requirements	All applicable treaties, acts, statutory instruments, regulations, codes of practice, permits, in effect or as amended from time to time at the field installation location(s) of the project.
may	Signifies a required task or action is optional and other choices are available.
Owner	Kinder Morgan Canada Inc. (KMC)
Owner’s representative	Agents or representatives for KMC including its engineering agencies, inspectors, and other authorized representatives.
Product pipe	The piping to be permanently installed for the project.
shall	Signifies a mandatory requirement.
Station	The horizontal position of a downhole survey measured from an established horizontal control system.
will	Signifies a required task or action is mandatory.

2.2 Acronyms and Abbreviations

2.2.1 Table 2 contains acronyms and abbreviations used in this specification.

TABLE 2: ACRONYMS AND ABBREVIATIONS

Term	Meaning
%	percent
API	American Petroleum Institute
CSA	Canadian Standards Association
DFDP	drilling fluid disposal plan
DFMP	drilling fluids management plan
DFO	Department of Fisheries and Oceans Canada
HDD	horizontal directional drilling
in.	inch, inches
m	metres
mm	millimetres
MSDS	material safety data sheet
NPS	nominal pipe size
SARA	Species at Risk Act
this specification	this Horizontal Directional Drill Construction Specification
WHMIS	Workplace Hazardous Material Information System
WPPS	Work plan procedure and schedule

3. APPLICABLE REGULATIONS, CODES, SPECIFICATIONS, STANDARDS AND ENVIRONMENTAL PROTECTION

3.2 Regulations, Codes, Specifications and Standards

3.2.1

All Work completed shall comply with the requirements of the Contractor submitted and Owner approved Work plan procedure and schedule, this specification, the contract documents and any applicable codes, standards and regulations related to the material, equipment and personnel.

3.2.2

The Work shall be carried out in strict accordance with, but not be limited to, the requirements of the following Acts, Standards and Regulations:

a Drilling Waste Management (Directive 050)

b. Department of Fisheries and Oceans (DFO) Fisheries Act

c. Transport Canada Navigable Waters Protection Act

d. Species at Risk Act (SARA)

e. CSA Z662-11 Oil and Gas Pipeline Systems

f. CSA Z245.1-07 (R2012) Steel Pipe

3.2.3

The Work shall be done in accordance with the contract documents and agreements, including subsequent addendums.

3.3 Environmental Protection and Monitoring

3.3.1

The Owner is committed to minimizing effects of project Work on the environment during construction. The Contractor is advised that special attention and focus shall be directed on all construction activities to ensure complete implementation and enforcement of environmental requirements. Pipeline construction shall be in strict accordance with all applicable federal and provincial acts and regulations and project environmental protection plans. Contractor's Work Plan, Procedure and Schedule (WPPS), to be submitted per Section 4 of the specification, shall address all operating practices and procedures related to HDD operations including all environmental concerns and mitigation procedures related to equipment refueling, spill containment and general handling practices for all hazardous substances.

3.3.2

Contractor shall be responsible to provide personnel to inspect the surface area around the drill path to ensure fluid migrations to the surface are immediately discovered and fracture containment procedures, as required in Section 4.2, are immediately enacted. These inspections shall be carried out on an ongoing basis during drilling and pipe installation process (minimum of every four (4) hours), and recorded on the daily records.

3.3.3

The Contractor shall monitor fluid volume levels within the drilling system and shall identify when a loss of fluid has occurred. If a fluid loss is detected, the Contractor shall halt operations immediately and conduct a detailed examination of the drill path. If no surface/waterbody migration is evident, the Contractor may resume operations at the approval of the Owner while monitoring fluid volume, pressure, and surface at a higher frequency rate.

3.3.4

Water monitoring shall be performed by the Owner. Water samples will be taken at locations up and down stream of the drill path prior to, during and after drilling activities as required by the Owner. If water turbidity levels increase for unknown reasons, the Contractor will stop drilling and enact the containment procedures of the Fracture Management Plan (clause 4.6.1).

3.3.5
All approvals, water sampling protocol, emergency response plans, and notifications will be kept onsite, in the doghouse or job trailer, and must be available to all personnel.

3.3.6
The Contractor shall maintain at least the following equipment and supplies in sufficient quantities on site:

a. sandbags
b. straw bales
c. geotextiles
d. plastic sheets
e. generators
f. boats
g. backhoes
h. absorbent booms
j. two or more operational trash pumps with sufficient lengths of leak free vacuum hose and suction heads to contain and clean up potential fluid spills

3.4 Permits and Licences

3.4.1
The Contractor shall procure required permits and licences that are not provided by the Owner in accordance with the contract documents. The Contractor shall become familiar with all permits or licences procured by the Owner and all laws, ordinances, and regulations relating to the Work and shall comply with all the requirements pertaining to the Work. The Contractor shall cooperate with Owner to ensure that all permits are obtained in a timely fashion to ensure the schedule is not affected.

3.4.2
Before beginning the Work, the Contractor shall confirm that all necessary permits and licenses are in place and on site before mobilization, regardless of whether the Contractor or the Owner is obtaining the permits.

3.4.3
The following approval documents will be acquired by Owner:

a. DFO crossing permit
b. Navigable Water permit (Transport Canada)
c. Environment notification under the Government of Alberta Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body and Code of Practice for Watercourse Crossings

d. Crossing agreements for foreign appurtenances, including notification requirements

e. Access routes to all of the following:
   i. Rights-of-Way (ROWs)
   ii. work sites
   iii. staging areas
   iv. water withdrawal sites
   v. fluid disposal areas

f. Temporary work space use

g. Clearing of main work areas or extra workspace

h. Access to inadvertent fluid release locations

i. Water withdrawal

j. Drill fluid disposal or land spreading

3.4.4

The following approval documents will be acquired by Contractor:

a. Landowner notifications, as per Line List requirements
b. Notification of appropriate authorities and licensees, if required by code of practice requirements, before commencement of crossing construction and before withdrawing water.
c. Any other permits, approvals and notifications required to conduct the Work.

3.5 Safety

3.5.1

At a minimum, the Contractor shall comply with the KMC Safety Manual for Mainline Construction and the authorities having jurisdiction. The Contractor shall submit additional safety requirements specific to directional drilling Work as part of the WPPS.

3.6 Pre-Construction

3.6.1

Prior to the start of any construction, the Contractor shall submit for Owner review and approval the documents listed in Table 3 of Section 4.1.1

4. PLANNING REQUIREMENTS

4.1 General

4.1.1

Table 3 outlines the schedule for submittals during the pre-construction phase of the project.

TABLE 3: PRE-CONSTRUCTION SUBMITTALS SCHEDULE

Document	Timing
Work plan procedure and schedule	One month before start of construction
Drilling fluid management plan	One month before start of construction
Contingency plan for inadvertent fluid returns	One month before start of construction
Drilling fluid disposal plan	One week before start of construction

4.1.2

The following plans shall be submitted by the Contractor with the tender:

a. a preliminary work plan, procedure and schedule
b. a preliminary drilling fluid management plan
c. a preliminary contingency plan for inadvertent fluid returns or loss
d. a preliminary buoyancy control plan (if required)

4.2 Work Plan, Procedure and Schedule

4.2.1

The Contractor shall submit a detailed WPPS a minimum of one month before the construction of any crossing.

4.2.2

The Owner shall approve the WPPS before construction. This approval is required before any drilling or excavation takes place.

4.2.3

The WPPS shall include the following items as a minimum:

a. A drawing of the drill site layout including:
   i. drill rig location
   ii. material stockpile areas
   iii. drilling mud containment sumps (if required)
   iv. hazardous material storage
   v. access requirements (Owner supplied)
   vi. temporary work space (Owner supplied)
   vii. temporary staging areas (Owner supplied)

If the Contractor proposes a different HDD design to that contained in Owner’s tender documents, then that design and the annular pressure curves shall be submitted at time of tender.

b. a safety program for protection of the Contractor’s and the Owner’s personnel, including any third party personnel
c. an environmental emergency response plan that, as a minimum, will include procedures for handling the following:
   i. potential erosion concerns (if required)
   ii. inadvertent release of drilling fluid both on land and in a watercourse

iii. spills involving hazardous fluid such as diesel fuel, gasoline, and lubricants

d. a description of the proposed surface tracking system and the drilling guidance system for the crossings, which includes the following information:
   i. the expected accuracy of the downhole guidance system
   ii. a description of external factors that could affect the accuracy of the proposed guidance system
   iii. the contingency measures in the event that inaccuracies with the guidance system are detected
e. the calculation of the maximum pull force and the maximum stress that will be exerted on the pipe as a result of the proposed radius of curvature and the length of pipe to be pulled
f. the type and composition of drilling fluid complete with alternatives to be used with Workplace Hazardous Materials Information System (WHMIS) data sheets and material safety data sheets (MSDSs) or both, where applicable
g. a description of the potential for drilling fluid loss because of the following situations, including containment and clean up method proposed:
   i. inadvertent returns to the surface
   ii. mud displacement during the pipe section pull
   iii. special procedures required for winter construction.
h. pilot hole details including size, type of bit or mud motor, drill fluid flow rate, and approximate drilling rate
i. reaming process details, including the type and diameter of reaming tools, reaming procedure, number of passes, and fluid flow rate
j. procedures for a cleaning or swabbing pass
k. a description of pipe section pull through procedure including:
   i. pipe section hook up arrangement
   ii. buoyancy control system proposed (if required)
   iii. pull force monitor
   iv. recognition when pipe section is stuck
l. a post–pull product line inspection plan that includes specific actions to be taken in the event that the installed pipe fails the post installation inspection
m. a list of proposed subcontractors, if any
n. a contingency plan to be employed in the event of the following scenarios:

   i. breakage of drill string or other component of the drill string during pilot hole drilling or reaming phases of the drill
   ii. drilling equipment or the product pipe becomes stuck in the hole
   iii. the hole collapses during pipe pull
   iv. misalignment during drilling of pilot hole

o. résumés of key individuals proposed for the Work and a project organizational chart

p. a detailed horizontal bar chart that outlines each scheduled activity in the order that it is performed and the proposed start and completion dates

q. entrance and exit angles shown on the drawings

r. procedures implemented to maintain mud flow and water supply during the winter

s. details of a buoyancy control system, which may be required during pullback to minimize pull requirements, pipe stresses and coating damages. If buoyancy control is required, the Contractor shall:
   i. include the methods to be used as part of the WPPS
   ii. supply all equipment and materials required to implement the buoyancy control plan
   iii. be responsible for any damage to the pull section resulting from the buoyancy implementation

t. a list of equipment that shall include the following items:
   i. drill rig, drill pipe, drill bits, reamers and all associated buildings, pumps and gensets
   ii. an equipment list and plan for lighting of the site during night operation
   iii. proposed steering equipment including the frequency of location checks and a coil layout plan
   iv. a solids control system, including a description of equipment such as mud pumps, shale shakers, de-sanders, centrifuges and the normal flow rate for this equipment

u. supplement steering monitoring device (e.g., Tru-Tracker, Para-Trak or equivalent) including potential steering interference concerns (if any)

v. a casing plan (if required), which includes the details for following items:
   i. methods of installation and removal including sealing
   ii. the length and diameter of casing
   iii. the installation angle and proposed depth of casing
   iv. details of the centralizer conductor required to ensure the pilot hole is centred in the borehole and optimal weight on the bit

v. any additional pipe protection measures if the casing is in place during the product pipeline pull

w. a site restoration plan

4.3 Drilling Fluids Management Plan

4.3.1

The Contractor shall prepare and submit to the Owner a drilling fluids management plan (DFMP) along with the WPPS. The DFMP shall be written so that it meets the requirements of the project environmental protection plan. At a minimum, the DFMP shall provide the following information about the drilling fluid:

a. type of drilling fluid to be used
b. type of any proposed drill fluid additives
c. MSDS for all fluids and additives
d. proposed flow rates matched with recycling capability
e. proposed test and test schedule for fluid such fluid density, viscosity and sand content
f. proposed ranges of fluid properties such as fluid density, viscosity and sand content
g. proposed primary and alternate fresh water sources
h. proposed tests to be conducted on the water and the testing schedule
i. method of mixing fluid and water, and storage requirements
j. method of slurry containment (trucking, pits, tanks)
k. method of monitoring drill fluid pressures (i.e., annular pressure, maximum anticipated pressures)
l. methods to be employed to manage high drill fluid pressures
m. supplying a minimum of three (3) types of material for plugging fractures in the formation being drilled, in suitable quantities for three (3) occurrences.

4.4 Contingency Plan for Inadvertent Fluid Returns

4.4.1

At least one month before the start of construction of a crossing, the Contractor shall prepare and submit for Owner approval a written contingency plan for inadvertent fluid returns at that crossing. This contingency plan shall be written to meet any requirements of the project environmental protection plan. At a minimum, the following information shall be provided:

a. a description of the annular pressure tool
b. a range of fluid pressure changes indicative of a potential inadvertent fluid return to the surface

c. monitoring procedures along and adjacent to the drill path, both onshore and in stream if applicable
d. communication methods between monitoring personnel and the rig operator
e. communication procedures for communication between the HDD Contractor, the Owner, and authorities having jurisdiction
f. decision points and procedures for suspending drill operations
g. containment methods
h. cleanup methods
i. downhole plugging agents
j. methods and procedures for implementation of the downhole plugging agents
k. a list of emergency response equipment

4.5 Drilling Fluid Disposal Plan

4.5.1

The Contractor shall submit a drilling fluid disposal plan (DFDP) for Owner approval at least one week before the start of construction. Disposal of drilling fluids shall comply with all relevant environmental regulations, landowner or tenant agreements, ROW and workspace agreements, and permit requirements, and in accordance with the drilling waste management plan supplied by the Contractor. The DFDP shall include, but not be limited to, the following:

a. test results demonstrating the complete composition of the drilling waste, including the relative quantities of water, bentonite, and other sediments and drill cuttings, as well as any additives mixed during drilling
b. methods for the containment and disposal of drilling fluids in accordance with the project environmental protection plan.
c. the estimated volume of drilling fluid and spoil to be disposed of and the approximate timing of the schedule for the material to be disposed
d. methods of disposal and transporting off site of drilling fluids and spoils

4.5.2

The owner or his representative will arrange for a disposal site and for disposal approvals from the landowner, tenant, or the authority having jurisdiction over the disposal site.

4.5.3

The Contractor shall immediately notify the Owner in writing of any requested change to the approved DFDP.

4.6 Fracture Management Plan

4.6.1

The Contractor shall submit a Fracture Management Plan for Owner approval at least one week before the start of construction. This plan shall include, but not be limited to, the following:

a. drilling fluid pressures
b. fluid volume
c. fluid parameters

5. SPECIFICATION OF RESPONSIBILITIES

5.1 Horizontal Directional Drilling Contractor

5.1.1

Before any work on site begins, all workers shall attend a project orientation to be provided by the Contractor in accordance with the contract documents. The Contractor shall ensure that all construction workers engaged on this Work completely understand the commitments and restrictions associated with the drilling specifications and understand that they must comply with these requirements.

5.1.2

The Contractor shall prepare a comprehensive WPPS (see Section 4.2). The WPPS shall provide assurance to the Owner and authorities having jurisdiction that all reasonable measures will be taken to protect the environment.

5.1.3

The Contractor shall conduct the Work in accordance with this specification, the WPPS and the contract documents.

5.1.4

Construction warning signs shall be provided in accordance with the contract documents. The warning signs shall be installed by the Contractor a minimum of 100 m upstream and 100 m downstream of the work site to warn boaters of pipeline construction activities in the case of a water crossing and on each side of a highway or other non water crossing. Activities shall be confined to workspace and access approved by the Owner.

5.1.5

Any changes proposed by the Contractor to the pilot hole design or the number and diameter of the reaming passes identified in the WPPS shall be approved in writing by the Owner before being implemented.

5.1.6

The Contractor shall provide the Owner with copies of all correspondence pertaining to environmental conditions including copies of permits or licences pertaining to the sites before commencing Work.

5.1.7
The Contractor shall be responsible for securing, transporting, storing and disposing all water required for drilling and hydrostatic testing.

5.1.8
The Contractor shall be responsible for the handling and disposal of all drilling fluid and cuttings used in the complete installation of the product pipe, including all vacuum truck rentals.

5.1.9
If the HDD Scope of Work includes all civil and pipe related activities, then the Contractor shall provide:

a. all weather access to the entry and exit points
b. all support required by the HDD Contractor to meet its drilling and product pipe pulling requirements
c. the properly prepared product pipe that has been welded, inspected, coated, pre-tested and approved for installation in accordance with the project construction specifications and procedures

5.2 The Owner

5.2.1
Will provide the Contractor with crossing design drawings and survey information including benchmarks to assist with the installation of the crossings.

5.2.2
Will provide information about the anticipated subsurface conditions as described by the borehole data and the geotechnical reports. The borehole data describes the actual location sampled. Extrapolation of these data to areas beyond the provided borings is at the sole discretion and responsibility of the Contractor. The Owner does not guarantee the extrapolated results to be accurate. The Contractor shall use previous experience and judgment in interpreting the provided data to prepare the proposal and install the crossing.

5.2.3
Shall provide the HDD contractor with an approved location for disposal of all drilling fluid from the project.

5.2.4
If so specified in the contract documents the Owner, through the designated mainline pipeline Contractor, will provide:

a. all weather access to the entry and exit points
b. support and equipment (ie. cranes, side booms, rollers, etc) required by the HDD Contractor to meet its drilling and product pipe pulling requirements

c. the properly prepared product pipe that has been welded, inspected, coated, pre-tested and approved for installation in accordance with the project construction specifications and procedures.

6. SPECIFICATIONS FOR SITE SURVEY AND DATA REVIEW

6.1 General

6.1.1

The Contractor shall review the drawings and geotechnical report data provided.

6.1.2

The Contractor may conduct, at its own expense, further drilling, survey work or both to obtain additional surface or subsurface information, as deemed necessary by the Contractor. All drilling and survey work shall comply with the requirements of authorities having jurisdiction over the area. Contractor shall provide Owner with sufficient advance notice to allow Owner to perform any necessary investigations and acquire permits and approvals.

6.1.3

The Contractor shall survey the drill site and alignment to accurately establish the drill entry point, the azimuth of the holes to be drilled and the drill exit locations in accordance with the drawings. The Owner or his representative will have access to all equipment, instruments, information and readings as required during construction. The Contractor will provide assistance converting data to force and torque units.

6.1.4

The Contractor shall maintain all benchmarks, survey monuments and other positioning stations. The Contractor shall complete a surface survey of their steering coil to within a tolerance of 150 mm.

6.1.5

The Contractor shall inspect the crossing sites before mobilization and perform the site preparation necessary to create a safe and unobstructed Work environment. If the contract documents specify site preparation as supplied by others then the Contractor shall advise if any additional preparation is required to accommodate equipment and personnel to ensure safe and expeditious completion of a crossing and to ensure accurate location of the drill bit at all times.

6.1.6

The following pre-construction information shall be recorded before the pilot hole is started.

a. the distance from the drilling bit to the downhole probe’s inclination sensors (bit to probe distance)

b. the distance from the rigs pipe break out point to the entry point (rig setback)

c. the length of the bottom hole assembly including motor, orienting sub, and non-magnetic pipe

7. SPECIFICATION FOR MOBILIZATION

7.1 General

7.1.1

Mobilization for the Work covered by this specification shall include the transportation of all equipment, materials and personnel to the work site to perform the Work. Mobilization shall include, but is not limited to, the following:

a. an initial site survey

b. drilling equipment setup (all equipment shall be washed in accordance with the contract documents before acceptance at the site)

c. the delivery of drilling equipment and materials to the site

d. the procurement of all permits and licences other than those specifically identified as being obtained by the Owner

e. mobilization shall not be considered complete until the drilling rig has been completely staffed, rigged up, in position at the work site and ready to drill

8. SPECIFICATION FOR MATERIALS RELATED TO DIRECTIONAL DRILLING

8.1 General

8.1.1

Before beginning its Work, the Contractor shall demonstrate to the Owner representative that all drill pipe, crossover subs, hole openers, bit, mud motors and any downhole tools to be used are suitably designed for the Work and have been inspected to API RP7G or DS-1™ for the appropriate category of drill or new pipe. The inspection needs to have taken place within three months of the start of drilling or the Contractor presents the history of the drill string since the most recent inspection.

8.1.2

Manual breaking of drill pipe on the exit side of the hole will not be permitted on the project. Powered tongs or wrenches are required as a minimum.

8.1.3

The Contractor shall use as a minimum 140 mm (5.5 in.) American Petroleum Institute (API) White Band Grade G drill pipe for drilling, reaming or pullback operations for all HDD crossings. The Contractor shall be responsible for providing drill pipe that is adequately sized for the project. The Contractor is also required to provide a drill string management plan that demonstrates that individual drill pipe joints are rotated through the drill string from highly stressed locations (such as near the reamer) to less stressed locations in the drill string. In addition, a suitable transition from reamer to normal drill pipe shall be used.

8.1.4
For casing installation, multiple sizes of casing may be required to reach the required depth and embedment into bedrock. The Contractor shall provide the Owner representative with appropriate documentation on casing pipe specifications including grade and wall thickness. The final casing pipe size shall be a minimum of 150 mm larger than the final ream size.

8.1.5
The Contractor shall furnish both a pulling head and a swivel complete with shackles and connections rated at the drilling rig capacity plus a minimum of 25%. Confirmation of this rating shall be provided to the Owner representative before use.

9. SPECIFICATION FOR CASING

9.1 General

9.1.1
Casing if required at entry, exit or both, shall be installed in accordance with the submitted WPPS.

9.1.2
Casing shall be installed into a competent formation that will enable the drill to proceed with no loss of fluid at this interface. All casing shall be sealed into bedrock or other solid formation so that fluid is not released below the casing. The casing shall be tested for a proper seal in competent bedrock or other solid material.

9.1.3
The casing shall be sized adequately to ensure the final reaming pass and pipeline pullback is completed with the casing in place and with no damage to the product pipe. All casing pipe shall be removed before demobilization and after pipe pullback.

10. SPECIFICATION FOR EQUIPMENT

10.1 General

10.1.1
The Contractor shall use a drilling rig capable of exceeding the amount of push and pull force required by the design calculations by a factor of approximately 1.5 to provide pullback of the product line.

10.1.2
The minimum push/pull drill rig required shall be indicated on the engineered crossing design drawing.

10.1.3
The Contractor shall provide the required drill rig anchoring system to safely resist all applied loads during drilling, reaming and pullback of the product pipe.

10.1.4
The Contractor may supply a hammer with an adapter head capable of installing and extracting the casing. The Contractor shall provide the hammer specification to the Owner, two weeks before the project start.

11. HORIZONTAL DIRECTIONAL DRILLING PROCEDURE

11.1 General

11.1.1
The Contractor shall ensure that all HDD operations are performed with supervisors and construction personnel thoroughly experienced in HDD and according to the conditions that will be encountered at a crossing. The Contractor shall provide all required drilling support, including drilling tool suppliers, survey systems, mud cleaning, mud disposal, and other required support systems used during the drilling operation. The Contractor shall ensure that the noise levels from the operating machinery meet all of the local codes regarding noise restrictions.

11.2 Pipeline Preparation

11.2.1
The product pipeline will be assembled on site in accordance with either Section5.1.9c or 5.2.4c and placed on rollers or on material that will protect the pipeline and readied for the pullback.

11.2.2
The Owner will inspect the pipe and any required repairs before the pull section enters the ground. The Contractor shall ensure the Owner has approved the product pipe in writing before the start of the pullback.

11.3 Instrumentation

11.3.1
The Contractor shall provide and maintain instrumentation that will accurately monitor (at a minimum) tank pit volume, mud flow (pump and return), pressure (annular/standpipe), rate of penetration, push/pull force, rotary torque, and rotational speed. The electronic information shall be accessible to the Owner representative onsite and will form part of the records required

at the end of the project. Online access shall be provided to the Owner or his representative.

11.3.2
The inspector shall have access to the Contractor's downhole survey and surface tracking data at all times.

11.3.3
The Contractor shall use an Owner approved surface tracking system (for example, Para Trak ll or equivalent) and an approved downhole steering system. The Contractor shall provide technicians and directional drillers experienced in the operation of the above equipment. The Contractor shall also provide sufficient spares for the above equipment to maintain directional capability at all times.

11.3.4
The Contractor shall monitor the position of the drill string with the downhole survey instruments and compute the position in the X , Y and Z axes relative to ground surface at a minimum of once per drill pipe length (approximately 9.5 m intervals).

11.3.5
The Contractor shall maintain and provide to Owner representative, upon request, the data generated by the downhole survey tools in a form suitable for independent calculation of the pilot hole profile. The tabulation of coordinates shall be referenced to the drilled entry point and shall accurately describe the location of the pilot hole.

11.4 Drilling Fluid

11.4.1
The Contractor shall supply a DFMP at the same time as the WPPS (see Section 4.3).

11.4.2
The Contractor shall provide a detailed mud plan from a qualified mud engineer. The mud engineer shall be available to monitor the drilling fluid parameters during the course of the drill and provide updated recommendations as required.

11.4.3
The drilling fluid or fluid composition shall be a mixture of fresh water and bentonite as recommended by the mud engineer. The use of any additives shall be subject to Owner approval. The frequency and the type of testing of the drilling fluid required to maintain drilling fluid properties shall be as recommended by the mud engineer. As a minimum, the mixing procedure will include regular testing and documenting of the mud's weight, viscosity

and sand content. This data shall be supplied to the Owner representative at a minimum on a daily basis.

11.4.4
The Contractor will be responsible for any fresh water testing to ensure its acceptability.

11.4.5
The MSDS on all drilling fluids and additives proposed for use shall be submitted to the Owner's representative for approval before drilling starts. No fluid shall be approved or used that does not comply with permit requirements and environmental regulations.

11.4.6
The Contractor shall obtain, transport, and store drilling fluids unless otherwise specified.

11.4.7
The Contractor shall properly contain all drilling fluids during the drilling operation.

11.4.8
Excess drilling fluid slurry shall be contained in a lined pit or containment area at exit and entry points until recycled or removed from the site. Entrance and exit pits should be of sufficient size to contain the expected return of drilling fluid and spoils.

11.4.9
Disposal of drilling fluids shall be conducted in compliance with all relevant environmental regulations, landowner or tenant agreements, ROW and workspace agreements, and permit requirements, and in accordance with the drilling waste management plan.

11.4.9.1 Recirculation

a. The Contractor shall maximize recirculation of drilling fluid returns.
b. The Contractor shall provide solids control and fluid cleaning equipment of a configuration and capacity that can process surface returns and produce drilling fluid suitable for reuse.
c. The drilling spoils are to be kept in as dry a form as possible for local mixing and burial or spreading, if permits allow, or for disposal at an approved location.

11.4.9.2 Drilling Fluid Loss

a. The Contractor shall endeavour to maintain full annular circulation of drilling fluids. Drilling fluid returns at locations other than the entry and exit points shall be minimized.

b. Key Contractor and inspection personnel shall review and be knowledgeable with the contingency plan for inadvertent fluid returns before the drilling activity starts.

c. The Contractor shall monitor drilling parameters for loss of circulation indicators. Monitoring shall include the following as a minimum:

   i. The Contractor will continually monitor the amount of fluid return to the fluid pit tank and the amount of make-up drilling fluid required in the mixing tanks during the drilling of the pilot hole and hole opening (reaming). The Contractor is responsible for reporting to the Owner's site representative any loss of circulation and for allowing additional monitoring to be carried out as required.

   ii. The Contractor will monitor the annular pressure of the drilling operation with appropriate downhole tooling to recognize if there is any drop in pressure possibly attributed to a loss of circulation or increase in pressure indicative of a blockage of the fluid return annular space.

   iii. The Owner's representative may carry out other drilling fluid monitoring activities related to inadvertent fluid returns including any in stream monitoring.

   iv. The Contractor shall provide full access and assistance in any monitoring performed by the Owner representative.

11.4.9.3 Site Restoration

a. The Contractor is responsible for general cleanup of the drill sites and cleaning and backfilling of all pits and sumps.

b. Upon approval of the product pipe after the successful pull, the Contractor shall remove all equipment, materials (such as fencing, gates, pit liners, and fill), and waste material from the sites. The owner's representative shall obtain the necessary permits for the disposal of waste materials and shall dispose of waste material at approved disposal sites only.

12. SPECIFICATION FOR PILOT HOLES

12.1 Design Drill Path

12.1.1

The Contractor shall ensure the HDD path of the installation is completed within the tolerances stated in this specification.

12.1.1.1 Directional Tolerance

a. The Contractor shall ensure that at any point during the drill the pilot hole is located within ±2 m in every orientation of the submitted and approved design.

b. The Contractor shall ensure that curves are drilled within the following tolerances.

   i. A single joint radius is as specified on the issued for construction (IFC) drawings.

   ii. A three joint radius is as specified on the IFC drawings (calculated over any three joints).

c. The Contractor shall notify the Owner’s representative if the drill ventures outside the tolerances mentioned above and shall provide a plan on how to steer back to the design drill path.

d. The Contractor shall ensure that drilling avoids adjacent utilities and structures. Furthermore, the Contractor shall be responsible for safe operations and any damage to adjacent utilities and structures.

e. Any conflicts between the noted tolerances and adjacent utilities or structures shall be brought immediately to the Owner’s representative’s attention.

12.1.1.2 Entry and Exit Locations

a. The pilot hole shall enter the ground surface at the location staked.

b. Entry and exit angles shall conform to the submitted design drawings.

c. The pilot hole shall exit the ground surface within ±2 m of the alignment shown on the approved design drawings but not less than 2 m from a ROW boundary.

d. If the pilot hole does not meet the tolerances mentioned in Clause 12.1.1.2, subsections (a) through (c) of this specification, the deviations shall be subject to approval by the Owner’s representative. If rejected, the options shall be discussed between the parties (including authorities having jurisdiction if necessary) and a new course of action determined. If necessary, the Contractor will revise its WPPS, which will require written approval from the Owner’s representative before being implemented.

13. SPECIFICATIONS FOR REAMING AND HOLE OPENING OPERATIONS

13.1 General

13.1.1

The Contractor shall review the number of hole opening and reaming passes based on drilling information from the pilot hole operation and the Contractor's own expertise. The Owner's representative shall approve any proposed changes by the Contractor to the number and diameter of opening or reaming passes identified in the WPPS before implementation. Upon completion of the last opening or reaming pass, the Contractor, in cooperation with the inspector, shall assess the hole to determine whether the carrier pipe should be pulled or a swabbing pass should be run. The swabbing pass removes any cuttings from the bore. The Owner representative may request additional swab passes. When swabbing passes are complete to the satisfaction of the Owner representative, the pullback operation can begin.

13.1.2

The reamed hole shall have a final reamed diameter of 1219 mm (48 in.) for the NPS 36 pipeline.

13.2 Pipe Installation and Pullback Operations

13.2.1

Pipe installation and pullback shall be conducted in accordance with the requirements of CSA Z662-11, Clause 6.2.11.4

13.2.2

The pullback section shall be installed in one continuous length if possible.

13.2.3

The combined stresses, including tensile, bending and hoop stresses shall not exceed the specified minimum yield strength (SMYS) for any portion of the pipe being installed.

13.2.4

A swivel shall be used to connect the pull section to the reaming assembly to minimize torsional stress imposed on the pull section.

13.2.5

The pull section shall be supported on elevated rollers at a spacing of no greater than 10 m during pullback (unless otherwise approved in writing by the Owner representative) to provide straight entry into the drilled hole. This spacing allows the pull section to move freely and to avoid damage to the pipe. The pull section shall be supported such that the pipe enters the bore hole with no restrictions and does not touch the ground between pipe support points or side booms as it enters the drilled hole. The end of the section as it leaves the rollers. The break over bend radius shall be such that the pipe is not overstressed during pullback.

13.2.6
After completion of the pullback, the Contractor may cap the ends of the crossing section.

13.2.7
For hydrostatic testing, refer to the hydrostatic test specification.

13.3 Backfill and Restoration

13.3.1
Trench and excavated areas on the Work site shall be backfilled, compacted and reclaimed in accordance with the contract documents.

13.3.2
Slurried materials shall not be used for backfill.

13.3.3
The Work site shall be restored to its original condition in accordance with the contract documents.

13.4 Demobilization

13.4.1
Demobilization shall include the following activities:

a. the demobilization of personnel, equipment and materials initially mobilized by the Contractor
b. the return to Owner of all surplus material originally supplied by Owner

14. SPECIFICATIONS FOR POST-CONSTRUCTION WORK

14.1.1
Upon completion of the drilled crossings, the Contractor shall submit a post-construction report that details any problems encountered during the directional drilling activities and the measures that were taken to solve or mitigate the problems. At a minimum, this post-construction report should include the following information:

a. any problems encountered (such as magnetic interference) with the accuracy of the steering system
b. any problems encountered with pipe damage
c. any problems with drilling fluids exiting to the surface, drilling fluid containment or drilling fluid disposal
d. any concerns raised during the course of the drilling activities
e. an as built drawing (in .pdf file format) and an AutoCAD file detailing the as built horizontal alignment and profile

PART 8:

TRANS MOUNTAIN FOLLOW-UP RESPONSE TO NEB IR NO. 2

NEB F-IR NO. 2.101e, NEB F-IR 2.101e – Attachment 1

Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
NEB Hearing Order OH-001-2014
Follow-Up Response to Information Request from
National Energy Board (NEB)

Engineering and safety

F-IR 2.101 Hydrology – watercourse crossing selection

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 44 of 110

A3S1D8, Application Volume 4A, Project Design and Execution – Engineering, Appendix I – Route Physiography and Hydrology Report:

ii) PDF page 21 of 97
iii) PDF page 22 of 97
iv) A3S2C1, Application Volume 5C, Environmental and Socio- Economic Assessment – Biophysical Technical Reports, TR 5C-7 – Fisheries (British Columbia) Technical Report, PDF page 3 of 106

A3S2S3, Application Volume 6B, Pipeline Environmental Protection Plan, Appendix I – Aquatic Resources:

v) PDF page 11 of 461
vi) PDF pages 356 to 393 of 461
vii) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 54 of 110

Preamble:

Reference i) provides the watercourse selection method as part of the engineering design principles. It defines that a watercourse has a bed and banks for a minimum of 100 metres at the crossing. Using this definition, 468 watercourses were identified.

Reference ii) provides a hydrologic desktop review of 474 notable water crossings out of 1,256 potential crossings (Reference iii)).

Reference iv) is a fisheries report that identifies 800 potential watercourse crossings. Reference v) is the Environmental Protection Plan that identifies the mitigation measures for 902 water crossings (Reference vi)).

Reference vii), Section 3.2.20.1, describes how watercourse crossings will be dealt with during the pipeline system engineering and design phase.

Request:

Please provide:

e) the methodology for integrating the information from the four different watercourse crossing databases for design and construction in Reference vii).

Original Response:

e) A master watercourse crossing table will be created by combining the Fish Habitat list and the Hydrology list to ensure that all watercourses have been captured and accounted for. Any watercourses not already identified in the hydrology list will receive additional engineering review to confirm if they required additional hydrological assessment and design.

Summary of New Commitments:

- A master watercourse crossing table will be created by combining the Fish Habitat list and the Hydrology list to ensure that all watercourses have been captured and accounted for and submitted as part of Technical Update No. 2 on August 22, 2014.

Commitment Response:

NEB F-IR No. 2.101e - Attachment 1 contains a master watercourse crossing table combining the Fish Habitat list and the Hydrology list for the proposed project corridor as submitted to the NEB on August 22, 2014. The list of watercourses affected by the proposed project is subject to change as detailed engineering design progresses.

NEB F-IR No. 2.101e - Attachment 1

Alberta

Watercourse Crossing ID	Watercourse Name	Class	Zone	Easting	Northing	UPI Unique ID	RK (Approx.)	Route
AB-0a	Unnamed tributary to North Saskatchewan River	Unknown site not visited	12	343311	5934599	W1.0	0.53	1003
AB-1	Unnamed tributary to Goldbar Creek	Class C (unmapped)	12	345121	5932355	W2.0	4.69	AR1092
AB-2	Goldbar Creek	Class C	12	345119	5932246	W3.0	4.8	AR1092
AB-2a	Unnamed NCD	NCD	12	345093	5931298	W4.0	5.75	AR1092
AB-2b	Unnamed NCD	NCD	12	345101	5931031	W5.0	6.02	AR1092
AB-2c	Unnamed NCD	NCD	12	345077	5930939	W6.0	6.11	AR1092
AB-3	Unnamed NCD	NCD	12	345072	5930635	W7.0	6.41	AR1092
AB-3a	Unnamed NCD	NCD	12	345027	5930406	W8.0	6.64	AR1092
AB-3b	Unnamed NCD	NCD	12	344919	5930222	W9.0	6.87	AR1092
AB-4	Unnamed Wetland	Wetland	12	344915	5929848	W10.0	7.24	AR1092
AB-4a	Unnamed NCD	NCD	12	345110	5928882	W11.0	8.24	AR1092
AB-5	Fulton Creek	Class C (unmapped)	12	345139	5927172	W14.0	10	AR1092
AB-6	Unnamed Wetland	Wetland	12	345121	5926452	W15.0	10.72	AR1092
AB-6z	Unnamed tributary to Mill Creek	Possible Wetland (waiting to confirm)	12	344518	5925736	W16.0	11.84	AR1092
AB-7	Mill Creek	Class C	12	343940	5925028	W19.0	12.74	AR1092
AB-8	Unnamed NCD	NCD	12	341416	5923563	W20.0	15.71	1003
AB-9	Unnamed Wetland	Wetland	12	338818	5923689	W21.0	18.31	1003
AB-10	Unnamed NCD	NCD	12	336787	5923839	W22.0	20.36	1003
AB-10a	Unnamed tributary to North Saskatchewan River	NCD	12	335922	5923861	W23.0	21.29	1003
AB-11	Unnamed NCD	NCD	12	335382	5923429	W24.0	22	1003
AB-11a	Unnamed NCD	Wetland	12	335241	5923588	W25.0	22.19	1003
AB-11b	Unnamed NCD	NCD	12	334327	5923410	W26.0	23.07	1003
AB-12	Blackmud Creek	Class C	12	333196	5923414	W27.0	24.21	1003
AB-13	Whitemud Creek	Class B	12	329705	5923217	W28.1	28.2	AR1115
AB-14	North Saskatchewan River	Class C	12	326598	5926764	W29.1	33.57	AR1115
AB-14a	Unnamed NCD	NCD	12	326206	5927262	W30.0	34.19	AR1115
AB-14b	Unnamed NCD	NCD	12	325830	5927432	W31.0	34.52	AR1115
AB-15	Unnamed tributary to North Saskatchewan River (locally known as Wedgewood Creek)	Class C (unmapped)	12	323858	5927914	W32.1	36.96	AR1115
AB-15a	Unnamed NCD	NCD	12	323803	5927913	W33.0	37	AR1115
AB-15b	Unnamed NCD	NCD	12	323401	5930842	W34.1	40.21	AR1115
AB-16	Unnamed Wetland	Wetland	12	323465	5931143	W35.1	40.53	AR1115
AB-17	Unnamed NCD	NCD	12	323394	5932276	W36.1	41.69	AR1115
AB-17a	Unnamed NCD	NCD	12	321387	5933076	W37.0	44.16	AR1103
AB-18	Dog Creek	Class C (unmapped)	12	306581	5935596	W38.0	59.37	1003
AB-19	Atim Creek	Class C	12	303784	5937254	W39.0	62.94	1003
AB-20	Unnamed tributary to Atim Creek	Class C (unmapped)	12	302780	5938022	W41.0	64.23	1003
AB-21	Unnamed tributary to Atim Creek	Class C (unmapped)	12	301633	5938311	W42.0	65.46	1003
AB-22	Unnamed NCD	NCD	11	695444	5937657	W47.0	69.14	1003
AB-23	Unnamed Wetland	Wetland	11	694614	5937679	W48.0	69.98	1003
AB-23a	Unnamed NCD	NCD or pond	11	684596	5938147	W50.0	80.07	1003
AB-24	Unnamed NCD	NCD	11	683659	5938071	W51.0	81.01	1003
AB-25	Kilini Creek	Class C (unmapped)	11	682093	5938152	W52.0	82.58	1003
AB-26	Unnamed Wetland	Wetland	11	681970	5938159	W53.0	82.71	1003
AB-27	Unnamed NCD	NCD	11	679973	5938262	W54.0	84.71	1003
AB-28	Unnamed Wetland	Wetland	11	679636	5938289	W55.0	85.05	1003
AB-29	Unnamed NCD	NCD	11	678957	5938197	W56.0	85.77	1003
AB-30	Unnamed Wetland	Wetland	11	677493	5938310	W57.0	87.25	1003

Alberta

Watercourse Crossing ID	Watercourse Name	Class	Zone	Easting	Northing	UPI Unique ID	RK (Approx.)	Route
AB-31	Unnamed Wetland	Wetland	11	676231	5938318	W58.0	88.51	1003
AB-32	Unnamed NCD	NCD	11	675567	5938410	W59.0	89.18	1003
AB-33	Unnamed tributary to Killini Creek	Class C (unmapped)	11	672111	5938594	W60.0	92.65	1003
AB-34	Unnamed tributary to Killini Creek	Class C (unmapped)	11	673634	5938512	W61.0	91.12	1003
AB-35	Unnamed tributary to Killini Creek	Class C (unmapped)	11	674613	5938459	W62.0	90.14	1003
AB-35a	Unnamed NCD	NCD	11	670659	5938594	W63.0	94.1	AR1070
AB-35b	Unnamed NCD	NCD	11	670511	5938639	W64.0	94.25	AR1070
AB-36	Unnamed tributary to Wabamun Lake	NCD	11	670261	5938671	W65.0	94.5	AR1070
AB-37	Unnamed NCD	Wetland	11	670053	5938680	W66.0	94.71	AR1070
AB-37a	Unnamed tributary to Wabamun Lake	Class C (unmapped)	11	669317	5938663	W67.0	95.45	AR1070
AB-37b	Unnamed NCD	NCD	11	669202	5938602	W68.0	95.57	AR1070
AB-37c	Unnamed NCD	NCD	11	669152	5938599	W69.0	95.62	AR1070
AB-38	Unnamed NCD	NCD	11	668805	5938639	W70.0	95.96	AR1070
AB-38a	Unnamed Wetland	Wetland	11	668533	5938642	W71.0	96.23	AR1070
AB-39	Unnamed Wetland	Wetland	11	668384	5938598	W72.0	96.39	AR1070
AB-39a	Unnamed Wetland	Wetland	11	666608	5938462	W73.0	98.21	AR1070
AB-39b	Unnamed tributary to Wabamun Lake	Class C (unmapped)	11	666424	5938388	W74.0	98.41	AR1070
AB-39c	Unnamed NCD	NCD	11	666203	5938306	W75.0	99.67	1003
AB-39d	Unnamed Wetland	Wetland	11	665742	5938159	W76.0	100.15	1003
AB-39e	Unnamed Wetland	Wetland	11	665715	5938171	W77.0	100.18	1003
AB-39f	Unnamed Wetland	Wetland	11	665215	5938084	W78.0	100.71	1003
AB-39g	Unnamed NCD	Wetland	11	663874	5937848	W79.0	102.11	1003
AB-39h	Unnamed tributary to Wabamun Lake	Class C (unmapped)	11	663630	5937997	W80.0	102.4	1003
AB-40	Unnamed NCD	NCD	11	663439	5938089	W81.0	102.61	1003
AB-40a	Unnamed NCD	NCD	11	662684	5938661	W82.0	103.77	1003
AB-41	Unnamed NCD	NCD	11	662276	5939380	W83.0	104.52	1003
AB-42	Unnamed NCD	NCD	11	662013	5939549	W84.0	104.87	1003
AB-42a	Unnamed NCD	NCD	11	659235	5939626	W85.0	107.66	1003
AB-43	Unnamed NCD	NCD	11	658688	5939634	W86.0	108.21	1003
AB-44	Unnamed tributary to Wabamun Lake	Class C (unmapped)	11	658348	5939655	W87.0	108.55	1003
AB-45	Unnamed tributary to Wabamun Lake	Class C (unmapped)	11	657989	5939666	W88.0	108.91	1003
AB-46	Unnamed NCD	NCD	11	657166	5939691	W89.0	109.73	1003
AB-47	Unnamed NCD	NCD	11	654295	5939651	W90.0	112.61	1003
AB-48	Unnamed tributary to Wabamun Lake	Class C (unmapped)	11	653594	5939686	W91.0	113.31	1003
AB-49	Unnamed tributary to Wabamun Lake	Class C (unmapped)	11	653561	5939684	W92.0	113.35	1003
AB-50	Unnamed NCD	NCD	11	653246	5939630	W93.0	113.66	1003
AB-51	Unnamed NCD	NCD	11	652450	5939634	W94.0	114.46	1003
AB-52	Unnamed tributary to Wabamun Lake	Class C (unmapped)	11	652210	5939625	W95.0	114.7	1003
AB-53	Unnamed NCD	NCD	11	651295	5939552	W96.0	115.62	AR1109
AB-54	Unnamed NCD	NCD	11	650795	5939532	W97.0	116.13	1003
AB-55	Unnamed Wetland	Wetland	11	645843	5939154	W98.0	121.16	1003
AB-56	Unnamed NCD	NCD	11	644277	5939232	W99.0	122.77	1003
AB-57	Unnamed NCD	NCD	11	643917	5939206	W100.0	123.13	1003
AB-58	Unnamed NCD	NCD	11	643334	5939176	W101.0	123.71	1003
AB-59	Unnamed tributary to Sturgeon River	Class C (unmapped)	11	640939	5939062	W102.0	126.12	1003
AB-60	Unnamed tributary to Isle Lake	Class C	11	640254	5939071	W103.0	126.81	1003
AB-61	Unnamed Wetland	Wetland	11	638028	5939221	W104.0	129.06	1003
AB-62	Unnamed Wetland	Wetland	11	637220	5939307	W105.0	129.88	1003

Alberta

Watercourse Crossing ID	Watercourse Name	Class	Zone	Easting	Northing	UPI Unique ID	RK (Approx.)	Route
AB-63	Unnamed Wetland	Wetland	11	635266	5939172	W106.0	131.84	1003
AB-64	Unnamed Wetland	Wetland	11	634078	5939261	W107.0	133.04	1003
AB-65	Unnamed Wetland	Wetland	11	634042	5939335	W108.0	133.08	1003
AB-66	Pembina River	Class C	11	632239	5939230	W110.0	135.04	1003
AB-66a	Unnamed NCD	NCD	11	630773	5939398	W111.0	136.54	1003
AB-68	Unnamed Wetland	Wetland	11	630414	5938986	W112.0	136.75	1003
AB-67	Unnamed NCD	NCD	11	630488	5939473	W113.0	136.84	1003
AB-69	Unnamed tributary to Lobstick River	Class C (unmapped)	11	630362	5939513	W114.0	136.97	1003
AB-70	Unnamed NCD	NCD	11	630160	5939592	W115.0	137.18	1003
AB-70a	Unnamed tributary to Lobstick River	NCD	11	629820	5939695	W116.0	137.54	1003
AB-71	Unnamed Wetland	Wetland	11	629605	5939730	W117.0	137.76	1003
AB-72	Unnamed NCD	NCD	11	629419	5939741	W118.0	137.95	1003
AB-73	Unnamed NCD	NCD	11	628454	5939795	W119.0	138.91	1003
AB-74	Unnamed NCD	NCD	11	627184	5939857	W120.0	140.19	1003
AB-75	Unnamed NCD	NCD	11	626597	5939877	W121.0	140.78	1003
AB-76	Unnamed NCD	NCD	11	626289	5939894	W122.0	141.08	1003
AB-77	Unnamed NCD	NCD	11	626187	5939899	W123.0	141.19	1003
AB-78	Zeb-igler Creek	Class C	11	624846	5939971	W124.0	142.53	1003
AB-79	Unnamed Wetland	Wetland	11	624513	5939988	W125.0	142.87	1003
AB-80	Unnamed NCD	NCD	11	622230	5939811	W126.0	145.17	1003
AB-81	Unnamed NCD	NCD	11	621826	5939731	W127.0	145.6	AR1095
AB-82	Unnamed tributary to Lobstick River	Class C (unmapped)	11	621438	5939677	W128.0	145.99	AR1095
AB-83	Unnamed NCD	NCD	11	621197	5939710	W129.0	146.24	AR1095
AB-84	Unnamed tributary to Lobstick River	Class C (unmapped)	11	620280	5939763	W130.0	147.14	1003
AB-85	Unnamed tributary to Lobstick River	Class C (unmapped)	11	619674	5939805	W131.0	147.75	1003
AB-86	Unnamed NCD	NCD	11	619602	5939817	W132.0	147.82	1003
AB-87	Unnamed NCD	NCD	11	618112	5939886	W133.0	149.32	1003
AB-88	Unnamed NCD	NCD	11	617958	5939883	W134.0	149.47	1003
AB-89	Unnamed Wetland	Wetland	11	617442	5939874	W135.0	149.99	1003
AB-90	Unnamed tributary to Chip Lake	Class C (unmapped)	11	615626	5939835	W137.0	151.81	1003
AB-91	Unnamed tributary to Chip Lake	Class C	11	615395	5939837	W138.0	152.04	1003
AB-91a	Unnamed tributary to Chip Lake	NCD	11	613256	5939595	W139.0	154.24	1003
AB-91b	Unnamed tributary to Chip Lake	NCD	11	612305	5939566	W140.0	155.2	AR1096
AB-92	Unnamed tributary to Chip Lake	Class C (unmapped)	11	611033	5939574	W141.0	156.49	1003
AB-93	Unnamed tributary to Chip Lake	Class C	11	610472	5939569	W142.0	157.05	1003
AB-94	Unnamed Wetland	Wetland	11	609545	5939521	W143.0	157.98	1003
AB-95	Unnamed NCD	NCD	11	608691	5939472	W144.0	158.86	1003
AB-96	Unnamed NCD	NCD	11	608266	5939539	W145.0	159.29	1003
AB-97	Unnamed NCD	NCD	11	608000	5939583	W146.0	159.56	1003
AB-98	Unnamed tributary to Chip Lake	Class C (unmapped)	11	607885	5939589	W147.0	159.67	1003
AB-99	Unnamed Wetland	Wetland	11	607764	5939611	W148.0	159.8	1003
AB-100	Unnamed Wetland	Wetland	11	605274	5939963	W149.0	162.31	1003
AB-101	Unnamed tributary to Chip Lake	Class C	11	603525	5940110	W150.0	164.11	AR1110
AB-102	Unnamed NCD	NCD	11	603343	5940240	W151.0	164.29	AR1110
AB-103	Unnamed NCD	NCD	11	602088	5940366	W152.0	165.61	1003
AB-104	Unnamed NCD	NCD	11	601584	5940385	W153.0	166.11	1003
AB-105	Unnamed NCD	NCD	11	600687	5940418	W154.0	167.01	1003
AB-106	Unnamed tributary to Chip Lake	Class C	11	599510	5940451	W155.0	168.2	1003

Alberta

Watercourse Crossing ID	Watercourse Name	Class	Zone	Easting	Northing	UPI Unique ID	RK (Approx.)	Route
AB-107	Unnamed NCD	NCD	11	597445	5940541	W156.0	170.28	1003
AB-108	Unnamed Wetland	Wetland	11	596774	5940564	W157.0	170.95	1003
AB-109	Unnamed Wetland	Wetland	11	596270	5940576	W158.0	171.45	1003
AB-110	Unnamed Wetland	Wetland	11	595811	5940601	W159.0	171.91	1003
AB-111	Little Brule Creek	Class C	11	594073	5940817	W160.0	173.68	1003
AB-112	Unnamed Wetland	Wetland	11	591892	5940853	W161.0	175.87	1003
AB-113	Unnamed NCD	NCD	11	590263	5940796	W162.0	177.5	1003
AB-114	Unnamed tributary to Brule Creek	Class C (unmapped)	11	588868	5940734	W163.0	178.91	1003
AB-115	Unnamed Wetland	Wetland	11	586954	5940877	W164.0	180.84	1003
AB-116	Brule Creek	Class C	11	586742	5940913	W165.0	181.05	1003
AB-117	Lobstick River	Class C	11	582524	5941148	W166.0	185.3	1003
AB-118	Unnamed tributary to Lobstick River	Class C (unmapped)	11	579009	5941517	W169.0	188.99	1003
AB-119	Carrot Creek	Class C	11	574924	5941261	W170.0	193.1	1003
AB-120	Unnamed NCD	NCD	11	572510	5941303	W171.0	195.52	1003
AB-121	Unnamed NCD	NCD	11	571166	5941254	W172.0	196.87	1003
AB-122	Unnamed NCD	NCD	11	570917	5941168	W173.0	197.14	1003
AB-123	Unnamed tributary to January Creek	Class C (unmapped)	11	569435	5940488	W174.0	198.78	1003
AB-124	Unnamed Lake tributary to January Creek	Class C (unmapped)	11	568569	5939926	W175.0	199.82	1003
AB-125	Unnamed tributary to January Creek	Class C (unmapped)	11	566023	5939002	W176.0	202.59	1003
AB-126	Unnamed tributary to January Creek	Class C (unmapped)	11	565847	5938995	W177.0	202.77	1003
AB-127	Unnamed Wetland	Wetland	11	565667	5938951	W178.0	202.95	1003
AB-128	January Creek	Class C	11	561562	5938935	W179.0	207.07	1003
AB-129	Wolf Creek	Class C	11	548594	5938610	W180.0	220.58	1003
AB-129a	Oxbow to Wolf Creek		11	548605	5938583	W181.0	220.58	1003
AB-130	Unnamed NCD	NCD	11	545585	5938204	W182.0	223.71	1003
AB-131	McLeod River	Class C	11	545404	5938268	W183.0	223.91	1003
AB-132	Bench Creek	Class C	11	541959	5938926	W184.0	227.54	1003
AB-133	Unnamed tributary to Bench Creek	Class C (unmapped)	11	538172	5938804	W185.0	231.45	1003
AB-134	Unnamed tributary to Bench Creek	Class C (unmapped)	11	537329	5938790	W186.0	232.29	1003
AB-135	Unnamed NCD	NCD	11	535236	5938677	W187.0	234.42	1003
AB-136	Bench Creek	Class C	11	533245	5937934	W189.0	236.57	1003
AB-137	Little Sundance Creek	Class C	11	525302	5936530	W190.0	245.15	AR1107
AB-138	Sundance Creek	Class C	11	522806	5936313	W191.0	248.02	1003
AB-139	Pond		11	515811	5932782	W193.0	257.1	AR1106
AB-140	Unnamed tributary to McLeod River	Class C (unmapped)	11	515164	5932793	W194.0	257.75	AR1106
AB-141	Unnamed tributary to McLeod River	Class C (unmapped)	11	512886	5932956	W195.0	260.1	1003
AB-142	Unnamed Wetland	Wetland	11	506278	5932826	W196.0	267.11	1003
AB-143	Unnamed tributary to McLeod River	Class C	11	503908	5933103	W197.0	269.57	1003
AB-144	Unnamed tributary to McLeod River	Class C (unmapped)	11	503428	5933125	W198.0	270.06	1003
AB-145	Unnamed NCD	NCD	11	497951	5932452	W199.0	275.81	1003
AB-146	Unnamed Wetland	Wetland	11	493989	5931508	W200.0	280.39	1003
AB-147	Unnamed Wetland	Wetland	11	489893	5932768	W201.0	284.81	1003
AB-148	Unnamed NCD	NCD	11	486365	5933239	W202.0	288.49	1003
AB-148a	Unnamed NCD	NCD	11	486229	5933227	W203.0	288.63	1003
AB-149	Unnamed NCD	NCD	11	485909	5933218	W204.0	288.95	1003
AB-150	Unnamed NCD	NCD	11	485367	5933115	W205.0	289.51	1003
AB-151	Unnamed NCD	NCD	11	484131	5932593	W206.0	290.86	1003
AB-151a	Unnamed Wetland	Wetland	11	483479	5932259	W207.0	291.59	1003

Alberta

Watercourse Crossing ID	Watercourse Name	Class	Zone	Easting	Northing	UPI Unique ID	RK (Approx.)	Route
AB-152	Unnamed NCD	NCD	11	483255	5932158	W208.0	291.84	1003
AB-153	Rooster Creek	Class C (unmapped)	11	483231	5932138	W209.0	291.87	1003
AB-154	Unnamed tributary to Ponoka Creek	Class C (unmapped)	11	481107	5930877	W210.0	294.42	1003
AB-155	Ponoka Creek	Class C	11	480727	5930256	W211.0	295.23	1003
AB-156	Unnamed NCD	NCD	11	480033	5930066	W212.0	295.97	1003
AB-156a	Unnamed NCD	NCD	11	478618	5929248	W213.0	297.63	1003
AB-156b	Unnamed NCD	NCD	11	478533	5929186	W214.0	297.73	1003
AB-157	Roundcroft Creek	Class C	11	477983	5928683	W215.0	298.56	1003
AB-158	Unnamed tributary to Roundcroft Creek	Class C (unmapped)	11	477740	5928715	W216.0	298.8	1003
AB-159	Unnamed NCD	NCD	11	476605	5928014	W217.0	300.15	1003
AB-160	Unnamed NCD	NCD	11	475808	5927494	W218.0	301.11	1003
AB-161	Unnamed NCD	NCD	11	475371	5927209	W219.0	301.63	1003
AB-162	Sandstone Creek	Class C	11	474699	5926737	W220.0	302.46	1003
AB-162a	Unnamed NCD	NCD	11	474690	5926739	W221.0	302.47	1003
AB-162b	Unnamed NCD	NCD	11	472800	5925891	W222.0	304.68	1003
AB-163	Unnamed tributary to Hunt Creek	Class C	11	472764	5925884	W223.0	304.72	1003
AB-162c	Unnamed NCD	NCD	11	472788	5925828	W224.0	304.72	1003
AB-164	Hunt Creek	Class C	11	472691	5925857	W225.0	304.79	1003
AB-165	Unnamed NCD	NCD	11	470885	5924964	W226.0	306.87	1003
AB-166	Unnamed NCD	NCD	11	469909	5924196	W227.0	308.12	1003
AB-167	Trail Creek	Class C (unmapped)	11	469136	5923725	W228.0	309.01	1003
AB-167a	Unnamed tributary to Athabasca River	NCD	11	467979	5922833	W229.0	310.6	1003
AB-168	Unnamed tributary to Athabasca River	Class C	11	467794	5922709	W230.0	310.83	1003
AB-168a	Unnamed Wetland	Wetland	11	467535	5921949	W231.0	311.73	1003
AB-169	Unnamed tributary to Athabasca River	Class C (unmapped)	11	467633	5921457	W232.0	312.24	1003
AB-170	Unnamed tributary to Athabasca	Class C (unmapped)	11	467644	5921418	W233.0	312.28	1003
AB-171	Unnamed tributary to Athabasca River	Class C (unmapped)	11	467825	5920953	W234.0	312.8	1003
AB-172	Unnamed tributary to Athabasca	Class C (unmapped)	11	467501	5920545	W235.0	313.36	1003
AB-173	Unnamed NCD	NCD	11	467498	5920010	W236.0	313.89	1003
AB-174	Unnamed NCD	NCD	11	466816	5919446	W237.0	315.02	1003
AB-175	Unnamed NCD	NCD	11	466770	5919385	W238.0	315.1	1003
AB-176	Unnamed tributary to Cache Percotte Creek	Class C (unmapped)	11	466446	5919001	W239.0	315.6	1003
AB-176a	Unnamed tributary to Cache Percotte Creek		11	466152	5918668	W240.0	316.05	1003
AB-177	Cache Percotte Creek	Class C (unmapped)	11	465870	5918406	W241.0	316.44	1003
AB-178	Unnamed tributary to Hardisty Creek	Class C (unmapped)	11	464377	5916914	W242.0	318.59	1003
AB-179	Unnamed tributary to Hardisty Creek	Class C (unmapped)	11	464059	5916674	W243.0	318.99	1003
AB-180	Hardisty Creek	Class C	11	463330	5916280	W244.0	319.92	AR1058
AB-181	Unnamed NCD	NCD	11	463036	5916168	W245.0	320.21	AR1058
AB-181a	Unnamed tributary to Hardisty Creek	NCD	11	462807	5916015	W246.0	320.49	AR1058
AB-182	Unnamed NCD	NCD	11	461667	5914878	W247.0	322.16	1003
AB-183	Unnamed NCD	NCD	11	461446	5914878	W248.0	322.38	1003
AB-184	Unnamed NCD	NCD	11	461081	5914716	W249.0	322.79	1003
AB-185	Happy Creek	Class C	11	460791	5914610	W250.0	323.11	1003
AB-186	Unnamed Wetland	Wetland	11	459140	5913766	W251.0	324.97	1003
AB-186a	Unnamed NCD	NCD	11	458323	5913301	W252.0	325.91	1003
AB-186b	Unnamed ?	Unknown	11	457940	5913084	W253.0	326.35	1003
AB-187	Unnamed Wetland	Wetland	11	457538	5912871	W254.0	326.81	1003
AB-188	Maskuta Creek	Class C	11	456980	5912444	W255.0	327.51	AR1086

Alberta

Watercourse Crossing ID	Watercourse Name	Class	Zone	Easting	Northing	UPI Unique ID	RK (Approx.)	Route
AB-188a	Unnamed NCD	NCD	11	454541	5909944	W256.0	331.38	AR1088
AB-189	Unnamed NCD	NCD	11	454269	5909801	W257.0	331.66	AR1088
AB-189a	Unnamed NCD	NCD	11	454241	5909696	W258.0	331.76	AR1088
AB-190	Unnamed NCD	NCD	11	454078	5909573	W259.0	331.96	AR1088
AB-191	Unnamed NCD	NCD	11	453812	5909259	W260.0	332.37	AR1088
AB-192	Unnamed Wetland	Wetland	11	453695	5909117	W261.0	332.56	AR1088
AB-192a	Unnamed NCD	NCD	11	453558	5908779	W262.0	332.91	AR1088
AB-193	Unnamed tributary to Maskuta Creek	Class C (unmapped)	11	453167	5908335	W263.0	333.49	AR1088
AB-194	Unnamed tributary to Maskuta Creek	Class C (unmapped)	11	453130	5908199	W264.0	333.63	AR1088
AB-195	Unnamed tributary to Maskuta	Class C (unmapped)	11	452343	5906547	W265.0	335.46	1003
AB-196	Unnamed NCD	NCD	11	452117	5906078	W266.0	336	AR1089
AB-197	Unnamed Wetland	Wetland	11	452016	5905863	W267.0	336.24	AR1089
AB-198	Unnamed Wetland	Wetland	11	451554	5905023	W268.0	337.2	1003
AB-199	Unnamed Wetland	Wetland	11	451535	5904991	W269.0	337.24	1003
AB-200	Unnamed NCD	NCD	11	451407	5904774	W270.0	337.49	1003
AB-201	Unnamed NCD	NCD	11	451331	5904643	W271.0	337.65	1003
AB-202	Unnamed tributary to Maskuta Creek	Class C (unmapped)	11	450819	5903781	W272.0	338.65	1003

British Columbia

Watercourse Crossing ID	Watercourse Name	Class	Zone	Easting	Northing	UPI Unique ID	RK (Approx.)	Route
BC-1	Unnamed Drainage	NVC	11	349212	5875616	W1000.0	489.74	2002
BC-2	Unnamed Drainage	NCD	11	349136	5875559	W1001.0	489.83	2002
BC-3	Baer Creek	S2	11	348532	5875184	W1002.0	490.55	2002
BC-4	Unnamed Drainage	NCD	11	347884	5874721	W1003.0	491.34	2002
BC-5	Marathon Creek	TBD (S2)	11	347674	5874591	W1004.0	491.59	2002
BC-6	Unnamed Channel	TBD (S6)	11	345313	5872737	W1005.0	494.67	2002
BC-7	Unnamed Drainage	NVC	11	344668	5872108	W1006.0	495.77	2002
BC-8	Terry Fox Creek	S3	11	344628	5872028	W1007.0	495.86	2002
BC-9	Unnamed Drainage	NVC	11	343872	5871715	W1008.0	499.86	AR2077
BC-10	Fraser River	S1B	11	343735	5871698	W1009.0	499.73	AR2077
BC-10a	TBD	TBD	11	343749	5871754	W1010.0	496.84	AR2076
BC-11	Unnamed Drainage	NVC	11	342788	5871625	W1011.0	497.81	2002
BC-12	Unnamed Channel	S6	11	344405	5871622	W1012.0	500.51	2002
BC-13	Unnamed Channel	TBD (S6)	11	344144	5871467	W1013.0	500.81	2002
BC-14	Unnamed Channel	S6	11	344014	5871133	W1014.0	501.17	AR2074
BC-15	Unnamed Channel	S6	11	343524	5870804	W1015.0	501.79	AR2074
BC-16	Unnamed Channel	S6	11	342803	5870599	W1016.0	502.54	AR2074
BC-17	Unnamed Channel	S6	11	341833	5870715	W1017.0	503.54	AR2074
BC-18	Unnamed Channel	S6	11	340784	5871238	W1018.0	504.73	AR2074
BC-19	Unnamed Drainage	NVC	11	339901	5870729	W1019.0	505.81	2002
BC-20	Unnamed Channel	S6	11	339806	5870423	W1020.0	506.13	2002
BC-21	Unnamed Channel	S6	11	339537	5869680	W1021.0	507.07	2002
BC-22	Unnamed Drainage (Wetland)	NCD-W	11	340846	5867152	W1022.0	510.07	2002
BC-23	Unnamed Drainage	NVC	11	341139	5866651	W1023.0	510.64	2002
BC-24	Unnamed Drainage	NVC	11	341416	5866279	W1024.0	511.11	2002
BC-25	Unnamed Drainage	NVC	11	342084	5865395	W1025.0	512.21	2002
BC-26	Hogan Creek	S6	11	343410	5863750	W1026.0	514.33	2002
BC-27	Teepee Creek	S3	11	344137	5862768	W1027.0	515.55	2002
BC-28	Crooked Creek	S3	11	345436	5861010	W1028.0	517.89	AR2107
BC-29	Unnamed Drainage	NVC	11	346135	5857736	W1029.0	521.37	2002
BC-30	Unnamed Drainage	NVC	11	346146	5857518	W1030.0	521.6	2002
BC-31	Unnamed Drainage	NVC	11	346149	5857401	W1031.0	521.72	2002
BC-32	Swift Creek	S1B	11	345952	5856592	W1032.0	522.55	2002
BC-33	Cranberry Creek	S6	11	345820	5855438	W1033.0	523.75	2002
BC-34	Unnamed Drainage	NVC	11	345791	5854345	W1034.0	524.83	2002
BC-35	Cranberry Creek	NVC	11	346265	5853610	W1035.0	525.74	2002
BC-36	Canoe River	S1B	11	347688	5848656	W1036.0	531.25	AR2047
BC-37	Unnamed Drainage (Wetland)	NCD-W	11	347896	5847182	W1037.0	532.79	2002
BC-38	Camp Creek	S2	11	347310	5845675	W1038.0	534.42	AR2048
BC-39	Unnamed Channel	S6	11	347452	5842636	W1039.0	537.69	2002
BC-40	Unnamed Drainage	NVC	11	348068	5841003	W1040.0	539.46	AR2087
BC-41	Unnamed Drainage	NVC	11	348300	5840705	W1041.0	539.84	AR2087

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Watercourse Crossing ID	Watercourse Name	Class	Zone	Easting	Northing	UPI Unique ID	RK (Approx.)	Route
BC-42	Unnamed Drainage	NVC	11	348553	5840411	W1042.0	540.23	AR2087
BC-43	Unnamed Channel	S3	11	348769	5840156	W1043.0	540.57	AR2087
BC-44	Unnamed Channel	S6	11	349300	5839478	W1044.0	541.46	2002
BC-45	Unnamed Channel	S6	11	349581	5839108	W1045.0	541.92	2002
BC-46	Unnamed Channel	S6	11	350354	5838633	W1046.0	542.84	AR2088
BC-47	Unnamed Channel	S6	11	350644	5838436	W1047.0	543.2	AR2088
BC-48	Unnamed Channel	S6	11	350904	5838066	W1048.0	543.66	AR2088
BC-49	Unnamed Drainage	NVC	11	351012	5837780	W1049.0	543.96	AR2088
BC-50	Unnamed Channel	S6	11	351303	5837161	W1050.0	544.67	2002
BC-51	Unnamed Channel	S3	11	351314	5837040	W1051.0	544.79	2002
BC-52	Camp Creek	S2	11	351655	5836144	W1052.0	545.87	2002
BC-53	Unnamed Channel	S6	11	351532	5835985	W1053.0	546.06	2002
BC-54	Unnamed Drainage	NCD	11	351527	5835852	W1054.0	546.19	2002
BC-55	Unnamed Channel	S3	11	352046	5835359	W1055.0	546.92	AR2089
BC-56	Camp Creek	S2	11	352601	5834985	W1056.0	547.59	AR2089
BC-57	Unnamed Drainage	NVC	11	352999	5834255	W1057.0	548.48	AR2089
BC-58	Unnamed Channel	S6	11	353438	5833684	W1058.0	549.18	AR2089
BC-59	Unnamed Channel	S6	11	353665	5833274	W1059.0	549.65	AR2089
BC-60	Unnamed Channel	S6	11	353763	5833140	W1060.0	549.82	2002
BC-61	Unnamed Channel	S6	11	353819	5833038	W1061.0	549.94	2002
BC-62	Unnamed Drainage	NCD	11	353992	5832820	W1062.0	550.21	2002
BC-63	Unnamed Channel	S5	11	354260	5832456	W1063.0	550.67	2002
BC-64	Unnamed Channel	S5	11	354898	5831912	W1064.0	551.49	2002
BC-64a	Unnamed Drainage	NVC	11	355384	5831588	W1065.0	552.13	AR2049
BC-65a	Albreda River	S2	11	355647	5831459	W1066.0	552.45	AR2049
BC-66	TBD	S5/S2	11	356181	5831285	W1067.0	552.95	2002
BC-67	Unnamed Drainage (Wetland)	NCD-W (FB)	11	356828	5830505	W1068.0	553.98	2002
BC-68	Unnamed Channel	S6	11	357516	5829839	W1069.0	554.93	2002
BC-69	Unnamed Channel	S6/S4	11	357530	5829795	W1070.0	554.97	2002
BC-70	Unnamed Channel	S4	11	357750	5829709	W1071.0	555.23	2002
BC-71	Unnamed Channel	S4	11	357795	5829322	W1072.0	555.54	2002
BC-72	Unnamed Channel	S5/S3	11	358076	5828714	W1073.0	556.17	AR2068
BC-73a	Unnamed Channel	TBD	11	358403	5828348	W1074.0	556.73	AR2068
BC-74a	Unnamed Channel	TBD	11	358363	5828148	W1075.0	556.94	AR2068
BC-74b	TBD	TBD	11	358370	5828092	W1076.0	556.95	AR2068
BC-75	Unnamed Drainage	NVC	11	358181	5827378	W1077.0	557.54	2002
BC-76	Clemina Creek	S2	11	357793	5826095	W1078.0	558.99	2002
BC-77	Unnamed Channel	S6	11	357702	5825761	W1079.0	559.33	2002
BC-78	Dora Creek	S2	11	357642	5825687	W1080.0	559.42	2002
BC-79	Unnamed Channel	S6	11	357552	5825499	W1081.0	559.62	2002
BC-80	Unnamed Channel	S4	11	357441	5824897	W1082.0	560.27	2002
BC-81	Unnamed Channel	S6	11	357273	5824142	W1083.0	561.04	AR2050
BC-82a	Albreda River	S2	11	356995	5823796	W1084.0	561.52	AR2050

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Watercourse Crossing ID	Watercourse Name	Class	Zone	Easting	Northing	UPI Unique ID	RK (Approx.)	Route
BC-83	Unnamed Channel	S6	11	356662	5823293	W1085.0	562.08	2002
BC-84	Unnamed Channel	S4	11	356601	5821872	W1086.0	563.57	AR2051
BC-85	Albreda River	S2	11	356695	5821810	W1087.0	563.67	AR2051
BC-86	Unnamed Drainage (Wetland)	NCD-W	11	356832	5821582	W1088.0	563.94	AR2051
BC-87	Unnamed Drainage	NVC	11	357166	5820487	W1089.0	565	2002
BC-88	Unnamed Channel	S6	11	357204	5820311	W1090.0	565.18	2002
BC-89	Unnamed Channel	S6/NCD-W (FB)	11	357226	5820187	W1091.0	565.3	2002
BC-90	Unnamed Channel	S3	11	357070	5819606	W1092.0	565.9	2002
BC-90a	Unnamed Drainage	NCD	11	357031	5819490	W1093.0	566.02	2002
BC-91	Unnamed Channel	S4	11	356896	5818998	W1094.0	566.52	2002
BC-92	Unnamed Drainage (Wetland)	NCD-W (FB)	11	356755	5818756	W1095.0	566.8	2002
BC-93	Dominion Creek	S2	11	356818	5818088	W1096.0	567.62	2002
BC-94	Moonbeam Creek	S2	11	355364	5814336	W1097.0	571.91	2002
BC-95	Unnamed Channel	S6	11	355212	5813519	W1098.0	572.74	AR2070
BC-96	Unnamed Drainage	NCD	11	355100	5813342	W1099.0	572.96	AR2070
BC-97	Unnamed Channel	S6	11	354960	5813106	W1100.0	573.23	AR2070
BC-98	Unnamed Channel	S6	11	354860	5813032	W1101.0	573.35	AR2070
BC-99	Unnamed Channel	S5	11	354800	5812944	W1102.0	573.47	AR2070
BC-100	Unnamed Drainage	NCD	11	354429	5812179	W1103.0	574.33	AR2070
BC-100a	Unnamed Channel	S5	11	354341	5811962	W1104.0	574.57	AR2070
BC-101	Unnamed Channel	S5	11	354310	5811794	W1105.0	574.74	AR2070
BC-101a	Unnamed Channel	S6	11	354156	5811606	W1106.0	574.97	AR2070
BC-102	Unnamed Drainage	NCD	11	354120	5811279	W1107.0	575.3	AR2070
BC-102a	Unnamed Drainage	NCD	11	354092	5811009	W1108.0	575.58	AR2070
BC-102b	Unnamed Channel	S6	11	354118	5810940	W1109.0	575.65	AR2070
BC-103	Unnamed Drainage	NCD	11	354096	5810723	W1110.0	575.87	AR2070
BC-104	Unnamed Channel	S2	11	353935	5810380	W1111.0	576.2	AR2070
BC-105	Unnamed Drainage	NCD	11	353772	5810083	W1112.0	576.65	AR2070
BC-106	Unnamed Channel	S6	11	353690	5809709	W1113.0	577.03	AR2070
BC-107	Switch Creek	S3	11	353597	5809129	W1114.0	577.61	AR2070
BC-108	Unnamed Channel	S6	11	353532	5808565	W1115.0	578.21	AR2070
BC-109	Unnamed Channel	S6	11	353222	5807738	W1116.0	579.13	AR2070
BC-109a	Unnamed Channel	S6/S4	11	352625	5807073	W1117.0	580.23	AR2070
BC-110	Serpentine Creek	S2	11	352570	5807008	W1118.0	580.3	AR2070
BC-111	North Thompson River	S1A	11	352062	5806372	W1119.0	581.16	2002
BC-112	Chappell Creek	S2	11	351527	5805704	W1120.0	582	2002
BC-113	Unnamed Channel	S6/S3	11	351212	5805012	W1121.0	582.79	2002
BC-114	Unnamed Drainage	NCD	11	351176	5804987	W1122.0	582.83	2002
BC-115	Unnamed Drainage	NCD	11	351181	5804876	W1123.0	582.93	2002
BC-116	Unnamed Channel	S6	11	351148	5804844	W1124.0	582.96	2002
BC-117	Unnamed Channel	S6	11	351134	5804785	W1125.0	583.03	2002
BC-118	Unnamed Drainage	NCD	11	351178	5804718	W1126.0	583.09	2002
BC-119	Unnamed Channel	S6	11	351199	5804578	W1127.0	583.23	2002

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Watercourse Crossing ID	Watercourse Name	Class	Zone	Easting	Northing	UPI Unique ID	RK (Approx.)	Route
BC-120	Amy Creek	S6	11	351269	5804204	W1128.0	583.61	2002
BC-121	Unnamed Channel	S6	11	351281	5803928	W1129.0	583.89	2002
BC-122	Unnamed Drainage	NCD	11	351371	5802806	W1130.0	585.1	AR2090
BC-123	Unnamed Drainage	NCD	11	351365	5802783	W1131.0	585.13	AR2090
BC-124	Unnamed Channel	S6	11	351399	5802586	W1132.0	585.33	AR2090
BC-125	Unnamed Channel	S6	11	351396	5802284	W1133.0	585.56	2002
BC-126	Unnamed Drainage	NCD	11	351365	5802153	W1134.0	585.69	2002
BC-127	Unnamed Channel	S6	11	351271	5801947	W1135.0	585.91	2002
BC-128	Unnamed Channel	S6	11	351252	5801886	W1136.0	585.98	2002
BC-129	Unnamed Channel	S6	11	351293	5801620	W1137.0	586.22	2002
BC-130	Unnamed Drainage	NCD	11	351440	5801167	W1138.0	586.7	2002
BC-131	Unnamed Drainage	NVC	11	351488	5800937	W1139.0	586.93	2002
BC-132	Unnamed Channel	S6/NCD-W (FB)	11	351545	5800685	W1140.0	587.2	2002
BC-134	Unnamed Drainage	NVC	11	351530	5800352	W1141.0	587.53	2002
BC-135	Unnamed Drainage	NVC	11	351471	5799923	W1142.0	587.97	2002
BC-136	Unnamed Drainage	NVC	11	351455	5799754	W1143.0	588.14	2002
BC-137	Unnamed Channel	S6	11	351427	5799653	W1144.0	588.24	2002
BC-138	Unnamed Channel	S6	11	351426	5799529	W1145.0	588.36	2002
BC-139	Unnamed Channel	S6	11	351353	5799310	W1146.0	588.58	2002
BC-140	Unnamed Channel	S6	11	351340	5798573	W1147.0	589.33	2002
BC-141	Unnamed Drainage	NCD	11	351340	5798450	W1148.0	589.45	2002
BC-142	Unnamed Drainage	NCD	11	351303	5798338	W1149.0	589.56	2002
BC-143	Unnamed Channel	S6	11	351295	5798177	W1150.0	589.73	2002
BC-144	Unnamed Channel	S6	11	351205	5797880	W1151.0	590.04	2002
BC-145	Unnamed Drainage	NCD	11	351199	5797851	W1152.0	590.07	2002
BC-146	Unnamed Channel	S6	11	351127	5797662	W1153.0	590.27	2002
BC-147	Unnamed Channel	S6	11	351067	5797373	W1154.0	590.56	2002
BC-148	Unnamed Channel	S6	11	351088	5797239	W1155.0	590.69	2002
BC-149	Unnamed Channel	S6	11	351114	5796959	W1156.0	590.98	2002
BC-150	Unnamed Drainage	NVC	11	351099	5796736	W1157.0	591.2	2002
BC-151	Miledge Creek	S1B	11	350781	5795173	W1158.0	592.94	2002
BC-152	Unnamed Channel	S6	11	350555	5794183	W1159.0	593.99	2002
BC-153	Unnamed Channel	S6/S3	11	349950	5791920	W1160.0	596.37	2002
BC-154	Unnamed Drainage	NVC	11	349926	5791802	W1161.0	596.5	2002
BC-155	Unnamed Channel	S6	11	349581	5791277	W1162.0	597.13	2002
BC-156	Unnamed Channel	S6/S4	11	349084	5790149	W1163.0	598.37	2002
BC-157	Unnamed Drainage	NCD	11	349070	5790006	W1164.0	598.51	2002
BC-158	Unnamed Channel	S6	11	349056	5789987	W1165.0	598.53	2002
BC-159	Unnamed Drainage	NCD	11	349053	5789953	W1166.0	598.56	2002
BC-160	Unnamed Channel	S6	11	349019	5789853	W1167.0	598.67	2002
BC-161	Unnamed Channel	S6	11	348858	5789373	W1168.0	599.17	2002
BC-162	Unnamed Drainage	NCD	11	348807	5789231	W1169.0	599.33	2002
BC-163	Unnamed Channel	S6	11	348804	5789214	W1170.0	599.34	2002

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BC-164	Unnamed Drainage	NCD	11	348787	5789170	W1171.0	599.39	2002
BC-165	Unnamed Drainage	NVC	11	348743	5789049	W1172.0	599.52	2002
BC-166	Unnamed Drainage	NCD	11	348571	5788567	W1173.0	600.03	2002
BC-167	Unnamed Channel	S6	11	348547	5788522	W1174.0	600.09	2002
BC-168	Thunder River	S1B	11	348418	5788455	W1175.0	600.24	2002
BC-169	Unnamed Drainage	NVC	11	347689	5786357	W1176.0	602.46	2002
BC-170	Unnamed Channel	S6	11	347283	5785592	W1177.0	603.33	2002
BC-171	Unnamed Drainage	NCD	11	347048	5785088	W1178.0	603.88	2002
BC-172	Unnamed Channel	S6	11	346817	5784473	W1179.0	604.54	2002
BC-173	Whitewater Creek	S5/S2	11	346603	5783869	W1180.0	605.18	2002
BC-174	Unnamed Channel	S5/S3	11	345601	5782847	W1181.0	606.64	2002
BC-175	Unnamed Channel	S3	11	345072	5782064	W1182.0	607.58	2002
BC-176	Cook Creek	S2	11	344404	5780401	W1183.0	609.41	2002
BC-177	Cedar Creek	S2	11	343591	5778305	W1184.0	611.65	2002
BC-178	Blue River	S1B	11	342426	5776508	W1185.0	613.83	AR2108
BC-179	Unnamed Drainage	NVC	11	342217	5776011	W1186.0	614.36	2002
BC-180	Goose Creek	NCD-W (FB)	11	341776	5773608	W1187.0	616.89	2002
BC-181	Unnamed Channel	S2	11	341263	5770812	W1188.0	619.83	2002
BC-182	North Thompson River	S1A	11	341238	5770664	W1189.0	619.98	2002
BC-183	Unnamed Drainage	NVC	11	340623	5769454	W1190.0	621.44	2002
BC-184	Unnamed Drainage	NCD	11	340708	5768481	W1191.0	622.48	AR2119
BC-185	Unnamed Drainage (Wetland)	NCD-W (FB)	11	340507	5768062	W1192.0	622.95	AR2119
BC-186	Unnamed Channel	S3	11	340105	5767347	W1193.0	623.77	AR2119
BC-187	Unnamed Channel	S3	11	340049	5767195	W1194.0	623.93	AR2119
BC-188	Unnamed Channel	S6	11	339985	5767079	W1195.0	624.06	AR2119
BC-189	Froth Creek	S2	11	339573	5764702	W1196.0	626.57	AR2119
BC-189a	TBD	TBD S6	11	339615	5762772	W1197.0	628.52	AR2119
BC-189b	TBD	TBD NCD	11	339471	5762547	W1198.0	628.78	AR2119
BC-189c	TBD	TBD NVC	11	339350	5762119	W1199.0	629.23	AR2119
BC-189d	TBD	TBD S6	11	339269	5761633	W1200.0	629.72	AR2119
BC-189e	TBD	TBD NCD	11	339214	5761374	W1201.0	629.99	AR2119
BC-189f	TBD	TBD NCD	11	338816	5759583	W1202.0	632.01	AR2119
BC-189g	TBD	TBD NCD	11	338862	5759406	W1203.0	632.23	AR2119
BC-189h	TBD	TBD S6	11	338814	5759131	W1204.0	632.54	AR2119
BC-189i	TBD	TBD	11	338775	5758850	W1205.0	632.82	AR2119
BC-193b	Foam Creek	TBD	11	338760	5758532	W1206.0	633.15	AR2119
BC-193c	TBD	TBD	11	338558	5757914	W1207.0	633.81	AR2119
BC-193d	TBD	TBD	11	338703	5757207	W1208.0	634.57	AR2119
BC-193e	TBD	TBD	11	338735	5757148	W1209.0	634.64	AR2119
BC-193f	TBD	TBD	11	338754	5757046	W1210.0	634.74	AR2119
BC-195a	TBD	TBD	11	339446	5756040	W1211.0	635.98	AR2119
BC-196b	TBD	TBD	11	339607	5755713	W1212.0	636.34	AR2119
BC-198b	TBD	TBD	11	339952	5755452	W1213.0	636.68	AR2119

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BC-200	Unnamed Channel	S6	11	339778	5755039	W1214.0	637.06	AR2119
BC-201	Finn Creek	S2	11	340053	5754392	W1215.0	637.79	AR2119
BC-202	Unnamed Drainage (Wetland)	NCD-W	11	340232	5754152	W1216.0	638.08	AR2119
BC-203	Unnamed Drainage	NCD	11	340462	5753690	W1217.0	639.57	2002
BC-204	Unnamed Drainage	NCD	11	340784	5752968	W1218.0	640.36	2002
BC-205	Unnamed Drainage	NCD	11	340784	5752631	W1219.0	640.71	2002
BC-206	Unnamed Drainage	NCD	11	340992	5751845	W1220.0	641.53	2002
BC-207	Unnamed Drainage	NCD	11	341117	5751450	W1221.0	641.95	2002
BC-208	Unnamed Drainage	NCD	11	341166	5751376	W1222.0	642.03	2002
BC-209	Unnamed Channel	S6	11	341180	5751292	W1223.0	642.11	2002
BC-210	Unnamed Channel	S3	11	341183	5751131	W1224.0	642.27	2002
BC-211	Unnamed Channel	S6	11	341204	5751013	W1225.0	642.39	2002
BC-212	Unnamed Channel	S6	11	341236	5750892	W1226.0	642.52	2002
BC-213	Unnamed Drainage (Wetland)	S4/NCD-W	11	341264	5750801	W1227.0	642.61	2002
BC-214	Unnamed Drainage (Wetland)	NCD-W (FB)	11	341257	5750646	W1228.0	642.76	2002
BC-215	Unnamed Drainage	S4/NCD-W (FB)	11	341282	5749684	W1229.0	643.74	AR2069
BC-216	Unnamed Drainage	NVC	11	341597	5748812	W1230.0	644.67	2002
BC-216a	TBD	TBD NCD	11	341575	5748708	W1231.0	644.77	2002
BC-217	Unnamed Channel	S4	11	341701	5748207	W1232.0	645.28	2002
BC-217a	Unnamed Channel	S3	11	341756	5747957	W1233.0	645.54	2002
BC-218	Unnamed Channel	S6/S4	11	341893	5747537	W1234.0	645.98	2002
BC-219	Unnamed Drainage	NCD-W	11	341943	5747386	W1235.0	646.14	2002
BC-220	Unnamed Channel	S4	11	341973	5747212	W1236.0	646.31	2002
BC-221	Unnamed Drainage	NVC	11	341980	5747066	W1237.0	646.46	2002
BC-222	Unnamed Drainage (Wetland)	NCD-W (FB)	11	342053	5746475	W1238.0	647.09	2002
BC-223	Unnamed Drainage	NVC	11	342196	5745829	W1239.0	647.76	2002
BC-224	Sundt Creek	S2	11	342242	5745592	W1240.0	648	2002
BC-225	Unnamed Drainage (Wetland)	NCD-W	11	342385	5745076	W1241.0	648.54	2002
BC-226	Unnamed Drainage	NCD	11	342435	5744895	W1242.0	648.72	2002
BC-227	Tumtum Creek	S2	11	342516	5744707	W1243.0	648.92	2002
BC-228	Unnamed Channel	S6/S3	11	342612	5744426	W1244.0	649.23	2002
BC-229	Unnamed Drainage (Wetland)	NCD-W	11	342505	5744042	W1245.0	649.64	2002
BC-230	Unnamed Channel	S4	11	342506	5743985	W1246.0	649.69	2002
BC-231	Unnamed Drainage	NVC	11	342356	5743582	W1247.0	650.12	2002
BC-232	Unnamed Drainage	NVC	11	342225	5743339	W1248.0	650.38	2002
BC-233	Unnamed Drainage	NVC	11	342002	5743090	W1249.0	650.72	2002
BC-234	Unnamed Drainage	NVC	11	341980	5743045	W1250.0	650.76	2002
BC-235	Unnamed Drainage (Wetland)	NCD-W	11	341696	5742983	W1251.0	651.13	2002
BC-236	North Thompson River	S1A	11	341289	5742820	W1252.0	651.56	2002
BC-237	Unnamed Drainage (Wetland)	NCD-W	11	340693	5742221	W1253.0	652.44	AR2091
BC-238	Unnamed Channel	S3	11	340567	5742008	W1254.0	652.69	AR2091
BC-239	Unnamed Channel	S3	11	340329	5741436	W1255.0	653.31	AR2091
BC-240	Unnamed Channel	S3	11	339883	5741247	W1256.0	653.87	AR2091

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BC-241	Unnamed Channel	S6	11	339657	5740792	W1257.0	654.38	AR2091
BC-242	Avola Creek	S3	11	339728	5739127	W1258.0	656.06	AR2091
BC-243	Unnamed Drainage	NCD	11	339628	5738034	W1259.0	657.17	AR2091
BC-243a	TBD	TBD NCD-W (FB)	11	339214	5736725	W1260.0	658.62	AR2091
BC-244	Unnamed Channel	S3	11	339010	5736294	W1261.0	659.15	AR2091
BC-245	Unnamed Channel	S6	11	338809	5735572	W1262.0	659.9	AR2091
BC-246	Unnamed Drainage (Wetland)	NCD-W	11	338371	5734623	W1263.0	661.07	AR2091
BC-247	Unnamed Drainage (Wetland)	S6 or NCD	11	337805	5734176	W1264.0	661.81	AR2091
BC-248	Unnamed Channel	S2	11	336890	5733118	W1265.0	663.27	AR2091
BC-249	Sager Creek	S2	11	336159	5732127	W1266.0	664.55	AR2091
BC-250	Unnamed Drainage (Wetland)	NCD-W	11	334817	5730963	W1267.0	666.33	AR2091
BC-251	Bearpark Creek	S6/S3	11	334681	5730765	W1268.0	666.57	AR2091
BC-252	Unnamed Drainage	NCD	11	334553	5730632	W1269.0	666.76	AR2091
BC-253	Unnamed Drainage	NVC	11	333237	5729656	W1270.0	668.53	AR2091
BC-254	Unnamed Drainage	NCD	11	333086	5729552	W1271.0	668.71	AR2091
BC-255	Unnamed Drainage	NCD	11	332782	5729232	W1272.0	669.15	AR2091
BC-256	Unnamed Drainage	NVC	11	332650	5728986	W1273.0	669.21	2002
BC-257	Unnamed Drainage	NCD	11	330536	5727960	W1274.0	671.93	2002
BC-258	Ivy Creek	S5	11	330465	5727990	W1275.0	672.01	2002
BC-259	Hornet Creek	S3	11	327591	5727196	W1276.0	675.06	AR2082
BC-260	Cormet Creek	S3	11	326657	5727385	W1277.0	675.98	AR2082
BC-261	Unnamed Drainage	NVC	11	325970	5727466	W1278.0	676.68	AR2082
BC-262	Jake Creek	S6	11	324457	5727935	W1279.0	678.33	2002
BC-263	Unnamed Drainage	NVC	11	324297	5728004	W1280.0	678.5	2002
BC-264	Unnamed Drainage	NCD	11	323949	5727996	W1281.0	678.84	2002
BC-265	Unnamed Channel	S6	11	323842	5727983	W1282.0	678.94	2002
BC-266	Unnamed Channel	S6	11	323824	5727944	W1283.0	678.96	2002
BC-267	Unnamed Drainage	NVC	11	323206	5727576	W1284.0	679.71	2002
BC-268	Unnamed Drainage	NVC	11	323143	5727561	W1285.0	679.77	2002
BC-269	Unnamed Drainage	NCD	11	323006	5727456	W1286.0	679.93	2002
BC-270	Unnamed Drainage	NCD	11	322065	5727537	W1287.0	680.87	2002
BC-271	Unnamed Drainage	NCD	11	321571	5727560	W1288.0	681.37	2002
BC-272	Unnamed Drainage	NVC	11	321392	5727554	W1289.0	681.55	2002
BC-273	Unnamed Drainage	NVC	11	321065	5727577	W1290.0	681.87	2002
BC-274	Unnamed Drainage	NVC	11	320204	5727766	W1291.0	682.81	AR2092
BC-275	Mad River	S2	11	319734	5728004	W1292.0	683.37	2002
BC-276	Unnamed Channel	S5/S3	11	318026	5728275	W1293.0	685.24	2002
BC-277	Cove Creek	S2	11	316856	5727993	W1294.0	686.44	2002
BC-278	Divide Creek	S6	11	316294	5727799	W1295.0	687.05	2002
BC-279	Bill Creek	S6	11	315358	5727110	W1296.0	688.26	AR2094
BC-280	Blackberg Creek	S6	11	315043	5726687	W1297.0	688.86	AR2094
BC-281	Unnamed Drainage	NVC	11	314402	5725887	W1298.0	690	AR2094
BC-282	Unnamed Channel	S6	11	314010	5725149	W1299.0	690.7	2002

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BC-283	Unnamed Channel	S6	11	313987	5725015	W1300.0	690.83	2002
BC-284	Unnamed Drainage	NVC	11	313894	5724847	W1301.0	691.02	2002
BC-285	Unnamed Drainage	NVC	11	313827	5724746	W1302.0	691.14	2002
BC-286	Montanna Creek	S6/S3	11	313607	5724219	W1303.0	691.71	2002
BC-287	Unnamed Drainage	NCD	11	313562	5724121	W1304.0	691.82	2002
BC-288	Unnamed Drainage	NCD	11	313520	5724006	W1305.0	691.95	AR2079
BC-289	Unnamed Channel	S6	11	313175	5720609	W1306.0	695.38	2002
BC-290	Unnamed Drainage	NCD	11	313049	5720451	W1307.0	695.58	2002
BC-291	Johnston Creek	NCD	11	311423	5719524	W1308.0	697.55	2002
BC-292	Unnamed Drainage	NCD	11	311264	5719325	W1309.0	697.8	2002
BC-293	Unnamed Drainage	NCD	11	308780	5718817	W1310.0	700.62	2002
BC-294	Unnamed Drainage	NCD	11	308084	5718914	W1311.0	701.32	2002
BC-295	Unnamed Drainage	NCD	11	307877	5718922	W1312.0	701.52	2002
BC-296	Peavine Creek	S2	11	307475	5719119	W1313.0	701.94	2002
BC-297	Unnamed Drainage	NCD	11	306995	5719018	W1314.0	702.43	2002
BC-298	Unnamed Drainage	NVC	11	306804	5718991	W1315.0	702.62	2002
BC-299	Unnamed Drainage	NVC	11	306769	5718990	W1316.0	702.65	2002
BC-300	Unnamed Channel	S6	11	305151	5718837	W1317.0	704.28	AR2080
BC-301	Unnamed Drainage	NVC	11	304996	5718782	W1318.0	704.45	AR2080
BC-302	Crossing Creek	S5/S3	11	301702	5719600	W1319.0	707.91	AR2095
BC-303	Unnamed Drainage	NVC	11	300849	5719808	W1320.0	708.79	2002
BC-304	Unnamed Drainage	NVC	11	299561	5720964	W1321.0	710.62	2002
BC-305	Noblequartz Creek	S5	11	299393	5721150	W1322.0	710.86	2002
BC-306	Unnamed Drainage	NVC	11	299219	5721214	W1323.0	711.04	2002
BC-307	Unnamed Drainage	NVC	11	298090	5721892	W1324.0	712.37	2002
BC-308	Unnamed Drainage	NVC	11	297317	5722448	W1325.0	713.33	2002
BC-309	Raft River	S1B	11	294175	5725201	W1326.0	717.67	AR2104
BC-310	School Creek	S3	10	707453	5726234	W1327.0	719.84	2002
BC-311	Unnamed Drainage	NVC	10	705952	5726139	W1328.0	721.35	2002
BC-312	Clearwater River	S1A	10	702102	5724656	W1329.0	725.53	AR2106
BC-313	Gill Creek	NCD-W	10	700796	5722368	W1330.0	728.75	2002
BC-314	Unnamed Drainage (Wetland)	NCD-W	10	699054	5718189	W1331.0	733.4	2002
BC-314a	TBD	TBD	10	698905	5717057	W1332.0	734.57	AR2059
BC-314b	TBD	TBD	10	698610	5716809	W1333.0	734.99	AR2059
BC-315	Mann Creek	S2	10	698509	5716833	W1334.0	735.09	AR2059
BC-316	Unnamed Channel	NCD or NVC	10	697301	5716634	W1335.0	736.25	2002
BC-317	Unnamed Drainage (Wetland)	NCD-W (FB)	10	696530	5716571	W1336.0	737.04	AR2083
BC-318	Unnamed Channel	S6	10	696249	5716513	W1337.0	737.33	AR2083
BC-319	Unnamed Channel	S6	10	696055	5716513	W1338.0	737.52	AR2083
BC-320	Unnamed Drainage	NVC	10	695017	5716382	W1339.0	738.55	AR2083
BC-321	Unnamed Drainage	NVC	10	694466	5715928	W1340.0	739.25	AR2083
BC-322	Unnamed Drainage	NCD	10	694101	5715671	W1341.0	739.7	AR2083
BC-323	Unnamed Drainage	NVC	10	693601	5714744	W1342.0	740.78	AR2083

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BC-324	Unnamed Drainage	NCD	10	692892	5713960	W1343.0	741.85	AR2083
BC-325	Unnamed Drainage	NCD	10	692939	5713635	W1344.0	742.22	2002
BC-326	Unnamed Drainage	NCD	10	692898	5713039	W1345.0	742.84	2002
BC-327	Unnamed Drainage	NCD	10	693048	5710449	W1346.0	745.48	2002
BC-328	Unnamed Channel	S6	10	693062	5709746	W1347.0	746.18	2002
BC-330	Lemieux Creek	S1B	10	692986	5706768	W1348.0	749.31	AR2084
BC-331	Nehalliston Creek	S2	10	692826	5705228	W1349.0	750.95	2002
BC-332	Eakin Creek	S2	10	692998	5703875	W1350.0	752.35	2002
BC-333	Unnamed Drainage	NVC	10	693317	5702452	W1351.0	753.85	2002
BC-334	Unnamed Channel	NCD or NVC	10	693313	5702091	W1352.0	754.21	2002
BC-335	Spokane Creek	S6	10	693373	5701003	W1353.0	755.33	2002
BC-336	Montigny Creek	S3	10	694122	5698652	W1354.0	757.89	2002
BC-337	Unnamed Drainage	NCD	10	694666	5696667	W1355.0	760.23	AR2098
BC-338	Thuya Creek	S2	10	694978	5695850	W1356.0	761.09	2002
BC-339	Bryan Creek	NCD	10	695207	5694327	W1357.0	762.7	AR2100
BC-340	Unnamed Drainage	NVC	10	695287	5694060	W1358.0	763	2002
BC-341	Unnamed Drainage	NVC	10	695833	5692976	W1359.0	764.21	2002
BC-342	Unnamed Channel	S6/S3	10	696522	5689819	W1360.0	767.59	2002
BC-343	Darlington Creek	S2	10	696564	5689224	W1361.0	768.2	2002
BC-344	Lindquist Creek	S2	10	696607	5688926	W1362.0	768.49	2002
BC-345	Unnamed Drainage	NVC	10	692911	5648560	W1363.0	811.85	AR3301
BC-346	Unnamed Drainage	NVC	10	692919	5648267	W1364.0	812.13	AR3301
BC-347	Unnamed Drainage	NVC	10	692899	5647930	W1365.0	812.47	AR3301
BC-348	Unnamed Drainage	NVC	10	692904	5647456	W1366.0	812.94	AR3301
BC-349	Unnamed Drainage	NVC	10	692872	5647241	W1367.0	813.17	AR3301
BC-350	Unnamed Drainage	NVC	10	692853	5647037	W1368.0	813.39	AR3301
BC-351	Unnamed Drainage	NVC	10	692857	5646654	W1369.0	813.77	AR3301
BC-352	Unnamed Drainage	NVC	10	692842	5646555	W1370.0	813.87	AR3301
BC-353	Unnamed Drainage	NVC	10	692822	5646438	W1371.0	813.96	AR3301
BC-354	Unnamed Drainage	NVC	10	692815	5646227	W1372.0	814.25	AR3301
BC-355	Unnamed Drainage	NVC	10	692802	5646058	W1373.0	814.37	AR3301
BC-356	Unnamed Drainage	NVC	10	692822	5645909	W1374.0	814.52	AR3301
BC-357	Unnamed Drainage	NVC	10	692845	5645438	W1375.0	815.08	AR3301
BC-358	Unnamed Drainage	TBD (S6 or NCD)	10	692651	5644755	W1376.0	815.67	3004
BC-359	Unnamed Drainage	TBD (NCD)	10	692391	5644217	W1377.0	816.27	3004
BC-360	Unnamed Drainage	TBD (NCD)	10	692182	5643688	W1378.0	816.84	3004
BC-361	Unnamed Drainage	TBD (NCD)	10	692136	5643431	W1379.0	817.1	3004
BC-362	Unnamed Drainage	TBD (NCD)	10	692123	5643353	W1380.0	817.18	3004
BC-363	Unnamed Drainage	TBD (NCD)	10	692079	5643110	W1381.0	817.42	3004
BC-364	Unnamed Drainage	NVC	10	692047	5642912	W1382.0	817.62	3004
BC-365	Unnamed Drainage	NVC	10	692034	5642776	W1383.0	817.76	3004
BC-366	Unnamed Drainage	NVC	10	692033	5642611	W1384.0	817.92	3004
BC-367	Unnamed Drainage	NVC	10	691910	5642427	W1385.0	818.13	3004

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Watercourse Crossing ID	Watercourse Name	Class	Zone	Easting	Northing	UPI Unique ID	RK (Approx.)	Route
BC-368	Unnamed Drainage	NVC	10	691864	5642061	W1386.0	818.51	3004
BC-369	Unnamed Drainage	NVC	10	691814	5641708	W1387.0	818.85	AR3289
BC-370	Unnamed Drainage	NVC	10	691806	5641231	W1388.0	819.43	AR3289
BC-371	Jamieson Creek	S2	10	691547	5640420	W1389.0	820.32	AR3289
BC-372	Unnamed Channel	S6	10	689937	5638351	W1390.0	823.36	3004
BC-373	Unnamed Drainage	NVC	10	689726	5638035	W1391.0	823.74	3004
BC-374	Unnamed Channel	S3	10	689237	5637357	W1392.0	824.58	3004
BC-375	Unnamed Drainage	NCD	10	689155	5637277	W1393.0	824.7	3004
BC-376	Lanes Creek	S2	10	688737	5636588	W1394.0	825.49	AR3200
BC-377	Unnamed Drainage	NVC	10	688408	5636462	W1395.0	825.9	3004
BC-378	Unnamed Drainage	NVC	10	687862	5635852	W1396.0	826.72	3004
BC-379	Unnamed Drainage	NVC	10	687739	5635625	W1397.0	826.97	3004
BC-380	Unnamed Drainage	NVC	10	687359	5634905	W1398.0	827.79	AR3201
BC-381	Dairy Creek	S3	10	687063	5634473	W1399.0	828.35	AR3201
BC-382	McQueen Creek	S6	10	686885	5633809	W1400.0	828.99	3004
BC-383	Unnamed Drainage	NCD	10	686962	5631733	W1401.0	831.21	3004
BC-384	Unnamed Drainage	NVC	10	686979	5631269	W1402.0	831.7	3004
BC-385	Unnamed Drainage	NVC	10	686786	5630746	W1403.0	832.26	3004
BC-386	Unnamed Drainage	NVC	10	686776	5630708	W1404.0	832.3	3004
BC-387	Unnamed Drainage	NVC	10	686477	5629901	W1405.0	833.16	3004
BC-388	Unnamed Drainage	NVC	10	686331	5629442	W1406.0	833.64	3004
BC-389	Unnamed Drainage	NVC	10	686193	5629043	W1407.0	834.06	3004
BC-390	Unnamed Drainage	NVC	10	686094	5628743	W1408.0	834.37	3004
BC-391	Unnamed Drainage	NVC	10	686079	5628707	W1409.0	834.41	3004
BC-392	Unnamed Drainage	NVC	10	685885	5628144	W1410.0	835	3004
BC-393	Unnamed Drainage	NVC	10	685834	5628044	W1411.0	835.11	3004
BC-394	Unnamed Drainage	NVC	10	685732	5627701	W1412.0	835.47	3004
BC-395	Unnamed Drainage	NVC	10	685608	5627331	W1413.0	835.86	3004
BC-396	Unnamed Drainage	NCD	10	685722	5627066	W1414.0	836.17	3004
BC-397	Unnamed Drainage	NCD	10	685991	5626603	W1415.0	836.71	3004
BC-398	Unnamed Drainage	NCD	10	685929	5626322	W1416.0	837	3004
BC-399	Unnamed Drainage	NVC	10	685852	5625718	W1417.0	837.61	3004
BC-400	Unnamed Drainage	NCD	10	685815	5625632	W1418.0	837.71	3004
BC-401	Unnamed Drainage	NVC	10	685869	5625268	W1419.0	838.06	3004
BC-402	Unnamed Drainage	NCD	10	685913	5624810	W1420.0	838.52	3004
BC-403	Unnamed Drainage	NCD	10	685914	5624782	W1421.0	838.55	3004
BC-404	Unnamed Drainage	NCD	10	685949	5624591	W1422.0	838.74	3004
BC-405	Unnamed Drainage	NVC	10	685913	5624394	W1423.0	838.95	3004
BC-406	Unnamed Drainage	NCD	10	685603	5623923	W1424.0	839.55	3004
BC-407	Unnamed Drainage	NVC	10	685555	5623885	W1425.0	839.61	3004
BC-408	Unnamed Drainage	NVC	10	685353	5623627	W1426.0	839.93	3004
BC-409	Unnamed Drainage	NVC	10	684097	5622735	W1427.0	841.53	3004
BC-410	Unnamed Drainage	NVC	10	683328	5622323	W1428.0	842.32	3004

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BC-411	Unnamed Drainage	NCD	10	682903	5622073	W1429.0	842.95	3004
BC-412	Unnamed Drainage	NCD	10	681893	5621557	W1430.0	844.11	3004
BC-413	Thompson River	S1A	10	681618	5619240	W1431.0	846.82	3004
BC-414	Unnamed Drainage (Wetland)	NCD-W (FB)	10	681765	5618675	W1432.0	847.4	3004
BC-415	Unnamed Drainage	NCD	10	681794	5618601	W1433.0	847.48	3004
BC-416	Unnamed Drainage	NCD	10	681930	5618307	W1434.0	847.82	3004
BC-417	Unnamed Drainage	NCD	10	682077	5617936	W1435.0	848.23	3004
BC-418	Unnamed Drainage	NVC	10	682267	5616790	W1436.0	849.44	3004
BC-419	Unnamed Drainage	NVC	10	682492	5616175	W1437.0	850.09	3004
BC-419a	Unnamed Drainage	NVC	10	683365	5612877	W1438.0	853.55	3004
BC-419b	Unnamed Drainage	NVC	10	683513	5612388	W1439.0	854.05	3004
BC-419c	Unnamed Drainage	NVC	10	683526	5612102	W1440.0	854.34	3004
BC-419d	Unnamed Drainage	NVC	10	683177	5611331	W1441.0	855.31	3004
BC-419e	TBD	TBD	10	682949	5611189	W1442.0	855.57	3004
BC-419f	TBD	TBD	10	682527	5610680	W1443.0	856.23	3004
BC-419g	Unnamed Drainage	NVC	10	681442	5609459	W1444.0	857.95	3004
BC-426	Peterson Creek	S6	10	681479	5608990	W1445.0	858.43	3004
BC-427	TBD	TBD	10	683348	5607591	W1446.0	860.86	3004
BC-428	TBD	TBD	10	683602	5607614	W1447.0	861.12	3004
BC-429	TBD	TBD	10	683950	5607003	W1448.0	861.92	3004
BC-430	TBD	TBD	10	684164	5606544	W1449.0	862.41	3004
BC-431	Unnamed Drainage	NVC	10	684779	5604390	W1450.0	864.65	3004
BC-432	Unnamed Drainage	NVC	10	684912	5604033	W1451.0	865.02	3004
BC-433	Anderson Creek	NCD-W (FB)	10	684973	5603816	W1452.0	865.25	3004
BC-434	Unnamed Drainage	NCD	10	685052	5603638	W1453.0	865.44	3004
BC-435	Unnamed Channel	S6	10	685190	5603276	W1454.0	865.84	3004
BC-436	Unnamed Drainage	NVC	10	685735	5601959	W1455.0	867.25	3004
BC-437	Unnamed Channel	S6	10	686189	5601015	W1456.0	868.32	AR3207
BC-438	Unnamed Drainage (Wetland)	NCD-W	10	686505	5599386	W1457.0	869.89	3004
BC-439	Unnamed Drainage (Wetland)	NCD-W	10	687026	5597621	W1458.0	871.87	3004
BC-440	Unnamed Drainage	NVC	10	686887	5597168	W1459.0	872.34	3004
BC-441	Droppingwater Creek	S6	10	686332	5595390	W1460.0	874.19	3004
BC-442	Unnamed Drainage	NCD	10	686285	5595191	W1461.0	874.39	3004
BC-443	Unnamed Drainage	NCD	10	685872	5593803	W1462.0	875.83	3004
BC-444	Unnamed Drainage	NCD	10	685866	5593735	W1463.0	875.9	3004
BC-445	Unnamed Drainage (Wetland)	NCD-W	10	685724	5593234	W1464.0	876.42	3004
BC-446	Unnamed Drainage	NCD	10	685490	5592537	W1465.0	877.15	3004
BC-447	Unnamed Drainage	NCD	10	685242	5591183	W1466.0	878.52	3004
BC-448	Unnamed Drainage (Wetland)	NCD-W	10	685034	5590031	W1467.0	879.68	3004
BC-449	Unnamed Drainage	NVC	10	684894	5589157	W1468.0	880.56	3004
BC-450	Unnamed Drainage	NVC	10	684715	5588094	W1469.0	881.63	3004
BC-451	Unnamed Drainage	NVC	10	684431	5586193	W1470.0	883.54	3004
BC-452	Unnamed Drainage	NCD	10	684132	5585345	W1471.0	884.44	3004

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BC-453	Unnamed Drainage	NCD	10	683660	5584025	W1472.0	885.83	3004
BC-454	Unnamed Drainage	NVC	10	683334	5583267	W1473.0	886.65	3004
BC-455	Unnamed Drainage (Wetland)	NCD-W	10	683136	5582765	W1474.0	887.19	3004
BC-456	Unnamed Drainage	NVC	10	683023	5582442	W1475.0	887.53	3004
BC-457	Unnamed Drainage	NVC	10	682780	5581806	W1476.0	888.21	3004
BC-458	Unnamed Drainage	NVC	10	682675	5581523	W1477.0	888.51	3004
BC-459	Moore Creek	S2	10	681510	5577520	W1478.0	892.86	AR3281
BC-460	Cultus Creek	S6	10	681326	5576938	W1479.0	893.45	3004
BC-461	Unnamed Drainage	NVC	10	681484	5576062	W1480.0	894.35	3004
BC-462	Unnamed Drainage	NVC	10	681505	5575694	W1481.0	894.71	3004
BC-463	Unnamed Drainage	NVC	10	681625	5574539	W1482.0	895.87	3004
BC-464	Unnamed Drainage	NVC	10	681615	5574388	W1483.0	896.04	3004
BC-465	Unnamed Drainage	NVC	10	681409	5573831	W1484.0	896.63	3004
BC-466	Disappearing Stream	NCD	10	681361	5573674	W1485.0	896.79	3004
BC-467	Unnamed Drainage	NVC	10	681081	5572950	W1486.0	897.58	3004
BC-468	Unnamed Drainage	NCD	10	680804	5572189	W1487.0	898.43	3004
BC-469	Unnamed Drainage	NCD	10	679484	5571251	W1488.0	900.11	3004
BC-470	Rocky Gulch	S6	10	679324	5571089	W1489.0	900.34	3004
BC-471	Unnamed Drainage	NVC	10	678767	5570094	W1490.0	901.56	3004
BC-472	Unnamed Drainage	NVC	10	678255	5569769	W1491.0	902.18	3004
BC-473	Klup Creek	S5	10	677393	5569142	W1492.0	903.27	3004
BC-474	Unnamed Drainage	NCD	10	677022	5568186	W1493.0	904.29	3004
BC-475	Unnamed Drainage	NCD	10	676324	5567065	W1494.0	905.63	3004
BC-476	Unnamed Drainage	NVC	10	675988	5566747	W1495.0	906.09	3004
BC-477	Unnamed Drainage	NVC	10	674055	5566599	W1496.0	908.06	3004
BC-478	Unnamed Drainage	NVC	10	671573	5566464	W1497.0	910.54	3004
BC-479	Zoht Creek	S6	10	670286	5566662	W1498.0	911.92	3004
BC-480	Unnamed Drainage	NCD	10	669599	5566211	W1499.0	912.75	3004
BC-481	Unnamed Drainage	NVC	10	668628	5564387	W1500.0	914.89	3004
BC-482	Clapperton Creek	S2	10	667892	5563721	W1501.0	915.95	3004
BC-483	Unnamed Drainage	NVC	10	667641	5563530	W1502.0	916.25	3004
BC-484	Unnamed Drainage	NVC	10	667320	5563147	W1503.0	916.74	3004
BC-485	Unnamed Channel	TBD (S6)	10	666357	5562294	W1504.0	918.03	3004
BC-486	Shuta Creek	S3	10	666092	5562083	W1505.0	918.37	3004
BC-487	Unnamed Channel	S6	10	665881	5561934	W1506.0	918.62	3004
BC-487a	TBD	TBD	10	666598	5562478	W1507.0	917.73	3004
BC-488	Unnamed Drainage	NCD	10	665535	5561578	W1508.0	919.12	3004
BC-489	Unnamed Drainage	NVC	10	665245	5561221	W1509.0	919.58	3004
BC-490	Unnamed Drainage	NVC	10	665009	5560916	W1510.0	919.96	3004
BC-491	Unnamed Drainage	NVC	10	664976	5560874	W1511.0	920.02	3004
BC-492	Unnamed Drainage	NVC	10	664893	5560758	W1512.0	920.16	3004
BC-493	Unnamed Channel	S6	10	664768	5560614	W1513.0	920.35	3004
BC-494	Unnamed Drainage	NVC	10	664423	5560244	W1514.0	920.85	3004
BC-495	Unnamed Drainage	NCD	10	664309	5560098	W1515.0	921.03	3004

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BC-496	Unnamed Drainage	NCD	10	664001	5559732	W1516.0	921.51	3004
BC-497	Unnamed Drainage	NCD	10	663660	5559278	W1517.0	922.07	3004
BC-498	Unnamed Drainage	NVC	10	663260	5558584	W1518.0	922.87	3004
BC-499	Unnamed Drainage	NVC	10	663152	5558362	W1519.0	923.11	3004
BC-500	Unnamed Drainage	NVC	10	663042	5558135	W1520.0	923.36	3004
BC-501	Unnamed Drainage	NVC	10	662247	5556864	W1521.0	924.87	3004
BC-502	Unnamed Drainage	NVC	10	661893	5556514	W1522.0	925.37	3004
BC-503	Unnamed Drainage	NVC	10	661620	5556219	W1523.0	925.77	3004
BC-504	Nicola River	S2	10	661603	5553985	W1524.0	928	3004
BC-505	Hamilton Creek	NCD	10	661438	5553262	W1525.0	928.75	3004
BC-506	Unnamed Drainage	NCD	10	661281	5553075	W1526.0	928.99	3004
BC-507	Unnamed Drainage	NCD	10	661225	5552990	W1527.0	929.09	3004
BC-508	Unnamed Drainage	NCD	10	661142	5552894	W1528.0	929.22	3004
BC-509	Unnamed Drainage	NCD	10	661011	5552727	W1529.0	929.43	3004
BC-510	Unnamed Drainage	NCD	10	660791	5552456	W1530.0	929.78	3004
BC-511	Unnamed Drainage	NVC	10	660640	5552269	W1531.0	930.01	3004
BC-512	Godey Creek	S3	10	660028	5551503	W1532.0	930.99	3004
BC-513	Unnamed Drainage	NVC	10	659739	5551128	W1533.0	931.46	3004
BC-514	Unnamed Channel	S6	10	659695	5551093	W1534.0	931.51	3004
BC-515	Unnamed Drainage	NCD	10	659504	5550736	W1535.0	931.92	3004
BC-516	Spanish Creek	NCD	10	659330	5550380	W1536.0	932.32	3004
BC-517	Unnamed Drainage	NVC	10	659063	5549736	W1537.0	933.02	3004
BC-518	Unnamed Drainage	NVC	10	658916	5549349	W1538.0	933.43	3004
BC-519	Unnamed Drainage	NVC	10	658234	5548891	W1539.0	934.27	3004
BC-520	Unnamed Drainage	NVC	10	658104	5548687	W1540.0	934.51	3004
BC-521	Unnamed Drainage	NVC	10	658041	5548496	W1541.0	934.71	3004
BC-522	Unnamed Drainage	NVC	10	657958	5548171	W1542.0	935.05	3004
BC-523	Unnamed Drainage	NVC	10	657607	5547824	W1543.0	935.55	3004
BC-524	Unnamed Drainage	NVC	10	657465	5547711	W1544.0	935.73	3004
BC-525	Unnamed Drainage	NVC	10	657444	5547689	W1545.0	935.76	3004
BC-526	Unnamed Drainage	NCD	10	657333	5547588	W1546.0	935.91	3004
BC-527	Unnamed Drainage	NCD	10	657198	5547447	W1547.0	936.1	3004
BC-528	Stirling Creek	S6	10	656488	5546326	W1548.0	937.52	3004
BC-529	Unnamed Drainage	NVC	10	656796	5545557	W1549.0	938.34	3004
BC-530	Unnamed Drainage	NVC	10	656813	5545490	W1550.0	938.41	3004
BC-531	Kwinshatin Creek	S3 (C)	10	655302	5543296	W1551.0	941.46	3004
BC-532	Unnamed Channel	S4 (C)	10	655245	5543246	W1552.0	941.54	3004
BC-533	Unnamed Channel	S3 (C)	10	655084	5543189	W1553.0	941.71	3004
BC-534	Skuagam Creek	S4 (C)	10	653987	5542890	W1554.0	942.96	3004
BC-536a	Castillion Creek	S6	10	652144	5541534	W1555.0	945.35	AR3185
BC-537a	Unnamed Channel	S6	10	650691	5539559	W1556.0	947.89	AR3185
BC-537b	Unnamed Drainage	NCD	10	650458	5539299	W1557.0	948.25	AR3185
BC-537c	Unnamed Drainage	NCD	10	650369	5539224	W1558.0	948.36	AR3185
BC-538a	Unnamed Drainage	NVC	10	649792	5538767	W1559.0	949.12	AR3185

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BC-538b	Salem Creek	S6	10	649674	5538721	W1560.0	949.24	AR3185
BC-539	Unnamed Drainage	NCD	10	649245	5538379	W1561.0	949.9	3004
BC-540	Unnamed Drainage	NVC	10	648584	5536954	W1562.0	951.5	3004
BC-541	Unnamed Drainage	NVC	10	649383	5535891	W1563.0	952.86	3004
BC-542	Unnamed Channel	S6	10	649668	5535454	W1564.0	953.37	3004
BC-543	Unnamed Drainage	NCD	10	649960	5534617	W1565.0	954.25	3004
BC-544	Unnamed Drainage	NVC	10	649973	5533988	W1566.0	954.87	3004
BC-545	Unnamed Drainage	NCD	10	649965	5533606	W1567.0	955.25	3004
BC-546	Unnamed Drainage	NCD	10	649858	5533024	W1568.0	955.86	AR3282
BC-547	Unnamed Drainage	NVC	10	649417	5531667	W1569.0	957.45	3004
BC-548	Coldwater River	S1B	10	649365	5531263	W1570.0	957.85	3004
BC-549	Gillis Creek	S3	10	649333	5531024	W1571.0	958.09	3004
BC-550	Unnamed Drainage	NCD	10	648669	5529335	W1572.0	959.98	AR3302
BC-551	Kingsvale Creek	S6	10	648649	5528781	W1573.0	960.54	AR3302
BC-552	Unnamed Drainage	NCD	10	648651	5528638	W1574.0	960.68	AR3302
BC-553	Unnamed Drainage	NCD	10	648601	5527620	W1575.0	961.72	AR3302
BC-554	Unnamed Channel	S5	10	648582	5527400	W1576.0	961.94	AR3302
BC-555	Unnamed Channel	S6	10	648076	5525040	W1577.0	964.37	3004
BC-556	Unnamed Channel	S6	10	648290	5524163	W1578.0	965.36	3004
BC-557	Unnamed Drainage	NVC	10	648829	5524071	W1579.0	965.91	3004
BC-557a	TBD	TBD	10	648864	5522985	W1580.0	967.21	3004
BC-558	Unnamed Channel	S5	10	648497	5520660	W1581.0	969.6	3004
BC-559	Coldwater River	S1B	10	648235	5520068	W1582.0	970.26	3004
BC-560	Unnamed Channel	S6	10	648132	5519800	W1583.0	970.55	3004
BC-561	Unnamed Channel	S6/S4	10	647787	5519290	W1584.0	971.16	3004
BC-562	Unnamed Channel	S3	10	647147	5518682	W1585.0	972.04	3004
BC-563	Unnamed Drainage	NCD	10	646994	5518123	W1586.0	972.69	AR3303
BC-564	Unnamed Channel	S3	10	646480	5517406	W1587.0	973.57	AR3303
BC-565	Unnamed Drainage	NCD	10	644982	5515741	W1588.0	975.97	AR3309
BC-566	Unnamed Channel	S6	10	644860	5515533	W1589.0	976.21	AR3309
BC-567	Unnamed Channel	S6/S4	10	644703	5515149	W1590.0	976.63	AR3309
BC-568	Unnamed Channel	S6	10	643959	5513468	W1591.0	978.54	3004
BC-569	Unnamed Drainage	NVC	10	643867	5513077	W1592.0	978.95	3004
BC-570	Coldwater River	S1B	10	643453	5512173	W1593.0	979.99	3004
BC-571	Juliet Creek	S1B	10	643142	5511551	W1594.0	980.81	AR3310
BC-572	Unnamed Drainage	NCD	10	643066	5511108	W1595.0	981.28	AR3310
BC-573	Unnamed Drainage	NCD	10	642951	5510790	W1596.0	981.64	AR3310
BC-574	Unnamed Drainage	NCD	10	642958	5510218	W1597.0	982.21	AR3310
BC-575	Unnamed Channel	S6	10	642896	5507669	W1598.0	984.75	AR3311
BC-575a	Unnamed Channel	S6	10	642932	5507504	W1599.0	984.92	AR3311
BC-576	Unnamed Channel	S6	10	642951	5507140	W1600.0	985.28	AR3311
BC-577	Unnamed Channel	S6	10	643030	5506576	W1601.0	985.85	AR3311
BC-578	Unnamed Drainage	NVC	10	643124	5505436	W1602.0	987	3004
BC-579	Mine Creek	S2	10	643142	5505373	W1603.0	987.06	3004

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BC-580	Unnamed Drainage	NCD	10	643154	5504788	W1604.0	987.64	AR3312
BC-580a	Unnamed Drainage	NCD	10	643126	5504510	W1605.0	987.92	AR3312
BC-581	Unnamed Channel	S6	10	643351	5503030	W1606.0	989.44	3004
BC-582	Coldwater River	S2	10	643548	5502492	W1607.0	990.01	3004
BC-583	Unnamed Channel	S6	10	643658	5500070	W1608.0	992.86	3004
BC-584	Unnamed Channel	S6	10	642597	5499248	W1609.0	994.2	3004
BC-585	Unnamed Channel	S6	10	642119	5499045	W1610.0	994.72	3004
BC-585a	Unnamed Channel	S6	10	641879	5498830	W1611.0	995.04	3004
BC-585b	Unnamed Channel	S6	10	641676	5498676	W1612.0	995.29	AR3304
BC-586	Unnamed Channel	S6	10	641588	5498601	W1613.0	995.41	AR3304
BC-587	Dry Gulch	NCD	10	641169	5498087	W1614.0	996.06	AR3304
BC-588	Fallslake Creek	S3	10	640281	5497243	W1615.0	997.29	AR3304
BC-589	Unnamed Channel	S6	10	639690	5496684	W1616.0	998.1	AR3304
BC-589a	Unnamed Channel	S6	10	639130	5496113	W1617.0	998.93	AR3304
BC-590	Unnamed Channel	S5	10	639065	5496050	W1618.0	999.02	AR3304
BC-590a	Unnamed Channel	S6	10	635775	5495166	W1619.0	1002.81	AR3304
BC-590b	TBD	TBD	10	637682	5494964	W1620.0	1000.82	AR3304
BC-590c	TBD	TBD	10	636060	5495161	W1621.0	1002.53	AR3304
BC-591	Boston Bar Creek	S5	10	635516	5495168	W1622.0	1003.1	AR3304
BC-592	Unnamed Channel	S5	10	634040	5495306	W1623.0	1004.64	AR3304
BC-593	Unnamed Channel	S6	10	632086	5493332	W1624.0	1007.61	AR3304
BC-594	Unnamed Channel	S6	10	631583	5492520	W1625.0	1008.59	AR3304
BC-595	Unnamed Channel	S5	10	631385	5491846	W1626.0	1009.29	AR3304
BC-596	Boston Bar Creek	S5	10	630582	5490531	W1627.0	1011.03	AR3304
BC-597	Unnamed Channel	S6	10	630503	5490398	W1628.0	1011.19	AR3304
BC-598	Unnamed Channel	S6	10	630506	5490306	W1629.0	1011.28	AR3304
BC-599	Unnamed Channel	S6	10	630317	5489632	W1630.0	1011.95	3004
BC-600	Unnamed Channel	S6	10	630253	5489294	W1631.0	1012.29	3004
BC-601	Unnamed Channel	S6	10	630115	5489034	W1632.0	1012.59	3004
BC-602	Unnamed Channel	S6	10	629978	5488623	W1633.0	1013.02	3004
BC-603	Unnamed Channel	S6	10	629940	5488527	W1634.0	1013.12	3004
BC-604	Unnamed Channel	S6	10	629909	5488419	W1635.0	1013.23	3004
BC-605	Unnamed Channel	S6	10	629882	5488364	W1636.0	1013.29	3004
BC-606	Unnamed Channel	S6	10	629810	5487916	W1637.0	1013.74	AR3314
BC-607	Unnamed Channel	S6	10	629805	5487880	W1638.0	1013.78	AR3314
BC-608	Unnamed Channel	S6	10	629749	5487807	W1639.0	1013.86	AR3314
BC-609	Unnamed Channel	S6	10	629718	5487735	W1640.0	1013.95	AR3314
BC-610	Unnamed Channel	S6	10	629703	5487588	W1641.0	1014.1	AR3314
BC-611	Unnamed Channel	S5	10	629684	5487467	W1642.0	1014.22	AR3314
BC-612	Unnamed Channel	S6	10	629655	5487296	W1643.0	1014.39	3004
BC-613	Unnamed Channel	S6	10	629649	5487203	W1644.0	1014.48	3004
BC-614	Unnamed Channel	S5	10	629652	5487075	W1645.0	1014.61	3004
BC-615	Unnamed Channel	S5	10	629687	5486849	W1646.0	1014.84	3004

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BC-616	Unnamed Channel	S6	10	629705	5486631	W1647.0	1015.05	3004
BC-617	Unnamed Channel	S5	10	629866	5486390	W1648.0	1015.34	AR3315
BC-618	Unnamed Drainage	NCD	10	629917	5486225	W1649.0	1015.52	AR3315
BC-619	Unnamed Channel	S6	10	629997	5486080	W1650.0	1015.68	AR3315
BC-619a	Unnamed Drainage	NCD	10	630034	5486002	W1651.0	1015.76	AR3315
BC-620	Unnamed Channel	S6	10	630055	5485888	W1652.0	1015.88	AR3315
BC-621	Unnamed Drainage	NCD	10	630174	5485665	W1653.0	1016.14	3004
BC-622	Unnamed Channel	S6	10	629682	5484197	W1654.0	1017.91	3004
BC-623	Unnamed Channel	S6	10	628952	5483841	W1655.0	1018.78	AR3287
BC-624	Unnamed Channel	S2	10	628804	5483822	W1656.0	1018.93	AR3287
BC-625	Unnamed Channel	S3	10	628627	5483858	W1657.0	1019.11	AR3287
BC-626	Unnamed Channel	S6	10	628301	5483898	W1658.0	1019.44	AR3287
BC-627	Unnamed Channel	S6	10	628206	5483899	W1659.0	1019.53	AR3287
BC-628	Unnamed Channel	S5	10	628048	5483865	W1660.0	1019.7	AR3287
BC-629	Ladner Creek	S2	10	627433	5483815	W1661.0	1020.33	AR3287
BC-630	Unnamed Channel	S3	10	626841	5483283	W1662.0	1021.14	3004
BC-631	Coquihalla River	S1B	10	626828	5482656	W1663.0	1021.78	3004
BC-632	Dewdney Creek	S1B	10	626659	5481660	W1664.0	1022.89	3004
BC-633	Unnamed Drainage	NVC	10	626584	5480911	W1665.0	1023.64	3004
BC-634	Karen Creek	S2	10	626502	5480112	W1666.0	1024.46	3004
BC-635	Unnamed Channel	S3	10	626133	5479285	W1667.0	1025.43	3004
BC-636	Coquihalla River	S1B	10	625423	5478527	W1668.0	1026.47	3004
BC-637	Unnamed Drainage	NCD	10	624727	5478166	W1669.0	1027.31	3004
BC-638	Unnamed Drainage	NVC	10	624482	5477979	W1670.0	1027.63	3004
BC-639	Coquihalla River	S1B	10	623566	5477661	W1671.0	1028.62	3004
BC-640	Unnamed Channel	S5	10	623369	5477436	W1672.0	1028.93	3004
BC-641	Unnamed Drainage	NCD	10	622640	5476053	W1673.0	1030.63	3004
BC-642	Unnamed Drainage	NCD	10	622605	5475912	W1674.0	1030.77	3004
BC-643	Unnamed Drainage	NCD	10	622572	5475810	W1675.0	1030.88	3004
BC-644	Unnamed Channel	S5	10	622323	5475360	W1676.0	1031.39	3004
BC-645	Coquihalla River	S1B	10	622174	5474218	W1677.0	1032.59	3004
BC-646	Railway Creek	S2	10	622080	5473623	W1678.0	1033.24	3004
BC-647	Unnamed Drainage	NCD	10	621855	5472615	W1679.0	1034.32	3004
BC-648	Unnamed Drainage	NVC	10	621937	5471849	W1680.0	1035.1	3004
BC-649	Unnamed Drainage	NCD	10	620583	5471250	W1681.0	1036.7	3004
BC-650	Unnamed Drainage	NVC	10	619757	5471047	W1682.0	1037.54	3004
BC-651	Unnamed Channel	S6	10	619650	5471322	W1683.0	1037.81	3004
BC-652a	Kopp Creek	S4	10	617089	5471237	W1684.0	1040.43	AR3294
BC-653a	Unnamed Channel	S6	10	616678	5471092	W1685.0	1040.88	AR3294
BC-654	Coquihalla River	S1B	10	614660	5470366	W1686.0	1043.25	3004
BC-655	Unnamed Channel	S6/NCD-W (FB)	10	612871	5469900	W1687.0	1045.3	AR3275
BC-656	Unnamed Drainage	NVC	10	611578	5469320	W1688.0	1046.97	3004
BC-657	Silverhope Creek	S1B	10	611321	5469320	W1689.0	1047.22	3004

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BC-658	Chawuthen Creek	S2	10	607106	5469038	W1690.0	1051.47	AR3264
BC-659	Unnamed Channel	S5	10	605590	5468876	W1691.0	1053	3004
BC-660	Unnamed Channel	S5	10	605453	5468873	W1692.0	1053.13	3004
BC-661	Unnamed Drainage	NVC	10	603740	5468132	W1693.0	1055.11	3004
BC-662	Hunter Creek	S1B	10	603499	5467826	W1694.0	1055.51	3004
BC-663	Unnamed Drainage	NCD	10	602608	5467042	W1695.0	1056.71	3004
BC-664	Unnamed Drainage	NVC	10	602101	5466395	W1696.0	1057.54	3004
BC-665	Unnamed Drainage	NVC	10	601657	5466006	W1697.0	1058.23	AR3175
BC-666	Lorenzetta Creek	S2	10	600143	5463664	W1698.0	1060.91	3004
BC-667	Unnamed Channel	S6	10	600026	5463422	W1699.0	1061.17	3004
BC-668	Wahleach Creek	S1B	10	599776	5463191	W1700.0	1061.49	3004
BC-669	Unnamed Drainage	NCD	10	598968	5462452	W1701.0	1062.62	AR3298
BC-669a	Unnamed Drainage	S4	10	598479	5461909	W1702.0	1063.35	AR3298
BC-669b	Unnamed Drainage	S4	10	598328	5461702	W1703.0	1063.59	AR3298
BC-669c	Unnamed Drainage	S4	10	598312	5461692	W1704.0	1063.6	AR3298
BC-669d	Unnamed Drainage	S6	10	598011	5461550	W1705.0	1063.93	AR3298
BC-671	Unnamed Drainage	NVC	10	597783	5461267	W1706.0	1064.3	AR3298
BC-672	Unnamed Drainage	NVC	10	597766	5461219	W1707.0	1064.35	AR3298
BC-673	Unnamed Drainage	NVC	10	597577	5460939	W1708.0	1064.67	AR3298
BC-674	Unnamed Channel	S6	10	597434	5460839	W1709.0	1064.84	AR3298
BC-675	Unnamed Drainage	NCD	10	597166	5460714	W1710.0	1065.13	AR3298
BC-676	Unnamed Channel	S5	10	597027	5460598	W1711.0	1065.32	AR3298
BC-677	Unnamed Drainage	NCD	10	596925	5459911	W1712.0	1066.27	3004
BC-678	Unnamed Channel	S5/S2	10	596902	5459693	W1713.0	1066.48	3004
BC-679	Unnamed Drainage	NCD	10	596730	5459121	W1714.0	1067.09	AR3265
BC-681	Unnamed Channel	S3	10	596336	5457111	W1715.0	1069.22	3004
BC-682	Unnamed Channel	S5/S3	10	596246	5456765	W1716.0	1069.58	3004
BC-683	Unnamed Channel	S6/S3	10	596210	5455635	W1717.0	1070.75	3004
BC-684	Unnamed Channel	S5/S3	10	596283	5455373	W1718.0	1071.02	3004
BC-685	Unnamed Channel	S1B	10	596317	5455056	W1719.0	1071.37	3004
BC-686	Unnamed Channel	S6/S3	10	596147	5454321	W1720.0	1072.13	3004
BC-687	Unnamed Channel	S5	10	596090	5454269	W1721.0	1072.21	3004
BC-688	Unnamed Channel	S2	10	596065	5454183	W1722.0	1072.32	3004
BC-689	Unnamed Channel	S5/S2	10	596009	5453952	W1723.0	1072.55	3004
BC-690	Unnamed Channel	S2	10	596046	5453690	W1724.0	1072.79	3004
BC-691	Unnamed Channel	S6	10	595933	5453569	W1725.0	1072.93	3004
BC-692	Unnamed Channel	S6	10	595817	5453440	W1726.0	1073.1	3004
BC-693	Unnamed Channel	S6/S3	10	595752	5453360	W1727.0	1073.2	3004
BC-694	Unnamed Channel	S6/S4	10	595504	5452961	W1728.0	1073.67	3004
BC-695	Unnamed Channel	S3	10	595281	5452423	W1729.0	1074.25	3004
BC-696	Unnamed Channel	S6	10	595149	5452278	W1730.0	1074.44	3004
BC-697	Unnamed Channel	S2	10	594893	5452088	W1731.0	1074.76	3004
BC-698	Unnamed Drainage	NCD	10	594681	5451916	W1732.0	1075.03	3004

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BC-699	Unnamed Drainage	NVC	10	594560	5451815	W1733.0	1075.2	3004
BC-700	Unnamed Channel	S4	10	593972	5451287	W1734.0	1076.01	AR3276
BC-700a	TBD	TBD	10	593982	5451255	W1735.0	1076.03	AR3276
BC-701	Unnamed Drainage	NCD	10	593881	5451106	W1736.0	1076.2	AR3276
BC-702	Unnamed Drainage	NVC	10	593333	5450669	W1737.0	1076.89	AR3276
BC-703	Unnamed Drainage	NCD	10	593144	5450531	W1738.0	1077.13	AR3276
BC-704	Unnamed Channel	S6	10	592663	5450111	W1739.0	1077.75	3004
BC-705	Anderson Creek	S2	10	592341	5449762	W1740.0	1078.25	3004
BC-706a	Unnamd Channel	S4	10	591906	5449326	W1741.0	1078.87	AR3292
BC-706c	Unnamed Channel	TBD	10	591910	5449322	W1742.0	1078.87	AR3292
BC-706b	Bridal Creek	S3	10	591604	5448817	W1743.0	1079.46	AR3292
BC-707a	Unnamed Channel	S6	10	591337	5448404	W1744.0	1079.98	AR3292
BC-707b	Unnamed Channel	S6	10	591215	5448280	W1745.0	1080.15	AR3292
BC-707c	unnamed Channel	S6	10	590944	5448262	W1746.0	1080.42	AR3292
BC-708	Nevin Creek	S3	10	588119	5447513	W1747.0	1083.39	3004
BC-709	Dunville Creek	S3	10	587695	5447186	W1748.0	1083.92	3004
BC-710	Unnamed Channel	S3	10	587292	5446944	W1749.0	1084.39	3004
BC-711	Unnamed Channel	S6	10	585530	5446201	W1750.0	1086.29	3004
BC-712	Unnamed Channel (known locally as Brown Ditch)	S3	10	585256	5446061	W1751.0	1086.6	3004
BC-713	Elk Creek	S3	10	584311	5445607	W1752.0	1087.65	3004
BC-714	Semmihault Creek	S3	10	579992	5443005	W1753.0	1092.7	3004
BC-715	Chilliwack Creek	S2	10	578945	5442276	W1754.0	1093.98	3004
BC-716	Chilliwack/Vedder River Side Channel	S1B	10	571533	5439092	W1755.0	1102.14	3004
BC-717	Chilliwack/Vedder River	S1B	10	571493	5438952	W1756.0	1102.28	3004
BC-718	Hopedale Slough	S2	10	571484	5438838	W1757.0	1102.39	3004
BC-719	Unnamed Channel	S2	10	571315	5438591	W1758.0	1102.69	3004
BC-720	Street Creek	S3	10	571211	5438091	W1759.0	1103.18	3004
BC-721	Unnamed Channel	S4	10	570016	5436776	W1760.0	1104.97	3004
BC-722	Stewart Slough	S2	10	569056	5436489	W1761.0	1106.03	3004
BC-723	Unnamed Channel	S3	10	565040	5435749	W1762.0	1110.1	3004
BC-724	Unnamed Channel	S3	10	565020	5435745	W1763.0	1110.12	3004
BC-725	Sumas Lake Canal	S1B	10	564480	5435646	W1764.0	1110.67	3004
BC-726	Sumas River	S1B	10	560553	5435216	W1765.0	1114.64	3004
BC-727	Neufeld Creek	S6	10	559232	5435510	W1766.0	1116.01	3004
BC-728	Tributary to Marshall Creek	S5	10	558821	5435770	W1767.0	1116.51	3004
BC-729	Tributary to Clayburn Creek/ Ledgeview Creek	S5	10	556741	5435990	W1768.0	1118.79	3004
BC-730	Unnamed Channel	S3	10	555464	5435985	W1769.0	1120.19	AR3293
BC-731	Clayburn Creek	S2	10	553409	5436669	W1770.0	1122.38	3004
BC-732	Clayburn Creek	S2	10	552480	5437022	W1771.0	1123.39	3004
BC-733	Tributary to Gilford Slough	S3	10	550725	5437686	W1772.0	1125.25	3004
BC-734	McLennan Creek	S2	10	548392	5438571	W1773.0	1127.76	3004
BC-735a	TBD	TBD	10	546913	5438947	W1774.0	1129.29	AR3296
BC-736	Unnamed Channel	S2	10	546508	5439407	W1775.0	1129.85	3004

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BC-737	Unnamed Drainage	NVC	10	545822	5439546	W1776.0	1130.54	3004
BC-738	Unnamed Drainage (Wetland)	NCD-W	10	543995	5440176	W1777.0	1132.47	3004
BC-739	Tributary to Hann Creek	TBD (S6 or NCD)	10	543250	5440430	W1778.0	1133.25	3004
BC-740	Unnamed Channel	S6	10	542391	5440735	W1779.0	1134.16	3004
BC-741	Unnamed Channel	S6	10	542244	5440790	W1780.0	1134.32	3004
BC-741a	Unnamed Drainage	NCD	10	542211	5440756	W1781.0	1134.34	3004
BC-742	Unnamed Channel	S6	10	541212	5441196	W1782.0	1135.42	3004
BC-743	Tributary to Nathan Creek	S6 / S4	10	540541	5441420	W1783.0	1136.12	3004
BC-744	Unnamed Channel	S3	10	540306	5441511	W1784.0	1136.37	3004
BC-745	Tributary to Nathan Creek	S6	10	539724	5441612	W1785.0	1136.94	3004
BC-746	Unnamed Channel	S6	10	539496	5441913	W1786.0	1137.27	3004
BC-747	Nathan Creek	S2	10	538748	5441903	W1787.0	1138.02	3004
BC-748	Tributary to Nathan Creek (Turkey Brook)	S5	10	537155	5442493	W1788.0	1139.76	3004
BC-749	West Creek	S2	10	534068	5443518	W1789.0	1142.99	3004
BC-750	Tributary to West Creek	S6	10	533406	5443691	W1790.0	1143.67	3004
BC-751	Davidson Creek	S3	10	531449	5444047	W1791.0	1145.66	3004
BC-752	Unnamed Drainage (Wetland)	NCD-W	10	530142	5444209	W1792.0	1146.97	3004
BC-753	Salmon River	S2	10	529778	5444366	W1793.0	1147.37	3004
BC-754	Unnamed Drainage (Wetland)	NCD-W (FB)	10	529469	5444481	W1794.0	1147.7	3004
BC-755	Unnamed Drainage	NCD	10	529330	5444497	W1795.0	1147.83	3004
BC-759	TBD	NCD	10	528080	5446116	W1796.0	1150.67	AR3253
BC-766	East Munday Creek	S3	10	526966	5447469	W1797.0	1152.44	3004
BC-767	West Munday Creek	S2	10	525491	5447839	W1798.0	1153.95	3004
BC-768	Yorkson Creek	S3	10	525187	5447895	W1799.0	1154.26	3004
BC-769	Unnamed Drainage	NVC	10	521412	5447609	W1800.0	1158.06	3004
BC-770	Unnamed Channel	S3	10	521076	5447654	W1801.0	1158.4	3004
BC-771	TBD	TBD	10	520035	5448129	W1802.0	1159.66	AR3290
BC-772	Unnamed Channel	S3	10	519352	5448858	W1803.0	1160.6	3004
BC-773	Unnamed Channel	TBD	10	518517	5449562	W1804.0	1161.68	3004
BC-774a	Centre Creek	S3	10	517613	5450052	W1805.0	1162.9	AR3300
BC-776a	Tributary to Fraser River	S3	10	516114	5450860	W1806.0	1164.68	AR3300
BC-777	Tributary to Fraser River	S3	10	515514	5451070	W1807.0	1165.37	AR3300
BC-778	Tributary to Bon Accord Creek	S3	10	513854	5451344	W1808.0	1167.05	AR3300
BC-779	TBD	TBD	10	513820	5451361	W1809.0	1167.07	AR3300
BC-780	Fraser River	S1A	10	513822	5451854	W1810.0	1167.54	AR3300
BC-780a	TBD	TBD	10	513613	5452555	W1811.0	1168.27	AR3300
BC-780d	TBD	TBD	10	513498	5452633	W1812.0	1168.49	AR3300
BC-780b	Unnamed Channel	S2	10	512369	5452448	W1813.0	1169.65	AR3300
BC-780c	TBD	TBD	10	511096	5452914	W1814.0	1170.92	3004
BC-781	Como Creek	S2	10	510872	5452973	W1815.0	1171.15	3004
BC-782	Nelson Creek	S2	10	509864	5453050	W1816.0	1172.17	AR3308
BC-783a	Keswick Park Creek	TBD (NVC?)	10	508681	5453549	W1817.0	1173.54	AR3307
BC-783b	Holmes Creek	TBD	10	507671	5454424	W1818.0	1174.89	AR3307

British Columbia

Watercourse Crossing ID	Watercourse Name	Class	Zone	Easting	Northing	UPI Unique ID	RK (Approx.)	Route
BC-784a	Austin Creek / Willoughby Creek/ Holmes Creek (Dr. Pearson)	TBD (S3 or S6)	10	507391	5454512	W1819.0	1175.16	AR3307
BC-785	Stoney Creek	S2	10	506591	5455438	W1820.0	1176.54	AR3307
BC-785a	Tributary to Eagle Creek	S5	10	504612	5457071	W1821.0	1179.52	AR3247
BC-785b	Tributary to Silver Creek	TBD (S6 or NCD)	10	505629	5457268	W1822.0	1179.77	3004
BC-785c	Tributary to Silver Creek	TBD (S6 or NCD)	10	505578	5457309	W1823.0	1179.77	3004
BC-785e	TBD	TBD	10	504619	5457847	W1824.0	0.6	AR4018
BC-785f	TBD	TBD	10	504480	5458162	W1825.0	0.94	AR4018
BC-785g	TBD	TBD	10	504414	5458323	W1826.0	1.12	AR4018
BCT-1	Unnamed Drainage	NVC	10	694219	5649317	W1827.0		
BCT-2	North Thompson River	S1A	10	693653	5649492	W1828.0		
BCT-3	Unnamed Drainage	NVC	10	693467	5649498	W1829.0		
BCT-4	Unnamed Drainage	NVC	10	693194	5649509	W1830.0		
BCT-5	Unnamed Drainage	NVC	10	692909	5649465	W1831.0		
BCT-6	Unnamed Drainage	NVC	10	692894	5649275	W1832.0		
BCT-7	Unnamed Drainage	NVC	10	681115	5611741	W1833.0		
BCT-8	Unnamed Drainage	NVC	10	692848	5648812	W1834.0		
BCT-9	Unnamed Drainage (Wetland)	NCD-W	10	671249	5535514	W1835.0		
BCT-10	Unnamed Drainage	NCD	10	670924	5535630	W1836.0		
BCT-11	Unnamed Drainage	NVC	10	670416	5535566	W1837.0		
BCT-12	Otter Creek	S6	10	669804	5535460	W1838.0		
BCT-13	Unnamed Channel	S6	10	669058	5535334	W1839.0		
BCT-14	Voght Creek	TBD (S3 or S6)	10	667885	5535233	W1840.0		
BCT-15	Unnamed Channel	TBD (S6)	10	667117	5535186	W1841.0		
BCT-16	Kanevale Creek	S3	10	663799	5534844	W1842.0		
BCT-17	Unnamed Drainage	NCD	10	662986	5534842	W1843.0		
BCT-18	Unnamed Drainage	NVC	10	662166	5534837	W1844.0		
BCT-19	Kimble Creek	NCD	10	661575	5534735	W1845.0		
BCT-20	Unnamed Drainage	NCD	10	660490	5534792	W1846.0		
BCT-21	Howarth Creek	S3	10	659763	5534861	W1847.0		
BCT-22	Unnamed Drainage	NVC	10	658245	5534723	W1848.0		
BCT-23	Unnamed Drainage	NVC	10	657801	5534617	W1849.0		
BCT-24	Unnamed Drainage	NVC	10	657278	5534466	W1850.0		
BCT-25	Unnamed Drainage	NCD	10	656656	5534268	W1851.0		
BCT-26	Unnamed Drainage	NVC	10	656357	5534165	W1852.0		
BCT-27	Unnamed Drainage	NVC	10	656098	5534144	W1853.0		
BCT-28	Nilsson Creek	S6	10	655596	5533980	W1854.0		
BCT-29	Unnamed Drainage	NVC	10	655041	5533833	W1855.0		
BCT-29a	Unnamed Channel	S6	10	654855	5533805	W1856.0		
BCT-30	Unnamed Drainage	NCD	10	654376	5533641	W1857.0		
BCT-31	Unnamed Drainage	NVC	10	653175	5533292	W1858.0		
BCT-32	Unnamed Drainage	NVC	10	653117	5533260	W1859.0		
BCT-33	Unnamed Drainage	NVC	10	653053	5533265	W1860.0		
BCT-34	Unnamed Drainage	NCD	10	652285	5533036	W1861.0		
BCT-35	Unnamed Drainage	NCD	10	649901	5533018	W1862.0		