



**RARE ECOLOGICAL COMMUNITY AND
RARE PLANT POPULATION
MANAGEMENT PLAN
FOR THE
TRANS MOUNTAIN PIPELINE ULC
TRANS MOUNTAIN EXPANSION PROJECT
NEB CONDITION 40**

March 2018

REV 4

687945

01-13283-GG-0000-CHE-RPT-0039 R4

Prepared for:



TRANSMOUNTAIN

Trans Mountain Pipeline ULC

Kinder Morgan Canada Inc.
Suite 2700, 300 – 5th Avenue S.W.
Calgary, Alberta T2P 5J2
Ph: 403-514-6400

TABLE OF CONCORDANCE

Condition 40 is applicable to the following legal instruments: OC-064 (CPCN), AO-004-OC-2 (OC2), XO-T260-007-2016 (Temp), XO-T260-008-2016 (Pump 1), XO-T260-009-2016 (Pump 2), and XO-T260-010-2016 (Tanks). Table 1 describes how this Report addresses the Condition requirements applicable to Project activities.

TABLE 1

LEGAL INSTRUMENT CONCORDANCE WITH NEB CONDITION 40: RARE ECOLOGICAL COMMUNITY AND RARE PLANT POPULATION MANAGEMENT PLAN

NEB Condition 40	OC-064 (CPCN)	AO-004-OC-2 (OC2)	XO-T260- 007-2016 (Temp)	XO-T260- 008-2016 (Pump1)	XO-T260- 009-2016 (Pump2)	XO-T260- 010-2016 (Tanks)
Trans Mountain must file with the NEB for approval, at least 5 months prior to commencing construction, an updated Rare Ecological Community and Rare Plant Population Management Plan for ecological communities of concern, rare plants and lichens, and early draft, candidate, proposed, or final critical habitat for plant and lichen species under <i>SARA</i> that are potentially affected directly or indirectly by the Project during construction or operations, that includes: a) a summary of supplementary survey results, and a demonstration of the overall adequacy of the rare ecological community and rare plant surveys, including the adequacy for the identification of biophysical attributes for any early draft, candidate, proposed, or final critical habitat under the <i>SARA</i> ;	Section 4.0 and Appendices D and E of this Plan	Section 4.0 and Appendices D and E of this Plan	Section 4.0 and Appendices D and E of this Plan	Section 4.0 and Appendices D and E of this Plan	Section 4.0 and Appendices D and E of this Plan	Section 4.0 and Appendices D and E of this Plan
b) avoidance and mitigation measures to be implemented during construction and operations, including all relevant measures committed to throughout the OH-001-2014 proceeding and any new measures resulting from supplementary surveys, with rationales and unambiguous criteria explaining under what circumstances each measure will be applied, and measurable goals against which the success of each measure will be evaluated;	Sections 1.4 and 5.0 and Appendix E of this Plan	Sections 1.4 and 5.0 and Appendix E of this Plan	Sections 1.4 and 5.0 and Appendix E of this Plan	Sections 1.4 and 5.0 and Appendix E of this Plan	Sections 1.4 and 5.0 and Appendix E of this Plan	Sections 1.4 and 5.0 and Appendix E of this Plan
c) a description of how the avoidance, mitigation, and offset hierarchy was considered in developing the Plan, with rationales for progressing from avoidance to mitigation to offsets;	Section 1.3 and 7.0 of this Plan	Section 1.3 and 7.0 of this Plan	Section 1.3 and 7.0 of this Plan	Section 1.3 and 7.0 of this Plan	Section 1.3 and 7.0 of this Plan	Section 1.3 and 7.0 of this Plan
d) details on post-construction monitoring, including survey methods, the appropriate number of years of monitoring to determine the success of each type of avoidance and mitigation measure, corrective actions that might be necessary, and the circumstances under which each such action would be taken;	Section 6.0 of this Plan	Section 6.0 of this Plan	Section 6.0 of this Plan	Section 6.0 of this Plan	Section 6.0 of this Plan	Section 6.0 of this Plan

TABLE 1 Cont'd

NEB Condition 40	OC-064 (CPCN)	AO-003-OC-2 (OC2)	XO-T260-007-2016 (Temp)	XO-T260-008-2016 (Pump1)	XO-T260-009-2016 (Pump2)	XO-T260-010-2016 (Tanks)
e) Preliminary Rare Ecological Community and Rare Plant Population Offset Plan for any ecological communities and rare plant and lichen species that have an at-risk status of S1, S1S2 or S2, or that are listed under federal or provincial legislation for protection, and for any early draft, candidate, proposed, or final critical habitat under the SARA, and that, after five years of operations, have ongoing effects. This preliminary plan must include: <ul style="list-style-type: none"> i. a rationale for why the community, species, or critical habitat cannot be avoided by a sufficient distance to avoid both direct and indirect residual effects; ii. the expected residual effects on that community, species, or critical habitat, including a discussion of the potential for time lags between when Project effects occur and when mitigation measures would become fully functional, and taking into account the success on past projects of the proposed mitigation and corrective measures in b) and d) above; iii. an analysis of the appropriateness of offsets for the community, species or critical habitat, taking their specific features into account, and of any potential limitations on offset effectiveness; iv. a description of how the avoidance, mitigation, monitoring, corrective, and offset measures are consistent with any applicable recovery, action or management strategies or plans for the community, species or critical habitat; v. an explanation with rationales of how the need for offset measures will be determined and how quantitative offset objectives will be developed, including the use and selection of offset ratios, with the aim of achieving no-net-loss; vi. the potential types of offset measures, the process for selecting which will be implemented, an estimation of the probability of their success, and how compensation sites will be selected; vii. a discussion of how the effectiveness of offset measures will be monitored, assessed, and reported on, and problems corrected; 	Sections 6.0 and 7.0 of this Plan	Sections 6.0 and 7.0 of this Plan	Sections 6.0 and 7.0 of this Plan	Sections 6.0 and 7.0 of this Plan	Sections 6.0 and 7.0 of this Plan	Sections 6.0 and 7.0 of this Plan
f) a description of how Trans Mountain has taken available and applicable Aboriginal Traditional Land Use (TLU) and TEK into consideration in developing the Plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal TLU information and TEK, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information;	Section 1.2 of this Plan	Section 1.2 of this Plan	Section 1.2 of this Plan	Section 1.2 of this Plan	Section 1.2 of this Plan	Section 1.2 of this Plan

TABLE 1 Cont'd

NEB Condition 40	OC-064 (CPCN)	AO-003-OC-2 (OC2)	XO-T260-007-2016 (Temp)	XO-T260-008-2016 (Pump1)	XO-T260-009-2016 (Pump2)	XO-T260-010-2016 (Tanks)
g) a summary of its consultations with Appropriate Government Authorities, any species experts and any potentially affected Aboriginal groups. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the Plan; and	Section 2.0 and Appendix A of this Plan	Section 2.0 and Appendix A of this Plan	Section 2.0 and Appendix A of this Plan	Section 2.0 and Appendix A of this Plan	Section 2.0 and Appendix A of this Plan	Section 2.0 and Appendix A of this Plan
h) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) (EPPs) to include any relevant information from the Plan, including confirmation that the avoidance, mitigation, monitoring, corrective, and offset measures in the Plan will be implemented to the extent feasible in the case of discovery via their inclusion in the Rare Ecological Communities or Rare Plant Species Discovery Contingency Plan.	Section 5.6 of this Plan	Section 5.6 of this Plan	Section 5.6 of this Plan	Section 5.6 of this Plan	Section 5.6 of this Plan	Section 5.6 of this Plan

EXECUTIVE SUMMARY

The Rare Ecological Community and Rare Plant Population Management Plan (the Plan) was prepared to meet the requirements of National Energy Board (NEB) Condition 40. This Plan has been prepared to describe mitigation measures for ecological communities of concern; rare plants and lichens; and early draft, candidate, or final critical habitat for plant and lichen species under the *Species at Risk Act (SARA)* that are potentially affected by the Project during construction or operations. The Plan includes a summary of supplemental survey results and consultation activities since the original filing of the Facilities Application (the Application) to the NEB in December 2013. The Plan is an update to the original Plan that was provided in the Application and builds on the existing mitigation measures for known rare ecological community and rare plant occurrences.

Rare plant and rare ecological community occurrences are encountered by the Trans Mountain Expansion Project ("TMEP" or "the Project") from near Edmonton, Alberta to Burnaby, British Columbia (BC). Environment and Climate Change Canada (ECCC, formerly Environment Canada) has identified critical habitat (in various stages of review) for five federally designated rare plant species that are either on Schedule 1 of *SARA* or designated as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and transect the pipeline construction footprint. These include final critical habitat for toothcup (*Rotala ramosior*) and Haller's apple moss (*Bartramia halleriana*); candidate regeneration critical habitat for whitebark pine (*Pinus albicaulis*); and early draft critical habitat for Mexican mosquito fern (*Azolla mexicana*) and Roell's brotherella moss (*Brotherella roellii*). However, there were no observations of toothcup, Haller's apple moss, whitebark pine trees, Mexican mosquito fern or Roell's brotherella moss on the Project Footprint during the vegetation surveys conducted from 2013 to 2017.

Trans Mountain Pipeline ULC (Trans Mountain) will avoid the majority of toothcup final critical habitat by implementing a trenchless crossing of the Thompson River at Mission Flats. However, based on vegetation survey information from 2013, 2014, and 2015, the portion of critical habitat that the Project does intersect does not possess the biophysical attributes for toothcup habitat. One Haller's apple moss final critical habitat polygons is transected between Hinton and Hargreaves. The Fraser Bridge population is transected by an existing access road (Road ID 20328.1.0). High-density candidate critical habitat for whitebark pine is not encountered by the pipeline construction footprint, however, some areas of candidate regeneration critical habitat for whitebark pine, as identified by ECCC, are crossed by the Project Footprint between Hargreaves and Hope, as well as by the reactivation segment between Hinton and Hargreaves. The Project Footprint crosses early draft critical habitat for Mexican mosquito fern near Little Fort, BC, as well as early draft critical habitat for Roell's brotherella moss between Hope and Burnaby, BC. Trans Mountain will continue to consult with ECCC regarding critical habitat to obtain the most up-to-date critical habitat delineation and recovery strategies.

Mitigation measures were developed for this Plan using the mitigation hierarchy of avoid, minimize, and restore on-site. Site-specific mitigation measures for rare plant or rare ecological community occurrences are contained in Appendix E. These mitigation measures will also be included in Volume 7 of the Environmental Plans and will be included on the Environmental Alignment Sheets found in Volume 8 of the Environmental Plans. Site-specific mitigation measures are designed to fully mitigate residual effects to ecological communities and rare plant species, as well as those species listed by the British Columbia Conservation Data Centre (BC CDC) as having an at-risk status of S1, S1S2, S2 or that are listed under federal or provincial legislation, therefore offset measures are not expected to be necessary.

Measurable outcomes and details of post-construction environmental monitoring (PCEM) to evaluate the effectiveness of mitigation and habitat restoration measures are provided. This Plan is part of the Environmental Management Plans (Section 5.3 of Volume 6 of the Environmental Plans) and will be summarized and updated in Section 5.1 of Volume 7 of the Environmental Plans to ensure that the mitigation and restoration measures are implemented. The results of PCEM for rare ecological communities and rare plant populations will be provided in the PCEM reports to be filed by Trans Mountain as per NEB Condition 151.

TABLE OF CONTENTS

	<u>Page</u>
TABLE OF CONCORDANCE	i
EXECUTIVE SUMMARY	IV
1.0 INTRODUCTION.....	1
1.1 Project Description	1
1.2 Traditional Ecological Knowledge and Traditional Land Use	2
1.3 Mitigation Hierarchy	6
1.4 Objectives and Measurable Goals	6
1.5 Commitment Management.....	8
1.6 Links to other Trans Mountain Environmental Plans	8
2.0 CONSULTATION AND ENGAGEMENT	10
3.0 CONTEXT AND APPROACH	11
3.1 Regulatory Context	11
3.2 Definitions of Rarity	11
3.3 Project Interactions	12
3.3.1 Temporary Construction Lands and Infrastructure	12
3.3.2 Pipeline Construction Footprint	12
3.4 Critical Habitat, Recovery Strategies, and Management Plans	14
3.4.1 Toothcup	15
3.4.2 Haller's Apple Moss	15
3.4.3 Whitebark Pine	15
3.4.4 Mexican Mosquito Fern	16
3.4.5 Roell's Brotherella Moss	16
3.4.6 Vancouver Island Beggarticks	16
4.0 SUPPLEMENTAL SURVEY RESULTS FROM 2014, 2015 AND 2017	17
4.1 Methods	17
4.1.1 Updated Rankings for Plant and Lichen Species of Concern.....	18
4.1.2 Field Data Collection	19
4.1.3 Terrestrial Ecosystem Mapping	20
4.2 Supplemental Survey Results Summary	20
5.0 MITIGATION MEASURES.....	22
5.1 Measures for Critical Habitat.....	23
5.1.1 Toothcup Critical Habitat.....	23
5.1.2 Toothcup Critical Habitat Mitigation Strategies	26
5.1.3 Whitebark Pine Candidate Regeneration Critical Habitat	27
5.1.4 Whitebark Pine Candidate Regeneration Critical Habitat Mitigation Strategies	27
5.1.5 Haller's Apple Moss Critical Habitat	28
5.1.6 Haller's Apple Moss Critical Habitat Mitigation Strategies	30
5.1.7 Mexican Mosquito Fern Early Draft Critical Habitat	30
5.1.8 Mexican Mosquito Fern Critical Habitat Mitigation Strategies	30
5.1.9 Roell's Brotherella Moss Early Draft Critical Habitat.....	31
5.1.10 Roell's Brotherella Moss Critical Habitat Mitigation Strategies	31
5.2 Measures for Critically Imperiled Vegetation features (Provincial Conservation Status Ranks: S1, S1S2, and S2).....	32
5.3 Measures for Special Concern to Imperiled Vegetation Features (Provincial Conservation Status Ranks: S2, S2S3, S1S3, S3, SNR, SH or SU).....	35
5.3.1 Rare Ecological Communities	35
5.3.2 Rare Plant Species	36

5.4	Rare Ecological Communities or Rare Plant Species within 2 m of the Project Footprint	38
5.5	Mitigation Summary	38
5.6	Update to Environmental Protection Plans	40
6.0	POST-CONSTRUCTION ENVIRONMENTAL MONITORING	41
6.1	Critical Habitat Monitoring	42
6.2	Monitoring of Provincially Listed Rare Plant Populations and Rare Ecological Communities	42
6.3	Adaptive Management and Potential Corrective Measures	44
7.0	PRELIMINARY RARE ECOLOGICAL COMMUNITY AND RARE PLANT POPULATION OFFSETS.....	47
7.1	Determining Need for Offsets	47
7.2	Offset Approach	49
7.3	Determining Offset Ratios	53
7.4	Offset Monitoring and Reporting	53
7.5	Offset Summary	53
8.0	CONCLUSION	54
9.0	REFERENCES.....	56
9.1	Personal Communications	56
9.2	Literature Cited.....	56
9.3	GIS Data and Mapping References.....	61

LIST OF APPENDICES

Appendix A	Consultation and Engagement.....	A-1
Appendix B	List of Aboriginal Groups Identified for Consultation Regarding the Rare Ecological Community and Rare Plant Population Management Plan.....	B-1
Appendix C	Terrestrial Ecosystem Mapping	C-1
Appendix D	Supplemental Survey Results from 2014, 2015 and 2017	D-1
Appendix E	Mitigation for the Occurrences of Rare Plants, Lichens, and Ecological Communities Observed Along the Project Footprint.....	E-1
Appendix F	Record of Stakeholder Notification of Plan	F-1

LIST OF FIGURES

Figure 5.1.1-1	Toothcup Critical Habitat Overlap with the Project Footprint at Mission Flats.....	25
Figure 5.1.5	Haller’s Apple Moss Critical Habitat Overlap with an Existing Access Road at Hargreaves, BC.....	29
Figure 7.1-1	Rare Plant Population and Ecological Community Offset Decision Framework.....	48

LIST OF TABLES

Table 1	Legal Instrument Concordance with NEB Condition 40: Rare Ecological Community and Rare Plant Population Management Plan	i
Table 2	TEK and TLU Information on Rare Plant Species Along the Pipeline Route	3
Table 3	Trans Mountain Plans Linked to this Plan	9
Table 4	Rare Plants and Lichens in Alberta with a Provincial Rarity Rank Change.....	18
Table 5	Rare Plants in BC with a Provincial Rarity Rank Change.....	18
Table 6	Toothcup Critical Habitat Area Overlap with the Project Footprint	24
Table 7	Performance Indicators and Measurable Targets for Critical Habitat.....	42
Table 8	Performance Indicators and Measurable Targets for Provincially Listed Rare Plant Populations and Rare Ecological Communities.....	43

Table 9	Potential Corrective Measures for Rare Ecological Community or Rare Plant Occurrences.....	45
Table 10	Summary and Evaluation of Offset Options for Rare Plants and Ecological Communities	51
Table 11	Example of Biodiversity Offset Ratios Based on Ecosystem Rarity	53
Table A-1	Summary of Regulatory Consultation Activities Related to Rare Vegetation Between May 2012 and August 2015.....	A-3
Table A-2	Summary of Regulatory Feedback Related to the Plan (July 2015 to February 2017).....	A-6
Table A-3	Summary of Regulatory Feedback Related to the Plan (May 2017 to August 2017)	A-11
Table A-4	Summary of Aboriginal Issues and Concerns Related to Rare Ecological Communities and Rare Plant Populations Between May 2012 and February 2017	A-13
Table A-5	Summary of Aboriginal Feedback Related to the Plan	A-14
Table F-1	Record of Notification.....	F-2

1.0 INTRODUCTION

The Rare Ecological Community and Rare Plant Population Management Plan (the Plan) was prepared to meet the requirements of National Energy Board (NEB) Condition 40 regarding the Trans Mountain Expansion Project (“the Project” or “TMEP”). The Plan was submitted to Appropriate Government Authorities, potentially affected Aboriginal groups and species experts on September 16, 2016 for review. Feedback was originally requested by January 13, 2017, however, feedback received as recently as August 2017 has been considered. Trans Mountain Pipeline ULC (Trans Mountain) incorporated any feedback into the final Plan or has provided rationale for why input has not been included as summarized in Appendix A.

Since the September 2016 release of the draft Plan, engineering design has continued to progress and there have been design updates that are described in detail in the TMEP Fall 2016 Project Updates (www.transmountain.com/environmental-protection-plans). All of the design updates have been reviewed, and the Project design updates that are relevant have been incorporated into this Plan. It is anticipated route refinement will continue to occur as engineering design progresses. Subsequent changes will be reviewed in consideration of impacts to this Plan.

This Plan has been prepared to describe mitigation measures for ecological communities of concern; rare plants and lichens; and early draft, candidate, or final critical habitat for plant and lichen species under the *Species at Risk Act* (SARA) that are potentially affected by the Project during construction or operations.

1.1 Project Description

Trans Mountain filed its Application with the NEB in December 2013. In developing its Application, Trans Mountain commenced an engagement and communications program of extensive discussions with landowners, engagement with Aboriginal groups and consultation with affected stakeholders. This program was intended to gather input from these groups into the Application and supporting Environmental and Socio-Economic Assessment (ESA), and to continue to assist Trans Mountain in the design and execution of the Project. Trans Mountain is also working with Appropriate Government Authorities to carry out the necessary reviews, studies, and assessments required for the Project.

For ease of description, the following terms are used:

Kilometre Post (KP): describes distances measured along the centreline of the pipeline.

Project Footprint: includes the area directly disturbed by surveying, construction, clean-up, and operation of the pipeline, as well as associated physical works and activities (including the temporary construction lands and infrastructure, the pipeline, reactivation, facilities, the Westridge Marine Terminal, and access roads). For clarity, specific components of the Project Footprint are further described by Trans Mountain below.

- Temporary construction lands and infrastructure refers to preparatory works to support Project construction and includes temporary camps, stockpile sites, equipment staging areas, and borrow pits located on land that has been previously disturbed, as well as access roads within the first 10 km of each designated construction spread. For ease of assessing Project interactions, these access roads are considered as part of the overall access road network.
- Pipeline construction footprint refers to the total area used to construct the pipeline and includes the right-of-way and temporary workspace (TWS).
- Reactivation of currently deactivated pipeline segments include an engineering assessment under Section 45 of the *NEB Onshore Pipeline Regulation* and associated construction activities. Currently known ground disturbance activities and associated access (as of December 2016), were assessed to determine the Project interactions. For ease of assessing Project interactions, these access roads were considered as part of the overall access road network.
- Facilities refer to pump stations, terminals (Edmonton, Sumas, and Burnaby), and associated infrastructure (i.e., traps), most of which are located on land that has been previously disturbed.

Westridge Marine Terminal has infrastructure located on land and in the marine environment, and is included in the Facilities component of the Project.

- Access roads include new temporary and permanent roads and existing roads that may require upgrades or improvements. For ease of assessing Project interactions, this includes the access roads to be developed as part of temporary construction lands and infrastructure, as well as those accesses associated with reactivation.

Contingency Alternate Routes: refers to three alternate pipeline route segments that have been assessed for use if construction on the preferred route is not feasible. These are not included in the Project Footprint defined above since they are considered contingency alternates.

- Raft River, in BC (KP 713.1 to KP 714.4), is an alternate open cut contingency alignment. The preferred primary crossing method, a horizontal directional drill (HDD), does not support an open cut contingency crossing method at the same location.
- Pembina River, in Alberta (KP 133.0 to KP 134.7), is an alternate open cut contingency alignment. Similar to Raft River, the preferred primary crossing method (HDD) does not support an open cut contingency crossing method at the same location.
- Westridge Delivery Lines (WDL KP 0.0 to WDL KP 3.4) is an alternate contingency alignment for a trenched installation around the Burnaby Conservation Area in BC. The preferred pipeline corridor requires tunnel construction and does not support a trenched contingency option; therefore, an alternate trenched contingency alignment has been identified.

Variations: as part of the Project Footprint update that occurred in December 2016, a number of route revisions located outside of the Project corridor were identified. Trans Mountain is seeking approval, from the NEB in 2017 for these route realignments. All of the variations have been reviewed in consideration of impacts to this Plan and changes have been incorporated.

1.2 Traditional Ecological Knowledge and Traditional Land Use

Aboriginal Traditional Knowledge (ATK) is typically documented as a means to preserve historical and familial connections, territorial occupation, land and resource use, and temporal execution strategies. ATK includes but is not limited to the collection of TEK during biophysical field survey participation for the Project and TLU study information from potentially affected Aboriginal communities. Preliminary background ATK data was compiled for the Application and was consulted during the development of this Plan. The following sources were used:

- publicly available ATK, TEK, and TLU reports;
- open houses and community gatherings;
- meetings and conversations with Aboriginal community representatives;
- public record of comparable past projects or previous environmental assessments;
- published reports from regulatory authorities involved in administering or regulating a specified area or resource (e.g., integrated resource plans, land and resource management plans, etc.); and
- Geographical Information System (GIS) tools to determine spatial relationships of source data to the Project.

TEK was collected during biophysical field surveys during 2014. The Upper Nicola Indian Band participated in vegetation surveys from August 5 to 19, 2014 along the Black Pines to Hope segment of the Project. Shxw'ōwhámél First Nation participated in vegetation surveys along the Hope to Burnaby segment on September 2, 2014, but no TEK was provided. Simpcw First Nation participated in vegetation surveys along the Black Pines to Hope, BC segment from May 17 to 24 and July 2 to 6, 2014. Field

participants did not share TEK for the purpose of the Project. However, all field participants contributed to the discussion of potential Project-related effects on resources and participated in the discussion of potential mitigation measures to reduce potential Project-related effects.

Trans Mountain has reviewed information provided in TLU reports from participating Aboriginal groups and traditional knowledge with respect to rare plants and ecological communities of concern. Trans Mountain will continue to take available and applicable Aboriginal TLU and TEK into consideration in developing the Plan. See Table 2 for TEK and TLU information on rare plant species along the pipeline route.

TABLE 2
TEK AND TLU INFORMATION ON
RARE PLANT SPECIES ALONG THE PIPELINE ROUTE

Species (Provincial Rank, Federal Rank)	Nearest KP UTM	TEK/TLU Information Provided	Concerns
Alberta			
Edmonton to Hinton Segment			
Beaked willow/ red-osier dogwood shrubland <i>Salix bebbiana</i> / <i>Cornus stolonifera</i> shrubland (S3?, T)	Not recorded	Traditional use plant(s) occur(s) in the community.	No concerns identified.
Multiple rare plants identified	KP 331.8	Traditional use plant(s).	The area is will not be disturbed.
British Columbia			
Hargreaves to Darfield Segment			
Lodgepole pine/velvet-leaved blueberry/clad lichens <i>Pinus contorta</i> / <i>Vaccinium myrtilloides</i> / <i>Cladonia</i> spp. (S2S3, blue)	KP 551.5	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 548.0	Traditional use plant(s) occur(s) in the community.	No concerns identified.
Michigan moonwort <i>Botrychium michiganense</i> sp. nov. ined. (S2, red)	Story, no location recorded	Traditional use plant.	Participant would like to see moonwort protected as community members already have to travel to collect the plants. Participant requested that moonwort be transplanted to another area if it is going to be affected by construction. Participant also requested that the community be consulted about moonwort.
Echo moonwort <i>Botrychium echo</i> (S1S2, red)	Aboriginal communities did not comment on this plant.		
Black spruce/skunk cabbage/ peat-mosses <i>Picea mariana</i> / <i>Lysichiton americanus</i> / <i>Sphagnum</i> spp. (S2S3, blue)	KP 620.0	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 764.0		
	KP 614.6	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 649.3	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 604.7		
	KP 729.8	Traditional use plant(s) occur(s) in the community.	No concerns identified.
KP 557.0			
KP 604.7	Traditional use plant(s) occur(s) in the community.	No concerns identified.	
KP 605.8			
KP 649.6	Traditional use plant(s) occur(s) in the community.	No concerns identified.	
Common cattail marsh <i>Typha latifolia</i> marsh (S3, blue)	KP 519.3	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 653.2	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 604.7		
White wintergreen <i>Pyrola elliptica</i> (S3, blue)	KP 668.3	Traditional use plant.	No concerns identified.

TABLE 2 Cont'd

Species (Provincial Rank, Federal Rank)	Nearest KP UTM	TEK/TLU Information Provided	Concerns	
Western redcedar – paper birch/ oak fern <i>Thuja plicata – Betula papyrifera / Gymnocarpium dryopteris</i> (S2S3, blue)	KP 541.6 KP 571.1	Traditional use plant(s) occur(s) in the community.	No concerns identified.	
	KP 573.7 KP 605.8	Traditional use plant(s) occur(s) in the community.	No concerns identified.	
	KP 502.5	Traditional use plant(s) occur(s) in the community.	No concerns identified.	
	KP 605.8 KP 639.4 KP 744.7 KP 552.0 KP 547.9 KP 580.3 KP 557.5 KP 557.6 KP 745.2	Traditional use plant(s) occur(s) in the community.	Participant requested that cedar trees be replanted in areas where tree replanting will occur.	
	KP 489.3 KP 557.5 KP 540.3	Traditional use plant(s) occur(s) in the community.	No concerns identified.	
	Rare plants in general	n/a	n/a	Participant requested that if a rare plant is going to be removed that it should be transplanted elsewhere.
	Black Pines to Hope Segment			
Douglas-fir/common snowberry – saskatoon <i>Pseudotsuga menziesii / Symphoricarpos albus – Amelanchier alnifolia</i> (S2, red)	KP 950.0 KP 953.9	Traditional use plant(s) occur(s) in the community.	No concerns identified.	
	KP 973.3	Traditional use plant(s) occur(s) in the community.	No concerns identified.	
	KP 977.1 KP 914.6	Traditional use plant(s) occur(s) in the community.	Participants noted that many berry crops, including saskatoons, have been depleted by human access to the Juliet Creek area. (The waypoint associated with the Juliet Creek area is 10U 0643308 5511801.)	
	KP 861.6 KP 861.4	Traditional use plant(s) occur(s) in the community. Participant identified a Douglas fir tree believed to be 200 to 300 years old. At the second location, the same participant identified a “grandfather” Douglas fir tree, and suggested that this tree likely seeded all the other firs in the area.	Participants requested that these trees be protected since older trees such as this one are crucial for spreading their seeds. These trees are located >50 m from the Project Footprint. Participant requested that all Douglas fir trees older than 150 years or with a diameter of approximately 3 m or greater be avoided during construction.	
	KP 909.8	Traditional use plant(s) occur(s) in the community.	No concerns identified.	
	KP 975.7	Traditional use plant(s) occur(s) in the community.	No concerns identified.	
	KP 935.2 KP 889.3 KP 971.2 KP 946.0	Traditional use plant(s) occur(s) in the community.	No concerns identified.	
Trembling aspen/common snowberry/Kentucky bluegrass <i>Populus tremuloides / Symphoricarpos albus / Poa pratensis</i> (S2, red)	KP 929.1	Traditional use plant(s) occur(s) in the community.	No concerns identified.	
Giant wildrye Herbaceous Vegetation <i>Leymus cinereus</i> Herbaceous Vegetation (S2, red)	KP 932.5	Traditional use plant.	No concerns identified.	
Ponderosa pine/ bluebunch wheatgrass <i>Pinus ponderosa / Pseudoroegneria spicata</i> (S3, blue)	KP 941.9	Traditional use plant(s) occur(s) in the community.	No concerns identified.	
	KP 864.8	Traditional use plant(s) occur(s) in the community.	No concerns identified.	

TABLE 2 Cont'd

Species (Provincial Rank, Federal Rank)	Nearest KP UTM	TEK/TLU Information Provided	Concerns
Common cattail Marsh <i>Typha latifolia</i> marsh (S3, blue)	KP 894.9	Traditional use plant(s) occur(s) in the community.	No concerns identified.
Hard-stemmed bulrush Deep Marsh <i>Schoenoplectus acutus</i> Deep Marsh (S3, blue)	KP 925.7	Traditional use plant(s) occur(s) in the community.	No concerns identified.
Trembling aspen / common snowberry / mountain sweet-cicely <i>Populus tremuloides</i> / <i>Symphoricarpos albus</i> / <i>Osmorhiza berteroi</i> (S1, red)	Aboriginal communities did not comment on this plant.		
Western redcedar - Douglas-fir / false Solomon's seal <i>Thuja plicata</i> – <i>Pseudotsuga menziesii</i> / <i>Maianthemum racemosum</i> (S1, red)	KP 938.2 KP 1010.2 KP 1145.9 KP 1032.7	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 1011.3 – 1012.2 KP 1016.2 – 1017.1 KP 1017.1 – 1019.2	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 962.1	Participant identified a site with quite a few western red cedars.	Participant noted that it is rare to find Western red cedars this far east of the coast.
	KP 945.9	Participants identified a cedar grove, considered a community of concern within the pipeline construction footprint.	Participants requested that cedar trees within the rare ecological community, which overlaps with the cedar grove identified, be left undisturbed where feasible. More information on this community and its relationship to the pipeline construction footprint is located in Appendix E of this Plan.
	KP 1017.9 – 1019.4	Traditional use plant(s) occur(s) in the community.	No concerns identified.
Amabilis fir - western redcedar / devil's club Moist Submaritime <i>Abies amabilis</i> – <i>Thuja plicata</i> / <i>Oplopanax horridus</i> Moist Submaritime (S3, blue)	KP 1016.1 – 1017.2	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 962.0	Traditional use plant(s) occur(s) in the community.	No concerns identified.
Hope to Burnaby Segment			
Western redcedar - Douglas-fir / vine maple <i>Thuja plicata</i> – <i>Pseudotsuga menziesii</i> <i>Acer circinatum</i> (S2S3, blue)	KP 1147.1 KP 1071.7	Traditional use plant(s) occur(s) in the community.	Participant requested that a prayer be offered to bless the cedars removed during construction prior to clearing.
	KP 1147.0 KP 1071.7	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 1147.0	Traditional use plant(s) occur(s) in the community.	Participant requested that culturally modified trees not be disturbed.
	KP 1147.0	Traditional use plant(s) occur(s) in the community.	Participant expressed concern that cedar trees removed from the right-of-way during construction would be misused or wasted.
	KP 1016.3	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 1017.2 – 1018.2	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	Not recorded	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 1080.5	Traditional use plant(s) occur(s) in the community.	No concerns identified.
Western redcedar / sword fern-skunk cabbage <i>Thuja plicata</i> / <i>Polystichum munitum</i> – <i>Lysichiton americanus</i> (S3?, blue)	KP 1051.2 – 1069.2	Traditional use plant(s) occur(s) in the community.	No concerns identified.
Hard-stemmed bulrush Deep Marsh <i>Schoenoplectus acutus</i> Deep Marsh (S3, blue)	KP 1069.6	Traditional use plant(s) occur(s) in the community.	No concerns identified.

TABLE 2 Cont'd

Species (Provincial Rank, Federal Rank)	Nearest KP UTM	TEK/TLU Information Provided	Concerns
Black cottonwood–red alder / salmonberry <i>Populus trichocarpa</i> / <i>Alnus rubra</i> / <i>Rubus spectabilis</i> (S3, blue)	KP 1116.9	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	Story – not recorded	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 1114.2	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 1080.5	Traditional use plant(s) occur(s) in the community.	No concerns identified.
	KP 976.9	Traditional use plant(s) occur(s) in the community.	No concerns identified.

1.3 Mitigation Hierarchy

The process of developing mitigation measures for this Plan follows the mitigation hierarchy of avoid, minimize and restore on-site as described in the Policy and Procedures for Mitigating Impacts on Environmental Values (BC Ministry of Environment [MOE] 2014a,b).

As outlined in Section 5.0, mitigation measures for rare ecological communities generally fall into categories of avoidance and disturbance reduction. Mitigation measures for rare plant occurrences generally fall into categories of avoidance, reducing disturbance and alternative reclamation techniques.

Avoidance is the preferred mitigation measure for rare ecological communities and rare species ranked S1, S1S2, or S2 as well as ecological communities and rare plant species that are protected under provincial or federal legislation or regulations. Disturbance reduction or alternative reclamation techniques will be recommended as a mitigation strategy in the event that complete avoidance is not feasible or where the Project encounters rare ecological communities or rare plant species ranked S2, S2S3, S1S3, S3, SNR, SH, or SU.

The BC Oil and Gas Commission (OGC) lists a number of ecological communities and plant and lichen species as High Priority Wildlife (BC OGC 2016). All ecological communities, plants, and lichens on the High Priority Wildlife list are included in the categories described above, with the exception of one S4 species, Scouler's corydalis (*Corydalis scouleri*), which is only found on southern Vancouver Island (E-Flora 2013) and therefore does not interact with the Project.

In some circumstances, preferred mitigation methods may not be feasible, for instance, when there are potential concerns relating to the site which may jeopardize construction and workers' safety. Mitigation has been developed which balances the efforts needed to apply the mitigation measures with the benefit to the resource being mitigated. Additional details regarding the feasibility and practicality of mitigation are provided in Section 5.5. Sites that are unavoidable will be mitigated as completely as practical using the mitigation hierarchy and considering the likelihood of mitigation success for the species and the site.

The likelihood of offsets will be reduced by implementing practical and feasible mitigation measure prior to and during construction and during adaptive management. Further discussion of the preliminary offset plan in the context of rare ecological community, rare plant, and rare lichen occurrences can be found in Section 7.0.

A full discussion of the hierarchy of mitigation measures for rare ecological communities, rare plants, and rare lichens is discussed in Section 5.0.

1.4 Objectives and Measurable Goals

The measurable goals for this Plan are defined based on:

- relevant measures committed to throughout the Project proceedings (see Section 1.6);
- NEB *Filing Manual* (NEB 2017);

- recovery objectives and approaches outlined in the applicable federal or provincial Recovery Plans for species designated under SARA or Committee on the Status of Endangered Wildlife in Canada (COSEWIC); and
- the likely Project interactions with biophysical attributes of early draft, candidate, or final critical habitat.

Mitigation measures will be implemented broadly to include provincially listed rare plants and rare ecological communities, as well as specifically for critically imperiled features and SARA (or COSEWIC) designated rare plants where the construction footprint intersects areas mapped as final, candidate regeneration, or early draft critical habitat as provided by ECCC (Environment Canada 2015a, 2015b, 2015c, and 2015d). These include measurable goals specific to the locations with the biophysical attributes of critical habitat for toothcup (*Rotala ramosior*), Haller's apple moss (*Bartramia halleriana*), whitebark pine (*Pinus albicaulis*), Mexican mosquito fern (*Azolla mexicana*), and Roell's brotherella moss (*Brotherella roellii*).

The goals of the mitigation measures include:

- avoid loss of potential critical habitat for toothcup, Haller's apple moss, whitebark pine, Mexican mosquito fern, and Roell's brotherella moss;
- avoid indirect disturbance and displacement of toothcup, Haller's apple moss, whitebark pine, Mexican mosquito fern, and Roell's brotherella moss;
- avoid loss and reduce disturbance to potential critically imperiled vegetation features (provincial conservation status ranks: S1, S1S2, and S2);
- avoid loss and reduce disturbance to potential special concern to imperiled vegetation features (provincial conservation status ranks: S2S3, S1S3, S3, SNR, SH, or SU);
- avoid loss and reduce disturbance to potential to vegetation features that are located within 2 m of the final Project Footprint; and
- reclaim disturbed habitat in areas identified by ECCC as final critical habitat to conditions that support attributes of critical habitat needs.

In addition to specific mitigation strategies for rare vegetation features (ranked S1, S1S2, S2 or rare species protected under provincial or federal legislation) discussed in Sections 5.1 and 5.2, measures may also include general mitigation options listed in Section 5.3.

Measurable goals to determine success as committed to by Trans Mountain, are discussed in NEB Information Request (IR) No. 3.026a-Attachment1. These include no construction disturbance evidence within rare ecological community or rare plant population as the preferred mitigation measure outcome for rare ecological communities (including wetlands of special concern), rare plants, and rare lichens. This mitigation measure is particularly favoured for communities, plants, and lichens ranked S1, S1S2, S2, and/or species or critical habitat protected under provincial or federal regulation.

Additional measurable goals to determine reclamation success through avoidance, disturbance reduction and potential alternative reclamation techniques include the following:

- **Avoidance:**
 - no construction disturbance evident within rare ecological community, rare plant or rare lichen population; and
 - observation of rare ecological community, rare plant or rare lichen population during post-construction monitoring during the first growing season following final clean-up, or in a subsequent year if the outcome of mitigation is not evident during the first growing season.

- **Disturbance Reduction:**
 - Reduce the spatial extent of construction disturbance within rare ecological community, rare plant or rare lichen populations, where feasible and when safety is not compromised; and
 - Reduce the magnitude of soil and seed bank disturbance within rare ecological community, rare plant or rare lichen populations.
- **Alternative Reclamation Techniques:**
 - survival of transplanted, relocated or inoculated species during the first growing season following final clean-up, or in a subsequent year if the outcome of mitigation is not evident during the first growing season; and
 - observation of similar landscape topology and soil moisture regime as was observed during baseline pre-construction surveys (*i.e.*, habitats are favorable for mitigation success). The performance indicators and targets that will be monitored to evaluate the effectiveness of the mitigation measures in achieving the goals of the Plan are described in Section 6.0. Monitoring will be focused at locations identified as having potential interaction with provincially listed rare plants and rare ecological communities, as well as toothcup final critical habitat, Haller's apple moss final critical habitat, whitebark pine candidate regeneration critical habitat, Mexican mosquito fern, and Roell's brotherella moss early draft critical habitat.

1.5 Commitment Management

Trans Mountain made a number of commitments regarding the Project during the OH-001-2014 proceedings and engagement activities up to May 2016. Commitments were made to improve and optimize Project planning and mitigation measures. As Trans Mountain has consolidated its commitments made during the Project proceedings into a Commitments Tracking Table in accordance with NEB Condition 6, the Table of Commitments in each plan has been removed.

The updated Commitments Tracking Table will be filed with the NEB pursuant to NEB Condition 6 and is available on Trans Mountain's web site at www.transmountain.com. Trans Mountain continues to monitor and track compliance with its commitments and will update, post to its website and file with the NEB updated versions of the Commitments Tracking Table according to the timeframes outlined in NEB Condition 6. Commitments with specific relevance to this Plan have been considered and incorporated in this Plan.

1.6 Links to other Trans Mountain Environmental Plans

Information from other environmental plans prepared for the Project that are related to rare ecological communities and rare plant populations has been considered in this Plan. The links between this Plan and other Trans Mountain plans are provided in Table 3.

TABLE 3

TRANS MOUNTAIN PLANS LINKED TO THIS PLAN

Environmental Plan	Description of the Environmental Plan	Linkage to this Plan
Pipeline EPP (Volume 2 of the Environmental Plans) (NEB Condition 72)	The Pipeline EPP contains Trans Mountain's environmental procedures and mitigation measures to be implemented during construction of the pipeline to avoid, reduce or mitigate potential adverse environmental effects. The EPP serves as reference information for construction and inspection personnel to support decision-making and to provide direction to more detailed information (i.e., resource-specific mitigation, management, and contingency plans).	The EPP includes general construction measures applicable to locations with known rare ecological communities and rare plant populations.
Reclamation Management Plan (Volume 6 of the Environmental Plans)	The Reclamation Management Plan contains the general reclamation measures to be implemented on the Project. The primary objective is to promote the re-establishment of natural ecosystems that are compositionally and functionally similar to pre-disturbance conditions.	The Reclamation Management Plan includes a table of site-specific mitigation measures that reflect this Plan.
Wetland Survey and Mitigation Plan (Volume 6 of the Environmental Plans) (NEB Condition 41)	The Wetland Survey and Mitigation Plan provides an overview of wetlands encountered by the Project, recommended mitigation measures and crossing methods to be implemented during construction, and reclamation measures to be implemented during construction and operations.	The Wetland Survey and Mitigation Plan provides mitigation measures for wetlands that are considered rare ecological communities.
Weed and Vegetation Management Plan (WVMP) (Volume 6 of the Environmental Plans) (NEB Condition 45)	The WVMP outlines procedures to identify, prevent, contain, control, and monitor the introduction or spread of invasive plant species within the Project area and to adjacent lands.	Invasive species are a key management concern in vegetated areas crossed by the Project.
Riparian Habitat Management Plan (RHMP) (Volume 6 of the Environmental Plans) (NEB Condition 71)	The RHMP is an ecosystem-based, site-specific plan that applies to riparian habitats associated with watercourse crossings encountered by the Project Footprint. The RHMP does not include riparian habitats associated with wetlands.	Where observed rare plant species or rare ecological communities occur within riparian habitat adjacent to stream crossings that are affected by the Project, vegetation functionality ratings have been rated as 'High'. Mitigation measures at these locations will be included in the Plan. The mitigation measures provided in the Plan will also correspond to measures outlined in the Riparian Habitat Management Plan.
Updates under SARA (NEB Condition 92)	NEB Condition 92 requires that Trans Mountain file a summary of any relevant updates under SARA, including new Schedule 1 listings and new or amended Recovery Strategies, Action Plans and Management Plans for species that have the potential to be affected by the Project.	The Plan will include relevant updates under SARA and mitigation measures specific to rare plant critical habitat that are on Schedule 1 of SARA.
Post-Construction Environmental Monitoring (PCEM) Reports (NEB Condition 151)	The PCEM Reports will provide a discussion of the effectiveness of mitigation, reclamation, or compensation measures that were committed to and implemented during construction of the Project. The PCEM Reports will describe the corrective actions taken during construction and provide recommendations for future remedial action in order to accomplish the goals of mitigation or reclamation where measures implemented were not effective.	Rare ecological communities and rare plant populations will be monitored during the PCEM Program.
Resource-Specific Mitigation Tables (Volume 7 of the Environmental Plans)	The Resource-Specific Mitigation Tables contain supplementary information on environmental features encountered by the Project and identify specific locations where mitigation measures are to be implemented during construction.	Rare ecological communities and rare plant populations are included.
Environmental Alignment Sheets (Volume 8 of the Environmental Plans)	The Environmental Alignment Sheets identify specific locations where mitigation measures are to be implemented during pipeline construction. The Environmental Alignment Sheets provide additional background information regarding environmental requirements and will be used in conjunction with the Construction Alignment Sheets	Rare ecological communities and rare plant populations are included.

2.0 CONSULTATION AND ENGAGEMENT

Consultation and engagement activities related to rare plants and rare ecological communities were completed between May 2012 and August 2017 with Appropriate Government Authorities, potentially affected Aboriginal groups and species experts. Opportunities to discuss rare plants and rare ecological communities and identify issues or concerns were provided to public stakeholders through online information, workshops, meetings, and ongoing engagement activities during the reporting period. Appendix A includes a comprehensive record of these engagement activities, stakeholder feedback, and Trans Mountain responses.

The draft Plan was released on September 16, 2016 for review and feedback. The feedback was originally requested by January 13, 2017, however, feedback received as recently as August 2017 has been considered. Trans Mountain incorporated any feedback into the final Plan or has provided rationale for why input has not been included, as summarized in Appendix A.

Engineering design changes were issued in the TMEP Fall 2016 Project Update document (<https://www.transmountain.com/environmental-protection-plans>) along with a further request for feedback. All of the changes have been reviewed, and the relevant Project design updates have been incorporated into this Plan.

3.0 CONTEXT AND APPROACH

The purpose of vegetation surveys was to identify all rare ecological communities of concern as well as plant (vascular plants, bryophytes [mosses and liverworts]) and lichen species of concern along the pipeline route, as defined by SARA, COSEWIC, the Alberta *Wildlife Act*, ACIMS, BC MOE's Identified Wildlife Management Strategy (IWMS) and the BC CDC. Furthermore, the Plan provides mitigation that will be implemented to the extent feasible in the event that ecological communities, plants or lichens of concern are observed on, or immediately adjacent to, the Project Footprint (*i.e.*, temporary construction lands and infrastructure, pipeline construction footprint, reactivation, facilities, access roads, or contingency alternate routes) during construction.

3.1 Regulatory Context

The NEB *Filing Manual* (NEB 2017) provides regulatory guidance for the assessment of vegetation resources where disturbance is expected to occur in previously undeveloped areas. Vegetation resources, including species at risk and species of special status, as defined by the NEB *Filing Manual*, may be affected by construction and operations activities associated with the Project. The scope and methods required to adequately assess vegetation resources were determined with the guidance of the NEB *Filing Manual*, in conjunction with published rare plant survey recommendations and guidelines, and precedence set by developments of similar scope in the vicinity of the Project.

Federally, SARA protects Endangered, Threatened or Special Concern vascular and non-vascular plants that are listed on Schedule 1. In addition, COSEWIC determines the national status of wild Canadian species, subspecies, varieties or other designatable units that are suspected of being at risk of extinction or extirpation. Under SARA, the government of Canada will take COSEWIC's designations into consideration when establishing the legal list of wildlife species at risk.

Provincially, rare plants and rare ecological communities are not protected by law. However, in accordance with the spirit and intent of provincial legislation that may apply to terrestrial vegetation on the Project, vegetation surveys were conducted on lands supporting native vegetation traversed by the pipeline route. For more detail regarding the regulatory standards in Alberta and BC, see Section 1.4 in Volume 5C (Vegetation Technical Report) of the Application.

3.2 Definitions of Rarity

Species and ecological communities in BC are assigned to the red or blue list on the basis of the provincial Conservation Status Rank assigned by the BC CDC (2015). Rankings of rarity draw attention to species and ecological communities that have particular threats, declining population trends, or restricted distributions that indicate that they require special consideration. These lists serve as a practical method to assist in making conservation and land use decisions and prioritize research, inventory, management and protection activities (BC CDC 2015).

Species and ecological communities of concern in Alberta are considered Tracked elements or Watched elements by ACIMS based on their level of conservation concern. Tracked elements are species or ecological communities that ACIMS is actively collecting information on and processing element occurrences for because they are current information suggests they are rare or of conservation concern due to threats to populations or habitats or documented declines. Watched elements are currently not considered as high conservation concern, but there is some information to suggest that they may become rare should there be significant alteration to the element's habitats or population (AEP 2015a).

Federally, SARA designates rare plants in Canada to prevent further loss, to provide the recovery of species that are extirpated, endangered, or threatened as a result of human activity, and to manage species of special concern to prevent them from becoming endangered or threatened. SARA does not designate rare ecological communities. COSEWIC assesses the conservation status of species that may be at risk in Canada, to report the results of its assessments, including their reasons and uncertainties, to the Canadian Endangered Species Conservation Council (CESCC) and to the Canadian public. COSEWIC uses the best available scientific, Aboriginal and community knowledge to assess species. The assessment process is independent and transparent.

Rare plants are defined as any provincially or federally listed vascular plant, mosses, liverworts, and lichens. Rare ecological communities include communities of conservation concern listed by ACIMS (AEP 2015a), BC CDC (2015) or the BC MOE's IWMS (BC Ministry of Water, Land, and Air Protection [MWLAP] 2004).

3.3 Project Interactions

Information on the specific components of the Project Footprint as defined in Section 1.1 and their interaction with rare ecological communities and rare plant populations is provided below.

3.3.1 Temporary Construction Lands and Infrastructure

There are no direct rare ecological communities, rare plant populations or critical habitat interactions with temporary construction lands and infrastructure, such as temporary camps, pipeline stockpile sites or equipment staging areas, and borrow pits, because these locations are mainly on land that has been previously disturbed.

3.3.2 Pipeline Construction Footprint

The Project encounters rare plant occurrences (including vascular plants, mosses, and lichens) and rare ecological communities observed during field surveys conducted from 2013 to 2015. Rare plant and rare ecological community occurrences are encountered by the Project Footprint from near Edmonton, Alberta to the Westridge Marine Terminal, BC, and are described in more detail in Appendix E.

The details and associated mitigation measures will be captured in the Vegetation Resource-Specific Mitigation Tables (Volume 7 of the Environmental Plans) and will be illustrated on the Environmental Alignment Sheets (Volume 8 of the Environmental Plans). Site-specific mitigation measures for rare plant or rare ecological community occurrences are contained in Appendix E.

3.3.2.1 Rare Ecological Communities and Rare Plants Provincially Ranked S1, S1S2, or S2

Included in the overall descriptions of Project interactions with rare ecological communities and rare plants above, nine rare plants occur along the pipeline construction footprint that are provincially ranked as S1S2 or S2, and 28 rare ecological communities occur along the pipeline construction footprint that are provincially ranked as S1 or S2 under their respective provincial status rankings. See Section 5.2 and Appendix E for more detail.

All other rare plant and rare ecological community observations along the Project Footprint are considered (red-listed) imperiled (S1S3 or SH), or special concern (blue-listed) and vulnerable to extirpation or extinction (S2S3 or S3). Some rare plants and rare ecological communities have an uncertain numeric rank (S-rank?); are not ranked (SNR); or their conservation status is unknown (SU).

3.3.2.2 Rare Plant Critical Habitat

As part of Project planning, ECCC provided to Trans Mountain information on final, candidate, and early draft critical habitat that overlaps the Project Footprint (Environment Canada 2015a). This information included final critical habitat for toothcup (*Rotala ramosior*) and Haller's apple moss (*Bartramia halleriana*); candidate regeneration critical habitat for whitebark pine (*Pinus albicaulis*); and early draft critical habitat for Mexican mosquito fern and Roell's brotherella moss. However, no observations of toothcup, Haller's apple moss, Mexican mosquito fern, Roell's brotherella moss or whitebark pine trees were observed on the pipeline construction footprint during the vegetation surveys conducted from 2013 to 2015. Toothcup and whitebark pine are listed as Endangered under SARA, Haller's apple moss and Mexican mosquito fern are listed as Threatened under SARA and Roell's brotherella moss is listed as Endangered under COSEWIC.

The Project Footprint includes the permanent pipeline easement, TWS, and the area required for right-of-way maintenance activities during operations.

The majority of final critical habitat for toothcup will be avoided, as it is located within the trenchless crossing of the Thompson River at Mission Flats at KP 843.4 to KP 843.5. Based on vegetation survey

information from 2013, 2014, and 2015, the portion of critical habitat that the Project intersects, does not possess the biophysical attributes for toothcup habitat.

High-density candidate critical habitat for whitebark pine is not encountered by the pipeline construction footprint. However, some areas of candidate regeneration critical habitat for whitebark pine as identified by ECCC are crossed by the Project between Hargreaves and Hope, BC. Additional areas of candidate regeneration critical habitat for whitebark pine may be intersected by the reactivation activities between Hinton, Alberta and Hargreaves, BC (discussed below).

The Project Footprint crosses some early draft critical habitat for Roell's brotherella moss between Hope and Burnaby, BC.

The Project Footprint crosses some early draft critical habitat for Mexican mosquito fern near Little Fort, BC.

The Project Footprint does not intersect with early draft critical habitat for Tall Bugbane between Hope and Burnaby, BC.

Trans Mountain will continue to consult with ECCC regarding critical habitat to obtain the most up-to-date critical habitat delineation and recovery strategies. Changes in construction plans may result in potential modifications to this Plan.

Reactivation

The reactivation component of the Project involves reactivating currently deactivated pipeline segments between the existing Hinton Pump Station in Alberta and the existing Hargreaves Trap Site in BC, as well as between the existing Darfield Pump Station and the proposed Black Pines Pump Station in BC. Reactivation construction activities will be undertaken in accordance with the *NEB Onshore Pipeline Regulations* and the Canadian Standards Association standard Z662 – Oil and Gas Pipeline Systems. The reactivation of the NPS 24 pipeline is a distinct Project activity from Trans Mountain's Operations and Maintenance (O&M) activities on existing pipelines, which are also planned. Project reactivation activities include: installation of additional mainline check valves and automated block valves; select automation of existing manual mainline block valves; and inspection and refurbishing of mainline block valves.

Although the critical habitat mapping provided by ECCC does not cover the reactivated segments, it is assumed that candidate regeneration critical habitat for whitebark pine may extend into the Hinton, Alberta to Hargreaves, BC reactivation segment. Reactivation activities, where they occur along this segment, will be confined to the area previously disturbed by the Trans Mountain Pipeline (TMPL) rights-of-way.

One Haller's apple moss critical habitat polygon (West Gate Cairn population) between Hinton, Alberta and Hargreaves, BC is located where reactivation works for O&M will take place (sleeve cut-outs 24 and 25). However, it is expected that no direct impact will occur because this location does not possess the habitat attributes necessary for the survival of this rare moss species and this location has been previously disturbed by construction of the existing TMPL rights-of-way. The biophysical attributes of this site were confirmed during a site visit on July 13, 2017. Consultation between Trans Mountain and ECCC regarding reactivation activities within Haller's apple moss critical habitat is ongoing. Since this activity is a component of reactivation not involving valve work, the SLV24 and SLV25 repairs are considered O&M activities and are not included in the scope of the Project and are not discussed further in this Plan.

Facilities

There are no direct rare plant or rare ecological community interactions with facilities, such as pump stations, terminals, tanks, and associated infrastructure because these locations are mainly on land that has been previously disturbed.

The Burnaby Terminal and Sumas Tank Farm are located within the area provided by ECCC as early draft critical habitat for Roell's brotherella (Environment Canada 2015a), however, Roell's brotherella moss has not been observed at these locations. Moreover, these locations are highly altered and do not possess the habitat attributes for the survival of Roell's brotherella moss.

The Hargreaves Trap Site is located within the area provided by ECCC as candidate regeneration critical habitat for whitebark pine (Environment Canada 2015a); however, whitebark pine trees have not been observed at this location. This location is also in the forested valley bottom where whitebark pine habitat is limited by closed canopy forests and low elevations. Mitigation measures will also be implemented at this location to avoid potential interactions that may occur.

Access Roads

One Haller's apple moss critical habitat polygon (Fraser Bridge population) is transected by an existing access road (Road ID 20328.1.0) at KP 489.2, near the Hargreaves Trap Site. However, it is expected that no direct impact will occur because road widening will not be required at this location. One whitebark pine candidate regeneration critical habitat polygon is transected by access roads between KP 489 to 494 and KP 494.9 to 499.6. One Roell's brotherella early draft critical habitat polygon is transected by an access road near KP 1077. However, it is expected that no direct impact will occur because no whitebark pine trees or Roell's brotherella moss plants are known from these access road locations, nor do these access roads impact habitat attributes required for their survival. By implementing mitigation measures as outlined in Appendix E of the Rare Ecological Community and Rare Plant Population Management Plan, no residual effects will result.

One rare moss species called *Racomitrium affine* (S2S3) was located near an existing access road (Road ID 30523.6.0) where TWS is planned. This site was revisited August 7, 2017. The large old birch hole could not be relocated and no mosses resembling *Racomitrium affine* were observed. No further mitigation is recommended at this site as the original occurrence could not be relocated.

Contingency Alternate Routes

Of the three contingency alternate routes, only the Raft River Contingency Alternate Route has an interaction with a rare plant population. Approximately 10 plants of white wintergreen (*Pyrolla elliptica*) were observed on the Raft River Contingency Alternate Route in two patches, along the centreline of the easement, extending into the workspace to the north approximately 155 m southwest of KP 713.2. This Contingency Alternate Route segment has been identified for use if construction on the preferred route is not feasible. Mitigation measures will be implemented at this location to avoid potential interactions that may occur.

Variations

The Sumas Tank Farm route realignment (KP 1115.0 – 1115.8) avoids one occurrence of the rare plant Pacific waterleaf (S2, red). The South Fraser Perimeter Road route realignment (KP 1159.0 – 1162.8) avoids two rare ecological communities, a western redcedar / slough sedge community (S2S3, blue) and a lodgepole pine / peat mosses Very Dry Maritime community (S3, blue), and crosses one rare ecological community, a common cattail marsh (S3, blue). Site-specific mitigation measures in Appendix E have been updated to reflect these changes.

3.4 Critical Habitat, Recovery Strategies, and Management Plans

ECCC released a final Recovery Strategy for toothcup after the Application was filed with the NEB in December 2013. This Recovery Strategy includes critical habitat that is intersected by the pipeline construction footprint at Mission Flats, near the City of Kamloops, BC (Environment Canada. 2015a). Haller's apple moss final Recovery Strategy was released in 2010 (Haller's Apple Moss Recovery Team); however, the Project's interaction with Haller's apple moss occurs within the reactivation areas between Hinton and Hargreaves, as such the details of the reactivation activities were being developed, and were not included in the original Application. Information on candidate regeneration whitebark pine critical habitat and early draft critical habitat for Mexican mosquito fern and Roell's brotherella moss was provided by ECCC (Environment Canada 2015a and 2015d). Environment Canada contributed to written evidence for critical habitat within Hearing Order OH-001-2014 issued by the National Energy Board (Environment Canada 2015d). ECCC released a Management Plan for Vancouver Island beggarticks after the Application was filed with the NEB in December 2013. Management Plans under the SARA do not identify critical habitat, however, this Management Plan for Vancouver Island beggarticks states that

the management objectives include protecting known locations from direct habitat loss (Environment Canada 2015e).

Toothcup, Haller's apple moss and whitebark pine are all listed as Endangered under Schedule 1 of SARA, while Mexican mosquito fern is listed as Threatened under Schedule 1 of SARA. Roell's brotherella moss is designated as Endangered by COSEWIC, but has not yet been added to Schedule 1 of SARA. Vancouver Island beggarticks are listed as Special Concern under Schedule 1 of SARA. Recovery strategies for Mexican mosquito fern and Roell's brotherella moss have not been finalized by ECCC. In the interim, the BC MOE has prepared provincial recovery strategies for Mexican mosquito fern and Roell's brotherella moss as advice to the Province of BC on the general approach required to recover species at risk (Southern Interior Rare Plants Recovery Team 2008, BC MOE 2013). The province prepares recovery strategies to ensure coordinated conservation actions and to meet its commitments to recover species at risk under the *Accord for the Protection of Species at Risk in Canada* and the *Canada–British Columbia Agreement on Species at Risk*.

3.4.1 Toothcup

A proposed *Recovery Strategy for the Toothcup (Rotala ramosior) in Canada* was released on August 27, 2014 with a consultation period ending on October 26, 2014 (Environment Canada 2014b). A final Recovery Strategy was released on August 25, 2015 (Environment Canada 2015b). The goal of the Recovery Strategy is to maintain the distribution and to maintain or (where feasible and appropriate) increase the abundance of extant populations of toothcup in Canada, including extant populations which may be identified or re-established in the future (Environment Canada 2015b).

A digital shapefile of this critical habitat was not received from ECCC until after the 2014 supplemental field work had been completed. Vegetation surveys were conducted at Mission Flats in May 2014 and from August to October 2014 based on hardcopy maps and proposed critical habitat received in September 2013 (Environment Canada 2013) in anticipation of potential interactions with pipeline activities. A shape-file of proposed critical habitat was received in November 2014 (Environment Canada 2014a), and was surveyed on August 18, 2015. The critical habitat polygon at Mission Flats became final on August 25, 2015 (Environment Canada 2015b).

3.4.2 Haller's Apple Moss

A final Recovery Strategy for Haller's apple moss was released in October 2010 which contained the locations of the critical habitat polygons in BC and Alberta (Haller's Apple Moss Recovery Team 2010). The information received from ECCC does not currently included the Project reactivation segments. The Recovery Strategy, as well as the critical habitat polygons provided by ECCC were reviewed by Trans Mountain to determine potential locations that intersect with the construction footprint or the reactivation activities. GIS staff digitized the two Haller's apple moss final critical habitat polygons from the Recovery Strategy that overlap with the reactivation segments (using the UTM locations at the four corners of each polygon) (Haller's Apple Moss Recovery Team 2010).

The population and distribution objective for Haller's apple moss is to maintain or increase population sizes at the 10 existing locations to ensure that populations remain viable over the long term and, where feasible, reintroduce the species to extirpated locations with suitable or capable habitat (Haller's Apple Moss Recovery Team 2010).

The Cairn 5S sub-population consists of 200 individuals located along cliffs and ledges shaded by dense forest. Critical habitat for the Fraser Bridge population is located on three private land holdings downstream of Mount Robson Provincial Park on steep cliffs and ledges above the Fraser River. The Fraser River population consists of 120 individuals also located on the south side of the river (Haller's Apple Moss Recovery Team 2010).

3.4.3 Whitebark Pine

An assessment and status report for whitebark pine was prepared in 2010 (COSEWIC 2010). A federal Recovery Strategy has not yet been released, although a draft Recovery Strategy was provided by ECCC in March 2015 (Environment Canada 2015c and 2015d). In 2010, COSEWIC designated whitebark pine as Endangered in Canada. Whitebark pine is a long-lived, five-needled pine restricted in Canada to high

elevations in the mountains of BC and Alberta. Whitebark pine is considered at risk due to declining populations from the effects of white pine blister rust, mountain pine beetle, climate change and fire exclusion (COSEWIC 2010). The lack of potential for rescue effect, life history traits such as delayed age at maturity, low dispersal rate, and reliance on dispersal agents all contribute to placing this species at high risk of extirpation in Canada (COSEWIC 2010). Whitebark pine was added to the list of legally protected species under Schedule 1 of SARA on June 20, 2012 (Alberta Whitebark and Limber Pine Recovery Team 2014).

A recovery plan for whitebark pine in Alberta was prepared in January 2014. The purpose of this recovery plan is to provide strategies for conservation and restoration for whitebark pine in Alberta (Alberta Whitebark and Limber Pine Recovery Team 2014).

ECCC provided candidate whitebark critical habitat to Trans Mountain to assess potential effects with the pipeline route (Environment Canada 2013 and 2015d); however, this information does not include the reactivation segments.

At selected areas, the candidate regeneration critical habitat biophysical attributes of whitebark pine habitat were reviewed and surveys were conducted to assess potential for whitebark pine to regenerate. Vegetation surveys specific to whitebark pine were conducted in June and August 2014, as well as in October 2015 at several locations that were selected based on the information provided by ECCC and professional judgment of the Vegetation Resource Specialist.

3.4.4 Mexican Mosquito Fern

A Recovery Strategy for Mexican mosquito fern has not been finalized by ECCC. The BC MOE has prepared a provincial Recovery Strategy for Mexican mosquito fern as advice to the Province of BC on the general approach required to recover species at risk. The provincial recovery goal for Mexican mosquito fern is to protect and maintain extant populations, and to re-introduce the species at extirpated sites, if deemed necessary (Southern Interior Rare Plants Recovery Team 2008). The provincial Recovery Strategy represents the best available scientific knowledge on what is required to achieve recovery of Mexican mosquito fern.

ECCC provided information on early draft critical habitat for Mexican mosquito fern on May 27, 2015 (Environment Canada 2015d) and August 25, 2015 (Environment Canada 2015a).

3.4.5 Roell's Brotherella Moss

A Recovery Strategy for Roell's brotherella moss has not been finalized by ECCC. The BC MOE has prepared a provincial Recovery Strategy for Roell's brotherella moss as advice to the Province of BC on the general approach required to recover species at risk. The provincial recovery goal for Roell's brotherella moss is to protect and maintain extant populations, and to re-introduce the species at extirpated sites, if deemed necessary (BC MOE 2013). The provincial Recovery Strategy represents the best available scientific knowledge on what is required to achieve recovery of Roell's brotherella moss.

Early draft critical habitat information for Roell's brotherella moss was received from ECCC on May 27, 2015 (Environment Canada 2015d) and August 25, 2015 (Environment Canada 2015a). The Project pipeline crosses early draft critical habitat for Roell's brotherella moss between Hope and Burnaby. Results of vegetation surveys in areas where Roell's brotherella moss is known to occur between Hope and Burnaby are provided in the Application.

3.4.6 Vancouver Island Beggarticks

Vancouver Island beggarticks are listed as a Special Concern under Schedule 1 of SARA. Since they are not Extirpated, Endangered or Threatened, there is no Recovery Strategy and no critical habitat for this species. However, ECCC released a Management Plan for Vancouver Island beggarticks after the Application was filed with the NEB in December 2013. This Management Plan states that the management objectives include protecting known locations from direct habitat loss. The pipeline construction footprint intersects a known occurrence polygon between KP 1177.0 and 1177.3 (BC MOE 2017). Five plants were observed in 1999 in a dried pool depression in a grassy area in a light industrial complex (BC MOE 2017). This species has not been observed at this site since 1999. Trans Mountain has consulted with BC MFLNRO regarding appropriate mitigation at this location.

4.0 SUPPLEMENTAL SURVEY RESULTS FROM 2014, 2015 AND 2017

The scope and methods required to adequately assess vegetation resources encountered by the Project Footprint were determined with the guidance of the NEB *Filing Manual*, in conjunction with published rare plant survey recommendations and guidelines, as well as precedents set by developments of similar scope in the vicinity of the Project. Rare plant survey methodology is based on the Alberta Native Plant Council (ANPC) Guidelines for Rare Plant Surveys in Alberta (ANPC 2012) and the BC Protocols for Rare Plant Surveys (Penny and Klinkenberg 2013). The rare plant surveys were conducted throughout the growing season during biologically appropriate times for the species with potential to occur in the area and at locations that could potentially contain sensitive ecosystems as well as riparian habitat. Field botanists possessed the relevant knowledge base of regional vegetation species and were familiar with the proper tools and methods for identifying rare ecological communities and rare plant species. Rare plants or rare lichens identified during field surveys were reported to the relevant provincial agencies.

Mapping methods for the Project were developed according to the Standards for Terrestrial Ecosystem Mapping (TEM) in BC (Resources Information Standards Committee 1998) and were applied to both the Alberta and BC portions of the Project. These methods were presented in Volume 5C (Vegetation Technical Report) of the Application and have been previously accepted by the NEB on other pipeline projects in western Canada.

Surveys for SARA vegetation species, identified in Tables 2-1 and 2-2 from ECCC's evidence, are available in the Vegetation Technical Report for surveys conducted in 2013. Additional surveys for relevant SARA vegetation species were also conducted in 2014, which resulted in no observed occurrences of SARA vegetation species within the pipeline corridor. Additional surveys for toothcup (*Rotala ramosior*), whitebark pine (*Pinus albicaulis*), and relevant vegetation species of concern were conducted from August to October 2015. Site visits to Haller's apple moss critical habitat polygons were conducted in July 2017. Targeted Roell's brotherella and Vancouver Island beggarticks surveys were conducted in August 2017. A rare plant survey on the Sumas Tank Farm route realignment (KP 1115.0-1115.8) was conducted in August 2017.

An aquatic plant was observed on the Hargreaves to Darfield, BC segment during field surveys in 2013 and flagged as potential Mexican mosquito fern (*Azolla mexicana*) in the 2013 Technical Report (the plant was not photographed or collected). Site-specific follow-up surveys were conducted at the location in August 2014 where more detailed observations and collections of aquatic plants were conducted. Mexican mosquito fern was not observed during this more thorough search, and it was determined that the plant observed in 2013 was likely small yellow water-buttercup (*Ranunculus gmelinii*) or white water-buttercup (*Ranunculus aquatilis*). The open water area where the aquatic plant was observed is not on the final pipeline construction footprint.

4.1 Methods

A literature review was conducted prior to conducting field surveys in 2013 to identify rare plants, rare lichens, and rare ecological communities with potential to occur in the natural subregions (in Alberta) and Biogeoclimatic (BGC) zones (in BC) in which the Project is located. The Application included tables of potential rare plants in BC and Alberta Literature and desktop review methods are the same as those provided in Technical Report 5C-9 and in the ESA (Volume 5A). The literature review to identify vegetation of concern with potential to occur along the Project was redone prior to surveys in 2014 and 2015 to account for any updates to federal and provincial tracking lists. Updated tables of vegetation species with potential to occur along the Project were provided to field crews prior to field work. Further information on the desktop review methods are provided in Technical Report 5C-9. In response to ECCC's information request (Government of Canada-Environment Canada IR No. 1.048), Peacock vinyl lichen (*Leptogium polycarpum*) was included as a potential rare lichen species of concern for the BC component of the Project.

Supplemental vegetation surveys were conducted in 2014 and 2015 to assess locations along the pipeline route that were not accessible during previous survey years, to complete TEM field verifications, and to confirm rare vegetation occurrences identified in 2013. Prior to field work, satellite imagery, TEM and known occurrences of rare species and communities were reviewed to identify areas of high potential to support rare plants, rare lichens, and rare ecological communities.

4.1.1 Updated Rankings for Plant and Lichen Species of Concern

Alberta provincial ranks have changed for 15 species (Table 4) and BC provincial ranks have changed for 19 species (Table 5) since the Application was filed with the NEB in December 2013. Numerous occurrences of rare plant species listed in Appendix F of Technical Report 5C-9 have been deemed not rare or no longer of concern. Where plant and lichen species are no longer tracked or listed as species of conservation concern, they have been removed from the mitigation measures tracking table.

TABLE 4

RARE PLANTS AND LICHENS IN ALBERTA WITH A PROVINCIAL RARITY RANK CHANGE

Species (Rank) – Prior to September 16, 2014	Rank Changes Update	Comments
<i>Anastrophyllum hellanum</i> (S2, Tracked)	(S3S4)	No longer rare
<i>Blasia pusilla</i> (S1, Tracked)	(SU, Tracked)	--
<i>Botrychium spathulatum</i> (S2, Tracked)	(S3, Tracked)	--
<i>Cardamine dentata</i> (S3, Watched)	(S2, Tracked)	Up ranked
<i>Carex capitata</i> (S3, Watched)	(S4, Tracked)	No longer rare
<i>Chrysopslenium iowense</i> (S3?, Tracked)	(S4, Watched)	No longer rare
<i>Cladonia squamosa</i> (S2, Tracked)	(S3, Tracked)	--
<i>Conocephalum salebrosum</i> (S2, Tracked)	(S2S4, Tracked)	--
<i>Juncus brevicaudatus</i> (S2, Tracked)	(S3)	No longer rare
<i>Lophozia guttulata</i> (S2, Tracked)	(S3)	No longer rare
<i>Najas flexilis</i> (S2, Tracked)	(S3, Tracked)	--
<i>Physciella chlorantha</i> (Not listed in Alberta)	(SU, Tracked)	--
<i>Riccardia latifrons</i> (S2, Tracked)	(S3S4)	No longer rare
<i>Sarmenthyphnum sarmentosum</i> (S2, Tracked)	(SU, Tracked)	--
<i>Sphenopholis obtusata</i> (S2, Tracked)	(S3)	No longer rare

Source: AEP 2015b,c,d

TABLE 5

RARE PLANTS IN BC WITH A PROVINCIAL RARITY RANK CHANGE

Species (Rank) – Prior to September 16, 2014	Rank Changes Update	Comments
<i>Anemone canadensis</i> (S2S3, blue)	(S3?, blue)	--
<i>Anemone virginiana</i> var. <i>cylindroidea</i> (S3, blue)	(S4, yellow)	No longer rare.
<i>Botrychium alaskense</i> (S1S3 according to NatureServe) ** not in database	(S3?, blue)	--
<i>Botrychium hesperium</i> (S2S3, blue)	(S3S4, yellow)	No longer rare.
<i>Botrychium michiganense</i> sp. Nov. ined. (S1S3, red)	(S2, red)	--
<i>Botrychium montanum</i> (S1, red)	(S2?, red)	--
<i>Botrychium pedunculatum</i> (S2, red)	(S3, blue)	--
<i>Botrychium simplex</i> var. <i>compositum</i> (S2S3, blue)	(S3, blue)	--
<i>Botrychium spathulatum</i> (S1, red)	(S3, blue)	--
<i>Carex sychnocephala</i> (S3, blue)	(S3S4, yellow)	No longer rare.
<i>Carex tenera</i> (S2S3, blue)	(S4, yellow)	No longer rare.
<i>Carex tonsa</i> var. <i>tonsa</i> (S2S3, blue)	(S3S4, yellow)	No longer rare.
<i>Dicranum flagellare</i> (S3, blue)	(S3S4, yellow)	No longer rare.
<i>Dicranum montanum</i> (S3, blue)	(S3S4, yellow)	No longer rare.
<i>Dryopteris cristata</i> (S2S3, blue)	(S3, blue)	--
<i>Eleocharis nitida</i> (S1, red)	(S2S3, blue)	--
<i>Pyrola elliptica</i> (S2S3, blue)	(S3, blue)	--
<i>Syntrichia caninervis</i> (S3?, blue)	(S3S4, yellow)	No longer rare.
<i>Tritomaria exsecta</i> (SNR, No status)	(S2S3, blue)	Newly rare.

Source: BC CDC 2016

4.1.2 Field Data Collection

The vegetation surveys included rare vascular plant surveys, weed surveys, targeted surveys for rare non-vascular plants and lichens, as well as specimen collections for non-vascular and lichen, as described in Technical Report 5C-9. Field data collection methods are the same as those described in Technical Report 5C-9 and in the ESA (Volume 5A). Further information regarding updated field data collection methods for critical habitat areas are provided below.

4.1.2.1 Toothcup Surveys

Ground surveys for toothcup were completed at Mission Flats near the City of Kamloops, BC (from KP 843.4 to KP 843.5) where potential population occurrences and proposed critical habitat areas were identified by ECCC (Environment Canada 2013, 2014b, 2015a, 2015b, and 2015d). Several surveys of the sandy shoreline where the pipeline route crosses the south side of the Thompson River were conducted in May 2014, August to October 2014 and August 2015. Toothcup surveys were conducted in September 2014 by a professional forester/agrologist with Tk'emlúpsemc Forestry Development Corp. This individual was trained on August 5, 2014 and subsequently surveyed the Mission Flats site in September 2014. Surveys extended beyond the 150 m wide pipeline corridor within the proposed critical habitat area on both sides of the corridor to fulfill the requirements of the toothcup Recovery Strategy in order to incorporate buffer zones and GPS error (Environment Canada 2014a, 2015b).

4.1.2.2 Haller's Apple Moss Surveys

A site visit to the Fraser Bridge critical habitat population (see Figure 5.1.5) along the existing access road was conducted on July 13, 2017. No road widening is currently planned at this location.

4.1.2.3 Whitebark Pine Surveys

Aerial surveys to assess potential whitebark pine critical habitat were conducted by helicopter overflight assessments. The vegetation crew consisted of an experienced botanist with the ability to identify whitebark pine trees, as well as a Vegetation Technician to assist with recording information. The vegetation crew viewed forested mountain slopes from low to high elevations within 2 km of the pipeline construction footprint where ECCC had identified candidate critical habitat (Environment Canada 2013). The Vegetation crew recorded GPS waypoints, took photographs, and made notes of the potential for critical habitat while a video-mounted, GPS-enabled camera recorded supplementary video footage from the helicopter. The video footage was later viewed to support the assessment of potential whitebark pine habitat distribution and abundance.

Whitebark pine typically occurs in high elevation, closed subalpine forests to upper subalpine habitats from approximately 1,000-1,600 m in north-central BC (COSEWIC 2010). Two portions of the pipeline construction footprint were targeted for assessment of potential whitebark pine habitat. Based on hardcopy maps provided by ECCC, portions of the Hargreaves to Darfield and Black Pines to Hope segments were identified as containing potential whitebark pine habitat within 2 km of the pipeline construction footprint (Environment Canada 2013).

Whitebark pine aerial overflight surveys were completed in the vicinity of the Coquihalla Summit Recreation Area on June 26, 2014 along portions of the Black Pines to Hope segment. Overflight surveys of potential whitebark pine habitat were completed along the Hargreaves to Darfield segment on August 19, 2014.

4.1.2.4 Mexican Mosquito Fern Surveys

Ground surveys were conducted at the appropriate time of year at the location where Mexican mosquito fern was potentially observed by field crews in 2013. Targeted surveys were conducted in August 2014 at potential locations.

4.1.2.5 Roell's Brotherella Moss Surveys

Ground surveys were conducted within most of the Roell's brotherella moss early draft critical habitat areas between Hope and Burnaby Terminal at the appropriate time of year in 2013 and 2014. Landowner

permission restrictions prevented access for ground surveys in some of the early draft critical habitat polygons. No observations of Roell's brotherella moss were recorded within the areas surveyed and no specimens of this moss were collected during non-vascular sampling.

Critical habitat areas for Roell's brotherella moss were reviewed using ArcGIS to select areas for baseline field surveys and post construction monitoring sites. The sites meeting habitat requirements for Roell's brotherella moss are characterized as cool, humid mixed deciduous and conifer second-growth forests generally near streams. Satellite imagery, riparian areas, Terrestrial Ecosystem Mapping (TEM) data, and the locations of known occurrences of Roell's brotherella moss from the BC CDC were considered when selecting sites. Species-specific moss collections in appropriate microsites were conducted within early draft critical habitat polygons at sites on the pipeline construction footprint selected through desktop review (KP 1077.1, KP 1115.5, 1066.4 and KP 1179.9). None of the specimens collected were determined to be Roell's brotherella moss (McIntosh pers comm). Certain locations selected through desktop review could not be visited due to issues with access and wildlife that was in the area at the time of the survey. At these locations, areas with the ecological attributes to support Roell's brotherella moss have been delineated using satellite imagery. Areas within early draft critical habitat with the biophysical attributes to support Roell's brotherella moss, confirmed in the field and/or identified through desktop review, are provided in Appendix E.

The biophysical data collected in the field will supplement existing Project baseline sampling and further inform post-construction monitoring.

4.1.3 Terrestrial Ecosystem Mapping

TEM was completed within the Vegetation Regional Study Area (RSA) to describe the diversity, relative abundance and distribution of vegetation communities, and the structural stages for lands where vegetation may be affected by the Project. TEM methods are the same as those described in Technical Report 5C-9 and in the ESA (Volume 5A). Further details are described in Appendix C.

4.2 Supplemental Survey Results Summary

Detailed supplemental survey results are described in Appendix D. The following list provides a summary of the supplemental vegetation and TEM survey results conducted for the Project.

- Since filing in 2013, Alberta provincial ranks have changed for 15 species (Table 4), and BC provincial ranks have changed for 19 species (Table 5). Numerous occurrences of rare plant species listed in Appendix F of Technical Report 5C-9 have been deemed not rare or no longer of concern.
- Ecological communities listed by ACIMS, the BC CDC, and the BC MOE's IWMS were observed along various segments of the pipeline route during 2014 and 2015 field surveys. The size and extent of each ecological occurrence observed on the Project Footprint are detailed in Appendix E.
- Surveys were conducted at the location where SARA-listed species Mexican mosquito fern was potentially observed in 2013. Mexican mosquito fern was not detected and it was determined that the plant observed in 2013 was most likely small yellow water-buttercup or white water-buttercup.
- Two late-season surveys were conducted between KP 1177.0 and KP 1177.3 at a previously reported location of Vancouver Island beggarticks (*Bidens amplissima*, S3, blue-list, SARA designation Special Concern). Five Vancouver Island beggartick plants were observed at this location in 1999 in a dried pool depression in a grassy area in a light industrial complex (BC MOE 2017). No Vancouver Island beggarticks were observed in 2014 or 2017.
- No plant or lichen species listed by COSEWIC or SARA were observed on the Project Footprint during the 2014, 2015 and 2017 vegetation surveys.

These results are consistent with the ESA Update which concluded that the significance conclusions for vegetation have not changed since the filing of the Application.

Adequate data collection in support of the Project has been completed for rare ecological communities and rare plant populations for the development of the final mitigation measures for rare plants, rare ecological communities, and critical habitat encountered by the Project. Mitigation measures are presented as a suite of options in Section 5.0. The additional pre-construction surveys planned will support the decision-making process of where the suite of mitigation measures should be applied, and refine the information provided in Appendix E.

5.0 MITIGATION MEASURES

The objective of mitigation measures provided in this Plan is to avoid or reduce potential Project effects to rare ecological communities, rare plant populations or federally designated critical habitat (SARA or COSEWIC) that are encountered by the Project.

Mitigation measures are divided into three broad categories: avoidance; disturbance reduction; and alternative reclamation techniques. Where avoidance and disturbance reduction are not feasible, alternative reclamation techniques, such as seed collection or transplantation of individual plants or populations, will be implemented. Mitigation for nearby occurrences of the same features often differ due to site-specific conditions and the specific location and extent of the population since the spatial relation of the feature and the Project Footprint are important factors driving mitigation.

Four categories of vegetation features (listed below) have been created to describe the suite of mitigation measures that will be implemented during pre-construction, construction, reclamation, and operations activities. The mitigation measures described in this section are a list of potential mitigation measures that were selected from for each identified rare plant or rare ecological community occurrence presented in Appendix E. The appropriate site-specific mitigation measures have been refined for each site based on the particular characteristics of the population or community, the site-specific characteristics, and construction methods for the site (to the extent that they are currently known). Site-specific mitigation measures for identified rare plant or rare ecological community occurrences are presented in Appendix E.

Site-specific mitigation measures are also presented in the Vegetation Resource-Specific Mitigation Tables (Volume 7 of the Environmental Plans) and illustrated on the Environmental Alignment Sheets (Volume 8 of the Environmental Plans).

Mitigation measures have been prepared in order of importance, for rare plants and ecological communities of concern that are potentially affected by the Project, starting with SARA and COSEWIC designated critical habitat, followed by critically imperiled features, then by provincially listed features and finally by vegetation features that are located within 2 m of the final Project Footprint as described below.

1. Measures to protect critical habitat designated by SARA or COSEWIC:
 - a. measures for toothcup critical habitat. Refer to Section 5.1.2 for the suite of mitigation measures and Appendix E for site-specific measures;
 - b. measures for whitebark pine candidate regeneration critical habitat. Refer to Section 5.1.4 for the suite of mitigation measures and Appendix E for site-specific measures;
 - c. measures for Haller's apple moss critical habitat. Refer to Section 5.1.6 for the suite of mitigation measures and Appendix E for site-specific measures;
 - d. measures for Mexican mosquito fern early draft critical habitat. Refer to Section 5.1.8 for the suite of mitigation measures and Appendix E for site-specific measures; and
 - e. measures for Roell's brotherella moss early draft critical habitat. Refer to Section 5.1.10 for the suite of mitigation measures and Appendix E for site-specific measures.
2. Measures for critically imperiled vegetation features (provincial conservation status ranks: S1, S1S2, and S2). Refer to Section 5.2 for the suite of mitigation measures and Appendix E for site-specific measures.
3. Measures for special concern to imperiled vegetation features (provincial conservation status ranks: S2S3, S1S3, S3, SNR, SH, or SU). Refer to Section 5.3 for the suite of mitigation measures and Appendix E for site-specific measures.
4. Measures for vegetation features that are located within 2 m of the final Project Footprint. Refer to Section 5.4 for the suite of mitigation measures and Appendix E for site-specific mitigation measures.

5.1 Measures for Critical Habitat

Critical habitat has been finalized for toothcup and Haller's apple moss while critical habitat for whitebark pine is still in candidate status. Both Mexican mosquito fern and Roell's brotherella moss are in early draft stage in terms of Recovery Strategy and critical habitat identification. Relevant mitigation measures committed to throughout the OH-001-2014 proceeding or resulting from supplementary surveys are included for SARA critical habitat areas that are intersected by the Project Footprint. Trans Mountain will continue to consult with ECCC to obtain the most up-to-date critical habitat information for toothcup, Haller's apple moss, whitebark pine, Mexican mosquito fern, and Roell's brotherella moss. Mitigation measures for toothcup, Haller's apple moss, whitebark pine, Mexican mosquito fern, and Roell's brotherella moss will be submitted, as part of the updated Vegetation Resource-Specific Mitigation Tables (Volume 7 of the Environmental Plans), at least 90 days prior to construction. In addition to the specific mitigation strategies discussed below, measures may also include general mitigation options listed in Sections 5.2 and 5.3.

ECCC's definition of critical habitat excludes anthropogenic disturbances and locations that do not possess one or more of the listed biophysical attributes for toothcup and Haller's apple moss critical habitat, as well as whitebark pine candidate regeneration critical habitat, and Mexican mosquito fern and Roell's brotherella moss early draft critical habitat (Environment Canada 2015d).

5.1.1 Toothcup Critical Habitat

The majority of critical habitat for toothcup will be avoided, as it is located within the planned trenchless crossing of the Thompson River. The Project Footprint will avoid habitat attributes for toothcup, and critical habitat areas will be considered during vegetation re-establishment and maintenance activities. These details and associated site-specific mitigation measures will be captured in the Vegetation Resource-Specific Mitigation Tables (Volume 7 of the Environmental Plans) and will be illustrated on the Environmental Alignment Sheets (Volume 8 of the Environmental Plans). The Project avoids disturbance of shoreline habitat that contains the critical habitat attributes for known toothcup populations at Mission Flats, and the planned mitigation to avoid introduction and spread of weeds will ensure that the Recovery Strategy objectives, as defined by ECCC, are not impacted.

The biophysical attributes of final critical habitat for toothcup in BC include the features described below (Environment Canada 2015b).

- Open, moist to wet, often alkaline, sandy, muddy, or rocky freshwater seasonally flooded flats and shorelines of lagoons or ponds (down to the lowest documented water level), as well as the associated draw-down zone adjacent to shorelines. Associated vegetation includes semi-aquatic species such as needle spike-rush (*Eleocharis acicularis*), and small herbaceous species including cudweed (*Gnaphalium* spp.).
- Areas occupied by individual plants or patches of plants, including the associated potential location error from Global Positioning System (GPS) units (ranging from 5-100 m uncertainty distance), plus an additional 50 m (*i.e.*, critical function zone distance) to encompass immediately adjacent areas.
- Toothcup is an annual plant that exists in a dynamic shoreline habitat and must re-establish each year from a seed bank. Connective habitat is critical to the survival and recovery of toothcup because it provides an avenue in which plants can propagate and be replenished from closely associated areas, genetic interchange can be maintained, and fine-scale distributions can shift in response to environmental changes.

Toothcup critical habitat is located within the Black Pines to Minter Gardens segment in BC (at approximately KP 843.4 to KP 843.5 (Figure 5.1.1-1). The total critical habitat area at the Mission Flats site is 7.0 ha and the Project Footprint intersects about 0.7 ha (10%) of critical habitat for toothcup (see Table 6). The trenchless crossing entry point on the south side of the Thompson River will be primarily located where existing anthropogenic features are already present (*i.e.*, an existing access road and cleared field) that are excluded from the critical habitat definition. Based on recent project planning, the Project Footprint overlaps about 0.4 ha of anthropogenic disturbance areas that are exempt from the critical habitat definition at the Mission Flats site (Environment Canada 2015b). The Project Footprint intersects only 4% (0.3 ha) of native vegetation areas within the critical habitat polygon. This native vegetation area is located to the southwest of the anthropogenic areas. However, based on vegetation survey information from 2013, 2014, and 2015, this portion of critical habitat identified by ECCC does not possess the biophysical attributes for toothcup habitat as described above. This area is dominated by young cottonwood trees and native rose shrubs within an altered depression area between Mission Flats Road and the park access road, and lacks the qualities of a dynamic shoreline habitat. Although the native vegetation on the Project Footprint does not possess the biophysical attributes for toothcup habitat, reclamation species used in this area will match pre-construction species (cottonwood and rose species).

TABLE 6

TOOTHCUP CRITICAL HABITAT AREA OVERLAP WITH THE PROJECT FOOTPRINT

	Critical Habitat ¹	Access Road Disturbance	Existing Anthropogenic Disturbance	Cottonwood – Rose Native Vegetation
Original Polygon (ha)	7.0	0	0	0
Portion within Project Footprint (ha)	0.7	0.1	0.3	0.3
Percentage within Project Footprint (%)	10	1	5	4

Note: Calculations in UTM 10.

1 Final critical habitat polygon as shown in the Recovery Strategy (Environment Canada 2015b)

FIGURE 5.1.1-1
TOOTH CUP CRITICAL HABITAT OVERLAP WITH THE PROJECT FOOTPRINT AT MISSION FLATS
RARE ECOLOGICAL COMMUNITY AND RARE PLANT POPULATION MANAGEMENT PLAN FOR THE TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT



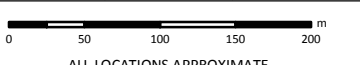
- Critical Habitat Toothcup
- Trans Mountain Expansion Project Kilometre Post (KP)
- Trans Mountain Expansion Project Proposed Pipeline Centreline
- Trans Mountain Pipeline (TMPL)
- Easement
- Temporary Workspace
- Extra Temporary Workspace
- Paved Road
- Railway
- Watercourse
- 20m Contour

Projection: NAD 1983 UTM Zone 10N.
 Routing: Existing TMPL Route Revision 0, provided by KMC, May 2012; Proposed Centreline SSEID005, KPs & Footprint, provided by UPI, Dec. 16, 2016; Critical Habitat: Environment Canada, 2016; Transportation: IHS Inc. 2016; TRIM Contours, Railways: provided by KMC, 2012; Hydrology: IHS Inc., 2004, BC FLNRO 2008; Imagery: provided by KMC, 2010.

This document is provided by Kinder Morgan Canada Inc. (KMC) for use by the intended recipient only. This information is confidential and proprietary to KMC and is not to be provided to any other recipient without the written consent of KMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around KMC's pipelines and facilities, all of which require KMC's prior written approval.

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	CH2M REF.	PAGE
201512_MAP_CH2M_VEG_00876_REV0_FIG5111.mxd	687945	SHEET 1 OF 1
DATE	REVISION	REVISION
March 2018	1	1
SCALE	PAGE SIZE	DISCIPLINE
1:5,000	11x17	VEG
DRAWN	CHECKED	DESIGN
CMR	DJN	JRO



ALL LOCATIONS APPROXIMATE

5.1.2 Toothcup Critical Habitat Mitigation Strategies

Project planning within final critical habitat for toothcup has included efforts to reduce the area of the Project Footprint, where feasible and when safety is not compromised (e.g., narrowing of the pipeline construction footprint, using the existing TMPL right-of-way as workspace to reduce clearing requirements). Many of the mitigation measures included in the Pipeline EPP (Volume 2 of the Environmental Plans) will serve to reduce disturbance during clearing and construction. The mitigation strategy described below encompasses the suite of potential mitigation measures from which site-specific mitigation measures have been selected, based on the particular characteristics of the population, the site-specific characteristics and construction methods for the site (to the extent that they are currently known). Site-specific mitigation measures are presented in Appendix E.

The following general measure applies to all of the mitigation strategies listed below:

- Refer to Environmental Alignment Sheets for extent of critical habitat on the pipeline construction footprint and inform all users of these boundaries, and of associated site-specific mitigation and access restrictions.

The preferred mitigation strategy for toothcup critical habitat includes the avoidance of the area by implementing one or both of the following measures:

- site the planned trenchless pipeline crossing off the Thompson River to avoid the majority of toothcup critical habitat; and/or
- endeavor to site TWS for planned pipeline trenchless crossing activities outside of final critical habitat for toothcup in previously disturbed areas.

Should complete avoidance of the toothcup critical habitat not be feasible, Trans Mountain will minimize the area disturbed within critical habitat for toothcup by implementing one or more of the following mitigation measures:

- use existing anthropogenic disturbances where feasible; and/or
- endeavour to site TWS for the Thompson River trenchless crossing outside of final critical habitat for toothcup or in areas that do not possess the ecological attributes required for toothcup habitat.

Further to the above, Trans Mountain will strive to avoid or reduce direct disturbance to toothcup by implementing the following mitigation measures:

- clearly mark all toothcup critical habitat within the immediate vicinity of the surveyed and flagged right-of-way and TWS prior to clearing or construction activities. Temporary fencing may be necessary to delineate areas of proposed toothcup critical habitat on and/or adjacent to the construction right-of-way;
- endeavour to maintain a 10 m buffer from final critical habitat areas that possess the ecological attributes required for toothcup. Temporary fencing or flagging will be employed to delineate adjacent areas of final toothcup critical habitat where a 10m buffer cannot be attained;
- reduce or avoid grubbing of roots in shrubby communities within temporary workspace, where feasible; and/or
- restore or enhance biophysical attributes of critical habitat within the pipeline construction footprint by revegetating the pipeline construction footprint in toothcup critical habitat with species present pre-construction.

5.1.3 Whitebark Pine Candidate Regeneration Critical Habitat

A federal Recovery Strategy for whitebark pine has not yet been released, though a draft Recovery Strategy was provided by ECCC in March 2015 (Environment Canada, 2015c). ECCC provided draft recovery objectives for whitebark pine in a “Summary of Critical Habitat Information for TMEP – November 2014” (Environment Canada 2014a). Candidate critical habitat for whitebark pine, as currently identified by ECCC, provides general information of where known (high-density) candidate critical habitat and candidate regeneration critical habitat may be present. High-density candidate critical habitat for whitebark pine is not encountered by the pipeline construction footprint. However, some areas of candidate regeneration critical habitat for whitebark pine are crossed by the pipeline construction footprint.

5.1.4 Whitebark Pine Candidate Regeneration Critical Habitat Mitigation Strategies

Project planning within candidate regeneration critical habitat for whitebark pine has included efforts to reduce the area of the Project Footprint, where feasible and when safety is not compromised (e.g., narrowing of the pipeline construction footprint, using the existing TMPL right-of-way as workspace to reduce clearing requirements). Many of the mitigation measures included in the Pipeline EPP (Volume 2 of the Environmental Plans) will serve to reduce disturbance during clearing and construction. The mitigation strategy described below encompasses the suite of potential mitigation measures from which site-specific mitigation measures have been selected, based on the particular characteristics of the population, the site-specific characteristics and construction methods for the site (to the extent that they are currently known). Site-specific mitigation measures are presented in Appendix E.

The following general measure applies to all of the mitigation strategies listed below:

- Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. The locations are not included on the Environmental Alignment Sheets (Volume 8 of the Environmental Plans) due to a Restricted License Agreement related to data sharing.

If critical habitat boundaries are finalized prior to construction, they will be added to mapping. However, if these areas are not yet finalized start and end KPs will be utilized.

Trans Mountain will minimize disturbance to whitebark pine candidate critical habitat that has been identified to support regeneration and recovery actions as defined by ECCC (Environment Canada 2015c) in habitats described below.

- All natural open parkland and forest openings (≥ 0.5 ha) occurring within a 2 km regeneration zone (i.e., the median dispersal distance of Clark’s Nutcracker) around the perimeter of high-density whitebark pine landscape polygons, within the known regional elevation limits, and/or within the projected climate change envelope model limits (where this information is available) for whitebark pine. The current routing of the pipeline construction footprint is outside the regional elevation limits.
- Avoid removing whitebark pine trees, shrubs or seedling on the Project Footprint (if any are identified prior to construction), in areas located within 2 km of high-density whitebark pine critical habitat, where feasible and following danger tree assessment.
- Additional areas where whitebark pine research and monitoring plots or transects have been established to directly inform and assist the recovery process, and/or which have the potential for re-measurement (i.e., through repeated survey/monitoring). These sites include, but may not be limited to: permanent health monitoring plots or transects; parent trees selected for ex-situ conservation; parent trees being tested for resistance to white pine blister rust (*Cronartium ribicola*); and climate change plots.
- Additional areas where recovery activities have been deliberately applied to create regeneration habitat (e.g., prescribed burning or mechanical removal of competing vegetation) for the purpose of whitebark pine seed sowing or whitebark pine seedling planting, and/or areas where whitebark pine seed sowing or seedling planting has already taken place in these habitats.

Trans Mountain will minimize the area disturbed within candidate regeneration critical habitat for whitebark pine by implementing one or more of the following mitigation measures:

- reduce the width of the Project Footprint, where feasible and safe for construction, on sites disturbed by fire or avalanche, which provide the open habitat required by this shade-intolerant species to regenerate;
- use the existing TMPL right-of-way for TWS, to the extent practical and where applicable;
- restore or enhance biophysical attributes of critical habitat by revegetating the pipeline construction footprint using native tree and shrub seeds and propagation materials where feasible; and/or
- avoid replanting competing vegetation that will deter whitebark pine habitat from regenerating or recovering, such as avoiding replanting competitive tree species, such as lodgepole pine (*Pinus contorta* var. *latifolia*) or shrubs of the genus *Ribes*, that may host white pine blister rust.

5.1.5 Haller's Apple Moss Critical Habitat

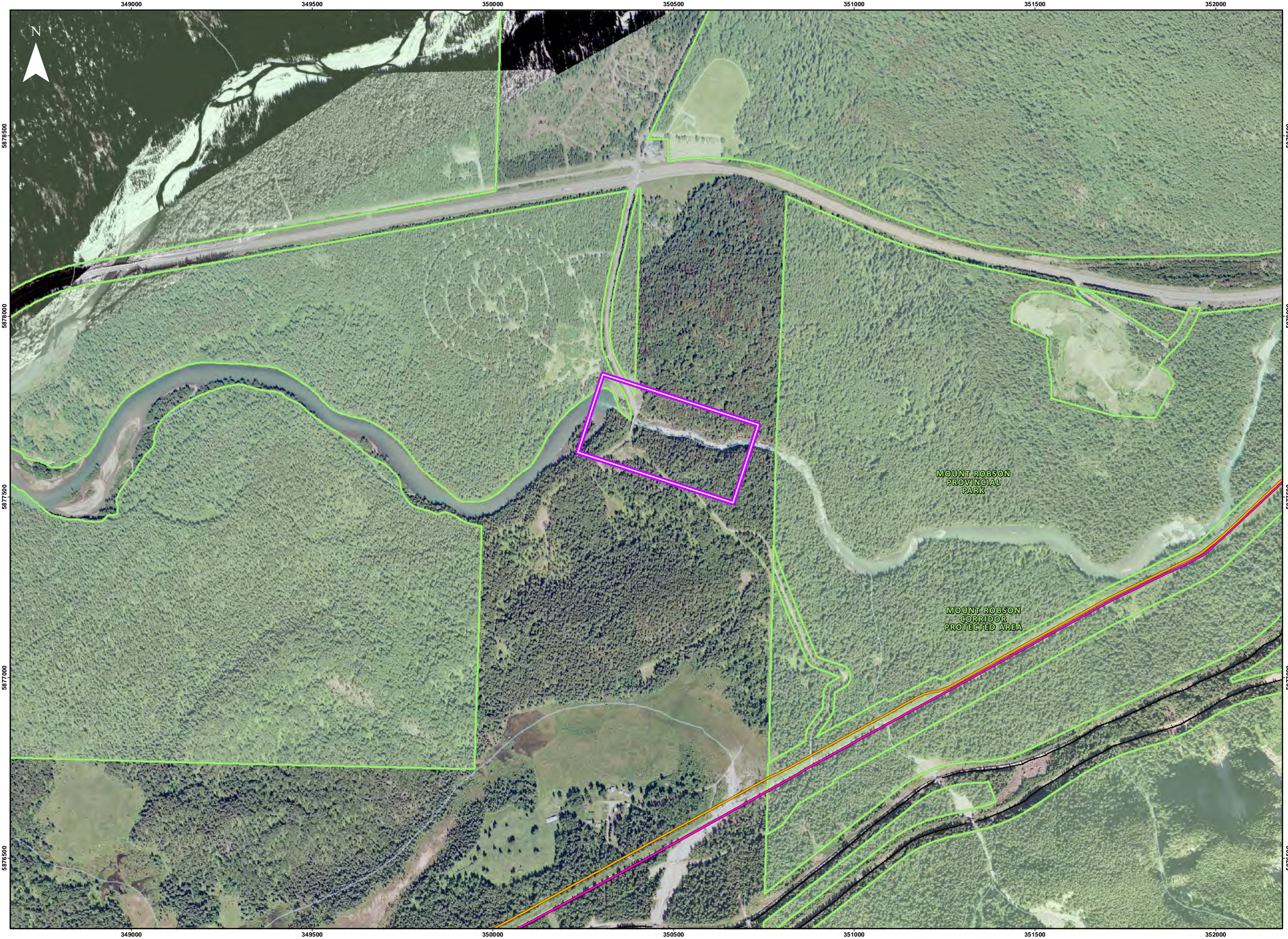
A Haller's apple moss critical habitat polygon interacts with an existing access road near Hargreaves within the Fraser Bridge critical habitat population (see Figure 5.1.5). A site visit to this location was conducted on July 13, 2017. Habitat attributes associated with Haller's apple moss are not found within the immediate vicinity of the access road. Dense coniferous forest cover does not occur immediately adjacent to the road. The west side of the access road has dense forest cover extending greater than 10 m from the road edge. The east side of the access road is mainly composed of shrub and young deciduous forest with some cleared areas. There are currently no plans to widen the access road for Project-related construction activities. Therefore, there are no current interactions between Haller's apple moss critical habitat polygons and the Project.

FIGURE 5.1.5

HALLER'S APPLE MOSS CRITICAL HABITAT OVERLAP WITH AN ACCESS ROAD AT HARGREAVES, BC

RARE ECOLOGICAL COMMUNITY AND RARE PLANT POPULATION MANAGEMENT PLAN FOR THE TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT

- Critical Habitat Haller's Apple Moss
- Trans Mountain Pipeline (TMPL)
- Inactive Trans Mountain Pipeline (TMPL)
- Paved Road
- Railway
- Watercourse
- Park / Protected Area

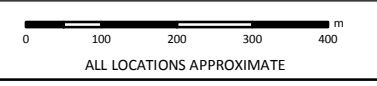


Projection: NAD 1983 UTM Zone 11N.
 Routing: Existing TMPL Route Revision 0, provided by KMC, May 2012; Haller's Apple Moss Critical Habitat: Environment Canada, 2016; Transportation: IHS Inc. 2016; Parks and Protected Areas: AltaLIS 2012, BC MFLNRO 2008, NRCAN 2016; TRIM Contours, Railways: provided by KMC, 2012; Hydrology: IHS Inc., 2004, BC FLNRO 2008; Imagery: provided by KMC, 2010.

This document is provided by Kinder Morgan Canada Inc. (KMC) for use by the intended recipient only. This information is confidential and proprietary to KMC and is not to be provided to any other recipient without the written consent of KMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around KMC's pipelines and facilities, all of which require KMC's prior written approval.

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	
201602_MAP_CH2M_VEG_00904_REV0_FIGURE515		SHEET 1 OF 1	
DATE	TERA REF.	REVISION	
March 2018	687945	0	
SCALE	PAGE SIZE	DISCIPLINE	
1:10,000	11x17	VEG	
DRAWN	CHECKED	DESIGN	
CMR	DJN	JRO	



201602_MAP_CH2M_VEG_00904_REV0_FIGURE515.mxd

5.1.6 *Haller's Apple Moss Critical Habitat Mitigation Strategies*

Although, there is currently no interaction between the Project and Haller's apple moss, the following mitigation measures have been provided to guide mitigation planning in the unlikely event that interactions are identified prior to or during construction:

- use the existing TMPL right-of-way for TWS, to the extent practical and where applicable;
- use existing anthropogenic disturbances where feasible;
- reduce disturbance to areas that possess the ecological attributes required for Haller's apple moss;
- endeavour to maintain a 10 m buffer from areas that may possess the ecological attributes required for Haller's apple moss where feasible;
- temporarily fence-off or flag potential habitat areas that may possess the ecological attributes required for Haller's apple moss, where a 10 m buffer cannot be attained;
- reduce or avoid grubbing of roots in shrubby communities within temporary workspace, where feasible; and/or
- if discovered, restore or enhance biophysical attributes of critical habitat within the reactivation segment by revegetating the pipeline construction footprint in selected areas using native grasses, forbs, tree or shrub seeds, and propagation materials to improve soil structure and reduce soil erosion.

5.1.7 *Mexican Mosquito Fern Early Draft Critical Habitat*

The recovery goal for Mexican mosquito fern is to protect and maintain extant populations and to re-introduce the species at extirpated sites, if deemed necessary (Southern Interior Rare Plants Recovery Team 2008). ECCC has identified early draft critical habitat for Mexican mosquito fern (Environment Canada 2015a and 2015d). Some early draft critical habitat is traversed by the Project Footprint near Little Fort, BC.

5.1.8 *Mexican Mosquito Fern Critical Habitat Mitigation Strategies*

Project planning within early draft critical habitat for Mexican mosquito fern has included efforts to reduce the area of the Project Footprint, where feasible and when safety is not compromised (e.g., narrowing of the pipeline construction footprint, using the existing TMPL right-of-way as workspace to reduce clearing requirements). Many of the mitigation measures included in the Pipeline EPP (Volume 2 of the Environmental Plans) will serve to reduce disturbance during clearing and construction. The mitigation strategy described below encompasses the potential mitigation measures from which mitigation measures have been selected, based on the particular characteristics of the population, the site-specific characteristics and construction methods for the site (to the extent that they are currently known). Site-specific mitigation measures are presented in Appendix E.

The following general measure applies to all of the mitigation strategies listed below:

- Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions.

Trans Mountain will minimize the area disturbed within early draft critical habitat for Mexican mosquito fern by implementing one or more of the following mitigation measures:

- use the existing TMPL right-of-way for TWS, to the extent practical;
- use existing anthropogenic disturbances where practicable;

- in the event that areas that possess the ecological attributes required for Mexican mosquito fern, such as open water features, are identified in critical habitat on the pipeline construction footprint prior to construction, reduce disturbance to these areas, where feasible and when safety is not compromised;
- endeavour to maintain a 10 m buffer from areas that possess the ecological attributes required for Mexican mosquito fern where feasible;
- temporarily fence-off or flag potential habitat areas, such as open water features, that may possess the ecological attributes required for Mexican mosquito fern where a 10 m buffer cannot be attained; and/or
- if discovered, restore or enhance biophysical attributes of critical habitat by revegetating the pipeline construction footprint in selected areas using native grasses, forbs, tree or shrub seeds, and propagation materials where feasible to improve soil structure and reduce soil erosion.

5.1.9 Roell's Brotherella Moss Early Draft Critical Habitat

ECCC has identified early draft critical habitat for Roell's brotherella moss (Environment Canada 2015a and 2015d). Some early draft critical habitat is traversed by the Project Footprint between Hope and Burnaby, BC. The Burnaby Terminal and Sumas Terminal are also located within the areas of early draft critical habitat provided by ECCC. Roell's brotherella moss has not been observed at these locations.

Environment Canada (2015d) provided the attributes of critical habitat (early draft) for this species. Roell's brotherella moss is found in cool, moist, mixed deciduous and coniferous forests (typically remnant second-growth forests), and closed-canopy floodplain regions along waterways at low elevations (generally <100 m). Roell's Brotherella moss has been found growing on the trunks of deciduous trees, notably red alder (*Alnus rubra*), bigleaf maple (*Acer macrophyllum*), western flowering dogwood (*Cornus nuttallii*), and birch (*Betula* sp.), as well as on rotting logs and stumps.

While targeted collection surveys have not identified Roell's brotherella on the Project Footprint, desktop review and field information confirm that riparian areas with mixed second-growth forest cover on the Project Footprint do provide the biophysical attributes to support this species. These locations are presented in Appendix E of this Plan, the Resource-Specific Mitigation Tables (Volume 7 of the Environmental Plans) and are illustrated on the Environmental Alignment Sheets (Volume 8 of the Environmental Plans). Mitigation measures will be implemented at these locations to reduce potential interactions that may occur.

5.1.10 Roell's Brotherella Moss Critical Habitat Mitigation Strategies

Project planning within early draft critical habitat for Roell's brotherella moss has included efforts to reduce the area of the Project Footprint, where feasible and when safety is not compromised (e.g., narrowing of the pipeline construction footprint, using the existing TMPL right-of-way as workspace to reduce clearing requirements). Many of the mitigation measures included in the Pipeline EPP (Volume 2 of the Environmental Plans) will serve to reduce disturbance during clearing and construction. The mitigation strategy described below encompasses the potential mitigation measures from which mitigation measures have been selected, based on the particular characteristics of the population, the site-specific characteristics and construction methods for the site (to the extent that they are currently known). Site-specific mitigation measures are presented in Appendix E.

Environment Canada (2015d) outlined three project activities likely to result in the destruction of early draft critical habitat:

- tree removal that affects the existing composition of coniferous and/or deciduous trees (e.g., forest harvesting, residential development, linear developments, trail construction);

- removal or alteration of appropriate substrates of trees, logs or stumps within 50 m of occurrences (critical function zones) (e.g., residential development, linear developments, trail construction); and
- activities (e.g., ditching, trenching, diversion of water, operation of water control devices that result in rapid water level changes or premature drying) that cause alteration in local hydrological characteristics.

These habitat mitigation strategies are designed to reduce the impacts of these activities.

Trans Mountain will minimize the area disturbed within early draft critical habitat for Roell's brotherella moss, complete pre-disturbance surveys for Roell's brotherella at all potential locations identified through desktop review and provided in Appendix E of this Plan, and salvage any occurrences of the species observed during pre-construction surveys. This will be done by implementing one or more of the following mitigation measures:

- use the existing TMPL right-of-way for TWS, to the extent practical;
- use existing anthropogenic disturbances where practicable;
- a qualified professional will visit all of the areas identified on the Environmental Alignment Sheets (Volume 8 of the Environmental Plans) and Appendix E of this Plan that were not previously surveyed for the presence of Roell's brotherella
- reduce disturbance to areas that possess the ecological attributes required for Roell's brotherella moss, where feasible and when safety is not compromised;
- endeavour to maintain a 10 m buffer from areas that possess the ecological attributes required for Roell's brotherella moss where feasible;
- temporarily fence-off or flag potential habitat areas that possess the ecological attributes required for Roell's brotherella moss, where a 10 m buffer cannot be attained;
- if Roell's brotherella moss is located on the pipeline construction footprint and it cannot be avoided, relocate its substrate to a suitable habitat in the immediate vicinity of the Project. The location (e.g., aspect and vertical position) and habitat (e.g., substrate, light and humidity conditions) of the receiving sites will emulate conditions, including the substrate types that occurred in the critical function zone at the transplant source location, to the extent feasible;
- ensure that local hydrological characteristics are maintained; and
- restore or enhance biophysical attributes of critical habitat by revegetating the pipeline construction footprint using native grasses, forbs, trees or shrubs, that will reduce soil erosion. Important species for Roell's brotherella moss include red alder (*Alnus rubra*) and bigleaf maple (*Acer macrophyllum*).

The following general measure applies to all of the mitigation strategies listed above:

- Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions.

5.2 Measures for Critically Imperiled Vegetation features (Provincial Conservation Status Ranks: S1, S1S2, and S2)

Nine rare plants occur along the construction footprint that are provincially ranked as S1S2 or S2. Twenty-eight rare ecological communities occur along the construction footprint that are provincially ranked as S1 or S2 under their respective provincial status rankings.

Eight rare plant occurrences along the Project Footprint are provincially ranked as S1S2 or S2 including:

- one occurrence of toothed bittercress (*Cardamine dentata*), a provincially listed, critically imperiled rare plant, ranked as S2 conservation status, is encountered by the Project;
- one occurrence of echo moonwort (*Botrychium echo*), a provincially listed (red-listed) critically imperiled rare plant, ranked as S1S2 conservation status, is encountered by the Project;
- three occurrences of Michigan moonwort (*Botrychium michiganense*), a provincially listed (red-listed), critically imperiled rare plant, ranked as S2 conservation status, are encountered by the Project;
- one occurrence of mountain moonwort (*Botrychium montanum*), a provincially listed (red-listed) critically imperiled rare plant, ranked as S2? Conservation status is encountered by the Project; and
- two occurrences of Pacific waterleaf (*Hydrophyllum tenuipes*), a provincially listed (red-listed) critically imperiled rare plant, ranked as S2 conservation status, are encountered by the Project.

Twenty-seven rare ecological community occurrences along the Project Footprint are provincially ranked as S1 or S2.

Two provincially listed (red-listed) critically imperiled rare ecological communities ranked as S1 communities are intersected by the Project Footprint, including:

- one occurrence of trembling aspen / common snowberry / mountain sweet-cicely forest (*Populus tremuloides* / *Symphoricarpos albus* / *Osmorhiza berteroi* forest); and
- one occurrence of western redcedar – Douglas-fir/false Solomon's seal forest (*Thuja plicata* – *Pseudotsuga menziesii* / *Maianthemum racemosum* forest).

Twenty-five provincially listed (red-listed) critically imperiled rare ecological communities ranked as S2 communities are intersected by the Project Footprint, including:

- one occurrence of beaked sedge marsh (*Carex rostrata* marsh);
- one occurrence of Sitka willow – Pacific willow/skunk cabbage swamp (*Salix sitchensis* – *Salix lasiandra* var. *lasiandra*/*Lysichiton americanus* swamp);
- one occurrence of Douglas-fir/common snowberry – saskatoon forest (*Pseudotsuga menziesii*/*Symphoricarpos albus* – *Amelanchier alnifolia* forest);
- one occurrence of trembling aspen/common snowberry/Kentucky bluegrass forest (*Populus tremuloides*/*Symphoricarpos albus*/*Poa pratensis* forest);
- two occurrences of rough fescue – bluebunch wheatgrass grassland (*Festuca campestris*/*Pseudoroegneria spicata* grassland);
- one occurrence of giant wildrye herbaceous vegetation (*Leymus cinereus* Herbaceous Vegetation);
- seven occurrences of big sagebrush/bluebunch wheatgrass grassland (*Artemisia tridentata*/*Pseudoroegneria spicata* grassland);
- three occurrences of ponderosa pine/bluebunch wheatgrass – rough fescue forest (*Pinus ponderosa*/*Pseudoroegneria spicata* – *Festuca campestris* forest);
- two occurrences of narrow-leaf willow shrubland (*Salix exigua* shrubland);

- five occurrences of Baltic rush – common silverweed marsh (*Juncus balticus* – *Potentilla anserina* marsh); and
- one occurrence of western redcedar/sword fern Dry Maritime forest (*Thuja plicata*/*Polystichum munitum* Dry Maritime forest).

Mitigation measures for critically imperiled rare plant occurrences fall into categories of avoidance, reducing disturbance and alternative reclamation techniques.

Avoidance is the preferred mitigation strategy when the Project encounters rare vegetation features ranked S1, S1S2, S2 or if rare species are protected under provincial or federal legislation. Where avoidance is not practicable, site-specific mitigation measures to reduce disturbance and use alternative reclamation techniques have been developed.

Site-specific mitigation measures for rare plant or rare ecological community occurrences are contained in Appendix E. The details and associated mitigation measures will be captured in the Vegetation Resource-Specific Mitigation Tables (Volume 7 of the Environmental Plans) and will be illustrated on the Environmental Alignment Sheets (Volume 8 of the Environmental Plans).

In the event that complete avoidance is not feasible or where the Project encounters rare species ranked S1, S1S2 or S2, the recommended mitigation strategy will include one or more the following construction mitigation measures:

- flag or fence-off the occurrence prior to commencing construction to avoid the resource site (Section 6.0 of Volume 2 of the Environmental Plans);
- narrow TWS , where feasible and when safety is not compromised, and avoid taking extra TWS within a 10 m radius of the occurrence;
- redirect construction traffic around the occurrence if practical. If traffic diversion is not practical, minimize traffic within the occurrence by creating a single lane travel corridor through the extent of the occurrence;
- post signs in the vicinity of the occurrence to alert workers of their presence and ensure their protection of sensitive environmental features. Alert Contractors that work will take place near sensitive features. Use site identification numbers to ensure confidentiality and protection of resources, where warranted (Section 6.0 of Volume 2 of the Environmental Plans);
- mow or walk down shrubs, use matting and/or use a stump mulcher rather than grubbing, if feasible, to minimize the loss of vegetation cover;
- restrict the application of herbicide within 30 m of known rare plant populations or rare plant communities. Spot spraying, wicking, mowing or hand picking are acceptable weed control measures in proximity to rare plants and rare plant communities (Section 7.0 of Volume 2 of the Environmental Plans);
- use geotextiles or protective ramping, matting and/or snow over the travel lane and/or spoil pile area in the vicinity of the population to minimize disturbance to the soil surface (see Rare Plant Ramp Protection Dwg. 2 and Temporary Bridge/Rare Plants Dwg. 3 provided in Appendix C of Volume 2 of the Environmental Plans);
- conduct shrub staking with suitable native woody species following completion of construction;
- salvage the root zone material (up to 15 cm) from within a 10 m radius of the occurrence; isolate root zone material from other spoil piles and identify with labelled stakes or flags; redistribute salvaged root zone material over the pipeline construction footprint at the location from which it was stripped; and
- monitor the effectiveness of implemented mitigation measures during rare plant PCEM.

5.3 Measures for Special Concern to Imperiled Vegetation Features (Provincial Conservation Status Ranks: S2, S2S3, S1S3, S3, SNR, SH or SU).

5.3.1 Rare Ecological Communities

Protection measures and environmental management techniques for rare ecological communities were determined following an assessment of the vegetation community, which accounted for the following site-specific conditions and community sensitivity criteria:

- community extent and abundance in the local area;
- the relative rarity of the community (*i.e.*, as indicated by its provincial [S] rank or the BC *Wildlife Act*);
- the growth form, primary mode of species reproduction and mode, as well as magnitude of seed or spore dispersal of the component plant species;
- construction activity timing;
- the location of the community with respect to the planned disturbance;
- the proportion of the community expected to be affected;
- the site preferences of the community and/or its component plant species;
- expected or known sensitivity or resilience to disturbance of the community and/or its component plant species; and
- past mitigation success of the community or similar communities.

Assessment and mitigation planning for rare ecological communities encountered by the Project included the following steps:

1. consulted with the ACIMS or the BC CDC to verify the community's ranking and known distribution within the province; and then
2. consulted with a qualified Vegetation Resource Specialist regarding preferred or recommended mitigation measures for the rare ecological community.

5.3.1.1 Mitigation Measures for Rare Ecological Communities

Mitigation measures for rare ecological communities generally fall into categories of avoidance and reducing disturbance. The recommended mitigation strategy for rare ecological community occurrences may include the suite of mitigation measures and options, in order of preference as listed below. One or more options may be used at a site. Site-specific mitigation measures for rare ecological communities are contained in Appendix E.

1. Flag or fence-off the occurrence prior to commencing construction to avoid the resource site (Section 6.0 of Volume 2 of the Environmental Plans).
2. Narrow down or reconfigure the area of disturbance, where feasible and when safety is not compromised, and protect the site using fencing or clearly mark the site using flagging and inform workers of access restrictions in the vicinity of flagged or fenced sites.
3. Reduce or avoid grubbing of roots in shrubby communities within TWS areas, where feasible.
4. Mow or walk down rather than wholly remove shrubs, where feasible.
5. Leave gaps in the topsoil or root zone material piles and subsoil piles to avoid the community.

6. Use protective matting, ramping and/or snow where surface disturbance is not required, to protect communities from scraping and compaction (see Rare Plant Ramp Protection Dwg. 2 and Temporary Bridge/Rare Plants Dwg. 3 provided in Appendix C of Volume 2 of the Environmental Plans).
7. Restrict the application of herbicide within 30 m of known rare plant populations or rare plant communities. Spot spraying, wicking, mowing or hand picking are acceptable weed control measures in proximity to rare plants and rare plant communities (Section 7.0 of Volume 2 of the Environmental Plans).
8. Employ appropriate salvage, propagation and transplant techniques for component species.
9. Conduct PCEM of rare ecological community occurrences to monitor the effectiveness of mitigation efforts.

5.3.2 Rare Plant Species

Protection measures and environmental management techniques for rare plant species were determined following the assessment of the occurrence, which accounted for the following site-specific conditions and species sensitivity criteria:

- occurrence size and abundance of the species in the local area;
- an estimate of the number of known rare plants within the occurrence;
- the relative rarity of the species (*i.e.*, as indicated by its provincial [S] rank, SARA, COSEWIC, the Alberta *Wildlife Act* and/or BC *Wildlife Act*);
- growth form and type of the species (*e.g.*, annual, biennial, perennial, aquatic, moss, liverwort, epiphyte, tree, and shrub);
- construction activity timing;
- location of the rare plant or individual with respect to the disturbance;
- primary mode of species reproduction (*e.g.*, spores, seeds, rhizomes, suckering or spreading, vegetative propagules);
- mode and magnitude of seed or spore dispersal;
- proportion of the occurrence expected to be affected;
- habitat and substrate preferences of the species;
- proximity of available habitat and substrate (based on similarity of habitats to the habitat of the rare species occurrence);
- expected or known sensitivity or resilience to disturbance of the species;
- past mitigation success of the species or similar species; and
- expected or known occurrence viability and/or sustainability (both pre-construction and post-construction).

Assessment and mitigation planning for rare plant occurrences encountered by the Project included the following steps:

1. consulted with ECCC, ACIMS and/or BC CDC to verify the species' ranking and known distribution within the province; and then
2. consulted with a qualified Vegetation Resource Specialist regarding preferred or recommended mitigation measures for the rare plant species.

5.3.2.1 General Mitigation Measures for Rare Plant Occurrences

Mitigation measures for rare plant occurrences generally fall into categories of avoidance, reducing disturbance and alternative reclamation techniques. Site-specific mitigation measures for rare plant occurrences are contained in Appendix E.

In the event that rare species ranked S1, S1S2 or S2 cannot be avoided for practical reasons or where the Project encounters rare species ranked, S2S3, S1S3, S3, SNR, SH or SU, the recommended mitigation strategy may include the following options, in order of preference. One or more options may be used at a site.

1. Flag or fence-off the occurrence prior to commencing construction to avoid the resource site (Section 6.0 of Volume 2 of the Environmental Plans).
2. Narrow down or reconfigure the area of disturbance, where feasible and when safety is not compromised, and protect the site using fencing or clearly mark the site using flagging and inform workers of access restrictions in the vicinity of flagged or fenced sites.
3. Leave gaps in the topsoil or root zone material piles and subsoil piles to avoid the site.
4. Use protective matting, ramping and/or snow (mark the area in case the snow melts) over the population where it occurs on the Project area, and other areas where topsoil or root zone material removal is not required, to protect vegetation from scraping and compacting (see Rare Plant Ramp Protection Dwg. 2 and Temporary Bridge/Rare Plants Dwg. 3 provided in Appendix C of Volume 2 of the Environmental Plans).
5. Restrict the application of herbicide within 30 m of known rare plant populations or rare plant communities. Spot spraying, wicking, mowing or hand picking are acceptable weed control measures in proximity to rare plants and rare plant communities (Section 7.0 of Volume 2 of the Environmental Plans).
6. Propagate rare plants via vegetative or reproductive means (*e.g.*, harvesting of seed, salvaging and transplanting or collecting of cuttings) and transplant at suitable receiving sites.
7. Conduct PCEM of rare plant occurrences to monitor the effectiveness of mitigation efforts.

Additional site-specific mitigation measures for non-vascular plants, where complete avoidance is not feasible, or where the Project encounters rare non-vascular plants ranked S2, S2S3, S1S3, S3, SNR, SH or SU, may include the following options:

- relocation of substrates (*e.g.*, decayed logs, portions of logs, individual branches, bark disk transplants, soil crusts) to suitable habitats in the immediate vicinity of the Project Footprint;
- relocation of portions of the plants population (*e.g.*, lichen pendants, moss peds, and liverwort thalii) to suitable habitats in the immediate vicinity of the Project Footprint;
- where transplanting is utilized, the location (*e.g.*, aspect and vertical position) and habitat (*e.g.*, substrate, light, and humidity conditions) of the receiving sites will emulate conditions at the transplant source location, to the extent practical;
- within the vicinity of the rare plant populations, strip the upper 15 cm of topsoil or root zone material separately (where feasible) from the remaining A horizon, then redistribute on top of the replaced topsoil or root zone material following final clean-up; and
- recontouring the landscape to pre-construction conditions.

5.4 Rare Ecological Communities or Rare Plant Species within 2 m of the Project Footprint

Occurrences of rare plants and rare ecological communities that are located within 2 m of the Project Footprint have been identified in Appendix E. The intent is to make Project personnel aware of their presence to avoid accidental encroachment.

The recommended mitigation strategy where rare plants and rare ecological communities are located within 2 m of the Project Footprint may include the following options:

- flag or fence-off the occurrence prior to commencing construction to avoid the resource site (Section 6.0 of Volume 2 of the Environmental Plans); and
- restrict the application of herbicide within 30 m of known rare plant populations or rare plant communities. Spot spraying, wicking, mowing or hand picking are acceptable weed control measures in proximity to rare plants and rare plant communities (Section 7.0 of Volume 2 of the Environmental Plans).

5.5 Mitigation Summary

Final decisions regarding mitigation measures implemented to reduce or avoid impacts to rare plants and rare ecological communities will be made by Trans Mountain in consultation with ECCO or Appropriate Government Authorities, a qualified Vegetation Resource Specialist and other stakeholders, when appropriate.

Site-specific mitigation measures for occurrences identified within the pipeline construction footprint will be provided in the Vegetation Resource-Specific Mitigation Tables (Volume 7 of the Environmental Plans) and will be provided on the Environmental Alignment Sheets (Volume 8 of the Environmental Plans) for construction planning. Mitigation measures for plants and communities of conservation concern will continue to be refined with engineering and Project Footprint modifications as final construction planning proceeds. The Environmental Inspectors will ensure the mitigation measures for vegetation features are implemented to reduce impacts to rare plants or rare ecological communities that could not be avoided.

Immediately prior to construction rare plant populations and rare ecological communities, which have potential to interact with the Project, will be marked (in a fashion appropriate to the conditions) by the Environmental Inspector and/or Resource Specialist. At this time project staking or survey grade GPS equipment will be used to determine the precise location of the feature (population or community) in relation to the Project and a final determination of what type(s) of workspaces the feature will interact with. Based on the mitigation in Appendix E and this site-specific information, the Environmental Inspector and/or Resource Specialist will decide about the feasibility of the mitigation measures and determine where each measure may be applied (more than one measure may be applied at a single site as the feature may intersect more than one type of workspace which could result in differing mitigation). The Environmental Inspector and/or Resource Specialist will use the mitigation hierarchy and the general mitigation presented in Section 5 of the plan to guide their decisions. Where feasible, the Environmental Inspector and/or Resource Specialist will consider opportunities to incorporate avoidance-type mitigation measures at a site scale. For instance, avoidance by realignment may not have been feasible but small-scale revisions to workspace may be determined to be feasible prior to construction.

Where feasibility or practicality is cited in the mitigation measures, the reasons that would lead Trans Mountain to consider less preferred mitigation could be any of the following, though the list is not exhaustive:

- Mitigation cannot be completed prior to construction.
- Mitigation will have impacts on planned construction methods.
- Mitigation will impact safety.
- Mitigation would impact other mitigation (e.g., environmental mitigation, safety measures, etc.)

- Mitigation will negatively affect reclamation.
- Mitigation requires specialized equipment.
- Mitigation impacts construction schedule.
- Mitigation impedes travel in the vicinity of the site.
- Mitigation does not have a high likelihood of success.
- Mitigation would impede operations and maintenance activities or be adversely effected by these activities.
- Mitigation is prohibitively costly to implement or maintain.
- Mitigation is too time consuming.

Feasibility and practicality will be determined by the Environmental Inspector and/or the Resource Specialist while marking the occurrences prior to construction. The decision will take into account mitigation in Appendix E of the plan, the mitigation hierarchy, the type(s) of workspaces the feature will interact with as well as site-specific conditions and community/species sensitivity criteria as described in Section 5.3.1 and 5.3.2. The decision of which mitigation to implement for each occurrence will be documented on the daily field reports submitted by the EI. For examples, see below.

Example 1: giant wildrye (*Leymus cinereus*) herbaceous vegetation (S2, red-listed) located at KP 827.38 to KP 827.43.

In this hypothetical situation, the Environmental Inspector and Resource Specialist have located the population prior to construction. They find the community occurring on the west side of the pipeline construction footprint and extending off to the west. The mitigation listed in Appendix E of the Rare Ecological Community and Rare Plant Population Management Plan includes:

- clearing in the rare ecological community will occur immediately before construction, if practical;
- employ appropriate salvage, propagation and transplant techniques for component species;
- conduct native seed collection for use in revegetation efforts at the site if feasible;
- leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side; and
- the Project grassland specialist will be onsite during clean-up activities.

The Environmental Inspector has information that lists the west side of this part of the pipeline right-of-way as being the travel side and construction will begin in the spring. The first step is to consider whether or not avoidance with minor changes to the workspace is feasible; the example assumes that avoidance would create an unsafe situation. When considering the mitigation, the Environmental Inspector determines it to be appropriate to cover the extent of the population that is located on the travel side with flex net. Given that many rare communities occur in the vicinity of this occurrence, and all call for clearing prior to construction, and the wildlife mitigation for the area calls for clearing prior to the migratory bird restricted activity period in the spring, the Environmental Inspector decides it is practical for clearing prior to construction to be conducted. Since the community will now have the disturbance reduced (by covering with flex net) the mitigation related to native seed collection is no longer applicable (and is less preferred as this is lower in the mitigation hierarchy under alternative reclamation techniques). Due to the observed location of the community, the mitigation related to gaps in the spoil piles is no longer applicable. The

Environmental Inspector notes the mitigation to be implemented for this population on the daily field report.

Example 2: echo moonwort (*Botrychium echo*; S1S2, red-listed) located at KP 535.18.

Based on surveys conducted in 2013 the population contained greater than 50 individuals in an approximately 10 m x 40 m area. Plants occur approximately 6 m southwest of the edge of the pipeline construction footprint.

In this hypothetical situation, the Environmental Inspector and Resource Specialist have located the population prior to construction. They find the plants occurring approximately 3 m east from the centerline; a different location in relation to the pipeline right-of-way than in 2013 (closer to the centerline). Avoidance is not feasible. The mitigation listed in Appendix E of the Rare Ecological Community and Rare Plant Population Management Plan includes: leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. Since the location of the population is no longer near the edge of the right-of-way the listed mitigation is not practical.

Due to the species rarity (red-listed) and in consultation with the Resource Specialist, the Environmental Inspector decides to implement mitigation for a similar species (Michigan moonwort [*Botrychium michiganense* sp. Nov. ined.]; S2, red-listed) located nearby at KP 515.04. The mitigation to be used includes: hand transplant the population during the active growing season to a biologically suitable recipient site (i.e., similar light and moisture regime) off of the pipeline construction footprint prior to construction. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.

The Environmental Inspector and Resource Specialist hand transplant a number of individuals from the population to off right-of-way and mark the location with flagging to aid in Post-Construction Monitoring. The Environmental Inspector has information that lists this part of the right-of-way will be stripped, so the Environmental Inspector flags the location and makes note to have the soil salvaged separately in the location from other spoil piles with "rare plant" stakes to identify the pile. The Environmental Inspector makes note of the mitigation in the daily field report.

Example 3: Roell's brotherella moss (*Brotherella roellii*) early draft critical habitat located at KP 1077.1.

A Roell's brotherella moss early draft critical habitat polygon spans the width of the pipeline construction footprint and extends off in both directions. An additional species-specific survey by a qualified professional was conducted on August 10, 2017. No Roell's brotherella moss was collected during the survey. However, habitat with the biophysical attributes to support this species was identified between KP 1077.1 and 1077.28.

Within this KP range the Environmental Inspector would implement access restrictions and reduce disturbance to forested areas where feasible and when safety is not compromised, and note these actions in the daily field report. Following construction local hydrological characteristics will be restored and the disturbed area (with the exception of a 6 m opening centred over the pipeline required by Pipeline Operation safety standards) will be replanted with an appropriate mix of coniferous and deciduous trees including red alder (*Alnus rubra*) and bigleaf maple (*Acer macrophyllum*).

The Rare Ecological Communities or Rare Plant Species Discovery Contingency Plan (see EPP) provides mitigation strategies for vegetation features in the event that potential rare ecological communities or rare plants are discovered within the pipeline construction footprint during construction.

5.6 Update to Environmental Protection Plans

Trans Mountain confirms that the Project EPPs will be updated to include relevant information from the Plan, including confirmation that the mitigation, monitoring, and corrective measures provided in the Plan will be implemented, as warranted.

6.0 POST-CONSTRUCTION ENVIRONMENTAL MONITORING

Vegetation Resource Specialists will review the construction mitigation measures and issues identified by the Environmental Inspectors as well as recommendations to address unresolved issues for rare plant and rare ecological communities where PCEM is recommended. Vegetation Resource Specialists will then revisit these locations during biologically appropriate times at intervals over a five-year period (e.g., years one, three and five following completion of reclamation activities) until the issue has been resolved.

The vegetation parameters to be assessed during PCEM, include the following:

- abundance, distribution, plant health, and phenology of rare plants and rare lichens;
- distribution of rare ecological communities, as well as the plant species present and associated percent cover for each layer;
- loss or alteration of rare plants, rare lichens, and/or rare ecological communities;
- vegetation cover re-establishment and the establishment of an early successional trajectory; and
- the absence of factors that may negatively impact the longevity of rare plant and rare ecological communities, such as bare soil exposure, visible erosion, weed presence/abundance, forest health pathogens, grazing pressure, and plant vigour.

For each rare ecological community and rare plant population the presence, abundance, density, distribution, areal extent, overall health, reproductive abundance and ability to maintain a viable local population have been documented during baseline and supplementary (i.e., pre-construction) assessments (see Appendix F of Volume 5C: Vegetation Technical Report).

For both rare plants and rare ecological communities, site conditions will also be documented (e.g., hydrology, weeds, contours), as well as photos and GPS waypoints of key locations will be recorded.

Vegetation monitoring is designed to detect changes compared to pre-construction conditions and thus evaluate the effectiveness of mitigation measures that were implemented during construction and reclamation of the Project.

If none of the “Threats to Rare Plant, Rare Lichen Population or Rare Ecological Community Occurrence” listed in Table 9 are present and if the measurable goals from Section 1.4 specific to the category of mitigation implemented for that population are achieved then the population or community would be considered resolved and would not be monitored in the subsequent monitoring year. However, all populations and communities, even if considered previously resolved, would be visited during the 5th year following the completion of reclamation activities.

For example, the mitigation recommended for the dainty moonwort (*Botrychium crenulatum*) observed at KP 577.25 is to hand transplant the population to a biologically suitable recipient site (i.e., similar light and moisture regime) off the pipeline construction footprint during the active growing season prior to construction. Hypothetically, an Environmental Inspector or Resource Specialist would transplant the individual plant off the construction footprint and flag it for post-construction environmental monitoring (PCEM). During PCEM, the Resource Specialist would return to the flagged location and identify if the measurable goals for alternative mitigation techniques are met at this location (i.e., is the dainty moonwort present at the location, are there reproductive structures present, is there a similar landscape topology and soil moisture regime as was observed during baseline pre-construction surveys?) If the answer is yes to all those questions, the Resource Specialist would identify if any of the threats listed in Table 9 are present. If there are no threats present, then the mitigation will be considered successful and the population would not be monitored again until the year five.

During PCEM, if the measurable goals for the type of mitigation implemented are not sufficiently met according to the Resource Specialist, and there are threats from Table 9 present at a location, then the Resource Specialist will determine the outcome of mitigation to not be evident. Detailed notes about each site are taken during PCEM that document the condition of the population of concern and landscape conditions leading to the decision of mitigation being determined adequate or not.

6.1 Critical Habitat Monitoring

In addition to monitoring of the rare plant and rare ecological community occurrences, monitoring will be conducted for those species at risk with identified critical habitat within the Project Footprint. Success will be measured according to the performance indicators and measurable targets in Table 7.

TABLE 7

PERFORMANCE INDICATORS AND MEASURABLE TARGETS FOR CRITICAL HABITAT

Measurable Goal	Performance Indicator	Measurable Target
<ul style="list-style-type: none"> Avoid loss of potential critical habitat for toothcup, Haller's apple moss, whitebark pine, Mexican mosquito fern, and Roell's brotherella moss Reclaim disturbed habitat in areas identified by ECCC as final, early draft, proposed or candidate regeneration critical habitat to conditions that support attributes of critical habitat needs. 	<ul style="list-style-type: none"> Plant species present and cover of weedy or invasive species Landscape topology and soil moisture 	<ul style="list-style-type: none"> At five years after reclamation, early seral species that support a successional trajectory to return the pre-construction plant community are established The percent cover of invasive species is less than or equal to pre-construction conditions Landscape topology and soil moisture regime is similar to pre-construction conditions Construction activities have not disturbed biophysical attributes for the species at risk within the critical habitat polygon(s) The pipeline construction footprint has been revegetated successfully according to the Reclamation Management Plan (Volume 6 of the Environmental Plans)
		<p>For whitebark pine, in addition to targets above:</p> <ul style="list-style-type: none"> Competing vegetation that deters whitebark pine habitat from regenerating or recovering, such as lodgepole pine trees or shrubs of the genus Ribes, that may host white pine blister rust have not been planted. The established whitebark pine research and monitoring plots or transects that directly informs and assists the recovery process have been avoided by Project activities. Areas where recovery activities have been deliberately applied to create regeneration habitat for the purpose of whitebark pine seed sowing or whitebark pine seedling planting have been avoided by Project activities.

6.2 Monitoring of Provincially Listed Rare Plant Populations and Rare Ecological Communities

Mitigation strategies for provincially listed rare plant populations and rare ecological communities are expected to avoid or reduce disturbance. Success will be measured according to the performance indicators and measurable targets in Table 8. General indicators and targets, applicable to all mitigation categories, are supplemented by more specific indicators and targets for each mitigation category.

TABLE 8

**PERFORMANCE INDICATORS AND MEASURABLE TARGETS FOR
 PROVINCIALLY LISTED RARE PLANT POPULATIONS AND RARE ECOLOGICAL COMMUNITIES**

General Mitigation Category	Measurable Goal	Performance Indicator	Measurable Target
All Categories	<ul style="list-style-type: none"> No construction disturbance evidence within rare ecological community or rare plant population as the preferred mitigation measure outcome for rare ecological communities, rare plants, and rare lichens (particularly for communities, plants, and lichens ranked S1, S1S2, S2, and/or species or critical habitat protected under provincial or federal regulation) 	<ul style="list-style-type: none"> Presence of the rare ecological community or rare plant population Cover of weedy or invasive species Landscape topology and soil moisture 	<ul style="list-style-type: none"> Presence of the rare ecological community or rare plant population Observation of rare ecological community, rare plant or rare lichen population during post construction monitoring during the first growing season following final clean-up, or in a subsequent year if the outcome of mitigation is not evident during the first growing season The percent cover of invasive species is less than or equal to pre-construction conditions The pipeline construction footprint has been revegetated successfully according to the Reclamation Management Plan (Volume 6 of the Environmental Plans) with contours restored, hydrology maintained and no erosion issues evident
Avoidance	<ul style="list-style-type: none"> No construction disturbance evident within rare ecological community, rare plant or rare lichen population; and Observation of rare ecological community, rare plant or rare lichen population during post construction monitoring during the first growing season following final clean-up, or in a subsequent year if the outcome of mitigation is not evident during the first growing season. 	<ul style="list-style-type: none"> Habitat of rare ecological community, rare plant or rare lichen population has not been disturbed directly by construction Indirect effects of construction on the habitat of rare ecological community, rare plant or lichen populations are within the range of natural variation 	<ul style="list-style-type: none"> No vegetation has been cleared or soil disturbed within rare ecological community, rare plant or rare lichen population Presence of the rare ecological community or rare plant population Observation of rare ecological community, rare plant or rare lichen population during post construction monitoring during the first growing season following final clean-up, or in a subsequent year if the outcome of mitigation is not evident during the first growing season
Disturbance Reduction	<ul style="list-style-type: none"> Reduce the spatial extent of construction disturbance within rare ecological community, rare plant or rare lichen populations; and Reduce the magnitude of soil and seed bank disturbance within rare ecological community, rare plant or rare lichen populations. 	<ul style="list-style-type: none"> Distribution of rare ecological communities, as well as the plant species present and associated percent cover for each layer Vegetation cover re-establishment and the establishment of an early successional trajectory Pre-existing population/ community and/or habitat of rare ecological community, rare plant, or rare lichen population has not been entirely removed by construction 	<ul style="list-style-type: none"> A portion of rare ecological community, rare plant or rare lichen population is present adjacent to the construction disturbance as a potential source for recolonization of the Project Footprint Observation of similar post-construction community species composition located within the TWS as was observed during pre-construction baseline surveys. At five years after reclamation, early seral species that support a successional trajectory to return the pre-construction plant community are established Observed rare ecological community is of similar extent or is on a trajectory to occupy a similar extent to pre-construction conditions Observed rare plant or rare lichen population is of similar distribution and abundance to pre-construction conditions (taking into account seasonal/annual variations)

TABLE 8 Cont'd

General Mitigation Category	Measurable Goal	Performance Indicator	Measurable Target
Alternative Reclamation Techniques	<ul style="list-style-type: none"> Survival of transplanted, relocated or inoculated species during the first growing season following final clean-up, or in a subsequent year if the outcome of mitigation is not evident during the first growing season; and Observation of similar landscape topology and soil moisture regime as was observed during baseline pre-construction surveys (<i>i.e.</i> habitats are favorable for mitigation success). 	<ul style="list-style-type: none"> Vegetation cover re-establishment and the establishment of an early successional trajectory Presence of transplanted, relocated or inoculated rare plant or rare lichen population Viability of rare ecological community, rare plants or rare lichens found in the vicinity of the reclaimed construction footprint 	<ul style="list-style-type: none"> At five years after reclamation, early seral species that support a successional trajectory to return the rare ecological community are established on the Project Footprint Habitat of receiving location off Project Footprint is similar to the donor site in terms of slope, aspect, landscape position, soil nutrient and moisture regime, and percent cover of invasive species. Survival of transplanted individuals and/or native seedling emergence, growth and survival during the growing season following final clean-up, or in a subsequent year if the outcome of mitigation is not evident during the first growing season; Survival of transplanted, relocated or inoculated moss or lichen populations during the first growing season following final clean-up. Production of sporophytes or other reproductive structures may indicate population viability (for some species); Rare plant or rare ecological community component species seeding emergence, growth and survival from replaced topsoil or root zone material during the first growing season following final clean-up, or in a subsequent year if the outcome of mitigation is not evident during the first growing season At five years after reclamation, abundance, distribution, and plant health of rare ecological community or rare plant populations is increasing since transplantation, relocation or inoculation (for those sites-not yet resolved)

6.3 Adaptive Management and Potential Corrective Measures

An adaptive management component will be included in the vegetation PCEM program, whereby results of the vegetation monitoring will be used to determine the need for further monitoring and the need for and nature of remedial measures to address identified issues. If a rare plant or rare ecological community is not present or its vigour appears to be compromised, corrective measures will be undertaken and further monitoring will be conducted. If alternative reclamation technique (*e.g.*, seed collection, sod/soil salvage, transplanting) was not successful, the reclamation technique may be repeated, or an alternative reclamation technique will be conducted, depending on what is possible and determined to be more successful. An occurrence may also be compromised due to visible and resolvable threats to an enduring rare plant or rare ecological community. A list of potential corrective measures for these circumstances and criteria under which each measure might be used during the PCEM program are described in Table 9.

TABLE 9
POTENTIAL CORRECTIVE MEASURES FOR
RARE ECOLOGICAL COMMUNITY OR RARE PLANT OCCURRENCES

Threat to Rare Plant, Rare Lichen Population or Rare Ecological Community Occurrence	Potential Corrective Measure(s)	Application Reference(s)	Circumstances Under Which the Corrective Measure(s) Will Be Applied During PCEM
Poor Vegetation Re-Establishment in Area	Additional seeding or planting.	Sections 7.0 of Appendix C and 8.6 of Volume 6B	Observation of poor vegetation re-establishment near rare plant, rare lichen population or rare ecological community occurrence
	Monitor vegetation establishment.	Section 7.3.10 of Appendix C of Volume 6B	Issue considered 'unresolved', requiring further environmental monitoring
Poor Site Conditions in Area	Re-establish site conditions favourable to the establishment of the species or communities of concern. Implement reclamation treatments to stabilize soils and surface materials to recreate conditions for early successional trajectory.	Section 7.3.11 of Appendix C of Volume 6B Section 9.3 of Volume 6A	Observation of unstable soils and surface materials, poor soil conditions or extreme exposure conditions near rare plant, rare lichen population or rare ecological community occurrence
	Monitor vegetation establishment.	Section 7.3.10 of Appendix C of Volume 6B	Issue considered 'unresolved', requiring further environmental monitoring
Anthropogenic Disturbance in Area	Establishment of access controls and reinstallation of existing fencing.	Sections 7.0 of Appendix C and 8.6 of Volume 6B	Observation of anthropogenic disturbance near rare plant, rare lichen population or rare ecological community occurrence
Changes to Site Hydrology in Area (i.e., Water Ponding)	Inspect water conveyance installations (e.g., ditches and culverts) and ensure they are functioning appropriately. Take appropriate action prior to and during the spring freshet to clear culverts blocked by ice or debris.	Sections 7.0 and 8.6 of Volume 6B	Observation of changes to original site hydrology near water conveyance installations near rare plant, rare lichen population or rare ecological community occurrence
	Change site hydrology and/or contours.	NEB IR No. 2.47d	Observation of changes to original site hydrology
	Re-establish grade and drainage features.	Sections 7.0 of Appendix C and 8.6 of Volume 6B	
Soil Erosion Due to Wind or Water and/or Sedimentation in Area	Installation and maintenance of temporary and permanent erosion and sediment control measures.	Sections 7.0 of Appendix C and 8.6 of Volume 6B	Observation of soil erosion due to wind, water or sedimentation near rare plant, rare lichen population or rare ecological community occurrence
	Erosion control measures may be one or a combination of the following: erosion matting; cover crop; wind fencing; tackifier and mulch; brush wind barrier; staked logs; and/or woody debris.	Section 7.3.4 of Appendix C of Volume 6B	
	Additional measures that may be implemented to address bank stability and riparian reclamation include: sediment fences; erosion control berms; erosion control blanket or coir matting; coniferous tree revegetations; and/or woody slash placement in the riparian area to promote woody vegetation establishment where appropriate. Implementation of these measures during the post-construction phase would require importation of materials to the affected site.	Section 7.3.5 of Appendix C of Volume 6B	Observation of soil erosion due to wind, water or sedimentation near rare plant, rare lichen population or rare ecological community occurrence
	Placing erosion control blanket or coir matting, woody slash or log diversions along the pipeline construction footprint on erodible soils or wind exposed sites to provide micro-habitat and support plant establishment.	Section 7.3.9 of Appendix C of Volume 6B	Observation of soil erosion due to wind, water or sedimentation near rare plant, rare lichen population or rare ecological community occurrence
Water Connectivity in Area	Where required, re-establish wetland water connectivity across the pipeline construction footprint by constructing channels through the trench crown.	Section 7.3.6 of Appendix C of Volume 6B	Observation of poor water connectivity near rare plant, rare lichen population or rare ecological community occurrence

TABLE 9 Cont'd

Threat to Rare Plant, Rare Lichen Population or Rare Ecological Community Occurrence	Potential Corrective Measure(s)	Application Reference(s)	Circumstances Under Which the Corrective Measure(s) Will Be Applied During PCEM
Control of Weeds or Problem Vegetation Species in Area	The Project will use an integrated management approach that could include mechanical and chemical methods to control noxious weeds and reduce the spread of problem vegetation. The mechanical 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.	Sections 7.3.12 and 14.0 of Appendix C of Volume 6B	Observation of weeds or other problem vegetation species competing with rare plant/lichen population or rare ecological community occurrence
Environmental Stresses (<i>i.e.</i> , Wind Exposure, Low Soil Moisture Stress [Desiccation]) in Area	Within the vicinity of the pipeline construction footprint, collect dormant woody plant material (deciduous stakes and/or brush) and select suitably sized transplants (small trees or shrubs) from a suitable donor site following approval from the applicable land manager.	Section 7.3.10 of Appendix C of Volume 6B	Observation of physiological markers of environmental stress within rare plant/lichen population or rare ecological community occurrence
	A grass cover crop and/or native grass seed mix 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 7.3.10 of Appendix C of Volume 6B	
	Implement plant protection measures (<i>e.g.</i> , soil mounds and berms, wind fencing and rollback) that work to minimize environmental stresses (<i>i.e.</i> , wind exposure, low soil moisture stress [desiccation]), to the extent feasible.	Section 7.3.10 of Appendix C of Volume 6B	

7.0 PRELIMINARY RARE ECOLOGICAL COMMUNITY AND RARE PLANT POPULATION OFFSETS

Site-specific mitigation measures are designed to fully mitigate residual effects to ecological communities and rare plant species that have an at-risk status of S1, S1S2, S2 or that are listed under federal or provincial legislation, or critical habitat. With implementation of the mitigation (Section 5.0, Appendix E) and adaptive management (Section 6.3), the likelihood of offsets will be reduced by implementing practical and feasible mitigation measure prior to and during construction and during adaptive management. Furthermore, those species and ecological communities to which the preliminary offset plan apply are those species for which having no construction disturbance evidence within the population/community is the favoured mitigation measure outcome (as described in Section 1.4). However, if after the implementation of mitigation and adaptive management ongoing effects are observed after five years of operations and as documented in the PCEM, the preliminary rare ecological community and rare plant population offset plan will be implemented.

NEB Conditions 40e and 155 require offsets for any ecological communities and rare plant and lichen species that have an at-risk status of S1, S1S2, or S2, or that are listed under federal or provincial legislation for protection, and for early draft, candidate, proposed or final critical habitat under SARA, if the mitigation measures in this Plan are determined unsuccessful after five years of operations. In the event that mitigation and corrective measures do not meet the goals of this Plan, the Preliminary Rare Ecological Community and Rare Plant Population Offset Plan describes the approach that will be used to determine if offsets are warranted, and appropriate methods to offset residual effects to rare ecological communities and rare plant populations.

7.1 Determining Need for Offsets

The mitigation hierarchy (BC MOE 2014a,b) and biodiversity offset standards (e.g., BC MOE 2014b, Business and Biodiversity Offsets Programme [BBOP] 2012, Department of Sustainability, Environment, Water, Population and Communities [DSEWPC] 2012a, Environment Canada 2012) emphasize the importance of focusing on measures to avoid, minimize and restore on-site before determining the need for offsets. Offsets are a measure of last resort within the mitigation hierarchy (BC MOE 2014a), as their ability to counterbalance ecological losses outside the Project Footprint is more uncertain and of greater risk than mitigation measures applied to the Project Footprint (Bull *et al.* 2013, Gibbons and Lindenmayer 2007, Morris *et al.* 2006).

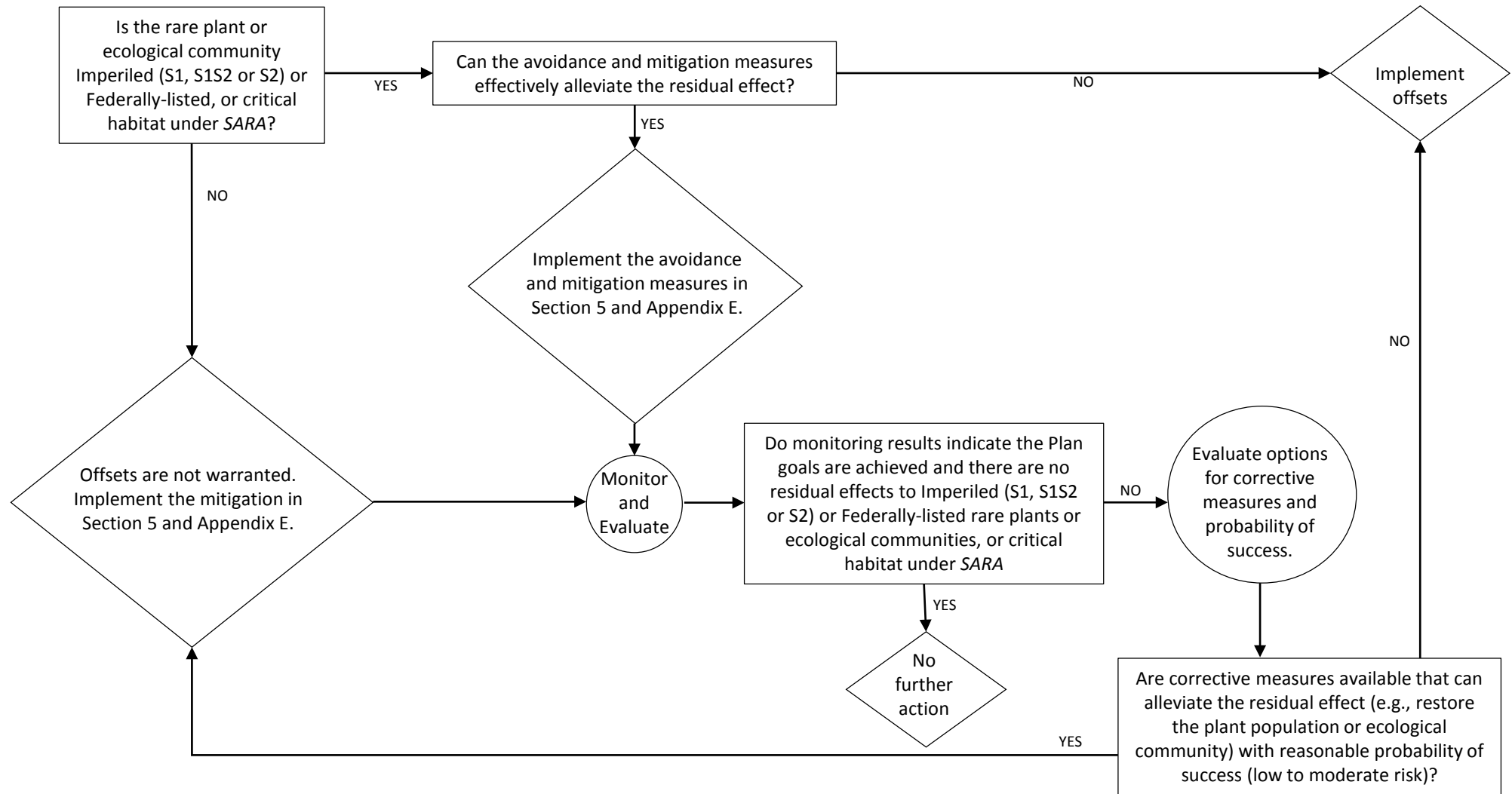
To limit risk and avoid the need for offsets, the focus of this Plan is on the first steps of the mitigation hierarchy to avoid, minimize and restore on-site (Sections 1.4 and 5.0). The avoidance and mitigation measures in this Plan are designed to effectively alleviate residual Project effects on rare plant populations and ecological communities, and critical habitat. The Project will avoid altering the attributes of critical habitat for rare plants as described in Section 5.1. Site-specific mitigation measures (Section 5.0 and Appendix E) and reclamation techniques (see the Reclamation Management Plan in Volume 6 of the Environmental Plans) are expected to mitigate residual effects to rare ecological communities and rare plant occurrences. There are numerous examples of successful rare plant and ecological community mitigation during and following pipeline construction (refer to Section 7.2.9 in Volume 5A of the ESA). Lessons learned from monitoring and adaptive management on other pipeline projects have been incorporated into the mitigation measures in this Plan.

Trans Mountain will monitor the effectiveness of the avoidance and mitigation measures, as described in Section 6.0. Monitoring will allow Trans Mountain to identify if and where the measures implemented do not meet the goals of the Plan, and whether there is a need for corrective measures and additional monitoring, or offsets (see Figure 7.1-1).

Upon completion of the five-year monitoring program, the monitoring results will be incorporated into the Rare Ecological Community and Rare Plant Population Mitigation Evaluation Report and Offset Plan, which will include a determination of the success of mitigation and a determination of the need for offsets, in accordance with NEB Condition 155. When the determination of offsets occurs, it will take into account operations and maintenance activities.

Figure 7.1-1

Rare Plant Population and Ecological Community Offset Decision Framework



7.2 Offset Approach

Offsets should be designed to achieve the best conservation outcome in the shortest timeframe practicable, considering the effort and resources expended (BC MOE 2014b). Design elements are defined for offset programs to assess the value and effectiveness of offset measures, and their ability to achieve the goals of the offset program (Bull *et al.* 2013, BBOP 2012, DSEWPC 2012b, McKenney 2005, McKenney and Kiesecker 2010). Several authors identify the following design elements for the development of conservation or biodiversity offsets (BC MOE 2014b, Doswald *et al.* 2012, Environment Canada 2012, Pilgrim and Ekstrom 2014, Sustainable Prosperity 2014).

- **Equivalency:** Compensate for adverse impacts by protecting, enhancing or restoring equivalent ecological mechanisms at another site.
- **Additionality:** Provide ecological protection beyond what would be provided under a business-as-usual scenario.
- **Location:** The location should have comparable ecosystem values, such as species composition and habitat structure, and should be determined based on an assessment of the relevant species and habitat/ecosystem context.
- **Timing:** The preference is for measures that can be implemented before the adverse impacts of development occur.
- **Duration:** The positive effects should last an appropriate amount of time (and ideally, permanently) to compensate for the duration of the ecological loss resulting from the project.
- **Accountability:** The process should be formalized through written documentation, or, where possible, formalized through permitting or other conditions.

Collectively, the design elements can help evaluate risks associated with offsets. Risks can be defined as described below.

- **Delivery Risk:** factors that contribute to delivery risk include effectiveness (*i.e.*, probability of failure or underperformance), additionality (*i.e.*, whether the offset is contributing to habitat or conservation objectives above and beyond what is required or already in place) and permanence (*i.e.*, protection from future disturbance). There is an inverse relationship between the delivery risk and effectiveness, additionality and permanence (*i.e.*, as effectiveness improves, delivery risk declines).
- **Spatial Risk:** the key factors that contribute to spatial risk include separation between the offset habitat and the habitat affected by the development, and equivalence of the habitat disturbed by the Project and the offset habitats. Spatial risk increases as the separation between offset and disturbance habitats increase, and with increasing difference in habitat features or values.
- **Temporal Risk:** temporal risk is associated with time to realize ecological or conservation benefit from the offset, such as the time required for habitat restoration measures to achieve target outcomes.

There are limitations inherent in offsetting rare plant populations or ecological communities that increase the delivery and spatial risks. It is not ecologically appropriate, or often feasible, to alter native habitats to create rare ecological communities. Although habitat enhancements such as erosion control, site stabilization, introduction of microhabitat features such as coarse woody debris, or managing drainage patterns in already disturbed or altered sites may create conditions that increase suitability for rare plant populations or ecological communities, there is considerable uncertainty that the rare plant species of interest would colonize a reclaimed site, or that the community composition would achieve the characteristics of a rare ecological community. In some cases, augmenting a rare plant population off the Project Footprint may be a possible offset method. However, the risk of further losses resulting from altering the habitat around rare plant populations excludes this approach from consideration for Imperiled (S1, S1S2 or S2) or Federally-listed rare plant populations.

Therefore, the approach to offsets for rare plant populations or ecological communities, if needed, will focus on replacement of ecological components (features or characteristics) that contribute to biodiversity, which may be affected as a result of residual Project effects to rare plants or ecological communities. Ecological components including variation in vegetation species and structure, coarse woody debris, or terrain features such as rock outcrops, mounds or depressions that influence soil moisture levels, potentially contribute to biodiversity.

Trans Mountain identified potential offset options for rare plant populations and ecological communities, which are consistent with the conservation mechanisms listed in the BC Environmental Mitigation Procedures (BC MOE 2014b) and other standard offset approaches (*e.g.*, BBOP 2012, DSEWPC 2012a, BC MOE 2014b, Calvet *et al.* 2015, Croft *et al.* 2011, Environment Canada 2012, McKenney 2005, Poulton 2015, Sustainable Prosperity 2014, Schneider 2011, ten Kate *et al.* 2004, Weber 2011):

- off-site reclamation or enhancement to augment a rare plant population or enhance ecological components that contribute to biodiversity;
- land securement;
- conservation covenants; and
- in-lieu offsets for ecosystem/land management that would enhance or protect biodiversity (financial support for public awareness and educational programs or land use management, implemented by and under the direction of provincial or local government or organizations).

Each of these options were evaluated for their suitability to the Project (Table 10), based on the delivery, temporal and spatial risks described above, as well as costs and predicted benefits to biodiversity. The results of the evaluation indicated that the most suitable offset options are off-site reclamation or enhancement outside the Project Footprint, either completed by Trans Mountain or supported by Trans Mountain (in-lieu funding to support ecosystem or land management measures) and implemented by and under the direction of the province or other appropriate organizations.

TABLE 10

SUMMARY AND EVALUATION OF OFFSET OPTIONS FOR RARE PLANTS AND ECOLOGICAL COMMUNITIES

Offset Option	Primary Objective	Treatment/ Action	Delivery Risk	Spatial Risk	Temporal Risk	Relative Costs ¹	Benefit ²	Value ³
1. Off-site reclamation/ enhancement	Reclaim or enhance disturbed areas to support suitable conditions for rare plants or ecological communities, and increase biodiversity.	<p>Reclaim, stabilize, and establish ecological components required by the rare plant or community, using a combination of the strategies described in Section 6.0:</p> <ul style="list-style-type: none"> soil and terrain stabilization recontour eroded slopes erosion control re-establish natural drainage patterns create suitable microsite conditions (e.g., mounds, uneven surface, coarse woody debris) propagate and plant native seed, shrubs or trees invasive plant management wild/domestic animal exclusion fencing access control 	<p>Delivery risk incorporates uncertainty in the effectiveness of offset measures. Delivery risk is high for replacement of rare plant populations or ecological communities in off-site locations. However, reclamation and enhancement measures for ecosystems that support biodiversity are well understood. There is sufficient knowledge to manage delivery risk associated with effectiveness of reclamation and enhancement measures to improve biodiversity potential in previously disturbed or degraded areas. However, given the variability in natural ecosystems and influence of seasonal climatic variation, uncertainty cannot be entirely eliminated. Potential for future disturbance of offset sites creates uncertainty that increases delivery risk. To achieve additionality, offsets must be in addition to what would be restored or protected without the offset.</p>	<p>Spatial risk is associated with location and ecological equivalence. Ideally, offset methods and locations should replace the species or communities lost as a result of the Project. However, this is likely not possible in some circumstances as discussed above. The biodiversity offset approach may not achieve equivalence (e.g., the rare plant species or ecological community lost may be replaced by different ecological components), which increases delivery risk. Land use and ownership/ tenure can challenge identification of suitable offset locations.</p>	<p>Time lags are inherent in restoration of natural ecosystems. Although restoration to mature and old vegetation community conditions requires decades, establishing a trajectory to a desired ecosystem can be achieved in a relatively short timeframe.</p>	Medium-High	High	High
2. Land Securement	Establish new protected areas that incorporate the rare plants or ecological communities lost as a result of the Project, or protect areas with high biodiversity value.	Purchase land and transfer rights to province for inclusion under protective orders.	<p>Limited opportunities and conflicting land interests could impede land securement. Additionality may not be achieved if other protective measures are already required or planned.</p>	<p>Spatial risk is high since locations that do not have conflicting land interests are of limited availability.</p>	<p>Temporal risk is high since government process, consultation requirements and potential conflicts in land interests can be lengthy and difficult. Temporal risk increases if newly protected areas require time for reclamation or enhancement to restore the rare plant population or ecological community.</p>	High	Low-Medium	Low

TABLE 10 Cont'd

Offset Option	Primary Objective	Treatment/ Action	Delivery Risk	Spatial Risk	Temporal Risk	Relative Costs ¹	Benefit ²	Value ³
3. Conservation Covenants	Establish new protective covenants on private or Crown lands to manage or protect areas of high biodiversity.	Facilitate collaboration between the provincial government, landowners, tenure holders, and other stakeholders to coordinate spatial constraints and management efforts.	Delivery risk considerations are similar to offset option 3.	Spatial risk considerations are similar to offset option 3.	Temporal risk considerations are similar to offset option 3.	Medium-High	Low-Medium	Low
4. Ecosystem or Land Management (in-lieu)	Manage existing land uses that contribute to degradation of biodiversity, or reclaim/enhance biodiversity in previously disturbed or degraded areas.	Financial support (for work completed by or under the direction of the province) to reclaim or enhance disturbed or degraded ecosystems, manage development or recreational activities to protect biodiversity, or support public education/ awareness initiatives to enhance protection of rare plants or ecological communities, or biodiversity.	Delivery risk is high for in-lieu offsets, since the province does not have an established mechanism for this kind of offsets for rare plants and ecological communities. Depending on the actions taken by government and compliance or cooperation by stakeholders, the ecological benefit to rare plants or ecological communities could vary. This uncertainty increases delivery risk.	Spatial risk would vary, depending on offset actions implemented, but could potentially be high if actions do not support enhancement of equivalent rare plants or ecological communities in the region affected by the Project.	Temporal risk is high, since government process, consultation requirements and potential conflicts in land interests can be lengthy and difficult. Depending on the actions implemented by government, there may be a time lag for actions to be effective, which increases temporal risk.	Low	Low-Medium	Medium

- Notes:
- 1 Relative costs are incurred by Trans Mountain.
 - 2 Benefit is rated low, medium, or high, and is the predicted value of the offset for biodiversity, considering delivery, spatial and temporal risks.
 - 3 Value is rated low, medium, or high, and is the overall expected value of the offset considering the benefit to the rare plants or ecological communities lost as a result of the Project (see Note 2) and relative costs (see Note 1). The value is used to identify the most suitable offset options.

7.3 Determining Offset Ratios

In the event that offsets for rare plants or ecological communities are deemed necessary following the five-year monitoring program, an offset ratio will be applied to mitigate delivery, spatial, and temporal risk. There are no established multipliers or offset ratios for replacement of rare plants or ecological communities in the Project area. An approach to offsetting biodiversity losses using a matrix based on ecosystem rarity has been suggested in other jurisdictions (Table 11). A similar approach may be suitable to guide the determination of appropriate offset ratios for the Project, if needed.

TABLE 11

EXAMPLE OF BIODIVERSITY OFFSET RATIOS BASED ON ECOSYSTEM RARITY

		Rarity of the Disturbed Ecosystem/Component			
		Rare	Uncommon	Common/Locally Abundant	Common/Widely Distributed and Abundant
Rarity of the Offset Ecosystem/Component	Rare	1 :1	1 :1	1 :1	1 :1
	Uncommon	2 :1	1 :1	1 :1	1 :1
	Common/Locally Abundant	3 :1	2 :1	1 :1	1 :1
	Common/Widely Distributed and Abundant	4 :1	3 :1	2 :1	1 :1

Notes: - Adapted from Croft *et al.* 2011. The ratios presented are not necessarily applicable to the Project and will be revisited upon completion of the five-year monitoring program.

If offsets are determined necessary upon completion of the five-year monitoring program, Trans Mountain will review updated policy and guidance, and consult with provincial authorities to determine appropriate offset ratios. The selected offset ratios will be reported in the Rare Ecological Community and Rare Plant Population Mitigation Evaluation Report and Offset Plan, and used to determine the amount of offsets required, in accordance with NEB Condition 155.

7.4 Offset Monitoring and Reporting

Offset measures, if needed, will be monitored using the same method described in Section 6.0, over a five-year period beginning in the first growing season following implementation of the offset measures. The monitoring period may be extended if corrective measures are needed to meet the offset targets, or reduced if targets are met in less time.

Trans Mountain will report the results of offset monitoring to the NEB in January following each monitoring phase (e.g., years one, three, and five). Monitoring results will inform Trans Mountain’s adaptive management process and the need for corrective measures, as described in Section 6.3.

7.5 Offset Summary

Trans Mountain has designed the avoidance and mitigation measures in this Plan to effectively alleviate residual Project effects on rare plants and ecological communities. These measures are expected to avoid residual loss of rare plants, rare ecological communities, or attributes of critical habitat for rare plants, such that the likelihood of offsets is reduced.

Trans Mountain will determine the need for offsets using the results of the monitoring program following the fifth year of monitoring. In the event that offsets are necessary following the five-year monitoring program, Trans Mountain’s evaluation finds that the most appropriate offset method is off-site reclamation or enhancement of the rare plants or ecological communities lost as a result of the Project.

In the event that offsets are determined necessary upon completion of the five-year monitoring program, Trans Mountain will review updated policy and guidance and consult with provincial authorities to determine appropriate offset ratios.

Offset measures will be monitored using the protocol described in Section 6.0.

8.0 CONCLUSION

The Plan was prepared in accordance with NEB Condition 40 that requires a description of the recommended mitigation measures for rare plants and ecological communities of concern potentially affected by the Project during construction or by Trans Mountain Pipeline operations.

The purpose of the rare ecological community and rare plant population management plan is to provide mitigation recommendations that will be implemented to the extent feasible for rare ecological communities of concern and plant (vascular plants, bryophytes [mosses and liverworts]) and lichen species of concern identified on the Project Footprint, as defined by SARA, COSEWIC, the Alberta *Wildlife Act*, ACIMS, BC MOE's IWMS, and the BC CDC. Furthermore, the Plan provides mitigation recommendations to be implemented where feasible in the event that ecological communities, plants or lichens of concern are observed on, or immediately adjacent to, the Project Footprint (*i.e.*, temporary construction lands and infrastructure, pipeline construction footprint, reactivation, facilities, access roads or contingency alternate routes) during construction.

The NEB *Filing Manual* (NEB 2017) provides regulatory guidance for the assessment of vegetation resources where disturbance is expected to occur in previously undeveloped areas. Vegetation resources, including species at risk and species of special status, as defined by the NEB *Filing Manual*, may be affected by construction and operations activities associated with the Project. The scope and methods required to adequately assess vegetation resources were determined with the guidance of the NEB *Filing Manual*, in conjunction with published rare plant survey recommendations and guidelines. The assessment also considered precedence set by developments of similar scope in the vicinity of the Project.

Rare ecological communities and rare plant occurrences (including vascular plants, mosses and lichens) are encountered by the Project from near Edmonton, Alberta to Burnaby, BC. Of these occurrences, a subset are provincially ranked as S1S2 or S2. The Project also interacts with one area of final critical habitat for toothcup; two areas of final critical habitat for Haller's apple moss; areas of candidate regeneration critical habitat for whitebark pine; an area of early draft critical habitat for Mexican mosquito fern; and areas of early draft critical habitat for Roell's brotherella moss.

Mitigation measures for rare ecological communities and rare plant occurrences generally fall into categories of avoidance, reducing disturbance and alternative reclamation techniques. Avoidance is the preferred mitigation measure for rare ecological communities and rare species ranked S1, S1S2, or S2 and ecological communities and rare plant species that are protected under provincial or federal legislation or regulations. Disturbance reduction or alternative reclamation techniques will be recommended as a mitigation strategy in the event that complete avoidance is not practical or where the Project encounters rare ecological communities or rare plant species ranked S2, S2S3, S1S3, S3, SNR, SH, or SU. Mitigation measures are included in Section 5.0 and Appendix E of this Plan; and reclamation techniques are included in the Reclamation Management Plan (Volume 6 of the Environmental Plans). Site-specific mitigation measures for occurrences identified within the pipeline construction footprint will be provided in the Vegetation Resource-Specific Mitigation Tables (Volume 7 of the Environmental Plans) and will be provided on the Environmental Alignment Sheets (Volume 8 of the Environmental Plans) for construction planning.

Site-specific mitigation measures are intended to fully mitigate residual effects to ecological communities and rare plant species as well as those with an at-risk status of S1, S1S2, S2 or are listed under federal or provincial legislation. The likelihood of offsets will be reduced by implementing practical and feasible mitigation measure prior to and during construction and during adaptive management.

Consultation with Appropriate Government Authorities, species experts and potentially affected Aboriginal groups regarding mitigation for relevant SARA critical habitat areas and other relevant vegetation species at risk will continue as the Project proceeds to construction, final clean-up and post-construction monitoring. Mitigation measures for plants and communities of conservation concern will continue to be refined with engineering and Project Footprint modifications as final construction planning proceeds.

The Environmental Inspectors will ensure the mitigation measures for vegetation features are implemented to reduce impacts to rare plants or rare ecological communities that could not be avoided. The Rare Ecological Communities or Rare Plant Species Discovery Contingency Plan (see Project EPPs, *e.g.*, Volume 2 of the Environmental Plans) provides mitigation strategies for vegetation features in the event that potential rare ecological communities or rare plants are discovered within the Project Footprint during construction.

9.0 REFERENCES

9.1 Personal Communications

CH2M wishes to acknowledge those people identified in the Personal Communications for their assistance in supplying information and comments incorporated into this report.

Allen, L. Senior Community Ecologist, Alberta Conservation Information Management System.
Edmonton, Alberta.

Bjork, C. Provincial Botanist and Lichenologist, Clearwater, BC.

Frank, K. Supervisor of Parks and Open Spaces. City of Spruce Grove, BC.

Goward, T. Lichenologist, Enrichened Consulting Ltd. Clearwater, BC.

Lebeau, A. Environmental Assessment Program Analyst, Canadian Wildlife Service – Pacific and Yukon Region, ECCC. Delta, BC.

McIntosh, T. Botanist, Biospherics Environmental Inc., Vancouver BC.

Zwaag, R. Director, Public Works. Township of Langley. Langley, BC.

9.2 Literature Cited

Alberta Biodiversity Monitoring Institute. 2010a. ABMI Human Footprint Map – North Saskatchewan (2010 Version 1.1) (digital file). Edmonton, Alberta. Available: <http://www.abmi.ca>. Acquired: December 2012. Last Update Check: December 2012.

Alberta Biodiversity Monitoring Institute. 2010b. ABMI Human Footprint Map – Upper Athabasca (2010 Version 1.1) (digital file). Edmonton, Alberta. Available: <http://www.abmi.ca>. Acquired: December 2012. Last Update Check: December 2012.

Alberta Environment and Parks. 2014. Alberta Conservation Information Management System. Tracking and Watch Lists. Website: [http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-\(acims\)/tracking-watch-lists.aspx](http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-(acims)/tracking-watch-lists.aspx). Accessed: December 2015.

Alberta Environment and Parks. 2015a. Alberta Conservation Information Management System (ACIMS). Website: [http://albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-\(acims\).aspx](http://albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-(acims).aspx). Accessed: November 2015.

Alberta Environment and Parks. 2015b. Alberta Conservation Information Management System (ACIMS). List of Elements in Alberta – Lichens (June 2015). Website: <http://www.albertaparks.ca/media/6255135/acims-list-of-elements-in-alberta-lichens.xlsx>. Accessed: November 2015.

Alberta Environment and Parks. 2015c. Alberta Conservation Information Management System (ACIMS). List of Elements in Alberta – Non-vascular Plants (July 2015). Website: <http://www.albertaparks.ca/media/6255121/acims-list-of-elements-in-alberta-non-vascular-plants.xlsx>. Accessed: November 2015.

Alberta Environment and Parks. 2015d. Alberta Conservation Information Management System (ACIMS). List of Elements in Alberta – Vascular Plants (July 2015). Website: http://www.albertaparks.ca/media/6255149/all_elements_plants_vascular_july2015.xlsx. Accessed: November 2015.

Alberta Environment and Sustainable Resource Development. 2012. Alberta Vegetation Inventory Crown Polygons (digital file). Calgary, Alberta. Received from FTP. Acquired: November 2012. Last Update Check: November 2012.

- Alberta Native Plant Council. 2012. *Alberta Native Plant Council Guidelines for Rare Vascular Plant Surveys in Alberta – 2012 Update*. Edmonton, Alberta. 22 pp.
- Alberta Soil Information Centre. 2001. AGRASID 3.0: Agricultural Region of Alberta Soil Inventory Database (Version 3.0) (digital file). Edmonton, Alberta. Available: [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/sag3249?opendocument](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag3249?opendocument). Acquired: September 2008. Last Update Check: May 2013.
- Alberta Whitebark and Limber Pine Recovery Team. 2014. *Alberta Whitebark Pine Recovery Plan 2013-2018*. Alberta Environment and Sustainable Resource Development, Alberta Species at Risk Recovery Plan No. 34. Edmonton, Alberta. 63 pp.
- Allen, L. 2011. *Alberta Conservation Information Center Ecological Community Sampling Guidelines*. Alberta Tourism Parks and Recreation. Edmonton, Alberta. 5 pp.
- Allen, L. 2014. *Alberta Conservation Information Management System Ecological Community Tracking List*. Alberta Tourism, Parks and Recreation. Edmonton, Alberta. 125 pp.
- Beckingham, J.D. and J.H. Archibald. 1996. *Field Guide to Ecosites of Northern Alberta*. Canadian Forest Service Northwest Region Northern Forestry Centre, Special Report 5. Vancouver, BC. 336 pp.
- Beckingham, J.D., I.G.W. Corns, and J.H. Archibald. 1996. *Field Guide to Ecosites of West-Central Alberta*. Canadian Forest Service Northwest Region Northern Forestry Centre, Special Report 9. Vancouver, BC. 540 pp.
- British Columbia Conservation Data Centre. 2016. BC Species and Ecosystems Explorer. Website: <http://www.env.gov.bc.ca/atrisk/toolintro.html>. Accessed: August 2016.
- British Columbia Ministry of Environment. 2013. *Recovery Plan for Roell's brotherella (Brotherella roellii) in British Columbia*. B.C. Ministry of Environment, Victoria, BC. 16 pp.
- British Columbia Ministry of Environment. 2014a. Policy for Mitigating Impacts on Environmental Values (Environmental Mitigation Policy): Working Document. Victoria, BC. 4 pp.
- British Columbia Ministry of Environment. 2014b. Procedures for Mitigating Impacts on Environmental Values (Environmental Mitigation Procedures): Working Document. Ecosystems Branch. Environmental Sustainability and Strategic Policy Division. Victoria, BC. 68 pp.
- British Columbia Ministry of Environment. 2015. Provincial Red and Blue Lists. Ministry of Environment. Website: <http://www.env.gov.bc.ca/atrisk/red-blue.html>. Accessed: October 2015.
- British Columbia Ministry of Environment, Conservation Data Centre. 2017. Species and Ecosystems at Risk – Publicly Available Occurrences – CDC (digital file). Victoria, BC. Available: <https://catalogue.data.gov.bc.ca/dataset/species-and-ecosystems-at-risk-publicly-available-occurrences-cdc>. Acquired: July 18, 2017. Last Update Check: July 18, 2017.
- British Columbia Ministry of Forests, Lands, and Natural Resource Operations. 2007a. Draft Land Management Handbook No. 15 Update for the ESSFmm1. Website: http://www.for.gov.bc.ca/hre/becweb/Downloads/Downloads_SubzoneReports/ESSFmm1.pdf. Accessed: November 2014.
- British Columbia Ministry of Forests, Lands, and Natural Resource Operations. 2007b. Draft Land Management Handbook No. 15 Update for the ICHmm. Website: http://www.for.gov.bc.ca/hre/becweb/Downloads/Downloads_SubzoneReports/ICHmm.pdf. Accessed: November 2014.

- British Columbia Ministry of Forests, Lands, and Natural Resource Operations. 2007c. Draft Land Management Handbook No. 15 Update for the SBSdh1. Website: http://www.for.gov.bc.ca/hre/becweb/Downloads/Downloads_SubzoneReports/SBSdh1.pdf. Accessed: November 2014.
- British Columbia Ministry of Water, Land, and Air Protection. 2004. *Procedures for Managing Identified Wildlife – Version 2004*. Victoria, BC. 52 pp.
- British Columbia Oil and Gas Commission. 2016. *Environmental Protection and Management Guideline Version 2.3*. Fort St John, BC. 71 pp.
- Bull, J.W., K.B. Suttle, A. Gordon, N.J. Singh, and E.J. Milner-Gulland. 2013. "Biodiversity Offsets in Theory and Practice." *Oryx*. 0 (0): 1-12.
- Burkinshaw, A.M., M.G. Willoughby, K. France, H. Loonen, and R.L. McNeil. 2009. *Range Plant Communities and Range Health Assessment Guidelines for the Central Parkland Subregion of Alberta*. Alberta Sustainable Resource Development, Land Division. Red Deer, Alberta. 136 pp.
- Business and Biodiversity Offsets Programme. 2012. Standard on Biodiversity Offsets. Washington, DC.
- Calvet, C., C. Napoléone, and J.-M. Salles. 2015. "The Biodiversity Offsetting Dilemma: Between Economic Rationales and Ecological Dynamics." *Sustainability*. 7 (6): 7357-7378.
- CH2M. 2016. *Addendum to the Rare Ecological Community and Rare Plant Population Management Plan for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project NEB Condition 40*. Calgary, Alberta. 5 pp.
- Committee on the Status of Endangered Wildlife in Canada. 2010. *COSEWIC Assessment and Status Report on the Whitebark Pine Pinus albicaulis in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. X + 44 pp.
- Committee on the Status of Endangered Wildlife in Canada. 2015. Canadian Species at Risk. Website: http://www.cosewic.gc.ca/eng/sct5/index_e.cfm. Accessed: October 2015.
- Croft, C.D., T. Zimmerling and K. Zimmer. 2011. Conservation Offsets: A Working Framework for Alberta. Sherwood Park, Alberta.
- Department of Sustainability, Environment, Water, Population and Communities. 2012a. *Environmental Protection and Biodiversity Conservation Act 1999: Environmental Offsets Policy*. Commonwealth of Australia. Canberra, Australia. 30 pp.
- Department of Sustainability, Environment, Water, Population, and Communities. 2012b. *How to Use the Offsets Assessment Guide*. Australian Government. 19 pp.
- Doswald, N., M. Barcellos Harris, M. Jones, E. Pilla, and I. Mulder. 2012. *Biodiversity Offsets: Voluntary and Compliance Regimes. A Review of Existing Schemes, Initiatives, and Guidance for Financial Institutions*. United Nations Environment Programme World Conservation Monitoring Centre and United Nations Environment Programme Finance Initiative. Cambridge, UK. 24 pp.
- Douglas, G., G.B. Straley, D. Meidinger, and J. Pojar. 1998-2002. *Illustrated Flora of British Columbia*. Volumes 1-8. Ministry of Sustainable Resource Management and Ministry of Forests. Province of British Columbia.
- E-Flora BC. 2013. "Distribution Map for *Corydalis scouleri* (scouler's corydalis)." In: Klinkenberg, Brian. (Editor) 2013. *E-Flora BC: Electronic Atlas of the Flora of British Columbia* [eflora.bc.ca]. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver. [Accessed: January, 2017]
- Environment Canada. 2012. *Operational Framework for Use of Conservation Allowances*. Gatineau, QC. 13 pp.

- Environment Canada. 2013. Proposed, Candidate, and Early Candidate Critical Habitat Maps for the Proposed Trans Mountain Expansion Project. Hard-copy maps provided by the Canadian Wildlife Service, Environment Canada. September 2013.
- Environment Canada. 2014a. *Summary of Critical Habitat Information for TMEP – November 2014*. Provided by Canadian Wildlife Service, Environment Canada. November 2014. 34 pp.
- Environment Canada. 2014b. Recovery Strategy for the Toothcup (*Rotala ramosior*) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa, ON.
- Environment Canada. 2015b. Recovery Strategy for the Toothcup (*Rotala ramosior*) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. 20 pp. + Annex.
- Environment Canada. 2015c. Recovery Strategy for Whitebark Pine (*Pinus albicaulis*) in Canada [Draft]. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa.
- Environment Canada. 2015d. *Hearing Order OH-001-2014 Trans Mountain ULC Application for the Trans Mountain Expansion Project*. Written Submission of Environment Canada to the National Energy Board. May 27, 2015. 295 pgs. Filing ID A4L8Y6.
- Environment Canada. 2015e. Management Plan for the Vancouver Island Beggarticks (*Bidens amplissima*) in Canada. *Species at Risk Act Management Plan Series*. Environment Canada, Ottawa. 4 pages + Annexes.
- Gibbons, P. and D.B. Lindenmayer. 2007. "Offsets for Land Clearing: No Net Loss or the Tail Wagging the Dog?" *Ecological Management & Restoration*. 8 (1): 26-31.
- Government of Canada. 2015. Species at Risk Public Registry. Website: <http://www.sararegistry.gc.ca>. Accessed: October 2015.
- 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.
- Haller's Apple Moss Recovery Team. 2010. Recovery Strategy for Haller's Apple Moss (*Bartramia halleriana*) in Canada. *Species at Risk Act Recovery Strategy Series*. Parks Canada Agency. Viii + 32 pp.
- Iverson, K., C. Cadrin, D. Spaeth Filatow, and C. Erwin. 2004. *Sensitive Ecosystems Inventory: Central Okanagan, 2000-2001. Volume 2: Terrestrial Ecosystem Mapping, Surface Erosion and Slope Stability, and Expanded Legend*. Canadian Wildlife Service, Pacific and Yukon Region, BC.
- Lloyd, D., K. Angove, G. Hope, and C. Thompson. 1990. *A Guide to Site Identification and Interpretation for the Kamloops Forest Region*. Land Management Handbook No. 23. BC Ministry of Forests, Research Branch. Victoria, BC.
- Lloyd, D., M. Ryan, N. Brand, M. Doney, V. Larson, and J. MacDonald. 2005. *Draft Site Classification for the 52 Biogeoclimatic Units in the Southern Interior Forest Region*. British Columbia Ministry of Forests. Kamloops, BC.
- MacKenzie, W.H. 2012. *Biogeoclimatic Ecosystem Classification of Non-Forested Ecosystems in British Columbia*. Technical Report 068. Victoria, BC.
- MacKenzie, W.H. and J.R. Moran. 2004. *Wetlands of British Columbia: A Guide to Identification*. Land Management Handbook No. 52. BC Ministry of Forests, Research Branch. Victoria, BC. 287 pp.
- McKenney, B. 2005. *Environmental Offset Policies, Principles and Methods: A Review of Selected Legislative Frameworks*.

- McKenney, B.A. and J.M. Kiesecker. 2010. "Policy Development for Biodiversity Offsets: A Review of Offset Frameworks." *Environmental Management*. 45 (1): 165-176.
- Morris, R.K.A., I. Alonso, R.G. Jefferson, and K.J. Kirby. 2006. "The Creation of Compensatory Habitat—Can It Secure Sustainable Development?" *Journal for Nature Conservation*. 14 (2): 106-116.
- National Energy Board. 2017. *Filing Manual*. Inclusive of Release 2017-01 (July 2017). Calgary, Alberta.
- NatureServe. 2015. NatureServe Explorer – An Online Encyclopedia of Life. Website: <http://www.natureserve.org/explorer/index.htm>. Accessed: October 2015.
- Penny J. and R. Klinkenberg. 2013. "Protocols for Rare Plant Surveys (Red- and Blue-listed Species)." In: Klinkenberg, Brian (Editor) 2013. *E-Flora BC: Electronic Atlas of the Plants of British Columbia*. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver, BC. Website: <http://www.geog.ubc.ca/biodiversity/eflora/ProtocolsforRarePlantSurveys.html>. Accessed: October 2015.
- Pilgrim, J.D., and J.M.M. Ekstrom. 2014. *Technical Conditions for Positive Outcomes from Biodiversity Offsets*. International Union for Conservation of Nature. Gland, Switzerland. 46 pp.
- Poulton, D.W. 2015. *Biodiversity and Conservation Offsets: A Guide for Albertans*. Calgary, Alberta.
- Resources Inventory Standards Committee. 1998. *Standards for Terrestrial Ecosystem Mapping in British Columbia*. Vancouver, BC. 100 pp.
- Schneider, R.R. 2011. *An Integrated Planning Approach for Selecting Conservation Offsets in Northern Alberta*.
- Southern Interior Rare Plants Recovery Team. 2008. *Recovery Strategy for the Mexican Mosquito Fern (Azolla mexicana) in British Columbia*. Prepared for the B.C. Ministry of Environment, Victoria, BC. 16 pp.
- Sustainable Prosperity. 2014. *Getting Biodiversity Offsets Right: A Research Agenda for Canada*. Ottawa, ON.
- Ten Kate, K., J. Bishop, and R. Bayon. 2004. *Biodiversity Offsets: Views, Experience, and the Business Case*. London, UK.
- TERA Environmental Consultants. 2013. *Vegetation Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project*. Volume 5C, Technical Report 5C-9. Prepared for Trans Mountain Pipeline ULC. Calgary, Alberta.
- CH2M HILL Energy Canada, Ltd. 2014. TEM Field Points from 2012-2014 Field Seasons (digital file). Calgary, Alberta. Acquired: May 2012 to August 2014.
- Weber, M. 2011. *Experimental Economic Evaluation of Offset Design Options for Alberta: A Summary of Results and Policy Recommendations*. Prepared for Alberta Land Use Secretariat.
- West Fraser Mills Ltd. 2013. Alberta Vegetation Inventory (digital file) received: via email. Acquired: October 2013.
- Weyerhaeuser. 2013. Alberta Vegetation Inventory (digital file) received: unknown. Acquired: September 2013.
- Willoughby, M.G., C. Stone, C. Hincz, D. Moisey, G. Ehler, and D. Lawrence. 2006. *Guide to Range Plant Community Types and Carrying Capacity for the Dry and Central Mixedwood Subregions in Alberta, 6th approximation*. Alberta Sustainable Resource Development, Public Lands and Forest Division. Edmonton, Alberta.

9.3 GIS Data and Mapping References

- AltaLIS. 2012. Alberta Provincial Parks (digital file). Calgary, Alberta. Available: http://www.altalis.com/products/base/20k_base_features.html. Acquired: August 2012. Last Update Check: September 17, 2014.
- British Columbia Ministry of Forests, Lands, and Natural Resource Operations. 2008. Tantalus Conservancy Areas; Freshwater Atlas Streams, Rivers, and Lakes; Ecological Reserves and Protected Areas (digital file). Victoria, BC. Available: <https://apps.gov.bc.ca/pub/dwds/home.so>. Acquired: September 2014. Last Update Check: November 20, 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.
- Government of Canada. 2015. Aboriginal Lands, Canada (digital file). Edmonton, Alberta. Available: <http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/815dd99d-4fbd-47cc-be02-7ad4b03a23ec.html>. Acquired: December 2015. Last Update Check: December 15, 2015.
- IHS Inc. 2004. IHS Hydro Region Data (digital file). Calgary, Alberta. Received: via DVD, visit <http://www.ihs.com> for more info. Acquired: June 2011. Last Update Check: November 16, 2015.
- IHS Inc. 2010. IHS Provincial Boundaries (digital file). Calgary, Alberta. Received: via DVD, visit <http://www.ihs.com> for more info. Acquired: June 2011. Last Update Check: April 21, 2014.
- IHS Inc. 2015. IHS Road Segments and First Nations (digital file). Calgary, Alberta. Received: via DVD, visit <http://www.ihs.com> for more info. Acquired: November 2015. Last Update Check: November 16, 2015.
- Kinder Morgan Canada. 2006-12. 0.5cm – 1m B/W & Colour Orthophotography (digital file). Calgary, Alberta. Received via FTP. Acquired: 2012-13.
- Kinder Morgan Canada. 2012. Baseline Routing (digital file). Calgary, Alberta. Received via FTP. Acquired: May 9, 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. 2014. National Road Network – British Columbia (digital file). Sherbrooke, QC. Available: <http://www.geobase.ca/geobase/en/data/nrn/index.html>. Acquired: September 2014. Last Update Check: March 11, 2015.
- Natural Resources Canada. 2015. 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: December 2015. Last Update Check: December 15, 2015.
- Universal Pegasus International. 2015. Proposed Centreline SSEID003, KPs & Footprint. Acquired: November 18, 2015.

APPENDIX A

CONSULTATION AND ENGAGEMENT

Consultation and engagement activities related to the Plan were completed with Appropriate Government Authorities, potentially affected Aboriginal groups and species experts. Opportunities to discuss rare ecological communities and rare plant populations, and to identify issues or concerns were also provided to public stakeholders during meetings, workshops, and ongoing engagement activities.

Consultation and engagement opportunities began in May 2012 with the Project announcement and are ongoing.

1.0 CONSULTATION AND ENGAGEMENT OVERVIEW: DRAFT PLAN DEVELOPMENT

Reports on public consultation activities completed between May 2012 and June 30, 2015 were filed with the National Energy Board (NEB) and are available in the Application (Volume 3A: Stakeholder and Volume 3B: Aboriginal; Filing ID [A55987](#)) as well as in Consultation Update No. 1 and Errata, Technical Update No. 1 (Filing ID [A59343](#)) / Consultation Update 2 (Filing IDs [A62087](#) and [A62088](#)), Consultation Update 3 (Filing IDs [A4H1W2](#) through [A4H1W8](#)) and Consultation Update 4 (Filing ID [A72224](#)). These reports include identification of issues and concerns as well as Trans Mountain's response and are included below. Where appropriate, Trans Mountain's response has been updated to reflect information developed since the original response was provided during the NEB proceeding for the Project.

Consultation and engagement activities completed between July 1, 2015 and February 2017 have not been filed on the public record with the NEB. Any new issues and concerns identified during this period, as well as Trans Mountain's response, are described below.

2.0 CONSULTATION AND ENGAGEMENT OVERVIEW: DRAFT PLAN

The draft Plan was released for review and feedback on September 16, 2016. The comment period closed on January 13, 2017, however, feedback received as recently as August 2017 has been considered. Email or mail notification regarding the Plan was sent to 141 public stakeholders, 17 regulatory authorities, and 116 Aboriginal groups. The notification included a summary description of the Plan, a request for review, the timing of the comment period, and contact information. Aboriginal groups were offered the opportunity for an in-person meeting to review the Plan. See Appendix F for a complete list of notified stakeholders.

In addition to direct notification, the online posting of each Plan was promoted through Trans Mountain's weekly e-newsletter, Trans Mountain Today, which provides Project updates, regulatory information, stories, and interviews to more than 6,000 subscribers. Each week Trans Mountain Today included a focus on a specific plan, or group of plans, as well as a reminder of all plans available for review.

2016

- September 22 – Wildlife Mitigation and Habitat Restoration Plans
- September 29 – Pipeline Environmental Protection Plans
- October 6 – Air Quality Management Plans
- October 13 – Watercourse and Water Ecosystems Plans
- October 20 – Vegetation Management Plans
- October 27 – Air Quality Plans
- November 3 – Socio-Economic Effects Monitoring Plan
- November 10 – Access Management Plan
- December 22 – General promotion all plans
- December 29 – General promotion all plans

2017

- January 5 – General promotion all plans
- January 12 – General promotion all plans

Trans Mountain is committed to ongoing engagement throughout the life of the Project. The start and end date for the review and comment period for each environmental management plan is defined. These timelines are required to allow time for preparation of the final Plan in order to meet regulatory requirements, and NEB submission dates.

3.0 CONSULTATION AND ENGAGEMENT: ACTIVITIES AND FEEDBACK

Consultation and engagement activities completed with identified stakeholder groups are described below, including: public stakeholders (Section 3.1); regulatory authorities (Section 3.2); and Aboriginal groups (Section 3.3).

Feedback on the draft Plan, Trans Mountain's response, and where each issue or concern is addressed in the Plan has been outlined in each section according to stakeholder group.

3.1 Public Consultation

3.1.1 Public Consultation Summary – May 2012 to June 2015

No specific feedback regarding rare plants and rare ecological communities was received during public consultation and engagement activities between May 2012 and June 30, 2015.

3.1.2 New Interests, Issues, Concerns and Response – July 2015 to February 2017 to February 2017

No new issues or concerns with respect to rare plants and rare ecological communities were identified through public engagement and communication opportunities during the July 2015 to February 2017 reporting period.

3.2 Regulatory Consultation

Section 2.0 of Technical Report 5C-9 of the Application provides a summary of the outcomes of the consultation and engagement activities conducted during the development of the Vegetation Technical Report related to baseline survey methods, as well as the assessment procedure and methods and mitigation recommendations. The full description of the public consultation, Aboriginal engagement and landowner relations programs are provided in Volumes 3A, 3B, and 3C of the Application, respectively, as well as Consultation Update No. 1 & Errata filed with the NEB in March 2014, Consultation Update No. 2 filed with the NEB in August 2014, and Technical Update No. 1 in July 2014. Additional consultation has been conducted to address the following activities since the Application was filed in December 2013.

Discussions with representatives of ECCC (formerly Environment Canada) regarding vegetation species at risk continued through 2014 and 2015. Discussions were generally with regards to updated survey methodology for vegetation species at risk and mitigation measures for rare ecological communities, rare plants, and rare lichens along the Project. The results of 2014 field surveys were provided to ECCC on September 9, 2014 which included observations of whitebark pine (*Pinus albicaulis*) trees located within 1 km of the pipeline corridor within the Coquihalla Summit Recreation Park. ECCC confirmed that the whitebark pine observations were within low-density stands and known, high-density candidate critical habitat will not be directly impacted by the Project; therefore, mitigation measures for reducing and/or avoiding potential impacts to whitebark pine trees or known, high-density habitat are not required (Lebeau pers. comm.). Further mapping of toothcup (*Rotala ramosior*) critical habitat was provided by ECCC on November 2014 and in August 2015. Details regarding mitigation for final toothcup critical habitat and candidate regeneration whitebark pine critical habitat are provided in Section 5.0 and the mitigation table in Appendix E. Consultation with ECCC regarding mitigation for toothcup critical habitat and other relevant vegetation species at risk will continue in 2016.

BC Parks was consulted throughout the preparation of the 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, including Finn Creek Provincial Park and Lac du Bois Grasslands

Protected Area. The Project no longer traverses the North Thompson River Provincial Park, but rather utilizes the existing TMPL right-of-way through the park. Details regarding the consultation and mitigation for rare plants, rare lichens, and rare ecological communities identified in these parks are described in the aforementioned documents. A Park Use Permit is in development for the Coquihalla Summit Recreation Area in support of Trans Mountain's formal request to allow for the construction of the TMEP and use of associated facilities including access to the pipeline right-of-way in the Coquihalla Summit Recreation Area.

ACIMS was consulted in August 2014 regarding a potential ecological community of concern associated with a small creek within Wabamun Lake Provincial Park, dominated by willows and ostrich fern. A Parks Ecologist determined the community to be uncommon and meriting mitigation if activities are planned within the community (Allen pers. comm.). However, it has been determined that the current Project Footprint will avoid the community.

3.2.1 Regulatory Consultation Summary – May 2012 to August 2015

Feedback regarding rare ecological communities and rare plant population management plan received during regulatory consultation and engagement activities between May 2012 and August 30, 2015 is summarized in Table A-1.

TABLE A-1

**SUMMARY OF REGULATORY CONSULTATION ACTIVITIES
 RELATED TO RARE VEGETATION BETWEEN MAY 2012 AND AUGUST 2015**

Stakeholder Group/Agency Name	Name and Title of Contact	Method of Contact	Date of Consultation Activity	Reason for Engagement	Issues/Concerns	Commitments/ Follow-Up Actions/ Comments	Where Addressed
FEDERAL CONSULTATION							
ECCC – Canadian Wildlife Service	Jennifer Wilson, Environment Assessment Officer	Email	September 9, 2013	ECCC provided hard-copy maps showing species with critical habitat (proposed, candidate, early draft) including toothcup and whitebark pine.	Potential Project interactions with critical habitat	Continue to consult with ECCC	N/A (superseded by new information)
ECCC – Canadian Wildlife Service	Agathe LeBeau, Environmental Assessment Program Analyst	Email	December 23, 2013	ECCC provided a <i>Summary of Draft Critical Habitat Information for TMEP – Dec. 2013</i> , which provided draft biophysical attribute descriptions for candidate critical habitat for toothcup	Potential Project interactions with critical habitat	Continue to consult with ECCC	N/A (superseded by new information)
ECCC – Canadian Wildlife Service	Jennifer Wilson, Environment Assessment Officer	Email	April 3, 2014	ECCC provided updated hard-copy maps for critical habitat (including candidate critical habitat for toothcup and whitebark pine), as well as an updated version of <i>Summary of Draft Critical Habitat Information for TMEP – March 2014</i> .	Potential Project interactions with critical habitat	Continue to consult with ECCC	N/A (superseded by new information)

TABLE A-1 Cont'd

Stakeholder Group/Agency Name	Name and Title of Contact	Method of Contact	Date of Consultation Activity	Reason for Engagement	Issues/Concerns	Commitments/ Follow-Up Actions/ Comments	Where Addressed
ECCC – Canadian Wildlife Service	Agathe Lebeau, Environmental Assessment Program Analyst	Email	February 12 to November 14, 2014	Federally listed plant species survey methodology review.	Provided survey methods and results from 2014 in relation to the pipeline corridor, including whitebark pine and toothcup.	Continue to consult with ECCC on toothcup critical habitat at Mission Flats, near the City of Kamloops, and providing density and distribution results of whitebark pine habitat surveys adjacent to the corridor.	Sections 4.1.2 and Appendix D of this Plan Section 6 of the Pipeline EPP (Volume 2 of the Environmental Plans)
ECCC – Canadian Wildlife Service	Ian Parnell, Acting Head of Species at Risk Recovery Unit	Email	November 13, 2014	ECCC provided shapefiles for critical habitat intersecting with the pipeline corridor and within a 1 km buffer. This included toothcup and whitebark pine, as well as an updated version of <i>Summary of Critical Habitat Information for TMEP – November 2014</i> .	Potential Project interactions with critical habitat	Continue to consult with ECCC	N/A (superseded by new information)
ECCC – Canadian Wildlife Service	Agathe Lebeau, Environmental Assessment Program Analyst	Email	March 23, 2015	To discuss the recovery objectives for whitebark pine in the <i>Summary of Critical Habitat Information for TMEP – November 2014</i> .	Contacted ECCC to discuss information related to whitebark pine.	Continue to consult with ECCC on whitebark pine Recovery Strategy.	Sections 3.3 and 5.1 of this Plan Section 6 of the Pipeline EPP (Volume 2 of the Environmental Plans)
ECCC – Canadian Wildlife Service	Randal Lake, Unit Head, Species at Risk Recovery	Email	August 25, 2015	ECCC provided updated shapefiles for critical habitat intersecting with the pipeline corridor and within a 1 km buffer including toothcup (final); whitebark pine (candidate); Mexican mosquito-fern (early draft); tall bugbane (candidate) and Roell's Brotherella Moss (early draft).	Potential Project interactions with critical habitat	Continue to consult with ECCC	Sections 3.0 and 5.0 of this Plan Section 6 of the Pipeline EPP (Volume 2 of the Environmental Plans)
PROVINCIAL/MUNICIPAL CONSULTATION – ALBERTA							
ACIMS	Lorna Allen, Parks Ecologist	Email	August 21, 2014	Ecological community of concern confirmation.	Status of uncommon willow/ostrich fern community.	Determined ecological community to be uncommon.	Appendix E of this Plan Section 6 of the Pipeline EPP (Volume 2 of the Environmental Plans)
Provincial Bryophyte Expert	René Belland	Email	November 2014	Consultation regarding bryophyte species rarity.	Provided expert experience regarding species of conservation concern.	Complete.	Sections 4.0 and 5.0 of this Plan Section 6 of the Pipeline EPP (Volume 2 of the Environmental Plans)

TABLE A-1 Cont'd

Stakeholder Group/Agency Name	Name and Title of Contact	Method of Contact	Date of Consultation Activity	Reason for Engagement	Issues/Concerns	Commitments/ Follow-Up Actions/ Comments	Where Addressed
PROVINCIAL/MUNICIPAL CONSULTATION – BC							
BC CDC	Jenifer Penny, Program Botanist	Email	May to November 2014	Vascular plant locations and confirmation.	Provided updated locations for vascular plant species and requested specimen be sent to a provincial botanist.	Complete.	Plan: Sections 4.0 and 5.0 of this Plan Section 6 of the Pipeline EPP (Volume 2 of the Environmental Plans)
Provincial Botanist	Curtis Bjork	Letter, Email	November 2014 to February 2015	Vascular plant specimen identification.	Provided identification and confirmation of specimen.	Determined specimen to be a species that is not provincially ranked or tracked (Bjork pers. comm.).	Sections 4.0 and 5.0 of this Plan Section 6 of the Pipeline EPP (Volume 2 of the Environmental Plans)
Provincial Lichen Expert	Trevor Goward	Email	April to November 2014	Lichen specimen identification; consultation regarding lichen species rarity.	Provided identifications and expert experience regarding tracked species and species that are not ranked by the BC CDC/ACIMS.	Complete.	Sections 4.0 and 5.0 of this Plan Section 6 of the Pipeline EPP (Volume 2 of the Environmental Plans)
Provincial Bryophyte Expert	Terry McIntosh	Email	April to November 2014	Bryophyte specimen identification; consultation regarding bryophyte species rarity.	Provided identifications and expert experience regarding tracked species and species that are not ranked by the BC CDC.	Complete.	Sections 4.0 and 5.0 of this Plan Section 6 of the Pipeline EPP (Volume 2 of the Environmental Plans)

3.2.2 Feedback Regarding the Draft Plan (September 2015 to February 2017)

A summary of regulatory feedback regarding the draft Plan is described in Table A-2.

TABLE A-2

**SUMMARY OF REGULATORY
 FEEDBACK RELATED TO THE PLAN (JULY 2015 TO FEBRUARY 2017)**

Stakeholder Group/Agency Name	Method of Contact	Date of Consultation Activity	Reason for Engagement	Stakeholder Feedback	Commitments/ Follow-Up Actions/Comments	Where Addressed
BC MFLNRO	Email	April 7, 2016	Seeking input on methods used to select and survey grasslands in the Project Footprint.	No recommendations/ concerns specific to rare ecological communities or rare plant populations.	The overall goal of the grasslands survey is to maintain and, where applicable, improve native grasslands by re-establishing ecological processes and functionality. To this end, Trans Mountain plans to revegetate the Project Footprint that passes through rare ecological communities within grasslands with the plant species that are indicative of those communities.	Appendix E of this Plan Section 6 of the Pipeline EPP (Volume 2 of the Environmental Plans)
BC OGC	Email	December 2016	Inclusion of more High Priority Wildlife species (legislated by OGC).	This report focused on federally listed species and does not account for many High Priority Wildlife species. It would be helpful if there could be a section in the report specific to species that were and were not encountered in the field surveys that is specific to OGC legislation. Specifically, it was noted that two plant species, Alkaline Wing-Nerved Moss and Vancouver Island Beggarticks were part of the application review, but were not addressed in this plan.	This report addresses all High Priority Wildlife (legislated by OGC) that were observed during field surveys as these species and communities are all included in the categories of species in Section 5.2 and Section 5.3 (with the exception of one species Scouler's corydalis, which is only found on southern Vancouver Island [E-flora BC 2017]). Alkaline Wing-Nerved Moss and Vancouver Island Beggarticks were not observed on the Project. The Project encounters a location where Vancouver Island Beggarticks were observed in 1999 but were not found during surveys in 2014 or 2017. Post-construction monitoring will be conducted at this location. Of the High Priority Wildlife species listed in Appendix D of the Environmental Protection and Management Guideline published by OGC, one community was identified through TEM: western redcedar - Douglas-fir/vine maple, which is included in Appendix E.	Section 5.2, 5.3, Appendix C and Appendix E of this Plan

TABLE A-2 Cont'd

Stakeholder Group/Agency Name	Method of Contact	Date of Consultation Activity	Reason for Engagement	Stakeholder Feedback	Commitments/ Follow-Up Actions/Comments	Where Addressed
FLNRO- Omineca	Email	February 2017	Mitigation of candidate regeneration sites for whitebark pine	When considering mitigation for candidate regeneration sites for whitebark pine, there should be consideration of planting rust-resistant stock, where available. Additionally, where punitive resistant trees at identified they should undergo cone collection and rust screen.	No whitebark pine has been observed on the pipeline construction footprint. The pipeline construction footprint is located in the valley bottom, where it is not likely that any whitebark pine will be observed. There are no plans to plant whitebark pine during reclamation. If whitebark pine is identified prior to construction, mitigation will be determined in consultation with ECCC.	Section 3.3.3, 5.1.3, 5.1.4, 5.5, Appendix A and Appendix D of this Plan.
FLNRO, Thompson Okanagan Region, Ecosystems	Email	February 2017	Measures for Critically Imperiled Vegetation features (Provincial Conservation Status Ranks: S1, S1S2, and S2)	Section 1.4 states that avoidance is the preferred strategy, but it is not clear in this plan, other than for SARA species, which occurrences or portions of occurrences of rare plants and ecological communities will be avoided. Except for SARA species, there is no specific information what species or communities can be avoided in Section 3.2, 5.2, or Appendix E.	Communities, plants, and lichens avoided by the current alignment of the Pipeline construction footprint are listed in the Technical Report 5C-9t and the 2014 Supplemental Vegetation Technical Report. Final placement of temporary workspace may avoid additional occurrences, or portions of occurrences. This will be reported in the PCEM reports for the project.	Section 6.0 of this Plan
FLNRO, Thompson Okanagan Region, Ecosystems	Email	February 2017	Measures for Critically Imperiled Vegetation features (Provincial Conservation Status Ranks: S1, S1S2, and S2)	Section 1.5 indicates that one of the measurable goals for determining the success of avoidance is the observation of the plant or community or lichen during the first growing season. We recommend the plan include a rationale as to why monitoring for this measure is only for the first growing season. Similarly, the measurable goals for the Alternative Reclamation Techniques are for the first growing season and we recommend including a rationale for why this was chosen.	The NEB <i>Filing Manual</i> (NEB 2017) states that post-construction reports subsequent to the initial as-built report should focus on the status of issues since the last post-construction filing. Rare ecological communities, plants, and lichen occurrences where the outcome of mitigation can be determined during the first growing season following construction are considered resolved and removed from the issues list in future years. Section 1.5 has been modified to clarify that occurrences will be monitored until the outcome of mitigation can be determined	Section 1.5 of this Plan

TABLE A-2 Cont'd

Stakeholder Group/Agency Name	Method of Contact	Date of Consultation Activity	Reason for Engagement	Stakeholder Feedback	Commitments/ Follow-Up Actions/Comments	Where Addressed
FLNRO, Thompson Okanagan Region, Ecosystems	Email	February 2017	Measures for Critically Imperiled Vegetation features (Provincial Conservation Status Ranks: S1, S1S2, and S2)	Section 3.2 refers to Appendix E for more details on project interactions with rare plants and rare ecological communities that cross the pipeline construction footprint. However, Appendix E needs to include more details on the area of overlap of each plant or community with the pipeline footprint. There is some information in Appendix E on the area of the occurrences, but this should be included for all species in a format to allow comparison to the area that will be avoided. Section 5 or Appendix E or both should state the area of overlap with the pipeline footprint including what portion of that area can not be avoided. This information is necessary to evaluate the proposed mitigation measures in Section 5.0 and for determining residual effects as required under part e) of NEB Condition 40. The information provided in Table 7 for Toothcup in Section 5.1.1 should be provided for all species and communities that will be impacted by the project.	Information on rare ecological communities, rare plants, and rare lichens was collected according to the methods in Technical Report 5C-9. The UTMs in Appendix E provide spatial information on baseline conditions. Additional spatial information on wetland communities in Appendix E is located in the Wetland Survey and Mitigation Plan (Volume 6 of the Environmental Plans) (NEB Condition 41)	Section 4.1.2 and Appendix E of this Plan Wetland Survey and Mitigation Plan (Volume 6 of the Environmental Plans) (NEB Condition 41)
FLNRO, Thompson Okanagan Region, Ecosystems	Email	February 2017	Supplemental Survey Results Summary	We recommend the plan should elaborate on what it means that Mexican Mosquito Fern was 'potentially' observed in 2013 in Section 4.1.2 and that more detailed information be included in Section 4.2 on methods that determined this species was not present.	More information has been added to Section 4 of this Plan	Section 4.0 and 4.2 of this Plan
FLNRO, Thompson Okanagan Region, Ecosystems	Email	February 2017	Mitigation Measures	Section 5.0 states "Four categories of vegetation features have been created to describe the mitigation measures that will be implemented during pre-construction, construction, reclamation and operations activities". The plan should include what these four categories are in this section and not refer to another plan.	Information added in text to list in Section 5.0	Section 5.0 of this Plan

TABLE A-2 Cont'd

Stakeholder Group/Agency Name	Method of Contact	Date of Consultation Activity	Reason for Engagement	Stakeholder Feedback	Commitments/ Follow-Up Actions/Comments	Where Addressed
FLNRO, Thompson Okanagan Region, Ecosystems	Email	February 2017	Toothcup Critical Mitigation Strategies	Section 5.1.1 Table 7 defines how much native vegetation within toothcup critical habitat will not be avoided, and so Section 5.1.2 should clearly describe which of the listed mitigation measures will be applied to that specific area that is not avoided. In addition, this section should indicate if the restored native vegetation will be the same as pre-construction species or not.	The native vegetation that will be disturbed in toothcup critical habitat does not possess the biophysical attributes necessary to support toothcup. However, measures in Section 5.1.2 will be applied where feasible. Appendix E has been modified to clarify this. Restored native vegetation in toothcup critical habitat will be similar with pre-construction species.	Section 5.1.1 and Appendix E of this Plan Reclamation Management Plan (Volume 6 of the Environmental Plans)
FLNRO, Thompson Okanagan Region, Ecosystems	Email	February 2017	Mexican Mosquito Fern Critical Habitat Mitigation Strategies	The plan states "reduce disturbance to areas that possess the ecological attributes required for Mexican mosquito fern, such as open water features", but should list the specific measures that will be used to meet this statement.	No open water features have been identified through desktop review or fieldwork on the Pipeline construction footprint in early draft Mexican mosquito fern critical habitat. Site-specific mitigation will be determined in the event that open water features are identified prior to construction. Appendix E has been modified to clarify this.	Appendix E of this Plan Wetland Survey and Mitigation Plan (Volume 6 of the Environmental Plans) (NEB Condition 41)
FLNRO, Thompson Okanagan Region, Ecosystems	Email	February 2017	Post Construction Environmental Monitoring	This section of the plan is not clear on exactly what the monitoring program will look like in terms of what measurements will be made, timing, and what targets will be met. The plan should include a similar format to PCEM from other NEB conditions that include a clear table indicating goals, indicators, and what will be measured (e.g. Table 6 in the Western Rattlesnake and Great Basin Gophersnake Mitigation and Habitat Restoration Plan).	Information in Sections 6.1 and 6.2 now in tables as suggested	Sections 6.1 and 6.2 of this Plan

TABLE A-2 Cont'd

Stakeholder Group/Agency Name	Method of Contact	Date of Consultation Activity	Reason for Engagement	Stakeholder Feedback	Commitments/ Follow-Up Actions/Comments	Where Addressed
Robyn Reudink, Lead – FLNRO Thompson Okanagan Region Ecosystem Section	Webinar	February 2017	Although avoidance is preferred strategy, and maybe the plan isn't clear, but what will be avoided out of what overlaps? Sounds like if it overlaps then it will be avoided? This is not clear in the plan.	Agreed, can be made more clear. To not have something on the right of way is one thing that happens in the routing- because the critical habitat is a bit more explicit. There are other things too, like the post construction monitoring of the Anchor Loop portion, that things were avoided as construction went along (as per E1). So because of this, it's not committed in the plan, as it's very site-specific, so there are options in Appendix E. Hence we have the mitigation hierarchy, which allows different options for different situations, as we are writing mitigations and as they are applied.	Communities, plants, and lichens observed during field studies for the Project and avoided by the current alignment of the pipeline construction footprint are listed in Appendix F of the Vegetation Technical Report (Filing ID A3S2Q2). Final placement of temporary workspace may avoid additional occurrences, or portions of occurrences. This will be reported in the PCEM reports for the Project.	Section 6.0 of this Plan

3.2.2 Feedback Regarding the Plan (May 2017 to August 2017)

A summary of regulatory feedback regarding the Plan is described in Table A-3.

Although not raised during consultation and thus, not included in the table below, there is additional feedback that has been considered for this Plan. In a letter dated May 25, 2017, the NEB raised a series of non-compliances referencing the Plan and requested that Trans Mountain prepare and submit a revised Plan. Trans Mountain's responses to the NEB and a revised Plan was submitted on June 23, 2017 and are available on the NEB website (Filing ID [A84616](#)). The NEB filed further Information Requests (IR 38) specific to Vancouver Island beggarticks and responses were filed on July 27, 2017 (Filing ID [A85179](#)). This Plan has been revised to address all those regulatory concerns received up until August 2017, including those of the NEB during the regulatory review process.

TABLE A-3

**SUMMARY OF REGULATORY
 FEEDBACK RELATED TO THE PLAN (MAY 2017 TO AUGUST 2017)**

Stakeholder Group/Agency Name	Method of Contact	Date of Consultation Activity	Reason for Engagement	Stakeholder Feedback	Commitments/ Follow-Up Actions/Comments	Where Addressed
ECCC	Email	May 31, 2017	Toothcup	From the map and text description, the new route appears to avoid parts of the critical habitat polygon where biophysical attributes were present, with a dogleg in the pipeline just south of the polygon deviating from paralleling the old pipeline right-of-way. In the portion of the critical habitat polygon where the right of way overlaps is where a directional drilling rig platform will be placed that feeds the pipeline under the river. The footprint appears to avoid areas that have biophysical attributes for critical habitat.	None	Section 5 of this Plan
			Haller's Apple Moss	Please clarify if the sleeve repair "SLV24" is on the inactive/original Trans Mountain pipeline segment Hinton to Hargreaves, near the Alberta-B.C. border. This location overlaps with critical habitat identified for Haller's Apple Moss. It is not clarified in the Rare Ecological Community and Rare Plant Population Management Plan (NEB condition 40), if this location refers to a 2001 inspection and repair project location and prior to critical habitat identification (described generally on page 4A-120 of Volume 4A – Project Design and Execution – Engineering), or if it refers to a newly planned repair of the inactive trans-mountain pipeline between 2017 and 2019 at the same time the new Trans Mountain pipeline right of way is developed. If the latter, this will happen after critical habitat has already been identified for Haller's Apple Moss, and legally protected by Gazette in a National Park. It is not clear which biophysical attributes of that habitat are currently absent at the sleeve location and all access and stockpile locations necessary to carry out the repair. Provide details for further evaluation by ECCC-CWS.	Since this activity is a component of reactivation not involving valve work, the SLV24 and SLV25 repairs are considered O&M activities and are not included in the scope of the Project. Consultation between TMEP and ECCC regarding reactivation activities within Haller's apple moss critical habitat is ongoing.	Section 3 of this Plan

TABLE A-3 Cont'd

Stakeholder Group/Agency Name	Method of Contact	Date of Consultation Activity	Reason for Engagement	Stakeholder Feedback	Commitments/ Follow-Up Actions/Comments	Where Addressed
BC MOE	Email	July 11, 2017	Rare Ecological Communities and Rare Plant Population Management Plan	It seems like they have made an effort to do complete species surveys and to consider appropriate and species-specific efforts for mitigation as well as to monitor/apply adaptive management. It is however very difficult to discern which plants were from BC in Appendix E (mitigation for the occurrences).	Appendix E has been split into two tables. One for Alberta and one for BC.	Appendix E of this Plan
				They should report their data to the CDC, including any updates from follow-up surveys.	Trans Mountain will report their data to the CDCs, including any updates from follow-up surveys.	Appendix C
Kym Welstead BC FLNRO	Phone meeting	August 8, 2017	Previous occurrence of Vancouver Island beggarticks on the pipeline construction footprint	Overall a reintroduction at this site does not seem ideal because we have no control over how the land is managed (mowing, hydrology changes) and the habitat is not good (dry by late summer, high vegetation cover).	Include this previously observed Vancouver Island beggarticks occurrence on the Environmental Alignment Sheets and in the post-construction monitoring of rare plants. Monitor and manage encroachment of invasive non-native/alien species within the area of potential habitat (identified on the Environmental Alignment Sheets) during post construction monitoring.	Appendix E of this Plan Environmental Alignment Sheets (Volume 8 of the Environmental Plans)

3.3 Aboriginal Engagement

Since April 2012, Trans Mountain has engaged with Aboriginal communities that might have an interest in the Project or have Aboriginal interests potentially affected by the Project, based on the proximity of their community and their assertion of traditional and cultural use of the land along the pipeline corridor to maintain a traditional lifestyle. The objectives of Aboriginal engagement are to:

- have an open, transparent and inclusive process that seeks to exchange information in a respectful manner;
- address concerns shared by those who might have an interest in the Project or have Aboriginal interests potentially affected by the Project;
- incorporate feedback into Project planning and execution; and
- provide opportunities to maximize Project benefits to Aboriginal communities and Aboriginal groups.

A comprehensive Aboriginal engagement process is lead by experienced engagement advisors in Alberta and BC, specialized in the areas of Aboriginal relations, law, economic development, education, training, employment, and procurement. Trans Mountain’s engagement process for the Project is flexible, allowing each community and group to engage in meaningful dialogue in the manner they choose and in a way to meet their objectives and values.

Each community has the opportunity to engage with Trans Mountain, depending on Project interests and potential effects. The following opportunities to engage have been provided:

- Project announcement;
- initial contact with Aboriginal community or Aboriginal group;
- meetings with Chief and Council and meetings with staff;
- host community information session(s);
- conduct Traditional Land Use (TLU) studies and socio-economic interviews;
- identify interests and concerns; and
- identify mitigation options.

Issues and concerns related to the rare ecological communities and rare plant population management plan raised during Aboriginal engagement from between early 2012 to February 2017 are summarized in Table A-4.

TABLE A-4
SUMMARY OF ABORIGINAL ISSUES AND CONCERNS RELATED TO RARE ECOLOGICAL COMMUNITIES AND RARE PLANT POPULATIONS BETWEEN MAY 2012 AND FEBRUARY 2017

Issue or Concern		Summary Trans Mountain Response	Where Addressed
Summary	Aboriginal Community		
Concern about potential effects to provincially blue and red-listed plant species used for medicine, food, clothing, technological uses, structures, and ceremonial purposes.	Skeetchestn Indian Band Tk'emlups te Secwépemc	Trans Mountain is committed to best practices in reclamation, always striving for opportunities leading to advancement. As with all of its construction projects, Trans Mountain will reclaim areas that are affected by the Project. Trans Mountain is committed to reclamation of the pipeline construction footprint and surrounding areas following construction. Following construction, Trans Mountain aims to return the pipeline construction footprint to pre-construction conditions, to the extent practical. This could include the planting of native plant and grass species at riparian and wetland areas, wildlife habitats and any other areas disturbed during construction. Post-construction monitoring and ongoing right-of-way maintenance will continue following construction.	Sections 1.3, 5.0, 6.0 and Appendix E of this Plan, Section 6 of the Pipeline EPP (Volume 2 of the Environmental Plans)
Concern about potential effects to rare plants used for medicine and traditional purposes.	Alexander First Nation Aseniwuche Winewak Nation	Where warranted, site-specific mitigation measures based on location and species have been developed in accordance with the Rare Ecological Community and Rare Plant Population Management Plan (Volume 6 of the Environmental Plans). These mitigation measures are provided in Appendix E of this Plan. Further discussion is provided under vegetation in Section 7.2.9 of Volume 5B of the ESA. Mitigation measures for vegetation are outlined in the Pipeline and Facilities EPPs (Volume 2 of the Environmental Plans).	Appendix E of this Plan, Pipeline EPP (Volume 2 of the Environmental Plans)

Trans Mountain will provide a copy of this Plan to affected Aboriginal groups for their review, and their feedback will be incorporated, as appropriate.

Trans Mountain continues its liaison with Indigenous Affairs and Northern Affairs Canada, the Government of Canada's Major Projects Management Office, the BC Ministry of Aboriginal Relations and Reconciliation, and the Alberta Ministry of Aboriginal Affairs to provide updates regarding Trans Mountain's engagement activities with Aboriginal groups.

3.3.1 Identifying Aboriginal Groups for Consultation

Trans Mountain used the First Nations Consultative Area Database Public Map Service to identify the Aboriginal groups with traditional territories that cross rare plants and ecological communities of concern. Appendix B lists the Aboriginal groups identified for consultation. Throughout regular engagement with

TMEP, any Aboriginal groups were added to the list if they identified rare plants and ecological communities of concern.

3.3.2 Consultation Activities

A letter was sent to the Aboriginal groups listed in Appendix B with a copy of the draft Plan on September 16, 2016. Where appropriate and upon request, a follow up meeting was arranged to discuss this Plan in more detail and address any concerns.

Trans Mountain has summarized the feedback received through Trans Mountain’s engagement on this Plan in Table A-5 and the summary includes how Trans Mountain responded to and addressed the concern or issue. It should be noted that although the engagement process also provided for opportunity for general discussion about Project construction and associated Aboriginal issues and opportunities; only feedback/issues directly related to rare plants and ecological communities of concern are provided in this Plan. Other issues and topics raised have been captured in the corresponding mitigation plan as appropriate.

This final Rare Ecological Community and Rare Plant Population Management Plan will be shared with the Aboriginal groups at the same time as the report is filed with the NEB in 2017.

**TABLE A-5
 SUMMARY OF ABORIGINAL FEEDBACK RELATED TO THE PLAN**

Issue or Concern		Summary Trans Mountain Response	Where Addressed
Summary	Aboriginal Community		
Concerns about plants and putting back medicinal plants.	Alexis Nakoda Sioux	Trans Mountain is committed to best practices in reclamation, always striving for opportunities leading to advancement. As with all of its construction projects, Trans Mountain will reclaim areas that are affected by the Project. Trans Mountain is committed to reclamation of the pipeline construction footprint. Following construction, Trans Mountain aims to return the pipeline construction footprint to pre-construction conditions, to the extent practical. This could include the planting of native plant and grass species at riparian and wetland areas, and wildlife habitats. Post-construction monitoring and ongoing right-of-way maintenance will continue following construction.	Sections 1.2, 1.3, 5.0, and 6.0, Section 6 of the Pipeline EPP (Volume 2 of the Environmental Plans)
Important to review existing information on Traditional Land Use (TLU) and Traditional Ecological Knowledge (TEK) studies	Metis Regional Council – Zone IV of the Métis Nation of Alberta	Trans Mountain has reviewed information provided in TLU reports from participating Aboriginal groups and traditional knowledge with respect to rare plants and ecological communities of concern. Detailed information used for mitigation is not included in this report due to requests for confidentiality. Trans Mountain will continue to take available and applicable Aboriginal TLU and TEK into consideration in developing the Plan.	Section 1.2
	Metis Nation of Alberta		
Enoch Cree values the plants on both sides of a water crossing; has several Elders that input into the consultation, and will review the NEB Condition 40 in more detail in the next few weeks.	Enoch Cree	Trans Mountain has conducted surveys in areas to identify rare ecological communities and rare plant and lichen species of concern along the pipeline route. Over 60 km of rare plant surveys were conducted on the Edmonton to Hinton segment of the route, including numerous watercourse crossings (refer to Appendix D of this Plan for details). All identified rare ecological community, rare plant and rare lichen sightings on the pipeline construction footprint are discussed in this Plan, and are mapped on the Environmental Alignment Sheets. For the purposes of the vegetation assessment rare ecological communities are defined as those identified by ACIMS. Rare plants and lichens are defined as species identified by the SARA, COSEWIC, the Alberta Wildlife Act and ACIMS (refer to the Vegetation Technical Report [Volume 5C]) for more details.	Condition 40, Appendix D Environmental Alignment Sheets
Elders are concerned about medicinal plants, and there are two Sucker Creek FN members that live in Jasper Park, and 16 Elders that know the area and plants very well. In lieu of site visits to 8 cultural sites, SCFN requested a map review of the sites.	Sucker Creek First Nation	TMEP will contact Sucker Creek in mid-April to share information on the reactivation sties and provide an update. If needed, the mapping session would take place in Sucker Creek in prior to construction.	N/A

Issue or Concern		Summary Trans Mountain Response	Where Addressed
Summary	Aboriginal Community		
Aseniwuche Winewak wants to discuss Condition 40 at a community meeting planned for April and discuss how their TEK/TLU was used	Aseniwuche Winewak	Known TEK/TLU sites are included on the Project Environmental Alignment sheets and reclamation measures applicable to the TEK/TLU sites are included in the Reclamation Management Plan.	Reclamation Management Plan, Section 9

APPENDIX B

LIST OF ABORIGINAL GROUPS IDENTIFIED FOR CONSULTATION REGARDING THE RARE ECOLOGICAL COMMUNITY AND RARE PLANT POPULATION MANAGEMENT PLAN

- Adams Lake Indian Band
- Aitchelitz First Nation (Stó:lō)
- Alexander First Nation
- Alexis Nakota First Nation
- Aseniwuche Winewak Nation
- Ashcroft Indian Band (Nlaka'pamux Nation)
- Asini Wachi Nehiyawak
- Boothroyd Band (Nlaka'pamux Nation)
- Boston Bar Band (Nlaka'pamux Nation)
- British Columbia Métis Federation
- Canim Lake Band (Tsq'escen')
- Canoe Creek (Stswecem'c Xgat'tem) Indian Band
- Chawathil First Nation (Stó:lō)
- Cheam First Nation (Stó:lō)
- Clinton Indian Band / Whispering Pines First Nation
- Coldwater Indian Band (Nlaka'pamux Nation)
- Cook's Ferry Indian Band (Nlaka'pamux Nation)
- Enoch Cree Nation
- Ermineskin First Nation
- Foothills Ojibway Society
- High Bar
- Horse Lake First Nation (Treaty 8)
- Kanaka Bar
- Katzie First Nation
- Kelly Lake Cree Nation
- Kelly Lake First Nation
- Kelly Lake Métis Settlement Society
- Ktunaxa Nation
- Kwantlen First Nation (Stó:lō)
- Kwaw-kwaw-Apilt First Nation (Stó:lō)
- Kwikwetlem First Nation
- Leq'a:mel First Nation (Stó:lō)
- Lheidli-T'enneh First Nation
- Lhtako Dene Nation
- Little Shuswap Indian Band
- Louis Bull Tribe
- Lower Nicola Indian Band (Nlaka'pamux Nation)
- Lower Similkameen Indian Band
- Lyackson First Nation
- Lytton First Nation (Nlaka'pamux Nation)
- Matsqui First Nation (Stó:lō)
- Métis Nation of Alberta Gunn Métis Local 55
- Métis Nation of British Columbia
- Métis Regional Council Zone IV of the Métis Nation of Alberta
- Michel First Nation
- Montana First Nation
- Musqueam Indian Band
- Nakcowinewak Nation of Canada
- Neskonlith Indian Band
- Nicola Tribal Association (Shackan Indian Band, Nooaitch Indian Band and Nicomen Indian Band)
- Nicomen Indian Band (NTA)
- Nooaitch Indian Band (Nlaka'pamux Nation)
- O'Chiese First Nation
- Okanagan Indian Band (added by OGC)
- Oregon Jack Creek Band (Nlaka'pamux Nation)

- Paul First Nation
- Pauquachin First Nation
- Penelakut First Nation
- Penticton Indian Band
- Peters Band (Stó:lō)
- Popkum First Nation (Stó:lō)
- Qayqayt First Nation (New Westminster)
- Saddle Lake Cree
- Samson Cree Nation
- Scowlitz First Nation (Stó:lō)
- Seabird Island Band (Stó:lō)
- Sechelt
- Semiahmoo First Nation
- Sencoten Alliance
- Shackan Indian Band (Nlaka'pamux Nation)
- Shuswap Indian Band
- Shuswap Nation Tribal Council
- Shxw'ōwhámél First Nation (Stó:lō)
- Shxwha:y Village (Stó:lō)
- Simpcw First Nation
- Siska Indian Band (Nlaka'pamux Nation)
- Skawahlook First Nation (Stó:lō)
- Skeetchestn First Nation
- Skowkale First Nation (Stó:lō)
- Skuppah Indian Band (Nlaka'pamux Nation)
- Skwah First Nation (Stó:lō)
- Soowahlie Indian Band (Stó:lō)
- Splatsin First Nation
- Spuzzum First Nation (Nlaka'pamux Nation)
- Squamish Nation
- Squiala First Nation (Stó:lō)
- St'at'imc Chiefs Council
- Stó:lō Collective
- Stoney Nakoda First Nation
- Sts'ailes Band (Chehalis Indian Band) (Stó:lō)
- St'uxwtews (Bonaparte Indian Band)
- Sucker Creek First Nation
- Sumas First Nation (Stó:lō)
- Sunchild First Nation
- Tk'emlups te Secwepemc (Kamloops)
- Toosey Indian Band
- Treaty 8 Nations of Alberta
- Tsartlip First Nation
- Tsawout First Nation
- Tsawwassen First Nation
- Tseycum First Nation
- Tsilhoqu'tin National Government
- Ts'kwaylaxw (Pavilion Indian Band)
- Tseil-Waututh Nation
- Tsuu T'ina First Nation
- Tzeachten First Nation (Stó:lō)
- Union Bar Indian Band (Stó:lō)
- Upper Nicola Band (Nlaka'pamux Nation)
- Upper Similkameen Indian Band
- Whitefish (Goodfish) Lake First Nation
- Williams Lake (T'exelc) Band
- Xat'sūll First Nation (Soda Creek)
- Yakwekwioose Band (Stó:lō)
- Yale First Nation (Stó:lō)

APPENDIX C
TERRESTRIAL ECOSYSTEM MAPPING

TABLE OF CONTENTS

	<u>Page</u>
TERRESTRIAL ECOSYSTEM MAPPING	C-6
1.0 INTRODUCTION.....	C-6
1.1 Objectives	C-6
1.2 Regulatory Standards	C-6
2.0 CONSULTATION	C-7
3.0 METHODS	C-8
3.1 Ecological Mapping.....	C-8
3.1.1 Study Area Boundaries	C-8
3.1.2 Geodatabase Creation and Pre-Stratification	C-9
4.0 RESULTS OF TERRESTRIAL ECOSYSTEM MAPPING	C-10
4.1 Limitations of Terrestrial Ecosystem Mapping	C-11
4.2 Terrestrial Ecosystem Mapping Results for Alberta.....	C-11
4.2.1 Central Mixedwood	C-11
4.2.2 Central Parkland	C-13
4.2.3 Dry Mixedwood	C-14
4.2.4 Lower Foothills	C-16
4.2.5 Montane	C-17
4.2.6 Upper Foothills	C-19
4.3 Terrestrial Ecosystem Mapping Results for British Columbia.....	C-20
4.3.1 Thompson Very Dry Hot Bunchgrass (BGxh2).....	C-20
4.3.2 Nicola Very Dry Warm Bunchgrass (BGxw1)	C-21
4.3.3 Undifferentiated and Parkland Coastal Mountain-Heather Alpine (CMAunp).....	C-22
4.3.4 Dry Maritime Coastal Western Hemlock (CWHdm)	C-23
4.3.5 Southern Dry Submaritime Coastal Western Hemlock (CWHds1).....	C-24
4.3.6 Southern Moist Submaritime Coastal Western Hemlock (CWHms1).....	C-26
4.3.7 Eastern Very Dry Maritime Coastal Western Hemlock (CWHxm1)	C-27
4.3.8 Rausch Moist Mild Engelmann Spruce - Subalpine Fir (ESSFmm1)	C-29
4.3.9 Moist Warm Engelmann Spruce - Subalpine Fir (ESSFmw)	C-30
4.3.10 Cascade Moist Warm Engelmann Spruce - Subalpine Fir (ESSFmw1).....	C-31
4.3.11 Northern Monashee Wet Cold Engelmann Spruce - Subalpine Fir (ESSFwc2)	C-32
4.3.12 North Thompson Dry Warm Interior Cedar - Hemlock (ICHdw3)	C-33
4.3.13 Thompson Moist Cool Interior Cedar - Hemlock (ICHmk2)	C-34
4.3.14 Moist Mild Interior Cedar - Hemlock (ICHmm).....	C-35
4.3.15 Thompson Moist Warm Interior Cedar - Hemlock (ICHmw3)	C-36
4.3.16 Mica Very Wet Cool Interior Cedar Hemlock (ICHvk1).....	C-37
4.3.17 Wells Gray Wet Cool Interior Cedar – Hemlock (ICHwk1)	C-38
4.3.18 Thompson Dry Cool Interior Douglas-Fir (IDFdk1)	C-40
4.3.19 Cascade Dry Cool Interior Douglas-Fir (IDFdk2).....	C-41
4.3.20 Thompson Moist Warm Interior Douglas-Fir (IDFmw2).....	C-42
4.3.21 Thompson Moist Warm – Steep South Phase Interior Douglas-Fir (IDFmw2b)	C-44
4.3.22 Okanagan Very Dry Hot Interior Douglas-Fir (IDFhx1).....	C-45
4.3.23 Thompson Very Dry Hot Interior Douglas-Fir (IDFhx2)	C-46
4.3.24 Thompson Very Dry Hot Interior Douglas-Fir, Grassland Phase (IDFhx2a)	C-47
4.3.25 Undifferentiated and Parkland Interior Mountain-Heather Alpine (IMAunp)	C-48
4.3.26 Leeward Moist Maritime Mountain Hemlock (MHmm2).....	C-50
4.3.27 South Thompson Dry Mild Montane Spruce (MSdm2)	C-51

4.3.28	Cascade Moist Warm Montane Spruce (MSmw1).....	C-52
4.3.29	Thompson Very Dry Hot Ponderosa Pine (PPxh2).....	C-54
4.3.30	McLennan Dry Hot Sub-Boreal Spruce (SBSdh1).....	C-55
5.0	SUMMARY.....	C-57

LIST OF TABLES

Table 1.2-1	Field Guides and Land Management Handbooks for Additional Natural Subregions and BGC Variants.....	C-6
Table 4.0-1	Natural Subregion and BGC Subzone Variant Tem Summary.....	C-10
Table 4.2-1	Ecosite Phases in the Central Mixedwood Natural Subregion.....	C-11
Table 4.2-2	All-Ecosystem Units in the Central Mixedwood Natural Subregion.....	C-12
Table 4.2-3	Ecosite Phases in the Central Parkland Natural Subregion.....	C-13
Table 4.2-4	All-Ecosystem Units in the Central Parkland Natural Subregion.....	C-14
Table 4.2-5	Ecosite Phases in the Dry Mixedwood Natural Subregion.....	C-14
Table 4.2-6	All-Ecosystem Units in the Dry Mixedwood Natural Subregion.....	C-15
Table 4.2-7	Ecosite Phases in the Lower Foothills Natural Subregion.....	C-16
Table 4.2-8	All-Ecosystem Units in the Lower Foothills Natural Subregion.....	C-17
Table 4.2-9	Ecosite Phases in the Montane Natural Subregion.....	C-18
Table 4.2-10	All-Ecosystem Units in the Montane Natural Subregion.....	C-18
Table 4.2-11	Ecosite Phases in the Upper Foothills Natural Subregion.....	C-19
Table 4.3-1	Site Series in the BGxh2.....	C-20
Table 4.3-2	All-Ecosystem Units in the BGxh2.....	C-20
Table 4.3-3	Site Series in the BGxw1.....	C-21
Table 4.3-4	All-Ecosystem Units in the BGxw1.....	C-22
Table 4.3-5	Site Series in the CMAunp.....	C-23
Table 4.3-6	Site Series in the CWHdm.....	C-23
Table 4.3-7	All-Ecosystem Units in the CWHdm.....	C-24
Table 4.3-8	Site Series in the CWHds1.....	C-24
Table 4.3-9	All-Ecosystem Units in the CWHds1.....	C-25
Table 4.3-10	Site Series in the CWHms1.....	C-26
Table 4.3-11	All-Ecosystem Units in the CWHms1.....	C-27
Table 4.3-12	Site Series in the CWHxm1.....	C-28
Table 4.3-13	All-Ecosystem Units in the CWHxm1.....	C-28
Table 4.3-14	Site Series in the ESSFmm1.....	C-29
Table 4.3-15	All-Ecosystem Units in the ESSFmm1.....	C-29
Table 4.3-16	Site Series in the ESSFmw.....	C-30
Table 4.3-17	All-Ecosystem Units in the ESSFmw.....	C-31
Table 4.3-18	Site Series in the ESSFmw1.....	C-31
Table 4.3-19	All-Ecosystem Units in the ESSFmw1.....	C-32
Table 4.3-20	Site Series in the ESSFwc2.....	C-33
Table 4.3-21	Site Series in the ICHdw3.....	C-33
Table 4.3-22	All-Ecosystem Units in the ICHdw3.....	C-34
Table 4.3-23	Site Series in the ICHmk2.....	C-34
Table 4.3-24	Site Series in the ICHmm.....	C-35
Table 4.3-25	All-Ecosystem Units in the ICHmm.....	C-35
Table 4.3-26	Site Series in the ICHmw3.....	C-36
Table 4.3-27	All-Ecosystem Units in the ICHmw3.....	C-37
Table 4.3-28	Site Series in the ICHvk1.....	C-37
Table 4.3-29	All-Ecosystem Units in the ICHvk1.....	C-38
Table 4.3-30	Site Series in the ICHwk1.....	C-39
Table 4.3-31	All-Ecosystem Units in the ICHwk1.....	C-39
Table 4.3-32	Site Series in the IDFdk1.....	C-40
Table 4.3-33	All-Ecosystem Units in the IDFdk1.....	C-40
Table 4.3-34	Site Series in the IDFdk2.....	C-41
Table 4.3-35	All-Ecosystem Units in the IDFdk2.....	C-42
Table 4.3-36	Site Series in the IDFmw2.....	C-43
Table 4.3-37	All-Ecosystem Units in the IDFmw2.....	C-43

Table 4.3-38	Site Series in the IDFmw2b	C-44
Table 4.3-39	All-Ecosystem Units in the IDFmw2b.....	C-44
Table 4.3-40	Site Series in the IDFxh1	C-45
Table 4.3-41	All-Ecosystem Units in the IDFxh1.....	C-45
Table 4.3-42	Site Series in the IDFxh2	C-46
Table 4.3-43	All-Ecosystem Units in the IDFxh2.....	C-47
Table 4.3-44	Site Series in the IDFxh2a	C-47
Table 4.3-45	All-Ecosystem Units in the IDFxh2a.....	C-48
Table 4.3-46	Site Series in the IMAunp	C-48
Table 4.3-47	All-Ecosystem Units in the IMAunp.....	C-49
Table 4.3-48	Site Series in the MHmm2	C-50
Table 4.3-49	All-Ecosystem Units in the MHmm2.....	C-50
Table 4.3-50	Site Series in the MSdm2	C-51
Table 4.3-51	All-Ecosystem Units in the MSdm2.....	C-51
Table 4.3-52	Site Series in the MSmw1	C-52
Table 4.3-53	All-Ecosystem Units in the MSmw1	C-53
Table 4.3-54	Site Series in the PPxh2	C-54
Table 4.3-55	All-Ecosystem Units in the PPxh2.....	C-54
Table 4.3-56	Site Series in the SBSdh1.....	C-55
Table 4.3-57	All-Ecosystem Units in the SBSdh1	C-55

DEFINITIONS AND ACRONYM LIST

Acronym/Definition	Full Name
ABMI	Alberta Biodiversity Monitoring Institute
AGRASID	Agricultural Region of Alberta Soil Inventory Database
AVI	Alberta Vegetation Inventory
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre
BC MFLNRO	British Columbia Ministry of Forests, Lands and Natural Resource Operations
BGC	Biogeoclimatic
ESA	Environmental and Socio-Economic Assessment
IR	Indian Reserve
NEB	National Energy Board
REC	rare ecological community
RSA	Regional Study Area
the Project	the Trans Mountain Expansion Project
TEM	terrestrial ecosystem mapping
TMEP	Trans Mountain Expansion Project

TERRESTRIAL ECOSYSTEM MAPPING

1.0 INTRODUCTION

Terrestrial ecosystem mapping (TEM) was completed within the Trans Mountain Expansion Project (referred to as “TMEP” or “the Project”) Vegetation Regional Study Area (RSA) to describe the diversity, relative abundance and distribution of vegetation communities as well as structural stages for lands where vegetation may be affected by the Project. TEM supports the Environmental and Socio-Economic Assessment (ESA) for the Project (Volume 5A).

1.1 Objectives

The objectives of the supplemental TEM Report are to:

- outline the regulatory standards, consultation and methods applicable to additional TEM completed along the Edson to Hinton portion of the Edmonton to Hinton Segment of the Vegetation RSA in Alberta and the Black Pines to Hope, Hope to Burnaby and Burnaby to Westridge Segments of the Vegetation RSA in British Columbia (BC); and
- provide an overview of the compiled final TEM results for Project, including all areas for which TEM has been completed within the pipeline corridor as defined in the Routing Update filed with the National Energy Board (NEB) in August 2014 as part of Technical Update No. 2.

1.2 Regulatory Standards

Section 1.2 of Appendix C to Technical Report 5C-9 of Volume 5C, Vegetation Technical Report (TERA 2013) outlines the Appropriate Government Authority standards for TEM. Table 1.1 of Appendix C to Technical Report 5C-9 provides the field guides and land management handbooks used for each Natural Subregion and Biogeoclimatic (BGC) subzone variant for which TEM was completed in 2013. Table 1.2-1 below outlines the resources used for additional Natural Subregions and BGC subzone variants included in this supplemental filing.

TABLE 1.2-1

FIELD GUIDES AND LAND MANAGEMENT HANDBOOKS FOR ADDITIONAL NATURAL SUBREGIONS AND BGC VARIANTS

Natural Subregion or BGC Variant	Code	Field Guide or Land Management Handbook ^{1,2}
ALBERTA		
Montane	MN	• <i>Field Guide to Ecosites of West-Central Alberta</i>
Upper Foothills	UF	• <i>Field Guide to Ecosites of West-Central Alberta</i>
BC		
Undifferentiated and Parkland Interior Mountain-Heather Alpine	IMAunp	• <i>Classification of Non-Forested Ecosystems</i>
South Thompson Dry Mild Montane Spruce	MSdm2	• <i>Land Management Handbook Number 23</i>
Cascade Moist Warm Montane Spruce	MSmw1	• <i>Okanagan Wet Belt Field Guide</i>

- Notes:**
- 1 Refer to Section 6.0 for complete field guide citations.
 - 2 Wetlands were classified using Wetlands of British Columbia (MacKenzie and Moran 2004) during TEM surveys.

2.0 CONSULTATION

Section 2.0 of Appendix C of Technical Report 5C-9 outlines the consultation conducted while developing the TEM methods for the Project.

3.0 METHODS

Methods used for TEM completed for this supplemental filing are consistent with the methods outlined in Section 3.0 of Appendix C of Technical Report 5C-9, with the following differences:

- the Vegetation RSA addressed by this supplemental filing is that associated with the pipeline corridor as defined in the Routing Update filed with the NEB in August 2014 as part of Technical Update No. 2;
- pre-stratification in the Edson to Hinton Segment of the Vegetation RSA used Alberta Vegetation Inventory (AVI) data; and
- mappers had access to additional field data from surveys conducted in October 2013 and the summer of 2014.

These differences are detailed in Section 3.1.

Survey Intensity Level 5 (*i.e.*, field verification of at least 5% of the polygons in the Vegetation RSA) was chosen for this Project. Due to the additional desktop and field work to identify all wetlands within the pipeline corridor and specific surveys conducted for rare plants and rare ecological communities, this survey intensity level is considered to provide an accurate depiction of the ecosystems within the Vegetation RSA and to meet the industry standard for TEM on a large project. Survey intensity level changed slightly with the addition of new areas for which TEM was completed and with route realignments. In total, field surveys have now been conducted for 5.9% of polygons within the Vegetation RSA.

3.1 Ecological Mapping

3.1.1 Study Area Boundaries

TEM was completed for the Vegetation RSA, which consists of a 2 km wide band generally from the centre of the pipeline corridor centre (*e.g.*, 1 km on both sides of the centre of the pipeline corridor). Figures 5.9-1 through 5.9-4 of Volume 5A of the Application give an overview of the Vegetation RSA spatial boundaries. The RSA also includes areas within a 1 km buffer of the boundaries of the following facilities:

- Edmonton Terminal;
- Gainford Pump Station;
- Niton Pump Station;
- Wolf Pump Station;
- Edson Pump Station;
- Hinton Pump Station;
- Rearguard Pump Station;
- Blue River Pump Station;
- Blackpool Pump Station;
- Hargreaves Pump Station;
- Darfield Pump Station;
- Black Pines Pump Station study area;
- Kamloops Pump Station;

- Kingsvale Pump Station;
- Sumas Pump Station;
- Sumas Terminal;
- Burnaby Terminal; and
- Westridge Marine Terminal.

3.1.2 Geodatabase Creation and Pre-Stratification

Soil data from the Agricultural Region of Alberta Soil Inventory Database (AGRASID) was not available for the Edson to Hinton portion of the Edmonton to Hinton Segment of the Vegetation RSA. For this portion of the pipeline corridor, pre-stratification used AVI data (Alberta Environment and Sustainable Resource Development [AESRD] 2012, West Fraser Mills Ltd. 2013, Weyerhaeuser 2013) rather than AGRASID (Alberta Soil Information Centre [ASIC] 2001) and Alberta Biodiversity Monitoring Institute (ABMI) Human Footprint data (ABMI 2010a,b), which were used for pre-stratification in other parts of the Vegetation RSA in Alberta.

Reference data for the BC geodatabase was updated to include field surveys completed in summer 2014 (TERA 2014). These surveys were completed in areas along the Joeyaska 2 Indian Reserve (IR), Coldwater IR, Coquihalla Recreation Area, Bridal Veil Falls Provincial Park, Peters 1 IR, Zhot 4 IR, Zhot 5 IR, Lac Du Bois Grassland Protected Area, North Thompson River Provincial Park and Finn Creek Provincial Park within the BGxw1, CWHdm, CWHds1, CWHms1, ESSFmw, IDfwm2, MSmw1 and PPxh2 BGC subzone variants. Field plot data from 2012 and 2013 in areas within the Montane Natural Subregion and the MSmw1 BGZ subzone variant were also included in the Alberta and BC geodatabases, respectively. The project footprint no longer intersects with Bridal Veil Falls Provincial Park.

4.0 RESULTS OF TERRESTRIAL ECOSYSTEM MAPPING

TEM has been completed for 100% of the total Vegetation RSA in Alberta, amounting to 67,656 ha within six Natural Subregions. TEM has been completed for 100% of the total Vegetation RSA in BC, amounting to 113,099 ha within 30 BGC subzone variants. A summary of the compiled TEM results, including all mapping and field work conducted from 2012 to 2014 within the Vegetation RSA, is provided in Table 4.0-1.

A total of 325 unique ecosite phase/site series are represented in the mapping area. Detailed descriptions of the ecosite phases and site series mapped for this Project are provided in the field guides and land management handbooks listed in Table 1.2-1 of this report and in Table 1.1 of Appendix C of Technical Report 5C-9 and they are not re-iterated in this report. Tables in Section 4.2 list the compiled TEM results for ecosite phases by Natural Subregion in Alberta. Tables in Section 4.3 list the compiled TEM results for site series by BGC subzone variant in BC. Tables in Section 4.3 also indicate whether or not each site series and all-ecosystem unit has been correlated with a rare ecological community (REC) by the BC Conservation Data Centre (BC CDC) (2015).

TABLE 4.0-1

NATURAL SUBREGION AND BGC SUBZONE VARIANT TEM SUMMARY

Natural Subregion/BGC Subzone Variant	Code	Mapped Area (ha)	Number of Polygons	Number of Ground Inspections ²	Number of Visual Inspections ²
ALBERTA					
Central Mixedwood	CM	4,660.5	394	1	16
Central Parkland	CP	13,948.6	549	1	3
Dry Mixedwood	DM	15,334.4	890	16	43
Lower Foothills	LF	29,062.7	3,127	41	150
Montane	MN	4,552.7	438	12	46
Upper Foothills	UF	92.3	8	--	--
BC					
Thompson Very Dry Hot Bunchgrass	BGxh2	2,155.3	263	5	16
Nicola Very Dry Warm Bunchgrass	BGxw1	4,197.2	438	16	41
Undifferentiated and Parkland Coastal Mountain-Heather Alpine	CMAunp	15.7	4	--	--
Dry Maritime Coastal Western Hemlock	CWHdm	8,008.6	336	5	3
Southern Dry Submaritime Coastal Western Hemlock	CWHds1	10,832.8	847	16	21
Southern Moist Submaritime Coastal Western Hemlock	CWHms1	2,842.7	267	3	--
Eastern Very Dry Maritime Coastal Western Hemlock	CWHxm1	13,978.4	714	13	6
Raush Moist Mild Engelmann Spruce – Subalpine Fir	ESSFmm1	69.8	17	--	--
Moist Warm Engelmann Spruce – Subalpine Fir	ESSFmw	237.5	28	1	--
Cascade Moist Warm Engelmann Spruce – Subalpine Fir	ESSFmw1	610.2	66	1	3
Northern Monashee Wet Cold Engelmann Spruce – Subalpine Fir	ESSFwc2	16.1	2	--	--
North Thompson Dry Warm Interior Cedar – Hemlock	ICHdw3	7,550.6	662	18	58
Thompson Moist Cool Interior Cedar – Hemlock	ICHmk2	167.9	15	--	--
Moist Mild Interior Cedar – Hemlock	ICHmm	2,582.0	189	--	1
Thompson Moist Warm Interior Cedar – Hemlock	ICHmw3	7,203.3	641	9	31
Mica Very Wet Cool Interior Cedar – Hemlock	ICHvk1	2,927.4	163	--	3
Wells Gray Wet Cool Interior Cedar – Hemlock	ICHwk1	8,155.7	508	2	2
Thompson Dry Cool Interior Douglas-Fir	IDFdk1	8,971.5	892	7	26
Cascade Dry Cool Interior Douglas-Fir	IDFdk2 ¹	3,994.2	562	7	21
Thompson Moist Warm Interior Douglas-Fir	IDFmw2 ¹	14,310.5	847	4	15
Thompson Moist Warm – Steep South phase Interior Douglas-Fir	IDFmw2b ¹	1,766.4	100	--	2
Okanagan Very Dry Hot Interior Douglas-Fir	IDFhx1	2,904.5	333	15	25
Thompson Very Dry Hot Interior Douglas-Fir	IDFhx2 ¹	4,475.0	449	5	8

TABLE 4.0-1 Cont'd

Natural Subregion/BGC Subzone Variant	Code	Mapped Area (ha)	Number of Polygons	Number of Ground Inspections ²	Number of Visual Inspections ²
Thompson Very Dry Hot Interior Douglas-Fir, Grassland Phase	IDFxh2a ¹	5,408.8	623	8	36
Undifferentiated and Parkland Interior Mountain-heather Alpine	IMAunp	201.5	22	--	--
Leeward Moist Maritime Mountain Hemlock	MHm2	1,710.6	236	--	--
South Thompson Dry Mild Montane Spruce	MSdm2	1,234.8	138	--	--
Cascade Moist Warm Montane Spruce	MSmw1	2,275.5	261	11	20
Thompson Very Dry Hot Ponderosa Pine	PPxh2	6,522.3	737	26	91
McLennan Dry Hot Sub-Boreal Spruce	SBSdh1	9,771.8	709	10	32

- Notes:**
- 1 Due to mapping adjustments in the Interior Douglas-Fir (IDF) BGC Zone (described in Section 4.1), the total area listed here for these IDF variants will not be equivalent to the respective sum of areas in the variant-specific tables in Section 4.3.
 - 2 Ground inspections and visual inspections are defined in Section 3.2 of Appendix C of Technical Report 5C-9.

4.1 Limitations of Terrestrial Ecosystem Mapping

An overview of the limitations of TEM for the Project is provided in Section 4.1 of Appendix C of Technical Report 5C-9. The specific limitations encountered by mappers in each Natural Subregion and BGC variant where TEM was completed in 2013 are provided in their respective subsections within Sections 4.2 and 4.3 of Appendix C of Technical Report 5C-9. Where additional limitations were encountered during supplemental TEM, these are outlined in the relevant subsections of Sections 4.2 and 4.3.

4.2 Terrestrial Ecosystem Mapping Results for Alberta

4.2.1 Central Mixedwood

TEM results for ecosite phases mapped in the Central Mixedwood Natural Subregion within the Vegetation RSA are listed in Table 4.2-1. TEM results for all-ecosystem units mapped in the Central Mixedwood Natural Subregion are listed in Table 4.2-2.

TABLE 4.2-1

ECOSITE PHASES IN THE CENTRAL MIXEDWOOD NATURAL SUBREGION

Ecosite Phase ¹	Code	Structural Stages	Mapped Area (ha)
plains wormwood	aa1	--	--
lichen Pj	a1	--	--
western porcupine grass	bb1	--	--
northern wheat grass	bb2	--	--
blueberry Pj-Aw	b1	1, 2, 2a, 2b, 3a, 3b, 4, 5	109.8
blueberry Aw(Bw)	b2	2b, 4, 5, 6	62.2
blueberry Aw-Sw	b3	1, 2, 2b, 3a, 3b, 4, 5, 6	246.3
blueberry Sw-Pj	b4	5	21.9
Labrador tea-mesic Pj-Sb	c1	2, 2b, 3a, 3b, 5	99.6
low-bush cranberry Aw	d1	1, 2b, 3a, 3b, 4, 5, 6	227.6
low-bush cranberry Aw-Sw	d2	2b, 4, 5, 6	259.1
low-bush cranberry Sw	d3	5, 6	41.3
saskatoon-snowberry	d4	--	--
California oatgrass-slender wheatgrass	dd1	--	--
dogwood Pb-Aw	e1	2, 2a, 2b, 3a, 3b, 4, 5	106.6
dogwood Pb-Sw	e2	5	205.3

TABLE 4.2-1 Cont'd

Ecosite Phase ¹	Code	Structural Stages	Mapped Area (ha)
dogwood Sw	e3	5	15.2
dogwood shrubland	e4	--	--
horsetail Pb-Aw	f1	2, 2b, 3a, 3b, 4, 5	15.4
horsetail Pb-Sw	f2	3a, 5	53.1
horsetail Sw	f3	--	--
horsetail/willow	f4	--	--
horsetail/Bw	f5	--	--
Labrador tea-subhygric Sb-Pj	g1	2, 2b, 3a, 4, 5	72.8
saline	g2	--	--
Labrador tea/horsetail Sw-Sb	h1	2, 3a, 3b, 4, 5	115.7
treed bog	i1	4, 5	51.1
shrubby bog	i2	2, 2a, 3a, 3b	64.1
treed poor fen	j1	4, 5	37.3
shrubby poor fen	j2	3a, 3b, 4	62.4
grassland poor fen	j3	2, 2a, 2b	13.8
treed rich fen	k1	5	2.5
shrubby rich fen	k2	3a, 3b	35.2
graminoid rich fen	k3	2a, 2b	46.3
marsh	l1	1, 2b	8.0

Note: 1 Derived from *Field Guide to Ecosites of Northern Alberta* (Beckingham and Archibald 1996) and *Guide to Range Plant Community Types and Carrying Capacity for the Dry and Central Mixedwood Subregions in Alberta*, 6th approximation (Willoughby et al. 2006).

TABLE 4.2-2

ALL-ECOSYSTEM UNITS IN THE CENTRAL MIXEDWOOD NATURAL SUBREGION

All-Ecosystem Unit	Code	Structural Stages	Mapped Area (ha)
cultivated field	CF	1, 2, 2a, 2b	2,020.9
active channel flood class	Fa	--	--
fringe flood class	Ff	--	--
low bench flood class	Fl	--	--
mid bench flood class	Fm	--	--
lake	LA	--	--
rock cliff	Rc	--	0.5
pond	PD	--	17.8
river	RI	--	--
rock outcrop	Ro	--	--
rural	Ru	1, 2a, 2b, 3a, 4, 5	71.4
rock talus	Rt	--	--
road	RZ	2, 2b	6.0
tame pasture	TP	2, 2a, 2b, 3a, 4	554.8
avalanche herb meadow	Vh	--	--
avalanche shrub thicket	Vs	--	--
avalanche treed	Vt	--	--
bog wetland	Wb	--	--
fen wetland	Wf	--	--
marsh wetland	Wm	--	--
swamp wetland	Ws	3a, 3b	16.7
shallow water aquatic	Ww	--	--
herb disclimax	Xh	--	--

TABLE 4.2-2 Cont'd

All-Ecosystem Unit	Code	Structural Stages	Mapped Area (ha)
shrub disclimax	Xs	--	--
urban	UR	--	--
grazing zooclimax	Zg	--	--
alkaline meadow	Ga	--	--
mine	Mi	--	--

4.2.2 Central Parkland

TEM results for ecosite phases mapped in the Central Parkland Natural Subregion within the Vegetation RSA are listed in Table 4.2-3. TEM results for all-ecosystem units mapped in the Central Parkland Natural Subregion are listed in Table 4.2-4.

TABLE 4.2-3

ECOSITE PHASES IN THE CENTRAL PARKLAND NATURAL SUBREGION

Ecosite Phase ¹	Code	Structural Stages	Mapped Area (ha)
sand dropseed grassland	a1	--	--
sandgrass/juniper shrubland	b1	--	--
sandgrass/juniper conifer-Pj	b2	--	--
sandgrass/juniper grassland	b3	--	--
needle and thread grassland	c1	--	--
needle and thread aspen	c2	--	--
needle and thread shrubland	c3	--	--
western porcupine grass grassland	d1	--	--
western porcupine grass shrubland	d2	--	--
western porcupine grass aspen	d3	--	--
saline blowout grassland	e1	--	--
saline blowout saltgrass seepage	e2	--	--
western wheat grass grassland	f1	--	--
western wheat grass shrubland	f2	--	--
rough fescue/snowberry grassland	g1	--	--
rough fescue/snowberry tame	g2	--	--
rough fescue/snowberry shrubland	g3	--	--
rough fescue/snowberry aspen	g4	2b, 3b, 4, 5	274.0
rough fescue/snowberry conifer	g5	6	4.6
silver sagebrush	h1	--	--
red osier dogwood spruce	i1	3a, 4, 5, 6	43.9
red-osier dogwood aspen	i2	2b, 3a, 3b, 4, 5	299.2
red-osier dogwood shrubland	i3	3b	0.9
foxtail barley grassland	j1	2b	1.4
horsetail deciduous	k1	--	--
horsetail conifer	k2	5	7.2
saline lowlands grassland	l1	--	--
graminoid fen	m1	2b	80.7
shrubby fen	m2	3a, 3b	98.8
marsh cattails	n1	2a, 2b	45.3
marsh	n2	--	--

Note: 1 Derived from Range Plant Communities and Range Health Assessment Guidelines for the Central Parkland Subregion of Alberta (Burkinshaw *et al.* 2009).

TABLE 4.2-4

ALL-ECOSYSTEM UNITS IN THE CENTRAL PARKLAND NATURAL SUBREGION

All-Ecosystem Unit	Code	Structural Stages	Mapped Area (ha)
cultivated field	CF	1, 2, 2b, 3a, 3b	4,867.2
active channel flood class	Fa	--	--
fringe flood class	Ff	--	--
low bench flood class	Fl	--	--
mid-bench flood class	Fm	--	--
lake	LA	--	43.7
rock cliff	Rc	--	--
pond	PD	--	161.8
river	RI	--	74.9
rock outcrop	Ro	--	--
rural	Ru	1, 2b, 3a, 3b, 4, 5	1,390.0
rock talus	Rt	--	--
road	RZ	1, 2b	687.8
tame pasture	TP	1, 2b, 3a, 3b, 5	1,787.1
avalanche herb meadow	Vh	--	--
avalanche shrub thicket	Vs	--	--
avalanche treed	Vt	--	--
bog wetland	Wb	--	4.1
fen wetland	Wf	2b, 3b	3.6
marsh wetland	Wm	--	--
swamp wetland	Ws	4, 5	36.3
shallow water aquatic	Ww	--	--
herb disclimax	Xh	--	--
shrub disclimax	Xs	--	--
urban	UR	1, 2b, 3a, 3b, 4, 5, 6	4,035.9
grazing zooclimax	Zg	--	--
alkaline meadow	Ga	--	--
mine	Mi	--	--

4.2.3 Dry Mixedwood

TEM results for ecosite phases mapped in the Dry Mixedwood Natural Subregion within the Vegetation RSA are listed in Table 4.2-5. TEM results for all-ecosystem units mapped in the Dry Mixedwood Natural Subregion are listed in Table 4.2-6.

TABLE 4.2-5

ECOSITE PHASES IN THE DRY MIXEDWOOD NATURAL SUBREGION

Ecosite Phase ¹	Code	Structural Stages	Mapped Area (ha)
plains woodworm	aa1	--	--
lichen Pj	a1	--	--
western porcupine grass	bb1	--	--
northern wheat grass	bb2	--	--
blueberry Pj-Aw	b1	2, 2a, 2b, 3a, 3b, 5	87.5
blueberry Aw(Bw)	b2	2a, 2b, 4, 5	51.2
blueberry Aw-Sw	b3	2a, 2b, 5	108.7
blueberry Sw-Pj	b4	--	--
Labrador tea-mesic Pj-Sb	c1	2, 2a, 2b, 3a, 3b, 4, 5	320.8
low-bush cranberry Aw	d1	1, 2, 2a, 2b, 3a, 3b, 4, 5, 6	1,041.8
low-bush cranberry Aw-Sw	d2	1, 2b, 3b, 4, 5, 6	1,136.6
low-bush cranberry Sw	d3	--	--

TABLE 4.2-5 Cont'd

Ecosite Phase ¹	Code	Structural Stages	Mapped Area (ha)
saskatoon-snowberry	d4	--	--
California oatgrass-slender wheat grass	dd1	--	--
dogwood Pb-Aw	e1	1, 2, 2b, 3a, 3b, 4, 5, 6	861.2
dogwood Pb-Sw	e2	2b, 3a, 5, 6	541.8
dogwood Sw	e3	5	1.9
dogwood shrubland	e4	3a	6.5
horsetail Pb-Aw	f1	2b, 3a, 3b, 5, 6	437.0
horsetail Pb-Sw	f2	3b, 5	54.6
horsetail Sw	f3	--	--
horsetail/willow	f4	3a, 3b, 5	37.6
horsetail/Bw	f5	3b, 5	11.6
Labrador tea-subhygic Sb-Pj	g1	2a, 2b, 3a, 4, 5, 6	434.2
saline	g2	--	--
Labrador tea/horsetail Sw-Sb	h1	2b, 3a, 3b, 4, 5, 6	163.6
treed bog	i1	2b, 3b, 4, 5	176.2
shrubby bog	i2	3a, 3b	61.9
treed poor fen	j1	2b, 3a, 3b, 4, 5	389.0
shrubby poor fen	j2	3a, 3b	205.8
grassland poor fen	j3	2, 2a, 2b	72.3
treed rich fen	k1	3b, 5	64.7
shrubby rich fen	k2	2b, 3a, 3b, 4, 5	82.8
graminoid rich fen	k3	2a, 2b, 5	64.3
marsh	l1	2a, 2b, 3b	39.0

Note: 1 Derived from Field Guide to Ecosites of Northern Alberta (Beckingham and Archibald 1996) and Guide to Range Plant Community Types and Carrying Capacity for the Dry and Central Mixedwood Subregions in Alberta, 6th approximation (Willoughby *et al.* 2006).

TABLE 4.2-6

ALL-ECOSYSTEM UNITS IN THE DRY MIXEDWOOD NATURAL SUBREGION

All-Ecosystem Unit	Code	Structural Stages	Mapped Area (ha)
cultivated field	CF	1, 2, 2a, 2b, 3b	3,448.7
active channel flood class	Fa	1, 2, 2a, 2b, 3a	5.4
fringe flood class	Ff	--	--
low bench flood class	Fl	--	--
mid-bench flood class	Fm	--	--
lake	LA	--	170.3
rock cliff	Rc	--	--
pond	PD	--	168.5
river	RI	--	22.9
rock outcrop	Ro	--	--
rural	Ru	1, 2, 2a, 2b, 3a, 3b, 4, 5	962.6
rock talus	Rt	--	--
road	RZ	1, 2, 2b	737.6
tame pasture	TP	2, 2a, 2b, 3a, 3b, 5	2,721.0
avalanche herb meadow	Vh	--	--
avalanche shrub thicket	Vs	--	--
avalanche treed	Vt	--	--
bog wetland	Wb	--	--

TABLE 4.2-6 Cont'd

All-Ecosystem Unit	Code	Structural Stages	Mapped Area (ha)
fen wetland	Wf	--	--
marsh wetland	Wm	2, 2a, 2b	128.7
swamp wetland	Ws	3a, 3b	262.3
shallow water aquatic	Ww	--	--
herb disclimax	Xh	--	--
shrub disclimax	Xs	--	--
urban	UR	1, 2b, 5	55.3
grazing zooclimax	Zg	--	--
alkaline meadow	Ga	--	--
mine	Mi	1, 2, 2b, 3a, 3b, 5	198.3

4.2.4 Lower Foothills

TEM results for ecosite phases mapped in the Lower Foothills Natural Subregion within the Vegetation RSA are listed in Table 4.2-7. TEM results for all-ecosystem units mapped in the Lower Foothills Natural Subregion are listed in Table 4.2-8.

TABLE 4.2-7

ECOSITE PHASES IN THE LOWER FOOTHILLS NATURAL SUBREGION

Ecosite Phase ¹	Code	Structural Stages	Mapped Area (ha)
shrubby grassland	a1	2b, 3a, 3b	14.8
bearberry/lichen PI	b1	2, 3a, 3b, 4, 5, 6	39.7
hairy wild rye PI	c1	2, 2b, 3, 3a, 3b, 4, 5, 6	332.3
hair wild rye Aw	c2	2, 2b, 3a, 3b, 4, 5, 6	642.1
hairy wild rye Aw-Sw-PI	c3	1, 2, 2b, 3a, 3b, 4, 5, 6	1,050.3
hairy wild rye Sw	c4	2, 2b, 4, 5, 6	98.8
Labrador tea-mesic PI-Sb	d1	2, 3a, 3b, 4, 5, 6	125.7
low-bush cranberry PI	e1	2, 2b, 3a, 3b, 4, 5, 6	301.9
low-bush cranberry Aw	e2	1, 2, 2b, 3a, 3b, 4, 5, 6	3,196.4
low-bush cranberry Aw-Sw-PI	e3	1, 2, 2b, 3a, 3b, 4, 5, 6	3,573.2
low-bush cranberry Sw	e4	2, 2b, 3a, 3b, 4, 5, 6	338.1
bracted honeysuckle PI	f1	2, 3a, 3b, 4, 5, 6	155.3
bracted honeysuckle Aw-Pb	f2	2, 2b, 3a, 3b, 4, 5, 6	447.7
bracted honeysuckle Aw-Sw-PI	f3	1, 2, 2b, 3a, 3b, 4, 5, 6	1,479.2
bracted honeysuckle Sw	f4	1, 2, 2b, 3a, 3b, 4, 5, 6	489.8
shrubby meadow	g1	3a, 3b	114.7
forb meadow	g2	2, 2a, 2b	73.1
Labrador tea-subhydric Sb-PI	h1	1, 2, 2b, 3a, 3b, 4, 5, 6	488.4
horsetail Pb-Aw	i1	2, 3a, 3b, 4, 5, 6	93.8
horsetail Pb-Sw	i2	2, 2b, 3a, 3b, 4, 5, 6	647.2
horsetail Sw	i3	2, 3a, 3b, 4, 5, 6	180.2
Labrador tea/horsetail Sb-Sw	j1	1, 2, 2b, 3, 3a, 3b, 4, 5, 6	1,310.8
treed bog	k1	3b, 4, 5	215.7
shrubby bog	k2	3a, 3b	39.3
treed poor fen	l1	1, 2, 2a, 2b, 3, 3a, 3b, 4, 5	1,643.6
shrubby poor fen	l2	2, 3a, 3b	61.0
treed rich fen	m1	2, 2b, 3, 3a, 3b, 4, 5, 6	1,659.8
shrubby rich fen	m2	3a, 3b, 5	283.6

TABLE 4.2-7 Cont'd

Ecosite Phase ¹	Code	Structural Stages	Mapped Area (ha)
graminoid rich fen	m3	2, 2b	175.2
marsh	n1	1, 2, 2b, 3a	105.8

Note: 1 Derived from Field Guide to Ecosites of West-Central Alberta (Beckingham *et al.* 1996).

TABLE 4.2-8

ALL-ECOSYSTEM UNITS IN THE LOWER FOOTHILLS NATURAL SUBREGION

All-Ecosystem Unit	Code	Structural Stages	Mapped Area (ha)
cultivated field	CF	1, 2, 2b, 3a, 3b	2,508.2
active channel flood class	Fa	1	1.1
fringe flood class	Ff	--	--
low bench flood class	Fl	--	--
mid-bench flood class	Fm	6	1.1
lake	LA	--	29.3
rock cliff	Rc	--	--
pond	PD	--	56.0
river	RI	--	51.7
rock outcrop	Ro	--	--
rural	Ru	1, 2, 2b, 3a, 3b, 4, 5, 6	885.5
rock talus	Rt	--	--
road	RZ	1, 2, 2a, 2b, 3a, 3b, 4	1,859.0
tame pasture	TP	1, 2, 2b, 3a, 5, 6	3,428.8
avalanche herb meadow	Vh	--	--
avalanche shrub thicket	Vs	--	--
avalanche treed	Vt	--	--
bog wetland	Wb	2, 4	26.0
fen wetland	Wf	2	0.9
marsh wetland	Wm	2b, 3a, 3b	61.3
swamp wetland	Ws	2, 2b, 3a, 3b, 4, 5, 6	241.5
shallow water aquatic	Ww	1, 2c, 3b	34.0
herb disclimax	Xh	--	--
shrub disclimax	Xs	--	--
urban	UR	1, 2b, 3a, 5, 6	460.3
grazing zooclimax	Zg	2b	--
alkaline meadow	Ga	--	--
mine	Mi	1, 1a	32.0

Limitations of Terrestrial Ecosystem Mapping in Additional Areas of the Lower Foothills Natural Subregion

Limitations encountered in the Edson to Hinton portion of the Edmonton to Hinton Segment of the Vegetation RSA were similar to those encountered in previously mapped parts of the Lower Foothills Natural Subregion. However, in addition, AGRASID data was not available for the Edson to Hinton portion. Mappers used slope position, land cover and professional judgment to infer soil conditions.

4.2.5 Montane

TEM results for ecosite phases mapped in the Montane Natural Subregion within the Vegetation RSA are listed in Table 4.2-9. TEM results for all-ecosystem units mapped in the Montane Natural Subregion are listed in Table 4.2-10.

TABLE 4.2-9

ECOSITE PHASES IN THE MONTANE NATURAL SUBREGION

Ecosite Phase ¹	Code	Structural Stages	Mapped Area (ha)
shrubby grassland	a1	3a	5.6
graminoid grassland	a2	--	--
bearberry Fd	b1	--	--
bearberry PI	b2	--	--
bearberry Aw	b3	3b, 6	2.9
bearberry Aw-Sw-PI	b4	1, 3a, 3b, 5, 6	119.7
bearberry Sw	b5	2b, 3a, 3b, 5, 6	235.5
hairy wild rye Fd	c1	--	--
hair wild rye PI	c2	3a, 5, 6	23.4
hairy wild rye Aw	c3	3a, 3b, 5, 6	106.2
hairy wild rye Aw-Sw-PI	c4	2b, 3a, 3b, 4, 5, 6, 7	1,425.0
hairy wild rye Sw	c5	2b, 3a, 3b, 4, 5, 6, 7	1,006.9
dogwood Pb-Aw	d1	3a, 5, 6	22.7
dogwood Pb-Sw	d2	3a, 3b, 5, 6	112.7
shrubby meadow	e1	3a, 3b, 6	12.0
forb meadow	e2	3a	1.3
horsetail Pb-Aw	f1	3b, 5, 6	42.9
horsetail Sw	f2	3a, 3b, 5, 6, 7	317.8
treed fen	g1	2b, 3a, 3b, 4, 5, 6	357.4
shrubby fen	g2	3a	76.9
graminoid fen	g3	2b	10.1
marsh	h1	2b	8.9

Note: 1 Derived from Field Guide to Ecosites of West-Central Alberta (Beckingham *et al.* 1996).

TABLE 4.2-10

ALL-ECOSYSTEM UNITS IN THE MONTANE NATURAL SUBREGION

All-Ecosystem Unit	Code	Structural Stages	Mapped Area (ha)
cultivated field	CF	2a, 2b	45.5
active channel flood class	Fa	--	--
fringe flood class	Ff	--	--
low bench flood class	Fl	1, 3a, 3b	4.1
mid-bench flood class	Fm	5	10.0
lake	LA	--	1.9
rock cliff	Rc	1	2.7
pond	PD	2c	12.2
river	RI	--	72.0
rock outcrop	Ro	--	--
rural	Ru	1, 2b	89.4
rock talus	Rt	--	--
road	RZ	1, 2b, 3a	245.6
tame pasture	TP	2b, 3b	30.6
avalanche herb meadow	Vh	--	--
avalanche shrub thicket	Vs	--	--
avalanche treed	Vt	--	--
bog wetland	Wb	--	--

TABLE 4.2-10 Cont'd

All-Ecosystem Unit	Code	Structural Stages	Mapped Area (ha)
fen wetland	Wf	--	--
marsh wetland	Wm	--	--
swamp wetland	Ws	--	--
shallow water aquatic	Ww	2c	9.1
herb disclimax	Xh	--	--
shrub disclimax	Xs	--	--
urban	UR	1, 2b	72.4
grazing zooclimax	Zg	--	--
alkaline meadow	Ga	--	--
mine	Mi	1	69.3

Limitations of Terrestrial Ecosystem Mapping in the Montane Natural Subregion

No limitations were encountered for TEM within the Montane Natural Subregion.

4.2.6 Upper Foothills

TEM results for ecosite phases mapped in the Upper Foothills Natural Subregion within the Vegetation RSA are listed in Table 4.2-11. No all-ecosystem units were identified in the Upper Foothills Natural Subregion.

TABLE 4.2-11

ECOSITE PHASES IN THE UPPER FOOTHILLS NATURAL SUBREGION

Ecosite Phase ¹	Code	Structural Stages	Mapped Area (ha)
shrubby grassland	a1	--	--
bearberry/lichen PI	b1	--	--
hairy wild rye PI	c1	--	--
hair wild rye Aw	c2	5	34.5
hairy wild rye Aw-Sw-PI	c3	--	--
hairy wild rye Sw	c4	--	--
Labrador tea-mesic PI-Sb	d1	--	--
tall bilberry/arnica PI	e1	--	--
tall bilberry/arnica Aw-Sw-PI	e2	5	53.4
tall bilberry/arnica Sw	e3	5	4.4
tall bilberry/arnica Fa	e4	--	--
bracted honeysuckle PI	f1	--	--
bracted honeysuckle Pb	f2	--	--
bracted honeysuckle Pb-Sw-PI	f3	--	--
bracted honeysuckle Sw	f4	--	--
bracted honeysuckle Fa	f5	--	--
bracted honeysuckle willow	f6	--	--
shrubby meadow	g1	--	--
forb meadow	g2	--	--
Labrador tea-subhydric Sb-PI	h1	--	--
Labrador tea/horsetail Sb-Sw	i1	--	--
horsetail Sw	j1	--	--
treed bog	k1	--	--
shrubby bog	k2	--	--
treed poor fen	l1	--	--
shrubby poor fen	l2	--	--

TABLE 4.2-11 Cont'd

Ecosite Phase ¹	Code	Structural Stages	Mapped Area (ha)
graminoid poor fen	l3	--	--
treed rich fen	m1	--	--
shrubby rich fen	m2	--	--
graminoid rich fen	m3	--	--

Note: 1 Derived from Field Guide to Ecosites of West-Central Alberta (Beckingham *et al.* 1996).

Limitations of Terrestrial Ecosystem Mapping in the Upper Foothills Natural Subregion

Within the Vegetation RSA, the Upper Foothills Natural Subregion comprises a limited area of approximately 92 ha. No limitations were encountered for TEM within the Upper Foothills.

4.3 Terrestrial Ecosystem Mapping Results for British Columbia

4.3.1 Thompson Very Dry Hot Bunchgrass (BGxh2)

TEM results for site series mapped in the BGxh2 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-1. TEM results for all-ecosystem units mapped in the BGxh2 BGC subzone variant are listed in Table 4.3-2.

TABLE 4.3-1

SITE SERIES IN THE BGxh2

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stages	Potential to Support REC	Mapped Area (ha)
Big sage – Bluebunch wheatgrass	01	d, j, k	c, w	1, 2b, 3a	yes	657.0
Bluebunch wheatgrass – Selaginella	02	s, w	k, q, z	1, 2b, 3a	--	141.0
Py – Red three-awn	03	d	q, z	1, 3b, 5, 6	yes	20.7
Py – Bluebunch wheatgrass	04	d	k, w	1, 3a, 3b, 4, 5, 6	yes	80.1
Big sage – Needle-and-thread grass	05	d	k, w	1, 2b, 3a	--	246.1
Rough fescue – Bluebunch wheatgrass	06	d	k	1, 2, 2b, 3a	yes	106.4
Act – Snowberry - Dogwood	07	d	c, k	2, 3, 3a, 3b, 5	yes	43.7
Woolly sedge – Arctic rush	08	d	w	2, 2b	yes	1.4

Note: 1 Derived from A Guide to Site Identification and Interpretation for the Kamloops Forest Region Land Management Handbook No. 23 (Lloyd *et al.* 1990).

TABLE 4.3-2

ALL-ECOSYSTEM UNITS IN THE BGxh2

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stages	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	c	2	--	16.1
active channel flood class	Fa	--	--	1, 2	--	0.1
fringe flood class	Ff	--	c	2, 3a, 3b	--	3.5
low bench flood class	Fl	--	--	--	--	--
mid-bench flood class	Fm ¹	--	--	--	yes	--
lake	LA	--	--	--	--	--
rock cliff	Rc	s	--	--	--	3.8
pond	PD	--	--	--	--	0.9
river	RI	--	--	--	--	148.1
rock outcrop	Ro	s	k, q, w, z	1	--	30.5

TABLE 4.3-2 Cont'd

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stages	Potential to Support REC	Mapped Area (ha)
rural	Ru	--	c	1,2, 2b, 3, 5	--	138.9
rock talus	Rt	s	k, w, z	1, 2b, 3a, 3b	--	7.8
road	RZ	--	--	1	--	29.3
tame pasture	TP	--	c	2	--	6.8
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf	--	--	--	--	--
marsh wetland	Wm ¹	--	--	2b	yes	0.2
swamp wetland	Ws	--	--	--	--	--
shallow water aquatic	Ww	--	--	--	--	--
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	c	1, 2, 2b, 5	--	438.3
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga ²	--	--	--	yes	--
mine	Mi	--	w	1, 2	--	34.6

- Notes:**
- 1 The following wetland types are known to support RECs within the BGxh2 variant: Cottonwood – Snowberry – Rose (Fm01); Swamp horsetail – Beaked sedge (Wm02); Cattail (Wm05); and Great bulrush (Wm06) (BC CDC 20152015).
 - 2 The following alkaline meadow types are known to support RECs within the BGxh2 variant: Field sedge (Gs03) (BC CDC 20152015).

4.3.2 Nicola Very Dry Warm Bunchgrass (BGxw1)

TEM results for site series mapped in the BGxw1 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-3. TEM results for all-ecosystem units mapped in the BGxw1 BGC subzone variant are listed in Table 4.3-4.

TABLE 4.3-3

SITE SERIES IN THE BGxw1

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stages	Potential to Support REC	Mapped Area (ha)
Bluebunch wheatgrass – junegrass	01	d, j, k	f,w	1, 2, 2b, 3a, 3b	yes	1,437.6
Bluebunch wheatgrass – Selaginella	02	s, w	k	2, 2b, 3a	--	131.7
Py – Bluebunch wheatgrass	03	d	k, s, w	2b, 3a, 3b, 4, 5, 6	yes	240.8
Big sage – Bluebunch wheatgrass	04	d	k, w	1, 2, 2b, 3a	yes	320.1
Py – Rough fescue – Bluebunch wheatgrass	05	d	k, w	2, 2b, 3, 3b, 4, 5, 6	yes	432.8
Rough fescue – Bluebunch wheatgrass	06	d	k, w	2, 2b, 3, 3a, 3b, 6	yes	184.1
Giant wildrye	07	d	f	2, 2b	yes	50.7
At – Snowberry - Kentucky bluegrass	08	d	c, f	2, 2b, 3, 3a, 3b, 4, 5	yes	163.8
Salt grass – Sedge	09	d	--	2, 2b	--	4.6

- Note:**
- 1 Derived from A Guide to Site Identification and Interpretation for the Kamloops Forest Region Land Management Handbook No. 23 (Lloyd *et al.* 1990).

TABLE 4.3-4

ALL-ECOSYSTEM UNITS IN THE BGxw1

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stages	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	f	2, 2b	--	497.0
active channel flood class	Fa	--	c	1	--	3.1
fringe flood class	Ff	--	c	2, 3a	--	0.1
low bench flood class	Ff ¹	--	--	2, 3, 3b	yes	16.2
mid-bench flood class	Fm ¹	--	--	2, 3, 3b, 5, 6	yes	79.1
lake	LA	--	--	--	--	8.3
rock cliff	Rc	s	d, w	1	--	0.8
pond	PD	--	--	--	--	1.0
river	RI	--	--	--	--	24.6
rock outcrop	Ro	s	w	1	--	23.7
rural	Ru	--	f	1, 2, 2b, 3a, 5, 6	--	55.8
rock talus	Rt	s	--	1, 3	--	2.7
road	RZ	--	--	1	--	86.7
tame pasture	TP	--	f	1, 2, 2b, 3	--	144.4
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf	--	--	--	--	--
marsh wetland	Wm ¹	--	--	2, 2b, 3b, 5	yes	10.9
swamp wetland	Ws ¹	--	--	3b	yes	4.9
shallow water aquatic	Ww	--	--	2	--	1.7
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	c,f	1, 2, 2b, 3b, 5	--	189.4
grazing zooclimax	Zg	--	--	2, 3a	--	78.6
alkaline meadow	Ga ²	--	--	--	yes	--
mine	Mi	--	--	1	--	2.0

- Notes:**
- 1 The following wetland types are known to support RECs within the BGxw1 variant: Sandbar willow (Ff06); Cottonwood – Snowberry – Rose (Fm01); Field sedge (Gs03); Awnead sedge (Wm03); Cattail (Wm05); Great bulrush (Wm06); Baltic rush (Wm07); and Bebb’s willow – Bluejoint (Ws03) (BC CDC 2015).
 - 2 The following alkaline meadow types are known to support RECs within the BGxw1 variant: Field sedge (Gs03) (BC CDC 2015).

Limitations of Terrestrial Ecosystem Mapping in the BGxw1 Variant

Limitations encountered in the newly mapped BGxw1 segments of the Vegetation RSA were similar to those encountered in previously mapped portions of the BGxw1. However, only black and white imagery was available for the additional segments, limiting interpretation.

4.3.3 Undifferentiated and Parkland Coastal Mountain-Heather Alpine (CMAunp)

TEM results for site series in the CMAunp BGC subzone variant mapped within the Vegetation RSA are listed in Table 4.3-5. No all-ecosystem units were identified in the CMAunp BGC subzone variant.

TABLE 4.3-5
SITE SERIES IN THE CMAunp

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stages	Potential to Support REC	Mapped Area (ha)
Alpine fellfield	Af	--	--	3a	--	1.3
Alpine grassland	Ag	--	--	--	--	--
Alpine heath	Ah	--	--	2	--	14.4
Alpine meadow	Am	--	--	--	--	--
Alpine nivation	As	--	--	--	--	--
Alpine tundra	At	--	--	--	--	--
Zoogenic alpine	Az	--	--	--	--	--
Alpine wetland	Wa	--	--	--	--	--

Note: 1 Derived from Biogeoclimatic Ecosystem Classification of Non-Forested Ecosystems in British Columbia Technical Report 068 (MacKenzie 2012).

4.3.4 *Dry Maritime Coastal Western Hemlock (CWHdm)*

TEM results for site series mapped in the CWHdm BGC subzone variant within the Vegetation RSA are listed in Table 4.3-6. TEM results for all-ecosystem units mapped in the CWHdm BGC subzone variant are listed in Table 4.3-7.

TABLE 4.3-6
SITE SERIES IN THE CWHdm

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stages	Potential to Support REC	Mapped Area (ha)
Hw – Flat moss	01	d, j, k	k, q, s, w	2b, 3a, 3b, 4, 5, 6, 7	yes	856.8
FdPl – Cladina	02	s, w	--	--	yes	--
FdHw – Salal	03	d	--	5, 6, 7	yes	30.7
Fd – Sword fern	04	d	--	--	yes	--
Cw – Sword fern	05	d	c, k, q, w	2, 3a, 3b, 4, 5, 6, 7	yes	1,001.1
HwCw – Deer fern	06	d	c, q, w	4, 5, 6	yes	79.9
Cw – Foamflower	07	d	k, q	2b, 3a, 3b, 4, 5, 6	yes	443.5
Ss – Salmonberry	08	d	--	3b, 5, 6	yes	50.3
Act – Red-osier dogwood	09	d	--	3b, 5, 6	yes	4.5
Act – Willow	10	d	--	2c, 3a, 3b, 6	yes	55.3
Pl – Sphagnum	11	d	--	--	--	--
CwSs – Skunk cabbage	12	d	--	--	yes	--
Cw – Salmonberry	13	d	--	5	yes	14.6
Cw – Black twinberry	14	d	--	--	yes	--
Cw – Slough sedge	15	d	--	3a	yes	2.8

Note: 1 Derived from A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region Land Management Handbook No. 28 (Green and Klinka 1994).

TABLE 4.3-7

ALL-ECOSYSTEM UNITS IN THE CWHdm

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	2, 2b	--	1,207.1
active channel flood class	Fa	--	--	--	--	--
fringe flood class	Ff	--	--	1	--	0.6
low bench flood class	Fl	--	--	3b, 4, 5, 6	--	49.7
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	--
rock cliff	Rc	s	--	--	--	--
pond	PD	--	--	--	--	4.6
river	RI	--	--	--	--	507.6
rock outcrop	Ro	s	--	--	--	--
rural	Ru	--	w	1, 2, 2b, 5, 6	--	444.9
rock talus	Rt	s	--	1	--	0.9
road	RZ	--	--	1	--	241.6
tame pasture	TP	--	--	--	--	--
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	q	3b	--	6.4
avalanche treed	Vt	--	q	4	--	9.0
bog wetland	Wb ¹	--	--	2, 3a, 3b	yes	71.4
fen wetland	Wf	--	--	--	--	--
marsh wetland	Wm ¹	--	--	2, 2c, 3a, 3b	yes	65.2
swamp wetland	Ws ¹	--	--	3a, 3b	yes	2.3
shallow water aquatic	Ww	--	--	2c	--	6.7
herb disclimax	Xh	--	--	2	--	0.9
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	1, 2b, 3a, 5, 6	--	2,566.0
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	1	--	71.6
Ocean	Oc	--	--	--	--	212.6

Note: 1 The following wetland types are known to support RECs within the CWHdm variant: Labrador tea – Bog-laurel – Peat-moss (Wb50); Common spike-rush (Wm04); Cattail (Wm05); and Sitka willow – Pacific willow – Skunk cabbage (Ws51) (BC CDC 2015).

4.3.5 Southern Dry Submaritime Coastal Western Hemlock (CWHds1)

TEM results for site series mapped in the CWHds1 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-8. TEM results for all-ecosystem units mapped in the CWHds1 BGC subzone variant are listed in Table 4.3-9.

TABLE 4.3-8

SITE SERIES IN THE CWHds1

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
HwFd – Cat’s-tail moss	01	d, j, k	c, k, s, q, w, z	1, 2, 3a, 3b, 4, 5, 6, 7	yes	2,334.7
FdPI – Kinnikinnick	02	s, w	k, s, q, z	4, 5, 6	yes	131.4
FdHw – Falsebox	03	d	k, s, q, c, w,	1, 2, 2b, 3a, 3b, 4, 5, 6, 7	yes	1,294.5

TABLE 4.3-8 Cont'd

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
Fd – Fairybells	04	d	c, k, s, q, z	2b, 3a, 3b, 4, 5, 6, 7	yes	523.3
Cw – Solomon's-seal	05	d	c, k, q, s, w, z	2b, 3a, 3b, 4, 5, 6, 7	yes	1,728.3
Hw – Queen's cup	06	d	s, q, w, z	3a, 3b, 4, 5, 6, 7	yes	99.2
Cw – Devil's club	07	d	k, q, w	2b, 3a, 3b, 4, 5, 6, 7	yes	528.1
Ss – Salmonberry	08	d	c	4, 5, 6	yes	39.1
Act – Red-osier dogwood	09	d	c	2b, 3a, 3b, 4, 5, 6	yes	870.1
Act – Willow	10	d	--	2b, 3a, 3b, 4, 5, 6	yes	123.6
PI – Sphagnum	11	d	--	--	--	--
CwSs – Skunk cabbage	12	d	--	3b	yes	3.5

Note: 1 Derived from A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region Land Management Handbook No. 28 (Green and Klinka 1994).

TABLE 4.3-9

ALL-ECOSYSTEM UNITS IN THE CWHds1

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	2a, 2b	--	536.4
active channel flood class	Fa	--	--	1	--	19.8
fringe flood class	Ff	--	--	2, 3a, 3b	--	14.3
low bench flood class	Fl	--	--	--	--	--
mid-bench flood class	Fm	--	--	4	--	1.4
lake	LA	--	--	--	--	69.0
rock cliff	Rc	s	q, z	1	--	22.8
pond	PD	--	--	--	--	9.9
river	RI	--	--	--	--	1,187.9
rock outcrop	Ro	s	c, q, w, z,	1	--	29.1
rural	Ru	--	c, w	1, 2, 2a, 2b, 3a, 4, 5	--	315.6
rock talus	Rt	s	k, q, w, z,	1, 3b	--	65.7
road	RZ	--	--	1, 1b	--	455.0
tame pasture	TP	--	--	--	--	--
avalanche herb meadow	Vh	--	q	--	--	5.0
avalanche shrub thicket	Vs	--	k, q	2d, 3a, 3b	--	19.3
avalanche treed	Vt	--	--	3b, 4	--	2.7
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf	--	--	2b	--	11.5
marsh wetland	Wm ¹	--	--	2b, 2c	yes	17.9
swamp wetland	Ws ¹	--	--	3a, 3b	yes	29.5
shallow water aquatic	Ww	--	--	--	--	--
herb disclimax	Xh	--	--	2b	--	7.1
shrub disclimax	Xs	--	z	3a	--	23.5
urban	UR	--	--	--	--	251.5

TABLE 4.3-9 Cont'd

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	1	--	61.7

Note: 1 The following wetland types are known to support RECs within the CWHds1 variant: Common spike-rush (Wm04); and Sitka willow – Pacific willow – Skunk cabbage (Ws51) (BC CDC 2015).

Limitations of Terrestrial Ecosystem Mapping in the CWHds1 Variant

Limitations encountered in the newly mapped portion of the Vegetation RSA were similar to those encountered in previously mapped parts of the CWHds1. However, in addition, only black and white, older imagery was available for a portion of these additional segments.

4.3.6 Southern Moist Submaritime Coastal Western Hemlock (CWHms1)

TEM results for site series mapped in the CWHms1 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-10. TEM results for all-ecosystem units mapped in the CWHms1 BGC subzone variant are listed in Table 4.3-11.

TABLE 4.3-10

SITE SERIES IN THE CWHms1

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
HwBa – Step moss	01	d, j, k	c, s, k, q, w, z	2, 3a, 3b, 4, 5, 6, 7	yes	556.2
FdPI – Kinnikinnick	02	s, w	q, s, z	2, 3a, 3b, 4, 5, 6, 7	yes	174.6
FdHw – Falsebox	03	d	k, s, w, q, w, z	2, 3a, 3b, 4, 5, 6, 7	yes	1,412.5
BaCw – Oak fern	04	d	s	5, 7	yes	12.8
HwBa – Queen's cup	05	d	k, s, w, q, z	2, 3a, 3b, 4, 5, 6, 7	--	97.3
BaCw – Devil's club	06	d	s, z	5, 6, 7	yes	15.5
Ss – Salmonberry	07	d	--	6	yes	4.4
Act – Red-osier dogwood	08	d	--	6	yes	0.8
Act – Willow	09	d	--	--	yes	--
PI – Sphagnum	10	d	--	--	--	--
CwSs – Skunk cabbage	11	d	--	--	yes	--

Note: 1 Derived from A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region Land Management Handbook No. 28 (Green and Klinka 1994).

TABLE 4.3-11

ALL-ECOSYSTEM UNITS IN THE CWHms1

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	--	--	--
active channel flood class	Fa	--	--	1	--	4.7
fringe flood class	Ff	--	--	6	--	2.0
low bench flood class	Fl	--	--	--	--	--
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	1.0
rock cliff	Rc	s	q	1, 2, 3a, 3b	--	63.5
pond	PD	--	--	--	--	--
river	RI	--	--	--	--	25.9
rock outcrop	Ro	s	--	1	--	6.3
rural	Ru	--	--	--	--	--
rock talus	Rt	s	s, q, w, z	1, 2, 3a, 3b	--	118.6
road	RZ	--	--	1	--	94.4
tame pasture	TP	--	--	--	--	--
avalanche herb meadow	Vh	--	s	3a, 3b	--	3.5
avalanche shrub thicket	Vs	--	s, w, q	3a, 3b	--	221.1
avalanche treed	Vt	--	--	3a, 6, 7	--	15.2
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf	--	--	--	--	--
marsh wetland	Wm ¹	--	--	--	yes	--
swamp wetland	Ws ¹	--	--	--	yes	--
shallow water aquatic	Ww	--	--	--	--	--
herb disclimax	Xh	--	--	2	--	1.2
shrub disclimax	Xs	--	z	3a, 3b	--	11.2
urban	UR	--	--	--	--	--
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	--	--	--

Note: 1 The following wetland types are known to support RECs within the CWHms1 variant: Common spike-rush (Wm04); and Sitka willow – Pacific willow – Skunk cabbage (Ws51) (BC CDC 2015).

Limitations of Terrestrial Ecosystem Mapping in the CWHms1 Variant

Limitations encountered in the newly mapped portion of the Vegetation RSA included a section of older, black and white imagery, which added some difficulty in imagery interpretation, especially for shallow soil areas. Some areas had snow cover, limiting the interpretation.

4.3.7 Eastern Very Dry Maritime Coastal Western Hemlock (CWHxm1)

TEM results for site series mapped in the CWHxm1 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-12. TEM results for all-ecosystem units mapped in the CWHxm1 BGC subzone variant are listed in Table 4.3-13.

TABLE 4.3-12
SITE SERIES IN THE CWHxm1

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
HwFd – Kindbergia	01	d, j, k	--	1, 2, 2b, 3, 3a, 3b, 4, 5, 6	yes	969.7
FdPI – Cladina	02	s, w	z	5	yes	1.3
FdHw – Salal	03	d	--	--	yes	--
Fd – Sword fern	04	d	w, z	3, 3b, 5	yes	20.4
Cw – Sword fern	05	d	k, q, w, z	2, 3, 3b, 4, 5, 6	yes	832.5
HwCw – Deer fern	06	d	--	5	yes	6.7
Cw – Foamflower	07	d	k, w	3, 3a, 3b, 4, 5, 6	yes	773.6
Ss – Salmonberry	08	d	--	3, 3a, 3b, 5, 6	yes	100.8
Act – Red-osier dogwood	09	d	--	3, 3b, 5, 6	yes	77.4
Act – Willow	10	d	--	3, 3a, 3b, 4, 5	yes	66.4
PI – Sphagnum	11	d	--	3b	yes	18.9
CwSs – Skunk cabbage	12	d	--	3, 3a, 3b, 5, 6	yes	78.4
Cw – Salmonberry	13	d	--	3, 3a	yes	29.9
Cw – Black twinberry	14	d	--	--	yes	--
Cw – Slough sedge	15	d	--	--	yes	--

Note: 1 Derived from A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region Land Management Handbook No. 28 (Green and Klinka 1994).

TABLE 4.3-13
ALL-ECOSYSTEM UNITS IN THE CWHxm1

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	1, 2, 2b, 3, 3a, 3b, 4, 5	--	5,556.6
active channel flood class	Fa	--	--	1	--	1.1
fringe flood class	Ff	--	--	3	--	3.5
low bench flood class	Fl	--	--	2	--	1.1
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	1.9
rock cliff	Rc	s	--	--	--	--
pond	PD	--	--	--	--	44.2
river	RI	--	--	--	--	225.1
rock outcrop	Ro	s	--	1	--	1.7
rural	Ru	--	--	1, 2, 2a, 2b, 3, 3a, 3b, 4, 5	--	1,652.0
rock talus	Rt	s	--	--	--	--
road	RZ	--	--	1	--	143.3
tame pasture	TP	--	--	1, 2, 2b, 3, 3a, 3b, 5	--	1,134.8
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb ¹	--	--	--	yes	--
fen wetland	Wf ¹	--	--	2, 3, 3a, 3b	yes	35.2
marsh wetland	Wm ¹	--	--	1, 2, 3, 3a, 3b	yes	96.5
swamp wetland	Ws ¹	--	--	3	yes	4.1
shallow water aquatic	Ww	--	--	--	--	--

TABLE 4.3-13 Cont'd

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	3a, 3b	--	7.0
urban	UR	--	--	1, 2, 2b, 3, 3a,3b, 5	--	2,075.1
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	1, 2	--	19.1

Note: 1 The following wetland types are known to support RECs within the CWHxm1 variant: Labrador tea – Bog-laurel – Peat-moss (Wb50); Sweet gale – Sitka sedge (Wf52); Slender sedge – White beak-rush (Wf53); Common spike-rush (Wm04); Cattail (Wm05); Great bulrush (Wm06); Sitka sedge – Hemlock-parsley (Wm50); Sitka willow – Pacific willow – Skunk cabbage (Ws51); and Western redcedar – Sword fern – Skunk cabbage (Ws53) (BC CDC 2015).

Limitations of Terrestrial Ecosystem Mapping in the CWHxm1 Variant

Limitations encountered in the newly mapped portions of the Vegetation RSA were similar to those encountered in previously mapped parts of the CWHxm1. Some of the imagery used in the mapping was of higher quality than for the previous work.

4.3.8 Roush Moist Mild Engelmann Spruce - Subalpine Fir (ESSFmm1)

TEM results for site series mapped in the ESSFmm1 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-14. TEM results for all-ecosystem units mapped in the ESSFmm1 BGC subzone variant are listed in Table 4.3-15.

TABLE 4.3-14

SITE SERIES IN THE ESSFmm1

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
Bl – Azalea – Gooseberry	01	d, j, k	k	3a, 5, 6	--	41.2
Bl – Huckleberry – Feathermoss	02	s, w	--	3b, 6	--	0.6
BlPI – Cladina	03	d	--	5	yes	0.1
Bl – Azalea – Rhododendron	04	d	k, q	3b, 4, 5, 6	--	24.0
Bl – Oak fern – Bramble	05	d	--	--	--	--
Bl – Devil's club – Lady fern	06	d	--	--	--	--
Bl – Labrador tea – Horsetail	07	d	--	--	--	--

Note: 1 Derived from Draft Land Management Handbook No. 15 Update for the ESSFmm1 (BC Ministry of Forests, Lands and Natural Resource Operations [BC MFLNRO] 2007a).

TABLE 4.3-15

ALL-ECOSYSTEM UNITS IN THE ESSFmm1

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	--	--	--
active channel flood class	Fa	--	--	--	--	--
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	--	--	--	--
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	--

TABLE 4.3-15 Cont'd

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
rock cliff	Rc	s	--	--	--	--
pond	PD	--	--	--	--	--
river	RI	--	--	--	--	--
rock outcrop	Ro	s	--	1	--	0.8
rural	Ru	--	--	--	--	--
rock talus	Rt	s	w	1	--	0.1
road	RZ	--	--	--	--	--
tame pasture	TP	--	--	--	--	--
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	3b	--	3.0
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf	--	--	--	--	--
marsh wetland	Wm	--	--	--	--	--
swamp wetland	Ws	--	--	--	--	--
shallow water aquatic	Ww	--	--	--	--	--
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	--	--	--
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	--	--	--

4.3.9 Moist Warm Engelmann Spruce - Subalpine Fir (ESSFmw)

TEM results for site series mapped in the ESSFmw BGC subzone variant within the Vegetation RSA are listed in Table 4.3-16. TEM results for all-ecosystem units mapped in the ESSFmw BGC subzone variant are listed in Table 4.3-17.

TABLE 4.3-16

SITE SERIES IN THE ESSFmw

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
BIa – Rhododendron	01	d, j, k	k, w	3b, 4, 5, 6, 7	--	138.3
BIPI – Juniper – Rhacomitrium	02	s, w	z	3b, 6	--	2.6
Fd – Falsebox – Pinegrass	03	d	--	3b	--	1.6
BI – Huckleberry – Falsebox	04	d	w	3b, 4, 5, 6	--	43.2
BIa – Azalea – Pipecleaner moss	05	d	--	6, 7a	--	6.1
BI – Gooseberry – Valerian	06	d	--	--	--	--
BIa – Oak fern – Lady fern	07	d	--	--	--	--
BI – Gooseberry – Horsetail	08	d	--	--	--	--

Note: 1 Derived from A Guide to Site Identification and Interpretation for the Kamloops Forest Region Land Management Handbook No. 23 (Lloyd *et al.* 1990).

TABLE 4.3-17

ALL-ECOSYSTEM UNITS IN THE ESSFmw

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	--	--	--
active channel flood class	Fa	--	--	--	--	--
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	--	--	--	--
mid- bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	--
rock cliff	Rc	s	w	1	--	0.4
pond	PD	--	--	--	--	--
river	RI	--	--	--	--	--
rock outcrop	Ro	s	w	1, 5	--	6.7
rural	Ru	--	--	--	--	--
rock talus	Rt	s	q, w	1	--	3.3
road	RZ	--	--	1	--	15.3
tame pasture	TP	--	--	--	--	--
avalanche herb meadow	Vh	--	--	2a	--	6.0
avalanche shrub thicket	Vs	--	k	3a, 3b	--	11.9
avalanche treed	Vt	--	--	5, 6	--	2.1
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf ¹	--	--	--	yes	--
marsh wetland	Wm ¹	--	--	--	yes	--
swamp wetland	Ws	--	--	--	--	--
shallow water aquatic	Ww	--	--	--	--	--
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	--	--	--
grazing zood climax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	--	--	--

Note: 1 The following wetland types are known to support RECs within the ESSFmw variant: Narrow-leaved cotton-grass – Shore sedge (Wf13); and Swamp horsetail – Beaked sedge (Wm02) (BC CDC 2015).

4.3.10 Cascade Moist Warm Engelmann Spruce - Subalpine Fir (ESSFmw1)

TEM results for site series mapped in the ESSFmw1 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-18. TEM results for all-ecosystem units mapped in the ESSFmw1 BGC subzone variant are listed in Table 4.3-19.

TABLE 4.3-18

SITE SERIES IN THE ESSFmw1

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
BIBa – Rhododendron – Five-leaved bramble	01.1	d	w	3a, 3b, 5, 6	--	69.9
BIBa – Huckleberry – Five-leaved bramble	01.2	j, d	k	3a, 3b, 5, 6	--	429.9
PI – Juniper – Kinnikinnick	02	s, j, c	z	5, 6	--	8.3
PIFd – Falsebox – Pinegrass	03	z, c, d	--	--	--	--
BI – Huckleberry – Grouseberry	04	c, d	--	5, 6	--	9.7
BI – Gooseberry – Valerian	05	j, d	--	3a, 6	--	16.9

TABLE 4.3-18 Cont'd

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
Se – Horsetail	06	d	--	--	--	--
Alder – Lady fern	Av01	q, c	--	--	--	--
Alder – Thimbleberry	Av03	c	--	--	--	--
Cow parsnip – Hellebore	Av08	j	--	--	--	--
Fireweed – Bluejoint reedgrass	Av09	j	--	--	--	--
Rock-moss – Clad lichens	Rt03	s	--	--	--	--
Juniper– Kinnikinnick – Subalpine fir	Ro05	s, j, c	--	--	--	--
Grouseberry – Clad lichens	Ro10	s, j, c	--	--	--	--

Note: 1 Derived from Draft Site Classification for the 52 Biogeoclimatic Units in the Southern Interior Forest Region (Lloyd *et al.* 2005).

TABLE 4.3-19

ALL-ECOSYSTEM UNITS IN THE ESSFmw1

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	--	--	--
active channel flood class	Fa	--	--	--	--	--
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	--	--	--	--
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	--
rock cliff	Rc	s	--	--	--	--
pond	PD	--	--	--	--	--
river	RI	--	--	--	--	--
rock outcrop	Ro	s	w	1	--	1.3
rural	Ru	--	--	--	--	--
rock talus	Rt	s	z	1	--	5.9
road	RZ	--	k, w	1	--	12.7
tame pasture	TP	--	--	--	--	--
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	5	--	2.2
bog wetland	Wb	--	--	3b, 5	--	2.1
fen wetland	Wf	--	--	--	--	--
marsh wetland	Wm	--	--	--	--	--
swamp wetland	Ws	--	--	--	--	--
shallow water aquatic	Ww	--	--	--	--	--
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	k, w, q	3, 3a, 3b	--	51.0
urban	UR	--	--	--	--	--
grazing zooclimax	Zg	--	--	3b	--	0.2
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	--	--	--

4.3.11 Northern Monashee Wet Cold Engelmann Spruce - Subalpine Fir (ESSFwc2)

TEM results for site series mapped in the ESSFwc2 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-20. No all-ecosystem units were identified in the ESSFwc2 BGC subzone variant.

TABLE 4.3-20

SITE SERIES IN THE ESSFwc2

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
Bl – Azalea – Oak fern	01	d, j, k	--	3a, 6	--	16.1
Bl – Huckleberry – Heron's- bill moss	02	s, w	--	--	--	--
Bl – Rhododendron – Heron's-bill moss	03	d	--	--	--	--
Bl – Valerian – Oak fern	04	d	--	--	--	--
Grouseberry – Clad lichens	05	d	--	--	--	--
Bl – Lady fern – Oak fern	06	d	--	--	--	--
Bl – Valerian – Arrow-leaved groundsel	07	d	--	--	--	--
Pl – Dwarf blueberry – Peat-moss	08	d	--	--	--	--
Bl – Horsetail	09	d	--	--	yes	--
Bl – Bluejoint	10	d	--	--	--	--
Rocktripe lichens – Rock-moss	72	s	--	--	--	--
Huckleberry – Rock-moss	73	s	--	--	--	--
Alder – Showy sedge	74	--	--	--	--	--
Alder – Lady fern	75	--	--	--	--	--
Willow – Mitrewort	76	--	--	--	--	--
Valerian – Showy sedge	77	--	--	--	--	--
Bluejoint – Fireweed	78	--	--	--	--	--
Lady fern – Hellebore	79	--	--	--	--	--
Valerian – Subalpine daisy	92	--	--	--	--	--

Note: 1 Derived from Draft Site Classification for the 52 Biogeoclimatic Units in the Southern Interior Forest Region (Lloyd *et al.* 2005).

4.3.12 North Thompson Dry Warm Interior Cedar - Hemlock (ICHdw3)

TEM results for site series mapped in the ICHdw3 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-21. TEM results for all-ecosystem units mapped in the ICHdw3 BGC subzone variant are listed in Table 4.3-22.

TABLE 4.3-21

SITE SERIES IN THE ICHdw3

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
FdCwHw – Falsebox – Feathermoss	01	d, j, k	c, k, s, q, w, z	2, 3, 3a, 3b, 4, 5, 6, 7	--	2,868.6
FdPl – Falsebox – Pinegrass	02	s, w	c, q, w	2, 3, 5, 7	--	49.6
FdPl – Falsebox – Feathermoss	03	d	c, s, q, w, z	1, 2, 3, 3a, 3b, 4, 5, 6, 7	--	2,001.6
CwHw – Oak fern	04	d	c, k, s, q, w	1, 2, 2b, 3a, 3b, 4, 5, 6, 7	--	769.1
Act – Dogwood – Lady fern	05	d	s	2, 3, 3b, 4, 5, 6, 7	--	288.7
CwSx – Devil's club – Lady fern	06	d	--	3, 3b, 5, 6, 7	--	71.2
CwSxw – Skunk cabbage	07	d	--	3, 3b, 5, 6	--	39.6
Aspen – Awned haircap moss	72	s	--	--	--	--
Heron's-bill moss – Clad lichens	73	s	w	2	--	3.8
\$EpAt – Falsebox – Thimbleberry	01ys	d	q, w	6, 7	--	106.1
\$At – Soopollallie – Pinegrass	03ys	d	s, w, z	5, 6	--	158.0

Note: 1 Derived from Draft Site Classification for the 52 Biogeoclimatic Units in the Southern Interior Forest Region (Lloyd *et al.* 2005).

TABLE 4.3-22

ALL-ECOSYSTEM UNITS IN THE ICHdw3

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	2b	--	28.0
active channel flood class	Fa	--	--	--	--	--
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	--	3, 3b	--	18.0
mid-bench flood class	Fm	--	--	6	--	0.5
lake	LA	--	--	--	--	9.6
rock cliff	Rc	s	--	--	--	--
pond	PD	--	--	--	--	8.0
river	RI	--	--	--	--	518.1
rock outcrop	Ro	s	w	2	--	4.1
rural	Ru	--	--	1, 2	--	18.7
rock talus	Rt	s	--	--	--	--
road	RZ	--	--	1, 2	--	222.4
tame pasture	TP	--	--	2, 2b	--	59.5
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	3b	--	3.7
fen wetland	Wf	--	--	2, 3, 3a, 3b	--	70.8
marsh wetland	Wm	--	--	2	--	74.7
swamp wetland	Ws ¹	--	--	2, 3a, 3b, 6	yes	151.8
shallow water aquatic	Ww	--	--	--	--	--
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	--	--	--
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	1, 2, 3	--	6.2

Note: 1 The following wetland type is known to support RECs within the ICHdw3 variant: Sitka willow – Pacific willow – Skunk cabbage (Ws51) (BC CDC 2015).

4.3.13 Thompson Moist Cool Interior Cedar - Hemlock (ICHmk2)

TEM results for site series mapped in the ICHmk2 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-23. No all-ecosystem units were identified in the ICHmk2 BGC subzone variant.

TABLE 4.3-23

SITE SERIES IN THE ICHmk2

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
CwSxw – Falsebox – Knight's plume	01	d, j, k	j, k, w,	3a, 3b, 4, 5, 6	yes	135.6
FdPI – Pinegrass – Kinnikinnick	02	s, w	--	--	--	--
FdPI – Falsebox – Pinegrass	03	d	--	--	--	--
FdPI – Falsebox – Feathermoss	04	d	w	3a, 3b, 5, 6	yes	32.3
CwSxw – Oak fern – Bunchberry	05	d	--	--	yes	--
CwSxw – Devil's club – Oak fern	06	d	--	--	--	--
Sxw – Horsetail	07	d	--	--	--	--
Heron's-bill moss – Clad lichens	72	s	--	--	--	--

TABLE 4.3-23 Cont'd

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
Juniper – Kinnikinnick	73	s	--	--	--	--
\$AtEp – Twinflower	01YS	d	--	--	--	--

Note: 1 Derived from Draft Site Classification for the 52 Biogeoclimatic Units in the Southern Interior Forest Region (Lloyd *et al.* 2005).

4.3.14 Moist Mild Interior Cedar - Hemlock (ICHmm)

TEM results for site series mapped in the ICHmm BGC subzone variant are listed in Table 4.3-24. TEM results for all-ecosystem units mapped in the ICHmm BGC subzone variant are listed in Table 4.3-25.

TABLE 4.3-24

SITE SERIES IN THE ICHmm

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
HwCw – Spruce – Step moss	01	d, j, k	d, k, j, q, w	1, 3, 3a, 3b, 4, 5, 6, 7	--	1,826.4
CwSxw – Soopolallie	02	s, w	w, z	3b, 4, 5, 6	yes	23.3
HwCw – Step moss	03	d	k, q	3, 3a, 4, 5	--	162.7
CwHw – Oak fern	04	d	k, w, q	3a, 4, 5, 6, 7	--	435.2
CwHw – Devil's club – Oak fern	05	d	k	3b, 4, 5, 6, 7	--	51.3
CwSxw – Devil's club – Horsetail	06	d	j	3, 3a, 6, 7	--	44.3
SbPI – Bog-laurel – Sphagnum	07	d	--	3a, 6	yes	1.7
CwSxw – Skunk cabbage – Sphagnum	08	d	--	3a, 5	yes	0.3

Notes: 1 Derived from Draft Land Management Handbook No. 15 Update for the ICHmm (BC MFLNRO 2007b).

TABLE 4.3-25

ALL-ECOSYSTEM UNITS IN THE ICHmm

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	1	--	0.4
active channel flood class	Fa	--	--	--	--	--
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	--	3b	--	2.1
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	--
rock cliff	Rc	s	--	--	--	--
pond	PD	--	w	--	--	2.7
river	RI	--	--	--	--	0.4
rock outcrop	Ro	s	--	1	--	0.7
rural	Ru	--	--	--	--	--
rock talus	Rt	s	--	--	--	--
road	RZ	--	--	1, 2	--	20.7
tame pasture	TP	--	j	2	--	0.3
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	3a	--	0.6

TABLE 4.3-25 Cont'd

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
fen wetland	Wf	--	--	--	--	--
marsh wetland	Wm	--	p	3b	--	4.8
swamp wetland	Ws ¹	--	--	2	yes	3.4
shallow water aquatic	Ww	--	p	3a	--	0.7
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	--	--	--
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	--	--	--

Note: 1 The following wetland type is known to support RECs within the ICHmm variant: Sitka willow – Pacific willow – Skunk cabbage (Ws51) (BC CDC 2015).

4.3.15 Thompson Moist Warm Interior Cedar - Hemlock (ICHmw3)

TEM results for site series mapped in the ICHmw3 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-26. TEM results for all-ecosystem units mapped in the ICHmw3 BGC subzone variant are listed in Table 4.3-27.

TABLE 4.3-26

SITE SERIES IN THE ICHmw3

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
HwCw – Falsebox – Feathermoss	01	d, j, k	c, s, q, w, z	1, 2, 3, 3a, 3b, 4, 5, 6, 7	--	2,791.5
Fd – Juniper – Kinnikinnick	02	s, w	--	--	--	--
PI – Velvet-leaved blueberry – Feathermoss	03	d	--	--	--	--
FdPI – Falsebox – Pinegrass	04	d	--	--	--	--
FdPI – Falsebox – Feathermoss	05	d	s, w, z	1, 2, 3, 3a, 3b, 4, 5, 6, 7	--	870.3
CwHw – Oak fern	06	d	k, q, w, z	2, 3, 3a, 3b, 4, 5, 6, 7	--	861.4
CwAct – Thimbleberry – Sarsaparilla	07	d	--	5, 6, 7	--	32.2
CwHw – Devil's club – Lady fern	08	d	--	2, 3, 3b, 4, 5, 6, 7	--	227.3
Act – Dogwood – Horsetail	09	d	--	7	--	77.0
CwHw – Horsetail	10	d	--	--	--	--
CwHw – Skunk cabbage	11	d	--	6	--	6.2
Sb – Labrador tea – Peat-moss	12	d	--	2, 3b, 5	--	25.5
HwSxw – Labrador tea – Peat-moss	13	d	--	1, 2, 3a, 3b, 4, 6	--	75.4
Awed haircap moss – Clad lichens	72	s	--	3b	--	0.2
Rock moss – Clad lichens	73	s	--	1	--	4.5
Oatgrass – kinnikinnick	82	w	--	--	--	--
\$CwHwfd – Falsebox	01ms	d, j, k	s, q, w	3, 3b, 4, 5, 6, 7	--	1,181.7

Note: 1 Derived from Draft Site Classification for the 52 Biogeoclimatic Units in the Southern Interior Forest Region (Lloyd *et al.* 2005).

TABLE 4.3-27

ALL-ECOSYSTEM UNITS IN THE ICHmw3

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	5	--	12.3
active channel flood class	Fa	--	--	--	--	--
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	--	3, 3a	--	4.1
mid-bench flood class	Fm	--	--	4, 6, 7	--	47.3
lake	LA	--	--	--	--	20.3
rock cliff	Rc	s	--	--	--	--
pond	PD	--	--	2	--	5.4
river	RI	--	--	--	--	298.0
rock outcrop	Ro	s	--	1	--	3.0
rural	Ru	--	--	1, 2	--	47.7
rock talus	Rt	s	--	--	--	--
road	RZ	--	--	1, 3	--	242.6
tame pasture	TP	--	--	--	--	--
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb ¹	--	--	5, 6	yes	25.7
fen wetland	Wf ¹	--	--	2, 3, 3a, 3b	yes	97.9
marsh wetland	Wm ¹	--	--	2, 3	yes	75.8
swamp wetland	Ws ¹	--	--	3, 3b, 6, 7	yes	90.9
shallow water aquatic	Ww	--	--	2	--	2.4
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	1	--	65.2
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	1, 2	--	11.3

Note: 1 The following wetland types are known to support RECs within the ICHmw3 variant: Black spruce – Buckbean – Peat-moss (Wb11); Slender sedge – Common hook-moss (Wf05); Tufted clubrush – Star moss (Wf11); Swamp horsetail – Beaked sedge (Wm02); and Sitka willow – Pacific willow – Skunk cabbage (Ws51) (BC CDC 2015).

4.3.16 Mica Very Wet Cool Interior Cedar Hemlock (ICHvk1)

TEM results for site series mapped in the ICHvk1 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-28. TEM results for all-ecosystem units mapped in the ICHvk1 BGC subzone variant are listed in Table 4.3-29.

TABLE 4.3-28

SITE SERIES IN THE ICHvk1

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
CwHw – Devil's club – Lady fern	01	d, j, k	k, q, w	3, 3a, 3b, 4, 5, 6, 7	--	1,951.3
HwCw – Feathermoss	02	s, w	--	--	--	--
HwCw – Azalea – Feathermoss	03	d	z	3, 5	--	17.0
HwCw – Oak fern	04	d	w	3a, 4, 5, 6, 7	--	57.3
CwHw – Spiny wood fern – Oak fern	05	d	k, w	3, 3a, 3b, 4, 5, 6, 7	--	469.5
Sxw – Thimbleberry - Oak fern	06	d	--	--	--	--
Sxw – Devil's club	07	d	--	--	--	--
Sxw – Dogwood – Horsetail	08	d	a, d	3a, 3b, 4, 5, 6, 7	--	254.3

TABLE 4.3-28 Cont'd

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
CwHw – Skunk cabbage	09	d	--	--	--	--
Sxw – Bulrush	10	d	d	6	--	1.1
Rocktripe lichens – Rock-moss	72	s	--	--	--	--
Rock-moss – Clad lichens	73	s	--	--	--	--
Dogwood – Thimbleberry	74	--	--	--	--	--
Willow – Lady fern	75	--	--	--	--	--
Alder – Lady fern	76	--	--	--	--	--
Devil's club – Oak fern	77	--	--	--	--	--
Indian hellebore – Bluejoint	78	--	--	--	--	--

Note: 1 Derived from Draft Site Classification for the 52 Biogeoclimatic Units in the Southern Interior Forest Region (Lloyd *et al.* 2005).

TABLE 4.3-29

ALL-ECOSYSTEM UNITS IN THE ICHvk1

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	--	--	--
active channel flood class	Fa	--	--	1	--	0.1
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Ff ¹	--	a	2, 3a, 3b	yes	27.9
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	--
rock cliff	Rc	s	--	--	--	--
pond	PD	--	--	--	--	--
river	RI	--	--	--	--	115.7
rock outcrop	Ro	s	--	1	--	3.2
rural	Ru	--	--	--	--	--
rock talus	Rt	s	--	--	--	--
road	RZ	--	--	1	--	25.7
tame pasture	TP	--	--	--	--	--
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	3b	--	1.6
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf ¹	--	--	--	yes	--
marsh wetland	Wm	--	--	--	--	--
swamp wetland	Ws ¹	--	--	2	yes	1.2
shallow water aquatic	Ww	--	--	2d, 3b	--	1.5
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	--	--	--
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	--	--	--

Note: 1 The following wetland types are known to support RECs within the ICHvk1 variant: Mountain alder – Common horsetail (Ff01); Slender sedge – Common hook-moss (Wf05); Tufted clubrush – Star moss (Wf11); Sitka willow – Sitka sedge (Ws06); and Sitka willow – Pacific willow – Skunk cabbage (Ws51) (BC CDC 2015).

4.3.17 Wells Gray Wet Cool Interior Cedar – Hemlock (ICHwk1)

TEM results for site series mapped in the ICHwk1 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-30. TEM results for all-ecosystem units mapped in the ICHwk1 BGC subzone variant are listed in Table 4.3-31.

TABLE 4.3-30
SITE SERIES IN THE ICHwk1

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
CwHw – Oak fern	01	d, j, k	d, j, k, q, w, z	2, 3, 3a, 3b, 4, 5, 6, 7, 7a	--	4,772.2
HwCw – Azalea – Feathermoss	02	s, w	--	3a, 4, 7	--	14.4
HwCw – Falsebox – Feathermoss	03	d	w, z	3, 3a, 3b, 4, 5, 6, 7, 7a	--	440.5
CwHw – Lady fern – Oak fern	04	d	k, q, w	3, 3a, 4, 5, 6, 7	--	319.5
CwHw – Devil's club – Lady fern	05	d	k, j, n, w	3, 3a, 3b, 4, 5, 6, 7	--	1,078.6
Bl Sxw – Thimbleberry – Oak fern	06	d	--	3, 4, 6, 7	--	54.0
Sxw – Devil's club – Lady fern	07	d	k	3a, 4, 5, 6, 7	--	187.3
Act – Dogwood – Thimbleberry	08	d	a, d	3a, 3b, 5, 6	--	125.1
CwHw – Horsetail	09	d	d	3a, 3b, 5, 6, 7	--	135.7
CwHw – Skunk cabbage	10	d	a, d, w	2, 3a, 3b, 4, 5, 6, 7	--	435.4
Rocktripe lichens – Rock-moss	72	s	--	--	--	--
Cedar – Feathermoss	73	s	--	--	--	--
Rock-moss – Clad lichens	74	--	--	--	--	--
Alder – Hooker's fairybells	75	--	--	--	--	--
Alder – Lady fern	76	--	--	--	--	--

Note: 1 Derived from Draft Site Classification for the 52 Biogeoclimatic Units in the Southern Interior Forest Region (Lloyd *et al.* 2005).

TABLE 4.3-31
ALL-ECOSYSTEM UNITS IN THE ICHwk1

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	--	--	--
active channel flood class	Fa	--	--	1	--	0.3
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl ¹	--	a	1, 2, 3a, 3b	yes	9.4
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	0.4
rock cliff	Rc	s	--	--	--	--
pond	PD	--	--	--	--	5.3
river	RI	--	--	--	--	242.4
rock outcrop	Ro	s	--	--	--	--
rural	Ru	--	--	--	--	--
rock talus	Rt	s	--	--	--	--
road	RZ	--	--	1	--	112.8
tame pasture	TP	--	--	--	--	--
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	3a	--	6.5
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	3a, 3b	--	1.9
fen wetland	Wf ¹	--	--	2	yes	8.9
marsh wetland	Wm ¹	--	d	1, 2, 2a, 3a, 3b	yes	138.7
swamp wetland	Ws ¹	--	--	2, 3a, 3b	yes	57.1
shallow water aquatic	Ww	--	--	2, 3a	--	9.3
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	--	--	--

TABLE 4.3-31 Cont'd

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	--	--	--

Note: 1 The following wetland types are known to support RECs within the ICHwk1 variant: Mountain alder – Common horsetail (FI02); Slender sedge – Common hook-moss (Wf05); Slender sedge – Buckbean (Wf06); Great bulrush (Wm06); Three-way sedge (Wm51); and Sitka willow – Pacific willow – Skunk cabbage (Ws51) (BC CDC 2015).

4.3.18 Thompson Dry Cool Interior Douglas-Fir (IDFdk1)

TEM results for site series mapped in the IDFdk1 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-32. TEM results for all-ecosystem units mapped in the IDFdk1 BGC subzone variant are listed in Table 4.3-33.

TABLE 4.3-32

SITE SERIES IN THE IDFdk1

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
FdPI – Pinegrass – Feathermoss	01	d, j, k	c, w	1, 2, 2a, 2b, 3, 3a, 3b, 4, 5, 6, 7	--	3,783.5
Fd – Snowberry – Bluebunch wheatgrass	02	s, w	--	2b, 3a, 5, 6, 7	--	57.9
Fd – Juniper – Pinegrass	03	d	c, k, s, w	2b, 3a, 3b, 5, 6, 7	--	427.9
Fd – Pinegrass – Yarrow	04	d	c, k, w	2, 2b, 3a, 3b, 5, 6, 7	--	2,361.1
SxwFd – Gooseberry – Feathermoss	05	d	c, k, w	2, 2a, 2b, 3a, 3b, 4, 5, 6, 7	--	1,486.0
Sxw – Horsetail	06	d	c	2, 3a, 3b, 4, 5, 6	--	353.6
Willow – Sedge	07	d	--	2b, 3a, 3b	--	35.7

Note: 1 Derived from A Guide to Site Identification and Interpretation for the Kamloops Forest Region Land Management Handbook No. 23 (Lloyd *et al.* 1990).

TABLE 4.3-33

ALL-ECOSYSTEM UNITS IN THE IDFdk1

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	f	2	--	11.2
active channel flood class	Fa	--	--	--	--	--
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	--	--	--	--
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	30.2
rock cliff	Rc	s	c	1	--	0.8
pond	PD	--	--	--	--	20.7
river	RI	--	--	--	--	--
rock outcrop	Ro	s	w	1	--	26.2
rural	Ru	--	--	1, 2, 2b, 5	--	8.7
rock talus	Rt	s	w	1	--	2.7
road	RZ	--	--	1	--	20.6
tame pasture	TP	--	--	2, 2b, 5, 6	--	71.1
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--

TABLE 4.3-33 Cont'd

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
bog wetland	Wb	--	--	3a, 3b	--	10.5
fen wetland	Wf ¹	--	--	2b, 2d, 3a, 3b	yes	42.1
marsh wetland	Wm ¹	--	k	2b, 3a	yes	54.1
swamp wetland	Ws ¹	--	--	3a, 3b, 4, 5, 6	yes	62.5
shallow water aquatic	Ww	--	--	2	--	8.2
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	--	--	--
grazing zooclimax	Zg	--	w	2, 2b	--	45.7
alkaline meadow	Ga ²	--	f, w	1, 2, 2b	yes	47.2
mine	Mi	--	--	1	--	3.4

- Notes:**
- 1 The following wetland types are known to support RECs within the IDFdk1 variant: Alkali saltgrass (Gs01); Nuttall's alkaligrass – Foxtail barley (Gs02); Tufted hairgrass (Gs04); Scrub birch – Water sedge (Wf02); Slender sedge – Common hook-moss (Wf05); Cattail (Wm05); Great bulrush (Wm06); and MacCalla's willow – Beaked sedge (Ws05) (BC CDC 2015).
 - 2 The following alkaline meadow types are known to support RECs within the IDFdk1 variant: Field sedge (Gs03) (BC CDC 2015).

Limitations of Terrestrial Ecosystem Mapping in the IDFdk1 Variant

Plot data collected during fall 2013 was used to inform mapping of the IDFdk1 segments. Field data, as well as field guide descriptions, indicated some overlap between different site series in soil moisture and nutrient regime. The 01 overlaps with the 04 in soil moisture, nutrient regime and some landscape positions posing some limitations in mapping. To enforce consistency in the newly mapped IDFdk1 segment (Kingsvale Transmission Line), the 04 site series was mapped primarily in areas of pure or dominant Douglas fir stands on mid to upper slopes, whereas the 01 site series was mapped in areas of mixed Douglas fir and lodgepole pine forests on mid to lower slopes. Additionally, site series 03 and 04 overlap in soil moisture, nutrient regime and some landscape positions. To enforce consistency, the 03 was mapped primarily in areas of pure Douglas fir stands, or those with a ponderosa pine component, on upper, warm slopes. The imagery used in mapping the IDFdk1 segments was of high quality.

4.3.19 Cascade Dry Cool Interior Douglas-Fir (IDFdk2)

TEM results for site series mapped in the IDFdk2 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-34. TEM results for all-ecosystem units mapped in the IDFdk2 BGC subzone variant are listed in Table 4.3-35.

TABLE 4.3-34

SITE SERIES IN THE IDFdk2

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
FdPI – Pinegrass – Feathermoss	01	d, j, k	c, q, w	1, 2, 2a, 3a, 3b, 4, 5, 6, 7	--	1,902.4
FdPy – Bluebunch wheatgrass – Pinegrass	02	s, w	c, k, q, z	2, 2b, 3a, 3b, 4, 5, 6, 7	yes	197.3
FdPy – Pinegrass	03	d	c, k, w, j, s, q, w, z	2b, 3a, 3b, 4, 5, 6, 7	yes	679.5
Fd – Feathermoss	04	d	c, q	3a, 4, 5, 6	--	44.1
SxwFd – Dogwood – Gooseberry	05	d	c, k, w	2, 3a, 3b, 4, 5, 6, 7	--	513.5
Sxw – Horsetail	06	d	c, k	1, 3a, 3b, 4, 5, 6	--	236.6
CwSxw – Twinberry – Soft-leaved sedge	07	d	c	3b, 5, 6	yes	6.8
Willow – Sedge	08	d	--	3a, 3b	--	8.5

- Note:**
- 1 Derived from A Guide to Site Identification and Interpretation for the Kamloops Forest Region Land Management Handbook No. 23 (Lloyd *et al.* 1990).

TABLE 4.3-35

ALL-ECOSYSTEM UNITS IN THE IDFdk2

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	c	2	--	10.4
active channel flood class	Fa	--	--	1	--	23.8
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	--	--	--	--
mid-bench flood class	Fm	--	c	3a, 3b, 4, 5, 6	--	58.1
lake	LA	--	--	--	--	11.2
rock cliff	Rc	s	c, d, k, w	1	--	11.3
pond	PD	--	--	--	--	2.0
river	RI	--	--	--	--	62.7
rock outcrop	Ro	s	--	1, 2, 2b	--	16.8
rural	Ru	--	c	1, 2	--	7.5
rock talus	Rt	s	z	1, 3a, 3b, 5	--	32.2
road	RZ	--	c, w	1, 2	--	104.7
tame pasture	TP	--	--	--	--	--
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf ¹	--	--	2b, 3a	yes	9.7
marsh wetland	Wm ¹	--	--	2b	yes	8.0
swamp wetland	Ws	--	--	3b	--	0.8
shallow water aquatic	Ww	--	--	2	--	1.3
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	1	--	0.6
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga ¹	--	--	--	yes	--
mine	Mi	--	--	1, 3a	--	44.4

- Notes:**
- 1 The following wetland types are known to support RECs within the IDFdk2 variant: Slender sedge – Buckbean (Wf06) and Cattail (Wm05) (BC CDC 2015).
 - 2 The following alkaline meadow types are known to support RECs within the IDFdk2 variant: Nuttall's alkaligrass – Foxtail barley (Gs02); Field sedge (Gs03); and Tufted hairgrass (Gs04) (BC CDC 2015).

Limitations of Terrestrial Ecosystem Mapping in the IDFdk2 Variant

Limitations encountered in the newly mapped IDFdk2 segment of the Vegetation RSA were similar to those encountered in previously mapped portions of the IDFdk2. The imagery used to map these segments was of high quality.

4.3.20 Thompson Moist Warm Interior Douglas-Fir (IDFmw2)

TEM results for site series mapped in the IDFmw2 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-36. TEM results for all-ecosystem units mapped in the IDFmw2 BGC subzone variant are listed in Table 4.3-37.

TABLE 4.3-36

SITE SERIES IN THE IDfMw2

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
CwFd – Falsebox – Prince's pine	01	d, j, k	a, c, j, k, q, w	2, 2a, 3a, 3b, 4, 5, 6, 7	--	6,190.2
Fd – Bluebunch wheatgrass	02	s, w	j, s, w	2, 3a, 4, 5, 6	--	148.2
Fd – Falsebox – Pinegrass	03	d	c, j, w	2, 3, 3a, 3b, 4, 5, 6	--	1,022.6
Fd – Feathermoss	04	d	k	5, 6	yes	41.1
CwFd – Thimbleberry – Sarsaparilla	05	d	k, j, w	2, 3, 3a, 3b, 4, 5, 6	--	1,185.7
CwSxw – Devil's club – Oak fern	06	d	a, j	2, 3a, 3b, 4, 5, 6	--	435.3
Cw – Horsetail	07	d	j	3a, 5, 6	--	46.5
SwxCw – Soft-leaved sedge	08	d	--	5	--	10.4
Sxw – Alder – Water sedge	09	d	--	2, 5, 6	--	58.7
Pelt lichen – Clad lichen	72	s	--	--	--	--
Selaginella – Bluebunch wheatgrass	73	s	--	--	--	--
Snowberry – Bluebunch wheatgrass	82	w	w	2, 5	--	18.6
\$EpAt – Thimbleberry – Snowberry	01ys	d	w	5, 6	--	276.5
\$Kentucky bluegrass – Rough fescue	83-ms	w	--	--	--	--

Note: 1 Derived from Draft Site Classification for the 52 Biogeoclimatic Units in the Southern Interior Forest Region (Lloyd *et al.* 2005).

TABLE 4.3-37

ALL-ECOSYSTEM UNITS IN THE IDfMw2

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	1, 2, 2b	--	2,278.4
active channel flood class	Fa	--	--	1, 3a, 3b	--	39.3
fringe flood class	Ff	--	--	3b, 5, 6	--	8.9
low bench flood class	Fl	--	a	2, 3a, 3b, 4, 5, 6	--	209.8
mid-bench flood class	Fm	--	--	2, 3a, 3b, 5, 6	--	200.9
lake	LA	--	--	--	--	69.9
rock cliff	Rc	s	d	1	--	0.7
pond	PD	--	--	2	--	9.7
river	RI	--	--	--	--	964.1
rock outcrop	Ro	S	d, s, w	1	--	12.0
rural	Ru	--	w	1, 2, 2b, 3b, 5, 6	--	384.6
rock talus	Rt	S	--	--	--	--
road	RZ	--	w	1, 2	--	149.5
tame pasture	TP	--	--	2, 3b, 5, 6	--	277.0
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf	--	--	2, 3, 3a	--	2.7
marsh wetland	Wm ¹	--	--	2, 2b, 3a, 3b	yes	20.9
swamp wetland	Ws	--	--	2, 2a, 3a, 3b	--	17.5
shallow water aquatic	Ww	--	--	2, 3a	--	6.8
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	1, 2	--	339.6
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	1	--	4.1

Note: 1 The following wetland type is known to support RECs within the IDfMw2 variant: Cattail (Wm05) (BC CDC 2015).

4.3.21 Thompson Moist Warm – Steep South Phase Interior Douglas-Fir (IDFmw2b)

TEM results for site series mapped in the IDFmw2b BGC subzone variant within the Vegetation RSA are listed in Table 4.3-38. TEM results for all-ecosystem units mapped in the IDFmw2b BGC subzone variant are listed in Table 4.3-39.

TABLE 4.3-38

SITE SERIES IN THE IDFmw2b

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
CwFd – Falsebox – Prince's pine	01	d, j, k	w	2, 3a, 3b, 5, 6	--	246.0
Fd – Bluebunch wheatgrass	02	s, w	--	2, 5, 6	--	88.1
Fd – Falsebox – Pinegrass	03	d	j, w	2, 3a, 5, 6	--	959.2
Fd – Feathermoss	04	d	--	--	--	--
CwFd – Thimbleberry – Sarsaparilla	05	d	--	5	--	12.3
CwSxw – Devil's club – Oak fern	06	d	--	--	--	--
Cw - Horsetail	07	d	--	--	--	--
SwxCw – Soft-leaved sedge	08	d	--	--	--	--
Sxw – Alder – Water sedge	09	d	--	--	--	--
Pelt lichen – Clad lichen	72	s	--	--	--	--
Selaginella – Bluebunch wheatgrass	73	s	--	--	--	--
Snowberry – Bluebunch wheatgrass	82	w	w	2	--	85.8
\$EpAt – Thimbleberry – Snowberry	01ys	d	w	3a, 5	--	68.8
\$Kentucky bluegrass – Rough fescue	83-ms	w	--	--	--	--

Note: 1 Derived from Draft Site Classification for the 52 Biogeoclimatic Units in the Southern Interior Forest Region (Lloyd *et al.* 2005).

TABLE 4.3-39

ALL-ECOSYSTEM UNITS IN THE IDFmw2b

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	2	--	75.0
active channel flood class	Fa	--	--	--	--	--
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	--	--	--	--
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	--
rock cliff	Rc	s	--	--	--	--
pond	PD	--	--	--	--	--
river	RI	--	--	--	--	--
rock outcrop	Ro	s	--	--	--	--
rural	Ru	--	--	2, 3, 3b, 5	--	74.4
rock talus	Rt	s	--	--	--	--
road	RZ	--	--	1, 2	--	28.9
tame pasture	TP	--	--	2	--	8.4
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf	--	--	--	--	--
marsh wetland	Wm	--	--	--	--	--
swamp wetland	Ws	--	--	--	--	--
shallow water aquatic	Ww	--	--	--	--	--

TABLE 4.3-39 Cont'd

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	--	--	--
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	--	--	--

4.3.22 Okanagan Very Dry Hot Interior Douglas-Fir (IDF_{xh1})

TEM results for site series mapped in the IDF_{xh1} BGC subzone variant within the Vegetation RSA are listed in Table 4.3-40. TEM results for all-ecosystem units mapped in the IDF_{xh1} BGC subzone variant are listed in Table 4.3-41.

TABLE 4.3-40

SITE SERIES IN THE IDF_{xh1}

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
FdPy – Pinegrass	01	d, j, k	c, q, w	2, 2b, 3, 3a, 3b, 4, 5, 6, 7	yes	1,180.0
FdPy – Bluebunch wheatgrass – Balsamroot	02	s, w	k, q	2, 3a, 5, 6, 7	yes	49.1
FdPy – Bluebunch wheatgrass – Pinegrass	03	d	k, w	2, 5, 6	yes	27.3
FdPy – Snowbrush – Pinegrass	04	d	c, k, w	2b, 3, 3a, 5, 6, 7	yes	284.9
FdPy – Pinegrass – Idaho fescue	05	d	c, k, w	2, 2b, 3, 3a, 3b, 4, 5, 6, 7	yes	283.7
FdPy – Spirea – Feathermoss	06	d	c, w	3, 3a, 5, 6	yes	49.1
FdPy – Snowberry – Spirea	07	d	c, k, w	2, 2b, 3, 3a, 3b, 4, 5, 6, 7	yes	237.6
SxwFd – Douglas maple – Dogwood	08	d	c, k, w	2, 3, 5, 6	yes	112.3
Willow – Sedge	09	d	--	3a	--	0.7

Note: 1 Derived from A Guide to Site Identification and Interpretation for the Kamloops Forest Region Land Management Handbook No. 23 (Lloyd *et al.* 1990).

TABLE 4.3-41

ALL-ECOSYSTEM UNITS IN THE IDF_{xh1}

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	2	--	171.2
active channel flood class	Fa	--	c	1	--	17.3
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Ff ¹	--	--	--	yes	--
mid-bench flood class	Fm ¹	--	c	2, 3, 3a, 3b, 5, 6	yes	96.5
lake	LA	--	--	--	--	--
rock cliff	Rc	s	--	1	--	3.0
pond	PD	--	--	--	--	1.6
river	RI	--	--	--	--	29.3
rock outcrop	Ro	s	--	1	--	2.1
rural	Ru	--	c	1, 2, 3b, 5	--	55.1
rock talus	Rt	s	--	1	--	1.8
road	RZ	--	f	1, 2	--	123.4
tame pasture	TP	--	c	2, 2b	--	42.1

TABLE 4.3-41 Cont'd

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf	--	--	--	--	--
marsh wetland	Wm ¹	--	--	2b	yes	0.6
swamp wetland	Ws	--	--	--	--	--
shallow water aquatic	Ww	--	--	--	--	--
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	1, 2	--	9.8
grazing zooclimax	Zg	--	w	2, 2b, 3, 3a, 6	--	102.5
alkaline meadow	Ga ²	--	--	--	yes	--
mine	Mi	--	w	1, 2, 2b, 3	--	23.5

- Notes:**
- 1 The following wetland types are known to support RECs within the IDFxh1 variant: Water birch – Rose (F107); Cottonwood – Snowberry – Rose (Fm01); Cattail (Wm05); and Great bulrush (Wm06) (BC CDC 2015).
 - 2 The following alkaline meadow types are known to support RECs within the IDFxh1 variant: Alkali saltgrass (Gs01) and Nuttall's alkaligrass – Foxtail barley (Gs02) (BC CDC 2015).

4.3.23 Thompson Very Dry Hot Interior Douglas-Fir (IDFxh2)

TEM results for site series mapped in the IDFxh2 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-42. TEM results for all-ecosystem units mapped in the IDFxh2 BGC subzone variant are listed in Table 4.3-43.

TABLE 4.3-42

SITE SERIES IN THE IDFxh2

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
FdPy – Pinegrass – Feathermoss	01	d, j, k	c, k, w	1, 2, 2b, 3a, 3b, 4, 5, 6, 7	yes	3,523.5
FdPy – Bluebunch wheatgrass – Rough fescue	02	s, w	k, s, q	2, 2a, 2b, 3a, 3b, 5, 6	yes	262.1
FdPy – Bluebunch wheatgrass – Balsamroot	03	d	c, k, w, z	2, 3a, 3b, 5, 6	yes	382.4
FdPy – Bluebunch wheatgrass – Pinegrass	04	d	c, k, s, w, z	2, 2b, 3a, 5, 6	yes	971.7
FdPy – Pinegrass	05	d	c, w	2, 3a, 5, 6	yes	421.2
Fd – Feathermoss	06	d	c, k, d, q, w	2, 3a, 5, 6	--	314.9
CwFd – Dogwood	07	d	c, k	2, 3a, 3b, 5, 6	yes	129.3
Sxw – Horsetail	08	d	--	2, 3a, 5, 6	--	84.1

- Note:**
- 1 Derived from A Guide to Site Identification and Interpretation for the Kamloops Forest Region Land Management Handbook No. 23 (Lloyd *et al.* 1990).

TABLE 4.3-43

ALL-ECOSYSTEM UNITS IN THE IDFxh2

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	2, 2b	--	171.0
active channel flood class	Fa	--	--	2	--	0.2
fringe flood class	Ff	--	--	2, 3b	--	5.6
low bench flood class	Fl	--	--	2, 3a, 3b, 5	--	89.5
mid-bench flood class	Fm	--	--	5	--	6.6
lake	LA	--	--	--	--	35.9
rock cliff	Rc	s	--	--	--	--
pond	PD	--	--	--	--	19.4
river	RI	--	--	--	--	177.7
rock outcrop	Ro	s	--	1	--	1.5
rural	Ru	--	--	2, 3a, 5	--	22.0
rock talus	Rt	s	w	1	--	6.1
road	RZ	--	--	1, 2	--	--
tame pasture	TP	--	--	2	--	27.2
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf	--	--	2, 2b, 3a, 5	--	74.1
marsh wetland	Wm ¹	--	--	1, 2, 2b, 3a	yes	13.8
swamp wetland	Ws	--	--	2, 2a, 3b	--	6.0
shallow water aquatic	Ww	--	--	2, 3a	--	12.7
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	--	--	--
grazing zooclimax	Zg	--	--	2, 2b, 3a	--	15.4
alkaline meadow	Ga ²	--	--	--	yes	--
mine	Mi	--	--	1	--	12.0

- Notes:**
- 1 The following wetland types are known to support RECs within the IDFxh2 variant: Cattail (Wm05) and Great bulrush (Wm06) (BC CDC 2015).
 - 2 The following alkaline meadow type is known to support RECs within the IDFxh2 variant: Alkali saltgrass (Gs01) (BC CDC 2015).

4.3.24 Thompson Very Dry Hot Interior Douglas-Fir, Grassland Phase (IDFh2a)

TEM results for site series mapped in the IDFh2a BGC subzone variant within the Vegetation RSA are listed in Table 4.3-44. TEM results for all-ecosystem units mapped in the IDFh2a BGC subzone variant are listed in Table 4.3-45.

TABLE 4.3-44

SITE SERIES IN THE IDFh2a

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
Fescue – Bluebunch wheatgrass	91	--	--	2, 2b, 3a, 5, 6	yes	1,879.6
Bluebunch wheatgrass – Needle-and-thread grass	92	--	s, k, w	1, 2, 2b, 3a	yes	99.3
Big sage – Kentucky bluegrass	93	--	w	3a	--	91.2
Balsamroot – Kentucky bluegrass	94	--	--	2, 2a, 3a	--	104.8
At – Snowberry – Kentucky bluegrass	95	--	f	2, 2a, 3a, 3b, 4, 5	yes	185.3

- Note:**
- 1 Derived from A Guide to Site Identification and Interpretation for the Kamloops Forest Region Land Management Handbook No. 23 (Lloyd *et al.* 1990).

TABLE 4.3-45

ALL-ECOSYSTEM UNITS IN THE IDFxh2a

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	f	2, 2b	--	184.8
active channel flood class	Fa	--	--	--	--	--
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	--	--	--	--
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	12.6
rock cliff	Rc	s	--	--	--	--
pond	PD	--	--	--	--	10.7
river	RI	--	--	--	--	--
rock outcrop	Ro	s	w	1	--	15.7
rural	Ru	--	c	1, 2, 2b, 3a, 5, 6	--	40.9
rock talus	Rt	s	w	1	--	2.9
road	RZ	--	--	1	--	72.0
tame pasture	TP	--	c	2, 2b	--	21.7
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf	--	f	2, 2b, 3a	--	12.8
marsh wetland	Wm	--	--	2, 2b	--	12.3
swamp wetland	Ws	--	c	3a, 3b	--	7.4
shallow water aquatic	Ww	--	--	2	--	2.7
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	1	--	2.0
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga ¹	--	--	--	yes	27.0
mine	Mi	--	--	1	--	25.5

Notes: 1 The following alkaline meadow type is known to support RECs within the IDFxh2a variant: Alkali saltgrass (Gs01) (BC CDC 2015).

4.3.25 Undifferentiated and Parkland Interior Mountain-Heather Alpine (IMAunp)

TEM results for site series mapped in the IMAunp BGC subzone variant within the Vegetation RSA are listed in Table 4.3-46. TEM results for all-ecosystem units mapped in the IMAunp BGC subzone variant are listed in Table 4.3-47.

TABLE 4.3-46

SITE SERIES IN THE IMAunp

Site Series ^{1,2}	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
Mountain Hemlock Moist Maritime Parkland (MHmmp) HmBa – Blueberry	01	d, j, k	q, w, s	5, 6, 7	--	22.8
MHmmp HmBa – Mountain-heather	02	s, w	z	3a, 5, 6, 7	--	22.4
MHmmp BaHm – Oak fern	03	d	w, s	7	--	0.2
Alpine fellfield	Af	--	--	--	--	--
Alpine grassland	Ag	--	--	--	--	--
Alpine heath	Ah	--	--	--	--	--
Alpine meadow	Am	--	--	--	--	--

TABLE 4.3-46 Cont'd

Site Series ^{1,2}	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
Alpine nivation	As	--	--	--	--	--
Alpine tundra	At	--	--	--	--	--
Zoogenic alpine	Az	--	--	--	--	--
Krummholz Class	Sk		s, q, w, z	7	--	46.9
Alpine wetland	Wa	--	--	2	--	1.2

- Notes:**
- 1 Derived from Biogeoclimatic Ecosystem Classification of Non-Forested Ecosystems in British Columbia Technical Report 068 (MacKenzie 2012).
 - 2 MHmmp codes were used when appropriate for isolated forested units in the IMAunp.

TABLE 4.3-47

ALL-ECOSYSTEM UNITS IN THE IMAunp

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	--	--	--
active channel flood class	Fa	--	--	--	--	--
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	--	--	--	--
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	0.1
rock cliff	Rc	s	w, z	1, 2	--	60.7
pond	PD	--	--	--	--	--
river	RI	--	--	--	--	--
rock outcrop	Ro	s	s, c	2	--	1.7
rural	Ru	--	--	--	--	--
rock talus	Rt	s	--	--	--	--
road	RZ	--	--	--	--	--
tame pasture	TP	--	--	--	--	--
avalanche herb meadow	Vh	--	s, z	7	--	4.9
avalanche shrub thicket	Vs	--	s, w	3b, 7	--	3.6
avalanche treed	Vt	--	s, w, z	4, 5, 6, 7	--	37.0
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf	--	--	--	--	--
marsh wetland	Wm	--	--	--	--	--
swamp wetland	Ws	--	--	--	--	--
shallow water aquatic	Ww	--	--	--	--	--
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	--	--	--
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	--	--	--

Limitations of Terrestrial Ecosystem Mapping in the IMAunp Variant

This variant was not within the previously mapped Vegetation RSA. While provincial BGC variant boundaries were followed as closely as possible, some forested areas located within the IMAunp were attributed with site series belonging the adjacent, lower elevation BGC variant (MHmmp) as this variant better described the observed forested communities. Delineated polygons having more scattered and open forested areas were attributed as either IMAunp Sk (Krummholtz) or treed avalanche tracks. The imagery available in some areas was covered by snow, which limited interpretation.

4.3.26 Leeward Moist Maritime Mountain Hemlock (MHmm2)

TEM results for site series mapped in the MHmm2 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-48. TEM results for all-ecosystem units mapped in the MHmm2 BGC subzone variant are listed in Table 4.3-49.

TABLE 4.3-48

SITE SERIES IN THE MHmm2

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
HmBa – Blueberry	01	d, j, k	k, q, w, z	3, 3a, 3b, 4, 5, 6, 7	--	874.8
HmBa – Mountain-heather	02	s, w	w, z	3b, 4, 5, 6, 7	--	257.1
BaHm – Oak fern	03	d	w	6, 7	--	48.1
HmBa – Bramble	04	d	w, z	6, 7	--	60.4
BaHm – Twistedstalk	05	d	--	6, 7	--	21.6
HmYc – Deer-cabbage	06	d	--	--	--	--
YcHm – Hellebore	07	d	--	6	--	0.6
HmYc – Sphagnum	08	d	--	--	--	--
YcHm – Skunk cabbage	09	d	--	--	--	--

Note: 1 Derived from A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region Land Management Handbook No. 28 (Green and Klinka 1994).

TABLE 4.3-49

ALL-ECOSYSTEM UNITS IN THE MHmm2

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	--	--	
active channel flood class	Fa	--	--	--	--	
fringe flood class	Ff	--	--	--	--	
low bench flood class	Fl	--	--	--	--	
mid-bench flood class	Fm	--	--	--	--	
lake	LA	--	--	--	--	
rock cliff	Rc	s	s, w	1	--	34.9
pond	PD	--	--	--	--	2.2
river	RI	--	--	--	--	
rock outcrop	Ro	s	q, z	1	--	69.6
rural	Ru	--	--	--	--	
rock talus	Rt	s	q, z	1, 3b	--	19.0
road	RZ	--	--	1	--	61.4
tame pasture	TP	--	--	--	--	
avalanche herb meadow	Vh	--	--	2b, 5	--	18.8
avalanche shrub thicket	Vs	--	k, q, w	2b, 3, 3a, 3b, 4	--	149.5
avalanche treed	Vt	--	k	3b, 4, 5, 6	--	51.3
bog wetland	Wb	--	--	--	--	
fen wetland	Wf	--	--	--	--	
marsh wetland	Wm	--	--	--	--	
swamp wetland	Ws	--	--	--	--	

TABLE 4.3-49 Cont'd

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
shallow water aquatic	Ww	--	--	--	--	
herb disclimax	Xh	--	--	--	--	
shrub disclimax	Xs	--	--	3a, 3b	--	41.3
urban	UR	--	--	--	--	
grazing zooclimax	Zg	--	--	--	--	
alkaline meadow	Ga	--	--	--	--	
mine	Mi	--	--	--	--	

4.3.27 South Thompson Dry Mild Montane Spruce (MSdm2)

TEM results for site series mapped in the MSdm2 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-50. TEM results for all-ecosystem units mapped in the MSdm2 BGC subzone variant are listed in Table 4.3-51.

TABLE 4.3-50

SITE SERIES IN THE MSdm2

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
Sxw – Falsebox – Feathermoss	01	d, j, k	c, q, w	3a, 3b, 4, 5, 6	--	590.2
Juniper – Bluebunch wheatgrass	02	s, w	q, z	3a, 4, 5, 6	yes	59.5
Pl – Juniper – Grouseberry	03	d	w	5, 6	--	45.1
Pl – Grouseberry – Pinegrass	04	d	k, j, q, w	3a, 4, 5, 6	--	331.2
Pl – Gooseberry – Grouseberry	05	d	c, w	3a, 3b, 5, 6	--	124.5
Sxw – Gooseberry – Devil's club	06	d	c	3a, 3b, 5, 6	yes	27.3
Sxw – Horsetail – Leafy moss	07	d	--	5, 6	yes	3.9

Note: 1 Derived from A Guide to Site Identification and Interpretation for the Kamloops Forest Region Land Management Handbook No. 23 (Lloyd *et al.* 1990).

TABLE 4.3-51

ALL-ECOSYSTEM UNITS IN THE MSdm2

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	--	--	--
active channel flood class	Fa	--	--	--	--	--
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	c	3a	--	2.0
mid-bench flood class	Fm	--	c	3a, 6	--	15.0
lake	LA	--	--	--	--	--
rock cliff	Rc	s	--	--	--	--
pond	PD	--	--	--	--	0.1
river	RI	--	--	--	--	8.3
rock outcrop	Ro	s	--	--	--	--
rural	Ru	--	--	--	--	--
rock talus	Rt	s	--	1	--	0.9

TABLE 4.3-51 Cont'd

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
road	RZ	--	--	1	--	15.7
tame pasture	TP	--	--	--	--	--
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf ¹	--	--	2b, 3a	yes	3.2
marsh wetland	Wm ¹	--	--	2b	--	0.9
swamp wetland	Ws	--	--	3b	--	0.2
shallow water aquatic	Ww	--	--	--	--	--
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	w	3b	--	6.8
urban	UR	--	--	--	--	--
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga ²	--	--	--	yes	--
mine	Mi	--	--	--	--	--

- Notes:**
- 1 The following wetland types are known to support RECs within the MSdm2 variant: Slender sedge – Common hook-moss (Wf05); Few-flowered spike-rush – Hook-moss (Wf09); Tufted clubrush – Star moss (Wf11); and Great bulrush (Wm06) (BC CDC 2015).
 - 2 The following alkaline meadow types are known to support RECs within the MSdm2 variant: Nuttall's alkaligrass – Foxtail barley (Gs02) and Tufted hairgrass (Gs04) (BC CDC 2015).

Limitations of Terrestrial Ecosystem Mapping in the MSdm2 Variant

The imagery used to map the MSdm2 was in black and white and was poor at displaying areas of shallow soils, posing a limitation to the identification of the O2 site series.

4.3.28 Cascade Moist Warm Montane Spruce (MSmw1)

TEM results for site series mapped in the MSmw1 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-52. TEM results for all-ecosystem units mapped in the MSmw1 BGC subzone variant are listed in Table 4.3-53.

TABLE 4.3-52

SITE SERIES IN THE MSmw1

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
Rock-moss – Clad lichens	Rt03	s	--	--	--	--
Juniper – Kinnikinnick – Haircap moss	Ro04	c, j, s	--	--	--	--
Rock-moss – Typic	Rt07	s, z	--	--	--	--
Juniper – Kinnikinnick	Rt08	s, z	--	--	--	--
SxwBa – Huckleberry – Feathermoss	01	d	c, k, w	3a, 3b, 4, 5, 6, 7	--	647.6
FdPI – Juniper – Kinnikinnick	02	c, s	k, q, z	3a, 3b, 4, 5, 6	--	122.4
PI – Grouseberry	03	c, d, w	k	5, 6, 7	--	23.1
FdPI – Falsebox – Pinegrass	04	d, w	j, k	3a, 3b, 5, 6	--	171.5
PIsw – Falsebox – Pipecleaner moss	05	d, j	c, w	1, 2, 3a, 3b, 5, 6, 7	--	640.3
Sxw – Gooseberry – Oak fern	06	d	c, k, w	3a, 3b, 5, 6, 7	--	148.2
Sxw – Devil's club – Oak fern	07	d	c	5, 6	--	34.5
Sxw – Horsetail – Glow moss	08	d, f	c	5, 6	--	42.3
Alder – Lady fern	Av01	q	--	--	--	--

TABLE 4.3-52 Cont'd

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
Alder – Thimbleberry	Av03	c	--	--	--	--
Cow-parsnip – Fireweed	Av07	c, k	--	--	--	--
Fireweed – Bluejoint	Av09	c, j	--	--	--	--

Note: 1 Derived from Draft Site Classification for the 52 Biogeoclimatic Units in the Southern Interior Forest Region (Lloyd *et al.* 2005).

TABLE 4.3-53

ALL-ECOSYSTEM UNITS IN THE MSmw1

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	--	--	--	--
active channel flood class	Fa	--	--	1, 3a	--	16.1
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	c	3a	--	20.8
mid-bench flood class	Fm	--	c	2, 3a, 6	--	18.8
lake	LA	--	--	--	--	19.2
rock cliff	Rc	s	z, w	1, 3a	--	13.6
pond	PD	--	--	--	--	6.0
river	RI	--	--	--	--	23.1
rock outcrop	Ro	s	w, z	1	--	14.8
rural	Ru	--	--	2	--	14.5
rock talus	Rt	s	k, w, z	1, 2, 3a, 3b	--	45.7
road	RZ	--	--	1	--	114.7
tame pasture	TP	--	--	--	--	--
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	s, w	3b	--	37.4
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf ¹	--	--	3a	yes	4.7
marsh wetland	Wm	--	--	2b	--	5.7
swamp wetland	Ws	--	--	3a, 3b	--	8.3
shallow water aquatic	Ww	--	--	--	--	--
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	s, w	3a, 3b	--	47.7
urban	UR	--	--	1	--	3.8
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	1, 3a	--	30.7

Note: 1 The following wetland type is known to support RECs within the MSmw1 variant: Shore sedge – Buckbean – Hook-moss (Wf08) (BC CDC 2015).

Limitations of Terrestrial Ecosystem Mapping in the MSmw1 Variant

Plot data collected during summer 2013 was used to inform mapping of site series in the MSmw1. Site series 03 and 04 overlap in soil moisture, nutrient regime and some landscape positions. To enforce consistency, the 03 site series was mapped on coarse, warm slopes, whereas the 04 site series was mapped on gentle glaciofluvial terraces with mixed lodgepole pine and Douglas fir stands. Most of the imagery used to map the MSmw1 variant was in black and white and was poor at displaying areas of shallow soils, posing a limitation to the identification of the 02 site series.

4.3.29 Thompson Very Dry Hot Ponderosa Pine (PPxh2)

TEM results for site series mapped in the PPxh2 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-54. TEM results for all-ecosystem units mapped in the PPxh2 BGC subzone variant are listed in Table 4.3-55.

TABLE 4.3-54
SITE SERIES IN THE PPxh2

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
Py – Bluebunch wheatgrass – Fescue	01	d, j, k	c, k, q, w	2, 2b, 3, 3a, 3b, 4, 5, 6	yes	2,131.0
FdPy – Bluebunch wheatgrass – Selaginella	02	s, w	k, q, z	2, 2b, 3, 3b, 5, 6, 7	--	291.0
Py – Bluebunch wheatgrass	03	d	c, w	1, 2, 2b, 3, 3a, 3b, 4, 5, 6	yes	626.1
Py – Big sage – Bluebunch wheatgrass	04	d	c, k, w	1, 2, 2b, 3, 3a, 3b, 4, 5, 6	yes	664.0
Big sage – Bluebunch wheatgrass – Fescue	05	d	c, k, s, w	1, 2, 2b, 3a, 6	yes	230.8
FdPy – Snowberry – Saskatoon	06	d	c, k, f, w	2, 2b, 3, 3a, 3b, 4, 5, 6	yes	407.8
Act – Water birch	07	d	c, f, w	2, 3, 3a, 3b, 4, 5, 6	yes	390.7

Note: 1 Derived from A Guide to Site Identification and Interpretation for the Kamloops Forest Region Land Management Handbook No. 23 (Lloyd *et al.* 1990).

TABLE 4.3-55
ALL-ECOSYSTEM UNITS IN THE PPxh2

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	c	2, 2b	--	552.1
active channel flood class	Fa	--	c	1	--	113.8
fringe flood class	Ff	--	c	1, 2, 3, 3b	--	5.1
low bench flood class	Fl ¹	--	--	3b	yes	4.6
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	0.5
rock cliff	Rc	s	d	1	--	1.5
pond	PD	--	--	--	--	2.4
river	RI	--	--	--	--	293.6
rock outcrop	Ro	s	k, w, z	1, 2, 2b	--	93.0
rural	Ru	--	c	1, 2, 2b, 3, 3a, 4, 5, 6	--	169.5
rock talus	Rt	s	--	1, 5, 6	--	62.6
road	RZ	--	c	1	--	86.2
tame pasture	TP	--	c	2, 2a, 2b, 3, 3a, 3b, 5	--	225.8
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf	--	--	--	--	--
marsh wetland	Wm ¹	--	c, f	2, 2b	yes	8.6
swamp wetland	Ws	--	--	3, 3b, 5	--	1.2
shallow water aquatic	Ww	--	--	--	--	--

TABLE 4.3-55 Cont'd

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	c	1, 2, 2b, 3b, 6	--	119.0
grazing zooclimax	Zg	--	c	2, 3a, 5	--	23.6
alkaline meadow	Ga ²	--	--	2b	yes	0.6
mine	Mi	--	--	1	--	17.2

- Notes:**
- 1 The following wetland types are known to support RECs within the PPxh2 variant: Water birch – Rose (FI07); Cattail (Wm05); and Great bulrush (Wm06) (BC CDC 2015).
 - 2 The following alkaline meadow types are known to support RECs within the PPxh2 variant: Alkali saltgrass (Gs01) and Field sedge (Gs03) (BC CDC 2015).

4.3.30 McLennan Dry Hot Sub-Boreal Spruce (SBSdh1)

TEM results for site series mapped in the SBSdh1 BGC subzone variant within the Vegetation RSA are listed in Table 4.3-56. TEM results for all-ecosystem units mapped in the SBSdh1 BGC subzone variant are listed in Table 4.3-57.

TABLE 4.3-56

SITE SERIES IN THE SBSdh1

Site Series ¹	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
SxwFd – Ricegrass	01	d, j, k	c, k, w, f, j, q	2, 3, 3a, 3b, 4, 5, 6, 7	--	6,204.3
PI – Velvet-leaved blueberry – Cladonia	02	s, w	s	2, 5	yes	10.5
FdPI – Pinegrass – Feathermoss	03	d	c, s, w	3a, 3b, 4, 5, 6, 7	--	206.3
PI – Pinegrass – Feathermoss	04	d	k, w	2, 3a, 3b, 4, 5, 6	--	503.2
PI – Labrador tea – Velvet-leaved blueberry	05	d	c	2, 3a, 4, 5	yes	449.4
SxwFd – Thimbleberry	06	d	k, w	3, 3a, 3b, 4, 5, 6, 7	yes	575.1
Sxw – Horsetail	07	d	f	2, 3a, 3b, 4, 5, 6, 7	--	529.2
Sb – Scrub birch – Sedge	08	d	p	2, 3a, 3b, 4, 5, 6	--	181.8

- Note:** 1 Derived from Draft Land Management Handbook No. 15 Update for the SBSdh1 (BC MFLNRO 2007c).

TABLE 4.3-57

ALL-ECOSYSTEM UNITS IN THE SBSdh1

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
cultivated field	CF	--	f	2, 2a	--	363.6
active channel flood class	Fa	--	--	1, 2	--	4.2
fringe flood class	Ff	--	--	--	--	--
low bench flood class	Fl	--	--	1, 2, 6, 7	--	3.0
mid-bench flood class	Fm	--	--	--	--	--
lake	LA	--	--	--	--	--
rock cliff	Rc	s	--	1	--	0.4
pond	PD	--	c	2	--	21.6

TABLE 4.3-57 Cont'd

All-Ecosystem Unit	Code	Assumed Modifiers	Atypical Modifiers	Structural Stage	Potential to Support REC	Mapped Area (ha)
river	RI	--	--	--	--	136.6
rock outcrop	Ro	s	a, c	1, 3a	--	5.7
rural	Ru	--	--	1, 2	--	39.3
rock talus	Rt	s	--	--	--	--
road	RZ	--	f	1, 2	--	280.6
tame pasture	TP	--	--	2	--	88.9
avalanche herb meadow	Vh	--	--	--	--	--
avalanche shrub thicket	Vs	--	--	--	--	--
avalanche treed	Vt	--	--	--	--	--
bog wetland	Wb	--	--	--	--	--
fen wetland	Wf	--	--	2	--	17.2
marsh wetland	Wm	--	--	2, 3a, 3b	--	71.4
swamp wetland	Ws ¹	--	--	2	yes	35.3
shallow water aquatic	Ww	--	--	2, 2d	--	6.3
herb disclimax	Xh	--	--	--	--	--
shrub disclimax	Xs	--	--	--	--	--
urban	UR	--	--	1, 2	--	37.8
grazing zooclimax	Zg	--	--	--	--	--
alkaline meadow	Ga	--	--	--	--	--
mine	Mi	--	--	--	--	--

Note: 1 The following wetland type is known to support RECs within the SBSdh1 variant: MacCalla's willow – Beaked sedge (Ws05) (BC CDC 2015).

5.0 SUMMARY

TEM was completed within the Vegetation RSA to describe the diversity, relative abundance and distribution of vegetation communities, and structural stages for lands where vegetation may be affected by the Project.

- This supplemental filing addresses TEM completed within two additional Natural Subregions in Alberta (Montane and Upper Foothills) and three additional BGC subzone variants in BC (IMAunp, MSdm2, MSmw1), as well as additional areas within Natural Subregions and BGC subzone variants previously mapped.
- TEM results for this supplemental filing are provided for the Vegetation RSA associated with the pipeline corridor as defined in the Routing Update filed with the NEB in August 2014 as part of Technical Update No. 2.
- In total, TEM has been completed for 100% of the Vegetation RSA in BC and Alberta.
- In total, 325 unique ecosite phases and site series are represented in the mapping area.
- TEM field surveys were completed from 2012 to 2014, achieving Survey Intensity Level 5 (*i.e.*, 5.9% of polygons were surveyed in the field). Due to additional desktop and field work to identify all wetlands within the pipeline corridor and specific surveys conducted for rare plants and rare ecological communities, this level of survey intensity is considered to meet the industry standards for TEM on a large project.

APPENDIX D

SUPPLEMENTAL SURVEY RESULTS FROM 2014, 2015 AND 2017

TABLE OF CONTENTS

		<u>Page</u>
SUPPLEMENTAL VEGETATION SURVEY RESULTS FROM 2014 AND 2015		D-4
1.0	INTRODUCTION.....	D-4
1.1	Methods	D-4
2.0	RESULTS OF FIELD DATA COLLECTION FROM 2014 AND 2015	D-5
2.1	General Information	D-5
2.2	Vegetation Communities of Concern	D-8
	2.2.1 Edmonton to Hinton Segment.....	D-13
	2.2.2 Hargreaves to Darfield Segment.....	D-13
	2.2.3 Black Pines to Hope Segment	D-13
	2.2.4 Hope to Burnaby Segment.....	D-13
	2.2.5 Burnaby to Westridge Segment	D-13
	2.2.6 Rearguard Pump Station	D-13
	2.2.7 Blackpool Pump Station	D-13
	2.2.8 Black Pines Pump Station.....	D-13
	2.2.9 Kingsvale Pump Station.....	D-14
	2.2.10 Sumas Terminal.....	D-14
	2.2.11 Burnaby Terminal.....	D-14
	2.2.12 Westridge Marine Terminal.....	D-14
2.3	Plant and Lichen Species of Concern.....	D-14
	2.3.1 Federally-Listed Rare Plant and Lichens	D-14
	2.3.2 Edmonton to Hinton Segment.....	D-14
	2.3.3 Hargreaves to Darfield Segment.....	D-15
	2.3.4 Black Pines to Hope Segment	D-16
	2.3.5 Hope to Burnaby Segment.....	D-16
	2.3.6 Burnaby to Westridge Segment	D-16
	2.3.7 Rearguard Pump Station	D-16
	2.3.8 Blackpool Pump Station.....	D-17
	2.3.9 Black Pines Pump Station.....	D-17
	2.3.10 Kingsvale Pump Station.....	D-17
	2.3.11 Sumas Terminal.....	D-17
	2.3.12 Burnaby Terminal.....	D-17
	2.3.13 Westridge Marine Terminal.....	D-17

LIST OF TABLES

Table 2.1-1	TEM and Vegetation Surveys by Natural Subregion for the Edmonton to Hinton Segment	D-5
Table 2.1-2	TEM and Vegetation Surveys by BGC Variant for the Hargreaves to Darfield Segment.....	D-6
Table 2.1-3	TEM and Vegetation Surveys by BGC Variant for the Black Pines to Hope Segment.....	D-6
Table 2.1-4	TEM and Vegetation Surveys by BGC Variant for the Hope to Burnaby Segment.....	D-8
Table 2.1-5	TEM and Vegetation Surveys by BGC Variant for the Burnaby to Westridge Segment.....	D-8
Table 2.2-1	Rare Ecological Communities Observed in Proximity to the Proposed Pipeline Corridor in 2014 and 2015	D-9
Table 2.2-2	Descriptions of Previously Undescribed Communities of Concern Observed Along the Proposed Pipeline Corridor.....	D-11

Table 2.3-1	Rare Plants and Lichens Observed in Proximity to the Alberta Portion of the Proposed Pipeline Corridor	D-15
Table 2.3-2	Rare Plants Observed In Proximity to the BC Portion of the Proposed Pipeline Corridor	D-15

SUPPLEMENTAL VEGETATION SURVEY RESULTS FROM 2014, 2015 AND 2017

1.0 INTRODUCTION

Vegetation field surveys were conducted where land access was available using appropriate standards and following industry guidelines (Penny and Klinkenberg 2013, ANPC 2012) during appropriate times in the growing season and at locations that could potentially contain sensitive ecosystems as well as riparian habitat.

The scope and methods required to adequately assess vegetation resources encountered by the pipeline corridor were determined with the guidance of the NEB Filing Manual, in conjunction with published rare plant survey recommendations and guidelines as well as precedence set by developments of similar scope in the vicinity of the Project. Rare plant survey methodology is based on the Alberta Native Plant Council Guidelines for Rare Plant Surveys in Alberta (ANPC 2012) and the BC Protocols for Rare Plant Surveys (Penny and Klinkenberg 2013). The rare plant surveys were conducted throughout the growing season during biologically appropriate times for the species with potential to occur in the area. Mapping methodology for the Project was developed according to the Standards for Terrestrial Ecosystem Mapping in BC (Resources Information Standards Committee 1998) and was applied to both the Alberta and BC portions of the Project. These methods were presented in Volume 5C (Vegetation Technical Report) of the Application and have been previously accepted by the NEB on other pipeline projects in western Canada. Rare ecological communities, rare plants or rare lichens identified during field surveys will be reported to the relevant provincial conservation data centres.

Surveys for SARA vegetation species identified in Tables 2-1 and 2-2 from Environment and Climate Change Canada's (ECCC, formerly Environment Canada) evidence are available in the Vegetation Technical Report for surveys conducted in 2013. Additional surveys for relevant SARA vegetation species were also conducted in 2014, which resulted in no observed occurrences of SARA vegetation species within the pipeline corridor. Additional surveys for toothcup, whitebark pine, and relevant vegetation species of concern were conducted through August to October 2015. Site visits to Haller's apple moss critical habitat polygons were made in July 2017. Targetted Roell's brotherella and Vancouver Island beggarticks surveys were conducted in August 2017. A rare plant survey on the Sumas Tank Farm route realignment (KP 1115.0 to 1115.8) was conducted in August 2017. Adequate data collection has been completed for rare ecological communities and rare plant populations in 2013, 2014, 2015, and 2017.

1.1 Methods

A literature review was conducted prior to surveys in 2014 and 2015 to identify rare plants, rare lichens and rare ecological communities with potential to occur in the natural subregions and Biogeoclimatic (BGC) zones in which the Project is located. The original application included Tables of potential rare plants in BC and AB. Literature and desktop review methods are the same as those used in Technical Report 5C-9 and in the ESA (Volume 5A). The literature review to identify vegetation of concern with potential to occur along the Project was redone prior to surveys in 2014 and 2015 to account for any updates to federal and provincial tracking lists. Updated tables of vegetation species with potential to occur along the Project are not included in this report, but were provided to field crews. Further information on the desktop review methods are provided in Technical Report 5C-9.

2.0 RESULTS OF FIELD DATA COLLECTION FROM 2014, 2015 AND 2017

2.1 General Information

Details of the TEM and vegetation surveys are summarized below by pipeline segment. Further information about TEM conducted in 2014 is provided in Appendix C of this Plan. Data collected from the revised pipeline corridor and alternative corridors, as well as data from the BC Parks, are included in Tables 2.1-1 through 2.1-5 for completeness. Results of the field surveys in the BC Parks is also included in the 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, including Finn Creek Provincial Park, North Thompson River Provincial Park, and Lac du Bois Grasslands Protected Area. Bridal Veil Falls Provincial Park and North Thompson Provincial Park are no longer crossed by the Project.

2.1.1 Edmonton to Hinton Segment

Details of the TEM and vegetation surveys from 2013, 2014 and 2015 for the Edmonton to Hinton Segment are summarized in Table 2.1-1.

TABLE 2.1-1

TEM AND VEGETATION SURVEYS BY NATURAL SUBREGION FOR THE EDMONTON TO HINTON SEGMENT

Natural Subregion ¹	Mapped Area in the Vegetation RSA ² (ha)	Area within the Pipeline Corridor (ha)	Number of TEM Plots ^{3,4}		Amount of Rare Plant Survey on the Pipeline Corridor (Dates/Distance)
			Ground	Visual	
Central Mixedwood	4,660.5	340.1	1	16	July 20, 2013 1.6 km
Central Parkland	13,952.9	1,181.9	1	3	June 7 to 8 and July 16, 2013 July 28 to August 1, 2014 2.6 km
Dry Mixedwood	15,334.4	1,278.9	16	43	June 8 to 12 and July 17 to 19, 2013 June 10 to 13 and July 28 to August 1, 2014 13.8 km
Lower Foothills	29,062.7	2,216.5	41	150	June 12 and 13, 18 to 27, July 21 to 22 and August 3 to 13, 2013 June 10 to 13 and July 28 to August 1, 2014 36.8 km
Upper Foothills ⁵	92.3	--	--	--	--
Montane	4,552.7	381.5	12	46	June 27 to 29 and August 13 to 14, 2013 June 10 to 13 and July 28 to August 1, 2014 7.8 km

- Notes:**
- 1 This table provides TEM data to natural subregion. For ecosite phase level data, please refer to the Supplemental TEM Technical Report in Appendix C of this Plan.
 - 2 TEM limitations are provided in Appendix C of this Plan.
 - 3 TEM field work was completed between 2012 and 2014. In Alberta, field surveys were conducted from August 17 to 21, 2012 and from May 17 to 28, 2013.
 - 4 Ground inspections and visual inspections are defined in Section 3.2 of Appendix C of Technical Report 5C-9.
 - 5 Denotes a natural subregion that occurs in the Vegetation RSA, but does not occur within the pipeline corridor.

2.1.2 Hargreaves to Darfield Segment

Details of the TEM and vegetation surveys for the Hargreaves to Darfield Segment are summarized in Table 2.1-2.

TABLE 2.1-2

**TEM AND VEGETATION SURVEYS BY BGC
VARIANT FOR THE HARGREAVES TO DARFIELD SEGMENT**

BGC Variant ¹	Mapped Area in the Vegetation RSA ¹ (ha)	Area Within the Pipeline Corridor (ha)	Number of TEM Plots ^{2,3}		Amount of Rare Plant Survey on the Pipeline Corridor (Dates/Distance)
			Ground	Visual	
ESSFmm1 ⁴	69.8	--	--	--	--
ESSFwc2 ⁴	16.1	--	--	--	--
ICHdw3	7,550.6	529.1	18	58	June 19 to 22 and August 4 to 7, 2013 21.4 km
ICHmk2 ⁴	167.9	--	--	--	--
ICHmm	2,582.0	72.3	--	1	August 11, 2013 0.8 km
ICHmw3	7,203.3	496.9	9	31	June 22 to 23 and August 6 to 8, 2013 July 3 to 8 and August 18 to 24, 2014 10.5 km
ICHvk1	2,927.4	225.6	--	3	June 24 to 25 and August 9, 2013 5 km
ICHwk1	8,155.7	635.1	2	2	June 23 to 27 and August 8 to 10, 2013 21.1 km
IDFmw2	14,310.5	1,017.8	4	15	June 18 to 20 and August 2 to 6, 2013 July 3 to 8 and August 18 to 24, 2014 August 19, 2015 27.7 km
IDFmw2b	1,766.4	118.3	--	2	September 29, 2012 2 km
IDFxh2 ⁴	564.7	--	--	--	July 3 to 8 and August 18 to 24, 2014 10.3 km
SBSdh1	9,771.8	892.3	10	32	June 27 to 29 and August 10 to 13, 2013 July 3 to 8 and August 18 to 24, 2014 28.9 km

- Notes:**
- 1 Descriptions of BGC variants and for TEM limitations are provided in Appendix C of this Plan.
 - 2 TEM field work was completed from 2012 to 2014. In BC, field surveys were conducted from September 28 to 29, 2012, from April 11 to 19, May 6 to 13, June 3 to 9 and September 30 to October 11, 2013, and from June 16 to 24 and August 6 to 22, 2014.
 - 3 Ground inspections and visual inspections are defined in Section 3.2 of Appendix C of Technical Report 5C-9.
 - 4 Denotes a BGC variant that occurs in the Vegetation RSA, but does not occur within the pipeline corridor.

2.1.3 Black Pines to Hope Segment

Details of the TEM and vegetation surveys for the Black Pines to Hope Segment are summarized in Table 2.1-3.

TABLE 2.1-3

**TEM AND VEGETATION SURVEYS BY BGC
VARIANT FOR THE BLACK PINES TO HOPE SEGMENT**

BGC Variant ¹	Mapped Area in the Vegetation RSA ¹ (ha)	Area within the Pipeline Corridor (ha)	Number of TEM Plots ^{2,3}		Amount of Rare Plant Survey on the Pipeline Corridor (Dates/Distance)
			Ground	Visual	
BGxh2	2,155.3	173.0	5	16	August 28, 2013 May 17 to 24, June 13 to 27, July 2 to 6 and August 5 to 19, 2014 August 18, 2015 4.8 km
BGxw1	4,197.2	292.5	16	41	May 30 to June 2 and July 24 to 25, 2013 May 17 to 24, June 13 to 27, July 2 to 6 and August 5 to 19, 2014 26.2 km

TABLE 2.1-3 Cont'd

BGC Variant ¹	Mapped Area in the Vegetation RSA ¹ (ha)	Area within the Pipeline Corridor (ha)	Number of TEM Plots ^{2,3}		Amount of Rare Plant Survey on the Pipeline Corridor (Dates/Distance)
			Ground	Visual	
CMAunp ⁴	15.7	--	--	--	May 17 to 24 and June 13 to 27, 2014 0.3 km
CWHds1	4,617.0	429.2	7	7	May 23 to 26 and July 15 to 19, 2013 May 17 to 24, June 13 to 27, July 2 to 6 and August 5 to 19, 2014 21.3 km
CWHms1	2,584.7	190.0	3	--	May 25 to 27 and July 17 to 19, 2013 June 13 to 27, 2014 16.8 km
ESSFmw	237.5	17.2	1	0	July 19, 2013 2 km
ESSFmw1	610.2	3.0	1	3	July 19, 2013 May 17 to 24 and June 13 to 27, 2014 3.6 km
IDFdk1	8,971.5	313.4	7	26	May 31 to June 2 and July 25, 2013 May 17 to 24, June 13 to 27, July 2 to 6 and August 5 to 19, 2014 15.1 km
IDFdk2	3,994.2	346.0	7	21	May 28 to 29 and July 21 to 22, 2013 May 17 to 24 and June 13 to 27, 2014 12.9 km
IDFhx1	2,904.5	249.6	15	25	May 29 to 30 and July 22 to 23, 2013 May 17 to 24, June 13 to 27, July 2 to 6 and August 5 to 19, 2014 14.7 km
IDFhx2	3,910.3	196.1	5	8	May 30, 2013 May 17 to 24, June 13 to 27, July 2 to 6, and August 5 to 19, 2014 10.6 km
IDFhx2a	5,408.8	350.4	8	36	May 30 to 31 and July 25, 2013 May 17 to 24, June 13 to 27, July 2 to 6 and August 5 to 19, 2014 18.7 km
IMAunp ⁴	201.5	--	--	--	May 17 to 24 and June 13 to 27, 2014 0.1 km
MHmm2	1,710.6	33.6	--	--	July 18, 2013 May 17 to 24 and June 13 to 27, 2014 25.1 km
MSdm2	1,234.8	28.0	--	--	July 21, 2013 0.8 km
MSmw1	2,275.5	220.0	11	20	May 28 and July 19 and 21, 2013 May 17 to 24 and June 13 to 27, 2014 32.0 km
PPhx2	6,522.3	511.4	26	91	May 31 to June 1, July 23 to 25 and August 26 to 29, 2013 May 17 to 24, June 13 to 27, July 2 to 6 and August 5 to 19, 2014 19.7 km

- Notes:**
- 1 Descriptions of BGC variants and for TEM limitations are provided in Appendix C of this Plan.
 - 2 TEM field work was completed from 2012 to 2014. In BC, field surveys were conducted from September 28 to 29, 2012, from April 11 to 19, May 6 to 13, June 3 to 9 and September 30 to October 11, 2013, and from June 16 to 24 and August 6 to 22, 2014.
 - 3 Ground inspections and visual inspections are defined in Section 3.2 of Appendix C of Technical Report 5C-9.
 - 4 Denotes a BGC variant that occurs in the Vegetation RSA, but does not occur within the pipeline corridor.

2.1.4 Hope to Burnaby Segment

Details of the TEM and vegetation surveys for the Hope to Burnaby Segment are summarized in Table 2.1-4.

TABLE 2.1-4

TEM AND VEGETATION SURVEYS BY BGC VARIANT FOR THE HOPE TO BURNABY SEGMENT

BGC Variant ¹	Mapped Area in the Vegetation RSA ¹ (ha)	Area within the Pipeline Corridor (ha)	Number of TEM Plots ^{2,3}		Amount of Rare Plant Survey on the Pipeline Corridor (Dates/Distance)
			Ground	Visual	
CWHdm	7,088.6	530.7	5	3	May 7 to 8, July 13 to 14 and August 20 and 23, 2013 April 25 to 28, June 13 to 27, August 5 to 19 and September 2 to 4, 2014 September 30, 2015 August 10, 2017 13.8 km
CWHds1	6,150.9	516.1	9	14	May 22 to 23 and July 13 to 15, 2013 April 25 to 28, June 13 to 27, August 5 to 19 and September 2 to 4, 2014 August 20, 2015 13.8 km
CWHms1 ⁴	258.0	--	--	--	April 25 to 28 and June 13 to 27, 2014 7.8 km
CWHxm1	13,978.4	1,092.6	13	6	May 7, 9, 10 and 22, July 13 to 14 and August 19 to 23, 2013 June 19, 2015 5.3 km

- Notes:**
- 1 Descriptions of BGC variants and for TEM limitations are provided in Appendix C of this Plan.
 - 2 TEM field work was completed from 2012 to 2014. In BC, field surveys were conducted from September 28 to 29, 2012, from April 11 to 19, 2013, from May 6 to 13, 2013, from June 3 to 9, 2013, from September 30 to October 11, 2013, from June 16 to 24, 2014 and from August 6 to 22, 2014.
 - 3 Ground inspections and visual inspections are defined in Section 3.2 of Appendix C of Technical Report 5C-9.
 - 4 Denotes a BGC variant that occurs in the Vegetation RSA but does not occur within the pipeline corridor.

2.1.5 Burnaby to Westridge Segment

Details of the TEM and vegetation surveys for the Burnaby to Westridge Segment are summarized in Table 2.1-5.

TABLE 2.1-5

TEM AND VEGETATION SURVEYS BY BGC VARIANT FOR THE BURNABY TO WESTRIDGE SEGMENT

BGC Variant ¹	Mapped Area in the Vegetation RSA ¹ (ha)	Area Within the Pipeline Corridor (ha)	Number of TEM Plots ²		Amount of Rare Plant Survey on the Pipeline Corridor (Dates/Distance)
			Ground	Visual	
CWHdm	920.0	96.7	--	--	May 7 to 8, July 13 to 14 and August 20 and 23, 2013 April 25 to 28, August 5 to 19 and September 2 to 4, 2014 13.5 km

- Note:**
- 1 Descriptions of BGC variants and for TEM limitations are provided in Appendix C of this Plan.
 - 2 Ground inspections and visual inspections are defined in Section 3.2 of Appendix C of Technical Report 5C-9.

2.1.6 Black Pines Pump Station

Table 2.2-3 in the Black Pines to Hope Segment above provides details of the TEM and vegetation surveys includes the Black Pines Pump Station.

2.2 Vegetation Communities of Concern

Including the cedar grove identified by TEK participants along the Hope to Burnaby Segment, 21 ecological communities listed by ACIMS, BC CDC and IWMS were observed in various amounts along the pipeline corridor during 2014 and 2015 field surveys (Appendix E of this Plan). These are presented in the following subsections organized according to pipeline corridor segment.

BC CDC-listed rare ecological communities observed during the 2014 and 2015 vegetation surveys are summarized in Table 2.2-1. Details of rare ecological communities not described in Technical Report 5C-9 are now summarized in Table 2.2-1.

TABLE 2.2-1

RARE ECOLOGICAL COMMUNITIES OBSERVED IN PROXIMITY TO THE PIPELINE CORRIDOR IN 2014 AND 2015¹

Common Name	Scientific Name	Provincial Designation ²	Number of Times Observed by Project Component ³							
			E-H	H-D	BP-H	H-B	B-W	BPS	BPPS	ST
Baltic rush - common silverweed	<i>Juncus balticus</i> - <i>Potentilla anserina</i>	S2, Red	--	--	3	--	--	--	--	--
Bebb's willow/bluejoint reedgrass	<i>Salix bebbiana</i> / <i>Calamagrostis canadensis</i>	S2S3, Blue	--	2	2	1	--	1	--	--
Big sagebrush/bluebunch wheatgrass	<i>Artemisia tridentata</i> / <i>Pseudoroegneria spicata</i>	S2, Red	--	--	2	--	--	--	--	--
Black cottonwood - spruces/red-osier dogwood	<i>Populus trichocarpa</i> - <i>Picea spp.</i> / <i>Cornus stolonifera</i>	S2?, Red	--	--	1	--	--	--	--	--
Black spruce/skunk cabbage/peat-mosses	<i>Picea mariana</i> / <i>Lysichiton americanus</i> / <i>Sphagnum spp.</i>	S2S3, Blue	--	2	--	--	--	--	--	--
Bluebunch wheatgrass - junegrass	<i>Pseudoroegneria spicata</i> - <i>Koeleria macrantha</i>	S3, Blue	--	--	6	--	--	--	--	--
Common cattail marsh	<i>Typha latifolia</i> Marsh	S3, Blue	--	8	2	2	--	--	--	--
Douglas-fir/common snowberry - saskatoon	<i>Pseudotsuga menziesii</i> / <i>Symphoricarpos albus</i> - <i>Amelanchier alnifolia</i>	S2, Red	--	--	1	--	--	--	1	--
Narrow-leaf willow shrubland	<i>Salix exigua</i> Shrubland	S2, Red	--	--	1	--	--	--	--	--
Ponderosa pine/bluebunch wheatgrass - rough fescue	<i>Pinus ponderosa</i> / <i>Pseudoroegneria spicata</i> - <i>Festuca campestris</i>	S2, Red	--	--	2	--	--	--	--	--
Rough fescue - bluebunch wheatgrass	<i>Festuca campestris</i> - <i>Pseudoroegneria spicata</i>	S2, Red	--	--	2	--	--	--	--	--
Sitka willow/Sitka sedge	<i>Salix sitchensis</i> / <i>Carex sitchensis</i>	S3, Blue	--	2	1	--	--	--	--	--
Slender sedge/common hook-moss	<i>Carex lasiocarpa</i> / <i>Drepanocladus aduncus</i>	S3, Blue	--	1	--	--	--	--	--	--
Swamp horsetail - beaked sedge	<i>Equisetum fluviatile</i> - <i>Carex utriculata</i>	S3, Blue	--	1	2	--	--	--	--	--
Trembling aspen/common snowberry/Kentucky bluegrass	<i>Populus tremuloides</i> / <i>Symphoricarpos albus</i> / <i>Poa pratensis</i>	S2, Red	--	--	2	--	--	--	--	--
Trembling aspen/common snowberry/mountain sweet-cicely	<i>Populus tremuloides</i> / <i>Symphoricarpos albus</i> / <i>Osmorhiza berterio</i>	S1, Red	--	--	1	--	--	--	--	--
Western hemlock-Douglas fir-bigleaf maple-western redcedar/sword fern-dull Oregon-grape	<i>Tsuga heterophylla</i> - <i>Pseudotsuga menziesii</i> - <i>Acer macrophyllum</i> - <i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Mahonia nervosa</i>	Ecological Community of Concern	--	--	--	1	--	--	--	--
Western redcedar - Douglas-fir/false Solomon's seal	<i>Thuja plicata</i> - <i>Pseudotsuga menziesii</i> / <i>Maianthemum racemosum</i>	S1, Red	--	--	1	--	--	--	--	--
Western redcedar/sword fern	<i>Thuja plicata</i> / <i>Polytichum munitum</i>	S2S3, Blue	--	--	--	3	--	--	--	2
Western redcedar/sword fern -skunk cabbage	<i>Thuja plicata</i> / <i>Polytichum munitum</i> - <i>Lysichiton americanus</i>	S3?, Blue	--	--	--	1	--	--	--	--
Willow/ostrich-fern	<i>Salix spp.</i> / <i>Matteuccia struthiopteris</i>	Ecological Community of Concern	1	--	--	--	--	--	--	--

- Notes:**
- This table does not include all rare ecological communities identified during wetland surveys. Further information on wetlands surveys is detailed in the Wetland Survey and Mitigation Plan for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project. Mitigation for rare wetland communities identified during wetland surveys is detailed in Appendix E of this Plan.
 - Definitions of provincial and federal ranks are summarized in the footnotes of Appendix E of this Plan.
 - Project Components are: E-H = Edmonton to Hinton Segment; H-D = Hargreaves to Darfield Segment; BP-H = Black Pines to Hope Segment; H-B = Hope to Burnaby Segment; B-W = Burnaby to Westridge Segment; BPS = Blackpool Pump Station; BPPS = Black Pines Pump Station; and ST = Sumas Terminal.

TABLE 2.2-2

DESCRIPTIONS OF PREVIOUSLY UNDESCRIBED COMMUNITIES OF CONCERN OBSERVED ALONG THE PIPELINE CORRIDOR¹

Common Name	Scientific Names	Provincial Designation ²	General Description/Location in Landscape	Water Table	Soils/Peat Depth	Dominants Plants	Common Plants	Observed Natural Regions or BGC Zones ³
Alberta								
Willow/ostrich-fern	<i>Salix</i> spp./ <i>Matteuccia struthiopteris</i>	Ecological community of concern	Located in a riparian area along a stream within Wabamun Provincial Park.	--	Soils are poorly drained ranging from hydric to sub-hydric and nutrient-rich.	Tall shining willow and pussy willow form the tall shrub layer, while ostrich fern is dominant in the herb layer.	Bluejoint Dewberry Horsetail species Red and white baneberry	Dry Mixedwood
BC								
Baltic rush - common silverweed	<i>Juncus balticus</i> - <i>Potentilla anserina</i>	S2, Red	Occurs in alkaline or saline locations with early-season saturation and decreasing water availability throughout the year.	Soils are generally moist, with early-season saturation.	Fine, poorly drained soils.	Baltic rush	Common silverweed Foxtail barley	IDF
Black cottonwood - spruces/red-osier dogwood	<i>Populus trichocarpa</i> - <i>Picea</i> spp./ <i>Cornus stolonifera</i>	S2?, Red	Occurs on sandy or gravelly areas next to flowing water at low elevations through the Interior.	Short flood periods with year-round irrigation of subsoil.	Soils are Cumulic Regosols or Gleyed Brunisols.	Black cottonwood Red-osier dogwood Mountain alder Spruce species	Highbush-cranberry Common horsetail Prickly rose Black twinberry	IDF
Black spruce/skunk cabbage/peat-mosses	<i>Picea mariana</i> / <i>Lysichiton americanus</i> / <i>Sphagnum</i> spp.	S2S3, Blue	Strongly mounded swamp/bog which occurs in Central Interior areas with a rainforest climate.	Standing water is present between soil mounds.	Layers of woody humic or mesic peat 20-150 cm deep over Terric Humisols/Mesisols or Terric Gleysols.	Black spruce Skunk cabbage Sphagnum species	Shore pine Subalpine fir Western hemlock	ICH
Douglas-fir/common snowberry - saskatoon	<i>Pseudotsuga menziesii</i> / <i>Symphoricarpos albus</i> - <i>Amelanchier alnifolia</i>	S2, Red	Occurs on valley bottoms along the Yalakom and Nicola rivers.	--	Mesic to sub-hydric with medium to very rich nutrient regime.	Ponderosa pine Common snowberry Saskatoon	Interior Douglas-fir Pinegrass	PP
Sitka willow/Sitka sedge	<i>Salix sitchensis</i> / <i>Carex sitchensis</i>	S3, Blue	Occurs near the coast and in mountains, Nass Basin, Southern Interior Mountains and the Sub-Boreal Interior.	Soil is saturated, and floods briefly in the spring.	Soils are most often Gleysols; sedge peat may be layered. Nutrient regime is medium to rich.	Sitka willow Sitka sedge Common horsetail	Small-flowered bulrush	IDF ICH
Slender sedge/common hook-moss	<i>Carex lasiocarpa</i> / <i>Drepanocladus aduncus</i>	S3, Blue	Fen occurs in the Interior at low elevations, surrounding small waterbodies on peat flats.	Prolonged surface flooding and continuous surface saturation.	Deep peat generally over Mesisols or Humisols and Fibrisols.	Slender sedge Common hook moss	Water sedge Beaked sedge	IDF
Trembling aspen/common snowberry/Kentucky bluegrass	<i>Populus tremuloides</i> / <i>Symphoricarpos albus</i> / <i>Poa pratensis</i>	S2, Red	Occurs along the Douglas Plateau and north and south of Kamloops.	--	Subhygric to hygric soils with a poor to very rich soil nutrient regime.	Trembling aspen	Common snowberry Kentucky bluegrass Nootka rose Blue wildrye	IDF BG
Trembling aspen/common snowberry/mountain sweet-cicely	<i>Populus tremuloides</i> / <i>Symphoricarpos albus</i> / <i>Osmorhiza berterio</i>	S1, Red	Occurs in the low and middle slopes of the Okanagan valley. Forest is present as patches on moist locations within coniferous forests with gentle slopes and organic matter in the soil.	--	Subhygric soils with a rich nutrient regime.	Trembling aspen Choke cherry Common snowberry	Mountain sweet-cicely Rose species Star-flowered false Solomon's-seal.	IDF
Western hemlock - Douglas fir - bigleaf maple - western redcedar/sword fern - dull Oregon-grape	<i>Tsuga heterophylla</i> - <i>Pseudotsuga menziesii</i> - <i>Acer macrophyllum</i> - <i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Mahonia nervosa</i>	Ecological community of concern	This mature forest community is not provincially-listed, but due to its local significance within metropolitan Vancouver, it was considered by vegetation specialists to merit special consideration.	--	--	Western hemlock Douglas fir Bigleaf maple Western redcedar Sword fern Dull Oregon-grape	--	CWH
Western redcedar - Douglas-fir/false Solomon's seal	<i>Thuja plicata</i> - <i>Pseudotsuga menziesii</i> / <i>Maianthemum racemosum</i>	S1, Red	Occurs in gently sloped riparian locations with cold air drainage.	--	Subhygric to hygric soils with a medium to rich nutrient regime.	Western redcedar Douglas fir Douglas maple	False Solomon's seal Paper birch Falsebox Sarsaparilla	IDF
Western redcedar/sword fern - Dry Maritime	<i>Thuja plicata</i> / <i>Polystichum munitum</i>	S2S3, Blue	Occurs at low elevations, from Hardwicke Island to the Chilliwack River, along the Sunshine Coast and the Fraser Valley.	--	Slightly dry to fresh soil with a rich to very rich soil nutrient regime.	Western redcedar Western hemlock Douglas-fir Sword fern	Vine maple Step moss Oregon beaked moss	CWH
Western redcedar/sword fern - skunk cabbage	<i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i>	S3?, Blue	Swamp occurs in the Georgia Depression in wet depressions, toe slopes and along the margins of peatlands.	Soils are wet in low areas and drier in raised mounds.	Soils are medium to rich Gleysols and Humisols, usually with a layer of woody peat.	Western redcedar Red alder Skunk cabbage	Western hemlock Bigleaf maple Indian-plum Salmonberry Sword fern	CWH

Sources: Green and Klinka 1994, Iverson *et al.* 2004, Lloyd *et al.* 1990, MacKenzie and Moran 2004

- Notes:
- 1 This table does not include all rare ecological communities identified during wetland surveys. Further information on wetlands surveys is detailed in the Wetland Survey and Mitigation Plan for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project. Mitigation for rare wetland communities identified during wetland surveys is detailed in Appendix E of this Plan.
 - 2 Definitions of provincial and federal ranks are summarized in the footnotes of Appendix E of this Plan.
 - 3 BG = Bunchgrass; CWH = Coastal Western Hemlock; ICH = Interior Cedar - Hemlock; IDF = Interior Douglas-fir; and PP = Ponderosa Pine.

2.2.1 Edmonton to Hinton Segment

One ecological community of concern was also observed along the Edmonton to Hinton Segment in 2014. The willow/ostrich fern (*Salix* ssp. / *Matteuccia struthiopteris*) community is not listed by ACIMS (AEP 2015a); however, it was recognized by the vegetation specialists as meeting the criteria for an ecological community of concern (*i.e.*, one that is uncommon and a potential candidate for addition to the ACIMS tracking or watch lists) (Allen 2011). As ostrich fern is an uncommon species, this community is also considered uncommon (Allen pers. comm.). This may be a new community or a variation of one currently tracked in Alberta.

2.2.2 Hargreaves to Darfield Segment

No BC IWMS-listed communities were observed along the Hargreaves to Darfield Segment during vegetation surveys, TEM surveys and wetland surveys in 2014 or 2015.

A total of 16 BC CDC-listed rare ecological communities were observed during the vegetation surveys, wetland surveys and TEM surveys. A summary of these rare ecological communities is provided in Appendix E of this report.

2.2.3 Black Pines to Hope Segment

No BC IWMS-listed communities were observed along the Black Pines to Hope Segment during vegetation surveys, TEM surveys and wetland surveys in 2014 or 2015.

A total of 29 BC CDC-listed rare ecological communities were observed during the vegetation surveys, wetland surveys and TEM surveys. A summary of these rare ecological communities is provided in Appendix E of this report.

2.2.4 Hope to Burnaby Segment

No BC IWMS-listed communities were observed along the Hope to Burnaby Segment during vegetation surveys, TEM surveys and wetland surveys in 2014 or 2015.

A total of seven BC CDC-listed rare ecological communities were observed during the vegetation surveys, wetland surveys and TEM surveys. A summary of these rare ecological communities is provided in Appendix E of this report.

In addition, one ecological community of concern, western hemlock - Douglas fir - bigleaf maple-western redcedar/sword fern-dull Oregon-grape, was also observed along the Hope to Burnaby Segment.

2.2.5 Burnaby to Westridge Segment

No BC IWMS-listed or BC CDC-listed rare ecological communities were observed along the Burnaby to Westridge Segment during vegetation surveys, TEM surveys or wetland surveys in 2014 or 2015.

2.2.6 Rearguard Pump Station

No BC IWMS-listed or BC CDC-listed rare ecological communities were observed at the Rearguard Pump Station during the 2014 vegetation surveys.

2.2.7 Blackpool Pump Station

No BC IWMS-listed or BC CDC-listed rare ecological communities were observed at the Blackpool Pump Station during vegetation surveys in 2014.

2.2.8 Black Pines Pump Station

No BC IWMS-listed or BC CDC-listed rare ecological communities were observed at the Black Pines Pump Station or power line during vegetation surveys in 2014.

2.2.9 Kingsvale Pump Station

No BC IWMS-listed or BC CDC-listed rare ecological communities were observed along the Kingsvale power line during the 2014 vegetation surveys.

2.2.10 Sumas Terminal

No BC IWMS-listed communities were observed at the Sumas Terminal during vegetation surveys in 2014.

Two occurrences of a BC CDC-listed rare ecological community, western redcedar/sword fern (S2S3, Blue-listed), were observed at the Sumas Terminal during the 2014 vegetation surveys. These two occurrences are no longer located on the Project Footprint.

2.2.11 Burnaby Terminal

No BC IWMS-listed or BC CDC-listed rare ecological communities were observed at the Burnaby Terminal during the 2014 vegetation surveys.

2.2.12 Westridge Marine Terminal

No BC IWMS-listed or BC CDC-listed rare ecological communities were observed at the Westridge Marine Terminal during the 2014 vegetation surveys.

2.3 Plant and Lichen Species of Concern

The abundance and distribution of the rare plants and lichens observed during the vegetation surveys are detailed in Appendix E of this Plan. No species designated under the Alberta *Wildlife Act* and/or BC IWMS were observed during the surveys.

2.3.1 Federally-Listed Rare Plant and Lichens

Species-specific surveys were conducted for five SARA-listed species, namely Mexican mosquito fern, Roell's brotherella moss, toothcup meadow-foam, Vancouver Island beggarticks and whitebark pine. These surveys are discussed under each Project segment.

No plant or lichen species listed by COSEWIC or the SARA were observed on the pipeline corridor during the 2014, 2015 or 2017 vegetation surveys. The SARA-listed species, Mexican mosquito fern, was initially reported to be potentially observed in 2013, however upon further investigation the plant was mistakenly identified and was confirmed to be not present during surveys in 2014.

2.3.2 Edmonton to Hinton Segment

No COSEWIC or SARA-listed species were potentially identified during field surveys in 2013 along the Edmonton to Hinton Segment, nor was critical habitat (Environment Canada 2013) located within the corridor. Therefore, no SARA-listed species-specific surveys were conducted along the Edmonton to Hinton Segment.

No COSEWIC or SARA-listed species were observed along the Edmonton to Hinton Segment during the vegetation surveys in 2014 or 2015. No species designated under the Alberta *Wildlife Act* were observed during the vegetation surveys.

Two ACIMS-listed rare plant species were identified along the proposed pipeline corridor for this segment in 2014. The observed ACIMS-listed rare species include five occurrences of vascular plants (Appendix E of this Plan). A summary of these rare plants is provided in Table 2.3-1.

TABLE 2.3-1

**RARE PLANTS AND LICHENS OBSERVED IN PROXIMITY
TO THE ALBERTA PORTION OF THE PIPELINE CORRIDOR**

Common Name	Scientific Name	Provincial Designation ¹	Number of Times Observed
Vascular Plants			
Golden saxifrage	<i>Chryso-splenium iowense</i>	S4, Watched	4
Spatulate grape fern	<i>Botrychium spathulatum</i>	S3, Tracked	1

Note: 1 Definitions of provincial designation are summarized in the footnotes of Appendix E of this Plan.

2.3.3 Hargreaves to Darfield Segment

Species-specific surveys were conducted along the Hargreaves to Darfield Segment for Mexican mosquito fern and whitebark pine. No COSEWIC and SARA-listed species were observed along the Hargreaves to Darfield Segment during the vegetation surveys.

Aerial surveys for whitebark pine along the portion of the Hargreaves to Darfield Segment north of Valemount, BC revealed whitebark pine located at high altitudes compared to the Project components, more than 1,000 m above the pipeline corridor.

No Mexican mosquito fern populations were observed at areas of high potential for occurrence along this segment during vegetation surveys in 2014.

No species designated under the BC IWMS were observed during the vegetation surveys.

A total of six BC CDC-listed rare plant species were identified along the proposed pipeline corridor for this segment in 2014. The observed BC CDC-listed rare species include seven vascular plant occurrences (Appendix E of this Plan). A summary of these rare plants is provided in Table 2.3-2.

TABLE 2.3-2

**RARE PLANTS OBSERVED IN PROXIMITY
TO THE BC PORTION OF THE PROPOSED PIPELINE CORRIDOR**

Common Name	Scientific Name	Provincial Designation ¹	Number of Times Observed
Crested wood fern	<i>Dryopteris cristata</i>	S3, Blue	1
Dainty moonwort	<i>Botrychium crenulatum</i>	S2S3, Blue	1
Hornemann's willowherb	<i>Epilobium hornemannii</i> ssp. <i>behringianum</i>	S2S3, Blue	1
Mountain moonwort	<i>Botrychium montanum</i>	S2?, Red	1
Spoon-shaped moonwort	<i>Botrychium spathulatum</i>	S3, Blue	1
White wintergreen	<i>Pyrola elliptica</i>	S3, Blue	2

Note: 1 Definitions of provincial and federal ranks are summarized in the footnotes of Appendix E of this Plan.

2.3.3.1 Hornemann's Willowherb (S2S3, Blue)

Hornemann's willowherb (*Epilobium hornemannii* subsp. *Behringianum* Rchb. [Hauskn]) is a perennial plant which ranges from 10-45 cm tall with stiff hairs along the stem. Finely toothed leaves range in shape from broadly elliptic to oblanceolate, narrowing towards the flowers. This subspecies is distinguished by the presence of persistent, broad old leaves at the base of the plant and by sharp-toothed margins to the leaves. The flower cluster is formed of pink or occasionally white flowers, with notched petals 3-9 mm long. Hornemann's willowherb is found in moist cliffs, meadows and river banks in mountainous regions (Douglas *et al.* 1998-2002). It is ranked S2S3 and is on the Blue-list in BC.

2.3.4 Black Pines to Hope Segment

Species-specific surveys were conducted for toothcup meadow-foam and whitebark pine along the Black Pines to Hope Segment. No COSEWIC or SARA-listed species were observed along the Black Pines to Hope Segment during the vegetation surveys.

Aerial surveys conducted in June 2014 for whitebark pine along the portion of the Blackpines to Hope Segment, adjacent to the Coquihalla Summit Recreation Area, exhibited whitebark pine habitat approximately 0.8 km (RK 1001 to RK 1004; KP 994 to KP 997) from pipeline construction footprint. This whitebark pine habitat was observed at high altitudes compared to the Project components, approximately 1,000 m above the pipeline corridor. No whitebark pine trees or whitebark pine habitat was observed during ground surveys conducted on October 1, 2015.

In addition, field surveys for potential toothcup meadow-foam populations near the City of Kamloops were conducted in May 2014, August to October 2014 and August 2015, however, no observations of this rare plant were recorded.

No species designated under the BC IWMS or the BC CDC were observed during the vegetation surveys.

2.3.5 Hope to Burnaby Segment

Targetted species-specific surveys were conducted for Roell's brotherella moss and Vancouver Island beggarticks along the Hope to Burnaby Segment. No COSEWIC or SARA-listed species were observed along the Hope to Burnaby Segment during the vegetation surveys.

Species-specific moss collections in appropriate microsites were conducted within early draft critical habitat polygons at sites on the pipeline construction footprint selected through desktop review of TEM polygons and riparian areas (KP 1077.1, KP 1115.5, and KP 1179.9). None of the specimens collected were determined to be Roell's brotherella moss (McIntosh pers comm). Areas within early draft critical habitat with the biophysical attributes to support Roell's brotherella moss, identified through desktop review or field work, are provided in Appendix E.

In addition, a second late-season survey was conducted between KP 1177.0 and KP 1177.3 at a previously reported location of Vancouver Island beggarticks (*Bidens amplissima*, S3, blue-list, SARA designation Special Concern). This location was also surveyed on August 17, 2014. Five Vancouver Island beggartick plants were observed at this location in 1999 in a dried pool depression in a grassy area in a light industrial complex (BC MOE 2017). No Vancouver Island beggarticks were observed in 2014 or 2017.

No species designated under the BC IWMS were observed during the vegetation surveys.

No BC CDC-listed species were observed during vegetation surveys in 2014, 2015 or 2017 along the Hope to Burnaby Segment.

2.3.6 Burnaby to Westridge Segment

No COSEWIC or SARA-listed species were potentially identified during field surveys in 2013 along the Burnaby to Westridge Segment, nor was critical habitat (Environment Canada 2013) located within the corridor. Therefore, no SARA-listed species-specific surveys were conducted along the Burnaby to Westridge Segment. No COSEWIC or SARA-listed species were observed along the Burnaby to Westridge Segment during the vegetation surveys in 2014 or 2015. No species designated under the BC IWMS were observed during the vegetation surveys.

No BC CDC-listed species were observed during vegetation surveys in 2014 or 2015 along the Burnaby to Westridge Segment.

2.3.7 Rearguard Pump Station

No COSEWIC or SARA-listed species were observed at the Rearguard Pump Station during the vegetation surveys. In addition, no species designated under the BC IWMS were observed during the pump station vegetation surveys.

No BC CDC-listed rare plant or lichen species were observed at the Rearguard Pump Station during the 2014 vegetation surveys.

2.3.8 Blackpool Pump Station

No COSEWIC or SARA-listed species were observed at the Blackpool Pump Station during the vegetation surveys. In addition, no species designated under the BC IWMS were observed during the pump station vegetation surveys.

No BC CDC-listed rare plant or lichen species were observed at the Blackpool Pump Station during the 2014 vegetation surveys.

2.3.9 Black Pines Pump Station

No COSEWIC or SARA-listed species were observed at the Black Pines Pump Station during the vegetation surveys. In addition, no species designated under the BC IWMS were observed during the pump station vegetation surveys.

One BC CDC-listed rare plant species, whip fork moss (S3, Blue-listed), was observed along the west section of the Black Pines power line during the 2014 vegetation surveys. This species was subsequently down-listed in 2015 (S3S4, Yellow), and as such is no longer deemed rare.

2.3.10 Kingsvale Pump Station

No COSEWIC or SARA-listed species were observed at the Kingsvale Pump Station during the vegetation surveys. In addition, no species designated under the BC IWMS were observed during the pump station vegetation surveys.

No BC CDC-listed rare plant or lichen species were observed along the Kingsvale power line during the 2014 vegetation surveys.

2.3.11 Sumas Terminal

No COSEWIC or SARA-listed species were observed at the Sumas Terminal during the vegetation surveys. In addition, no species designated under the BC IWMS were observed during the vegetation surveys.

No BC CDC-listed rare plant or lichen species were observed at the Sumas Terminal during the 2014 vegetation surveys.

2.3.12 Burnaby Terminal

No COSEWIC or SARA-listed species were observed at the Burnaby Terminal during the vegetation surveys. In addition, no species designated under the BC IWMS were observed during the vegetation surveys.

No BC CDC-listed rare plant or lichen species were observed at the Burnaby Terminal during the 2014 vegetation surveys.

2.3.13 Westridge Marine Terminal

No COSEWIC or SARA-listed species were observed at the Westridge Marine Terminal during the vegetation surveys. In addition, no species designated under the BC IWMS were observed during the vegetation surveys.

No BC CDC-listed rare plant or lichen species were observed at the Westridge Marine Terminal during the 2014 vegetation surveys.

APPENDIX E

MITIGATION FOR THE OCCURRENCES OF RARE PLANTS, LICHENS, AND ECOLOGICAL COMMUNITIES OBSERVED ALONG THE PROJECT FOOTPRINT

APPENDIX E

MITIGATION FOR THE OCCURRENCES OF RARE PLANTS, LICHENS AND ECOLOGICAL COMMUNITIES OBSERVED ALONG THE PIPELINE CONSTRUCTION FOOTPRINT

TABLE E-1

MITIGATION FOR THE OCCURRENCES OF RARE PLANTS, LICHENS AND ECOLOGICAL COMMUNITIES OBSERVED ALONG THE PIPELINE CONSTRUCTION FOOTPRINT IN ALBERTA

Species (Provincial Rank) ¹	Feature ID ²	Legal Location	KP ³	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing ⁴
Alberta								
Edmonton to Edson Segment								
<i>Physciella</i> lichen <i>Physciella chloantha</i> (SU)	PHYSCHL695383	5-25-51-25 W4M	28.20	July 16, 2013	Occurs on the bark of a dead alder stump in a riparian area.	Specimen was collected within the temporary workspace, approximately 8 m south of the centreline.	This site was revisited August 16, 2017. The alder stump has been colonised by ants and significant additional decay has occurred. No bark or <i>Physciella</i> lichen was observed. No further mitigation is recommended at this site as original occurrence has been altered and the lichen is no longer present.	12U 329703, 5923202
Willow species/strich fern <i>Salix</i> spp. / <i>Matteuccia struthiopteris</i>	SALISPP315645	NE 12-53-4 W5M	95.55	June 13, 2014	Unique wetland community identified along the southern edge of the pipeline construction footprint during rare plant/rare ecological community surveys.	Community occurs on the southern edge of the pipeline construction footprint, approximately 16 m south of the centreline and 4 m from the pipeline construction footprint edge.	No mitigation is required as this community is more than 4 m from the pipeline construction footprint, however, follow general mitigation measures to avoid accidental encroachment.	11U 669315, 5938657 11U 669292, 5938584
Beaked willow/red-osier dogwood shrubland <i>Salix bebbiana</i> / <i>Cornus stolonifera</i> shrubland (S3?)	SALIBEB433082 VG-2 Wetland Report ID Edmo-Edso_WC82apoint63	N1/2 10-53-4 W5M	99.57 to 100.19	June 1, 2013	Rare community identified during wetland surveys.	Community spans the entire width of the proposed pipeline construction footprint, extending off of the proposed pipeline construction footprint in both directions.	Schedule construction to occur during frozen ground conditions where feasible. To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 665433, 5938083 11U 664828, 5938008
Beaked willow/red-osier dogwood shrubland <i>Salix bebbiana</i> / <i>Cornus stolonifera</i> shrubland (S3?)	SALIBEB943100 VG-2 Wetland Report ID Edmo-Edso_WC82bpoint63	NW-10-53-4 W5M	99.80 to 100.33	July 17, 2013	Community on the pipeline construction footprint for 75 m. Community was located in a flat shrubby swamp.	Community spans the pipeline construction footprint and extends off in both directions.	Schedule construction to occur during frozen ground conditions where feasible. To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 665190, 5938124 11U 664686, 5937978
<i>Sarmenthynum</i> moss <i>Sarmenthynum sarmentosum</i> (SU)	SARMSAR589628	14-16-53-5 W5M	112.33	May 22, 2013	Occurs on a rock by a stream.	Plant occurs approximately 2 m north of centerline.	This site was revisited August 16, 2017. The stream has been heavily used by cattle and suitable habitat is no longer present. No <i>Sarmenthynum</i> moss was observed on the rocks in the vicinity of the original observation. No further mitigation is recommended at this site as original occurrence has been altered and the moss could not be located.	11U 653589, 5939628
Green spur-fruited fork moss <i>Oncophorus virens</i> (S3)	ONCOVIR697377	3-19-53-7 W5M	135.58	May 21, 2013	Occurs at base of tree stump in the last stages of decay in a white spruce, aspen and birch forest.	Specimen was collected approximately 24 m south of the centreline.	This site was revisited August 16, 2017. The population was relocated off of the pipeline construction footprint to a similar location (e.g., tree cover, moisture, slope) to the north of the pipeline construction footprint. The recipient site is located at 11U 630589, 5939515, approximately 55 m from the pipeline construction footprint and has been marked to avoid accidental disturbance.	Original location: 11U 630718, 5939372 Transplant location: 11U 630589 5939515
Snakeskin liverwort <i>Conocephalum salebrosum</i> (S2S4)	CONOSAL720601 VG-5	12-23-53-10 W5M	158.80 to 158.81	July 20, 2013	Three patches consisting of approximately 100, 200, and 200 thalli, respectively were observed in a 40 m × 10 m area of a treed riparian fen in bare wet soil under where a spruce tree used to be.	The patches all occur south of the centreline.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 607706, 5939563 11U 607709, 5939567 11U 607720, 5939601
Three-leaved goldthread <i>Coptis trifolia</i> (S3, W)	COPTTRI720823	12-29-53-11 W5M to 12-30-53-11 W5M	173.88 to 175.26	July 21, 2013 May 21, 2013	More than 460 leaves were observed in a dozen patches ranging in area from 20 cm × 50 cm to 240 m × 35 m in open lodgepole pine woodland habitat. Plants occurred regularly, although at times discontinuously, throughout the existing pipeline construction footprint both to the north and south but most prominently to the south.	Plants occur between approximately 35 m north to 45 m south from the centreline.	Since this is a Watch List species, mitigation is not recommended.	11U 591470, 5940846 11U 592299, 5940873 11U 592354, 5940807 11U 592727, 5940816 11U 592848, 5940832
Toothed bittercress <i>Cardamine dentata</i> (S2)	CARDDEN568932 VG-8	5-26-53-14 W5M	198.74	June 13, 2013	Two plants were observed approximately 18 m apart within a shrubby riparian fen.	Plants occur approximately 12 m north of centreline and approximately 5 m from the northwest edge of the pipeline construction footprint.	If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 568550, 5939920 11U 568568, 5939932

TABLE E-1 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Beaked sedge marsh <i>Carex rostrata</i> marsh (S2)	CAREROS833828 VG-1 Wetland Report ID Edso- Hint_W238	2-5-53-19 W5M	255.70 to 255.83	August 6, 2013	Community was observed in a sedge zone of a deep basin marsh around a small lake although not immediately adjacent to the lake but as a band in the middle. May be more extensive on the east side of a small lake heading north. West side of lake did not appear to contain this community.	Community occurs within the northern extent of the pipeline construction footprint, and extends north off of the pipeline construction footprint.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 515863, 5932783 11U 515728, 5932781
Slender naiad <i>Najas flexilis</i> (S3)	NAJAFLE799775 VG-9	2-5-53-19 W5M	255.77	August 6, 2013	Population size and extent is unknown. Plant occurred within a small lake, which was surrounded by a deep basin marsh and therefore difficult to access. Only one patch was observed in a 0.4 m x 0.4 m area.	Plants occur approximately 15 m from the centreline.	See mitigation for beaked sedge marsh occurrence at KP 255.70 to 255.83 above. Slender naiad is an aquatic, floating plant and will be dependent on the success of wetland mitigation for the beaked sedge marsh at KP 255.70 to KP 255.83.	11U 515799, 5932775
Crested wood fern <i>Dryopteris cristata</i> (S3, T)	GYMNDIS011317	15-36-52-23 W5M	285.41 to 285.43	August 6, 2013	Two subpopulations were observed. The first consisted of 150 plants in a 22 m x 10 m area. The second consisted of 200 plants in a 25 m x 12 m area. Both subpopulations occur at the base of a hill.	Both subpopulations have been avoided by the proposed pipeline construction footprint.	No mitigation is required as this population is more than 5 m from the pipeline construction footprint, however, follow general mitigation measures to avoid accidental encroachment.	11U 488004, 5933330 11U 488006, 5933311 11U 488008, 5933309 11U 488011, 5933317 11U 488031, 5933259 11U 488050, 5933262 11U 488054, 5933262
Snakeskin liverwort <i>Conocephalum salebrosum</i> (S2S4)	CONOSAL244152 VG-10	15-36-52-23 W5M	290.36 to 290.45	August 11, 2013	> 100 thalli were observed in an approximately 85 m x 3 m area. Plants occur on a creek bank on vertical sides where shaded and on bare soil with mosses.	Plants occur within the pipeline construction footprint, extending from the centreline to approximately 3 m from the southeast edge. The possibility exists that this population may extend off of the pipeline construction footprint in both directions.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, conduct separate strippings salvage along the riparian bank, isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 483235, 5932133 11U 483244, 5932152 11U 483301, 5932191 11U 483238, 5932147
<i>Pellia</i> species <i>Pellia</i> sp. (SU)	PELISP238152 VG-11	15-36-52-23 W5M	290.44	August 11, 2013	Occurs on a moist vertical bank at the edge of a stream under speckled alder.	Specimen was collected approximately 6 m north of the centreline.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, conduct separate strippings salvage along the riparian bank, isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 483238, 5932152
Snakeskin liverwort <i>Conocephalum salebrosum</i> (S2S4)	CONOSAL958657	11-21-52-23 W5M	297.14	August 12, 2013	Approximately 13 thalli were observed in a 40 cm x 20 cm area along a creek bank adjacent to mosses.	Population has been avoided by the pipeline construction footprint. Plants occurred approximately 27 m south from the centreline, approximately 6 m from the south edge of the pipeline construction footprint.	No mitigation is required as this population is more than 6 m from the pipeline construction footprint, however, follow general mitigation measures to avoid accidental encroachment.	11U 477958, 5928657
<i>Pellia</i> species <i>Pellia</i> sp. (SU, T)	PELISP954658	11-21-52-23 W5M	297.14	August 12, 2013	Occurs on bare soil on the vertical side of a creek within a spruce and black cottonwood forest.	Population has been avoided by the proposed pipeline construction footprint. Specimen was collected approximately 27 m south from the centreline in the temporary workspace, approximately 6 m from the south edge of the footprint.	No mitigation is required as this population is more than 6 m from the pipeline construction footprint, however, follow general mitigation measures to avoid accidental encroachment.	11U 477954, 5928658
Dainty moonwort <i>Botrychium crenulatum</i> (S2S3, blue)	BOTRCRE291430	12-14-50-26 W5M	331.84	June 29, 2013	Six plants were observed within a 0.5 m radius of the recorded UTM.	Population has been avoided by the pipeline construction footprint. Plants occurred approximately 20 m northwest from the centreline.	No mitigation is required as this population is more than 6 m from the pipeline construction footprint, however, follow general mitigation measures to avoid accidental encroachment.	11U 453291, 5908430

TABLE E-2

MITIGATION FOR THE OCCURRENCES OF RARE PLANTS, LICHENS AND ECOLOGICAL COMMUNITIES OBSERVED ALONG THE PIPELINE CONSTRUCTION FOOTPRINT IN BRITISH COLUMBIA

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
British Columbia								
Hargreaves to Darfield Segment								
Whitebark pine candidate regeneration critical habitat <i>Pinus albicaulis</i> candidate regeneration critical habitat	PINUALB_CRITHAB1 VG-12 and VG-15	b-020-B/083-E-03 to d-075-K/083-D-14 and c-075-K/083-D-14 to and d-60-K/083-D-14	489.16 to 494.34; and 494.76 to 499.79 (Hargreaves Trap Site)	Aerial survey was conducted on August 19, 2014. Ground surveys were conducted in July and August, 2014	No whitebark pine trees were observed within 2 km of the centreline.	A whitebark pine candidate regeneration critical habitat polygon (Environment Canada 2014a) spans the width of the pipeline construction footprint in this location, including the Hargreaves Trap Site. Also extending off of the pipeline construction footprint in both directions (north and south) and continues east into Mount Robson Park where reactivation sites are planned along the existing TMPL line. Access roads transect these polygons.	The extent of candidate regeneration critical habitat is not publicly available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Restore or enhance biophysical attributes of critical habitat along the pipeline construction footprint by revegetating the pipeline construction footprint using native tree and shrub seeds and propagation materials where feasible; Avoid replanting competing vegetation that will deter whitebark pine habitat from regenerating or recovering, such as avoiding replanting competitive tree species, such as lodgepole pine (<i>Pinus contorta</i> var. <i>latifolia</i>) or shrubs of the genus <i>Ribes</i> that may host white pine blister rust. Note: Several of the general avoidance measures in Section 5.1.4 do not apply to this site since the pipeline construction footprint is outside of the regional elevation limits, no whitebark pine trees have been observed within 2 km of the centreline at this site and no plots, transects or recovery activities have been identified at this site.	11U 349273, 5875697 to 11U 345190, 5872668 and 11U 344833, 5872484 to 11U 341083, 5871018
Dainty moonwort <i>Botrychium crenulatum</i> (S2S3, blue)	BOTRCRE378756	d-075-K/083-D-14	494.13	July 5, 2014	Three plants were observed in a single clump along the existing TMPL right-of-way.	Plants occur approximately 18 m south from the centreline.	No mitigation is required as this population is more than 2 m from the pipeline construction footprint, however, follow general mitigation measures to avoid accidental encroachment.	--
Lodgepole pine/velvet-leaved blueberry/clad lichens <i>Pinus contorta</i> / <i>Vaccinium myrtilloides</i> / <i>Cladonia</i> spp. (S3?, blue)	PINUCON429673 VG-17	b-030-K/083-D-14	504.87 to 505.16	June 27, 2013	Community parallels the northeastern edge of the pipeline construction footprint.	Community occurs at the centre of the pipeline construction footprint and extends northeastward off of the proposed construction footprint to the north.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, conduct separate strippings salvage along the riparian bank, isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 340429, 5867673 11U 340597, 5867447
Lodgepole pine/velvet-leaved blueberry/clad lichens <i>Pinus contorta</i> / <i>Vaccinium myrtilloides</i> / <i>Cladonia</i> spp. (S3?, blue)	PINUCON705317 VG-18	c-020-K/083-D-14 to d-020-K/083-D-14	505.27 to 505.32	June 29, 2013	Community parallels the centre of the pipeline construction footprint for approximately 110 m.	Community crosses the centre of the pipeline construction footprint extending to the east and continuing off of the pipeline construction footprint.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 340705, 5867317 11U 340676, 5867330 11U 340664, 5867353 11U 340719, 5866347
Lodgepole pine/velvet-leaved blueberry/clad lichens <i>Pinus contorta</i> / <i>Vaccinium myrtilloides</i> / <i>Cladonia</i> spp. (S3?, blue)	PINUCON142717 VG-19	a-020-K/083-D-14 to b-019-K/083-D-14	505.96 to 506.07	June 29, 2013	Rare community parallels the centre of the pipeline construction footprint for approximately 110 m.	Community occurs on the northeastern side of the pipeline construction footprint, extending southwest across the centreline.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 341086, 5866805 11U 341120, 5866763 11U 341142, 5866717
Michigan moonwort <i>Botrychium michiganense</i> sp. nov. ined. (S2, red)	BOTRMIC744591 VG-20	d-034-F/083-D-14	515.04	June 29, 2013	One plant was observed.	Plant occurs within the pipeline construction footprint, approximately 4 m southwest from the centreline.	Hand transplant the population during the active growing season to a biologically suitable recipient site (i.e., similar light and moisture regime) off of the pipeline construction footprint prior to construction. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 345744, 5859591
Dainty moonwort <i>Botrychium crenulatum</i> (S2S3, blue)	BOTRCRE749896 VG-21	d-094-C/083-D-14 to a-094-C/083-D-14	518.87 to 519.09	June 28, 2013	Population occurs over a 200 m length along the existing TMPL right-of-way.	Plants occur approximately 30 m east from the centreline.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side.	11U 345748, 5855687 11U 345749, 5855896
Lodgepole pine/velvet-leaved blueberry/clad lichens <i>Pinus contorta</i> / <i>Vaccinium myrtilloides</i> / <i>Cladonia</i> spp. (S3?, blue)	PINUCON702649 VG-22	d-094-C/083-D-14 to a-094-C/083-D-14	518.95 to 519.12	May 12, 2013	Community was observed in patches over a 175 m length adjacent to an existing pipeline construction footprint.	Community spans the full width of the pipeline construction footprint.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 345691, 5855696 11U 345702, 5855649 11U 345706, 5855797 11U 345710, 5855821 11U 345720, 5855799
Scrub birch/water sedge <i>Betula nana</i> / <i>Carex aquatilis</i> (S3, blue)	BETUNAN853310 VG-24 Wetland Report ID Jasp-Blue_WC506dpoint5	a-001-C/083-D-14	528.25 to 528.39	June 11, 2013	Rare community identified during wetland surveys.	Community occurs on the western side of the pipeline construction footprint, extending west off of the pipeline construction footprint.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 347886, 5847265 11U 347901, 5847121

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Lodgepole pine/velvet-leaved blueberry/clad lichens <i>Pinus contorta</i> / <i>Vaccinium myrtilloides</i> / <i>Cladonia</i> spp. (S3?, blue)	PINUCON123185 VG-25	b-081-K/083-D-11 to a-082-K/083-D-11	530.35 to 530.51	August 12, 2013	Community was observed in patches within an approximately 300 m × 20 m area.	Community occurs approximately 25 m west of the centreline and extends off of the pipeline construction footprint to the west.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	10U 752123, 5849185 10U 752141, 5849221 10U 752158, 5849218 10U 752245, 5849471
Dainty moonwort <i>Botrychium crenulatum</i> (S2S3, blue)	BOTRCRE096862 VG-26	c-040-J/083-D-11	535.10 to 535.15	June 27, 2013	18 plants were observed in a 50 m × 7 m area along the edge of an existing right-of-way.	Plants occur approximately 24 m west of the centreline and extend off of the pipeline construction footprint to the west.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side.	11U 348092, 5840894 11U 348096, 5840862 11U 348116, 5840856
Echo moonwort <i>Botrychium echo</i> (S1S2, red)	BOTRECH560076 VG-27	c-040-J/083-D-11	535.18	August 11, 2013	Location of this population contained greater than 50 individuals (including a second rare <i>Botrychium</i>) in an approximately 10 m × 40 m area.	Plants occur approximately 6 m southwest of the edge of the pipeline construction footprint.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side.	10U 753560, 5845076
Mountain moonwort <i>Botrychium montanum</i> (S2?, red)	BOTRMON560076 VG-28	c-040-J/083-D-11	535.18	August 11, 2013	Location of this plant contained greater than 50 individuals (including a second rare <i>Botrychium</i>) in an approximately 10 m × 40 m area.	Plants occur approximately 6 m southwest of the edge of the pipeline construction footprint.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side.	10U 753560, 5845076
Dainty moonwort <i>Botrychium crenulatum</i> (S2S3, blue)	BOTRCRE193763 VG-29	b-040-J/083-D-11	535.27 to 535.30	June 27, 2013	11 plants were observed in a 30 m × 1.5 m area along the edge of an existing right-of-way.	Plants occur approximately 20 m west of the centreline.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side.	11U 348193, 5840763 11U 348197, 5840756 11U 348208, 5840740
Dainty moonwort <i>Botrychium crenulatum</i> (S2S3, blue)	BOTRCRE274645 VG-30	b-040-J/083-D-11	535.41	June 27, 2013	Three plants were observed in a 20 cm × 5 cm area along the edge of an existing right-of-way.	Plants occur approximately 3 m southwest of the edge of the pipeline construction footprint.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side.	11U 348274, 5840645
Dainty moonwort <i>Botrychium crenulatum</i> (S2S3, blue)	BOTRCRE389514 VG-31	a-040-J/083-D-11	535.58 to 535.62	June 27, 2013	Five plants were observed in a 5 m × 35 m area along the edge of an existing right-of-way.	Plants occur approximately 7 m southwest of the edge of the pipeline construction footprint.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side.	11U 348389, 5840514 11U 348411, 5840489
Whitebark pine candidate regeneration critical habitat <i>Pinus albicaulis</i> candidate regeneration critical habitat	PINUALB_CRITHAB2 VG-32	c-029-J/083-D-11 to b-096-G/083-D-11	536.07 to 540.68	--	--	A whitebark pine candidate regeneration critical habitat polygon (Environment Canada 2014a) spans the width of the proposed pipeline construction footprint in this location, extending off in both directions.	The extent of candidate regeneration critical habitat is not publically available and is provided with the permission of ECC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Restore or enhance biophysical attributes of critical habitat along the pipeline construction footprint by revegetating the pipeline construction footprint using native tree and shrub seeds and propagation materials where feasible; Avoid replanting competing vegetation that will deter whitebark pine habitat from regenerating or recovering, such as avoiding replanting competitive tree species, such as lodgepole pine (<i>Pinus contorta</i> var. <i>latifolia</i>) or shrubs of the genus <i>Ribes</i> that may host white pine blister rust. Note: Several of the general avoidance measures in Section 5.1.4 do not apply to this site since the pipeline construction footprint is outside of the regional elevation limits, no whitebark pine trees have been observed at this site and no plots, transects or recovery activities have been identified at this site.	11U 348913, 5840003N 11U 351459, 5836750N
Bebb's willow/bluejoint reedgrass <i>Salix bebbiana</i> / <i>Calamagrostis canadensis</i> (S3, blue)	SALIBEB684958 VG-33 Wetland Report ID Jasp-Blue_W516	c-018-J/083-D-11 to a-018-J/083-D-11	537.62 to 537.85	June 12, 2013	Rare community identified during wetland surveys.	Community occurs within the southwest edge of the pipeline construction footprint, and continues off.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 349689, 5838964 11U 349907, 5838883
Lodgepole pine/velvet-leaved blueberry/clad lichens <i>Pinus contorta</i> / <i>Vaccinium myrtilloides</i> / <i>Cladonia</i> spp. (S3?, blue)	PINUCON726075 VG-34	d-076-G/083-D-11 to c-075-G/083-D-11	542.24 to 542.32	August 11, 2013	Community was observed covering an area approximately 90 m × 30 m.	Community spans the width of the pipeline construction footprint and extends off to the south.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side.	10U 757726, 5840075 10U 757746, 5840024 10U 757749, 5840087 10U 757796, 5840017
Lodgepole pine/velvet-leaved blueberry/clad lichens <i>Pinus contorta</i> / <i>Vaccinium myrtilloides</i> / <i>Cladonia</i> spp. (S3?, blue)	PINUCON812942 VG-35	d-076-G/083-D-11 to c-075-G/083-D-11	542.37 to 542.39	August 11, 2013	Community was observed covering an area approximately 75 m × 50 m.	Community occurs on the south portion of the pipeline construction footprint, and extends off to the south.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side.	10U 757812, 5839942 10U 757820, 5839973 10U 757835, 5840008 10U 757841, 5839909 10U 757869, 5839971
Homemann's willowherb <i>Epilobium homemannii</i> ssp. <i>behringianum</i> (S2S3, blue)	EPILHOR172779 VG-38	d-008-H/083-D-11	551.87	July 7, 2014	One plant was observed along a riverbank. This species is a perennial herb with stolons and other plants may be present at the location.	Plant occurs approximately 6 m west of centreline.	If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 358172, 5828779

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Swamp horsetail - beaked sedge marsh <i>Equisetum fluviatile</i> – <i>Carex utriculata</i> (S3, blue)	EQUIFLU106138 VG-43 Wetland Report ID Jasp-Blue_W539point5	a-019-A/083-D-11	561.47 to 561.60	June 12, 2013	Rare community identified during wetland surveys.	Community occurs on the pipeline construction footprint and extends off to the northwest.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 357139, 5820086 11U 357086, 5819958
Canada anemone <i>Anemone canadensis</i> (S3?, blue)	ANEMCAN086809 VG-44	a-019-A/083-D-11	561.75 to 561.82	June 26, 2013	Approximately 450 plants were observed on an existing right-of-way in an approximately 70 m by 20 m area.	Plants occur within the pipeline construction footprint, crossing the centreline.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 357086 5819809 11U 357082 5819803 11U 357079 5819742 11U 357083 5819768 11U 357074 5819742
Whitebark pine candidate regeneration critical habitat <i>Pinus albicaulis</i> candidate regeneration critical habitat	PINUALB_CRITHAB3 VG-46	a-051-J/083-D-06 to c-012-J/083-D-06	567.85 to 571.26	--	--	A whitebark pine candidate regeneration critical habitat polygon (Environment Canada 2014a) spans the width of the proposed pipeline construction footprint in this location, extending off of the proposed pipeline construction footprint in both directions.	The extent of candidate regeneration critical habitat is not publicly available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Restore or enhance biophysical attributes of critical habitat along the pipeline construction footprint by revegetating the pipeline construction footprint using native tree and shrub seeds and propagation materials where feasible; Avoid replanting competing vegetation that will deter whitebark pine habitat from regenerating or recovering, such as avoiding replanting competitive tree species, such as lodgepole pine (<i>Pinus contorta</i> var. <i>latifolia</i>) or shrubs of the genus <i>Ribes</i> that may host white pine blister rust. Note: Several of the general avoidance measures in Section 5.1.4 do not apply to this site since the pipeline construction footprint is outside of the regional elevation limits, no whitebark pine trees have been observed at this site and no plots, transects or recovery activities have been identified at this site.	11U 355402, 5814438 11U 354177, 5811407
Dainty moonwort <i>Botrychium crenulatum</i> (S2S3, blue)	BOTRCRE019304 VG-52	b-064-G/083-D-06	577.25	June 25, 2013	A single plant was observed in an open meadow within an old burned clear-cut.	Plants occur within the proposed pipeline construction footprint, approximately 2 m southeast of the centreline.	Hand transplant the population to a biologically suitable recipient site (i.e., similar light and moisture regime) off the pipeline construction footprint during the active growing season prior to construction.	11U 352019, 5806304
Dainty moonwort <i>Botrychium crenulatum</i> (S2S3, blue)	BOTRCRE865089 VG-53	a-065-G/083-D-06	577.51	June 25, 2013	Three plants were observed in a 20 m × 20 m area. Plants occur in a shaded opening within a regenerated burnt clear-cut at the edge of the open meadow.	Plants occur approximately 12 m southeast of the centreline.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 351865, 5806089
Michigan moonwort <i>Botrychium michiganense</i> sp. nov. ined. (S2, red)	BOTRMIC505204 VG-54	d-095-B/083-D-06	583.73 to 583.77	June 25, 2013	26 plants were observed in a 50 m × 5 m area at a forest edge along an existing right-of-way.	Plants span the pipeline construction footprint.	Hand transplant the portion of the population located on the trench line to a biologically suitable recipient site (i.e., similar light and moisture regime) off the pipeline construction footprint during the active growing season prior to construction. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 351505, 5800204 11U 351526, 5800160
Michigan moonwort <i>Botrychium michiganense</i> sp. nov. ined. (S2, red)	BOTRMIC453718 VG-55	a-095-B/083-D-06	584.22	June 25, 2013	Two plants were observed in a 1 m × 1 m area at a forest edge along an existing right-of-way.	Plants occur approximately 4 m west of centreline.	Hand transplant the population to a biologically suitable recipient site (i.e., similar light and moisture regime) off the pipeline construction footprint during the active growing season prior to construction. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 351453, 5799718
Upswept moonwort <i>Botrychium ascendens</i> (S3, blue)	BOTRASC111871 VG-56	b-065-B/083-D-06	587.11	June 24, 2013	Two plants were observed in a 24 m × 5 m area along an existing right-of-way being encroached with native revegetation.	Plants occur approximately 1 m west of centreline.	Hand transplant the population to a biologically suitable recipient site (i.e., similar light and moisture regime) off the pipeline construction footprint during the active growing season prior to construction. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 351111, 5796871
Upswept moonwort <i>Botrychium ascendens</i> (S3, blue)	BOTRASC134639 VG-57	c-055-B/083-D-06	587.35	June 24, 2013	Eight plants were observed in a 2 m × 2 m area along an existing right-of-way being encroached with native revegetation.	Plants occur approximately 8 m west of centreline.	Hand transplant the population to a biologically suitable recipient site (i.e., similar light and moisture regime) off the pipeline construction footprint during the active growing season prior to construction. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 351134, 5796639

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Sitka willow/Sitka sedge <i>Salix sitchensis</i> / <i>Carex sitchensis</i> (S3, blue)	SALISIT199610 VG-58 Wetland Report ID Jasp-Blue_W565point79	d-055-B/083-D-06	587.41 to 587.69	July 12, 2013	Rare community identified during wetland surveys.	Community occurs on the eastern edge of the pipeline construction footprint and extends off to the east.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 351200, 5796609 11U 351234, 5796329
Bebb's willow/bluejoint reedgrass <i>Salix bebbiana</i> / <i>Calamagrostis canadensis</i> (S3, blue)	SALIBEB809922 VG-60 Wetland Report ID Blue-Darf_WC585point4	d-063-F/083-D-03 to a-063-F/083-D-03	607.07 to 607.23	June 13, 2013	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint and extends off to the east.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 343809, 5778922 11U 343780, 5778761
Black spruce/skunk cabbage/peat-mosses <i>Picea mariana</i> / <i>Lysichiton americanus</i> / <i>Sphagnum</i> spp. (S2S3, blue)	PICEMAR881711 VG-61 and VG-62 Wetland Report ID Blue-Darf_WC590point1	c-015-F/083-D-03	611.89 to 612.14	July 14, 2013	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint and extends off to the east at the community's northern extent. The majority of the community occurs off of the proposed pipeline construction footprint to the west.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 341882, 5774710 11U 341862, 5774455
Black spruce/skunk cabbage/peat-mosses <i>Picea mariana</i> / <i>Lysichiton americanus</i> / <i>Sphagnum</i> spp. (S2S3, blue)	PICEMAR816399 VG-63 Wetland Report ID Blue-Darf_WC590apoint5	c-015-F/083-D-03 to c-005-F/083-D-03	612.21 to 612.96	June 13, 2013	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint, extending off of in both directions.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 341854, 5774385 11U 341816, 5773638
Common cattail Marsh <i>Typha latifolia</i> marsh (S3, blue)	TYPHLAT822409 VG-64 Wetland Report ID Blue-Darf_WC590cpoint5	c-005-F/083-D-03 to b-005-F/083-D-03	613.20 to 613.58	June 13, 2013	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint, extending off of in both directions.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 341782, 5773396 11U 341787, 5773055
Common cattail Marsh <i>Typha latifolia</i> marsh (S3, blue)	TYPHLAT528795 VG-66 Wetland Report ID Blue-Darf_WC592bpoint7	c-085-C/083-D-03	614.92 to 614.94	June 14, 2013	Rare community identified during wetland surveys.	Community occurs pipeline construction footprint and extends off to the east.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 341514, 5771792 11U 341506, 5771766
Sitka willow - Pacific willow/skunk cabbage <i>Salix sitchensis</i> – <i>Salix lasiandra</i> var. <i>lasiandra</i> / <i>Lysichiton americanus</i> (S2, red)	SALISIT043708 VG-67 Wetland Report ID Blue-Darf_WC594point4	d-076-C/083-D-03	616.05 to 616.05	June 14, 2013	Rare community identified during wetland surveys.	Community occurs within the proposed water access at this location, extending off of the proposed access footprint in both directions.	Ensure pre-construction contours are restored to maintain site hydrology.	11U 341043, 5770708 11U 341044, 5770704
Crested wood fern <i>Dryopteris cristata</i> (S3, blue)	DRYOCR1893918 VG-69 and VG-71	d-066-C/083-D-03 to c-066-C/083-D-03	616.87 to 617.00	June 23, 2013	Approximately 187 plants were observed in an approximately 260 m × 40 m area predominantly along the northern and western edge of a lake riparian area but a few were also observed within the adjacent forest.	Population occurs approximately 7 m south of centreline, and extends south off of the pipeline construction footprint.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 340853, 5769856 11U 340884, 5769902 11U 340887, 5769908 11U 340893, 5769918 10U 752162, 5773630 10U 752184, 5773675 10U 752191, 5773697 10U 752233, 5773766 10U 752246, 5773778 10U 752275, 5773793 10U 752287, 5773799 10U 752306, 5773795 10U 752327, 5773837 10U 752328, 5773794 10U 752338, 5773794 10U 752376, 5773779

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Common cattail marsh <i>Typha latifolia</i> marsh (S3, blue)	TYPHLAT070962 VG-70 Wetland Report ID Blue-Darf_WC595apoint3	d-066-C/083-D-03 c-066-C/083-D-03	616.94 to 617.00	June 14, 2013	Rare community identified during wetland surveys.	Community occurs within the southern half of the pipeline construction footprint, and extends off to the south.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 340937, 5769939 11U 340891, 5769913
Common cattail Marsh <i>Typha latifolia</i> marsh (S3, blue)	TYPHLAT062734 VG-81 Wetland Report ID Blue-Darf_WC614apoint9	b-075-F/082-M-14 to c-065-F/082-M-14	636.81 to 637.03	June 14, 2014	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint and extends off in both directions.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 341041, 5751721 11U 341108, 5751508
Common cattail Marsh <i>Typha latifolia</i> marsh (S3, blue)	TYPHLAT219419 VG-82 Wetland Report ID Blue-Darf_WC615bpoint65	a-065-F/082-M-14 to d-055-F/082-M-14	637.94 to 638.14	June 14, 2014	Rare community identified during wetland surveys.	Community occurs on the pipeline construction footprint and extends off to the west.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 341250, 5750611 11U 341220, 5750418
Common cattail Marsh <i>Typha latifolia</i> marsh (S3, blue)	TYPHLAT554259 VG-84 Wetland Report ID Blue-Darf_WC622apoint5	b-93-C/82-M-14	644.67 to 644.78	June 14, 2014	Rare community identified during wetland surveys.	Community occurs within the pipeline construction footprint and extends off to the west.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 342554, 5744257 11U 342521, 5744148
Sitka willow/Sitka sedge <i>Salix sitchensis</i> / <i>Carex sitchensis</i> (S3, blue)	SALISIT954039 VG-89 Wetland Report ID Blue-Darf_WC639apoint5	c-041-L/002-M-11 to d-042-L/082-M-11	661.49 to 661.60	September 27, 2015	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint and extends off to the northwest.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 334954, 5731039 11U 334874, 5730960
Crested wood fern <i>Dryopteris cristata</i> (S3, blue)	DRYOCR1895961 VG-90	d-042-L/082-M-11	661.53 to 661.61	June 21, 2013	> 116 plants were observed in an approximately 85 m × 20-50 m area. Plants occur in a shrubby wetland and to a lesser extent in an open fen area.	Plants span the entire width of the proposed easement and east into the proposed temporary workspace and proposed extra temporary workspace.	Narrow the proposed temporary workspace along the southern edge to the extent feasible within a 10 m radius of the occurrence. If narrowing is not feasible, leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 334892, 5730933 11U 334895, 5730961 11U 334908, 5731017 11U 749443, 5734488 11U 749463, 5734403 11U 749493, 5734472
Silvery sedge <i>Carex canescens</i> ssp. <i>disjuncta</i> (SU)	CARECAN950296 VG-91	b-009-L/082-M-11	670.19 to 670.20	June 21, 2013	10 plants were observed in a 12 m × 20 m area.	Plants occur on and off of the pipeline construction footprint. Plants are mostly off of the pipeline construction footprint to the south and occur up to approximately 1 m north of the south edge.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	11U 327948, 5727286 11U 327950, 5727296 11U 327956, 5727282
Common cattail Marsh <i>Typha latifolia</i> marsh (S3, blue)	TYPHLAT656884 VG-93 Wetland Report ID Blue-Darf_W682point4	a-011-E/082-M-12	704.70 to 704.73	June 17, 2013	Rare community identified during wetland surveys.	Community spans the width of the pipeline construction footprint.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	11U 300657, 5719884 11U 300639, 5719916
White wintergreen <i>Pyrola elliptica</i> (S3, blue)	PYROELL177040 VG-97	d-048-H/092-P-09	723.35 to 723.36	July 4, 2014	More than 100 plants were observed in an approximately 40 m × 12 m depression area on an existing right-of-way and extending into an adjacent forest.	Plants occur on the east side of the pipeline construction footprint.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	10U 701206, 5723061 10U 701202, 5723065 10U 701187, 5723053 10U 701177, 5723040 10U 701170, 5723036 10U 701179, 5723032 10U 701167, 5723033

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Bebb's willow/bluejoint reedgrass <i>Salix bebbiana</i> / <i>Calamagrostis canadensis</i> (S3, blue)	SALIBEB554588 VG-98	c-073-B/092-P-09	732.51 to 732.52	June 19, 2013	Rare community identified during wetland surveys.	The community spans the entire width of the pipeline construction footprint and extends off to the north.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 696534, 5716522 10U 696522, 5716498
Western redcedar - paper birch/oak fern <i>Thuja plicata</i> – <i>Betula papyrifera</i> / <i>Gymnocarpium dryopteris</i> (S2S3, blue)	THUJPLI839386 VG-99	b-078-J/092-P-08	745.21 to 745.31	August 3, 2013	Community extended approximately 80 m × 30 m adjacent to an existing right-of-way.	Community occurs approximately 3 m east of the centreline and extends off to the southeast.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Replant western redcedar trees in areas where tree planting will occur.	10U 692839, 5706386 10U 692862, 5706300 10U 692863, 5706375
Crested wood fern <i>Dryopteris cristata</i> (S3, blue)	DRYOCRI867118 VG-100	c-068-J/092-P-08	745.48 to 745.49	July 7, 2014	Two plants were observed approximately 5 m apart along the edge of an open water wetland.	Plants occur approximately 6 m east of the centreline.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	10U 692862, 5706125 10U 692858, 5706119
Mexican mosquito fern early draft critical habitat <i>Azolla mexicana</i> early draft critical habitat	AZOLMEX_CRITHAB VG-101	a-018-J/092-P-08 to b-097-G/092-P-08	750.85 to 753.02	--	--	A Mexican mosquito fern early draft critical habitat polygon (Environment Canada 2015c) spans the width of the pipeline construction footprint in this location, extending off of the pipeline construction footprint in both directions.	The extent of early draft critical habitat is not publically available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. In the event that areas that possess the ecological attributes required for Mexican mosquito fern, such as open water features, are identified in critical habitat on the pipeline construction footprint prior to construction, reduce disturbance to these areas. Restore or enhance biophysical attributes of critical habitat by revegetating the pipeline construction footprint using native grasses, forbs, tree or shrub seeds and propagation materials where feasible to improve soil structure and reduce soil erosion. Note: Several of the disturbance reduction mitigation measures listed in Section 5.1.8 will only apply if ecological attributes, such as open water features, are identified.	10U 693363, 5701000 10U 693985, 5699000
Black Pines to Minter Gardens Segment								
Douglas-fir/common snowberry - saskatoon <i>Pseudotsuga menziesii</i> / <i>Symphoricarpos albus</i> – <i>Amelanchier alnifolia</i> (S2, red)	PSEUMEN850270 PSEUMEN940470 VG-102	d-051-K/092-I-16 to a-041-K/092-I-16	806.73 to 807.71	October 9, 2013	This community was observed in a 1.17 km × 0.1 km area paralleling an existing right-of-way.	Community occurs on both edges of the pipeline construction footprint. From approximately 7 m east of centreline the community extends to off the pipeline construction footprint to the east. From approximately 4 m west of centreline the community extends off of the pipeline construction footprint to the west.	If feasible, and following danger tree assessment, Douglas-fir trees older than 150 years or with a diameter of approximately 3 m or greater will be avoided at this location during construction. Mow or walk down shrubs or use a stump mulcher rather than grubbing, if feasible, to minimize the loss of vegetation cover. Conduct shrub staking with suitable native woody species following completion of construction if feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	10U 693000, 5649435 10U 692888, 5649435 10U 692850, 5648270 10U 692897, 5648270 10U 692970, 5648850 10U 693010, 5648650 10U 692940, 5648470
Trembling aspen/common snowberry/Kentucky bluegrass <i>Populus tremuloides</i> / <i>Symphoricarpos albus</i> / <i>Poa pratensis</i> (S2, red)	POPOTRE729259 VG-103	c-088-C/092-I-16 to b-088-C/092-I-16	825.64 to 825.75	May 22, 2014	Community extends across the pipeline construction footprint for approximately 110 m.	Community spans the entire width of the pipeline construction footprint and extends off to the southwest.	Mow or walk down shrubs or use a stump mulcher rather than grubbing, if feasible, to minimize the loss of vegetation cover. Conduct shrub staking with suitable native woody species following completion of construction if feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped.	10U 686757, 5633264 10U 686729, 5633259 10U 686786, 5633244 10U 686755, 5633215 10U 686679, 5633226 10U 686709, 5633170 10U 686652, 5633180 10U 686658, 5633154 10U 686686, 5633130 10U 686656, 5633130
Rough fescue - bluebunch wheatgrass <i>Festuca campestris</i> / <i>Pseudoroegneria spicata</i> (S2, red)	FESTCAM686131 VG-104	b-088-C/092-I-16 to d-079-C/092-I-16	825.79 to 826.21	May 22, 2014	Community extends across the entire pipeline construction footprint for approximately 400 m.	Community spans the width of the pipeline construction footprint and extends off on both sides.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 686686, 5633131 10U 686588, 5632722

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Giant wildrye Herbaceous Vegetation <i>Leymus cinereus</i> Herbaceous Vegetation (S2, red)	LEYMCIN987616 VG-106	c-068-C/092-I-16	827.39 to 827.43	May 22, 2014	Community was observed in an approximately 70 m x 50 m patch and a second small patch to the east of the pipeline construction footprint.	The 70 m x 50 m patch occurs on the west side of the pipeline construction footprint and extends off to the west. The second small patch occurs off the pipeline construction footprint to the east.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 687004, 5631657 10U 686987, 5631616 10U 687012, 5631611 10U 687062, 5631692
Big sagebrush/bluebunch wheatgrass <i>Artemisia tridentata</i> / <i>Pseudoroegneria spicata</i> (S2, red)	ARTETRI701560 and ARTETRI694437 VG-107	d-059-C/092-I-16 to c-058-C/092-I-16 and b-058-C/092-I-16 to a-059-C/092-I-16	828.56 to 828.65 and 828.68 to 828.77	May 19, 2014	Community extends across the entire pipeline construction footprint for approximately 100 m.	Community spans the entire width of the pipeline construction footprint and extends off in both directions with a gap along an existing telecommunications right-of-way, which is dominated by seeded agronomic species.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Reduce or avoid grubbing of roots in shrubby communities within temporary workspace, where feasible. Cut off or walk down rather than wholly remove shrubs, where feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 686651, 5630582 10U 686792, 5630532 10U 686701, 5630560 10U 686762, 5630448 10U 686619, 5630494 10U 686705, 5630467 10U 686694, 5630437 10U 686750, 5630419 10U 686606, 5630461 10U 686724, 5630338 10U 686580, 5630377 10U 686623, 5630369
Rough fescue - bluebunch wheatgrass <i>Festuca campestris</i> / <i>Pseudoroegneria spicata</i> (S2, red)	FESTCAM623369 VG-110	a-059-C/092-I-16 to b-039-C/092-I-16	828.55 to 831.03	May 19, 2014	Community extends across the pipeline construction footprint for approximately 2.5 km.	Community spans the entire width of the pipeline construction footprint and extends off in both directions with a gap along an existing telecommunications right-of-way, which is dominated by seeded agronomic species.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 686701, 5630560 10U 686623, 5630369 10U 685901, 5628245
Bluebunch wheatgrass – junegrass <i>Pseudoroegneria spicata</i> / <i>Koeleria macrantha</i> (S3, blue)	PSEUSPI623369 VG-108	a-059-C/092-I-16 to b-058-C/092-I-16	828.77 to 829.00	July 4, 2014	Community extends across the entire pipeline construction footprint for approximately 300 m within a larger grassland complex.	Community spans the entire width of the pipeline construction footprint and extends off in both directions with a gap along an existing telecommunications right-of-way, which is dominated by seeded agronomic species.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species. Conduct native seed collection for use in revegetation efforts at the site if feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 686623, 5630369 10U 686580, 5630383 10U 686595, 5630139 10U 686647, 5630117 10U 686504, 5630167 10U 686723, 5630335
Big sagebrush/bluebunch wheatgrass <i>Artemisia tridentata</i> / <i>Pseudoroegneria spicata</i> (S2, red)	ARTETRI582133 VG-109	a-059-C/092-I-16 to d-049-C/092-I-16	829.01 to 829.27	July 4, 2014	Community extends across the pipeline construction footprint for approximately 270 m within a larger grassland complex.	Community spans the entire width of the pipeline construction footprint and extends off in both directions with a gap along an existing telecommunications right-of-way, which is dominated by seeded agronomic species.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Reduce or avoid grubbing of roots in shrubby communities within temporary workspace, where feasible. Cut off or walk down rather than wholly remove shrubs, where feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 686582, 5630133 10U 686504, 5630159 10U 686648, 5630110 10U 686555, 5629897 10U 686418, 5629901 10U 686433, 5629891
Big sagebrush/bluebunch wheatgrass <i>Artemisia tridentata</i> / <i>Pseudoroegneria spicata</i> (S2, red)	ARTETRI180995 VG-111	a-049-C/092-I-16 to c-039-C/092-I-16	829.70 to 830.22	May 19, 2014	Community extends across the entire pipeline construction footprint for approximately 600 m within a larger grassland complex.	Community spans the entire width of the pipeline construction footprint and extends off in both directions with a gap along an existing telecommunications right-of-way, which is dominated by seeded agronomic species.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Reduce or avoid grubbing of roots in shrubby communities within temporary workspace, where feasible. Cut off or walk down rather than wholly remove shrubs, where feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 686340, 5629483 10U 686180, 5628995

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Ponderosa pine/bluebunch wheatgrass <i>Pinus ponderosa</i> / <i>Pseudoroegneria spicata</i> (S3, blue)	PINUPON111782 VG-112	c-039-C/092-I-16	830.21 to 830.44	May 19, 2014	Community extends across the entire pipeline construction footprint for approximately 300 m patch within a larger grassland complex.	Community spans the entire width of the pipeline construction footprint and extends off in both directions with a gap along an existing telecommunications right-of-way, which is dominated by seeded agronomic species.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Reduce or avoid grubbing of roots in parkland communities within temporary workspace, where feasible. Cut off or walk down rather than wholly remove trees and shrubs, where feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 686180, 5628995 10U 686111, 5628782
Big sagebrush/bluebunch wheatgrass <i>Artemisia tridentata</i> / <i>Pseudoroegneria spicata</i> (S2, red)	ARTETRI901245 VG-105	c-039-C/092-I-16	830.64 to 831.02	May 19, 2014	Community extends across the entire pipeline construction footprint for approximately 450 m within a larger grassland complex.	Community spans the entire width of the pipeline construction footprint and extends off in both directions with a gap along an existing telecommunications right-of-way, which is dominated by seeded agronomic species.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Reduce or avoid grubbing of roots in shrubby communities within temporary workspace, where feasible. Cut off or walk down rather than wholly remove shrubs, where feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 686027, 5628592 10U 685901, 5628245
Ponderosa pine/bluebunch wheatgrass - rough fescue <i>Pinus ponderosa</i> / <i>Pseudoroegneria spicata</i> - <i>Festuca campestris</i> (S2, red)	PINUPON573276 VG-113	d-030-C/092-I-16 to a-030-C/092-I-16	831.47 to 832.04	May 19, 2014	Community extends approximately 700 m along the pipeline construction footprint.	Community spans the entire width of the pipeline construction footprint and extends off in both directions with a gap along an existing telecommunications right-of-way, which is dominated by seeded agronomic species.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Reduce or avoid grubbing of roots in parkland communities within temporary workspace, where feasible. Cut off or walk down rather than wholly remove trees and shrubs, where feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 685790, 5627803 10U 685573, 5627276
Big sagebrush/bluebunch wheatgrass <i>Artemisia tridentata</i> / <i>Pseudoroegneria spicata</i> (S2, red)	ARTETRI108331 VG-114 and VG-115	c-080-K/092-I-09 to a-072-L/092-I-09	836.26 to 837.57	May 22, 2014	Community extends across the entire pipeline construction footprint for approximately 1.3 km.	Community spans the entire width of the pipeline construction footprint.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Reduce or avoid grubbing of roots in shrubby communities within temporary workspace, where feasible. Cut off or walk down rather than wholly remove shrubs, where feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 685304, 5623422 10U 685108, 5623331 10U 684188, 5622745
Narrow-leaf willow Shrubland <i>Salix exigua</i> Shrubland (S2, red)	SALIEXI774134 VG-116	d-035-L/092-I-09 to c- 034-L/092-I-09	843.00 to 843.04	August 28, 2013	Community is 150 m x 40 m on a gravel bar in the Thompson River.	Community is avoided by the HDD of the Thompson River and is therefor not on the footprint.	No mitigation is required as this community is will be avoided by the HDD, however, follow general mitigation measures to avoid accidental encroachment.	10U 681680, 5619151 10U 681818, 5619190 10U 681768, 5619166 10U 681675, 5619139 10U 681774, 5619134 10U 681841, 5619138
Narrow-leaf willow Shrubland <i>Salix exigua</i> Shrubland (S2, red)	SALIEXI890948 and SALIEXI802757 VG-117 and VG-119 Wetland Report ID Kaml- Merr_NW819point	a-035-L/092-I-09 to c- 024-L/092-I-09	843.22 to 843.52	August 28, 2013	Flood association community occurring in an approximately 930 m x 310 m area.	Community spans the entire pipeline construction footprint and extends off in either direction. A large portion of the community is avoided by the HDD of the Thompson River.	Reduce or avoid grubbing of roots in shrubby communities within temporary workspace, where feasible. Cut off or walk down rather than wholly remove shrubs, where feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. Ensure pre-construction contours are restored to maintain site hydrology.	10U 681705, 5618919 10U 681792, 5618640

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Toothcup critical habitat <i>Rotala ramosior</i> critical habitat	ROTARAM_CRITHAB VG-118	a-035-L/092-I-09 to c-024-L/092-I-09	843.35 to 843.52	--	No toothcup plants have been observed during vegetation surveys along the pipeline construction footprint.	The HDD entry point on the south side of the Thompson River will be primarily located where existing anthropogenic features are already present (i.e., access road and cleared field) that are excluded from the critical habitat definition. Based on recent project planning, the pipeline construction footprint overlaps about 0.4 ha of anthropogenic disturbance areas that are exempt from the critical habitat definition at the Mission Flats site (Environment Canada 2015a). The pipeline construction footprint intersects only 4% (0.303 ha) of native vegetation areas within the critical habitat polygon. This native vegetation area is located to the southwest of the anthropogenic areas. However, based on vegetation survey information from 2013, 2014 and 2015, this portion of critical habitat does not possess the biophysical attributes for toothcup habitat.	Refer to Environmental Alignment Sheets for extent of critical habitat on the pipeline construction footprint and inform all users of these boundaries, and of associated site-specific mitigation and access restrictions. Clearly mark all toothcup critical habitat within the immediate vicinity of the surveyed and flagged right-of-way and TWS prior to clearing or construction activities. Temporary fencing may be necessary to delineate areas of proposed toothcup critical habitat on and/or adjacent to the construction right-of-way. Reduce or avoid grubbing of roots in shrubby communities within temporary workspace where feasible. Restore or enhance biophysical attributes of critical habitat within the pipeline construction footprint by revegetating the pipeline construction footprint in toothcup critical habitat with species present pre-construction. Note: several of the mitigation measures listed in Section 5.1.2 have already been implemented regarding the avoidance and the reduction in disturbance to the area within the critical habitat polygon.	10U 681721, 5618885 10U 681802, 5618597
Big sagebrush/bluebunch wheatgrass <i>Artemisia tridentata</i> / <i>Pseudoroegneria spicata</i> (S2, red)	ARTETRI935289 VG-120	c-024-L/092-I-09 to b-024-L/092-I-09	843.72 to 844.22	May 23, 2014	Community was observed over a 490 m length along the pipeline construction footprint.	Community spans the entire width of the pipeline construction footprint and extends off in both directions.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Reduce or avoid grubbing of roots in shrubby communities within temporary workspace, where feasible. Cut off or walk down rather than wholly remove shrubs, where feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 681845, 5618445 10U 681935, 5618289 10U 681946, 5618249 10U 681970, 5618146 10U 682055, 5618002
Ponderosa pine/bluebunch wheatgrass - rough fescue <i>Pinus ponderosa</i> / <i>Pseudoroegneria spicata</i> - <i>Festuca campestris</i> (S2, red)	PINUPON385397 VG-121 and VG-122	b-024-L/092-I-09 to d-004-L/092-I-09	844.24 to 845.91	May 23, 2014	Community spans the entire pipeline construction footprint for a length of 1.65 km. Frequently fragmented by a winding gravel road and an existing right-of-way seeded with agronomics.	Community spans the entire width of the pipeline construction footprint and extends off in both directions.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Reduce or avoid grubbing of roots in parkland communities within temporary workspace, where feasible. Cut off or walk down rather than wholly remove trees and shrubs, where feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 682055, 5618002 10U 682112, 5617153 10U 682385, 5616397
Trembling aspen/common snowberry/Kentucky bluegrass <i>Populus tremuloides</i> / <i>Symphoricarpos albus</i> / <i>Poa pratensis</i> (S2, red)	POPUTRE839148	d-035-E/092-I-09	853.25 to 853.26	May 20, 2014	Community was observed along a 70 m x 20-30 m area.	Community occurs approximately 5 m from the pipeline construction footprint edge to the east.	No mitigation is required as this population is approximately 5 m from the pipeline construction footprint, however, follow general mitigation measures to avoid accidental encroachment.	--
Common cattail Marsh <i>Typha latifolia</i> marsh (S3, blue)	TYPHLAT603069 VG-123 Wetland Report ID Kaml- Merr_WC857apoint3	c-035-E/092-I-09	853.51 to 853.54	August 7, 2014	The community occurs for 70 m within an approximately 10 m wide linear wetland. The hard-stemmed bulrush Deep Marsh is separated from the common cattail Marsh by a road and a culvert.	The marsh occurs within the pipeline construction footprint from approximately 12 m west of the centreline and extends off to the west.	To the extent feasible avoid placing windowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 681595 5610038 10U 681592 5609995
Hard-stemmed bulrush Deep Marsh <i>Schoenoplectus acutus</i> Deep Marsh (S3, blue)	SCHOACU595993 VG-124 Wetland Report ID Kaml- Merr_WC857bpoint3	c-035-E/092-I-09	853.54 to 853.58	October 22, 2014	This community occupies the fringe of a Y-shaped wetland that is approximately 220 m long and 60 m wide. The hard-stemmed bulrush Deep Marsh is separated from the common cattail Marsh by a road and a culvert.	This community spans the entire width of the pipeline construction footprint and extends off to the southeast. The southern portion of the community occurs within the proposed water access at this location.	To the extent feasible avoid placing windowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 681595, 5610002 10U 681611, 5609951

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Bebb's willow/bluejoint reedgrass <i>Salix bebbiana</i> / <i>Calamagrostis canadensis</i> (S3, blue)	SALIBEB314604 VG-125 Wetland Report ID Kaml-Merr_WC831cpoint6	c-003-E/092-I-9	857.06 to 857.10	October 22, 2014	Rare community identified during wetland surveys. This Bebb's willow – bluejoint community is part of a wetland complex.	This community spans the entire width of the pipeline construction footprint and extends off to the north.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 683321, 5607596 10U 683370, 5607575
Common cattail Marsh <i>Typha latifolia</i> marsh (S3, blue) and Hard-stemmed bulrush Deep Marsh <i>Schoenoplectus acutus</i> Deep Marsh (S3, blue)	TYPHLAT349558 VG-126 Wetland Report ID Kaml-Merr_WC831apoint6	c-003-E/092-I-9	857.07 to 857.10	October 22, 2014	Rare community identified during wetland surveys. This Cattail – great bulrush community is part of a wetland complex.	This community occurs within the southern portion of the pipeline construction footprint and extends off to the south.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 683349, 5607558 10U 683377, 5607568
Bebb's willow/bluejoint reedgrass <i>Salix bebbiana</i> / <i>Calamagrostis canadensis</i> (S3, blue)	SALIBEB541590 VG-127 Wetland Report ID Kaml-Merr_WC831fpoint6	d-003-E/092-I-9	857.28 to 857.39	September 25, 2015	Rare community identified during wetland surveys. This Bebb's willow - bluejoint community is part of a wetland complex.	This community spans the entire width of the pipeline construction footprint and extends off in both directions.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 683541, 5607590 10U 683651, 5607578
Baltic rush - common silverweed <i>Juncus balticus</i> – <i>Potentilla anserina</i> (S2, red)	JUNCBAL546590 VG-128 Wetland Report ID Kaml-Merr_WC831dpoint6	d-003-E/092-I-9	857.29 to 857.32	September 25, 2015	Rare community identified during wetland surveys. This Baltic rush community is part of a wetland complex.	Community occurs within the southern edge of the pipeline construction footprint and extends off to the south.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 683546, 5607590 10U 683644, 5607581
Baltic rush - common silverweed <i>Juncus balticus</i> – <i>Potentilla anserina</i> (S2, red)	JUNCBAL574632 VG-131 Wetland Report ID Kaml-Merr_WC831epoint6	a-013-E/092-I-9 to d-003-E/092-I-9	857.31 to 857.32	September 25, 2015	Rare community identified during wetland surveys. This Baltic rush community is part of a wetland complex.	Community occurs within the northern edge of the pipeline construction footprint.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 683574, 5607632 10U 683582, 5607631
Swamp horsetail - beaked sedge <i>Equisetum fluviatile</i> – <i>Carex utriculata</i> (S3, blue)	EQUIFLU730752 EQUIFLU779559 VG-129 Wetland Report ID Kaml-Merr_WC840c	a-030-C/092-I-09	866.18 to 866.25 and 866.28 to 866.35	October 30, 2013	Rare community identified during wetland surveys.	Community occurs along the eastern edge of the pipeline construction footprint for approximately 170 m, with a 30 m gap where the wetland edge is off of the pipeline construction footprint, and spans the entire extent of proposed water access.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 686697, 5599601 10U 686714, 5599531 10U 686728, 5599505 10U 686766, 5599446
Bebb's willow/bluejoint reedgrass <i>Salix bebbiana</i> / <i>Calamagrostis canadensis</i> (S3, blue)	SALIBEB130929 VG-130 Wetland Report ID Kaml-Merr_WC842b	b-009-C/092-I-9	867.93 to 868.06	September 27, 2015	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint and extends off in both directions.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 687132, 5597929 10U 687103, 5597795
Sitka willow/Sitka sedge <i>Salix sitchensis</i> / <i>Carex sitchensis</i> (S3, blue)	SALISIT015076 VG-132 Wetland Report ID Kaml-Merr_WC850	a-022-L/092-I-08 to d-012-L/092-I-08	876.07 to 876.17	May 8, 2014	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint and extends off in both directions.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 685065, 5590066 10U 685059, 5589964
Bebb's willow/bluejoint reedgrass <i>Salix bebbiana</i> / <i>Calamagrostis canadensis</i> (S3, blue)	SALIBEB555234 VG-133 Wetland Report ID Kaml-Merr_W859point2	c-025-E/092-I-08	885.29 to 885.33	May 7, 2014	Rare community identified during wetland surveys.	Community occurs within the pipeline construction footprint, approximately 1 m west of centreline and extends off to the west.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 682556, 5581242 10U 682515, 5581210

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Bluebunch wheatgrass – junegrass <i>Pseudoroegneria spicata</i> / <i>Koeleria macrantha</i> (S3, blue)	PSEUSPI011699 VG-137	b-037-D/092-I-08	894.38 to 894.45	June 23, 2014	Community was observed in an 87 m × 32 m area within the pipeline construction footprint.	Community occurs approximately 25 m west of the centreline. Another occurrence of the same community occurs on the east side of the pipeline construction footprint, more than 30 m from the centreline.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 681011, 5572699 10U 680982, 5572708 10U 680993, 5572646 10U 680975, 5572654 10U 680961, 5572626
Baltic rush - common silverweed <i>Juncus balticus</i> – <i>Potentilla anserina</i> (S2, red)	JUNCBAL860736 VG-140 Wetland Report ID Kaml-Merr_WC875point4	a-082-I/092-I-02 to b-082-I/092-I-02	901.31 to 901.43	May 7, 2014	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint and extends off to the east.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 676861, 5567735 10U 676817, 5567625
Baltic rush - common silverweed <i>Juncus balticus</i> – <i>Potentilla anserina</i> (S2, red)	JUNCBAL760479 VG-141 Wetland Report ID Kaml-Merr_WC875point5	c-072-I/092-I-02	901.59 to 901.62	May 7, 2014	Rare community identified during wetland surveys.	Community occurs within the eastern portion of the pipeline construction footprint and extends off to the east.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 676758, 5567480 10U 676734, 5567450
Baltic rush - common silverweed <i>Juncus balticus</i> – <i>Potentilla anserina</i> (S2, red)	JUNCBAL714413 VG-141 Wetland Report ID Kaml-Merr_WC875point6	c-072-I/092-I-02	901.67 to 901.71	May 7, 2014	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 676715, 5567412 10U 676681, 5567386
Ponderosa pine/bluebunch wheatgrass - rough fescue <i>Pinus ponderosa</i> / <i>Pseudoroegneria spicata</i> – <i>Festuca campestris</i> (S2, red)	PINUPON160098 VG-143	c-024-J/092-I-02	914.93 to 914.94	June 20, 2014	Community was observed in a 40 m × 10 m area.	Community occurs approximately 24 m southeast of centreline and extends off to the southeast.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Reduce or avoid grubbing of roots in parkland communities within temporary workspace, where feasible. Cut off or walk down rather than wholly remove trees and shrubs, where feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 666168, 5562103 10U 666160, 5562098 10U 666183, 5562070 10U 666157, 5562098
Big sagebrush/bluebunch wheatgrass <i>Artemisia tridentata</i> / <i>Pseudoroegneria spicata</i> (S2, red)	ARTETRI475652 VG-144	d-050-G/092-I-02 to a-050-G/092-I-02	923.96 to 924.20	July 24, 2013	Community was observed in a 263 m × 250 area.	Community spans the full width of the pipeline construction footprint and extends off in both directions.	Clearing in the rare ecological community will occur immediately before construction, if practical. Employ appropriate salvage, propagation and transplant techniques for component species as detailed in Table 5-10 and Table 5-11 of the Grasslands Survey and Mitigation Plan for the TransMountain Pipeline, NEB Condition 42 and Table 6-9 of the Reclamation Management Plan (Volume 6, of the Environmental Plans). Conduct native seed collection for use in revegetation efforts at the site if feasible. Reduce or avoid grubbing of roots in shrubby communities within temporary workspace, where feasible. Cut off or walk down rather than wholly remove shrubs, where feasible. Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. The Project grassland specialist will be onsite during clean-up activities.	10U 661475, 5554652 10U 661517, 5554644 10U 661524, 5554569 10U 661606, 5554703 10U 661628, 5554455 10U 661642, 5554691 10U 661660, 5554693 10U 661729, 5554577 10U 661737, 5554676 10U 661742, 5554449
Bebb's willow/bluejoint reedgrass <i>Salix bebbiana</i> / <i>Calamagrostis canadensis</i> (S3, blue)	SALIBEB697217 VG-145 Wetland Report ID Merr-Hope_WC898point6	b-049-G/092-I-02 to c-039-G/092-I-02	924.45 to 924.74	October 31, 2013	Rare community identified during wetland surveys. Community was observed in an area approximately 290 m × 150 m on both sides of a watercourse.	Community spans the full width of the pipeline construction footprint and extends off in both directions.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 661647, 5554204 10U 661613, 5553913
Bebb's willow/bluejoint reedgrass <i>Salix bebbiana</i> / <i>Calamagrostis canadensis</i> (S3, blue)	SALIBEB389634 VG-149 Wetland Report ID Merr-Hope_W906point8	b-074-C/092-I-2 to a-075-C/092-I-2	932.60 to 932.76	October 31, 2013	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint and extends off to the southeast.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 657389, 5547634 10U 657244, 5547557

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Trembling aspen/common snowberry/ mountain sweet-cicely <i>Populus tremuloides</i> / <i>Symphoricarpos albus</i> / <i>Osmorhiza berteroi</i> (S1, red)	POPUTRE935910 VG-154	b-083-L/092-H-15	945.53 to 945.56	August 11, 2014	Community was observed in a 34 m × 20 m area.	Community occurs within the northern portion of the pipeline construction footprint, approximately 2 m northwest of centreline.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Conduct shrub staking with suitable native woody species following completion of construction	10U 649942, 5538928 10U 649946, 5538929 10U 649953, 5538902 10U 649935, 5538910 10U 649939, 5538891 10U 649929, 5538899 10U 649929, 5538906
Western redcedar - Douglas-fir/false Solomon's seal <i>Thuja plicata</i> - <i>Pseudotsuga menziesii</i> / <i>Maianthemum racemosum</i> (S1, red)	THUJPLI670743 VG-155	c-073-L/092-H-15	945.84 to 945.90	August 11, 2014	Community was observed in an approximately 174 m × 41 m area.	Community spans the full width of the pipeline construction footprint and extends off in both directions.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped.	10U 649665, 5538797 10U 649691, 5538745 10U 649700, 5538715 10U 649708, 5538699 10U 649712, 5538645 10U 649643, 5538804 10U 649691, 5538630 10U 649660, 5538696 10U 649620, 5538762 10U 649601, 5538811
black cottonwood-red alder / salmonberry <i>Populus trichocarpa</i> / <i>Alnus rubra</i> / <i>Rubus spectabilis</i> (S3, Blue)	POPUTRI399066 VG-156 Wetland Report ID Merr-Hope_NW927point5	c-094-E/92-H-15 to b-094-E/92-H-15	954.67 to 954.86	June 17, 2014	Rare community identified during wetland surveys.	A portion of this community is avoided by HDD, the remainder is located on the east side of the pipeline construction footprint and extends off to the east.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 649322, 5531031 10U 649304, 5531031
Bebb's willow/bluejoint reedgrass <i>Salix bebbiana</i> / <i>Calamagrostis canadensis</i> (S3, blue)	SALIBEB177868 VG-164 Wetland Report ID Merr-Hope_NW941	a-067-D/092-H-15	968.68 to 968.71	November 1, 2013	Rare community identified during wetland surveys.	Community occurs within the pipeline construction footprint and extends off to the south.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 647173, 5518731 10U 647151, 5518709
Whitebark pine candidate regeneration critical habitat <i>Pinus albicaulis</i> candidate regeneration critical habitat	PINUALB_CRITHAB4 VG-169	d-012-l/092-H-11 to a-081-h/092-H-11	984.46 to 987.48	--	--	A whitebark pine candidate regeneration critical habitat polygon (Environment Canada 2014a) spans the width of the pipeline construction footprint and extends off in both directions.	The extent of candidate regeneration critical habitat is not publically available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Restore or enhance biophysical attributes of critical habitat along the pipeline construction footprint by revegetating the pipeline construction footprint using native tree and shrub seeds and propagation materials where feasible; Avoid replanting competing vegetation that will deter whitebark pine habitat from regenerating or recovering, such as avoiding replanting competitive tree species, such as lodgepole pine (<i>Pinus contorta</i> var. <i>latifolia</i>) or shrubs of the genus <i>Ribes</i> that may host white pine blister rust. Note: Several of the general avoidance measures in Section 5.1.4 do not apply to this site since the pipeline construction footprint is outside of the regional elevation limits, no whitebark pine trees have been observed at this site and no plots, transects or recovery activities have been identified at this site.	10U 643150, 5504852 to 10U 643903, 5502067
Alaska moonwort <i>Botrychium alaskense</i> (S3?, blue)	BOTRALA172877 VG-170	d-002-l/092-H-11 to a-002-l/092-H-11	985.38 to 985.45	July 21, 2013	Plant occurs with other <i>Botrychium</i> species and identification was confirmed following field surveys.	Plant occurs within the pipeline construction footprint, approximately 2 m east of the centreline and extends off to the east.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped.	10U 643172, 5503877 10U 643179, 5503887 10U 643168, 5503927 10U 643183, 5503957
Whitebark pine candidate regeneration critical habitat <i>Pinus albicaulis</i> candidate regeneration critical habitat	PINUALB_CRITHAB5 VG-173	a-019-h/092-H-11 to c-003-g/092-H-11	998.39 to 1002.96	--	--	A whitebark pine candidate regeneration critical habitat polygon (Environment Canada 2014a) spans the width of the pipeline construction footprint and extends off in both directions.	The extent of candidate regeneration critical habitat is not publically available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Restore or enhance biophysical attributes of critical habitat along the pipeline construction footprint by revegetating the pipeline construction footprint using native tree and shrub seeds and propagation materials where feasible; Avoid replanting competing vegetation that will deter whitebark pine habitat from regenerating or recovering, such as avoiding replanting competitive tree species, such as lodgepole pine (<i>Pinus contorta</i> var. <i>latifolia</i>) or shrubs of the genus <i>Ribes</i> that may host white pine blister rust. Note: Several of the general avoidance measures in Section 5.1.4 do not apply to this site since the pipeline construction footprint is outside of the regional elevation limits, no whitebark pine trees have been observed at this site and no plots, transects or recovery activities have been identified at this site.	10U 637091, 5495041 to 10U 632855, 5494740
Amabilis fir - western redcedar/devil's club Moist Submaritime <i>Abies amabilis</i> - <i>Thuja plicata</i> / <i>Oplopanax horridus</i> Moist Submaritime (S3, blue)	ABIEAMA822165 VG-177	b-094-B/092-H-11	1004.84 to 1004.90	July 18, 2013	Community was observed in a 60 m × 50 m area.	Community occurs within the pipeline construction footprint.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	10U 631872, 5493165

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Amabilis fir - western redcedar/devil's club Moist Submaritime <i>Abies amabilis</i> - <i>Thuja plicata</i> / <i>Oplopanax horridus</i> Moist Submaritime (S3, blue)	ABIEAMA909461 VG-178	a-047-B/092-H-11	1010.25 to 1010.30	May 26, 2013	Community was observed in a 50 m x 40 m area.	Community occurs within the pipeline construction footprint.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	10U 629909, 5488461
<i>Racomitrium</i> moss <i>Racomitrium affine</i> (S2S3, blue)	RACOAFF210656	c-024-K/092-H-06	1025.94	May 24, 2013	Occurs on a west facing slope, on the underside of a large old birch hole.	Specimen was collected approximately 8 m from the southeast edge of the pipeline construction footprint. An access road is also planned at this location.	This site was revisited August 7, 2017. The large old birch hole could not be located and no mosses resembling <i>Racomitrium affine</i> were observed. No further mitigation is recommended at this site as original occurrence could not be relocated.	10U 623495, 5477592
Roell's brotherella moss early draft critical habitat <i>Brotherella roellii</i> early draft critical habitat	BROTROE_CRITHAB1 VG-182	c-051-E/092-H-06 to c-052-E/092-H-06	1037.76 to 1038.19	--	No specimens of Roell's brotherella moss were observed during ground surveys within the pipeline construction footprint.	A Roell's brotherella moss early draft critical habitat polygon (Environment Canada 2015c) spans the width of the pipeline construction footprint and extends off in both directions.	The extent of early draft critical habitat is not publically available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Restore or enhance biophysical attributes of critical habitat by revegetating the pipeline construction footprint using native grasses, forbs, tree or shrub seeds and propagation materials where feasible to improve soil structure and reduce soil erosion. Note: Several of the disturbance reduction measures listed in Section 5.1.10 are only applicable where biophysical attributes of critical habitat are present.	10U 617002, 5471233 10U 616347, 5470990
Location of interest that possesses the ecological attributes required for Roell's brotherella moss within Roell's brotherella moss early draft critical habitat	BROTROE_ECOLATR1-1 VG-218	d-052-E/092-H-06	1038.05 to 1038.18	--	Identified through desktop review of ecological attributes.	Location of interest with ecological attributes for Roell's brotherella moss is present on the pipeline construction footprint based on desktop review.	Pre-disturbance, screen for Roell's brotherella. Reduce disturbance to areas that possess the ecological attributes required for Roell's brotherella moss, where feasible and when safety is not compromised If Roell's brotherella moss is located on the pipeline construction footprint and it cannot be avoided, relocate its substrate to a suitable habitat in the immediate vicinity of the Project. The location (e.g., aspect and vertical position) and habitat (e.g., substrate, light and humidity conditions) of the receiving sites will emulate conditions, including the substrate types that occurred in the critical function zone at the transplant source location, to the extent feasible. Ensure pre-construction contours are restored to maintain site hydrology.	10U 616725, 5471155 10U 616610, 5471099
Roell's brotherella moss early draft critical habitat <i>Brotherella roellii</i> early draft critical habitat	BROTROE_CRITHAB2 VG-183	d-044-B/092-H-05 to b-034-B/092-H-05	1062.56 to 1064.24	--	No specimens of Roell's brotherella moss were observed during ground surveys within the pipeline construction footprint.	A Roell's brotherella moss early draft critical habitat polygon (Environment Canada 2015c) spans the width of the pipeline construction footprint and extends off in both directions.	The extent of early draft critical habitat is not publically available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Restore or enhance biophysical attributes of critical habitat by revegetating the pipeline construction footprint using native grasses, forbs, tree or shrub seeds and propagation materials where feasible to improve soil structure and reduce soil erosion. Note: Several of the disturbance reduction measures listed in Section 5.1.10 are only applicable where biophysical attributes of critical habitat are present.	10U 597016, 5460624 10U 596661, 5459000
Location of interest that possesses the ecological attributes required for Roell's brotherella moss within Roell's brotherella moss early draft critical habitat	BROTROE_ECOLATR2-1 VG-219	d-044-B/092-H-05	1062.56 to 1062.60	--	Identified through desktop review of ecological attributes.	Location of interest with ecological attributes for Roell's brotherella moss is present on the pipeline construction footprint based on desktop review.	Pre-disturbance, screen for Roell's brotherella. Reduce disturbance to areas that possess the ecological attributes required for Roell's brotherella moss, where feasible and when safety is not compromised If Roell's brotherella moss is located on the pipeline construction footprint and it cannot be avoided, relocate its substrate to a suitable habitat in the immediate vicinity of the Project. The location (e.g., aspect and vertical position) and habitat (e.g., substrate, light and humidity conditions) of the receiving sites will emulate conditions, including the substrate types that occurred in the critical function zone at the transplant source location, to the extent feasible. Ensure pre-construction contours are restored to maintain site hydrology.	10U 597000, 5460637 10U 596990, 5460589
Location of interest that possesses the ecological attributes required for Roell's brotherella moss within Roell's brotherella moss early draft critical habitat	BROTROE_ECOLATR2-2 VG-220	a-044-B/092-H-05 to d-034-B/092-H-05	1063.37 to 1063.43	--	Identified through desktop review of ecological attributes.	Location of interest with ecological attributes for Roell's brotherella moss is present on the pipeline construction footprint based on desktop review.	Pre-disturbance, screen for Roell's brotherella. Reduce disturbance to areas that possess the ecological attributes required for Roell's brotherella moss, where feasible and when safety is not compromised If Roell's brotherella moss is located on the pipeline construction footprint and it cannot be avoided, relocate its substrate to a suitable habitat in the immediate vicinity of the Project. The location (e.g., aspect and vertical position) and habitat (e.g., substrate, light and humidity conditions) of the receiving sites will emulate conditions, including the substrate types that occurred in the critical function zone at the transplant source location, to the extent feasible. Ensure pre-construction contours are restored to maintain site hydrology.	10U 596825, 5459841 10U 596841, 5459781
Roell's brotherella moss early draft critical habitat <i>Brotherella roellii</i> early draft critical habitat	BROTROE_CRITHAB3 VG-184	b-024-B/092-H-05 to c-095-J/092-H-04	1065.25 to 1067.36	--	No specimens of Roell's brotherella moss were observed during ground surveys within the proposed pipeline construction footprint.	A Roell's brotherella moss early draft critical habitat polygon (Environment Canada 2015c) spans the width of the pipeline construction footprint and extends off in both directions.	The extent of early draft critical habitat is not publically available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Restore or enhance biophysical attributes of critical habitat by revegetating the pipeline construction footprint using native grasses, forbs, tree or shrub seeds and propagation materials where feasible to improve soil structure and reduce soil erosion. Note: Several of the disturbance reduction measures listed in Section 5.1.10 are only applicable where biophysical attributes of critical habitat are present.	10U 596524, 5458001 10U 596346, 5456000
Location of interest that possesses the ecological attributes required for Roell's brotherella moss within Roell's brotherella moss early draft critical habitat	BROTROE_ECOLATR3-1 VG-221	b-024-B/092-H-05	1066.15 to 1066.22	--	Identified through desktop review of ecological attributes.	Location of interest with ecological attributes for Roell's brotherella moss is present on the pipeline construction footprint based on desktop review.	Pre-disturbance, screen for Roell's brotherella. Reduce disturbance to areas that possess the ecological attributes required for Roell's brotherella moss, where feasible and when safety is not compromised If Roell's brotherella moss is located on the pipeline construction footprint and it cannot be avoided, relocate its substrate to a suitable habitat in the immediate vicinity of the Project. The location (e.g., aspect and vertical position) and habitat (e.g., substrate, light and humidity conditions) of the receiving sites will emulate conditions, including the substrate types that occurred in the critical function zone at the transplant source location, to the extent feasible. Ensure pre-construction contours are restored to maintain site hydrology.	10U 596315, 5457150 10U 596324, 5457082

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Location of interest that possesses the ecological attributes required for Roell's brotherella moss within Roell's brotherella moss early draft critical habitat	BROTROE_ECOLATR3-2 VG-222	d-024-B/092-H-05	1066.51 to 1066.57	--	Identified through desktop review of ecological attributes.	Location of interest with ecological attributes for Roell's brotherella moss is present on the pipeline construction footprint based on desktop review.	Pre-disturbance, screen for Roell's brotherella. Reduce disturbance to areas that possess the ecological attributes required for Roell's brotherella moss, where feasible and when safety is not compromised. If Roell's brotherella moss is located on the pipeline construction footprint and it cannot be avoided, relocate its substrate to a suitable habitat in the immediate vicinity of the Project. The location (e.g., aspect and vertical position) and habitat (e.g., substrate, light and humidity conditions) of the receiving sites will emulate conditions, including the substrate types that occurred in the critical function zone at the transplant source location, to the extent feasible. Ensure pre-construction contours are restored to maintain site hydrology.	10U 596251, 5456792 10U 596237, 5456734
Minter Gardens to Burnaby Segment								
Western redcedar - Douglas-fir/vine maple <i>Thuja plicata</i> - <i>Pseudotsuga menziesii</i> / <i>Acer circinatum</i> (S2S3, blue)	THUJPLI990791	d-075-J/092-H-04	1069.70	April 13, 2013	Identified to be a potential rare community based on TEM plot data.	TEM plot location is not within the pipeline construction footprint.	No mitigation is required as this population is more than 5 m from the pipeline construction footprint, however, follow general mitigation measures to avoid accidental encroachment.	10U 595990, 5453791
Western redcedar/sword fern-skunk cabbage <i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i> (S3?, blue)	THUJPLI063461 VG-186 Wetland Report ID Hope-Abbo_WC1046point5	c-029-J/092-H-04	1075.66 to 1075.89	2014	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint and extends off in both directions.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 592044, 5449468 10U 591927, 5449281
Roell's brotherella moss early draft critical habitat <i>Brotherella roellii</i> early draft critical habitat	BROTROE_CRITHAB4 VG-187	a-030-J/092-H-04 to d-011-K/092-H-04	1076.22 to 1077.49	--	No specimens of Roell's brotherella moss were observed during ground surveys within the pipeline construction footprint.	A Roell's brotherella moss early draft critical habitat polygon (Environment Canada 2015c) spans the width of the pipeline construction footprint and extends off in both directions. An access road transects this polygon near KP 1077.	The extent of early draft critical habitat is not publically available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Restore or enhance biophysical attributes of critical habitat by revegetating the pipeline construction footprint using native grasses, forbs, tree or shrub seeds and propagation materials where feasible to improve soil structure and reduce soil erosion. Note: Several of the disturbance reduction measures listed in Section 5.1.10 are only applicable where biophysical attributes of critical habitat are present. Section 4.1.2 describes pre-construction surveys to be completed for this species.	10U 591737, 5449014 to 10U 590999, 5448259
Location of interest that possesses the ecological attributes required for Roell's brotherella moss within Roell's brotherella moss early draft critical habitat	BROTROE_ECOLATR4-1 VG-223	a-030-J/092-H-04	1076.73 to 1076.79	--	Identified through desktop review of ecological attributes.	Location of interest with ecological attributes for Roell's brotherella moss is present on the pipeline construction footprint based on desktop review.	Pre-disturbance, screen for Roell's brotherella. Reduce disturbance to areas that possess the ecological attributes required for Roell's brotherella moss, where feasible and when safety is not compromised. If Roell's brotherella moss is located on the pipeline construction footprint and it cannot be avoided, relocate its substrate to a suitable habitat in the immediate vicinity of the Project. The location (e.g., aspect and vertical position) and habitat (e.g., substrate, light and humidity conditions) of the receiving sites will emulate conditions, including the substrate types that occurred in the critical function zone at the transplant source location, to the extent feasible. Ensure pre-construction contours are restored to maintain site hydrology.	10U 591516, 5448681 10U 591499, 5448622
Location of interest that possesses the ecological attributes required for Roell's brotherella moss within Roell's brotherella moss early draft critical habitat	BROTROE_ECOLATR4-2 VG-224	c-020-J/092-H-04	1077.10 to 1077.28	August 10, 2017	Mature mixedwood forest of western redcedar, bigleaf maple, paper birch and red alder. The terrain is made up of creek beds and blocky boulders covered with step moss. A rich assemblage of pleurocarpous mosses dominate the tree bases with scattered patches of acrocarpous mosses. No Roell's brotherella moss was collected during the species specific survey at this location.	Location of interest with ecological attributes for Roell's brotherella moss is present on the pipeline construction footprint.	Reduce disturbance to areas that possess the ecological attributes required for Roell's brotherella moss, where feasible and when safety is not compromised. Ensure pre-construction contours are restored to maintain site hydrology.	10U 591359, 5448374 10U 591209, 5448285
Western redcedar/sword fern Dry Maritime <i>Thuja plicata</i> / <i>Polystichum munitum</i> Dry Maritime (S2?, blue)	THUJPLI502448 VG-188	a-030-J/092-H-04 to d-020-J/092-H-04	1076.85 to 1076.89 and 1076.94 to 1076.98	August 14, 2014	Community extends over an area approximately 230 m x > 40 m on the east side of the existing right-of-way.	Community occurs within the southeastern side of the pipeline construction footprint, there is a 40 m gap where this community is off of the pipeline construction footprint to the east.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	10U 591557, 5448645 10U 591542, 5448619 10U 591513, 5448546 10U 591514, 5448533 10U 591565, 5448469 10U 591515, 5448483 10U 591522, 5448475 10U 591544, 5448474 10U 591502, 5448448 10U 591474, 5448438 10U 591458, 5448435

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Common cattail Marsh <i>Typha latifolia</i> marsh (S3, blue)	TYPHLAT741822 VG-189 DR_1-24-18-2	c-086-B/092-G-01	1114.78 to 1114.80	August 22, 2013	Community was observed in a 15 m × 30 m area.	Community occurs within the pipeline construction footprint.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	10U 558741, 5435822 10U 558754, 5435829 10U 558743, 5435828 10U 558766, 5435808
Roell's brotherella moss early draft critical habitat <i>Brotherella roellii</i> early draft critical habitat	BROTROE_CRITHAB5 VG-190	c-086-B/092-G-01 to a-098-B/092-G-01	1115.03 to 1116.92 (Sumas Tank Farm)	--	No specimens of Roell's brotherella moss were observed during ground surveys within the pipeline construction footprint.	A Roell's brotherella moss early draft critical habitat polygon (Environment Canada 2015c) spans the width of the pipeline construction footprint and extends off in both directions as well as intersecting the Sumas Tank Farm.	The extent of early draft critical is not publically available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Restore or enhance biophysical attributes of critical habitat by revegetating the pipeline construction footprint using native grasses, forbs, tree or shrub seeds and propagation materials where feasible to improve soil structure and reduce soil erosion. Note: Several of the disturbance reduction measures listed in Section 5.1.10 are only applicable where biophysical attributes of critical habitat are present.	10U 558567, 5435987 to 10U 556979, 5436216
Pacific waterleaf <i>Hydrophyllum tenuipes</i> (S2, red)	HYDRTEN570162 VG-191, VG-192, and VG-193	a-097-B/092-G-01 to a-098-B/092-G-01	1115.90 to 1116.88	May 8, 2013	> 12,000 plants were observed in three subpopulations in an approximately 970 m × 100 m area.	Most plants are present off of the pipeline construction footprint. The third subpopulation spans the width of the pipeline construction footprint and extends off to the southeast.	Leave a gap in the spoil pile within a 10 m radius of this population if it is located on spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	10U 557011, 5436258 10U 557038, 5436160 10U 557570, 5436162 10U 557647, 5436131 10U 557985, 5436130
Western redcedar/sword fern-skunk cabbage <i>Thuja plicata</i> / <i>Polystichum munitum</i> – <i>Lysichiton americanus</i> (S3?, blue)	THUJPLI597176 VG-231 Wetland Report ID Hope-Abbo_W1086point1	b-097-B/92-G-01	1116.29 to 1116.40	November 2, 2013	Rare community identified during wetland surveys.	Community occurs on the southern edge of the pipeline construction footprint, and extends off to the south.	Schedule construction to occur during frozen ground conditions where feasible. To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 557599, 5436175 10U 557486, 5436197
Location of interest that possesses the ecological attributes required for Roell's brotherella moss within Roell's brotherella moss early draft critical habitat	BROTROE_ECOLATR5-1 VG-225	b-097-B/092-G-01 to a-098-B/092-G-01	1116.45 to 1116.51	August 10, 2017	Tall willow shrubs and scattered trees within a wet skunk cabbage dominated swamp forest. Common tree species include red alder, black cottonwood, western redcedar and Sitka spruce. No Roell's brotherella moss was collected during the species specific survey at this location.	Location of interest with ecological attributes for Roell's brotherella moss is present on the pipeline construction footprint.	Reduce disturbance to areas that possess the ecological attributes required for Roell's brotherella moss, where feasible and when safety is not compromised Ensure pre-construction contours are restored to maintain site hydrology.	10U 557437, 5436218 10U 557379, 5436227
Pacific waterleaf <i>Hydrophyllum tenuipes</i> (S2, red)	HYDRTEN529933 VG-194	c-089-B/092-G-01 to d-090-B/092-G-01	1118.27 to 1118.58	May 10, 2013	> 12,000 plants were observed in a 310 m × 130 m area.	Plants span the width of the pipeline construction footprint and extend off in both directions.	Leave a gap in the spoil pile within a 10 m radius of this population if it is located on spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	10U 555529, 5435933 10U 555549, 5435948 10U 555600, 5436050 10U 555652, 5435983 10U 555669, 5436016 10U 555830, 5435836
Hard-stemmed bulrush Deep Marsh <i>Schoenoplectus acutus</i> Deep Marsh (S3, blue)	SCHOACU049127 VG-195 Wetland Report ID Abbo-Burn_W1100point93	b-032-E/92-G-01	1130.99 to 1131.05	April 29, 2013	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint and extends off to the north.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 544049, 5440127 10U 544003, 5440173
Roell's brotherella moss early draft critical habitat <i>Brotherella roellii</i> early draft critical habitat	BROTROE_CRITHAB6 VG-197	a-070-E/092-G-01 to d-062-H/092-G-02	1138.54 to 1140.16	--	No vegetation surveys were conducted for Roell's brotherella moss within the pipeline construction footprint.	A Roell's brotherella moss early draft critical habitat polygon (Environment Canada 2015c) spans the width of the pipeline construction footprint and extends off in both directions.	The extent of early draft critical habitat is not publically available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Restore or enhance biophysical attributes of critical habitat by revegetating the pipeline construction footprint using native grasses, forbs, tree or shrub seeds and propagation materials where feasible to improve soil structure and reduce soil erosion. There are no areas where biophysical attributes of critical habitat are present within the pipeline construction footprint within this early draft critical habitat polygon.	10U 534491, 5443350 10U 534278, 5443409
Black cottonwood-red alder/salmonberry <i>Populus trichocarpa</i> / <i>Alnus rubra</i> / <i>Rubus spectabilis</i> (S3, blue)	POPUTRI491350 VG-198	a-073-H/092-G-02	1141.20 to 1141.42	August 22, 2013	Community was observed in a 200 m × 75 m area.	Community occurs within south portion of the pipeline construction footprint.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped. Ensure pre-construction contours are restored to maintain site hydrology.	10U 534491, 5443350 10U 534278, 5443409

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Western redcedar – Sitka spruce/skunk cabbage <i>Thuja plicata</i> – <i>Picea sitchensis</i> / <i>Lysichiton americanus</i> (S3?, blue)	THUJPLI060497 VG-199	b-073-H/092-G-02	1141.65 to 1141.74	August 22, 2013	Community was observed along an elevated streambed for 60 m along the pipeline construction footprint.	Community occurs within the pipeline construction footprint and extends off to the southwest.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped.	10U 534060, 5443497 10U 534010, 5443462
Roell's brotherella moss early draft critical habitat <i>Brotherella roellii</i> early draft critical habitat	BROTROE_CRITHAB7 VG-200 and VG-202	c-075-H/092-G-02 to c-076-H/092-G-02	1143.78 to 1144.32	--	No vegetation surveys were conducted for Roell's brotherella moss within the pipeline construction footprint.	A Roell's brotherella moss early draft critical habitat polygon (Environment Canada 2015c) spans the width of the pipeline construction footprint and extends off in both directions.	The extent of early draft critical habitat is not publically available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Restore or enhance biophysical attributes of critical habitat by revegetating the pipeline construction footprint using native grasses, forbs, tree or shrub seeds and propagation materials where feasible to improve soil structure and reduce soil erosion. Note: Several of the disturbance reduction measures listed in Section 5.1.10 are only applicable where biophysical attributes of critical habitat are present.	10U 532000, 5443969 10U 531711, 5444000
Location of interest that possesses the ecological attributes required for Roell's brotherella moss within Roell's brotherella moss early draft critical habitat	BROTROE_ECOLATR7-1 VG-226	d-076-H/092-G-02	1144.27 to 1144.38	--	Identified through desktop review of ecological attributes.	Location of interest with ecological attributes for Roell's brotherella moss is present on the pipeline construction footprint based on desktop review.	Pre-disturbance, screen for Roell's brotherella. Reduce disturbance to areas that possess the ecological attributes required for Roell's brotherella moss, where feasible and when safety is not compromised If Roell's brotherella moss is located on the pipeline construction footprint and it cannot be avoided, relocate its substrate to a suitable habitat in the immediate vicinity of the Project. The location (e.g., aspect and vertical position) and habitat (e.g., substrate, light and humidity conditions) of the receiving sites will emulate conditions, including the substrate types that occurred in the critical function zone at the transplant source location, to the extent feasible. Ensure pre-construction contours are restored to maintain site hydrology.	10U 531518, 5444036 10U 531411, 5444006
Black cottonwood–red alder/salmonberry <i>Populus trichocarpa</i> / <i>Alnus rubra</i> / <i>Rubus spectabilis</i> (S3, blue)	POPUTRI459982 VG-201	d-076-H/092-G-02	1143.28 to 1143.34	August 23, 2013	Community was observed along the floodplain of a large creek.	Community occurs within the pipeline construction footprint and extends off to the southwest.	Leave gaps in the spoil piles within a 10 m radius of the occurrence if this is spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side. If the area will be stripped, salvage the organic layer (up to 15 cm) from within a 10 m radius of the occurrence; isolate topsoil from other spoil piles and identify with labelled stakes or flags; redistribute salvaged topsoil over the pipeline construction footprint at the location from which it was stripped Ensure pre-construction contours are restored to maintain site hydrology.	10U 531459, 5443982 10U 531466, 5443991 10U 531486, 5444027
Bebb's willow/bluejoint reedgrass <i>Salix bebbiana</i> / <i>Calamagrostis canadensis</i> (S3, blue)	SALIBEB889369 VG-203 Wetlands Report ID Abbo-Bum_WC1115point7	a-088-H/092-G-02	1146.01 to 1146.07	November 3, 2013	Rare community identified during wetland surveys.	Community spans the entire width of the pipeline construction footprint and extends off to both sides.	To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 529827, 5444346 10U 529769, 5444355
Common cattail Marsh <i>Typha latifolia</i> marsh (S3, blue)	TYPHLAT906384 VG-207 Wetlands Report ID Abbo-Bum_W1129point5	a-041-J/92-G-02	1161.86 to 1162.25	August 16, 2014	Community was observed for 200 m in a wetland crossed by the pipeline construction footprint.	Community occurs on the pipeline construction footprint and extends off to the southwest.	It is anticipated that the directional drill planned at this location will mostly avoid this community. Mitigation is provided for the corner of the wetland where the HDD pad is planned and in the event that the directional drill fails. To the extent feasible avoid placing windrowed material in wetlands during grading and avoid placing trench spoil within a 10 m radius of the occurrence if it is located on the spoil side, or temporarily cover the site (e.g., with snow, geotextile pads, flex net, swamp mats) if this is travel side and stripping is not required. If the area will be stripped, keep wetland soils separate from upland soils and replace salvaged wetland substrates/upper soils in the appropriate order following construction. Ensure pre-construction contours are restored to maintain site hydrology.	10U 518061, 5449709 10U 517748, 5449941
Historical Vancouver Island beggarticks occurrence <i>Biden amplissima</i> (S3, blue, SARA-designation Special Concern))	BIDEAMP_HIST VG-228	b-03-D/92-G-07 to c-03-D/92-G-07	1177.05 to 1177.24	August 17, 2014 August 9, 2017	Five Vancouver Island beggartick plants were observed at this location in 1999. Surveys in 2014 and 2017 did not locate any plants. The area that contains habitat similar to that where plants were observed in 1999 is 190 m x 20 m.	Area of potential habitat is entirely within the pipeline construction footprint.	Include this previously observed Vancouver Island beggarticks occurrence on the Environmental Alignment Sheets and in the post-construction monitoring of rare plants to determine if Vancouver Island beggarticks are present post-construction. Monitor and manage encroachment of invasive non-native/alien species within the area of potential habitat (identified on the Environmental Alignment Sheets) during post construction monitoring.	10U 506352, 5455855 10U 506328, 5455664
Roell's brotherella moss early draft critical habitat <i>Brotherella roellii</i> early draft critical habitat	BROTROE_CRITHAB8 VG-208	d-015-D/092-G-07 to d-025-D/092-G-07	1179.77 to 1180.01	--	No specimens of Roell's brotherella moss were observed during ground surveys within the pipeline construction footprint.	A Roell's brotherella moss early draft critical habitat polygon (Environment Canada 2015c) spans the width of the pipeline construction footprint and extends off in both directions as well as intersecting the footprint of the Burnaby Storage Terminal.	The extent of early draft critical habitat is not publically available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Restore or enhance biophysical attributes of critical habitat by revegetating the pipeline construction footprint using native grasses, forbs, tree or shrub seeds and propagation materials where feasible to improve soil structure and reduce soil erosion. Note: Several of the disturbance reduction measures listed in Section 5.1.10 are only applicable where biophysical attributes of critical habitat are present.	10U 504971, 5457066 10U 505000, 5457225
Location of interest that possesses the ecological attributes required for Roell's brotherella moss within Roell's brotherella moss early draft critical habitat	BROTROE_ECOLATR8-1 VG-229	a-025-D/092-G-07 to b-025-D/092-G-07	1179.87 to 1180.06	August 9, 2017	Young mixed forests of red alder, bigleaf maple, paper birch and black cottonwood. The creek beds have been altered by concrete drainage pathways. No Roell's brotherella moss was collected during the species specific survey at this location.	Location of interest with ecological attributes for Roell's brotherella moss is within the existing terminal.	No mitigation is recommended at this location because the treed riparian area will not be reclaimed following construction.	10U 504633, 5457369 10U 504695, 5457444 10U 504925, 5457242 10U 505116, 5457115 10U 504856, 5457125

TABLE E-2 Cont'd

Species (Provincial Rank) ¹	Feature ID	Legal Location	KP ²	First Observation Date	Abundance and Distribution	Relation to Pipeline Construction Footprint/Project Component	Mitigation and Discussion	UTM Zone Easting, Northing
Westridge Lateral								
Roell's brotherella moss early draft critical habitat <i>Brotherella roellii</i> early draft critical habitat	BROTROE_CRITHAB8 VG-208	d-015-D/092-G-07 to d-025-D/092-G-07	0 to 1.00		No specimens of Roell's brotherella moss were observed during ground surveys within the pipeline construction footprint.	A Roell's brotherella moss early draft critical habitat polygon (Environment Canada 2015c) spans the width of the pipeline construction footprint and extends off in both directions as well as intersecting the footprint of the Burnaby Storage Terminal.	The extent of early draft critical habitat is not publically available and is provided with the permission of ECCC. Inform all users of the KP range within which to apply the associated site-specific mitigation and access restrictions. Most the the Early Draft Critical Habitat on the Westridge Extension will be avoided by the construction of the Burnaby Tunnel. Where disturbed areas will be revegetated restore or enhance biophysical attributes of critical habitat by revegetating the pipeline construction footprint using native grasses, forbs, tree or shrub seeds and propagation materials where feasible to improve soil structure and reduce soil erosion. Note: Several of the disturbance reduction measures listed in Section 5.1.10 are only applicable where biophysical attributes of critical habitat are present.	10U 504971, 5457066 10U 505000, 5457225
Location of interest that possesses the ecological attributes required for Roell's brotherella moss within Roell's brotherella moss early draft critical habitat	BROTROE_ECOLATR8-1 VG-229	a-025-D/092-G-07 to b-025-D/092-G-07	0.00 to 0.43	August 9, 2017	Young mixed forests of red alder, bigleaf maple, paper birch and black cottonwood. The creek beds have been altered by concrete drainage pathways. No Roell's brotherella moss was collected during the species specific survey at this location.	Location of interest with ecological attributes for Roell's brotherella moss is within the existing terminal.	No mitigation is recommended at this location because the treed riparian area will not be reclaimed following construction.	10U 504633, 5457369 10U 504695, 5457444 10U 504925, 5457242 10U 505116, 5457115 10U 504856, 5457125
Location of interest that possesses the ecological attributes required for Roell's brotherella moss within Roell's brotherella moss early draft critical habitat	BROTROE_ECOLATR8-2 VG-230	c-025-D/092-G-07	0.88 to 0.91	--	Identified through desktop review of ecological attributes.	Location of interest with ecological attributes for Roell's brotherella moss is present on the pipeline construction footprint based on desktop review.	This area of potential habitat will be avoided by construction of the Burnaby Tunnel.	10U 504620, 5457870 10U 504607, 5457919

Sources: AEP 2015b,c,d, Allen 2014, BC CDC 2016, BC MOE 2015, COSEWIC 2015, Government of Canada 2015, NatureServe 2015

Notes:

- 1 Provincial (S) ranks are assigned by the provincial CDC(s). Ranks range from 1 (five or fewer occurrences) to 5 (demonstrably secure under present conditions); all definitions below are adapted from NatureServe (2015).
 - S1 = Critically Imperiled: because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation. Typically, five or fewer occurrences or very few remaining individuals (< 1,000).
 - S2 = Imperiled: because of rarity or because of some factor(s) making it very vulnerable to extirpation. Typically, 6-20 occurrences or few remaining individuals (1,000-3,000).
 - S3 = Vulnerable: because rare and uncommon, or found in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically, 21-100 occurrences or between 3,000 and 10,000 individuals.
 - S#S# = Range Rank: a numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status of the element.
 - SU = Unrankable: currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
 - S#? = Inexact numeric rank: denotes inexact numeric rank.

Red List: Ecological communities or rare vegetation species which either no longer exist, face imminent extirpation or extinction, or are likely to become Endangered or Threatened if limiting factors are not reversed.

Blue List: Ecological communities or rare vegetation species considered at risk (i.e., having characteristics making them sensitive or vulnerable to human activities or natural events).

- 2 All features have a Vegetation Feature ID, features shown on the Environmental Alignment Sheets (typically those with mitigation) have a second feature ID (VG-##), and communities that overlap with wetlands have a Wetland Report ID.
- 3 All KPs are approximate.
- 4 UTM's provided are either those collected in the field or, for certain polygon features such as wetlands and critical habitat, the locations where the polygon edges intersect the project footprint.

APPENDIX F
RECORD OF STAKEHOLDER NOTIFICATION OF PLAN

TABLE F-1
RECORD OF NOTIFICATION

Stakeholder Group	Contact Name (if applicable)	Date	Method of Contact
Landowners	N/A	September 11, 2016	Letter
Aboriginal Groups (please refer to Appendix E)	N/A	September 26, 2016	Letter
Vancouver Fraser Port Authority	Tim Blair	September 20, 2016	Email
Jasper National Park of Canada	Mayabe Dia	September 20, 2016	Email
Alberta Environment and Parks	Corinee Kristensen	September 20, 2016	Email
Ministry of Transportation and Infrastructure	Lisa Gow	September 20, 2016	Email
BC Parks	Ken Morrison	September 20, 2016	Email
BC Oil and Gas Commission	Brian Murphy	September 20, 2016	Email
Ministry of Natural Gas Development	Linda Beltrano	September 20, 2016	Email
Forests, Lands and Natural Resource Operations	Andrea Mah	December 22, 2016	Email
Forests, Lands and Natural Resource Operations	Susan Fitton	September 20, 2016	Email
FVAQC	Roger Quan	October 21, 2016	Email
ECCC	Phil Wong	October 21, 2016	Email
ECCC	Rachel Mayberry	October 28, 2016	Email
ECCC	Coral Deshireld	December 21, 2016	Email
ECCC	Phil Wong	December 21, 2016	Email
Vancouver Fraser Port Authority	Patrick Coates	September 20, 2016	Email
Department of Fisheries and Oceans	Sandra Hollick-Kenyon	December 3, 2016	Email
Department of Fisheries and Oceans	Alston Bonamis	December 3, 2016	Email
City of Edmonton	N/A	January 19 – 23, 2017	Letter
City of Spruce Grove	N/A	January 19 – 23, 2017	Letter
Municipality of Jasper	N/A	January 19 – 23, 2017	Letter
Parkland County	N/A	January 19 – 23, 2017	Letter
Strathcona County	N/A	January 19 – 23, 2017	Letter
Town of Edson	N/A	January 19 – 23, 2017	Letter
Town of Hinton	N/A	January 19 – 23, 2017	Letter
Town of Stony Plain	N/A	January 19 – 23, 2017	Letter
Village of Wabamun	N/A	January 19 – 23, 2017	Letter
Yellowhead County	N/A	January 19 – 23, 2017	Letter
City of Kamloops	N/A	January 19 – 23, 2017	Letter
City of Kamloops RCMP Detachment	N/A	January 19 – 23, 2017	Letter
Kamloops Hotel Association	N/A	January 19 – 23, 2017	Letter
Kamloops Chamber of Commerce	N/A	January 19 – 23, 2017	Letter
Kamloops Ministry of Jobs, Tourism, Skills Training	N/A	January 19 – 23, 2017	Letter
City of Merritt	N/A	January 19 – 23, 2017	Letter
City of Merritt RCMP Detachment	N/A	January 19 – 23, 2017	Letter
Clearwater Employment Services	N/A	January 19 – 23, 2017	Letter
Tourism Wells Grey	N/A	January 19 – 23, 2017	Letter
Clearwater Chamber of Commerce	N/A	January 19 – 23, 2017	Letter
District of Clearwater	N/A	January 19 – 23, 2017	Letter
District of Clearwater RCMP Detachment	N/A	January 19 – 23, 2017	Letter
Interior Health	N/A	January 19 – 23, 2017	Letter
Merritt Chamber of Commerce	N/A	January 19 – 23, 2017	Letter
Northern Health	N/A	January 19 – 23, 2017	Letter
Regional District of Fraser Fort George	N/A	January 19 – 23, 2017	Letter
Thompson Nicola Regional District	N/A	January 19 – 23, 2017	Letter

TABLE F-1 Cont'd

Stakeholder Group	Contact Name (if applicable)	Date	Method of Contact
Town of Blue River	N/A	January 19 – 23, 2017	Letter
Venture Kamloops	N/A	January 19 – 23, 2017	Letter
Village of Valemount	N/A	January 19 – 23, 2017	Letter
Village of Valemount RCMP Detachment	N/A	January 19 – 23, 2017	Letter
Valley District	N/A	January 19 – 23, 2017	Letter
Valemount Learning Centre	N/A	January 19 – 23, 2017	Letter
Work Skills BC- Valemount	N/A	January 19 – 23, 2017	Letter
VARDA	N/A	January 19 – 23, 2017	Letter
Valemount Chamber of Commerce	N/A	January 19 – 23, 2017	Letter
Grassland's Conservation Council	N/A	January 19 – 23, 2017	Letter
Abbotsford Chamber of Commerce	N/A	January 19 – 23, 2017	Letter
Abbotsford Police Department	N/A	January 19 – 23, 2017	Letter
ASCA	N/A	January 19 – 23, 2017	Letter
BC Invasive Species	N/A	January 19 – 23, 2017	Letter
BC Ministry of Children and Family Development	N/A	January 19 – 23, 2017	Letter
BC Ministry of Social Development	N/A	January 19 – 23, 2017	Letter
BC Nature	N/A	January 19 – 23, 2017	Letter
BC Wildlife Federation	N/A	January 19 – 23, 2017	Letter
Burnaby Board of Trade	N/A	January 19 – 23, 2017	Letter
Burnaby RCMP Detachment	N/A	January 19 – 23, 2017	Letter
Chilliwack Chamber of Commerce	N/A	January 19 – 23, 2017	Letter
Chilliwack Economic Partners	N/A	January 19 – 23, 2017	Letter
City of Abbotsford	N/A	January 19 – 23, 2017	Letter
City of Burnaby	N/A	January 19 – 23, 2017	Letter
City of Chilliwack	N/A	January 19 – 23, 2017	Letter
City of Coquitlam	N/A	January 19 – 23, 2017	Letter
City of New Westminster	N/A	January 19 – 23, 2017	Letter
City of Port Coquitlam	N/A	January 19 – 23, 2017	Letter
City of Port Moody	N/A	January 19 – 23, 2017	Letter
City of Surrey	N/A	January 19 – 23, 2017	Letter
Coquitlam RCMP Detachment	N/A	January 19 – 23, 2017	Letter
Corporation of Delta	N/A	January 19 – 23, 2017	Letter
District of Hope	N/A	January 19 – 23, 2017	Letter
Eagle Creek	N/A	January 19 – 23, 2017	Letter
Fraser Valley Invasive Plant Council	N/A	January 19 – 23, 2017	Letter
Fraser Valley Regional District	N/A	January 19 – 23, 2017	Letter
Glen Valley Watershed Society	N/A	January 19 – 23, 2017	Letter
Hope Chamber of Commerce	N/A	January 19 – 23, 2017	Letter
Hope Community Policing Office	N/A	January 19 – 23, 2017	Letter
Langley Chamber of Commerce	N/A	January 19 – 23, 2017	Letter
LEPS	N/A	January 19 – 23, 2017	Letter
LFVAQCC	N/A	January 19 – 23, 2017	Letter
Metro Vancouver	N/A	January 19 – 23, 2017	Letter
Newton RCMP Detachment	N/A	January 19 – 23, 2017	Letter
RCMP Division 'E'	N/A	January 19 – 23, 2017	Letter
Sapperton Fish and Game	N/A	January 19 – 23, 2017	Letter
Stoney Creek	N/A	January 19 – 23, 2017	Letter
Surrey Board of Trade	N/A	January 19 – 23, 2017	Letter
Surry Environmental Partners	N/A	January 19 – 23, 2017	Letter
Surrey RCMP Detachment	N/A	January 19 – 23, 2017	Letter

TABLE F-1 Cont'd

Stakeholder Group	Contact Name (if applicable)	Date	Method of Contact
Township of Langley	N/A	January 19 – 23, 2017	Letter
Township of Langley RCMP Detachment	N/A	January 19 – 23, 2017	Letter
TriCities Chamber of Commerce	N/A	January 19 – 23, 2017	Letter
Upper Fraser Valley Regional Detachment	N/A	January 19 – 23, 2017	Letter
Village of Anmore	N/A	January 19 – 23, 2017	Letter
Village of Belcarra	N/A	January 19 – 23, 2017	Letter
Yorkson	N/A	January 19 – 23, 2017	Letter
ACGI Shipping	N/A	January 19 – 23, 2017	Letter
Barnett Marine Park	N/A	January 19 – 23, 2017	Letter
BC Ambulance	N/A	January 19 – 23, 2017	Letter
BC Chamber of Shipping	N/A	January 19 – 23, 2017	Letter
BC Coast Pilots (BCCP)	N/A	January 19 – 23, 2017	Letter
BROKE (Burnaby Residents Opposed to Kinder Morgan Expansion)	N/A	January 19 – 23, 2017	Letter
Canadian Pacific (CP) Rail	N/A	January 19 – 23, 2017	Letter
Canexus- Ero- Newalta-Univar Community Advisory Panel (CAP)	N/A	January 19 – 23, 2017	Letter
Canexus Chemicals	N/A	January 19 – 23, 2017	Letter
Chevron	N/A	January 19 – 23, 2017	Letter
CN Rail	N/A	January 19 – 23, 2017	Letter
Council of Marine Carriers	N/A	January 19 – 23, 2017	Letter
District of North Vancouver	N/A	January 19 – 23, 2017	Letter
Empire Shipping	N/A	January 19 – 23, 2017	Letter
Erco Worldwide	N/A	January 19 – 23, 2017	Letter
First Nation Emergency Services Society (FNESS)	N/A	January 19 – 23, 2017	Letter
First Nation Health Authority	N/A	January 19 – 23, 2017	Letter
Fraser Health Authority	N/A	January 19 – 23, 2017	Letter
Inchcape Shipping	N/A	January 19 – 23, 2017	Letter
Island Tug and Barge	N/A	January 19 – 23, 2017	Letter
Kask Brothers	N/A	January 19 – 23, 2017	Letter
Ledcor Resources and Transportation Limited Partnership	N/A	January 19 – 23, 2017	Letter
Mason Agency (Shipping Service)	N/A	January 19 – 23, 2017	Letter
MLA- Burnaby Lougheed	N/A	January 19 – 23, 2017	Letter
MLA- Burnaby North	N/A	January 19 – 23, 2017	Letter
MLA- Coquitlam – Burke Mountain	N/A	January 19 – 23, 2017	Letter
MLA- North Vancouver Lonsdale	N/A	January 19 – 23, 2017	Letter
MLA- North Vancouver Seymour	N/A	January 19 – 23, 2017	Letter
MLA- Port Moody- Coquitlam	N/A	January 19 – 23, 2017	Letter
MP- Delta	N/A	January 19 – 23, 2017	Letter
MP- North Burnaby Seymour	N/A	January 19 – 23, 2017	Letter
MP- North Vancouver	N/A	January 19 – 23, 2017	Letter
MP- Vancouver Centre	N/A	January 19 – 23, 2017	Letter
MP- Vancouver East	N/A	January 19 – 23, 2017	Letter
MP- Vancouver Quadra	N/A	January 19 – 23, 2017	Letter
MP- West Vancouver – Sunshine Coast – Sea to Sky Country	N/A	January 19 – 23, 2017	Letter
North Shore NOPE	N/A	January 19 – 23, 2017	Letter
North Vancouver Chamber of Commerce	N/A	January 19 – 23, 2017	Letter
Pacific Coast Terminal	N/A	January 19 – 23, 2017	Letter

TABLE F-1 Cont'd

Stakeholder Group	Contact Name (if applicable)	Date	Method of Contact
Pacific Pilotage Authority	N/A	January 19 – 23, 2017	Letter
Pacific Wildlife Foundation	N/A	January 19 – 23, 2017	Letter
Peter Kiewit Infrastructure Co.	N/A	January 19 – 23, 2017	Letter
Seaspan	N/A	January 19 – 23, 2017	Letter
Shell Terminal	N/A	January 19 – 23, 2017	Letter
Simon Fraser University	N/A	January 19 – 23, 2017	Letter
SMIT Marine	N/A	January 19 – 23, 2017	Letter
Suncor Terminal	N/A	January 19 – 23, 2017	Letter
UBC Stellar Sea Lion (Marine Mammal) Research Centre	N/A	January 19 – 23, 2017	Letter
Vancouver Aquarium	N/A	January 19 – 23, 2017	Letter
Vancouver Board of Trade	N/A	January 19 – 23, 2017	Letter
Vancouver Coastal Health Authority	N/A	January 19 – 23, 2017	Letter
Vancouver Pile and Dredge	N/A	January 19 – 23, 2017	Letter
West Vancouver Chamber of Commerce	N/A	January 19 – 23, 2017	Letter
Westward Shipping	N/A	January 19 – 23, 2017	Letter
Wild Bird Trust	N/A	January 19 – 23, 2017	Letter
Metro Vancouver Regional District	Ali Ergudenler	January 19 – 23, 2017	Email
Metro Vancouver Regional District	Roger Quan	January 19 – 23, 2017	Email