



# VEGETATION TECHNICAL REPORT FOR THE TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT

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Prepared for:



**TRANSMOUNTAIN**

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Trans Mountain Pipeline ULC would also like to express their appreciation for the contribution by counties, municipalities, Regional Districts and Invasive Plant Councils/Committees as well as regional ecologists to the success of the vegetation and Terrestrial Ecosystem Mapping program for the proposed Trans Mountain Expansion Project.

## EXECUTIVE SUMMARY

Trans Mountain Pipeline ULC (Trans Mountain) is a Canadian corporation with its head office located in Calgary, Alberta. Trans Mountain is a general partner of Trans Mountain Pipeline L.P., which is operated by Kinder Morgan Canada Inc., and is fully owned by Kinder Morgan Energy Partners, L.P. Trans Mountain is the holder of the NEB certificates for the Trans Mountain pipeline system (TMPL system).

The TMPL system has an operating capacity of approximately 47,690 m<sup>3</sup>/d (300,000 bbl/d) using 23 active pump stations and 40 petroleum storage tanks. The expansion will increase the capacity to 141,500 m<sup>3</sup>/d (890,000 bbl/d).

The proposed expansion will comprise the following.

1. Pipeline segments that complete a twinning (or “looping”) of the pipeline in Alberta and British Columbia (BC) with about 987 km of new buried pipeline.
2. New and modified facilities, including pump stations and tanks.
3. Three new berths at the Westridge Marine Terminal in Burnaby, BC, each capable of handling Aframax class vessels.

TERA Environmental Consultants (TERA) was commissioned to prepare the following Vegetation Technical Report. Provided in this report are the results of the desktop and literature review and the field program conducted for the project in 2012 and 2013. The report also provides the results of Aboriginal participation during the vegetation and Terrestrial Ecosystem Mapping (TEM) field surveys. Approval to treat collected Traditional Ecological Knowledge within this report as public knowledge was received by the participating Aboriginal communities listed herein.

A desktop review of federal and provincial rare plant, rare lichen and rare ecological communities with the potential to occur along the entire proposed pipeline corridor and at facilities was conducted. In addition, a desktop review was conducted of invasive species of concern, including consulting with all counties, municipalities, Regional Districts and Invasive Plant Councils/Committees along the entire proposed pipeline corridor. Consultation was completed with federal and provincial regulatory authorities to discuss and receive input on the methods proposed prior to the field work being undertaken.

In Alberta, there are five rare plant or lichen species listed by the Committee on the Status on Endangered Wildlife in Canada or the *Species at Risk Act* (SARA) that are considered to have low potential to occur along the Alberta segment of the proposed pipeline corridor (known from > 10 km from the proposed pipeline corridor). In BC, there are 10 rare plant or lichen species listed by the Committee on the Status on Endangered Wildlife in Canada or the SARA that are considered to have a high potential of occurring on BC segments of the proposed pipeline corridor (known from within 1 km of the proposed pipeline corridor). There are 11 species considered to have moderate potential (known from 1-10 km from the proposed pipeline corridor) and 34 species considered to have low potential. Prior to field work satellite imagery, TEM and known occurrences of rare species and communities were reviewed in order to identify areas with high potential to support rare plants, rare lichens and rare ecological communities. Where land access was available, field surveys were conducted in 2012 and 2013 for TEM and in 2013 for vegetation (*i.e.*, rare species and rare communities and weeds).

Field surveys focused on the new proposed pipeline segments (*i.e.*, did not include the segments to be reactivated between Hinton to Hargreaves and Darfield to Black Pines) and the new or existing facilities that require clearing of native vegetation.

During the 2013 vegetation surveys a total of 52 km of the proposed pipeline corridor and two facilities were surveyed in Alberta. Field surveys resulted in the observation of 5 rare ecological community occurrences and 53 rare plant and lichen species occurrences in Alberta, all along the proposed pipeline corridor. Weed species, including Prohibited Noxious and Noxious, were observed along the proposed pipeline corridor. The abundance of weed species along the proposed pipeline corridor ranged from low to high.

TEM was conducted for approximately 49,502 ha of the Vegetation Regional Study Area (RSA) in Alberta and identified 87 unique ecosite phases within 4 natural subregions. The most affected vegetation

communities in Alberta were the marsh ecosite in the Lower Foothills Natural Subregion (LFn) and the Labrador tea-mesic ecosite in the Central Mixedwood Natural Subregion (CMWc).

In BC, a total of 211 km of the proposed pipeline corridor and two facilities were surveyed. Field surveys resulted in the observation of 49 potential rare ecological community occurrences and 124 rare plant and lichen occurrences. All but one occurred along the proposed pipeline corridor, with the exception occurring along the Black Pines power line. In addition, one observation along the proposed pipeline corridor included a potential SARA-listed species, Mexican mosquito fern, which will require confirmation during 2014 surveys if it is in proximity to the Footprint. In BC, weed species, including provincially and regionally Noxious, were also observed along the proposed pipeline corridor. The abundance of weed species along the BC proposed pipeline corridor ranged from low to high.

TEM was conducted for approximately 110,191 ha of the Vegetation RSA in BC and identified 185 unique site series within 27 Biogeoclimatic variants. In BC, the most affected vegetation communities were the MacLennan Dry Hot Sub-Boreal Spruce (SBSdh1) variant on the Hargreaves to Darfield segment, the Moist Warm Engelmann Spruce-Subalpine Fir (ESSFmw) variant on the Black Pines to Hope segment and the Southern Dry Submaritime Coastal Western Hemlock (CWHds1) and Eastern Very Dry Maritime Coastal Western Hemlock (CWHxm1) variants for the Hope to Burnaby segment.

A comprehensive vegetation program was conducted in 2012 and 2013, including TEM field verification and vegetation surveys. For this report, where access was not available, desktop studies, literature reviews, information available as a result of 60 years of operation and field data gathered from adjacent lands as well as professional judgement were used to make predictions. Based on the above and the fact that the effects of pipelines and available mitigation and environmental protection measures are well-known, TERA is confident in the predictions about the potential effects of construction, operation and maintenance activities. In order to confirm the effects assessment conclusions and gather site-specific information for the implementation of mitigation from the project-specific Environmental Protection Plans, additional studies will be conducted on those areas where access was not available.

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### DEFINITIONS AND ACRONYM LIST

Acronym	Full Name/Definition
ACIMS	Alberta Conservation Information Management System
AENV	Alberta Environment
AESRD	Alberta Environment and Sustainable Resource Development
ANPC	Alberta Native Plant Council
ANSFN	Alexis Nakota Sioux First Nation
ASRD	Alberta Sustainable Resource Development
ATK	Aboriginal Traditional Knowledge
BC	British Columbia
BC MOE	British Columbia Ministry of Environment
BC MOFR	British Columbia Ministry of Forests and Range
BC MFLNRO	British Columbia Ministry of Forests, Lands and Natural Resource Operations
BC OGC	British Columbia Oil and Gas Commission
BEC	Biogeoclimatic Ecosystem Classification
BG	Bunchgrass
BGC	Biogeoclimatic
BP-H	Black Pine to Hope Segment
CDC	Conservation Data Centre
CEA	<i>Canadian Environmental Assessment (Act or Agency)</i>
CMA	Coastal Mountain-heather Alpine
CNR	Canadian National Railway
COSEWIC	Committee on the Status on Endangered Wildlife in Canada
CWH	Coastal Western Hemlock
CWS	Canadian Wildlife Service
dbh	Diameter at breast height
EC	Environment Canada
EDRR	Early Detection Rapid Response
Element	A technical discipline or discrete component of the biophysical or human environment identified in the National Energy Board <i>Filing Manual</i> .
EO	Element Occurrence
EPP	Environmental Protection Plan
ESA	Environmental and Socio-Economic Assessment
ESSF	Engelmann-Spruce Subalpine Fir
EUB	Alberta Energy and Utilities Board
FD	Forest District
FFGRD	Fraser-Fort George Regional District
FNA	Flora of North America
Footprint	The area that will be directly disturbed by surveying, construction and clean-up of the pipeline and associated physical works and activities. Generally 45 m wide encompassing the permanent pipeline right-of-way and temporary workspace.
<i>FRPA</i>	<i>Forest and Range Practices Act</i>
FVIPC	Fraser Valley Invasive Plant Council
FVRD	Fraser Valley Regional District
GIS	Geographical Information System
Golder	Golder Associates
GVRD	Greater Vancouver Regional District
H-B	Hope to Burnaby Segment
H-D	Hargreaves to Darfield Segment
ICH	Interior Cedar-Hemlock
IDF	Interior Douglas-Fir

Acronym	Full Name/Definition
Indicator	A biophysical, social or economic property or variable that society considers to be important and is assessed to predict Project-related changes and focus the effects assessment on key issues. One or more indicators are selected to describe the present and predicted future condition of an element. Societal views are understood by the assessment team through published information such as management plans and engagement with regulators, public, Aboriginal and other interested groups.
IPMA	Integrated Pest Management Area
ISCMV	Invasive Species Council of Metro Vancouver
IVM	Integrated Vegetation Management
IWMS	Identified Wildlife Management Strategy
KI	Key Indicator (also see Indicator)
KMC	Kinder Morgan Canada Inc.
LSA	Local Study Area: The zone of influence or area where the element and associated indicators are most likely to be affected by Project construction and operation. This generally represents a buffer from the centre of the proposed pipeline corridor.
LRMP	Land and Resource Management Plan
MDP	Municipal Development Plan
Mitigation	Mean measures for the elimination, reduction or control of the adverse environmental effects of the Project and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means.
MH	Mountain Hemlock
MLBV	Mainline Block Valves (Automated)
MS	Montane Spruce
NEB	National Energy Board
NGPLP	Northern Gateway Pipelines Limited Partnership
NWIPC	Northwest Invasive Plant Council
OGAA	<i>Oil and Gas Activities Act</i>
OGMA	Old Growth Management Area
PCM	Post-Construction Monitoring: A type of monitoring program that may be used to verify that mitigation measures effectively mitigated the predicted adverse environmental effects.
PP	Ponderosa Pine
proposed pipeline corridor	Generally a 150 m wide corridor encompassing the pipeline construction right-of-way and temporary workspace.
PTP	Pacific Trails Pipelines Ltd. Partnership
RDFFG	Regional District of Fraser-Fort George
RSA	Regional Study Area: The area extending beyond the Local Study Area boundary where the direct and indirect influence of other activities could overlap with Project-specific effects and cause cumulative effects on the environmental or socio-economic indicator.
RK	Reference Kilometre
SARA	<i>Species at Risk Act</i>
SBS	Sub-Boreal Spruce
SIWMC	Southern Interior Weed Management Committee
Supplemental studies	Studies to be conducted post submission of the application to confirm the effects assessment conclusions and gather site-specific information for the implementation of mitigation from the Project-specific Environmental Protection Plans.
TEK	Traditional Ecological Knowledge
TEM	Terrestrial Ecosystem Mapping
TERA	TERA Environmental Consultants
the Project	Trans Mountain Expansion Project
TLU	Traditional Land Use
TMEP	Trans Mountain Expansion Project

<b>Acronym</b>	<b>Full Name/Definition</b>
TMPL	Trans Mountain Pipeline
TNRD	Thompson-Nicola Regional District
Trans Mountain	Trans Mountain Pipeline ULC

## 1.0 INTRODUCTION

### 1.1 Project Overview

Trans Mountain Pipeline ULC (Trans Mountain) is a Canadian corporation with its head office located in Calgary, Alberta. Trans Mountain is a general partner of Trans Mountain Pipeline L.P., which is operated by Kinder Morgan Canada Inc. (KMC), and is fully owned by Kinder Morgan Energy Partners, L.P. Trans Mountain is the holder of the National Energy Board (NEB) certificates for the Trans Mountain Pipeline (TMPL) system.

The TMPL system commenced operations 60 years ago and now transports a range of crude oil and petroleum products from Western Canada to locations in central and southwestern British Columbia (BC), Washington State and offshore. The TMPL system currently supplies much of the crude oil and refined products used in BC. The TMPL system is operated and maintained by staff located at Trans Mountain's regional and local offices in Alberta (Edmonton, Edson and Jasper) and BC (Clearwater, Kamloops, Hope, Abbotsford and Burnaby).

The TMPL system has an operating capacity of approximately 47,690 m<sup>3</sup>/d (300,000 bbl/d) using 23 active pump stations and 40 petroleum storage tanks. The expansion will increase the capacity to 141,500 m<sup>3</sup>/d (890,000 bbl/d).

The proposed expansion will comprise the following.

1. Pipeline segments that complete a twinning (or "looping") of the pipeline in Alberta and BC with about 987 km of new buried pipeline.
2. New and modified facilities, including pump stations and tanks.
3. Three new berths at the Westridge Marine Terminal in Burnaby, BC, each capable of handling Aframax class vessels.

The expansion has been developed in response to requests for service from Western Canadian oil producers and West Coast refiners for increased pipeline capacity in support of growing oil production and access to growing West Coast and offshore markets. NEB decision RH-001-2012 reinforces market support for the expansion and provides Trans Mountain the necessary economic conditions to proceed with design, consultation and regulatory applications.

Application is being made pursuant to Section 52 of the *NEB Act* for the proposed Trans Mountain Expansion Project (referred to as "TMEP" or "the Project"). The NEB will undertake a detailed review and hold a Public Hearing to determine if it is in the public interest to recommend a Certificate of Public Convenience and Necessity for construction and operation of the Project. Subject to the outcome of the NEB Hearing process, Trans Mountain plans to begin construction in 2016 and go into service in 2017.

Trans Mountain has embarked on an extensive program to engage Aboriginal communities and to consult with landowners, regulatory authorities (e.g., regulators and municipalities), stakeholders and the general public. Information on the Project is also available at [www.transmountain.com](http://www.transmountain.com).

The scope of the Project will involve:

- using existing active 610 mm (NPS 24) and 762 mm (NPS 30) O.D. buried pipeline segments;
- constructing three new 914 mm (NPS 36) O.D. buried pipeline segments totalling approximately 987 km:
  - Edmonton to Hinton – 339.4 km;
  - Hargreaves to Darfield – 279.4 km; and
  - Black Pines to Burnaby – 367.9 km;



- reactivating two 610 mm (NPS 24) O.D. buried pipeline segments that have been maintained in a deactivated state:
  - Hinton to Hargreaves – 150 km; and
  - Darfield to Black Pines – 43 km;
- constructing two 3.6 km long 762 mm (NPS 30) O.D. buried delivery lines from Burnaby Terminal to Westridge Marine Terminal (the Westridge delivery lines);
- installing 23 new sending or receiving traps (16 on the Edmonton-Burnaby mainlines), for in-line inspection tools, at nine existing sites and one new site;
- adding 35 new pumping units at 12 locations (*i.e.*, 11 existing and 1 new pump station site);
- reactivating the existing Niton Pump Station that has been maintained in a deactivated state;
- constructing 20 new tanks located at the Edmonton (5), Sumas (1) and Burnaby (14) terminals, preceded by demolition of 2 existing tanks at Edmonton (1) and Burnaby (1), for a net total of 18 tanks to be added to the system; and
- constructing one new dock complex, with a total of three Aframax-capable berths, as well as a utility dock (for tugs, boom deployment vessels and emergency response vessels and equipment) at Westridge Marine Terminal, followed by the deactivation and demolition of the existing berth.

Figure 1 in Appendix A provides the location of the proposed Project.

As part of the NEB application for the Project, Trans Mountain commissioned TERA Environmental Consultants (TERA) to conduct vegetation studies in the Project area. The following report provides the results of the vegetation field surveys conducted from 2012 to 2013.

## **1.2 Traditional Ecological Knowledge**

Trans Mountain has engaged with Aboriginal communities and organisations that may be affected by the Project or that may have an interest in the Project based on the proximity of their community and their assertion of traditional and cultural use of the land along the proposed pipeline corridor to maintain a traditional lifestyle.

TERA was commissioned to facilitate the participation of potentially affected Aboriginal communities during the vegetation field surveys conducted for the Project. The objective is to incorporate Aboriginal views and the experiential knowledge of the land that has accumulated over generations and passed down from the Elders (Traditional Ecological Knowledge [TEK]) into the consideration of potential Project-related environmental effects. The field reconnaissance was conducted along Crown lands as well as some privately-owned lands potentially disturbed by Project construction, including associated physical works and activities. This report includes the results of the Aboriginal participation during the vegetation field surveys. Approval to treat collected TEK within this report as public knowledge was received by the participating Aboriginal communities listed herein.

### 1.3 Objectives

The objectives of the vegetation surveys are to:

- collect information on the vegetation communities present, through Terrestrial Ecosystem Mapping (TEM) and field surveys;
- collect information on variants/ecosites, riparian vegetation communities and forest health, as necessary to support other disciplines;
- identify any ecological communities of concern and plant (vascular plants, bryophytes [mosses and liverworts]) and lichen species of concern along the proposed pipeline corridor, as defined by the *Species at Risk Act (SARA)*, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the *Alberta Wildlife Act*, the Alberta Conservation Information Management System (ACIMS), BC Identified Wildlife Management Strategy (IWMS) and the BC Conservation Data Centre (CDC);
- identify any uncommon sites or habitat features with high potential to support plant and lichen species of concern;
- identify infestations of non-native, invasive species of concern, including provincial weed species; and
- provide mitigation recommendations in the event that ecological communities of concern, plants or lichens of concern or infestations of invasive species of concern are observed.

The objectives of Aboriginal participation during the vegetation field surveys are to:

- document the TEK of Aboriginal communities;
- augment the design and execution of the field surveys;
- inform baseline environmental conditions;
- identify potential effects of the Project on vegetation resources;
- integrate TEK into the consideration and mitigation of environmental effects; and
- contribute to final Project design.

This report describes the methods and results of field surveys, and provides general vegetation mitigation recommendations for the construction, operations and reclamation phases of the Project. The results of this vegetation report do not identify residual or cumulative environmental effects nor provide conclusions regarding significance. Volume 5A Environmental and Socio-Economic Assessment (ESA) Biophysical Assessment provides the potential residual and cumulative effects of the pipelines and facilities components of the Project on vegetation and provides an evaluation of significance.

### 1.4 Regulatory Standards

Regulatory standards are discussed below.

#### 1.4.1 Federal Standards

The NEB *Filing Manual* (NEB 2013) 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, the SARA legally protects 76 plant species in Canada (60 vascular plant species, 12 non-vascular plant species and 4 lichen species) (Government of Canada 2013). The species protected by the SARA are listed on Schedule 1 of the Act and designated as Endangered, Threatened or Special Concern. The SARA states the specific protection required. The COSEWIC is a scientific body that assesses the status of additional species and recommends species to the SARA for listing. No ecological communities are protected by the SARA. There are 10 SARA and/or COSEWIC-listed plant and lichen species that are considered to have high potential to occur along the proposed pipeline corridor (known from within 1 km of the proposed pipeline corridor) and 11 species that are considered to have moderate potential to occur along the proposed pipeline corridor (known from 1-10 km from the proposed pipeline corridor).

The Project will also be reviewed under the *Canadian Environmental Assessment (CEA) Act, 2012*, which addresses potential adverse environmental effects that are within federal jurisdiction, including: federal lands; effects that cross provincial or international boundaries; and effects on Aboriginal peoples, such as their use of lands and resources for traditional purposes.

Aboriginal Traditional Knowledge (ATK) is considered within the vegetation report as per guidance from the NEB *Filing Manual* (NEB 2013) and Section 19(3) of the *CEA Act, 2012*.

#### **1.4.2 Provincial Standards in Alberta**

The NEB *Filing Manual* 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 (Alberta Native Plant Council [ANPC] 2012) and precedence set by developments of similar scope in the vicinity of the Project.

Legislation in Alberta that may apply to terrestrial vegetation on the Project include the:

- Environmental Handbook for Pipeline Construction (Alberta Environment [AENV] 1988);
- Guide for Pipelines pursuant to the *Environmental Protection and Enhancement Act and Regulations* (AENV 1994a);
- *Weeds on Industrial Development Sites: Regulations and Guidelines*, R&R/03-4 (AENV 2003a);
- *Best Management Guidelines: Enhanced Approval Process* (Government of Alberta 2011); and
- *Integrated Standards and Guidelines: Enhanced Approval Process* (Government of Alberta 2013).

In accordance with the spirit and intent of the Alberta Energy and Utilities Board (EUB) Information Letter 2002-1 Principles for Minimizing Surface Disturbance in Native Prairie and Parkland Areas (EUB 2002), vegetation surveys were conducted on lands supporting native vegetation traversed by the proposed pipeline corridor.

There are no provincial guidelines for mapping ecological units in Alberta. Therefore, the provincial guidelines for mapping ecological units in BC were adopted for the portion of the Project in Alberta.

In Alberta, Municipal Development Plans (MDPs) and government policies provide broad strategic direction for land use planning and provide vision, objectives, and goals for sustainable land and resource use. The objectives of management plans relevant to the Project area were taken into account when developing mitigation specific to vegetation resources (see the Pipeline and Facilities Environmental Protection Plans [EPPs] in Volumes 6B and 6C, respectively). A list of all the management plans considered for the Project with a summary of the objectives specific to vegetation is provided in Appendix 7.1 in Section 7 of Volume 5A. In Alberta, objectives of the management plans include maintaining natural vegetation throughout the development process, preserving natural vegetation including trees in all undeveloped and riparian areas, protection and restoration of ecological systems and natural areas, limiting clear-cutting, minimizing the introduction and spread of exotic vegetation species

and discouraging further clearing or development in areas where native vegetation is important for soil conservation, water resources protection or wildlife habitat.

### **1.4.3 Provincial Standards in British Columbia**

The scope and methods required to adequately assess vegetation resources in BC were determined with the guidance of the NEB *Filing Manual*, in conjunction with rare plant survey recommendations and guidelines (Penny and Klinkenberg 2012) as well as precedence set by developments of similar scope in the vicinity of the Project.

Legislation in BC that may apply to terrestrial vegetation on the Project include the:

- *BC Environmental Assessment Act*;
- *Oil and Gas Activities Act (OGAA)*;
- *Forest and Range Practices Act (FRPA)*;
- Provincial Non-Spatial Old Growth Order (BC Integrated Land Management Bureau 2004);
- *Weed Control Act*; and
- *Integrated Pest Management Act*.

Throughout BC, regional invasive species councils oversee the management of Noxious and Invasive plants.

Mapping methodology for the Project was developed according to the Standards for TEM in BC (Resources Information Standards Committee 1998) and was applied to both the Alberta and BC portions of the Project.

Provincial vegetation policy includes the IWMS and the designation of Old Growth Management Areas (OGMAs) which are implemented through the *FRPA* and the BC CDC resource ranking and the BC Conservation Framework which are implemented through the BC Ministry of Environment (BC MOE). The intent of the provincial initiatives applies to pipeline projects through the implementation of the OGAA.

The IWMS is a provincial tool used to guide species management. The IWMS established Regionally Important Wildlife Species that rely on habitats not otherwise protected under provincial forestry legislation. The IWMS identifies 17 ecological communities and 2 vascular plant species in BC. Of these, one community (western redcedar – Douglas-fir/vine maple community [*Thuja picata* – *Pseudotsuga menziesii*/*Acer circinatum* community]) has been previously observed on lands in the vicinity of the proposed

The BC Conservation Framework manages species and communities of concern by ecosystem and prioritizes them for recovery actions (BC MOE 2009). There are 94 communities and 148 plant (vascular, non-vascular) and lichen species in BC that are Priority 1. Of these, 50 communities and 31 species are known to occur in the Biogeoclimatic (BGC) zones and Forest Districts (FDs) that the proposed pipeline corridor crosses.

OGMAs are old or late seral forests provincially designated in order to protect and maintain biodiversity (Forest Practices Board 2012). There are two types of OGMAs: legal; and non-legal. Legal OGMAs must be incorporated into a forest stewardship plan by forest licensees. Non-legal OGMAs do not need to be incorporated in a forest stewardship plan by forest licensees if they can achieve targets in other ways (Forest Practices Board 2012). OGMAs are briefly discussed in this report, but are covered in depth in the Managed Forest Areas and Forest Health Technical Report (Volume 5D).

In BC, Land and Resource Management Plans (LRMPs), MDPs and government policies provide broad strategic direction for land use planning and provide vision, objectives, and goals for sustainable land and resource use. The objectives of management plans relevant to the Project area were taken into account when developing mitigation specific to vegetation resources (see the Pipeline and Facilities EPPs in

Volumes 6B and 6C, respectively). A list of all the management plans considered for the Project with a summary of the objectives specific to vegetation is provided in Volume 5A (Section 7.0, Appendix 7.1). In BC, objectives of the management plans include maintaining long-term natural diversity of native plant species, maintaining natural vegetation throughout the development process, controlling Noxious weed species, preserving natural vegetation including trees in all undeveloped and riparian areas, protection and restoration of natural areas including grasslands and old growth forests and discouraging further clearing or development in areas where native vegetation is important for soil conservation, slope stability and water resources protection.

## **2.0 CONSULTATION AND ENGAGEMENT**

Trans Mountain and its consultants have conducted a number of consultative activities to inform Aboriginal communities, stakeholders, landowners and regulatory authorities about the approach to assessing potential environmental and socio-economic effects for the Project, and to seek input throughout the Project planning process.

### **2.1 Public Consultation, Aboriginal Engagement and Landowner Relations**

Trans Mountain has implemented and continues to conduct open, extensive and thorough public consultation, Aboriginal engagement and landowner relations programs. These programs were designed to reflect the unique nature of the Project as well as the diverse and varied communities along the proposed pipeline and marine corridors. These programs were based on Aboriginal communities, landowner and stakeholder groups' interests and inputs, knowledge levels, time and preferred methods of engagement. In order to build relationships for the long-term, these programs were based on the principles of accountability, communication, local focus, mutual benefit, relationship building, respect, responsiveness, shared process, sustainability, timelines and transparency.

Feedback related to vegetation that was raised through various Aboriginal engagement and public consultation activities including public open houses, ESA Workshops, Community Workshops and one-on-one meetings is summarized below and was considered in the development of this technical report and the assessment of vegetation in Volume 5A:

- changes to and restoration of vegetation composition, especially in areas of native vegetation (including grasslands);
- vegetation management of the right-of-way and concerns related to weed control and brushing;
- identification and preservation of rare plant communities and species at risk; and
- weed and invasive species introduction and spread.

The full description of the public consultation, Aboriginal engagement and landowner relations programs are located in Volumes 3B. Section 3.0 of Volume 5A summarizes the consultation and engagement activities that have focused on identifying and assessing potential issues and concerns related to vegetation which may be affected by the construction and operation of the Project. Information collected through the public consultation, Aboriginal engagement and landowner relations programs for the Project was considered in the development of this technical report, and the assessment of vegetation in Volume 5A.

### **2.2 Regulatory Consultation**

Feedback related to vegetation that was raised through various consultation processes helped identify stakeholder engagement concerns to be discussed with federal and provincial regulatory authorities in Alberta and BC. Discussions focused on survey methodology, weed and invasive species introduction and spread, developing survey methodology for the vegetation surveys and TEM completed for the Project along with identification and preservation of rare plant communities and species at risk. All regulatory consultation conducted is summarized in Table 2.2-1.

Federal consultation included Environment Canada (EC) representatives including Ecologists from the Thompson-Okanagan Region, Omineca and Northeast Region and the Coastal Region. Consultation included an introduction to the Project, work plans, preliminary Key Indicators (KIs) and field survey methods for vegetation and TEM completed for the Project. Federal consultation is summarized in Table 2.2-1.

Provincial consultation in Alberta included the City of Edmonton, Strathcona County, Parkland County, City of Spruce Grove, Town of Stony Plain, Village of Wabamun, Yellowhead County and ACIMS. Consultation focused on weeds of concern, spread of invasive species, preferred invasive species control practices and preservation of rare plant communities and species at risk. Provincial consultation in Alberta is summarized in Table 2.2-1.

Provincial consultation in BC included Fraser-Fort George Regional District (FFGRD), Northwest Invasive Plant Council (NWIPC), Thompson-Nicola Regional District (TNRD), BC Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO), Southern Interior Weed Management Committee (SIWMC), Fraser Valley Regional District (FVRD), Fraser Valley Invasive Plant Council (FVIPC), Greater Vancouver Regional District (GVRD), Invasive Species Council of Metro Vancouver (ISCMV) and the BC CDC. Consultation focused on weeds of concern, spread of invasive species, preferred invasive species control practices and preservation of rare plant communities and species at risk. Provincial consultation in BC is summarized in Table 2.2-1.

Feedback related to vegetation that was raised through various regulatory consultations is summarized below and was considered in the development of this technical report and the assessment of vegetation in Volume 5A:

- listed and non-listed weed species; their spread and control;
- crop diseases; their spread and control;
- recommended survey methodology for rare plant and TEM surveys;
- identification and preservation of rare plant communities and species at risk; and
- preliminary KIs related to vegetation.

**TABLE 2.2-1**  
**SUMMARY OF CONSULTATION ACTIVITIES RELATED TO VEGETATION**

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
<b>FEDERAL CONSULTATION</b>						
EC – Canadian Wildlife Service (CWS)	Paul Gregoire, Senior Environmental Assessment Officer	Meeting (see below) Mr. Gregoire via Telephone	April 17, 2013	Review work plans for the wildlife, vegetation, wetland and marine components for the Project. Preliminary KIs and field survey methods were introduced and discussed.	--	April 19, 2013: the list of preliminary wildlife KIs is sent to EC for further review and comment. April 21, 2013: a copy of the meeting minutes is sent to EC for review. May 21, 2013: EC reviews the meeting minutes and provides comments and questions. Further comment is also provided on the list of preliminary wildlife KIs. May 22, 2013: EC provides additional comments on the width of the Wetlands and Vegetation Local Study Areas (LSAs) and suggests that the wetlands functional assessment include surveys to identify the presence and distribution of migratory birds and species at risk in relation to specific potentially affected wetlands and associated riparian areas. August 25, 2013: a copy of the revised meeting minutes is provided to EC that responds to their questions from May 21 and 22, 2013. The approach involving spring and summer surveys by regional Vegetation Specialists was accepted.
EC – CWS	Harp Gill, Senior Environmental Assessment Officer  Jennifer Wilson, Special Projects Officer  Andrew Robinson, Senior Environmental Assessment Officer  Rene McKibbin, Environmental Assessment Officer (Advisor to EC with Gebauer and Associates)  Paul Gregoire, Senior Environmental Assessment Officer	Meeting Mr. Gregoire via Telephone	April 17, 2013	Project introduction. Review of work plans including TEM Survey methodologies. Review of the results of consultation with provincial Ecologists.	EC asked how much new right-of-way there would be, how all information could be collected in 1 year of field work and if there was any existing TEM that could be used. EC asked why all field work being conducted, especially wetlands, could not be fed back into TEM. EC asked what data sources would be used for TEM. EC accepted TERA's use of Survey Intensity Level 5 and acknowledged that some compromises had to be made given the scope of the Project, but emphasized that the approach needs to be justified and defensible.	TERA offered additional details about timelines and plans for supplementary TEM mapping and field plots in fall 2013 and 2014. TERA offered additional details about TEM data sources.
EC – CWS	Jan Kirkby, Landscape Ecologist	Email	November 7, 2013	Project introduction. TEM Survey methodologies.	No response to date.	None.
<b>PROVINCIAL CONSULTATION – Alberta</b>						
City of Edmonton	Daniel Laubhann, city's weed group	Email	April 17 to 22, 2013	Project Introduction. Weeds of concern. Preferred invasive species control practices.	Weeds of concern list and city's <i>Integrated Pest Management Policy</i> provided. Concern with spread of weeds from Parkland County and Yellowhead highway. Request for detailed map of project area within city.	More detailed map was provided on October 8, 2013.
Strathcona County	Joel Gould, Agricultural Fieldman  Diana Laviolette Brown, Assistant Agricultural Fieldman  Lori Mills, Energy Exploration Liaison	Email	September 30, 2013	Project Introduction. Weeds of concern. Preferred invasive species control practices.	Provided information on a clubroot positive location and weeds of concern along the Project. Additional comments possible following confirmation of the Footprint.	None.
Parkland County	James Leskiw, Supervisor, Agricultural Agronomics	Email, Telephone	April 17 to 22, 2013	Project Introduction. Weeds and crop diseases of concern. Preferred invasive species and crop disease control practices.	Provided list of clubroot positive fields. Recommended the Clubroot Management Plan be followed. Concerns regarding spread and introduction of Noxious and Prohibited Noxious weeds. Request for detailed map of Project area within county.	More detailed map was provided on October 8, 2013.
City of Spruce Grove	Info@sprucegrove.org	Email Telephone	April 17, 2013 – No response was received.  Follow-up email and call on September 30, 2013.	Project introduction. Weeds of concern. Preferred invasive species control practices.	No response.	On September 30, 2013, the email mailbox was full and message was undeliverable. A call was placed to the city. No one responded and there was no voicemail.
Town of Stony Plain	Rudy Zacharias, Communications Coordinator	Email	April 17 to 18, 2013	Project introduction. Weeds and crop diseases of concern. Preferred invasive species and crop disease control practices.	Provided list of weeds of concern. Inquired about equipment decontamination procedures, weed control/eradication plans and regular weed inspection plans for right-of-way.	May 6, 2013 provided answers to questions regarding mitigation for decontamination of equipment, weed management and monitoring.
Village of Wabamun	Trevor Anderson, Economic Development Officer/Marketing Coordinator	Email	April 17 to 18, 2013	Project introduction. Weeds and crop diseases of concern. Preferred invasive species and crop disease control practices.	Have no specific concerns regarding weeds or crop diseases.	None.
Yellowhead County	Sonja Pichette, Agricultural Services Coordinator	Email	April 17 to 24, 2013	Project introduction. Weeds and crop diseases of concern. Preferred invasive species and crop disease control practices.	Provided a list of weeds of concern and the general location of clubroot positive fields which are all considerably distant from the proposed Project.	None.



TABLE 2.2-1 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
ACIMS	Lorna Allen	Email	September 13, 2013	Rare ecological community confirmation.	--	None.
<b>PROVINCIAL CONSULTATION – BC</b>						
FFGRD	Jim Martin, Chief Administrative Officer	Email	April 17 to 22, 2013	Project introduction. Weeds and crop diseases of concern. Preferred invasive species and crop disease control practices.	Referred to Andrea Eastham of the NWIPC.	Follow-up email was sent to Andrea Eastham on September 30, 2013.
NWIPC	Andrea Eastham, Program Manager	Email	April 17, 2013  Follow-up email was sent on September 30, 2013.	Project introduction. Weeds and crop diseases of concern. Preferred invasive species and crop disease control practices.	On October 3, 2013, a list of sites treated for invasive plant infestations was provided. Species of concern were identified as well as issues from the TMX Anchor Loop project that they wish to avoid with the current Project. Concerns include spread and introduction of infestations. Requested maintaining clean storage sites and clean vehicles and equipment (with inspections and reporting), treating infestations prior to construction, comply with no herbicide and bio-release sites and submitting invasive species data to the provincial database. Expressed desire to participate in the invasive management component of the Project.	None.
TNRD	Peter Hughes, Director of Environmental Services  Jamie Vieira, Operations Supervisor, Environmental Health Services	Email	April 17, 2013	Project introduction. Weeds and crop diseases of concern. Preferred invasive species and crop disease control practices.	On June 28, 2013, the Pest Management Plan was provided. Reference was made to provincial Noxious weeds, regionally-listed weeds and the <i>Invasive Plant Regulation</i> under the <i>FRPA</i> as well as to treatment methods. It was recommended to contact David Ralph of the Invasive Plant Program at the BC MFLNRO as well as Jo-Ann Fox, the Manager of the SIWMC.	On October 9, 2013, David Ralph was emailed for input. On April 18, 2013 Jo-Anne Fox was emailed for input.
BC MFLNRO	David Ralph, Invasive Plant Program	Email	October 9, 2013	Project introduction. Weeds and crop diseases of concern. Preferred invasive species and crop disease control practices.	Awaiting response.	Follow up again in November.
SIWMC	Jo-Anne Fox, Coordinator	Email	April 18, 2013	Project introduction. Weeds and crop diseases of concern. Preferred invasive species and crop disease control practices.	Provided the Thompson-Nicola Strategic Plan 2013 identifying species of concern and management methods.	None.
FVRD	Stacey Barker, Manager of Environmental Services	Email	April 17, 2013  Follow-up email was sent on October 1, 2013.	Project introduction. Weeds and crop diseases of concern. Preferred invasive species and crop disease control practices.	On October 2, 2013, a list of weed species of concern and a website with location, distribution and treatment information was proposed. Recommended conducting field surveys for weeds immediately prior to construction.	None.
FVIPC	Jeanne Hughes, Coordinator	Email	April 17, 2013  Follow-up email was sent on October 1, 2013.	Project introduction. Weeds and crop diseases of concern. Preferred invasive species and crop disease control practices.	Awaiting response.	None.
GVRD	Alison Evely, Natural Resource Management Specialist  Heather McNell, Regional Planning Division Manager	Email	April 17, 2013  Follow-up email was sent on October 1, 2013.	Project Introduction. Weeds and crop diseases of concern. Preferred invasive species and crop disease control practices.	On October 3, 2013, the Integrated Pest Management Plan identifying weeds of concern and treatment approaches was provided (Evely 2012). Reference was also made to the ISCMV website for information.	None.
ISCMV	Jennifer Grenz, Manager  Tasha Murray, Administration and Education Manager	Email	April 17, 2013  Follow-up email was sent on October 1, 2013.	Project introduction. Weeds and crop diseases of concern. Preferred invasive species and crop disease control practices.	Awaiting response.	None.
BC CDC	cdcdata@gov.bc.ca	Email	April 18, 2013	Request resources regarding rare ecological communities for which there is little or no information in Land Management Handbooks.	Provided some additional links to information sources.	None.
BC CDC	Jenifer Penny	Email Telephone	June 17, 2013 to present	Information on the status of unranked liverworts.	Provided preliminary information on the status of unranked liverworts in BC.	Requested that high level information on all liverwort occurrences (not just rare species) be submitted to the BC CDC to assist in ranking.
Government of BC	Corey Erwin, Vegetation Ecologist	Email	July 27, 2012	Project introduction. TEM Survey methodologies.	No response to date.	None.
Thompson-Okanagan Region, Government of BC	Michael Ryan, Research Ecologist	Telephone	August 28 and September 12, 2012	Project introduction. TEM Survey methodologies.	Michael Ryan invited TERA to follow up via email.	See below.
		Email	October 26 to November 15, 2012	Project introduction. TEM Survey methodologies.	Michael Ryan advised Survey Intensity Level 4 and requested additional details about existing TEM relevant to the Project. Michael Ryan offered contact information for other regional Ecologists. Michael Ryan advised how to correlate the 2005 draft BEC Classification for the Thompson-Okanagan Region with the current Red and Blue-listed rare ecological communities.	TERA offered additional detail about rare plant and rare ecological community surveys as justification for Survey Intensity Level 5. TERA offered additional details about existing TEM. TERA requested further comment on Survey Intensity Level 5 with regards to additional. No further comment has been received.

TABLE 2.2-1 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
		Email	February 22 to April 15, 2013	Land Management Handbook advice.	TERA requested input on which Land Management Handbooks to use to classify vegetation communities in the MSmw1 and ESSFmw1 (Refer to Appendix C for description of BGC variants). Michael Ryan provided draft Land Management Handbooks by Lloyd <i>et al.</i> (2005) and a cross walk table between the site series in the ESSFmw1 and the ESSFmw.	None.
Omineca and NE Region, Government of BC	Bruce Rogers, Research Ecologist	Email	October 29 to November 23, 2012	Project introduction. TEM Survey methodologies.	Bruce Rogers advised Survey Intensity Level 4. Bruce Rogers requested PDF of the proposed pipeline corridor showing the ESSFmm1.	TERA offered additional detail about rare plant and rare ecological community surveys as justification for Survey Intensity Level 5. TERA offered additional details about existing TEM. TERA sent requested PDF. TERA requested further comment on Survey Intensity Level 5 with the additional surveys. No further comment has been received.
Coastal Region, Government of BC	Dr. Sari Sanders, Research Ecologist	Email	October 29 to November 15, 2012	Project introduction. TEM Survey methodologies.	No response to date.	None.
Provincial Lichen Expert	Trevor Goward	Meeting, Telephone, Email	March to November 2013	Lichen specimen identification; consultation regarding lichen species rarity.	Provided identifications and expert experience regarding species that are not ranked by the BC CDC and those that are tracked but are not considered provincially rare or requiring mitigation.	None.
Provincial Lichen Expert	Curtis Bjork	Email	October 2013	Consultation regarding lichen and bryophyte species rarity.	Provided expert experience regarding species that are not ranked by the BC CDC and those that are tracked but are not considered provincially rare or requiring mitigation.	None.
Provincial Bryophyte Expert	Terry McIntosh	Email	March to October 2013	Coordinating field survey; bryophyte specimen confirmation.	Conducted field surveys; provided confirmation of <i>Schistidium</i> moss specimens.	None.
Provincial Bryophyte Expert	Rene Belland	Email	October to November 2013	Consultation regarding bryophyte species rarity.	Provided expert experience regarding tracked species.	None.
Provincial Bryophyte Expert	Peter Whitehead	Meeting, Telephone, Email	March to November 2013	Coordinating field survey; consultation regarding bryophyte species rarity.	Conducted field surveys; provided expert experience regarding species that are tracked but are not considered provincially rare or requiring mitigation.	None.
Provincial Bryophyte Expert	Sandra Davis	Meeting, Telephone, Email	March to November 2013	Bryophyte specimen identification; consultation regarding bryophyte species rarity.	Provided identifications and expert experience regarding species that are not ranked by the BC CDC and those that are tracked but are not considered provincially rare or requiring mitigation.	None.
Provincial Rare Plant Expert	Matt Fairbarns	Email	June 18, 2013 to present	Input on survey timing, habitats and whether or not preferred habitat is on the proposed right-of-way for the species in the rare plant potential tables.	Provided us with tracked changes in the potential tables on July 3 and 4, 2013.	None.

## **3.0 METHODS**

### **3.1 Project Interactions and Identification of Potential Effects**

Pipeline and facility construction and operation activities have the potential for both direct and indirect effects on native vegetation, plant and lichen species of concern and vegetation communities of concern. Construction, clearing, topsoil or root zone material salvaging and grading may cause direct effects on vegetation through soil removal and disturbance, as well as compaction by heavy machinery or soil and equipment storage piles. These activities can also cause indirect effects on vegetation adjacent to the Footprint through alterations to the environment including changes to light levels, hydrology, salinity and nutrient availability. Some plant species of concern and vegetation communities of concern may be more susceptible to direct and indirect effects from pipeline construction and operation activities, due to tolerance for disturbance, ability to recolonize disturbed soil and site-specific characteristics, such as the proportion of the species or community that is disturbed.

Pipeline and facility construction and operation activities also have the potential to spread or introduce Noxious weed species and other invasive species of concern. This may occur both directly, through the distribution of seeds via machinery, as well as indirectly, through habitat disturbances that can facilitate establishment and growth of invasive plant populations. Some plant species of concern and vegetation communities of concern may be more susceptible to effects from invasive species, due to tolerance for plant competition and depending on whether the site characteristics of the feature of concern are very susceptible to weed encroachment.

### **3.2 Assessment Indicators and Measurement Endpoints**

For this assessment, an indicator is defined as a biophysical, social or economic property or variable that society considers important and is assessed to predict Project-related changes and focus the effect assessment on key issues. One or more indicators are selected to describe the present and predicted future condition of an element. Societal views are understood by the assessment team through published information such as management plans and engagement with regulators, the public, Aboriginal communities and other interested groups. The selection of indicators for vegetation included: consideration of the filing requirements in the NEB *Filing Manual*; experience gained during previous projects with similar conditions/potential issues; initial feedback from Aboriginal communities, regulatory authorities and stakeholders; initial feedback from participants in the ESA Workshops; public issues raised through the media; and the professional judgement of the assessment team. A list of the proposed indicators for vegetation was discussed during the Edmonton, Kamloops and Surrey ESA Workshops. There was general consensus by the participants of the workshops that the proposed indicators were appropriate for evaluating the effects of the Project on vegetation.

One or more measurement endpoints (measurable parameters) are identified for each indicator to allow quantitative or qualitative measurement of potential Project effects. The endpoints have been selected based on: the NEB *Filing Manual*; experience gained through previous projects with similar conditions/potential issues; feedback from regulatory authorities and stakeholders; available research literature; and professional judgment of the assessment team. The degree of change in these measurable parameters is used to characterize and evaluate the magnitude of Project-related effects. A selection of measurement endpoints may also be the focus of monitoring and follow-up programs, where applicable.

The vegetation indicators chosen for the Project include:

- vegetation communities of concern;
- plant and lichen species of concern; and
- presence of infestations of Noxious, Provincial weed species and presence of other invasive non-native species identified as a concern.

See Table 3.2-1 for the list of vegetation indicators, their measurement endpoints and the rationale for inclusion.

The vegetation communities of concern indicator addresses rare ecological communities as identified by ACIMS, the BC IWMS and the BC CDC, as well as the communities identified as the most affected by the Project (as determined through TEM). In addition, this indicator addresses vegetation communities identified during consultation as being of concern, specifically grassland communities within the Bunchgrass (BG) BGC Zone. This indicator addresses the NEB *Filing Manual* requirement to consider avoidance of sensitive or rare communities.

Grassland communities in the Kamloops region and old growth forests were suggested as vegetation communities of concern. Upon consideration by the assessment team, all grassland communities in the Kamloops region were adopted as measurement endpoints for the vegetation communities of concern indicator. Old growth forests were determined to be better assessed at other scales and are further discussed in Section 7.2.9.4 of Volume 5A.

Native vegetation was not initially included as a vegetation community of concern because it is a very coarse measurement that combines many different types of vegetation communities. Additionally, taking each distinct vegetation community through the assessment process is not possible and there was concern in the ESA and Community Workshops that all native vegetation may be important for genetic diversity, habitat for rare plant species and habitat for traditionally used plants. Areas of native vegetation are also raised as a concern in numerous regional management plans (AENV 2003a, EUB 2002, Fiera Biological Consulting 2009, Henderson 2011, Maslovat 2009). Therefore, native vegetation was included under the vegetation communities of concern indicator. In addition, the most affected vegetation communities are assessed separately.

Vegetation communities most affected by the proposed pipeline corridor are a measure of specific native vegetation communities which will have a greater areal disturbance as a result of the effects of construction and operations compared to other native vegetation communities in the Vegetation Regional Study Area (RSA). Vegetation communities most affected was chosen as a measurement rather than communities of limited distribution (*i.e.*, those communities which occur least frequently in the Vegetation RSA) due to the length of the proposed pipeline corridor and the diversity of habitats encountered by the Vegetation RSA.

The plant and lichen species of concern indicator addresses rare plant and lichen species as identified by the SARA, COSEWIC, the Alberta *Wildlife Act*, ACIMS, the BC IWMS and the BC CDC. This addresses the NEB *Filing Manual* requirement to determine effects related to plant species at risk or of special status.

The third vegetation indicator addresses infestations of Noxious weeds, Provincial weed species and other invasive non-native species identified as a concern. Participants in the ESA Workshops also raised concern about invasive species that are not provincially-listed as weeds (*e.g.*, crested wheatgrass). The assessment team decided to modify the weed indicator to include other non-native species discussed in consultation. This indicator will inform efforts to address the NEB *Filing Manual* requirements to consider weed control measures and seed mixes.

Input on the proposed vegetation indicators was also sought from EC and CWS (Section 2.0); both agencies were in agreement that the proposed vegetation indicators were appropriate and suggested no additional indicators for consideration.

**TABLE 3.2-1**

**ASSESSMENT INDICATORS AND MEASUREMENT ENDPOINTS FOR VEGETATION**

<b>Vegetation Indicators</b>	<b>Measurement Endpoints</b>	<b>Rationale for Indicator Selection</b>
Vegetation communities of concern	Hectares of native vegetation altered on the Footprint, in the Vegetation LSA and RSA. Percent potential alteration of the most affected vegetation communities (variant and/or ecosite) on the Footprint, in Vegetation LSA and RSA. Hectares of grassland communities within the BG BGC altered on the Footprint, in the Vegetation LSA and RSA. Abundance and distribution of rare ecological communities altered on the proposed pipeline corridor, in the Vegetation LSA and RSA.	The selection of indicators and measurement endpoints considered NEB <i>Filing Manual</i> requirements for the vegetation element, addressed concerns raised by participants of the ESA Workshops and was informed by regulatory authorities (i.e., EC and CWS). Native vegetation may be important for genetic diversity, habitat for rare plant species and habitat for traditionally used plants, therefore, native vegetation was added as a community of concern. All grassland communities in the Kamloops region were adopted as measurement endpoints for the vegetation communities of concern assessment indicator after concerns were raised during the ESA Workshops in the region.
Plant and lichen species of concern	Abundance and distribution of observed rare plant and lichen populations on the proposed pipeline corridor.	The selection of indicators and measurement endpoints considered NEB <i>Filing Manual</i> requirements for the vegetation element, addressed concerns raised by participants of the ESA Workshops and was informed by regulatory authorities (i.e., EC and CWS).
Presence of infestations of Noxious or Provincial weed species and presence of other invasive non-native species identified as a concern	Qualitative assessment of weed issues including weed species identified as being of concern in the vicinity of the Project, as well as the density and distribution of observed weeds and invasive non-native species.	The selection of indicators and measurement endpoints considered NEB <i>Filing Manual</i> requirements for the vegetation element, addressed concerns raised by participants of the ESA Workshops and was informed by regulatory authorities (i.e., EC and CWS). Participants in the ESA engagement workshops raised concerns about invasive species that are not provincially-listed as weeds. The assessment team decided to modify the weed indicator to include other non-native species discussed in consultation.

**3.3 Study Area Boundaries**

The proposed pipeline was considered in relation to a proposed pipeline corridor, a LSA, a RSA and a Footprint.

The proposed pipeline corridor is comprised of the area that is to be directly disturbed by the Project construction and clean-up activities, including associated physical works and activities (i.e., permanent right-of-way, temporary construction workspace, temporary log decks and valve sites). The proposed pipeline corridor is considered to be generally a 150 m wide corridor. See the definition of the proposed pipeline corridor provided in Section 7.0 of Volume 5A (Table 7.1-2).

The Vegetation LSA generally consists of a 300 m wide band from the centre of the proposed pipeline corridor (e.g., 150 m on both sides of the centre of the proposed pipeline corridor). The Vegetation RSA consists of the area extending beyond the Vegetation LSA and generally consists of a 2 km wide band from the centre of the proposed pipeline corridor (e.g., 1 km on either side of the centre of the proposed pipeline corridor).

The Vegetation LSA represents the zone of influence in which vegetation resources are most likely to be affected by the construction and operation of the Project. Key considerations used to establish the spatial boundaries of the Vegetation LSA for the Project include the distance that edge effects to plant species and communities are expected to extend from a disturbed area. The spatial extent of changes in vegetation composition may be affected by a number of factors. In one study, increased light was shown to allow the invasion of shade-intolerant vegetation up to 30 m (Ranney *et al.* 1981). Some tree species exhibit increased growth and regeneration within 30-60 m of clear-cut edges, however, tree mortality can also increase (Bannerman 1998). Within an old-growth Douglas-fir forest, air temperature and humidity were generally found to be influenced to a depth of 120-180 m in areas adjacent to a clear-cut edge, while soil temperature and moisture were influenced from 60-120 m from the edge (Chen *et al.* 1990). While some roadway effects are not applicable to pipeline construction, equipment traffic along the construction right-of-way, the use of temporary access and the removal of vegetation may result in some comparable effects. Forman *et al.* (2003) found that the greatest changes to microclimate and dust levels occurred within the first 30-50 m from road edges, while the greatest changes in hydrological function, salinity and nitrogen levels could extend 100-200 m from the disturbed area. Based on the above concepts, a 300 m wide LSA, generally from the centre of the proposed pipeline corridor was established

to assess Project-related effects to vegetation resources. No comments from regulators or stakeholders regarding the Vegetation LSA or RSA were received.

The Vegetation RSA represents the area where the direct and indirect influence of other land uses and activities could interact with proposed Project-specific effects and may cause cumulative effects on vegetation. Key considerations used to establish the spatial boundaries of the Vegetation RSA for the Project included the separation distance typically used to distinguish one rare plant population from another; the dispersal of non-native, invasive species to or from the Footprint; provision of baseline data and mapping sufficient to support accurate assessment of wildlife habitat resources within the respective LSA of that biophysical component; and the Footprint of the Project within a regional landscape context.

An Element Occurrence (EO) is the area of land or water in which a rare species or rare ecological community of conservation interest is or was present (BC MOE 2011, NatureServe 2002). EOs generally refer to a local population or metapopulation (NatureServe 2002). Although there are many factors which may be taken into account in determining individual EOs, the default minimum separation distance for plant species EOs is 1 km (NatureServe 2002, 2004).

Although dispersal distances depend on a number of factors, many weed species produce large numbers of seeds that are wind dispersed (Forman *et al.* 2003). For example, many of the species listed in the BC *Weed Control Regulation* belong to the sunflower family (*Asteraceae*), which is adapted for wind dispersal. Forman *et al.* (2003) found that the spread of non-native, invasive species could extend up to 1 km from the disturbed area.

A 2 km wide Vegetation RSA corresponds with the Wildlife LSA for the Project, which will facilitate accurate mapping, modeling and assessment of wildlife habitat at a scale where it is most likely to be affected by Project construction and operations. In addition, within a 2 km wide Vegetation RSA, the Footprint represents a non-trivial proportion of the land base, allowing for meaningful assessment of potential effects to native vegetation species and communities within a greater ecological context. Based on the above concepts, a 2 km wide RSA, generally from the centre of the proposed pipeline corridor was established to assess Project-related effects to vegetation resources.

The Footprint is the area that will be directly disturbed by surveying, construction and clean-up of the pipeline and associated physical works and activities (including, where appropriate, the permanent right-of-way, pump stations, tanks, Westridge Marine Terminal, temporary construction workspace, temporary stockpile sites, temporary staging sites, construction camps, access roads, power lines). The Footprint assumes certain quantitative values for the area that will be directly disturbed by Project facilities and activities within the proposed pipeline corridor, including: a 45 m pipeline construction right-of-way (assumed conservative average value including permanent easement and temporary workspace); permanent access road at Black Pines Pump Station (assumed 5 m wide x 25 m long); temporary access roads (assumed to use existing access, where practical); camp and stockpile sites (assumed 7 ha averaging one every 80 km on existing disturbance); valves (assumed to be within the disturbed right-of-way); and power lines (assumed 50 m wide).

Some vegetation elements (*e.g.*, potential hectares of native vegetation altered, potential percent of vegetation communities most affected, potential hectares of grassland altered) were assessed in relation to the Footprint (*i.e.*, 45 m wide right-of-way), whereas other elements (*i.e.*, rare ecological communities, rare plant and lichen species) were assessed in relation to the proposed pipeline corridor (*i.e.*, 150 m wide right-of-way).

### 3.4 Existing Conditions

Pre-construction conditions for vegetation are defined as the current state of the environment (not pre-disturbance or natural conditions). The current state of the environment is determined from the desktop review, field surveys and TEM. The current state of the environment will be used as the baseline for assessing Project-specific effects and cumulative effects.

The proposed Project parallels existing rights-of-way for approximately 89% of its length. Existing rights-of-way include the TMPL, Canadian National Railway (CNR), highways and fibre optics and transmission line rights-of-way. The proposed pipeline corridor encounters a diversity of land uses

including native vegetation (e.g., treed, native prairie), agriculture (e.g., cultivation, tame pasture, hay) and commercial/industrial development.

The Edmonton to Hinton Segment traverses lands dominated by human impact (i.e., cities, towns, agriculture, roads, pasture), with urban land use dominating in the east. Forested areas and other native land uses (i.e., rivers, wetlands, regenerating burn areas) make up approximately 30% of this segment. Based on the areas surveyed for land use to date along the Edmonton to Hinton Segment, approximately 72 km is treed, approximately 9 km is treed pasture, approximately 66 km is hay, approximately 40 km is cultivation and approximately 35 km is tame pasture.

The Hargreaves to Darfield Segment traverses a wide variety of terrain, including flat or gently undulating valley bottoms, hills, steep slopes and narrow valleys. Forested lands dominate this segment, with wetlands, streams and fens interspersed along the landscape, while urban land use and agriculture are encountered around the communities and towns along the proposed pipeline corridor. Based on the areas surveyed for land use to date along the Hargreaves to Darfield Segment, approximately 47 km is treed, approximately 3 km is treed pasture, approximately 19 km is tame pasture and approximately 12 km is hay.

The Black Pines to Hope Segment encounters a variety of land uses, including forested areas, grasslands, watercourses and wetlands. Human-impacted land use in this segment includes agriculture and urban development around the communities, including the City of Kamloops. Based on the areas surveyed for land use to date along the Black Pines to Hope Segment, approximately 65 km is treed, approximately 16 km is native grassland, and approximately 12 km is treed pasture, approximately 18 km is tame pasture and approximately 4 km is hay.

The Hope to Burnaby Segment is dominated by human land use, including agriculture and urban development primarily to the west in the Lower Mainland. To the east, native land uses include forested and riparian areas. The Burnaby to Westridge Segment is located within the Lower Mainland and is dominated by urban and industrial land use, with residual forest stands from Reference Kilometre (RK) 1.0 to RK 1.93 and RK 2.84 to RK 3.6. Based on the areas surveyed for land use to date along the Hope to Burnaby Segment, approximately 24 km is treed, approximately 1 km is treed pasture, approximately 5 km is tame pasture and approximately 5 km is hay.

For an indication of the pre-construction distribution of rare plants, rare ecological communities and weed species, please refer to the Results of the Literature/Desktop Review (Section 4.0). For an indication of the amount of hectares (ha) of native vegetation that have been altered in the Vegetation LSA and RSA from pre-disturbance conditions, please refer to the cumulative effects assessment (Section 8.8 of Volume 5A).

Where a pre-construction weed survey identifies that infestations of listed weeds (Prohibited Noxious, Noxious, Provincial Noxious or Regional Noxious) occur on the proposed pipeline corridor at high densities (see Section 3.6.2 for definitions of high density in Alberta and BC), pre-construction conditions may be deemed unacceptable. These locations may require treatment prior to construction.

### **3.5 Literature/Desktop Review**

Preliminary TEM and literature review of previously observed rare plant, rare lichen species and rare ecological communities was conducted for lands within the Vegetation RSA.

A literature review was conducted prior to the survey to identify rare plants, rare lichens and rare ecological communities with potential to occur in the natural subregions and BGC zones in which the Project is located. Satellite imagery and TEM were reviewed in order to identify areas with high potential to support rare plants, rare lichens and rare ecological communities (e.g., native grasslands, under-represented ecosystems and TEM polygons determined during preliminary mapping to contain site series with potential to support rare ecological communities), as well as potential wetland and drainage features along the proposed pipeline corridor.

Using data available from ACIMS, BC MOE, COSEWIC and the Government of Canada, tables of potential rare vascular plants, rare non-vascular plants and rare lichen species (Table D-1) and rare ecological communities (Table D-2) were compiled. The ACIMS plant tracking list and watch list and

ACIMS rare ecological community data are available by natural subregion (ACIMS 2013a, Allen 2013). Habitat and phenological information included in Tables D-1 and D-2 was derived from Moss (1983), the Flora of North America (FNA) Editorial Committee (1993+), Kershaw *et al.* (2001) and Allen (2013).

BC provides rare vascular plant data by BGC Zone and FD (BC MOE 2013). All Red and Blue-listed vascular plants in the BGC zones and FDs of the Project were included in Table D-3. BC CDC rare ecological community data are provided by BGC subzone and FD (BC MOE 2013). All Red and Blue-listed communities in the BGC zones and FDs encountered by the proposed pipeline corridor were included in Table D-4. Habitats and phenological information were added using Douglas *et al.* (2002) and Douglas *et al.* (1998-2002), Klinkenberg (2013), BC MOE (2013) and the University of BC (2013).

Table D-3 was modified to include whether the known range and habitat of each plant occur along the proposed pipeline corridor. Ranges are based on whether an occurrence of the species is known from within 100 km of the Project (Alberta Tourism, Parks and Recreation 2012a,b, BC CDC 2012a,b). Whether the individual species' habitats were present along the proposed pipeline corridor was determined based on habitat types expected to occur in the proposed pipeline corridor and were later confirmed based on habitat types observed during the vegetation surveys. Table D-4 was modified to include whether the known range of the community occurs along the proposed pipeline corridor. This was accomplished using distribution maps of the component species (Douglas *et al.* 1998-2002, Kershaw *et al.* 2001, Moss 1983) and, if necessary, through personal communication with ACIMS and the BC CDC.

SARA, COSEWIC and provincial *Wildlife Act* designations are included in Tables D-1 and D-3. Alberta General Status ranks (determined every 5 years by Alberta Environment and Sustainable Resource Development [AESRD], formerly Alberta Sustainable Resource Development [ASRD] [2010]) were reviewed, but were not included in Table D-1 since the ranks do not provide additional information beyond the ACIMS and Alberta *Wildlife Act* ranks.

Records of known rare plant and rare ecological community occurrences within 5 km of the existing TMPL right-of-way were acquired from ACIMS and the BC CDC.

Representatives from counties, regional weed management committees and municipalities were contacted to identify site and County-specific weed and crop disease concerns as well as recommended mitigation measures. Weeds of management concern identified in the Alberta *Weed Control Regulation* and the BC *Weed Control Regulation*, and where available the additional species identified during consultation, were reviewed prior to the commencement of the vegetation survey.

The general vegetation patterns crossed by the Vegetation LSA, consisting of natural subregions in Alberta and BGC zones in BC, were reviewed.

Species nomenclature for this report is according to the list of all elements in Alberta (ACIMS 2013b) for sections pertaining to Alberta and according to the BC Species and Ecosystems Explorer (BC MOE 2013) for sections pertaining to BC, with more current taxonomic information drawn from NatureServe (2012a) when necessary.

### **3.5.1 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 Traditional Land Use (TLU) study information from potentially affected Aboriginal communities. Prior to TEK field data collection, preliminary background ATK data was compiled. 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 assessment;



- published reports from regulatory authorities involved in administering or regulating a specified area or resource (e.g., Integrated Resource Plans, LRMPs, etc.); and
- geographical information system tools to determine spatial relationships of source data to the Project.

The preliminary background ATK data was verified and augmented as a result of the TEK field data collection.

### **3.6 Field Data Collection**

The vegetation survey was comprised of a rare vascular plant survey, a weed survey component, a targeted survey for rare non-vascular plants and lichens as well as targeted non-vascular and lichen specimen collection, as described below. The field survey schedule is detailed in Section 5.0 of this report.

Field work for the vegetation survey considered an approximately 150 m wide corridor, which represents the typical width of the proposed pipeline corridor. Since vegetation communities may extend outside of the 150 m corridor, information regarding their composition and general habitat potential to support rare plants can be identified for contiguous areas within the Vegetation RSA.

TERA has implemented proper record keeping practices for information obtained during vegetation field surveys to ensure that the survey results can be acquired for future reference.

Consultation was conducted with federal and provincial regulatory authorities and other relevant authorities on requirements for baseline information and methods, as detailed in Section 2.0 of this report.

#### **3.6.1 Rare Plants and Rare Ecological Communities**

Information collected during the desktop review identified potential rare plant and lichen species, potential rare ecological communities and areas of high rare plant habitat potential.

TERA's rare plant survey methodology is based on the ANPC *Guidelines for Rare Plant Surveys in Alberta* (ANPC 2012) and the BC *Protocols for Rare Plant Surveys* (Penny and Klinkenberg 2012). The rare plant surveys were conducted throughout the growing season during biologically appropriate times for the species with potential to occur in the area. Biologically appropriate timing was determined through review of flowering timing information (where available).

Vegetation Specialists: traversed each selected segment of the proposed pipeline corridor; noted the dominant plant communities; recorded all identifiable species; and searched for rare plants and uncommon habitat. A purposeful meander technique was used to survey the proposed 150 m wide proposed pipeline corridor. The crew surveyed out from their starting point along one side of the centreline, meandering as much of the 75 m as practical, and then meandered back along the other side of the centreline, meandering as much of that 75 m as practical. At locations where potentially important microsites were observed, more detailed searches were performed. All rare plant surveys were conducted during biologically appropriate timing for the region and species being surveyed to the extent feasible.

Where rare plant species were observed, thorough searches were conducted to determine the extent of the populations. The populations were mapped and photographed, UTM co-ordinates were recorded and detailed reporting forms were completed for future submission to ACIMS or the BC CDC. Voucher specimens of rare plant species were generally collected. Species identification was confirmed by other established botanists and/or by comparison with specimens at an appropriate herbarium, when necessary.

Where rare ecological communities were observed, the communities were mapped and photographed and their locations were recorded. Full species lists were recorded and percent cover for each species was estimated. Descriptions of the sites and vegetation were documented on detailed reporting forms for future submission to ACIMS or the BC CDC.

### Rare Non-Vascular Plants and Lichens

An assessment was conducted to determine the likelihood of encountering rare non-vascular species and lichens within the proposed pipeline corridor, including review of the range and habitat of these species. Records provided by ACIMS and the BC CDC indicated that there are known rare non-vascular plant and lichen species in the vicinity of the Project.

Non-vascular plant and lichen specialists reviewed the habitat requirements of the known species and the expected habitats located along the proposed pipeline corridor in order to select and prioritize areas for non-vascular and lichen surveys and collections. The non-vascular and lichen field survey focused primarily on high potential habitats and representative ecosystems encountered by the proposed pipeline corridor, where land access was in place at the time of surveys.

In addition to the focused survey described above, vascular plant surveyors were provided with lists of potential rare non-vascular plant and lichen species and their respective habitats. Where vascular plant surveyors observed potential rare non-vascular plant and lichen species, specimens were collected for future identification by specialists, except in the case of potential SARA or COSEWIC-listed species where photos were taken and detailed site information was collected instead.

The BC CDC does not currently have published ranks for many liverworts and crustose lichens. In order to determine whether an identified species warranted mitigation or not, the CDC provided preliminary liverwort ranks through personal communication (Penny pers. comm.). The status of un-ranked BC lichens was confirmed by provincial experts (Bjork, Goward pers. comm.).

#### **3.6.2 Non-Native and Invasive Species**

All incidental observations of listed weeds and non-listed, non-native species were recorded at all locations where they were observed during the survey.

Classes were assigned for the density and distribution of each species, in each quarter-section or land use where they were observed. Numerical density distribution codes were assigned for all weed species observed during the survey; in Alberta following the density distribution guide provided in the ASRD (now AESRD) Rangeland Health Assessment Guide (Adams *et al.* 2009) and in BC following the guidelines established by the BC MFLNRO (Luttmerding *et al.* 1990). A high density of weeds was considered to be Class 5 or higher according to the Alberta system, or Class 7 or higher according to the BC system.

Representatives from the following Alberta municipalities were consulted regarding weeds of concern and preferred invasive species control practices: City of Edmonton; Strathcona County; Parkland County; City of Spruce Grove; Town of Stony Plain; Village of Wabamun; and Yellowhead County. Representatives from the following BC municipalities and agencies were consulted regarding weeds of concern and preferred invasive species control practices: FFGRD; NWIPC; TNRD; BC MFLNRO, SIWMC, FVRD, FVIP, GVRD, ISCMV and BC CDC. A summary of consultation activities is provided in Table 2.2-1 in Section 2.0 of this report.

#### **3.6.3 Collection of Traditional Ecological Knowledge**

TERA, on behalf of Trans Mountain, facilitated the participation of potentially affected Aboriginal communities during the vegetation field surveys conducted for the Project. Opportunities for Project participation were made available to potentially affected Aboriginal communities that have an interest in the Project, based on their proximity to the Project and/or their assertion of traditional and cultural rights of the land. All Aboriginal communities potentially affected by the Project were invited to participate in the vegetation field surveys conducted for the Project to allow for the collection of TEK.

Engagement for the Project was initiated in the spring of 2012 and continued throughout 2013. The methods used to determine how participants were to be involved in Project field surveys were the same for all Aboriginal communities. Each field survey was discussed with the individual community, usually with staff from the community lands department. This discussion included details regarding the type, timing and locations of work to be conducted and, based on this information, each community chose which of their members would participate in each field survey. The participating Aboriginal communities are listed in Table 3.6.3-1 from east to west in relation to the Project.

**TABLE 3.6.3-1**

**ABORIGINAL VEGETATION FIELD SURVEY PARTICIPATION FOR THE PROJECT**

Community	Bryolichen Survey	TEM	Vegetation Survey	Results Review Follow-Up
<b>Edmonton to Hinton Segment</b>				
Saddle Lake Cree Nation	May 20 to 21, 2013	May 18 to 27, 2013	June 7 to 13, 2013 June 18 to 29, 2013 July 16 to 22, 2013	November 28, 2013
Enoch Cree Nation	--	August 15 to 21, 2012 May 18 to 22, 2013	June 7 to 13, 2013 August 4, 8 to 9, 11, 2013	November 28, 2013
Alexander First Nation	--	August 15 to 21, 2012 May 18 to 27, 2013	June 7 to 13, 2013 June 18 to 29, 2013 July 16 to 22, 2013	November 28, 2013
Samson Cree Nation	May 20 to 21, 2013	August 16 to 21, 2012 May 18 to 27, 2013	June 7 to 13, 2013 June 18 to 29, 2013	November 28, 2013
Ermineskin Cree Nation	May 20 to 21, 2013	August 15 to 21, 2012 May 18 to 27, 2013	June 7 to 13, 2013 June 18 to 29, 2013	October 31, 2013
Montana First Nation	May 20 to 21, 2013	August 16 to 21, 2012	June 18 to 29, 2013	November 28, 2013
Louis Bull Tribe	--	August 15 to 21, 2012	June 18 to 29, 2013	November 28, 2013
Alexis Nakota Sioux First Nation	May 20 to 21, 2013	August 15 to 21, 2012 May 18 to 27, 2013	June 7 to 13, 2013	November 28, 2013
Paul First Nation	--	--	June 7 to 13, 2013 July 16 to 22, 2013	November 8, 2013
Nakcowinewak Nation of Canada	--	May 18 to 27, 2013	June 7 to 13, 2013 June 18 to 29, 2013 August 3 to 14, 2013	November 25, 2013
Sunchild First Nation	--	August 15 to 21, 2012 May 18 to 27, 2013	June 7 to 13, 2013 August 3 to 14, 2013	November 28, 2013
<b>Hargreaves to Darfield Segment</b>				
Lheidli T'enneh	--	--	May 11 to 12, 2013 May 19, 2013 June 27 to 29, 2013	November 28, 2013
Aseniwuche Winewak Nation	--	--	June 27 to 29, 2013 August 10 to 12, 2013	November 28, 2013
Lhtako Dene Nation	--	--	June 29, 2013	June 29, 2013
Simpow First Nation	--	--	June 18 to 29, 2013 August 2 to 13, 2013	N/A
<b>Black Pines to Hope Segment</b>				
Lower Nicola Indian Band	--	April 16 to 18, 2013	May 17, 2013 July 21 to 25, 2013	November 28, 2013
<b>Hope to Burnaby Segment</b>				
Yale First Nation	--	April 12 to 15, 2013	May 22 to 26, 2013 July 13 to 25, 2013	November 28, 2013
Chawathil First Nation	--	April 12 to 15, 2013	May 16, 2013 May 22 to 26, 2013 July 13 to 25, 2013	November 28, 2013
Shxw'ow'hamel First Nation	--	April 12 to 15, 2013	May 22 to 26, 2013 July 13 to 25, 2013	November 28, 2013
Cheam First Nation	--	April 12 to 15, 2013	--	November 28, 2013
Seabird Island Band	--	April 12 to 15, 2013	--	November 28, 2013
Popkum First Nation	--	--	May 22 to 26, 2013	November 28, 2013
Leq'á:mel First Nation	--	April 12 to 15, 2013	May 7 to 10, 2013 May 22 to 26, 2013	November 8, 2013

Simpcw First Nation field participants did not share TEK with TERA 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.

### 3.6.3.1 *Field Reconnaissance*

In 2012 and 2013, TEK was gathered and recorded during the vegetation field surveys (Table 3.6.3-1). The dates provided in Table 3.6.3-1 may not correspond to the dates noted elsewhere in this report since additional time was spent in the field with the Aboriginal participants for mobilization and demobilization to the field, pre-field work meetings and wrap-up meetings. The field crew consisted of Vegetation Specialists, Aboriginal participants and a TERA facilitator. Translators were available in the field upon the request of a community. TERA facilitators accompanied participants during the field surveys to identify potential effects of the Project on environmental resources, to explain potential construction techniques, to describe Project specifications, to document TEK and to ensure that proprietary information was kept in confidence.

During the field surveys, traditional methods of resource procurement were discussed, as well as modern methods currently employed. Additional important information shared by the Aboriginal participants included: seasonality of resource harvesting; species of traditional importance; identification of traditionally harvested plants; description of uses and preparation techniques; and plant rarity and abundance. Geographical locations were identified, as were areas that are not used and the reasons why. Potential mitigation measures to reduce any Project-related effects on a resource were also discussed during the vegetation field surveys. Open discussions occurred regularly between participants and Vegetation Specialists regarding the resources present and available to Aboriginal communities. These discussions were important to help build relationships among the field crews. Aboriginal participants spoke about aspects of the environment that were important to them and the importance of the resource from a western science perspective was also discussed. The vegetation TEK collected during the biophysical field surveys has added results that western science may not have gathered or considered, confirmed results that had been collected through the field surveys, as well as has identified and confirmed issues of concern to be addressed in Volume 5A. The TEK collected is also used to assist in the review of potential Project-related effects on vegetation.

### 3.6.3.2 *Results Review/Reporting*

Review of collected TEK and discussions of potential Project-related effects and mitigation strategies described in this report were conducted directly with participating community members during the field surveys. Confirmation of the accuracy of the information incorporated and approval of the inclusion of the confidential and proprietary information in Project planning occurred during community results review follow-up (Table 3.6.3-1). Information collected during the field surveys that relate primarily to traditional land and resource use or to other elements has been incorporated into the following reports with permission of the participating communities:

- Managed Forests Areas and Forest Health Technical Report (Volume 5D);
- Traditional Land and Resource Use Technical Report (Volume 5D);
- Socio-Economic Technical Report (Volume 5D);
- Community Health Technical Report (Volume 5D); and
- Screening Level Human Health Risk Assessment of Pipeline and Facilities (Volume 5D).

A detailed summary of Trans Mountain's engagement activities with each potentially affected Aboriginal community is provided in Volume 3B of the application.

### **3.7 Terrestrial Ecosystem Mapping**

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 in support of the ESA for the Project.

To ensure consistency between mappers, the RSA was pre-stratified based on anthropogenic disturbance and soils data in Alberta and based on slope and aspect in BC. Preliminary mapping occurred following the 2012 TEM field surveys. Quality assurance and quality control measures were employed to ensure consistency of delineation and attribution among ecosystem mappers and to ensure accuracy of the TEM. Final mapping occurred after the 2013 TEM field surveys.

Polygons were delineated representing relatively homogenous ecosystems and structural stages. Each polygon was assigned up to three proportionally described site series, structural stage and site modifiers. Field surveys of 5.3% of polygons within the Vegetation RSA (*i.e.*, Survey Intensity Level 5) were completed during the 2012 and 2013 field seasons.

The detailed TEM methods are described in Section 3.0 of the TEM Report (Appendix C of this report).

## 4.0 RESULTS OF LITERATURE/DESKTOP REVIEW/INTERVIEWS

### 4.1 General Information

Different ecosystem classification systems are applied to portions of the Project within Alberta and BC. In Alberta, ecosystems are identified as natural regions and subregions. The breakdown of which natural subregions are associated with various project components can be found in Table 4.1-1. In BC, the BGC Ecosystem Classification (BEC) System identifies BGC zones and subzones. The breakdown of which BGC zones and subzones are associated with various project components can be found in Tables 4.1-2, 4.1-3 and 4.1-4.

**TABLE 4.1-1**

**ALBERTA NATURAL SUBREGIONS BY PROJECT COMPONENT**

Natural Subregion	Project Component							
	Edmonton to Hinton Segment	Edmonton Terminal	Gainford Pump Station	Niton Pump Station Reactivation	Wolf Pump Station	Edson Pump Station	Hinton Pump Station	Jasper Pump Station
Central Parkland	✓	✓						
Dry Mixedwood	✓		✓					
Central Mixedwood	✓							
Lower Foothills	✓			✓	✓	✓		
Montane	✓						✓	✓

The Central Parkland Natural Subregion occupies over 50,000 km<sup>2</sup> of land and most of these lands are under cultivation. Undulating till plains and hummocky uplands dominate the landscape. Lacustrine and fluvial deposits are common with some substantial eolian deposits in the northern and eastern parts of the subregion. Plains rough fescue dominates the vegetation communities in the southern and eastern areas of the subregion with small aspen-dominated communities occurring in moister habitats. The northern and western parts of the subregion are composed of aspen forest with grasslands restricted to the driest areas. Black Chernozem soils normally occur under grasslands while Dark Grey Chernozems and Luvisols generally occur in trembling aspen forests (Natural Regions Committee 2006). See Table 4.1-1 for which Project components are located in the Central Parkland Natural Subregion.

The Dry Mixedwood is the most southern and the warmest of the Boreal Forest Subregions in Alberta. It is dominated by level to gently undulating glacial till and lacustrine plains. Hummocky uplands are prevalent in the south where Grey Luvisols are the dominant soil type. Gleysols and Organic soils dominate wetland areas. Aspen forests with understories dominated by prickly rose, low-bush cranberry, beaked hazelnut and Canada buffaloberry are typical of the uplands. Treed, shrubby or sedge-dominated fens are common in wet areas. Jack pine typically dominates dry, well drained areas (Natural Regions Committee 2006). See Table 4.1-1 for which Project components are located in the Dry Mixedwood Natural Subregion.

The Central Mixedwood Natural Subregion is the largest natural subregion in Alberta and is characterized by upland forests and wetlands on level to gently undulating plains. Upland forests are a mosaic of aspen, mixedwood and white spruce. Common understory species include: low-bush cranberry; prickly rose; green alder; Canada buffaloberry; hairy wild rye; bunchberry; wild sarsaparilla; and dewberry. Jack pine stands occur on coarser materials. Wetlands are often extensive and are dominated by black spruce fens and bogs (Natural Regions Committee 2006). See Table 4.1-1 for which Project components are located in the Central Mixedwood Natural Subregion.

Natural landscapes in the Lower Foothills Natural Subregion are characterized by rolling, till-covered plateaus forested by mesic, closed canopy mixed stands of aspen, lodgepole pine, white spruce and balsam poplar. Common understory species on mesic sites include: green alder; low-bush cranberry;

prickly rose; wild sarsaparilla; dewberry; common fireweed; and bluejoint (Natural Regions Committee 2006). See Table 4.1-1 for which project components are located in the Lower Foothills Natural Subregion.

The Montane Natural Subregion is influenced by warm air masses moving along the Athabasca River valley. Vegetation communities are mainly comprised of closed forest communities dominated by lodgepole pine, Douglas-fir, aspen and white spruce. Typical understory species in these communities include Canada buffaloberry, white meadowsweet, thimbleberry, snowberry, saskatoon, pine reed grass and hairy wild rye. Deciduous forests occur on fluvial fans, terraces and flood plains. Open grasslands occur on dry and exposed sites and are dominated by various grasses including June grass, northern wheatgrass, western wheatgrass, Kentucky bluegrass and slender wheatgrass (Natural Regions Committee 2006). See Table 4.1-1 for which Project components are located in the Montane Natural Subregion.

**TABLE 4.1-2**  
**BC BGC ZONE/SUBZONE BY PIPELINE SEGMENTS**

BGC Zone	BGC Subzone	Project Component			
		Hargreaves to Darfield Segment	Black Pines to Hope Segment	Hope to Burnaby Segment	Burnaby to Westridge Segment
Interior Cedar-Hemlock (ICH)	Moist Mild (mm)	✓			
	Wells Gray Wet Cool (wk1)	✓			
	Mica very wet cool (vk1)	✓			
	Thompson Moist Warm (mw3)	✓			
	North Thompson Dry Warm (dw3)	✓			
Sub-Boreal Spruce (SBS)	McLennan Dry Hot (dh1)	✓			
Interior Douglas-fir (IDF)	Thompson Moist Warm (mw2)	✓			
	Thompson Moist Warm – Steep South phase (mw2b)	✓			
	Thompson Very Dry Hot (xh2)		✓		
	Thompson Very Dry Hot – Grassland phase (xh2a)		✓		
	Thompson Dry Cool (dk1)		✓		
	Okanagan Very Dry Hot (xh1)		✓		
	Cascade Dry Cool (dk2)		✓		
Ponderosa Pine (PP)	Thompson Very Dry Hot (xh2)		✓		
BG	Nicola Very Dry Warm (xw1)		✓		
	Thompson Very Dry Hot (xh2)		✓		
Montane Spruce (MS)	South Thompson Dry Mild (dm2)		✓		
	Cascade Moist Warm (mw1)		✓		
Engelmann-Spruce Subalpine Fir (ESSF)	Cascade Moist Warm (mw1)		✓		
ESSF	Moist Warm (mw)		✓		
Mountain Hemlock (MH)	Leeward Moist Maritime (mm2)		✓		
Coastal Western Hemlock (CWH)	Southern Moist Submaritime (ms1)		✓		
	Southern Dry Submaritime (ds1)		✓	✓	
	Dry Maritime (dm)			✓	✓
	Eastern Very Dry Maritime (xm1)			✓	

TABLE 4.1-3

BC BGC ZONE/SUBZONE BY PUMP STATIONS AND POWER LINES

BGC Zone	BGC Subzone	Rearguard Pump Station	Blue River Pump Station	Blackpool Pump Station	Darfield Pump Station	Black Pines Pump Station	Black Pines Power Line	Kamloops Pump Station	Kingsvale Pump Station	Kingsvale Power Line	Sumas Pump Station
SBS	McLennan Dry Hot (dh1)	✓									
ICH	Thompson Moist Warm (mw3)		✓								
IDF	Thompson Moist Warm (mw2)			✓	✓						
	Thompson Very Dry Hot (xh2)									✓	
	Thompson Very Dry Hot – Grassland phase (xh2a)									✓	
	Thompson Dry Cool (dk1)									✓	
	Okanagan Very Dry Hot (xh1)								✓	✓	
	Cascadia Dry Cool (dk2)									✓	
PP	Thompson Very Dry Hot (xh2)					✓	✓	✓			
BG	Nicola Very Dry Warm (xw1)							✓			
CWH	Southern Dry Submaritime (ds1)										
	Dry Maritime (dm)										
	Eastern Very Dry Maritime (xm1)										✓



**TABLE 4.1-4**

**BC BGC ZONE/SUBZONE BY TERMINALS**

BGC Zone	BGC Subzone	Project Component		
		Sumas Terminal	Burnaby Terminal	Westridge Marine Terminal
CWH	Dry Maritime (dm)	✓	✓	✓

The ICH BGC Zone has the highest diversity of tree species of any zone in BC. Western redcedar and western hemlock dominate mature climax forests. White spruce, Engelmann spruce, spruce hybrids and subalpine fir are common and can form a part of climax stands with either western hemlock or redcedar, especially in areas of cold air drainage and ponding or of higher elevations. Western larch, Douglas-fir and western white pine are common seral species in the central and southern areas of this zone on mesic and drier sites. PP occurs on dry and warm slopes in some areas. Englemann spruce, white spruce, spruce hybrids, subalpine fir and black cottonwood are dominant in moist to wet areas. Lodgepole pine, trembling aspen and paper birch are common in all areas. Wetlands are infrequent due to the mountainous terrain throughout most of the zone. Where they do occur, they are usually small transitional bogs, fens and skunk cabbage swamps. Riparian and lakeshore marshes tend to be more common (Meidinger and Pojar 1991). The Project crosses five subzones in the ICH BGC Zone: Moist Mild (mm); Wells Gray Wet Cool (wk1); Mica Very Wet Cool (vk1); Thompson Moist Warm (mw3); and North Thompson Dry Warm (dw3). See Tables 4.1-2, 4.1-3 and 4.1-4 for which Project components are located in the ICH BGC Zone. The SBS BGC Zone dominates the central interior of BC. The climate in this zone is one of extremes; the winter is severe and snowy and the summers are relatively warm and moist. However, the winters are slightly shorter and the growing season is slightly longer than those of other boreal zones. The zone is characterized by upland coniferous forests of subalpine fir and hybrid white spruce. Lodgepole pine is common in mature forests in the drier parts of the zone and both lodgepole pine and trembling aspen establish extensive seral stands. Paper birch often occurs on moist rich sites following disturbance. Douglas-fir occurs abundantly on dry, warm, rich sites and less commonly in mesic forests. Black spruce also occurs occasionally in climax upland forest. Major streams and rivers are bordered by alluvial forests that are dominated by black cottonwood with an occasional spruce. Wetlands are common and include sedge marshes, shrub and tree dominated fens, treed swamps and bogs (Meidinger and Pojar 1991). The Project crosses one subzone in the SBS BGC Zone, the McLennan Dry Hot (dh1). See Tables 4.1-2, 4.1-3 and 4.1-4 for which Project components are located in the SBS BGC Zone.

The landscape of the IDF BGC Zone consists largely of open to closed, mature forests of Douglas-fir. Pure Douglas-fir climax stands are common. Mixed stands of Douglas-fir and lodgepole pine are often present in areas frequently affected by fire. PP occurs at lower elevations south of Little Fort, persisting as a climax species on drier sites. Hybrid white spruce occurs on moister sites and is most common at higher elevations transitional to the MS BGC Zone. Western redcedar sometime occurs in mature forest in moister areas transitional to the Coastal Western Hemlock or ICH zones. Trembling aspen is a widely distributed seral species throughout the zone. Extensive grassland communities also occur in parts of the zone due to a combination of edaphic and topographic conditions and fire history. Non-forested wetlands are common in this zone and include marshes, sedge and shrub fens, shrub-carrs and saline meadows. Willow swamps often occur along small streams and drainages (Meidinger and Pojar 1991). The Project crosses seven subzones in the IDF BGC Zone: the Thompson Moist Warm (mw2); the Thompson Moist Warm – Steep South phase (mw2b); the Thompson Very Dry Hot (xh2); the Thompson Very Dry Hot - Grassland phase (xh2a); the Okanagan Very Dry Hot (xh1); the Thompson Dry Cool (dk1); and the Cascade Dry Cool (dk2). See Tables 4.1-2, 4.1-3 and 4.1-4 for which Project components are located in the IDF BGC Zone.

The PP BGC Zone is the driest and has the warmest summer temperatures of all the forested zones in BC. The forests in this zone are dominated by very open PP stands with an understory consisting largely of bluebunch wheatgrass. Grasslands are commonly scattered throughout the zone. Fires have played an important role in the ecology of the zone. Douglas-fir is common on moist and very moist sites associated with gullies, draws and streams, although Douglas-fir also occurs as a minor component of drier sites in the northern part of the zone. Trembling aspen dominates riparian or seepage areas while black cottonwood occurs on flood plains. Alkaline ponds can occur in depressional areas (Meidinger and

Pojar 1991). The Project crosses one Subzone in the PP Pine BGC Zone, the Thompson Very Dry Hot (xh2). See Tables 4.1-2, 4.1-3 and 4.1-4 for which Project components are located in the PP BGC Zone.

The BG BGC Zone is an arid zone largely characterized by grasslands dominated by BGs, such as bluebunch wheatgrass, with cryptogams (plants that reproduce via spores) and shrubs, such as big sagebrush, also present. The vegetation reflects minor changes in topography, aspect and drainage. Patterns of plant communities are poorly understood because of heavy livestock grazing throughout the zone, which has led to an increased abundance of unpalatable or weedy vascular species. Drier areas are dominated by needle-and-thread grass and sand dropseed while areas with shallow soils over bedrock can support compact selaginella. PP and Douglas-fir grow on steep rocky slopes and in moist draws. At higher elevations within this zone Kentucky bluegrass and short-awned porcupinegrass are more common. Small patches of trembling aspen can occur on wetter areas at higher elevations. Wetlands are common throughout the zone and include shrub dominated habitats, marshes with shallow open water and saline meadows (Meidinger and Pojar 1991). The Project crosses two subzones in the BG BGC Zone, the Nicola Very Dry Warm (xw1) and the Thompson Very Dry Hot (xh2). See Tables 4.1-2, 4.1-3 and 4.1-4 for which Project components are located in the BG BGC Zone.

The MS BGC Zone is characterized by climax stands of hybrid white spruce and subalpine fir. Common understory species include black huckleberry, pinegrass, falsebox, Utah honeysuckle and grouseberry. Extensive, young and maturing seral stands of lodgepole pine are common in areas following wildfires. Douglas-fir is a climax species on slopes with south aspect. Western redcedar occurs in wetter areas that are transitional to the ICH zone. Trembling aspen occurs throughout the zone. Wetlands area are uncommon due to mountainous topography but where they do occur they are usually shrub fens (Meidinger and Pojar 1991). The Project crosses two subzones in the MS BGC Zone, the South Thompson Dry Mild (dm2) and the Cascade Moist Warm (mw1). See Tables 4.1-2, 4.1-3 and 4.1-4 for which Project components are located in the MS BGC Zone.

The ESSF BGC Zone is the uppermost (highest elevation) zone in southern interior BC and is characterized by mountainous terrain. The climate is generally cool with a short growing season and a long winter. As a result most of the precipitation (50-70%) is in the form of snow. Engelmann spruce and subalpine fir are the dominant climax tree species. Engelmann spruce typically dominates the canopy of mature stands with subalpine fir being more common in the understory. In drier areas or areas affected by fire, lodgepole pine may be dominant (Meidinger and Pojar 1991). The proposed pipeline corridor crosses two subzones in the ESSF BGC Zone, the Moist Warm (mw) and the Cascade Moist Warm (wm1). See Tables 4.1-2, 4.1-3 and 4.1-4 for which Project components are located in the ESSF BGC Zone.

The MH BGC Zone occurs at relatively high elevations (400-1,000 m) and is characterized by short, cool summers and long, cool, wet winters, with heavy snow cover for several months (Meidinger and Pojar 1991). The most common tree species in the zone are MH, amabilis fir and yellow-cedar, although they do not grow in continuous stands and are largely confined to lower elevations. Other characteristics of the MH Zone are: the high occurrence of shrubs such as blueberries and copperbush; the relatively low occurrence of herbs; the dominance of bryophytes and the high significance of advance regeneration of amabilis fir and MH (Meidinger and Pojar 1991). Subalpine heath areas located at higher elevations are dominated by heathers, partridge-foot, alpine club-moss and crowberry. The proposed pipeline corridor crosses one subzone in the MH BGC Zone, the Leeward Moist Maritime (mm2). See Tables 4.1-2, 4.1-3 and 4.1-4 for which Project components are located in the MH BGC Zone.

The CWH is, on average, the wettest BGC zone in BC. Western hemlock is the most common tree species in forested areas. Western redcedar occurs throughout the zone and Douglas-fir is abundant in drier areas of the zone. Amabilis fir and yellow-cedar are common in wetter areas of the zone. Shore pine is common on very dry or very boggy areas throughout the zone. Grand fir, western white pine and bigleaf maple occur in warmer and drier southern parts of the zone. Red alder grows in disturbed sites, such as logged areas and black cottonwood occurs along large rivers with extensive flood plains. Sitka spruce occurs over a wide variety of habitats north of Vancouver Island but is restricted to flood plains and exposed beaches in the south (Meidinger and Pojar 1991). The Project crosses four subzones in the CWH BGC Zone: the Southern Moist Submaritime (ms1); the Southern Dry Submaritime (ds1); the Dry Maritime (dm); and the Eastern Very Dry Maritime (xm1). See Tables 4.1-2, 4.1-3 and 4.1-4 for which Project components are located in the CWH BGC Zone.

## Aboriginal Traditional Knowledge

Aboriginal people have used vegetation resources for a wide variety of cultural, social and economic uses: for consumption; to produce trade items as well as for commercial sale to traders and non-indigenous people in contemporary and historical times (Lifeways of Canada Ltd. 2012, Northern Gateway Pipelines Limited Partnership [NGPLP] 2010, Tomkins 2010). Today, Aboriginal communities continue to harvest medicinal and food plants on Crown land within their traditional territories (MacPherson Leslie & Tyerman LLP 2011, NGPLP 2010).

Where available, background ATK information collected for each component of the Project is included in the corresponding subsections below.

### **4.1.1 Edmonton to Hinton Segment**

The Edmonton to Hinton Segment, located in Alberta, encounters five Natural Subregions, the Central Parkland Subregion of the Parkland Natural Region, the Dry Mixedwood and Central Mixedwood Subregions of the Boreal Forest Natural Region, the Lower Foothills Subregion of the Foothills Natural Region and the Montane Subregion of the Rocky Mountain Natural Region (Table 4.1-1).

## Aboriginal Traditional Knowledge

Along the Edmonton to Hinton Segment, the desktop review identified that several Aboriginal communities use a variety of plants found in their traditional territories for different purposes. Edible plants, fruit, bulbs and roots include prairie onion, wild parsnip, bulrush, Jack pine cambium, poplar tree cambium, high- and low-bush cranberry, common blueberry, tall bilberry (huckleberry), saskatoon berry, northern gooseberry, wild red currant, common yarrow, common and alpine bearberry, wild red raspberry (loganberry) and Canada buffaloberry (soapberry). Medicinal plants include western wood lily (tiger lily), common bearberry (kinnikinnick), spruce, juniper, common Labrador tea (muskeg leaves), wild mint, sweet-flag (rat root), sweet grass, sage, willow fungus, snowbrush (red root) and bark (ANSFN 2013, Lifeways of Canada Ltd. 2012, NGPLP 2010). Aboriginal people harvest these plants during spring, summer and early fall near their communities where possible (ANSFN 2013, Neufeld 2012). ANSFN members harvest blueberries, raspberries, strawberries, saskatoon berries, choke cherries, mushrooms, wild rice and hazelnuts near their reserve at Lac Ste Anne (approximately 12 km north of RK 106), but need to travel further to harvest alder, trembling aspen, dock, sweet flag (rat root), red willow fungus and sage (ANSFN 2013, Lifeways of Canada Ltd. 2012). Samson Cree Nation reports harvest activities near the reserve at Hobbema (approximately 60 km south of RK 23). Important harvesting areas have also been identified near Hinton, along lands from RK 315 to RK 326; near Grand Cache (approximately 115 km northwest of RK 326), near Whitecourt (approximately 60 km north of RK 180) and near Fox Creek (approximately 92 km north of RK 259) (NGPLP 2012). Certain plants, such as balsamroot, bitter-root and beaked hazelnut can now only be found in undisturbed land near Hinton and Grande Cache, Whitecourt and Fox Creek, making distant travel increasingly necessary. Development in Alberta has affected valuable and fragile medicinal plant and berry gathering areas and many plants are becoming difficult to locate (Lifeways of Canada Ltd. 2012).

Concerns identified during engagement on other development projects in the region include the effects of development on medicinally and spiritually important plants, reclamation of the right-of-way using native plants and contamination of plants through use of herbicides and pesticides (NGPLP 2010).

### **4.1.2 Hargreaves to Darfield Segment**

The Hargreaves to Darfield Segment, encounters three BGC zones in BC, the ICH, the SBS and the IDF zones (Table 4.1-2).

## Aboriginal Traditional Knowledge

Along the Hargreaves to Darfield Segment, the desktop review identified that several Aboriginal communities use a variety of plants found in their traditional territories for different purposes. Edible plants, fruit, bulbs and roots include rhubarb, cow-parsnip (also called wild rhubarb and wild celery), wild onion, bulrush and cattail species, saskatoon berry, huckleberry, Canada buffaloberry (soapberry), raspberry, blueberry, choke cherry, cranberry, strawberry, thimbleberry, gooseberry, hazelnuts and rose hips. Medicinal plants include pine bark, sweet flag (rat root), tiger lily, *kwadas* roots and Jack pine

cambium. Other plants are also used for medicinal purposes but information and names are confidential. Trees such as alder, pine, fir and birch are also harvested and used (Pacific Trails Pipelines Ltd. Partnership [PTP] 2007).

Aboriginal people harvest these plants during spring, summer and early fall near their communities where possible (Archaeo Research Limited 2002, PTP 2007). Lhtako Dene Nation report that community members gather plants in areas around Nyland Lake (approximately 186 km west of RK 529), along the west side of the Fraser River (crossed by the proposed pipeline corridor at RK 1170), at Maud Lake (approximately 177 km west of RK 596), at Dragon Mountain (approximately 204 km west of RK 517) and at Ten Mile Lake (approximately 207 km west of RK 508) (Archaeo Research Limited 2002).

Concerns identified during engagement on other development projects in the region include the effects of development on vegetation and contamination of plants through use of herbicides and pesticides (Archaeo Research Limited 2002, NGPLP 2012). Toosey First Nation has noted that cattle grazing has substantially reduced the diversity of plant life in their asserted traditional territories. In particular, the white glacier lily (avalanche lily) and mariposa lily species are rarely found today, prompting concern in the community for the viability of these and other important plant populations.

#### **4.1.3 Black Pines to Hope Segment**

The Black Pines to Hope Segment encounters seven BGC zones in BC, the IDF, PP, BG, MS, ESSF, MH and CWH zones (Table 4.1-2).

##### Aboriginal Traditional Knowledge

Along the Black Pines to Hope Segment, the desktop review identified that plant harvesting is considered a fundamental part of traditional culture. Edible plants include rose species, stinging nettle, white glacier lily (avalanche lily), tiger lily, cow-parsnip, *Solanum* spp. (wild potato), bitterroot, nodding onion, saskatoon, strawberry species, mushrooms and cambium from lodgepole and PP (First Nations Environmental Contaminants Program n.d., Golder Associates [Golder] 2008). Traditional medicines include bearberries (kinnickinnick), snowberries, cactus, spruce, juniper berries, pineapple weed, bitterroot, common yarrow, prince's pine, showy aster, creeping Oregon-grape, grouseberries, Labrador tea (Hudson bay tea), rose hip tea, mint tea and roots of *Ligusticum* ssp. (bear roots) (First Nations Environmental Contaminants Program n.d., Golder 2008). Nooaitch Indian Band members continue to gather berries, plants, tree bark and roots on their reserves and in their asserted traditional territory (Knucwentwecw Development Corporation Consulting 2011). Aboriginal people harvest these plants during spring, summer and early fall near their communities where possible.

Concerns identified during engagement on other development projects in the region include potential loss and/or alternation of traditional plants, clearing of vegetation and contamination of plants through use of herbicides and pesticides (First Nations Environmental Contaminants Program n.d., Golder 2008). Some communities are concerned that commonly-harvested indigenous species will be negatively affected by development and that threatened species may begin to disappear, also noting that development throughout the region has limited suitable habitat for plant harvesting (Wonders 2008).

#### **4.1.4 Hope to Burnaby Segment**

The Hope to Burnaby Segment is located entirely within the CWH BGC Zone (Table 4.1-2).

##### Aboriginal Traditional Knowledge

Along the Hope to Burnaby Segment, the desktop review identified several edible plants and fruits including saskatoon berry (serviceberry), strawberry, hazelnuts, cranberry, blueberry, huckleberry, salmonberry, blackberry, Canada buffaloberry (soapberry), thimbleberry, cow-parsnip, mushrooms, wild onion, currants, roots and cambium (Golder 2008). Medicinal plants include devil's club, cascara, cherry bark, stinging nettle, salal, horsetail, black tree lichens, skunk cabbage, white glacier lily (avalanche lily), balsamroot, tiger lily, bitterroot and cambium from lodgepole and PPs (Golder 2008).

#### **4.1.5 Burnaby to Westridge Segment**

The Burnaby to Westridge Segment is located entirely within the CWH BGC Zone (Table 4.1-2).

## Aboriginal Traditional Knowledge

Along the Burnaby to Westridge Segment, the desktop review identified several edible plants and fruits including saskatoon berry (serviceberry), strawberry, hazelnuts, cranberry, blueberry, huckleberry, salmonberry, blackberry, Canada buffaloberry (soapberry), thimbleberry, cow-parsnip, mushrooms, wild onion, currants, roots and cambium (Golder 2008, Kwikwetlem First Nation 2007, Musqueam Indian Band 2011). Medicinal plants include devil's club, cascara, cherry bark, stinging nettle, salal, horsetail, black tree lichens, skunk cabbage, white glacier lily (avalanche lily), balsamroot, tiger lily, bitterroot and cambium from lodgepole and PPs (Golder 2008, Kwikwetlem First Nation 2007, Musqueam Indian Band 2011). Tree species used are the western redcedar for wooden utensils and ceremonial objects, paper birch, pine, cottonwood, lodgepole pine, Douglas-fir, alder-leaved buckthorn, dogwood, willow and vine maple (Musqueam Indian Band 2011, Simovic 2001).

Wapato is a nutritious tuber often found scattered throughout marshy areas. The production of wapato required great care and attention since the harvest was done by canoe or by wading into the shallows and treading on the plants until the roots floated to the surface. These plants continue to be traded with coastal communities for shellfish and other saltwater resources (Golder 2008).

Marsh areas are often harvested for cranberries, and wapato. Food plants and berries are gathered at higher elevations in the late summer and the fall (Golder 2008). Historically, berries were harvested and eaten or dried for the winter months when ceremonial feasts were held. Old, mature forests of Douglas-fir and cedar are located in valleys of Squamish First Nation's asserted traditional territory. Western redcedar is known as the "tree of life" and is harvested for functional and cultural uses, with wood and bark being used to build dugout canoes, longhouses, masks, boxes, eating implements and other products (Squamish First Nation 2001, Wonder 2008).

Kwantlen First Nation report that the Stave River area 3 km north of RK 1119 is an important location for gathering several kinds of plants, while the swamp, meadows and sloughs of Port Hammond (approximately 4.1 km north of RK 1154) provided ideal habitat for wapato (Neary 2011). Fruits, grains and tubers have also been cultivated and timber harvested from Langley Indian Reserve 6 and Indian Reserve 7 (approximately 3.2 km west of RK 1148) (Neary 2011). Katzie First Nation reports that there are individually and communally owned cranberry bogs on both sides of Pitt River which flows into the Fraser River (approximately 4 km north of RK 1164) (Glavin 2008). Kwikwetlem First Nation report that the south side of the Fraser River from the Pattulo Bridge (4 km west of RK 1168) to the Golden Ears Bridge (3.9 km north of RK 1153) is used for salmonberry, huckleberry and blueberry and wood gathering and that the north Fraser River shoreline from the Pitt River to New Westminster contains several plant and wood gathering sites for cedar bark and wood, cherry bark, cattails, cottonwood bark, stinging nettle, alder wood, hazelnuts, salmonberries, huckleberries, blueberries and cranberries. Most of these plants are collected from sloughs, riverbanks and upland environments, however, members travel further to areas like Pitt Lake to collect blueberries and Labrador tea (Kwikwetlem First Nation 2007). For many of communities in this region, harvesting was organized according to a system of land management that restricted the right to harvest to specific families. The Fraser River was used by family groups that owned the individual and collective rights to harvest there. Today private land ownership and development of areas have led to shared use of harvesting sites (Golder 2008).

Concerns identified during engagement on other development projects in the region include clearing of vegetation and contamination of plants through use of herbicides and pesticides, and loss and alteration of traditional use sites for plant gathering. Plants identified as having limited availability today include balsamroot, bitterroot and beaked hazelnut (Golder 2008).

### **4.1.6      *Edmonton Terminal***

The existing Edmonton Terminal, located in Alberta, is within the Central Parkland Subregion of the Parkland Natural Region (Table 4.1-1). More specifically, it is located at SW 5-53-23 W4M at RK 0.0. No disturbance of native vegetation is proposed at the Edmonton Terminal and all work will be conducted within the existing disturbed fenced area. Therefore, there will be no further mention of the terminal in regards to communities of concern and rare plants and lichens.

### Aboriginal Traditional Knowledge

ATK for the Edmonton Terminal has been captured under the Edmonton to Hinton Segment where the station is located (Section 4.1.1).

#### **4.1.7 Gainford Pump Station**

The existing Gainford Pump Station, located in Alberta, is within the Dry Mixedwood of the Boreal Forest Natural Region (Table 4.1-1). More specifically, it is located at NE 13-53-6 W5M at RK 117.5. Current land use at this facility site is industrial and the surrounding land is forested. Some treed lands will be disturbed within the existing boundary of the Gainford Pump Station.

### Aboriginal Traditional Knowledge

ATK for the Gainford Pump Station has been captured under the Edmonton to Hinton Segment where the station is located (Section 4.1.1).

#### **4.1.8 Niton Pump Station**

The existing Niton Pump Station at SW 34-53-13 W5M (RK 191.4) is to be reactivated as part of the Project. This station, located in Alberta, lies within the Lower Foothills Subregion of the Foothills Natural Region (Table 4.1-1). No disturbance of native vegetation is proposed at the Niton Pump Station, therefore, there will be no further mention of the station in regards to communities of concern and rare plants and lichens.

### Aboriginal Traditional Knowledge

ATK for the Niton Pump Station has been captured under the Edmonton to Hinton Segment where the station is located (Section 4.1.1).

#### **4.1.9 Wolf Pump Station**

The existing Wolf Pump Station, located in Alberta, lies within the Lower Foothills Subregion of the Foothills Natural Region (Table 4.1-1). More specifically, it is located at NW 19-53-14 W5M at RK 206.2. No disturbance of native vegetation is proposed at the Wolf Pump Station, therefore, there will be no further mention of the station in regards to communities of concern and rare plants and lichens.

### Aboriginal Traditional Knowledge

ATK for the Wolf Pump Station has been captured under the Edmonton to Hinton Segment where the station is located (Section 4.1.1).

#### **4.1.10 Edson Pump Station**

The existing Edson Pump Station, located in Alberta, lies within the Lower Foothills Subregion of the Foothills Natural Region (Table 4.1-1). More specifically, it is located at SW 18-53-18 W5M at RK 247.1. No disturbance of native vegetation is proposed at the Edson Pump Station and all work will be conducted within the existing disturbed fenced area. Therefore, there will be no further mention of the station in regards to communities of concern and rare plants and lichens. Only weed surveys are expected at the Edson Pump Station.

### Aboriginal Traditional Knowledge

ATK for the Edson Pump Station has been captured under the Edmonton to Hinton Segment where the station is located (Section 4.1.1).

#### **4.1.11 Hinton Pump Station**

The existing Hinton Pump Station, located in Alberta, is within the Montane Subregion of the Rocky Mountain Natural Region (Table 4.1-1). More specifically, it is located at NW 33-49-26 W5M at RK 339.4. Expansion of the Hinton Pump Station will require acquisition of approximately 0.32 ha of new partially forested Crown land to the west of and adjacent to existing Trans Mountain facility lands.

### Aboriginal Traditional Knowledge

ATK for the Hinton Pump Station has been captured under the Edmonton to Hinton Segment where the station is located (Section 4.1.1).

#### **4.1.12 Jasper Pump Station**

The existing Jasper Pump Station, located in Alberta, lies within the Montane Subregion of the Rocky Mountain Natural Region (Table 4.1-1). More specifically, it is located at NW 2-46-1 W6M. No disturbance of native vegetation is proposed at the Jasper Pump Station; all activities are confined to the existing station boundaries. Therefore, there will be no further mention of the station in regards to communities of concern and rare plants and lichens.

### Aboriginal Traditional Knowledge

Aboriginal communities reported that a variety of medicinal plants and berries grow near the Jasper Pump Station. The area is primarily forested but some plants favour cleared areas (TERA 2005).

#### **4.1.13 Rearguard Pump Station**

The existing Rearguard Pump Station is located entirely within the SBS BGC Zone (Table 4.1-3). More specifically, it is located at d-068-K/083-D-14 at RK 498.3. The expansion of the Rearguard Pump Station will require the acquisition of approximately 0.7 ha of new forested Crown land adjacent to and to the east of existing Trans Mountain facility lands.

### Aboriginal Traditional Knowledge

ATK for the Rearguard Pump Station has been captured under the Hargreaves to Darfield Segment where the station is located (Section 4.1.2).

#### **4.1.14 Blue River Pump Station**

The existing Blue River Pump Station is located entirely within the ICH BGC Zone (Table 4.1-3). More specifically, it is located at a-035-F/083-D-03 at RK 614.7. No disturbance of native vegetation is proposed at the Blue River Pump Station, therefore, there will be no further mention of the station in regards to communities of concern and rare plants and lichens.

### Aboriginal Traditional Knowledge

ATK for the Blue River Pump Station has been captured under the Hargreaves to Darfield Segment where the station is located (Section 4.1.2).

#### **4.1.15 Blackpool Pump Station**

The existing Blackpool Pump Station is located entirely within the IDF BGC Zone (Table 4.1-3). More specifically, it is located at d-075-B/092-P-08 at RK 769.0. No disturbance of native vegetation is proposed at the Blackpool Pump Station, therefore, there will be no further mention of the station in regards to communities of concern and rare plants and lichens.

### Aboriginal Traditional Knowledge

ATK for the Blackpool Pump Station has been captured under the Hargreaves to Darfield Segment where the station is located (Section 4.1.2).

#### **4.1.16 Darfield Pump Station**

The existing Darfield Pump Station is located entirely within the IDF BGC Zone (Table 4.1-3). More specifically, it is located at d-075-B/092-P-08 at RK 769.0. The expansion of the Darfield Pump Station will be both within the existing disturbed fenced area and west onto cultivated agricultural lands and require a small amount (0.07 ha) of land. No disturbance of native vegetation is proposed at the Darfield Pump Station, therefore, there will be no further mention of the station in regards to communities of concern and rare plants and lichens.

### Aboriginal Traditional Knowledge

ATK for the Darfield Pump Station has been captured under the Hargreaves to Darfield Segment where the station is located (Section 4.1.2).

#### **4.1.17 Black Pines Pump Station**

The proposed new Black Pines Pump Station and associated power line are both located entirely within the PP BGC Zone (Table 4.1-3). More specifically, this new station is located on forested and pasture lands at d-041-K/092-I-16 at RK 811.9. The Black Pines Pump Station will require a new land base of approximately 150 m x 150 m (approximately 2.3 ha) for the pump station and substation. A new 138 kV power line approximately 2.2 km long in a 50 m wide right-of-way will also be installed at the proposed Black Pines site. Current land use along the power line is forested.

### Aboriginal Traditional Knowledge

ATK for the Black Pines Pump Station has been captured under the Black Pines to Hope Segment where the station is located (Section 4.1.3).

#### **4.1.18 Kamloops Pump Station**

The existing Kamloops Pump Station is located within both the PP and BG BGC zones (Table 4.1-3). More specifically, it is located at d-094-E/092-I-09 at RK 850.8. No disturbance of native vegetation is proposed at the Kamloops Pump Station, therefore, there will be no further mention of the station in regards to communities of concern and rare plants and lichens.

### Aboriginal Traditional Knowledge

ATK for the Kamloops Pump Station has been captured under the Black Pines to Hope Segment where the station is located (Section 4.1.3).

#### **4.1.19 Kingsvale Pump Station**

The existing Kingsvale Pump Station and associated power line are located entirely within the IDF BGC Zone (Table 4.1-3). More specifically, the station is located at b-023-L/092-H-15 at RK 956.0. Some forested lands will be disturbed within the existing boundary of the Kingsvale Pump Station. A new 138 kV power line approximately 23.5 km long in a 50 m wide right-of-way will also be installed at the site. Current land use along the power line is forested.

### Aboriginal Traditional Knowledge

ATK for the Kingsvale Pump Station has been captured under the Black Pines to Hope Segment where the station is located (Section 4.1.3).

#### **4.1.20 Sumas Pump Station**

The existing Sumas Pump Station is located entirely within the CWH BGC Zone (Table 4.1-3). More specifically, it is located at c-073-B/092-G-01 at RK 1114.2. All work will be conducted within the existing disturbed fenced area and no disturbance of native vegetation is proposed at the Sumas Pump Station. Therefore, there will be no further mention of the station in regards to communities of concern and rare plants and lichens.

### Aboriginal Traditional Knowledge

ATK for the Sumas Pump Station has been captured under the Hope to Burnaby Segment where the station is located (Section 4.1.4).

#### **4.1.21 Sumas Terminal**

The existing Sumas Terminal is located entirely within the CWH BGC Zone (Table 4.1-4). More specifically, it is located at a-097-B/092-G-01 at RK 1117.5. The proposed activities are within the existing



Sumas Terminal property boundary, however, the existing fenceline will be moved approximately 20 m north (0.7 ha of new disturbance) into adjacent forested land.

#### Aboriginal Traditional Knowledge

ATK for the Sumas Terminal has been captured under the Hope to Burnaby Segment where the station is located (Section 4.1.4).

##### **4.1.22 Burnaby Terminal**

The existing Burnaby Terminal is located entirely within the CWH BGC Zone (Table 4.1-4). More specifically, it is located at a-025-D/092-G-07 at RK 1180.2. The proposed activities are within the existing Burnaby Terminal property boundary on previously disturbed industrial lands. No disturbance of native vegetation is proposed at the Burnaby Terminal, therefore, there will be no further mention of the terminal in regards to communities of concern and rare plants and lichens.

#### Aboriginal Traditional Knowledge

ATK for the Burnaby Terminal has been captured under the Hope to Burnaby Segment where the station is located (Section 4.1.4).

##### **4.1.23 Westridge Marine Terminal**

The Westridge Marine Terminal expansion is located entirely within the CWH BGC Zone (Table 4.1-4). More specifically, it is located at d-047-D/092-G-07 at RK 3.6 on reclaimed foreshore lands. The expansion of the existing Westridge Marine Terminal will include the construction of one dock with three operational berths, as well as a utility dock. During the marine habitat assessment conducted by Stantec Consultants Ltd., the area was determined to be heavily altered by past development. For further information see Marine Resources – Westridge Marine Terminal Technical Report (Volume 5C). Since the entire area of the marine riparian habitat at the Westridge Marine Terminal is modified or man-made, there will be no further mention of the terminal in regards to communities of concern and rare plants and lichens.

#### Aboriginal Traditional Knowledge

ATK for the Westridge Marine Terminal has been captured under the Burnaby to Westridge Segment where the terminal is located (Section 4.1.5).

## **4.2 Vegetation Communities of Concern**

Vegetation communities of concern are currently not listed by the *SARA*, the *Alberta Wildlife Act* or the *BC Wildlife Act*.

ACIMS provided records of rare ecological community EOs known from within 5 km of the proposed pipeline corridor (ACIMS 2013c). Details of the previously recorded occurrences are summarized in Table 4.2-1.

**TABLE 4.2-1**

**PREVIOUSLY RECORDED RARE ECOLOGICAL COMMUNITY OCCURRENCES WITHIN 5 KM OF ALBERTA PROJECT COMPONENTS**

Common Name	Scientific Name	Provincial Rank <sup>1</sup>	Project Component	Number of Recorded EOs	Distance to Proposed Pipeline Corridor <sup>2,3</sup> (km)
black spruce/red-osier dogwood/feathermoss	<i>Picea mariana</i> / <i>Cornus stolonifera</i> / <i>feathermoss</i>	S1S2	Edmonton to Hinton Segment	1	1.6
tamarack – black spruce/red-osier dogwood – wild red raspberry	<i>Larix laricina</i> – <i>Picea mariana</i> / <i>Cornus stolonifera</i> – <i>Rubus idaeus</i>	S1S2	Edmonton to Hinton Segment	1	1.7

**Source:** ACIMS 2013c

- Notes:**
- 1 Definitions of provincial ranks are summarized in the footnotes of Appendix B.
  - 2 All distances are approximate.
  - 3 ACIMS may buffer the location of an occurrence when mapping precision is low due to the age of the data, the detail submitted, or a landowner's wish to withhold the specific location from the public. The occurrence may be located anywhere within the buffer. Distances in this Table were measured from the proposed pipeline corridor to the nearest edge of each buffer.

Of the BC IWMS communities, seven have the potential to occur on lands in the Vegetation RSA based on BGC subzones crossed. Details of the communities are summarized in Table 4.2-2.

**TABLE 4.2-2**

**RARE ECOLOGICAL COMMUNITIES LISTED UNDER THE BC IWMS WITH POTENTIAL TO OCCUR ALONG THE BC PROJECT COMPONENTS**

Common Name	Scientific Name	Provincial Designation <sup>1</sup>	Relevant BGC Zone and Subzone by Project Component <sup>2</sup>		Potential to Interact with Project
			BP-H	H-B	
Alkali saltgrass Herbaceous Vegetation	<i>Distichlis spicata</i> var. <i>stricta</i> Herbaceous Vegetation	S2, Red	IDFdk1 IDFhx1 IDFhx2 IDFhx2a	--	In BC, this community occupies low elevations only at the southern end of the Rocky Mountain Trench (Lea 2004). The known range and previously recorded occurrences of this community ranging from 79 km to greater than 100 km from the proposed pipeline corridor suggests the interaction potential is low.
Antelope-brush/ needle-and-thread grass	<i>Purshia tridentata</i> / <i>Hesperostipa comata</i>	S1, Red	IDFhx1	--	In BC, this community is restricted to valley bottoms and lower slopes in the southern Rocky Mountain Trench south of Canal Flats and bounded on the west by St. Mary River, on the east by Baynes Lake and extending to the United States border at Tobacco Plains (Erickson 2004). The known range and lack of previously recorded occurrences of this community within 100 km of the proposed pipeline corridor suggests the interaction potential is low.
Douglas-fir/dull Oregon-grape	<i>Pseudotsuga menziesii</i> / <i>Mahonia nervosa</i>	S2, Red	--	CWHxm1	In BC, this community is restricted to low elevations along southeast Vancouver Island, the Gulf Islands south of Cortes Island, a narrow strip along the Sunshine Coast and near Halfmoon Bay (Pojar <i>et al.</i> 2004a). The known range and previously recorded occurrences of this community ranging from 49 km to greater than 100 km from the proposed pipeline corridor suggests the interaction potential is low.
Water birch/rose species	<i>Betula occidentalis</i> / <i>Rosa</i> spp.	S1, Red	IDFhx1 PPhx2	--	Previously recorded occurrences of this community ranges from 81 km to greater than 100 km from the proposed pipeline corridor suggesting the interaction potential is low.

**TABLE 4.2-2 Cont'd**

Common Name	Scientific Name	Provincial Designation <sup>1</sup>	Relevant BGC Zone and Subzone by Project Component <sup>2</sup>		Potential to Interact with Project
			BP-H	H-B	
Alkali saltgrass Herbaceous Vegetation	<i>Distichlis spicata</i> var. <i>stricta</i> Herbaceous Vegetation	S2, Red	IDFd1 IDFx1 IDFx2 IDFx2a	--	In BC, this community occupies low elevations only at the southern end of the Rocky Mountain Trench (Lea 2004). The known range and previously recorded occurrences of this community ranging from 79 km to greater than 100 km from the proposed pipeline corridor suggests the interaction potential is low.
western redcedar/devil's club	<i>Thuja plicata</i> / <i>Oplopanax horridus</i>	S1S2, Red	CWHds1	CWHds1	In BC this community occurs in the drainages of the lower Fraser River east and north of Chilliwack, in the eastern portion of the Cascade Mountains from upper Harrison Lake to Homothko River and north of Knight Inlet (Pojar <i>et al.</i> 2004b). The lack of previously recorded occurrences of this community within 100 km of the proposed pipeline corridor suggests the interaction potential is low.
western redcedar – Douglas-fir/vine maple	<i>Thuja plicata</i> – <i>Pseudotsuga menziesii</i> / <i>Acer circinatum</i>	S2S3, Blue	CWHds1	CWHds1	In BC this community occurs in the drainages of the lower Fraser River east and north of Chilliwack and in the eastern portion of the Cascade Mountains from upper Harrison Lake to Homothko River (Pojar 2004). The lack of previously recorded occurrences of this community within 100 km of the proposed pipeline corridor suggests the interaction potential is low.
western hemlock – Douglas-fir/electrified cat's-tail moss Dry Submaritime 1	<i>Tsuga heterophylla</i> – <i>Pseudotsuga menziesii</i> / <i>Rhytidiadelphus triquetrus</i> Dry Submaritime 1	S2, Red	CWHds1	CWHds1	In BC this community occurs in the drainages of the lower Fraser River east and north of Chilliwack and in the eastern portion of the Coast/Cascade Mountains from upper Harrison Lake to Homothko River (Pojar <i>et al.</i> 2004c). The lack of previously recorded occurrences of this community within 100 km of the proposed pipeline corridor suggests the interaction potential is low.

**Source:** BC MOE 2013

- Notes:**
- 1 Definitions of provincial designations are summarized in the footnotes of Appendix B.
  - 2 The Project Segments referred to are: BP-H = Black Pines to Hope Segment; and H-B = Hope to Burnaby Segment.

Of the communities ranked as Priority 1 by the BC MOE Conservation Framework, 50 are known to occur in the BGC zones and FDs that the proposed pipeline corridor crosses.

The BC CDC provided records of rare ecological community EOs known from within 5 km of the Project (BC CDC 2012a,b). Details of the previously recorded occurrences are summarized in Table 4.2-3.

**TABLE 4.2-3**

**PREVIOUSLY RECORDED RARE ECOLOGICAL COMMUNITY OCCURRENCES WITHIN 5 KM OF BC PROJECT COMPONENTS**

Common Name	Scientific Name	Provincial Designation <sup>1</sup>	Project Component	Number of Recorded EOs	Distance to Proposed Project Component <sup>2,3</sup> (km)
<b>Proposed Pipeline Corridor</b>					
lodgepole pine/velvet-leaved blueberry/ <i>Clad</i> lichens	<i>Pinus contorta</i> / <i>Vaccinium myrtilloides</i> / <i>Cladonia</i> spp.	S2S3, Blue	Hargreaves to Darfield Segment	3	0.0-2.7
Douglas-fir – western hemlock/salal Dry Maritime	<i>Pseudotsuga menziesii</i> – <i>Tsuga heterophylla</i> / <i>Gaultheria shallon</i> Dry Maritime	S2S3, Blue	Hope to Burnaby Segment	1	2.9
Garry oak/oceanspray	<i>Quercus garryana</i> / <i>Holodiscus discolor</i>	S1, Red	Hope to Burnaby Segment	1	2.9
<b>Pump Stations and Terminals</b>					
lodgepole pine/velvet-leaved blueberry/ <i>Clad</i> lichens	<i>Pinus contorta</i> / <i>Vaccinium myrtilloides</i> / <i>Cladonia</i> spp.	S2S3, Blue	Rearguard Pump Station	2	3.4 – 3.7

**TABLE 4.2-3 Cont'd**

Common Name	Scientific Name	Provincial Designation <sup>1</sup>	Project Component	Number of Recorded EOs	Distance to Proposed Project Component <sup>2,3</sup> (km)
Douglas-fir – western hemlock/salal Dry Maritime	<i>Pseudotsuga menziesii</i> – <i>Tsuga heterophylla</i> / <i>Gaultheria shallon</i>	S2S3, Blue	Sumas Terminal	1	3.9
Garry oak/oceanspray	<i>Quercus garryana</i> / <i>Holodiscus discolor</i>	S1, Red	Sumas Terminal	1	4.7

**Sources:** BC CDC 2012a,b

- Notes:**
- 1 Definitions of provincial designations are summarized in the footnotes of Appendix B.
  - 2 All distances are approximate.
  - 3 Where there are numerous occurrences of the same species, the range in distance to the proposed Project component is provided based on the closest and furthest occurrence.

#### **4.2.1 Edmonton to Hinton Segment**

ACIMS provided records of rare ecological community EOs known from within 5 km of the proposed pipeline corridor, which included two rare ecological communities (ACIMS 2013c). Details of the previously recorded occurrences are summarized in Table 4.2-1.

#### **4.2.2 Hargreaves to Darfield Segment**

No ecological communities listed under the IWMS for the BGC subzones present on this segment are known to occur from within 5 km of the segment (BC CDC 2012a,b).

The BC CDC provided records of rare ecological community EOs known from within 5 km of the proposed pipeline corridor, which included three rare ecological communities (BC CDC 2012a,b). Details of the previously recorded occurrences are summarized in Table 4.2-3.

#### **4.2.3 Black Pines to Hope Segment**

Six ecological communities listed under the IWMS are known to occur in the IDF, PP and CWH subzones present within the Black Pines to Hope Segment (BC MOE 2013). The six ecological communities are detailed in Table 4.2-2. Based on the known range, occurrences and habitat requirements of these communities, they are not expected to occur along the proposed pipeline corridor within the Black Pines to Hope Segment (Table 4.2-2).

No previously recorded occurrences of rare ecological communities with an IWMS designation are known from within 5 km of the Black Pines to Hope Segment (BC CDC 2012a,b).

There are also no BC CDC records of known rare ecological communities within 5 km of the proposed pipeline corridor for the Black Pines to Hope Segment (BC CDC 2012a,b).

During consultation, grassland communities within the BG BGC Zone in the Kamloops region were also identified as communities of concern. The proposed pipeline corridor intersects the BG BGC Zone at a few locations in the Black Pines to Hope Segment, while avoiding it for most of the pipeline length. The BG BGC Zone is intersected from approximately RK 829.4 to RK 848.8, RK 849.7 to RK 850.8, RK 896.8 to RK 897.0, RK 897.5 to RK 898.5, RK 899.0 to RK 899.1, RK 918.5 to RK 921.4, and RK 922.7 to RK 933.0 for a total of approximately 35 km.

#### **4.2.4 Hope to Burnaby Segment**

Four ecological communities listed under the IWMS are known to occur in the CWH subzones present within the Hope to Burnaby Segment of the proposed pipeline corridor (BC MOE 2013). The four ecological communities are detailed in Table 4.2-2. Based on the known range, occurrences and habitat requirements of these communities, they are not expected to occur along the proposed pipeline corridor within the Hope to Burnaby Segment (Table 4.2-2).

The BC CDC provided records of rare ecological community EOs known from within 5 km of the proposed pipeline corridor for the Hope to Burnaby Segment, which included two rare ecological communities (BC CDC 2012a,b). Details of the previously recorded occurrences are summarized in Table 4.2-3.

#### **4.2.5 Burnaby to Westridge Segment**

No ecological communities listed under the IWMS are known to occur in the CWH subzones present within the Burnaby to Westridge Segment of the proposed pipeline corridor (BC CDC 2012a,b). No previously recorded occurrences of rare ecological communities listed under the IWMS program are known from within 5 km of the Burnaby to Westridge Segment of the proposed pipeline corridor (BC CDC 2012a,b).

There are no BC CDC records of known rare ecological communities within 5 km of the proposed pipeline corridor for the Hope to Burnaby Segment (BC CDC 2012a,b).

#### **4.2.6 Gainford Pump Station**

There are no ACIMS records of known rare ecological communities within 5 km of the Gainford Pump Station (ACIMS 2013c).

#### **4.2.7 Hinton Pump Station**

There are no ACIMS records of known rare ecological communities within 5 km of the Hinton Pump Station (ACIMS 2013c).

#### **4.2.8 Rearguard Pump Station**

No ecological communities listed under the IWMS are known to occur in the BGC subzone of this site or from within 5 km of the Rearguard Pump Station (BC CDC 2012a,b).

There is one rare ecological community known from within 5 km of the Rearguard Pump Station (BC CDC 2012a,b). Details of the previously recorded occurrence are summarized in Table 4.2-3.

#### **4.2.9 Black Pines Pump Station**

No ecological communities listed under the IWMS are known to occur in the BGC subzone of this site or from within 5 km of the Black Pines Pump Station and power line (BC CDC 2012a,b).

There are no BC CDC records of known rare ecological communities within 5 km of the Black Pines Pump Station and power line (BC CDC 2012a,b).

#### **4.2.10 Kingsvale Pump Station**

No ecological communities listed under the IWMS are known to occur in the BGC subzone of this site or from within 5 km of the Kingsvale Pump Station and power line (BC CDC 2012a,b).

There are no BC CDC records of known rare ecological communities within 5 km of the Kingsvale Pump Station and power line (BC CDC 2012a,b).

#### **4.2.11 Sumas Terminal**

No ecological communities listed under the IWMS are known to occur in the BGC subzone of this site or from within 5 km of this terminal (BC CDC 2012a,b).

There are two known rare ecological communities from within 5 km of the Sumas Terminal (BC CDC 2012a,b). Details of the previously recorded occurrences are summarized in Table 4.2-3.

### **4.3 Plant and Lichen Species of Concern**

COSEWIC assesses the status of species and based on these assessments, the species may then be accepted for legal protection under the *SARA*. *SARA*-listed species (those on Schedule 1) are protected by the *SARA* on federal land.

In Alberta, the current legislation to protect species at risk, the Alberta *Wildlife Act*, was amended in 2007 to include some federally-designated plant species, which are afforded protection on all lands in Alberta.

In BC, the current legislation to protect species at risk, the BC *Wildlife Act*, does not currently list any plant species.

Of the two plant species designated by the IWMS, one, tall bugbane, has the potential to occur on lands in the vicinity of the proposed pipeline corridor.

Of the species ranked as Priority 1 by the BC MOE Conservation Framework, 31 species are known to occur in the BGC zones and FDs that the proposed pipeline corridor crosses.

#### **4.3.1 Edmonton to Hinton Segment**

##### Federal Rare Plants and Lichen

No plant species listed as Endangered, Threatened or Special Concern under the *SARA* or COSEWIC are known to occur in the Central Parkland, Dry Mixedwood, Central Mixedwood and Lower Foothills Natural Subregions (ACIMS 2013a). In the Montane Natural Subregion, there are five plant species with conservation status under the *SARA* and/or COSEWIC. Federal species of concern for the Edmonton to Hinton Segment of the proposed pipeline corridor are listed in Table 4.3.1-1.

Based on the known range, occurrences and habitat requirements of the five federally-listed plant species in the Edmonton to Hinton Segment, there is low potential for these species to occur along the proposed pipeline corridor (Table 4.3.1-1).

TABLE 4.3.1-1

FEDERAL SPECIES OF CONCERN ALONG THE ALBERTA PORTION OF THE PROPOSED PIPELINE CORRIDOR

Federal <sup>1</sup>		Common Name	Scientific Name <sup>4</sup>	Type	Natural Subregion <sup>5, 6</sup>					Potential Interaction with Project	
COSEWIC Designation <sup>2</sup>	SARA Designation <sup>3</sup>				CM	CP	DM	LF	M		
Endangered	Endangered	whitebark pine	<i>Pinus albicaulis</i>	vascular plant						L	<b>LOW:</b> In Canada, whitebark pine extends from the Canada-United States border to about 200 km north of Fort Saint James in the Coast Mountains and to about 150 km north of Jasper in the Rocky Mountains (COSEWIC 2010a). It occurs typically in high elevation, upper subalpine habitats ranging from timberline down to closed subalpine forest. Previously recorded occurrences of whitebark pine range from approximately 30 km to greater than 100 km from the proposed pipeline corridor and correspond to the geographical location described above suggesting the interaction potential is low.
Threatened	Threatened	Haller's apple moss	<i>Bartramia halleriana</i>	moss						L	<b>LOW:</b> The Canadian range of Haller's apple moss includes western Jasper National Park, Alberta, and adjacent BC along the Rocky Mountain Trench from about McBride south to Wood River. A total of 15 extant populations are known. The species is a habitat specialist, restricted to non-calcareous cliffs or talus in low elevation forests with high humidity and it has low dispersal ability (COSEWIC 2011a). A previously recorded occurrence of Haller's apple moss is located approximately 47 km from the proposed pipeline corridor and corresponds to the geographical location described above suggesting the interaction potential is low.
Threatened	Threatened	Porsild's bryum moss	<i>Haplodontium macrocarpum</i>	moss						L	<b>LOW:</b> In Alberta, Porsild's bryum moss is found at three sites; Whitehorse Wildland Park, Mountain Park and Kananaskis Country (COSEWIC 2003a). It grows in mainly mountainous areas on wet calcareous cliffs. Previously recorded occurrences of Porsild's bryum moss range from approximately 14 km to 40 km from the proposed pipeline corridor suggesting the interaction potential is low. No geographical location was identified for these occurrences.
Special Concern	Special Concern	western blue flag	<i>Iris missouriensis</i>	vascular plant						L	<b>LOW:</b> In Canada, western blue flag is restricted to about 500 km <sup>2</sup> in the grasslands of southern Alberta (COSEWIC 2010b). The known range and lack of previously recorded occurrences of western blue flag within 100 km of the proposed pipeline corridor suggest the interaction potential is low.
Data Deficient	--	long-stalked whitlow-grass	<i>Draba juvenilis</i>	vascular plant						L	<b>LOW:</b> Long-stalked whitlow-grass is endemic to the Canadian Rockies (COSEWIC 2011b). In Alberta, it occurs on moist banks and ledges in alpine areas or in ravines, near streams and springs and on gravelly beaches and open grassy slopes (Kershaw <i>et al.</i> 2001). Previously recorded occurrences of long-stalked whitlow-grass range from approximately 40-90 km from the proposed pipeline corridor and correspond to the geographical location described above suggesting the interaction potential is low.

Sources: ACIMS 2013a, COSEWIC 2011b, 2013a, Government of Canada 2013

Notes:

- 1 Species listed by SARA and COSEWIC are current as of October 2013.
- 2 COSEWIC 2013a. Species listed as Extirpated or Not at Risk were generally not included in the table without other noteworthy factors being present.  
**Endangered:** a species facing imminent extirpation or extinction.  
**Threatened:** a species likely to become Endangered if limiting factors are not reversed.  
**Special Concern:** a species that is particularly sensitive to human activities or natural events, but is not an Endangered or Threatened species.  
**Data Deficient:** A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk to extinction.
- 3 SARA. The Act establishes Schedule 1 as the list of species to be protected on all federal lands in Canada.  
**Endangered:** a species that is facing imminent extirpation or extinction.  
**Threatened:** a species that is likely to become an Endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.  
**Special Concern:** a species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
- 4 ACIMS uses synonyms for some federally-listed species. The ACIMS scientific name for Porsild's bryum moss is *Mielichhoferia macrocarpum*.
- 5 The natural subregions are: CM=Central Mixedwood; CP=Central Parkland; DM=Dry Mixedwood; LF=Lower Foothills; and M=Montane.
- 6 All plant species with the potential to occur based on Natural Subregion are indicated. The potential for the proposed pipeline corridor to interact with a plant species is described as follows: L=Low, M=Moderate and H=High. Generally the potential interaction score is base on the known range as well as the distance of known occurrences to the proposed pipeline corridor as follow: L = occurrences > 10 km; M = occurrences > 1-10 km; and H = occurrences ≤ 1 km.

## Provincial Rare Plants and Lichens

No plant species listed under the Alberta *Wildlife Act* are known to occur in the Central Parkland, Dry Mixedwood, Central Mixedwood and Lower Foothills Natural Subregions (ACIMS 2013a). The three plant species listed under the Alberta *Wildlife Act* known to occur in the Montane Natural Subregion are: whitebark pine; limber pine (*Pinus flexilis*); and Porsild's bryum moss which are all designated as Endangered. Definitions of provincial designations are provided in the footnotes of Appendix B.

No previously recorded occurrences of rare plant species with an Alberta *Wildlife Act* designation are known from within 5 km of Edmonton to Hinton Segment (ACIMS 2013c).

As previously described, whitebark pine and Porsild's bryum moss are not expected to occur along the proposed pipeline corridor in the Edmonton to Hinton Segment (Table 4.3.1-1). Limber pine is known in Alberta from the border with Montana to as far north as Windy Point and Abraham Lake, west of Nordegg (ASRD and Alberta Conservation Association 2007). The known range and lack of previously recorded occurrences of limber pine within 100 km of the proposed pipeline corridor suggest that limber pine is also not expected to occur along the corridor in the Edmonton to Hinton Segment.

ACIMS provided records of rare plant EOs known from within 5 km of the Edmonton to Hinton Segment, which included 46 rare vascular plants, 33 mosses, 18 lichens and 9 liverworts (ACIMS 2013c). Details of the previously recorded occurrences are summarized in Table 4.3.1-2.

**TABLE 4.3.1-2**  
**PREVIOUSLY RECORDED RARE PLANT AND LICHEN**  
**OCCURRENCES WITHIN 5 KM OF THE EDMONTON TO HINTON SEGMENT**

Common Name	Scientific Name	Type	Provincial Rank <sup>1</sup>	Number of Recorded EOs	Distance to Proposed Pipeline Corridor <sup>2,3,4</sup> (km)
aloe-like rigid screw moss	<i>Aloina rigida</i>	moss	S2	1	2.1
bean-spored rim-lichen	<i>Lecania dubitans</i>	lichen	S2S4	1	3.3
black woodsript lichen	<i>Xylographa parallela</i>	lichen	S2S4	1	4.0
bog adder's-mouth	<i>Malaxis paludosa</i>	vascular plant	S1	1	4.0
<i>Brachythecium</i> moss	<i>Brachythecium rutabulum</i>	moss	S2?	1	within buffer
<i>Brachythecium</i> moss	<i>Brachythecium frigidum</i>	moss	SU	1	within buffer
<i>Brachythecium</i> moss	<i>Brachythecium acuminatum</i>	moss	S1S2	1	1.5
broad-leaved arrowhead	<i>Sagittaria latifolia</i>	vascular plant	S2	1	1.6
brown moss	<i>Drepanocladus crassicosatus</i>	moss	S2	1	4.0
<i>Bryum</i> moss	<i>Bryum algovicum</i>	moss	S2	2	within buffer to 4.8
bumpy rim-lichen	<i>Lecanora hybocarpa</i>	lichen	S2	1	4.0
<i>Campyllum</i> moss	<i>Campyllum radicale</i>	moss	S2	1	3.7
cat-tongue liverwort	<i>Conocephalum salebrosum</i>	liverwort	S2	1	0.4
clam lichen	<i>Hypocenomyce friesii</i>	lichen	S2	1	within buffer
clammy hedge-hyssop	<i>Gratiola neglecta</i>	vascular plant	S2	4	0.4-1.1
comb liverwort	<i>Riccardia multifida</i>	liverwort	S2S3	1	3.7
crystalwort	<i>Riccia fluitans</i>	liverwort	S2	1	4.9
curl-leaved fork moss	<i>Dicranella crispa</i>	moss	S2	1	3.9
Donian beardless moss	<i>Seligeria donniana</i>	moss	S2	1	0.7
dot lichen	<i>Hypocenomyce anthracophila</i>	lichen	S1	1	0.1
dot lichen	<i>Bacidia bagliettoana</i>	lichen	S2	2	0.7-1.4
dot lichen	<i>Micarea melaena</i>	lichen	S1	1	4.2
endive peltia	<i>Pellia endiviifolia</i>	liverwort	S2	1	4.5
flagon-fruited splachnum moss	<i>Splachnum ampullaceum</i>	moss	S2	1	within buffer
flat fruited pelt lichen	<i>Peltigera horizontalis</i>	lichen	S2S3	2	1.2-3.8
flat-topped white aster	<i>Doellingeria umbellata</i> var. <i>pubens</i>	vascular plant	S2	11	0.6-4.2
<i>Fontinalis</i> moss	<i>Fontinalis missourica</i>	moss	S1	1	4.6
fox sedge	<i>Carex vulpinoidea</i>	vascular plant	S2	2	0.7-2.2



**TABLE 4.3.1-2 Cont'd**

Common Name	Scientific Name	Type	Provincial Rank <sup>1</sup>	Number of Recorded EOs	Distance to Proposed Pipeline Corridor <sup>2,3,4</sup> (km)
frosted rim-lichen	<i>Lecanora caesiurubella</i> ssp. <i>saximontana</i>	lichen	S1	1	3.3
hooded ramalina	<i>Ramalina obtusata</i>	lichen	S2	1	1.8
lime entodon moss	<i>Entodon concinnus</i>	moss	S2	2	2.3-4.2
<i>Limprichtia</i> moss	<i>Limprichtia cossonii</i>	moss	SU	2	3.6-3.7
linear-leaved pondweed	<i>Potamogeton strictifolius</i>	vascular plant	S2	1	4.9
long-leaved bluets	<i>Hedyotis longifolia</i>	vascular plant	S2	1	5.0
long-stalked beardless moss	<i>Desmatodon heimii</i>	moss	S2	1	within buffer
<i>Lophozia</i> liverwort	<i>Lophozia badensis</i>	liverwort	S1	1	within buffer
Macloskey's violet	<i>Viola pallens</i>	vascular plant	S2S3	1	3.3
maidenhair moss	<i>Fissidens adianthoides</i>	moss	S2	2	within buffer to 4.5
marsh muhly	<i>Muhlenbergia racemosa</i>	vascular plant	S2	5	0.3-4.8
<i>Meesia</i> moss	<i>Meesia longisetata</i>	moss	S1	1	2.5
Ontario rhodobryum moss	<i>Rhodobryum ontariense</i>	moss	S2	2	3.7-4.1
mottled-disk lichen	<i>Trapeliopsis flexuosa</i>	lichen	S1S3	1	4.0
mountain bladder fern	<i>Cystopteris montana</i>	vascular plant	S2	1	1.5
narrow-leaved chain-teeth moss	<i>Desmatodon cernuus</i>	moss	S1	1	3.7
pepper-spore lichen	<i>Rinodina albertana</i>	lichen	S2	1	1.4
<i>Pohlia</i> moss	<i>Pohlia atropurpurea</i>	moss	S1	1	4.9
porcupine sedge	<i>Carex hystericina</i>	vascular plant	S1	1	within buffer
powdered fringed lichen	<i>Heterodermia speciosa</i>	lichen	S2	1	1.2
<i>Pseudevernia</i> lichen	<i>Pseudevernia consocians</i>	lichen	S1	1	4.2
Purple-fringed Riccia	<i>Ricciocarpos natans</i>	liverwort	S2	1	4.9
<i>Riccardia</i> liverwort	<i>Riccardia latifrons</i>	liverwort	S2	3	2.2-4.4
rigid screw moss	<i>Didymodon rigidulus</i>	moss	S2	1	1.1
rusty ragged moss	<i>Brachythecium plumosum</i>	moss	S2	1	3.7
sandwort	<i>Arenaria longipedunculata</i>	vascular plant	S1	1	within buffer
scalloped grapefern	<i>Botrychium crenulatum</i>	vascular plant	S1	1	2.0
<i>Scouleria</i> moss	<i>Scouleria aquatica</i>	moss	S2	1	within buffer
short-tooth hump moss	<i>Amblyodon dealbatus</i>	moss	S2	1	3.7
slender beak-rush	<i>Rhynchospora capillacea</i>	vascular plant	S1	3	3.7-4.9
slender hairy-cap moss	<i>Polytrichum longisetum</i>	moss	S1	1	0.5
slender naiad	<i>Najas flexilis</i>	vascular plant	S2	3	1.7-4.9
slender spikerush	<i>Eleocharis elliptica</i>	vascular plant	S2?	1	3.9
smooth sweet cicely	<i>Osmorhiza longistylis</i>	vascular plant	S2	3	1.8-4.0
soot lichen	<i>Cyphelium tigillare</i>	lichen	S2	1	within buffer
spatulate grape fern	<i>Botrychium spathulatum</i>	vascular plant	S2	1	0.1
spotted Joe-pye weed	<i>Eupatorium maculatum</i>	vascular plant	S1S2	1	4.3
spring moss	<i>Aongstroemia longipes</i>	moss	S2	1	4.9
stubble lichen	<i>Calicium salicinum</i>	lichen	S1	1	0.0
twisted bog moss	<i>Sphagnum contortum</i>	moss	S2	2	within buffer to 1.7
two-leaved waterweed	<i>Elodea bifoliata</i>	vascular plant	S2	2	within buffer to 0.9
undulated crane's bill moss	<i>Atrichum undulatum</i>	moss	S1S2	1	within buffer
watermeal	<i>Wolffia columbiana</i>	vascular plant	S2	1	0.6

**Source:** ACIMS 2013c

- Notes:**
- 1 Definitions of provincial ranks are summarized in the footnotes of Appendix B.
  - 2 All distances are approximate.
  - 3 ACIMS may buffer the location of an occurrence when mapping precision is low due to the age of the data, the detail submitted, or a landowner's wish to withhold the specific location from the public. The occurrence may be located anywhere within the buffer. Distances in this table were measured from the proposed pipeline corridor to the nearest edge of each buffer. When the proposed pipeline corridor intersects the buffer, distances are noted as "within buffer".

- 4 Where there are numerous occurrences of the same species, the range in distance to the proposed pipeline corridor is provided based on the closest and furthest occurrence.

### **4.3.2 Hargreaves to Darfield Segment**

#### **Federal Rare Plants and Lichens**

When considering all BGCs within the Hargreaves to Darfield Segment there are a total of 19 plant and lichen species with conservation status under the *SARA* and/or *COSEWIC* of which 8 are designated as Endangered, 5 are designated as Threatened, 4 are designated as Special Concern, 1 is designated as Threatened under *COSEWIC* but has no status under the *SARA* and 1 is designated as Special Concern under *COSEWIC* but Threatened under the *SARA*. Federal species of concern are listed in Table 4.3.2-1.

Based on known range, occurrences and habitat requirements, 16 of the 19 federally-listed plant and lichen species in the Hargreaves to Darfield Segment are not expected to occur along the proposed pipeline corridor (Table 4.3.2-1).

The remaining three federally-listed species may have a higher potential of occurring along the proposed pipeline corridor and include: whitebark pine; Haller's apple moss; and Mexican mosquito fern, which are designated as Endangered, Threatened and Threatened respectively under the *SARA* and *COSEWIC*. Table 4.3.2-1 provides the habitat description for these species.

Six occurrences of rare plants with a *SARA* and *COSEWIC* designation, including Haller's apple moss and Mexican mosquito fern, have been previously recorded within 5 km of the Hargreaves to Darfield Segment (BC CDC 2012a,b). Details of the previously recorded occurrences are summarized in Table 4.3.2-2.

TABLE 4.3.2-1

FEDERAL SPECIES OF CONCERN ALONG THE BC PORTION OF THE PROPOSED PIPELINE CORRIDOR

Federal <sup>1</sup>		Common Name <sup>4</sup>	Scientific Name <sup>4</sup>	Type	BGC Zone <sup>5</sup>									Potential Interaction with Project	Project Component <sup>6,7</sup>					
COSEWIC Designation <sup>2</sup>	SARA Designation <sup>3</sup>				BG	CWH	ESSF	ICH	IDF	MS	MH	PP	SBS		H-D	BP-H	H-B	B-W		
Endangered	Endangered	bent spike-rush, southern mountain population	<i>Eleocharis geniculata</i>	vascular plant	Y										<b>LOW:</b> Bent spike-rush, southern mountain population, has been reported from one location in BC, a property on the east shore of Osoyoos Lake (COSEWIC 2009a). Searches for bent spike-rush at many sites in BC in the years prior to 2009 suggest the range has not changed (COSEWIC 2009a). The known range and lack of previously recorded occurrences of bent spike-rush within 100 km of the proposed pipeline corridor suggest the interaction potential is low.		L			
		bog bird's-foot trefoil	<i>Lotus pinnatus</i>	vascular plant		Y										<b>LOW:</b> There are currently seven known populations of bog bird's-foot trefoil in Canada, all of which are found near Nanaimo on Vancouver Island, or on the neighbouring Gabriola Island (COSEWIC 2004a). In recent years, thorough searches (possibly excluding private lands) conducted in BC have not discovered new sites (COSEWIC 2013b). Previously recorded occurrences of bog bird's-foot trefoil range from approximately 59-75 km from the proposed pipeline corridor and correspond to the geographical locations described above suggesting the interaction potential is low.		L	L	L
		branched phacelia	<i>Phacelia ramosissima</i>	vascular plant	Y						Y					<b>LOW:</b> The total branched phacelia population in BC consists of three separate populations all on the slopes of Mount Kruger, near Osoyoos, in the southern Okanagan Valley (COSEWIC 2005a). The known range and lack of previously recorded occurrences of branched Phacelia within 100 km of the proposed pipeline corridor suggest the interaction potential is low.	L	L		
		deltoid balsamroot	<i>Balsamorhiza deltoidea</i>	vascular plant		Y										<b>LOW:</b> In Canada, deltoid balsamroot has been reported from at least 16 coastal locations on the southeast side of Vancouver Island, from Campbell River to the vicinity of Victoria (COSEWIC 2009b). Previously recorded occurrences of deltoid balsamroot range from approximately 73 km to greater than 100 km from the proposed pipeline corridor and correspond to the geographical locations described above suggesting the interaction potential is low.		L	L	L
		dwarf woolly-heads, southern mountain population	<i>Psilocarphus brevissimus</i>	vascular plant								Y				<b>LOW:</b> In BC, the dwarf woolly-heads southern mountain population occurs at three known sites from only the Similkameen Valley south of Princeton (COSEWIC 2006a). The Princeton populations appear to be restricted to non-saline vernal pools, a rare habitat type at low elevations in south central BC. Previously recorded occurrences of dwarf woolly-heads range from approximately 41 km to 42 km from the proposed pipeline corridor and correspond to the geographical locations described above suggesting the interaction potential is low.	L	L		
		Grand Coulee owl-clover	<i>Orthocarpus barbatus</i>	vascular plant	Y									Y		<b>LOW:</b> In Canada, Grand Coulee owl-clover occurs at four sites in the southern Okanagan and Similkameen valleys (COSEWIC 2005b). All sites are within a 2.5 km x 16 km band along the United States border. Searches in both valleys from 1996 to present have found no further populations (COSEWIC 2005b). The known range and lack of previously recorded occurrences of Grand Coulee owl-clover within 100 km of the proposed pipeline corridor suggest the interaction potential is low.	L	L		
		marginated streamside moss	<i>Scouleria marginata</i>	moss						Y						<b>LOW:</b> Marginated streamside moss appears restricted to southern BC where it has been found only once at a location near Boundary Lake and Boundary Creek in the Kootenay Region near the Canadian-American border (COSEWIC 2002a, 2012a). The known range and lack of previously recorded occurrences of marginated streamside moss within 100 km of the proposed pipeline corridor suggest the interaction potential is low.	L			
		nugget moss	<i>Microbryum vlassovii</i>	moss	Y									Y		<b>MODERATE:</b> In Canada, nugget moss has been reported from two locations in south central BC (east of Kamloops and on the east side of Penticton) (COSEWIC 2006b). Only the Penticton population was confirmed during the most recent survey (COSEWIC 2012b). It occurs on undisturbed and compact silts and clays on lacustrine banks and low-elevation grasslands. Although there are no previously recorded occurrences of nugget moss within 100 km of the proposed pipeline corridor, the known range and presence of suitable habitat suggests the interaction potential near Kamloops may be moderate.		M		
		pink sand-verbena	<i>Abronia umbellata</i>	vascular plant		Y										<b>LOW:</b> Prior to 1927, pink sand-verbena was known in Canada only at Bamfield (shore of Pachena Bay) and at Ahousat (near Tofino) on the central West Coast of Vancouver Island. It was also recently observed in 2000 and 2001 at Clo-oose Bay south of Tofino (COSEWIC 2004b). The known range and lack of previously recorded occurrences of pink sand-verbena within 100 km of the proposed pipeline corridor suggest the interaction potential is low.		L	L	L
		poor pocket moss	<i>Fissidens pauperculus</i>	moss		Y										<b>LOW to MODERATE:</b> In Canada, there is only one known population of poor pocket moss, which is located in a public city nature park in North Vancouver (Lynn Canyon), BC. It consists of a single small clump with adjacent tufts within a stream bed in a forest (COSEWIC 2011c). The known range and a previously recorded occurrence of poor pocket moss at approximately 7 km to 10 km from the proposed pipeline corridor and corresponding to the geographical location described above suggest the interaction potential may be low to moderate.		L	L	M
		prairie lupine	<i>Lupinus lepidus</i>	vascular plant		Y										<b>LOW:</b> In Canada, prairie lupine is restricted to southeastern Vancouver Island in BC. Historically, it was found from just north of Duncan, south to Oak Bay and west to Langford (COSEWIC 2009c). Previously recorded occurrences of prairie lupine range from approximately 77 km to greater than 100 km from the proposed pipeline corridor and correspond to the geographical location described above suggesting the interaction potential is low.		L	L	L
		rayless goldfields	<i>Lasthenia glaberrima</i>	vascular plant		Y										<b>LOW:</b> There is only one known population of rayless goldfields in Canada, in East Sooke Regional Park, near Victoria, BC. Targeted surveys from 2003 to 2006 have failed to discover additional populations (COSEWIC 2008a). The known range and lack of previously recorded occurrences of rayless goldfields within 100 km of the proposed pipeline corridor suggest the interaction potential is low.		L	L	L
		rigid apple moss	<i>Bartramia stricta</i>	moss		Y										<b>LOW:</b> In Canada, rigid apple moss occurs at five sites on southeastern Vancouver Island and the adjacent Gulf Islands, where it is restricted to Garry Oak ecosystems (COSEWIC 2009d). Previously recorded occurrences of rigid apple moss range from approximately 76 km to 98 km from the proposed pipeline corridor and correspond to the locations just described suggesting the interaction potential is low.		L	L	L
		rusty cord-moss	<i>Entosthodon rubiginosus</i>	moss										Y		<b>MODERATE:</b> In Canada, rusty cord-moss has been found at four sites in south-central BC: the White Lake area in the southern Okanagan Valley; southeast of Princeton; northwest of Kamloops; and south of Riske Creek in the Cariboo Forest Region (COSEWIC 2004c). It is restricted to seasonally damp and alkaline, usually silt- or clay-rich soil at edges of ponds, lakes and sloughs, and on seepage slopes in relatively dry environment. Previously recorded occurrences of rusty cord-moss range from approximately 8-42 km from the proposed pipeline corridor and correspond to the geographical locations described above, with the closest occurrence just northwest of Kamloops suggesting that the interaction potential may be moderate.		M		
		scarlet ammannia	<i>Ammannia robusta</i>	vascular plant	Y											<b>LOW:</b> Scarlet ammannia is found in the Osoyoos Lake area of south central BC with four sites recorded: one at Haynes Point, two in the Osoyoos Indian Reserve and one at Veronica Lake (COSEWIC 2013c). The known range and lack of previously recorded occurrences of scarlet ammannia within 100 km of the proposed pipeline corridor suggest the interaction potential is low.		L		
seaside centipede lichen	<i>Heterodermia sitchensis</i>	lichen		Y										<b>LOW:</b> In Canada, seaside centipede lichen occurs from the Pacific Rim National Park Reserve to an area 210 km north of Vancouver Island (COSEWIC 2006c). The known range and lack of previously recorded occurrences of seaside centipede lichen within 100 km of the proposed pipeline corridor suggest the interaction potential is low.		L	L	L		
short-rayed alkali aster	<i>Symphotrichum frondosum</i>	vascular plant	Y									Y		<b>MODERATE:</b> In BC, short-rayed alkali aster is known from primarily in the southern Okanagan Valley where it has been confirmed at four locations: the shores of Osoyoos Lake; Vaseux Lake; Skaha Lake and Max Lake (COSEWIC 2006d). An ephemeral disjunct population was reported from Surrey, along the shore of the Fraser River. This site is now Extirpated, however, this indicates that the species most likely occurs upstream in the Fraser-Thompson drainage basin (COSEWIC 2006d). It is a late emergent shoreline species reported from lakeshore habitats in moist drawdown zones of sandy beaches and perimeters of alkali lakes and ponds in BC. Previously recorded occurrences of short-rayed alkali aster at approximately 99 km to greater than 100 km from the proposed pipeline corridor indicate a low potential, however, with consideration of this species possible range along the Fraser River the potential interaction may be moderate.		M				

TABLE 4.3.2-1 Cont'd

Federal <sup>1</sup>		Common Name <sup>4</sup>	Scientific Name <sup>4</sup>	Type	BGC Zone <sup>5</sup>									Potential Interaction with Project	Project Component <sup>6,7</sup>				
COSEWIC Designation <sup>2</sup>	SARA Designation <sup>3</sup>				BG	CWH	ESSF	ICH	IDF	MS	MH	PP	SBS		H-D	BP-H	H-B	B-W	
Endangered (cont'd)	Endangered (cont'd)	silver hair moss	<i>Fabronia pusilla</i>	moss		Y									<b>LOW to HIGH:</b> In Canada, silver hair moss has only been found at two sites in BC: near Lower Arrow Lake in the Kootenay Valley; and on the west end of Sumas Mountain east of Abbotsford. Silver hair moss grows on semi-exposed rock or the surface of tree bark (COSEWIC 2002b, 2012c). A previously recorded occurrence of silver hair moss at approximately 1 km from the proposed pipeline corridor corresponding to the Sumas Mountain location just described suggests the interaction potential may be high on the Hope to Burnaby Segment.		L	H	L
		slender collomia	<i>Collomia tenella</i>	vascular plant							Y				<b>LOW:</b> In Canada, the slender collomia has been observed only in the Similkameen River Valley, in the vicinity of Princeton, in southwestern BC (Douglas and Penny 2003). A previously recorded occurrence of slender collomia at approximately 40 km from the proposed pipeline corridor corresponding to the geographical location described above suggests the interaction potential is low.	L	L		
		small-flowered lipocarpa	<i>Lipocarpa micrantha</i>	vascular plant	Y										<b>LOW:</b> In BC, a single extant small-flowered lipocarpa population is known to exist at Lake Osoyoos in the Okanagan Valley. A second population at Lake Osoyoos was extirpated by 1985 (COSEWIC 2002c). The known range and a previously recorded occurrence of small-flowered lipocarpa at approximately 98 km from the proposed pipeline corridor and located by Okanagan Lake suggests the interaction potential is low.		L		
		southern maiden-hair fern	<i>Adiantum capillus-veneris</i>	vascular plant								Y			<b>LOW:</b> In Canada, the southern maiden-hair fern is known from three to four subpopulations at the Fairmont Hot Springs in southeastern BC (COSEWIC 2011d). The known range and lack of previously recorded occurrences of southern maiden-hair fern within 100 km of the proposed pipeline corridor suggest the interaction potential is low.	L	L		
		Spalding's campion	<i>Silene spaldingii</i>	vascular plant										Y	<b>LOW:</b> In Canada, Spalding's campion is limited to an area of less than 1 km <sup>2</sup> in the northern part of the rolling Tobacco Plains on a private ranch near Roosville, BC (COSEWIC 2005c). The known range and lack of previously recorded occurrences of Spalding's campion within 100 km of the proposed pipeline corridor suggest the interaction potential is low.		L		
		stoloniferous pussytoes	<i>Antennaria flagellaris</i>	vascular plant									Y		<b>LOW:</b> In Canada, stoloniferous pussytoes has been observed only in the Similkameen River Valley, southwest of Princeton, in southwestern BC (COSEWIC 2004d). Three populations are known along a 3.2 km stretch of Highway 3 between Stevenson Lake and Tracey Lake in the Similkameen River Valley. Previously recorded occurrences of stoloniferous pussytoes range from approximately 40 km to 48 km from the proposed pipeline corridor and correspond to the geographical location described above suggesting the interaction potential is low.	L	L		
		streambank lupine	<i>Lupinus rivularis</i>	vascular plant		Y									<b>LOW to MODERATE:</b> In Canada, there are six known populations of streambank lupine in southwestern BC: one on Vancouver Island; and five in the lower Fraser Valley at Surrey, Delta and Port Coquitlam (COSEWIC 2002d). It occupies open sandy or gravelly, moist, river or creek bank sites subject to flooding and proximal to the coast with generally little ground cover. Previously recorded occurrences of streambank lupine range from approximately 3 km to 97 km from the proposed pipeline corridor and correspond to the Fraser Valley locations suggesting the interaction potential may be low to moderate.		L	M	L
		tall bugbane	<i>Actaea elata</i>	vascular plant		Y								Y	<b>LOW to HIGH:</b> In Canada, there are seven extant populations of tall bugbane, as well as one historic and two unverified populations, all found sporadically in the Chilliwack River valley west of the Coast-Cascade Mountain range in BC (Penny and Douglas 2001). It grows in shady, moist, mixed, mature western red cedar-hemlock and Douglas-fir, but also in predominately deciduous stands. Previously recorded occurrences of tall bugbane range from approximately 1-94 km from the proposed pipeline corridor and correspond to the locations in the Chilliwack River valley from Bridal Veil Provincial Park, BC to just west of Cultus Lake, BC suggesting the interaction potential may be low to high.		L	H	L
		tall woolly-heads	<i>Psilocarphus elatior</i>	vascular plant		Y									<b>LOW:</b> In Canada, tall woolly-heads occurs in southwestern BC, southeastern Alberta and southwestern Saskatchewan. In BC the population is restricted to southern Vancouver Island. (COSEWIC 2013d). Previously recorded BC occurrences of tall woolly-heads range from approximately 76 km to 95 km from the proposed pipeline corridor and correspond to the southern Vancouver Island location suggesting the interaction potential is low.		L	L	L
		toothcup <sup>8</sup>	<i>Rotala ramosior</i>	vascular plant	Y										<b>HIGH:</b> In BC, toothcup is found along Kamloops Lake and Osoyoos Lake (COSEWIC 2013e). It inhabits moist, sandy shorelines or moist to dried, alkaline flats. Previously recorded occurrences of toothcup range from less than one km to 4 km from the proposed pipeline and correspond to candidate/draft toothcup critical habitat suggesting the interaction potential may be high.		H		
		white meconella	<i>Meconella oregana</i>	vascular plant		Y									<b>LOW:</b> In Canada, white meconella has been documented in low-lying coastal areas from Victoria to Nanaimo, in the Gulf Islands and in Port Alberni and is fully contained within Garry Oak Ecosystem (COSEWIC 2005d). Previously recorded occurrences of white meconella range from approximately 53 km to 98 km from the proposed pipeline corridor and correspond to the geographical locations described above suggesting the interaction potential is low.		L	L	L
		whitebark pine <sup>8</sup>	<i>Pinus albicaulis</i>	vascular plant		Y	Y	Y	Y	Y	Y	Y		Y	<b>LOW to HIGH:</b> In Canada, whitebark pine extends from the Canada-United States border to about 200 km north of Fort. Saint James in the Coast Mountains and to about 150 km north of Jasper in the Rocky Mountains (COSEWIC 2010a). It occurs typically in high elevation, upper subalpine habitats ranging from timberline down to closed subalpine forest. Previously recorded occurrences of whitebark pine range from approximately 5 km to greater than 100 km from the proposed pipeline corridor corresponding to locations in Manning Provincial Park, BC and the closest occurrences north of Valemount, BC. Candidate/draft whitebark pine critical habitat occurs within 1 km of the proposed corridor in two locations. This suggests the interaction potential is low on some segments and high on other segments.	H	H	L	L
		yellow montane violet praemorsa subspecies	<i>Viola praemorsa</i> ssp. <i>praemorsa</i>	vascular plant		Y									<b>LOW:</b> Yellow montane violet praemorsa subspecies is only known in Canada from along the southeastern coast of Vancouver Island in BC and on adjacent islands in the Strait of Georgia (COSEWIC 2007). Previously recorded occurrences of yellow montane violet praemorsa subspecies range from approximately 66-99 km from the proposed pipeline corridor and correspond to the geographical locations described above suggesting the interaction potential is low.		L	L	L
--	Roell's brotherella moss	<i>Brotherella roellii</i>	moss		Y								<b>LOW to HIGH:</b> In Canada, Roell's brotherella moss is known from 26 current and 4 historical records at isolated locations within the Lower Mainland of the Fraser River and Howe Sound area of BC. In the Lower Mainland, scattered sites occur between Point Grey on the western end of Vancouver and as far east as Ruby Creek, just west of Hope, BC (COSEWIC 2010c). It occurs in cool, humid second-growth mixedwood forests on stream terraces, swampy flood plains and occasionally in ravines with creeks. Many of the current locations occur within city parks. Although there are no previously recorded occurrences of Roell's brotherella moss documented within 100 km of the proposed pipeline corridor, the known range suggests the interaction potential may be low to high.		L	H	L		
--	batwing vinyl lichen	<i>Leptogium platynum</i>	lichen		Y								<b>LOW to MODERATE:</b> In Canada, a total of seven populations of batwing vinyl lichen have been reported from BC. Six populations are from the south of Vancouver Island and one from Lower Fraser Valley. The species is restricted to rock outcrops subjected to periodic seepage (COSEWIC 2011e). Previously recorded occurrences of batwing vinyl lichen range from approximately 2-97 km from the proposed pipeline corridor and correspond to the geographical locations described above, with the closest occurrences on the west end of Sumas Mountain near Chilliwack, suggesting the interaction potential may be low to moderate.		L	M	L		

TABLE 4.3.2-1 Cont'd

Federal <sup>1</sup>		Common Name <sup>4</sup>	Scientific Name <sup>4</sup>	Type	BGC Zone <sup>5</sup>									Potential Interaction with Project	Project Component <sup>6,7</sup>				
COSEWIC Designation <sup>2</sup>	SARA Designation <sup>3</sup>				BG	CWH	ESSF	ICH	IDF	MS	MH	PP	SBS		H-D	BP-H	H-B	B-W	
Threatened	Threatened	alkaline wing-nerved moss	<i>Pterygoneurum kozlovii</i>	moss	Y					Y			Y		<b>LOW to MODERATE:</b> A total of 24 populations of alkaline wing-nerved moss have been reported from BC. Twenty-two populations are from three areas in the south central part of the province, nine in the south Okanagan Valley, concentrated around Osoyoos, six in the North Thompson River valley from Kamloops to the Ashcroft area, as well as seven in the Cariboo Region west and south west of Williams Lake (COSEWIC 2004e). Two additional populations have been reported from the Rocky Mountain Trench. Disjunct populations in the Kamloops region range from just east of the city west to Spences Bridge/Cache Creek and include the Pavilion and Clinton area. This species is restricted to the drier portions of the province where seasonally wet alkaline habitats are characteristic of the local ecosystem. Previously recorded occurrences of alkaline wing-nerved moss range from approximately 2 km to greater than 100 km from the proposed pipeline corridor and correspond to the locations just described, with the closest occurrences just west of Kamloops, suggesting the interaction potential may be low to moderate.	L	M		
		Bolander's quillwort <sup>9</sup>	<i>Isoetes bolanderi</i>	vascular plant		Y				Y		Y			<b>LOW:</b> In Canada, Bolander's quillwort is known only from Summit Lake in Waterton National Park. The species prefers upper subalpine to alpine ponds and small lakes with clear, oligotrophic water supporting little or no associated vegetation, where Bolander's quillwort occurs (COSEWIC 2006e). However, more recent occurrences are known from BC and range from 11-18 km from the proposed pipeline corridor along the Black Pines to Hope Segment only, suggesting the interaction potential is low.		L		
		cliff paintbrush	<i>Castilleja rupicola</i>	vascular plant							Y				<b>MODERATE:</b> In Canada, 15 extant and historical populations of cliff paintbrush are known from only the Chilliwack and Skagit river drainages (in the Cascade Mountains of southwestern BC) and on Brunswick Mountain, in the southern Coast Mountains of BC (COSEWIC 2005e). The species occurs on gravelly or stony soils, often in crevices on cliffs, rock outcrops and ridges in the subalpine and alpine zones. Previously recorded occurrences of cliff paintbrush range from approximately 4-51 km from the proposed pipeline corridor, with the closest occurrences east of Bridal Veil Falls Provincial Park, suggesting the interaction potential may be moderate.		M	M	
		Gray's desert-parsley	<i>Lomatium grayi</i>	vascular plant		Y									<b>LOW:</b> In Canada, two populations of Gray's desert-parsley are known from Saltspring and Galiano Islands of the Gulf Islands in southern BC (COSEWIC 2008b). Previously recorded occurrences of Gray's desert-parsley range from 55-66 km from the proposed pipeline corridor and correspond to the locations just described suggesting the interaction potential is low.		L	L	L
		Haller's apple moss	<i>Bartramia halleriana</i>	moss				Y						Y	<b>HIGH:</b> The Canadian range of Haller's Apple Moss includes western Jasper National Park, Alberta and adjacent BC along the Rocky Mountain Trench from about McBride south to Wood River. A total of 15 extant populations are known. The species is a habitat specialist, restricted to non-calcareous cliffs or talus in low elevation forests with high humidity, and it has low dispersal ability (COSEWIC 2011a). Previously recorded occurrences of Haller's Apple Moss range from less than one km to 70 km from the proposed pipeline corridor, with the closest occurrence at Avola, suggesting the interaction potential may be high.	H			
		Lemmon's holly fern	<i>Polystichum lemmonii</i>	vascular plant			Y								<b>LOW:</b> In Canada, Lemmon's holly fern is known only from the Baldy Mountain area on the eastern side of the Okanagan River valley in south central BC. The species is restricted to sites where ferromagnesian or ultramafic rocks outcrop. In BC, only two small ridges in the Baldy Mountain area are known to support the species (COSEWIC 2003b). The known range and lack of previously recorded occurrences of Lemmon's holly fern within 100 km of the proposed pipeline corridor suggest the interaction potential is low.		L		
		Macoun's meadowfoam	<i>Limnanthes macounii</i>	vascular plant		Y									<b>LOW:</b> In Canada, Macoun's meadowfoam is known only from southern Vancouver Island and several adjacent islands and has not been found on the mainland of BC (COSEWIC 2004f). Previously recorded occurrences of Macoun's meadowfoam range from approximately 56 km to greater than 100 km from the proposed pipeline corridor and correspond to the geographical locations described above suggesting the interaction potential is low.		L	L	L
		Mexican mosquito fern	<i>Azolla mexicana</i>	vascular plant				Y	Y						<b>LOW to HIGH:</b> In Canada, Mexican mosquito fern is restricted to BC. The eight extant populations occur in three regions of south central BC: the Little Fort/North Thompson River area; the Shuswap Lake area; and Vernon (COSEWIC 2008c). It is a shade-tolerant species found along the shores or in primarily still-waters of lakes, ponds, streams and other wetlands as well as in ditches. Previously recorded occurrences of Mexican mosquito fern range from approximately less than 100 m to 98 km from the proposed pipeline corridor and correspond to the geographical locations described above, with the closest occurrence at Little Fort, suggesting the interaction potential may be low to high.	H	L		
		mountain holly fern	<i>Polystichum scopulinum</i>	vascular plant			Y		Y						<b>LOW:</b> There are five known mountain holly fern populations in Canada. The three recorded populations in BC all occur in the Tulameen River valley, restricted to a band between Olivine Mountain and Grasshopper Mountain, northwest of Princeton (COSEWIC 2005f). Previously recorded occurrences of mountain holly fern range from approximately 13 km to 16 km from the proposed pipeline corridor and correspond to the geographical location described above suggesting the interaction potential is low.	L	L		
		phantom orchid	<i>Cephalanthera austiniiae</i>	vascular plant		Y									<b>LOW to HIGH:</b> In Canada, phantom orchid is found only in the extreme southwest of BC, with populations on the Saanich Peninsula of Vancouver Island, Saltspring Island and the lower Fraser Valley on the mainland (COSEWIC 2013f). It grows in the humus litter in coniferous forests with little ground cover and is often found at the base of mature birch trees but has grown on limestone tailings. This species prefers south or west-facing slopes of low mountains or hills. Previously recorded occurrences of phantom orchid range from approximately 1 km to greater than 100 km from the proposed pipeline corridor with the closest occurrences south of Chilliwack, BC suggesting the interaction potential may be low to high.		L	H	L
		purple sanicle	<i>Sanicula bipinnatifida</i>	vascular plant		Y									<b>LOW:</b> In Canada, purple sanicle occurs only on southeastern Vancouver Island and the adjacent Gulf Islands (COSEWIC 2013g). Previously recorded occurrences of purple sanicle from approximately 51 km to greater than 100 km from the proposed pipeline corridor and correspond to the geographical location described above suggesting the interaction potential is low.		L	L	L
		seaside bone lichen	<i>Hypogymnia heterophylla</i>	lichen		Y									<b>LOW:</b> In Canada, the four known locations where the seaside bone lichen occurs are at the southwest tip of Vancouver Island in East Sooke Regional Park, Bentinck Island and Sheringham Point (COSEWIC 2008d). The known range and lack of previously recorded occurrences of seaside bone lichen within 100 km of the proposed pipeline corridor suggest the interaction potential is low.		L	L	L
		showy phlox	<i>Phlox speciosa</i> ssp. <i>occidentalis</i>	vascular plant	Y				Y				Y		<b>LOW:</b> In Canada, showy phlox is known historically in the Okanagan Valley from Summerland in the north, south to Skaha Lake (formerly Dog Lake) and southwest to the Twin Lakes. Extant and newly discovered populations are concentrated in a cluster around Yellow Lake and Twin Lakes, between Keremeos and Penticton, BC (COSEWIC 2004g). Previously recorded occurrences of showy phlox from approximately 90 km to 92 km from the proposed pipeline corridor and correspond to the geographic locations described above suggesting the interaction potential is low.	L	L		
	--	crumpled tarpaper lichen	<i>Collema coniophilum</i>	lichen				Y					Y		<b>LOW:</b> Crumpled tarpaper lichen is currently known to be endemic to Canada. Extant populations are concentrated in a small humid portion of the Rocky Mountain trench, east of Prince George and the Upper Adams River, in the Columbia Mountains (COSEWIC 2010d). A previously recorded occurrence of crumpled tarpaper lichen is known from approximately 15 km from the proposed pipeline corridor and located north east of Avola suggesting the interaction potential is low.	L			
Special Concern	Threatened	Lyall's mariposa lily	<i>Calochortus lyallii</i>	vascular plant					Y						<b>LOW:</b> In Canada, Lyall's mariposa lily is known only from East Chopaka, an upland area west of Osoyoos between Osoyoos Lake and the Similkameen River in south central BC (COSEWIC 2011f). The known range and lack of previously recorded occurrences of Lyall's mariposa lily within 100 km of the proposed pipeline corridor suggest the interaction potential is low.	L	L		

TABLE 4.3.2-1 Cont'd

Federal <sup>1</sup>		Common Name <sup>4</sup>	Scientific Name <sup>4</sup>	Type	BGC Zone <sup>5</sup>									Potential Interaction with Project	Project Component <sup>6,7</sup>							
COSEWIC Designation <sup>2</sup>	SARA Designation <sup>3</sup>				BG	CWH	ESSF	ICH	IDF	MS	MH	PP	SBS		H-D	BP-H	H-B	B-W				
Special Concern	Special Concern	banded cord-moss	<i>Entosthodon fascicularis</i>	moss		Y			Y							<b>LOW to MODERATE:</b> In Canada, banded cord-moss is known to be restricted mainly to a small coastal area in southwestern BC, with one population is in the Kootenay region in eastern BC. Along the coast, it has been found on southeastern Vancouver Island and adjacent Islands (COSEWIC 2005g). It usually grows on soil, sometimes in leaf litter with other mosses and around the base of vascular plants and often in open to semi-shaded habitats with seasonally moist areas and rock outcroppings. Previously recorded occurrences of banded cord-moss range from approximately 2 km to 99 km from the proposed pipeline corridor and with the closest occurrence at a new location just east of Abbotsford, suggesting the interaction potential may be low to moderate.	L	L	M	L		
		Columbian carpet moss	<i>Bryoerythrophyllum columbianum</i>	moss	Y					Y		Y	Y				<b>LOW to MODERATE:</b> In Canada, Columbian carpet moss appears to be restricted to BC, in the south Okanagan Valley, near Kamloops, near Spence's Bridge and at one site along the Fraser River in the Cariboo Region (COSEWIC 2004h). This species is restricted to soil in semi-arid steppe and grassland habitats in BC. Previously recorded occurrences of Columbian carpet moss range from approximately 5 km to 94 km from the proposed pipeline corridor with the closest occurrence northeast of Kamloops, suggesting the interaction potential may be low to moderate.	L	M			
		cryptic paw lichen	<i>Nephroma occultum</i>	lichen		Y				Y								<b>LOW:</b> Within Canada, cryptic paw lichen is restricted to BC where it is known from 45 localities coinciding with the intermontane valleys of the Coast Range (from Taku to near Chilliwack) and the Columbia Mountains (upper Fraser River to Duncan River) (COSEWIC 2006f). It is confined to moist old growth forests at elevations below 1,200 m. Previously recorded occurrences of cryptic paw lichen range from approximately 13 km to 96 km from the proposed pipeline corridor and correspond to the geographic locations described above suggesting the interaction potential is low.	L	L	L	L
		giant helleborine <sup>10</sup>	<i>Epipactis gigantea</i>	vascular plant	Y	Y				Y	Y			Y				<b>LOW to MODERATE:</b> Giant helleborine has been known in the South Okanagan and Similkameen Valleys in BC.(COSEWIC 2013h). It requires a moist, calcareous habitat and is found in wet areas around hot mineral springs, on lakeshores and at the base of slopes, where there is an ample supply of base-rich water. The orchid can also occur in open wetland areas or in broken shade at the forest edge. Previously recorded occurrences of giant helleborine range from approximately 4 km to 98 km from the proposed pipeline corridor with the closest occurrences at new locations just north and south of Chilliwack in BC, suggesting the interaction potential may be low to moderate.	L	L	M	L
		oldgrowth specklebelly lichen	<i>Pseudocyphellaria rainierensis</i>	lichen		Y						Y						<b>LOW:</b> In Canada, oldgrowth specklebelly is limited to coastal or near-coastal areas of southern BC (COSEWIC 2010e). A previously recorded occurrence of oldgrowth specklebelly lichen at approximately 22 km from the proposed pipeline corridor just south of Chilliwack Lake suggests the interaction potential may be low.		L	L	L
		Vancouver Island beggarticks	<i>Bidens amplissima</i>	vascular plant		Y												<b>LOW to HIGH:</b> In Canada, Vancouver Island beggarticks has been found in the Lower Fraser Valley (from east of Abbotsford to Richmond) and on southern Vancouver Island, with one additional record on the mainland coast of BC just north of Vancouver Island (COSEWIC 2013i). It is a wetland species generally limited to habitat around pond, lake and stream margins where water levels fluctuate and shows a distinct preference for silty alluvial soils. It may also occur in tidal zones where it is inundated twice a day and dries out between tides. Previously recorded occurrences of Vancouver Island beggarticks range from less than 1 km to greater than 100 km from the proposed pipeline corridor and correspond to the geographical locations described above suggesting the interaction potential may be low to high.		L	H	L
		white-top aster	<i>Sericocarpus rigidus</i>	vascular plant		Y												<b>LOW:</b> In Canada, white-top aster is distributed among 22 populations in BC: 20 from Victoria to Nanaimo, 1 in Port Alberni and 1 on Hornby Island (COSEWIC 2009e). Previously recorded occurrences of white-top aster range from approximately 64 km to greater than 100 km from the proposed pipeline corridor and correspond to the geographical location described above suggesting the interaction potential is low.		L	L	L
Special Concern	--	peacock vinyl lichen	<i>Leptogium polycarpum</i>	lichen		Y										<b>LOW to HIGH:</b> In Canada, peacock vinyl lichen is restricted to coastal BC. Population has been found on southern Vancouver Island, mainland inlets and the main valleys of the Coast Range (COSEWIC 2011g). It occurs in low elevations on the branches and (mossy) trunks of deciduous trees, particularly bigleaf maple and red alder, in rather well-lit, mid-successional stands. Previously recorded occurrences of peacock vinyl lichen range from less than 100 m to 89 km from the proposed pipeline corridor with the closest occurrences near Bridal Falls and Hope, suggesting the interaction potential may be low to high.		L	H	L		

Sources: BC CDC 2012a,b, BC MOE 2013, COSEWIC 2013a, Government of Canada 2013

Notes:

- Species listed by SARA and/or COSEWIC are current as of October 2013.
- COSEWIC 2013a. Species listed as Extirpated, Not at Risk or Data Deficient were generally not included in the table without other noteworthy factors being present.  
**Endangered:** a species facing imminent extirpation or extinction.  
**Threatened:** a species likely to become Endangered if limiting factors are not reversed.  
**Special Concern:** a species that is particularly sensitive to human activities or natural events, but is not an Endangered or Threatened species.
- SARA. The Act establishes Schedule 1 as the list of species to be protected on all federal lands in Canada. The Act also applies to all lands in Canada for Schedule 1 bird species cited in the Migratory Birds Convention Act and Schedule 1 aquatic species as determined by Fisheries and Oceans Canada.  
**Endangered:** a species that is facing imminent extirpation or extinction.  
**Threatened:** a species that is likely to become an Endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
- Below are the synonyms used by the BC CDC for federally-listed species. Only differences are noted.

BC CDC Species Synonyms:

Federal Common Name	Common Name	Scientific Name
bog bird's-foot trefoil	bog bird's-foot lotus	Hosackia pinnata
branched Phacelia	--	Phacelia ramosissima var. ramosissima
dwarf woolly-heads, southern mountain population	--	Psilocarphus brevissimus var. brevissimus
pink sand-verbena	--	Abronia umbellata var. breviflora
short-rayed alkali aster	short-rayed aster	--
tall bugbane	--	Actaea elata var. elata
toothcup	toothcup meadow-foam	--
yellow montane violet praemorsa subspecies	yellow montane violet	--

5 The BGC zones are: BG=Bunchgrass; CWH=Coastal Western Hemlock; ICH=Inter Cedar-Hemlock; ESSF=Engelmann Spruce-Subalpine Fir; IDF=Interior Douglas-fir; MH=Mountain Hemlock; MS=Montane Spruce; PP=Ponderosa Pine; and SBS=Sub-Boreal Spruce.

6 The Project components are: B-W=Burnaby to Westridge Segment; BP-H=Black Pines to Hope Segment; H-B=Hope to Burnaby Segment; and H-D=Hargreaves to Darfield Segment.

- 7 All plant species with the potential to occur in the component of the Project based on BGC zone are indicated. The potential for each Project component to interact with a plant species is described as follows: L=Low, M=Moderate and H=High. Generally the potential interaction score is based on the known range as well as the distance of known occurrences to the proposed pipeline corridor as follows: L = occurrences > 10 km; M = occurrences > 1-10 km; and H = occurrences ≤ 1 km. Where only one of range or occurrences suggests a higher interaction potential, the higher score was issued.
- 8 EC provided Project-specific hard copy maps of critical habitat for species at risk in BC (EC 2013). The information on critical habitat is provided in this report with permission from EC and this information is subject to change since critical habitat mapping is not final until posted in a final recovery strategy on the Species at Risk Public Registry. EC makes no representation and gives no warranty of any kind with respect to the accuracy, usefulness, novelty, validity, scope, completeness or currency of the Canada Digital Data and expressly disclaims any implied warranty of merchantability or fitness for a particular purpose of the Canada Digital Data.
- 9 The most updated COSEWIC report for *Isoetes bolanderi*, published in 2006, describes this species only occurring in Alberta (COSEWIC 2006e). However, more recent known occurrences in BC warrant its inclusion in the above table. The three BGC zones where *Isoetes bolanderi* are known to occur were retrieved from the BC Flora (2013).
- 10 Giant helleborine, although ranked by SARA, is on Schedule 3 which refers to a need for an assessment by COSEWIC. The last COSEWIC assessment was completed in 1998. However, a reassessment against revised criteria is required for species designated by COSEWIC prior to October 1999 before they can be considered for addition to Schedule 1 (Government of Canada 2013). Therefore, currently giant helleborine does not have protection under the SARA.

### Provincial Rare Plants and Lichen

No plant species listed under the IWMS are known to occur in the ICH, the SBS and the IDF BGC zones or from within 5 km of the Hargreaves to Darfield Segment (BC CDC 2012a,b, BC MOE 2013, Table 4.3.2-2).

The BC CDC provided records of rare plant EOs known from within 5 km of the Hargreaves to Darfield Segment, which included 13 rare vascular plants and 2 mosses (BC CDC 2012a,b). Details of the previously recorded occurrences are summarized in 4.3.2-2.

**TABLE 4.3.2-2**

**PREVIOUSLY RECORDED RARE PLANT  
OCCURRENCES WITHIN 5 KM OF THE HARGREAVES TO DARFIELD SEGMENT**

Common Name	Scientific Name	Type	Provincial Rank <sup>1</sup>	Number of Recorded EOs	Distance to Proposed Pipeline Corridor <sup>2,3</sup> (km)
bald sedge	<i>Carex tonsa var. tonsa</i>	vascular plant	S2S3, Blue	1	0.7
bearded sedge	<i>Carex comosa</i>	vascular plant	S2, Red	1	0.0
dwarf clubrush	<i>Trichophorum pumilum</i>	vascular plant	S2S3, Blue	1	3.1
Haller's apple moss	<i>Bartramia halleriana</i>	moss	S2, Red	2	0.4-2.2
Hall's willowherb	<i>Epilobium halleanum</i>	vascular plant	S2S3, Blue	1	0.5
little fescue	<i>Festuca minutiflora</i>	vascular plant	S2S3, Blue	1	4.0
meadow willow	<i>Salix petiolaris</i>	vascular plant	S2S3, Blue	1	1.8
Mexican mosquito fern	<i>Azolla mexicana</i>	vascular plant	S2, Red	4	0.1-2.3
mountain moonwort	<i>Botrychium montanum</i>	vascular plant	S1, Red	1	0.0
pink Agoseris	<i>Agoseris lackschewitzii</i>	vascular plant	S2S3, Blue	1	4.2
slender spike-rush	<i>Eleocharis elliptica</i>	vascular plant	S2S3, Red	1	3.8

**Sources:** BC CDC 2012a,b

- Notes:**
- 1 Definitions of provincial ranks are summarized in the footnotes of Appendix B.
  - 2 All distances are approximate.
  - 3 Where there are numerous occurrences of the same species, the range in distance to the proposed pipeline corridor is provided based on the closest and furthest occurrence.

### **4.3.3 Black Pines to Hope Segment**

#### Federal Rare Plants and Lichens

When considering all BGCs within the Black Pines to Hope Segment, there are a total of 52 plant and lichen species with conservation status under the SARA and/or COSEWIC of which 29 are designated as Endangered, 12 are designated as Threatened, 7 are designated as Special Concern, 2 are designated as Endangered under COSEWIC but have no status under the SARA, 1 is designated as Special Concern under COSEWIC but Threatened under the SARA and 1 is designated as Special Concern under COSEWIC but has no status under the SARA. Federal species of concern are listed in Table 4.3.2-1.

Based on known range, occurrences and habitat requirements, 44 of the 52 federally-listed plant and lichen species in the Black Pines to Hope Segment are not expected to occur along the proposed pipeline corridor (Table 4.3.2-1). Of the remaining species, 6 have a moderate potential and 2 have a high potential of occurring along the proposed pipeline corridor.

Species with moderate interaction potential include nugget moss, rusty cord-moss and short-rayed alkali aster, all designated as Endangered under COSEWIC and the SARA, alkaline wing-nerved moss and cliff paintbrush, both designated as Threatened under COSEWIC and the SARA and Columbian carpet moss, designated as Special Concern under COSEWIC and the SARA. Species with a high interaction potential include toothcup and whitebark pine which are both designated as Endangered under COSEWIC and the SARA. Table 4.3.2-1 provides the habitat description for these species.



Five occurrences of rare plants and lichen with a SARA and/or COSEWIC designation, including alkaline wing-nerved moss, Columbian carpet moss, peacock vinyl lichen and toothcup meadow-foam, have been previously recorded within 5 km of the Black Pines to Hope Segment of the proposed pipeline corridor (BC CDC 2012a,b). Details of the previously recorded occurrences are summarized in Table 4.3.3-1.

### Provincial Rare Plants and Lichens

While no plant species listed under the IWMS are known to occur in the PP, BG, IDF, MS and ESSF BGC zones, one plant species, tall bugbane, is known to occur in both the CWH and MH BGC zones (BC MOE 2013). Based on the known range, occurrences and habitat requirements of tall bugbane, this species is not expected to occur along the proposed pipeline corridor within the Black Pines to Hope Segment (Table 4.3.2-1).

No previously recorded occurrences of rare plants with a IWMS designation are known from within 5 km of the Black Pines to Hope Segment (BC CDC 2012a,b).

The BC CDC provided rare plant EOs known from within 5 km of the Black Pines to Hope Segment, which included 21 rare vascular plants, 2 mosses and 1 lichen (BC CDC 2012a,b). Details of the previously recorded occurrences are summarized in Table 4.3.3-1.

**TABLE 4.3.3-1**  
**PREVIOUSLY RECORDED RARE PLANT AND LICHEN**  
**OCCURRENCES WITHIN 5 KM OF THE BLACK PINES TO HOPE SEGMENT**

Common Name	Scientific Name	Type	Provincial Rank <sup>1</sup>	Number of Recorded EOs	Distance to Proposed Pipeline Corridor <sup>2,3</sup> (km)
alkaline wing-nerved moss	<i>Pterygoneurum kozlovii</i>	moss	S2, Red	1	1.8
bearded sedge	<i>Carex comosa</i>	vascular plant	S2, Red	1	0.0
blue grama	<i>Bouteloua gracilis</i>	vascular plant	S2, Red	2	1.4-2.5
booth's willow	<i>Salix boothii</i>	vascular plant	S2S3, Blue	1	3.9
Columbian carpet moss	<i>Bryoerythrophyllum columbianum</i>	moss	S2S3, Blue	1	4.7
Englemann's spike-rush	<i>Eleocharis engelmannii</i>	vascular plant	S1, Red	1	3.3
Geyer's onion	<i>Allium geyeri</i> var. <i>tenerum</i>	vascular plant	S2S3, Blue	1	4.9
Hall's willowherb	<i>Epilobium halleanum</i>	vascular plant	S2S3, Blue	1	0.9
mock-pennyroyal	<i>Hedeoma hispida</i>	vascular plant	S1, Red	1	3.2
Oregon checker-mallow	<i>Sidalcea oregana</i> var. <i>procera</i>	vascular plant	S1, Red	2	2.7-4.5
ovalpurse	<i>Homungia procumbens</i>	vascular plant	S3, Blue	2	0.3-2.1
peacock vinyl lichen	<i>Leptogium polycarpum</i>	lichen	S1S2, Red	1	0.2
scarlet gaura	<i>Gaura coccinea</i>	vascular plant	S1, Red	1	2.8
Suksdorf's lupine	<i>Lupinus bingenensis</i> var. <i>subsaccatus</i>	vascular plant	S2, Red	1	0.0
tall beggarticks	<i>Bidens vulgata</i>	vascular plant	S1, Red	1	4.3
toothcup meadow-foam	<i>Rotala ramosior</i>	vascular plant	S1, Red	2	0.3-3.7
wedgescale orache	<i>Atriplex truncata</i>	vascular plant	S3, Blue	4	0.8-2.3

**Sources:** BC CDC 2012a,b

- Notes:**
- 1 Definitions of provincial ranks are summarized in the footnotes of Appendix B.
  - 2 All distances are approximate.
  - 3 Where there are numerous occurrences of the same species, the range in distance to the proposed pipeline corridor is provided based on the closest and furthest occurrence.

#### **4.3.4 Hope to Burnaby Segment**

##### **Federal Rare Plants and Lichens**

When considering all BGCs within the Hope to Burnaby Segment there are a total of 30 plant and lichen species with conservation status under the SARA and/or COSEWIC of which 15 are designated as Endangered, 6 are designated as Threatened, 6 are designated as Special Concern, 2 are designated as Endangered under COSEWIC but have no status under the SARA and 1 is designated as Special Concern under COSEWIC but has no status under the SARA. Federal species of concern are listed in Table 4.3.2-1.

Based on known range, occurrences and habitat requirements, 19 of the 30 federally-listed plant and lichen species in the Hope to Burnaby Segment are not expected to occur along the proposed pipeline corridor (Table 4.3.2-1). Of the remaining species, 5 have a moderate potential and 6 have a high potential of occurring along the proposed pipeline corridor.

Species with moderate interaction potential include: streambank lupine which is designated as Endangered under COSEWIC and the SARA; batwing vinyl lichen which is designated as Endangered under COSEWIC but has no status under the SARA; cliff paintbrush which is designated as Threatened under COSEWIC and the SARA; and banded cord-moss and giant helleborine which are designated as Special Concern under COSEWIC and the SARA.

Giant helleborine, although ranked by SARA, is on Schedule 3 which refers to a need for an assessment by COSEWIC. The last COSEWIC assessment was completed in 1998. However, a reassessment against revised criteria is required for species designated by COSEWIC prior to October 1999 before they can be considered for addition to Schedule 1 (Government of Canada 2013). Therefore, currently giant helleborine does not have protection under the SARA.

Species with a high interaction potential include: silver hair moss and tall bugbane which are designated as Endangered under COSEWIC and the SARA; Roell's brotherella moss which is designated as Endangered under COSEWIC but has no status under the SARA; phantom orchid which is designated as Threatened under COSEWIC and the SARA; Vancouver Island beggarticks which is designated as Special Concern under COSEWIC and the SARA; and peacock vinyl lichen which is designated as Special Concern under COSEWIC but has no status under the SARA. Table 4.3.2-1 provides the habitat description for these species.

A total of 27 occurrences of rare plants and lichen with a SARA and/or COSEWIC designation, including banded cord-moss, batwing vinyl lichen, cliff paintbrush, giant helleborine, peacock vinyl lichen, phantom orchid, silver hair moss, streambank lupine, tall bugbane and Vancouver Island beggarticks have been previously recorded within 5 km of the Hope to Burnaby Segment of the proposed pipeline corridor (BC CDC 2012a,b). Details of the previously recorded occurrences are summarized in Table 4.3.4-1

##### **Provincial Rare Plants and Lichens**

One plant species, tall bugbane, listed under the IWMS is known to occur in the CWH zone (BC MOE 2013). Five previously recorded occurrences of tall bugbane are known from within 5 km of the Black Pines to Hope Segment (Table 4.3.4-1). Based on the known range, occurrences and habitat requirements of tall bugbane there is a high potential that this species may occur along the proposed pipeline corridor within the Hope to Burnaby Segment (Table 4.3.2-1).

The BC CDC provided records of rare plant EOs known from within 5 km of the Hope to Burnaby Segment, which included 55 rare vascular plants, 2 mosses and 3 lichens (BC CDC 2012a,b). Details of the previously recorded occurrences are summarized in Table 4.3.4-1.

**TABLE 4.3.4-1**  
**PREVIOUSLY RECORDED RARE PLANT AND LICHEN OCCURRENCES WITHIN 5 KM OF THE HOPE TO BURNABY SEGMENT**

Common Name	Scientific Name	Type	Provincial Rank <sup>1</sup>	Number of Recorded EOs	Distance to Proposed Pipeline Corridor <sup>2,3</sup> (km)
banded cord-moss	<i>Entosthodon fascicularis</i>	moss	S2S3, Blue	1	1.7
batwing vinyl lichen	<i>Leptogium platynum</i>	lichen	S1S2, Red	1	1.8
bearded sedge	<i>Carex comosa</i>	vascular plant	S2, Red	1	0.0
blue vervain	<i>Verbena hastata</i> var. <i>scabra</i>	vascular plant	S2S3, Blue	1	0.0
cliff paintbrush	<i>Castilleja rupicola</i>	vascular plant	S3, Blue	1	3.7
false-pimpemel	<i>Lindernia dubia</i> var. <i>anagallidea</i>	vascular plant	S2S3, Red	6	0.0-3.4
fox sedge	<i>Carex vulpinoidea</i>	vascular plant	S2S3, Blue	2	0.8-2.3
giant helleborine	<i>Epipactis gigantea</i>	vascular plant	S3, Blue	1	4.1
green-fruited sedge	<i>Carex interrupta</i>	vascular plant	S2, Red	1	3.5
Henderson's checker-mallow	<i>Sidalcea hendersonii</i>	vascular plant	S3, Blue	1	2.2
leafy mitrewort	<i>Mitella caulescens</i>	vascular plant	S2S3, Blue	1	4.9
mountain sneezeweed	<i>Helenium autumnale</i> var. <i>grandiflorum</i>	vascular plant	S2S3, Blue	3	1.0-2.8
northern water-meal	<i>Wolffia borealis</i>	vascular plant	S2, Red	1	1.2
Nuttall's waterweed	<i>Elodea nuttallii</i>	vascular plant	S3, Blue	2	1.3-3.0
Pacific waterleaf	<i>Hydrophyllum tenuipes</i>	vascular plant	S2, Red	3	0.3-2.9
peacock vinyl lichen	<i>Leptogium polycarpum</i>	lichen	S1S2, Red	2	0.0-0.2
phantom orchid	<i>Cephalanthera austiniiae</i>	vascular plant	S2, Red	8	1.5-4.5
pink water speedwell	<i>Veronica catenata</i>	vascular plant	S1, Red	1	1.4
pointed broom sedge	<i>Carex scoparia</i>	vascular plant	S2S3, Blue	1	2.3
pointed rush	<i>Juncus oxymersis</i>	vascular plant	S2S3, Blue	1	4.7
short-fruited Smelowskia	<i>Smelowskia ovalis</i>	vascular plant	S2S3, Blue	1	2.0
silver hair moss	<i>Fabronia pusilla</i>	moss	SH, Red	1	1.2
slender-spiked mannagrass	<i>Glyceria leptostachya</i>	vascular plant	S2S3, Blue	1	0.0
small spike-rush	<i>Eleocharis parvula</i>	vascular plant	S2S3, Blue	1	3.0
small-flowered bittercress	<i>Cardamine parviflora</i>	vascular plant	S2S3, Blue	1	1.9
streambank lupine	<i>Lupinus rivularis</i>	vascular plant	S1, Red	1	3.0
tall bugbane	<i>Actaea elata</i> var. <i>elata</i>	vascular plant	S1, Red	5	0.6-4.6
three-flowered waterwort	<i>Elatine rubella</i>	vascular plant	S2S3, Blue	2	2.3-3.0
two-edged water-starwort	<i>Callitriche heterophylla</i> var. <i>heterophylla</i>	vascular plant	S2S3, Blue	1	4.3
ussurian water-milfoil	<i>Myriophyllum ussuriense</i>	vascular plant	S3, Blue	1	0.2
Vancouver Island beggarticks	<i>Bidens amplissima</i>	vascular plant	S3, Blue	6	0.4-4.1

**Sources:** BC CDC 2012a,b

- Notes:**
- 1 Definitions of provincial ranks are summarized in the footnotes of Appendix B.
  - 2 All distances are approximate.
  - 3 Where there are numerous occurrences of the same species, the range in distance to the proposed pipeline corridor is provided based on the closest and furthest occurrence.

### 4.3.5 Burnaby to Westridge Segment

#### Federal Rare Plants and Lichens

When considering all BGCs within the Burnaby to Westridge Segment there are a total of 29 plant and lichen species with conservation status under the SARA and/or COSEWIC of which 15 are designated as Endangered, 5 are designated as Threatened, 6 are designated as Special Concern, 2 are designated as Endangered under COSEWIC but have no status under the SARA and 1 is designated as Special

Concern under COSEWIC but has no status under the SARA. Federal species of concern are listed in Table 4.3.2-1.

Based on known range, occurrences and habitat requirements, all but 1 of 29 federally-listed plant species on the Burnaby to Westridge Segment are not expected to occur within the proposed pipeline corridor (Table 4.3.2-1). The remaining species, poor pocket moss (listed as Endangered under the SARA and COSEWIC), has a moderate potential of occurring along the proposed pipeline corridor. Table 4.3.2-1 provides the habitat description for this species.

No previous occurrences of rare plant and lichen species with a SARA and/or COSEWIC designation are known from within 5 km of the Burnaby to Westridge Segment of the proposed pipeline corridor (BC CDC 2012a,b).

### Provincial Rare Plants and Lichens

One plant species, tall bugbane, listed under the IWMS is known to occur in the CWH zone (BC MOE 2013). However, no previously recorded occurrences of rare plant and lichen species with an IWMS designation are known from within 5 km of the Burnaby to Westridge Segment of the proposed pipeline corridor (Table 4.3.5-1). Based on the known range, occurrences and habitat requirements of tall bugbane, this species is not expected to occur along the proposed pipeline corridor of the Burnaby to Westridge Segment (Table 4.3.2-1).

The BC CDC provided records of one rare plant EO known from within 5 km of the Hope to Burnaby Segment (BC CDC 2012a,b). Details of the previously recorded occurrence are provided in Table 4.3.5-1.

**TABLE 4.3.5-1**

**PREVIOUSLY RECORDED RARE PLANT  
 OCCURRENCE WITHIN 5 KM OF THE BURNABY TO WESTRIDGE SEGMENT**

Common Name	Scientific Name	Type	Provincial Rank <sup>1</sup>	Number of Recorded EOs	Approximate Distance to Proposed Pipeline Corridor <sup>2</sup> (km)
false-pimpernel	<i>Lindernia dubia</i> <i>var. anagallidea</i>	vascular plant	S2S3, Red	1	1.3

**Sources:** BC CDC 2012a,b

- Notes:**
- 1 Definitions of provincial ranks are summarized in the footnotes of Appendix B.
  - 2 All distances are approximate.

### **4.3.6 Gainford Pump Station**

#### Federal Rare Plants

No plant species listed as Endangered, Threatened or Special Concern under the SARA or COSEWIC are known to occur in the Central Parkland Natural Subregion where the Gainford Pump Station is located (Table 4.3.6-1).

No previous occurrences of rare plants and lichen with a SARA and/or COSEWIC designation are known from within 5 km of the Gainford Pump Station (ACIMS 2013c).

**TABLE 4.3.6-1**

**FEDERAL SPECIES OF CONCERN IN THE VICINITY OF  
THE PUMP STATIONS FOR THE ALBERTA PORTION OF THE PROJECT**

Federal		Common Name	Scientific Name <sup>3</sup>	Type	Potential Interaction with Project <sup>4</sup>	Project Component <sup>5,6</sup>	
COSEWIC Designation <sup>1</sup>	SARA Designation <sup>2</sup>					G	H
Endangered	Endangered	whitebark pine	<i>Pinus albicaulis</i>	vascular plant	<b>LOW:</b> Previously recorded occurrences of whitebark pine range from approximately 30 km to greater than 100 km from the pump station. This suggests the interaction potential is low.		L
Threatened	Threatened	Haller's apple moss	<i>Bartramia halleriana</i>	moss	<b>LOW:</b> Previously recorded occurrences of Haller's apple moss range from approximately 47-66 km from the pump station. This suggests the interaction potential is low.		L
Threatened	Threatened	Porsild's bryum moss	<i>Haplodontium macrocarpum</i>	moss	<b>LOW:</b> Previously recorded occurrences of Porsild's bryum moss range from approximately 14-91 km from the pump station. This suggests the interaction potential is low.		L
Special Concern	Special Concern	western blue flag	<i>Iris missouriensis</i>	vascular plant	<b>LOW:</b> The known range and lack of previously recorded occurrences of western blue flag within 100 km of the pump station suggest the interaction potential is low.		L
Data deficient	--	long-stalked whitlow-grass	<i>Draba juvenilis</i>	vascular plant	<b>LOW:</b> The known range and lack of previously recorded occurrences of long-stalked whitlow-grass within 100 km of the pump station suggest the interaction potential is low.		L

**Sources:** ACIMS 2013a, COSEWIC 2011b, 2013a, Government of Canada 2013

**Notes:**

- 1 COSEWIC 2013a. Species listed as Extirpated or Not at Risk were generally not included in the table without other noteworthy factors being present.  
**Endangered:** a species facing imminent extirpation or extinction.  
**Threatened:** a species likely to become Endangered if limiting factors are not reversed.  
**Special Concern:** a species that is particularly sensitive to human activities or natural events, but is not an Endangered or Threatened species.  
**Data Deficient:** A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk to extinction.
- 2 SARA. The *Act* establishes Schedule 1 as the list of species to be protected on all federal lands in Canada.  
**Endangered:** a species that is facing imminent extirpation or extinction.  
**Threatened:** a species that is likely to become an Endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
- 3 ACIMS uses synonyms for some federally-listed species. The ACIMS scientific name for Porsild's bryum moss is *Mielichhoferia macrocarpum*.
- 4 For information on the known range for each plant species refer to Table 4.3.1-1. All plant species are known only within the Montane Natural Subregion of the Project.
- 5 The pump stations are: G=Gainford; and H=Hinton.
- 6 The potential for each Project component to interact with a plant species is described as follows: L=Low, M=Moderate and H=High. Refer to the footnotes of Table 4.3.1-1 for a full description.

**Provincial Rare Plants**

No plant species listed under the Alberta *Wildlife Act* are known to occur in the Central Parkland (ACIMS 2013a).

No previously recorded occurrences of rare plant species with an Alberta *Wildlife Act* designation are known from within 5 km of the Gainford Pump Station (ACIMS 2013c).

ACIMS provided records of rare plant EOs known from within 5 km of the Gainford Pump Station, which included 3 rare vascular plants and 2 mosses (ACIMS 2013c). Details of the previously recorded occurrences are summarized in Table 4.3.6-2.

**TABLE 4.3.6-2**

**PREVIOUSLY RECORDED RARE PLANT  
OCCURRENCES WITHIN 5 KM OF THE GAINFORD PUMP STATION**

Common Name	Scientific Name	Type	Provincial Rank <sup>1</sup>	Number of Recorded EOs	Approximate Distance to Pump Station <sup>2,3</sup> (km)
broad-leaved arrowhead	<i>Sagittaria latifolia</i>	vascular plant	S2	1	1.7
marsh muhly	<i>Muhlenbergia racemosa</i>	vascular plant	S2	1	0.4
slender hairy-cap moss	<i>Polytrichum longisetum</i>	moss	S1	1	4.0
twisted bog moss	<i>Sphagnum contortum</i>	moss	S2	1	4.0
two-leaved waterweed	<i>Elodea bifoliata</i>	vascular plant	S2	1	3.1

**Source:** ACIMS 2013c

- Notes:**
- 1 Definitions of provincial ranks are summarized in the footnotes of Appendix B.
  - 2 All distances are approximate.
  - 3 ACIMS may buffer the location of an occurrence when mapping precision is low due to the age of the data, the detail submitted, or a landowner's wish to withhold the specific location from the public. The occurrence may be located anywhere within the buffer. Distances in this table were measured from the proposed pipeline corridor to the nearest edge of each buffer.

**4.3.7 Hinton Pump Station**

Federal Rare Plants and Lichens

In the Montane Natural Subregion where the Hinton Pump Station is located, there are five plant species with conservation status under the SARA and/or COSEWIC (ACIMS 2013a). Federal species of concern at the Hinton Pump Station are listed in Table 4.3.6-1.

Based on the known range, occurrences and habitat requirements of the five federally-listed plant species in the Montane Natural Subregion, none are expected to occur at the Hinton Pump Station (Tables 4.3.1-1 and 4.3.6-1).

Provincial Rare Plants and Lichens

No plant species listed under the Alberta *Wildlife Act* are known to occur in the Montane Natural Subregion (ACIMS 2013a).

No previously recorded occurrences of rare plant species with an Alberta *Wildlife Act* designation are known from within 5 km of the Hinton Pump Station (ACIMS 2013c).

ACIMS provided records of rare plant EOs known from within 5 km of the Hinton Pump Station, which included 3 rare vascular plants and 3 mosses (ACIMS 2013c). Details of the previously recorded occurrences are summarized in Table 4.3.7-1.

**TABLE 4.3.7-1**

**PREVIOUSLY RECORDED RARE PLANT  
OCCURRENCES WITHIN 5 KM OF THE HINTON PUMP STATION**

Common Name	Scientific Name	Type	Provincial Rank <sup>1</sup>	Number of Recorded EOs	Approximate Distance to Pump Station <sup>2,3</sup> (km)
<i>Brachythecium</i> moss	<i>Brachythecium frigidum</i>	moss	SU	1	within buffer
<i>Bryum</i> moss	<i>Bryum algovicum</i>	moss	S2	1	0.3
long-stalked beardless moss	<i>Desmatodon heimii</i>	moss	S2	1	0.3
sandwort	<i>Arenaria longipedunculata</i>	vascular plant	S1	1	2.9
scalloped grapefern	<i>Botrychium crenulatum</i>	vascular plant	S1	1	1.9
spatulate grape fern	<i>Botrychium spathulatum</i>	vascular plant	S2	1	3.4

**Source:** ACIMS 2013c

- Notes:**
- 1 Definitions of provincial ranks are summarized in the footnotes of Appendix B.
  - 2 All distances are approximate.
  - 3 ACIMS may buffer the location of an occurrence when mapping precision is low due to the age of the data, the detail submitted, or a landowner's wish to withhold the specific location from the public. The occurrence may be located anywhere within the buffer. Distances in this Table were measured from the proposed pipeline corridor to the nearest edge of each buffer. When the proposed pipeline corridor intersects the buffer, distances are noted as "within buffer".

#### **4.3.8 Rearguard Pump Station**

##### Federal Rare Plants and Lichens

In the SBS BGC zone where the Rearguard Pump Station is located, there are a total of 3 plant species with conservation status under the *SARA* and/or *COSEWIC* of which 1 is designated as Endangered, 1 is designated as Threatened and 1 is designated as Threatened under *COSEWIC* but has no status under the *SARA*. Federal species of concern are listed in Table 4.3.8-1.

Based on known range, occurrences and habitat requirements, 2 of the 3 federally-listed plant species are not expected to occur at the Rearguard Pump Station (Table 4.3.8-1).

The remaining federally-listed species, whitebark pine which is designated as Endangered under the *SARA* and *COSEWIC*, has a high potential of occurring at the Rearguard Pump Station. Table 4.3.2-1 provides the habitat description for these species. There are no federally-listed rare plant or lichen occurrences from BC CDC within 5 km of the Rearguard Pump Station (BC CDC 2012a,b).

TABLE 4.3.8-1

FEDERAL SPECIES OF CONCERN IN THE VICINITY OF THE TERMINALS, POWER LINES AND PUMP STATIONS FOR THE BC PORTION OF THE PROJECT

Federal		Common Name <sup>3</sup>	Scientific Name <sup>3</sup>	Type	Potential Interaction with Project <sup>4</sup>	Pump Stations <sup>5,6</sup>			Power Lines <sup>5,6</sup>		Terminal <sup>5,6</sup>	
COSEWIC Designation <sup>1</sup>	SARA Designation <sup>2</sup>					R	BP	KI	BP-PL	KI-PL	SU	
Endangered	Endangered	bog bird's-foot trefoil	<i>Lotus pinnatus</i>	vascular plant	LOW: The known range and lack of previously recorded occurrences of bog bird's-foot trefoil within 100 km of the terminal suggests the interaction potential is low.						L	
		branched phacelia	<i>Phacelia ramosissima</i>	vascular plant	LOW: The known range and lack of previously recorded occurrences of branched phacelia within 100 km of the power lines and pump stations suggests the interaction potential is low.		L	L	L	L		
		deltoid balsamroot	<i>Balsamorhiza deltoidea</i>	vascular plant	LOW: The known range and lack of previously recorded occurrences of deltoid balsamroot within 100 km of the terminal suggests the interaction potential is low.							L
		dwarf woolly-heads, southern mountain population	<i>Psilocarphus brevissimus</i>	vascular plant	LOW: Previously recorded occurrences of dwarf woolly-heads range from approximately 59 km to greater than 100 km from the power line and pump station. This suggests the interaction potential is low.			L			L	
		Grand Coulee owl-clover	<i>Orthocarpus barbatus</i>	vascular plant	LOW: The known range and lack of previously recorded occurrences of Grand Coulee owl-clover within 100 km of the power lines and pump stations suggest the interaction potential is low.		L	L	L	L		
		nugget moss	<i>Microbryum vlassovii</i>	moss	LOW: The known range and lack of previously recorded occurrences of nugget moss within 100 km of the power line and pump station suggests the interaction potential is low.		L		L			
		pink sand-verbena	<i>Abronia umbellata</i>	vascular plant	LOW: The known range and lack of previously recorded occurrences of pink sand-verbena within 100 km of the terminal suggests the interaction potential is low.							L
		poor pocket moss	<i>Fissidens pauperculus</i>	moss	LOW: A previously recorded occurrence of poor pocket moss at 66 km from the terminal suggests the interaction potential is low.							L
		prairie lupine	<i>Lupinus lepidus</i>	vascular plant	LOW: The known range and lack of previously recorded occurrences of prairie lupine within 100 km of the terminal suggests the interaction potential is low.							L
		rayless goldfields	<i>Lasthenia glaberrima</i>	vascular plant	LOW: The known range and lack of previously recorded occurrences of rayless goldfields within 100 km of the pump station suggest the interaction potential is low.							L
		rigid apple moss	<i>Bartramia stricta</i>	moss	LOW: Previously recorded occurrence of rigid apple moss at 95 km from the terminal suggests the interaction potential is low.							L
		rusty cord-moss	<i>Entosthodon rubiginosus</i>	moss	LOW: Previously recorded occurrences of rusty cord-moss range from approximately 32-91 km from the power line and pump station. This suggests the interaction potential is low.		L		L			
		seaside centipede lichen	<i>Heteroderma sitchensis</i>	lichen	LOW: The known range and lack of previously recorded occurrences of seaside centipede lichen within 100 km of the terminal suggests the interaction potential is low.							L
		short-rayed alkali aster	<i>Symphotrichum frondosum</i>	vascular plant	LOW: The known range and lack of previously recorded occurrences of short-rayed alkali aster within 100 km of the power line and pump station suggests the interaction potential is low.		L		L			
		silver hair moss	<i>Fabronia pusilla</i>	moss	MODERATE: A previously recorded occurrence of silver hair moss approximately 2 km from the terminal suggests the interaction potential may be moderate.							M
		slender collomia	<i>Collomia tenella</i>	vascular plant	LOW: Previously recorded occurrences of slender collomia range from 59-63 km from the pump station and power line. This suggests the interaction potential is low.				L		L	
		southern maiden-hair fern	<i>Adiantum capillus-veneris</i>	vascular plant	LOW: The known range and lack of previously recorded occurrences of southern maiden-hair fern within 100 km of the pump station and power line suggest the interaction potential is low.			L			L	
		Spalding's campion	<i>Silene spaldingii</i>	vascular plant	LOW: The known range and lack of previously recorded occurrences of Spalding's campion within 100 km of the pump station and power line suggest the interaction potential is low.		L		L			
		stoloniferous pussytoes	<i>Antennaria flagellaris</i>	vascular plant	LOW: Previously recorded occurrences of stoloniferous pussytoes range from approximately 58-73 km from the pump station and power line. This suggests the interaction potential is low.			L			L	
		streambank lupine	<i>Lupinus rivularis</i>	vascular plant	LOW: Previously recorded occurrences of streambank lupine range from approximately 43-57 km from the terminal. This suggests the interaction potential is low.							L
tall bugbane	<i>Actaea elata</i>	vascular plant	MODERATE: Previously recorded occurrences of tall bugbane range from approximately 8-39 km from the terminal. This suggests the interaction potential may be moderate.							M		
tall woolly-heads	<i>Psilocarphus elatior</i>	vascular plant	LOW: The known range and lack of previously recorded occurrences of tall woolly-heads within 100 km of the terminal suggests the interaction potential is low.							L		
white meconella	<i>Meconella oregana</i>	vascular plant	LOW: Previously recorded occurrences of white meconella range from approximately 78-88 km from the terminal. This suggests the interaction potential is low.							L		
whitebark pine <sup>7</sup>	<i>Pinus albicaulis</i>	vascular plant	LOW to HIGH: Previously recorded occurrences of whitebark pine range from approximately 16 km to greater than 100 km from the terminals and pump stations. However, candidate/draft whitebark pine critical habitat occurs within 1 km of the Rearguard Pump Station. This suggests the interaction potential is low at some facilities and high at others.	H		L			L	L		
yellow montane violet praemorsa subspecies	<i>Viola praemorsa ssp. praemorsa</i>	vascular plant	LOW: The known range and lack of previously recorded occurrences of yellow montane violet praemorsa subspecies within 100 km of the terminal suggests the interaction potential is low.							L		
Endangered	--	Roell's brotherella moss	<i>Brotherella roellii</i>	moss	LOW: The known range and lack of previously recorded occurrences of Roell's brotherella moss within 100 km of the terminal suggests the interaction potential is low.						L	
		batwing vinyl lichen	<i>Leptogium platynum</i>	lichen	MODERATE: Previously recorded occurrences of batwing vinyl lichen range from approximately 3-83 km from the terminal. This suggests the interaction potential may be moderate.						M	
Threatened	Threatened	alkaline wing-nerved moss	<i>Pterygoneurum kozlovii</i>	moss	LOW: Previously recorded occurrences of alkaline wing-nerved moss range from approximately 36-98 km from the power lines and pump stations. This suggests the interaction potential is low.		L	L	L	L		
		Bolander's quillwort	<i>Isoetes bolanderi</i>	vascular plant	LOW: The known range and lack of previously recorded occurrences of Bolander's quillwort within 100 km of the pump station and power line suggests the interaction potential is low.			L		L		
		Gray's desert-parsley	<i>Lomatium grayi</i>	vascular plant	LOW: Previously recorded occurrences of Gray's desert-parsley range from approximately 97-100 km from the terminal. This suggests the interaction potential is low.						L	
		Haller's apple moss	<i>Bartramia halleriana</i>	moss	LOW: Previously recorded occurrences of Haller's apple moss range from approximately 10-78 km from the pump station. This suggests the interaction potential is low.	L						
		Macoun's meadowfoam	<i>Limnanthes macounii</i>	vascular plant	LOW: Previously recorded occurrences of Macoun's meadowfoam range from approximately 91-93 km from the terminal. This suggests the interaction potential is low.							L
		Mexican mosquito fern	<i>Azolla mexicana</i>	vascular plant	LOW: A previously recorded occurrences of Mexican mosquito fern at 96 km from the power line suggests the interaction potential is low.			L			L	
		mountain holly fern	<i>Polystichum scopulinum</i>	vascular plant	LOW: Previously recorded occurrences of mountain holly fern range from approximately 42-46 km from the pump station and power line. This suggests the interaction potential is low.			L		L		



TABLE 4.3.8-1 Cont'd

Federal		Common Name <sup>3</sup>	Scientific Name <sup>3</sup>	Type	Potential Interaction with Project <sup>4</sup>	Pump Stations <sup>5,6</sup>			Power Lines <sup>5,6</sup>		Terminal <sup>5,6</sup>
COSEWIC Designation <sup>1</sup>	SARA Designation <sup>2</sup>					R	BP	KI	BP-PL	KI-PL	SU
Threatened (cont'd)	Threatened (cont'd)	phantom orchid	<i>Cephalanthera austiniiae</i>	vascular plant	<b>MODERATE:</b> Previously recorded occurrences of phantom orchid range from 2-100 km from the terminal. This suggests the interaction potential may be moderate.						M
		purple sanicle	<i>Sanicula bipinnatifida</i>	vascular plant	<b>LOW:</b> Previously recorded occurrences of purple sanicle range from approximately 69-100 km from the terminal. This suggests the interaction potential is low.						L
		seaside bone lichen	<i>Hypogymnia heterophylla</i>	lichen	<b>LOW:</b> The known range and lack of previously recorded occurrences of seaside bone lichen within 100 km of the terminal suggests the interaction potential is low.						L
		showy phlox	<i>Phlox speciosa ssp. occidentalis</i>	vascular plant	<b>LOW:</b> Previously recorded occurrences of showy phlox range from approximately 84-99 km from the power lines and pump stations. This suggests the interaction potential is low.		L	L	L	L	
	--	crumpled tarpaper lichen	<i>Collema coniophilum</i>	lichen	<b>LOW:</b> The known range and lack of previously recorded occurrences of crumpled tarpaper lichen within 100 km of the pump station suggests the interaction potential is low.	L					
Special Concern	Threatened	Lyall's mariposa lily	<i>Calochortus lyallii</i>	vascular plant	<b>LOW:</b> The known range and lack of previously recorded occurrences of Lyall's mariposa lily within 100 km of the transmission line and pump stations suggest the interaction potential is low.			L		L	
Special Concern	Special Concern	banded cord-moss	<i>Entosthodon fascicularis</i>	moss	<b>MODERATE:</b> Previously recorded occurrences of banded cord-moss range from approximately 2 km to greater than 100 km from the terminal. This suggests the interaction potential may be moderate.						M
		Columbian carpet moss	<i>Bryoerythrophyllum columbianum</i>	moss	<b>LOW:</b> Previously recorded occurrences of Columbian carpet moss range from 28-100 km from the power lines and pump stations. This suggests the interaction potential is low.		L	L	L	L	
		cryptic paw lichen	<i>Nephroma occultum</i>	lichen	<b>LOW:</b> A previous recorded occurrences of cryptic paw lichen at 55 km from the terminal suggests the interaction potential is low.						L
		giant helleborine <sup>8</sup>	<i>Epipactis gigantea</i>	vascular plant	<b>LOW:</b> Previously recorded occurrences of giant helleborine range from approximately 14 km to greater than 100 km from the facilities. This suggests the interaction potential is low.		L	L	L	L	L
		oldgrowth specklebelly lichen	<i>Pseudocyphellaria rainierensis</i>	lichen	<b>LOW:</b> A previously recorded occurrences of oldgrowth specklebelly lichen at 53 km from the terminal suggests the interaction potential is low.						L
		Vancouver Island beggarticks	<i>Bidens amplissima</i>	vascular plant	<b>LOW to MODERATE:</b> Previously recorded occurrences of Vancouver Island beggarticks range from approximately 3 km to greater than 100 km from the terminal This suggests the interaction potential is low to moderate.						M
		white-top aster	<i>Sericocarpus rigidus</i>	vascular plant	<b>LOW:</b> The known range and lack of previously recorded occurrences of white-top aster within 100 km of the terminal suggests the interaction potential is low.						L
Special Concern	No Status	peacock vinyl lichen	<i>Leptogium polycarpum</i>	lichen	<b>LOW to HIGH:</b> Previously recorded occurrences of peacock vinyl lichen range from 32-99 km from the terminal suggesting the interaction potential is low.						L

Sources: BC CDC 2012a,b, BC MOE 2013, COSEWIC 2013a, Government of Canada 2013.

Notes:

1 COSEWIC 2013a. Species listed as Extirpated, Not at Risk or Data Deficient were generally not included in the table without other noteworthy factors being present.

**Endangered:** a species facing imminent extirpation or extinction.

**Threatened:** a species likely to become Endangered if limiting factors are not reversed.

**Special Concern:** a species that is particularly sensitive to human activities or natural events, but is not an Endangered or Threatened species.

2 SARA. The Act establishes Schedule 1 as the list of species to be protected on all federal lands in Canada.

**Endangered:** a species that is facing imminent extirpation or extinction.

**Threatened:** a species that is likely to become an Endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.

3 Below are the synonyms used by the BC CDC for federally-listed species. Only differences are noted.

**BC CDC Species Synonyms:**

Federal Common Name	Common Name	Scientific Name
bog bird's-foot trefoil	bog bird's-foot lotus	Hosackia pinnata
branched Phacelia	--	Phacelia ramosissima var. ramosissima
dwarf woolly-heads, southern mountain population	--	Psilocarphus brevissimus var. brevissimus
pink sand-verbena	--	Abronia umbellata var. breviflora
short-rayed alkali aster	short-rayed aster	--
tall bugbane	--	Actaea elata var. elata
toothcup	toothcup meadow-foam	--
yellow montane violet praemorsa subspecies	yellow montane violet	--

4 For information on the known range and the BGC zones where each plant species has the potential to occur refer to Table 4.3.2-1.

5 The pump stations are: BP=Black Pines; KI=Kingsvale; and R=Rearguard. The power lines are: BP-PL=Black Pines; and KI-PL=Kingsvale. The terminal is: SU=Sumas.

6 All plant species with the potential to occur in the component of the Project based on BGC zone where the component occurs are indicated. The potential for each Project component to interact with a plant species is described as follows: L=Low; M=Moderate; and H=High. Refer to Table 4.3.2-1 footnotes for full description.

7 EC provided Project-specific hard-copy maps of critical habitat for species at risk in BC (EC 2013). The information on critical habitat is provided in this report with permission from EC and this information is subject to change since critical habitat mapping is not final until posted in a final recovery strategy on the Species at Risk Public Registry. EC makes no representation and gives no warranty of any kind with respect to the accuracy, usefulness, novelty, validity, scope, completeness or currency of the Canada Digital Data and expressly disclaims any implied warranty of merchantability or fitness for a particular purpose of the Canada Digital Data.

8 Giant helleborine, although ranked by SARA, is on Schedule 3 which refers to a need for an assessment by COSEWIC. The last COSEWIC assessment was completed in 1998. However, a reassessment against revised criteria is required for species designated by COSEWIC prior to October 1999 before they can be considered for addition to Schedule 1 (Government of Canada 2013). Therefore, currently giant helleborine does not have protection under the SARA.

### Provincial Rare Plants

No plant species listed under the IWMS are known to occur in the SBS BGC zones or from within 5 km of the Rearguard Pump Station (Table 4.3.8-2) (BC CDC 2012a,b, BC MOE 2013).

There is one rare plant occurrence from the BC CDC within 5 km of the Rearguard Pump Station (BC CDC 2012a,b). Details are provided in Table 4.3.8-2.

**TABLE 4.3.8-2**

**PREVIOUSLY RECORDED RARE PLANT  
 OCCURRENCES WITHIN 5 KM OF THE REARGUARD PUMP STATION**

Common Name	Scientific Name	Type	Provincial Rank <sup>1</sup>	Number of Recorded EOs	Approximate Distance to Proposed Pump Station <sup>2</sup> (km)
bald sedge	<i>Carex tonsa</i> var. <i>tonsa</i>	vascular plant	S2S3, Blue	1	4.0

**Sources:** BC CDC 2012a,b

**Notes:** 1 Definitions of provincial ranks are summarized in the footnotes of Appendix B.

2 All distances are approximate.

### **4.3.9 Black Pines Pump Station**

#### Federal Rare Plants and Lichens

In the PP BGC zone, where the Black Pines Pump Station and power line are located, there are a total of 10 plant and lichen species with conservation status under the SARA and/or COSEWIC of which 6 are designated as Endangered, 2 are designated as Threatened and 2 are designated as Special Concern. Federal species of concern are listed in Table 4.3.8-1.

Based on known range, occurrences and habitat requirements, all 10 federally-listed plant and lichen species are not expected to occur at the Black Pines Pump Station or along the power line (Table 4.3.8-1).

There are no federally-listed rare plant or lichen occurrences from BC CDC within 5 km of the Black Pines Pump Station or along the power line (BC CDC 2012a,b).

#### Provincial Rare Plants and Lichens

No plant species listed under the IWMS are known to occur in the PP BGC zones or from within 5 km of the Black Pines Pump Station and power line (BC CDC 2012a,b, BC MOE 2013).

There are no rare plant occurrences from the BC CDC within 5 km of the Black Pines Pump Station or power line (BC CDC 2012a,b).

### **4.3.10 Kingsvale Pump Station**

#### Federal Rare Plants and Lichens

In the IDF BGC zone where the Black Kingsvale Pump Station and power line are located, there are a total of 15 plant and lichen species with conservation status under the SARA and/or COSEWIC of which 7 are designated as Endangered, 5 are designated as Threatened, 2 are designated as Special Concern and 1 is designated as Special Concern under COSEWIC but has a Threatened designation under the SARA. Federal species of concern are listed in Table 4.3.8-1.

Based on known range, occurrences and habitat requirements, all 15 federally-listed plant and lichen species are not expected to occur at the Kingsvale Pump Station or along the power line (Table 4.3.8-1).

There are no federally-listed rare plant or lichen occurrences from BC CDC within 5 km of the Kingsvale Pump Station or power line (BC CDC 2012a,b).

### Provincial Rare Plants and Lichens

No plant species listed under the IWMS are known to occur in the IDF BGC zones or from within 5 km of the Kingsvale Pump Station and power line (BC CDC 2012a,b, BC MOE 2013).

There are no rare plant occurrences from the BC CDC within 5 km of the Kingsvale Pump Station or power line (BC CDC 2012a,b).

#### **4.3.11 Sumas Terminal**

### Federal Rare Plants and Lichens

In the CWH BGC zone where the Sumas Terminal is located, there are a total of 29 plant and lichen species with conservation status under the SARA and/or COSEWIC of which 15 are designated as Endangered, 5 are designated as Threatened, 6 are designated as Special Concern, 2 are designated as Endangered under COSEWIC but have no status under the SARA and 1 is designated as Special Concern under COSEWIC but has no status under the SARA. Federal species of concern are listed in Table 4.3.8-1.

Based on known range, occurrences and habitat requirements, 23 of the 29 federally-listed plant and lichen species are not expected to occur at the Sumas Terminal (Table 4.3.8-1). Of the remaining species, 6 have a moderate potential of occurring at the Sumas Terminal.

Species with moderate interaction potential include: silver hair moss and tall bugbane which are designated as Endangered under COSEWIC and the SARA; phantom orchid which is designated as Threatened under COSEWIC and the SARA; banded cord-moss and Vancouver Island beggarticks which are designated as Special Concern under COSEWIC and the SARA and batwing vinyl lichen which is designated as Endangered under COSEWIC but has no status under the SARA.

A total of 7 occurrences of rare plants and lichen with a SARA and/or COSEWIC designation, including banded cord-moss, batwing vinyl lichen, phantom orchid, silver hair moss, and Vancouver Island beggarticks have been previously recorded within 5 km of the Sumas Terminal (BC CDC 2012a,b). Details of the previously recorded occurrences are summarized in Table 4.3.11-1.

### Provincial Rare Plants and Lichens

One plant species, tall bugbane, listed under the IWMS is known to occur in the CWH zone (BC CDC 2012a,b). Two previously recorded occurrences of tall bugbane are known from within 5 km of the Black Pines to Hope Segment (Table 4.3.11-1). Based on the known range, occurrences and habitat requirements of tall bugbane there is a moderate potential that this species may occur at the Sumas Terminal (Table 4.3.8-1).

The BC CDC provided records of rare plant EOs known from within 5 km of the Sumas Terminal, which included 8 rare vascular plants, 2 mosses and 1 lichen (BC CDC 2012a,b). Details of the previously recorded occurrences are summarized in Table 4.3.11-1.

**TABLE 4.3.11-1**

**PREVIOUSLY RECORDED RARE PLANT  
 OCCURRENCES WITHIN 5 KM OF THE SUMAS TERMINAL**

Common Name	Scientific Name	Type	Provincial Rank <sup>1</sup>	Number of Recorded EOs	Approximate Distance to Proposed Terminal <sup>2,3</sup> (km)
banded cord-moss	<i>Entosthodon fascicularis</i>	moss	S2S3, Blue	1	2.6
batwing vinyl lichen	<i>Leptogium platynum</i>	lichen	S1S2, Red	1	3.4
fox sedge	<i>Carex vulpinoidea</i>	vascular plant	S2S3, Blue	1	4.0
pacific waterleaf	<i>Hydrophyllum tenuipes</i>	vascular plant	S2, Red	3	2.9-4.0
phantom orchid	<i>Cephalanthera austiniiae</i>	vascular plant	S2, Red	2	1.9-2.5
silver hair moss	<i>Fabronia pusilla</i>	moss	SH, Red	1	1.5

**TABLE 4.3.11-1 Cont'd**

Common Name	Scientific Name	Type	Provincial Rank <sup>1</sup>	Number of Recorded EOs	Approximate Distance to Proposed Terminal <sup>2,3</sup> (km)
Vancouver Island beggarticks	<i>Bidens amplissima</i>	vascular plant	S3, Blue	2	3.3-3.5

**Source:** BC CDC 2012a,b

- Notes:**
- 1 Definitions of provincial ranks are summarized in the footnotes of Appendix B.
  - 2 All distances are approximate.
  - 3 Where there are numerous occurrences of the same species, the range in distance to the proposed pipeline corridor is provided based on the closest and furthest occurrence.

#### 4.4 Provincial Weed Species and Other Invasive Non-Native Species of Concern

According to the Alberta *Weed Control Act*, Prohibited Noxious weeds are those that must be destroyed and Noxious weeds are those that must be controlled by the owner or occupant of those lands on which the weeds are present. In BC, Provincial Noxious weeds are those that must be controlled in all regions and Regional Noxious weeds are those that must be controlled in the region(s) for which they are listed. There are many additional, non-listed species that are introduced to Alberta and BC (*i.e.*, non-native), including some agronomic and horticultural species, that can be invasive in certain land uses. Additional invasive non-native species of concern are identified through consultation.

In BC the TNRD, the *FRPA* and Invasive Plant Councils/Committees use additional designations to identify problematic species in their respective management regions (Fox 2013, FVIPC 2012, ISCMV 2013, NWIPC 2012, SIWMC 2013, TNRD 2010). The TNRD designates weeds in four categories: Category 1; Category 2; Category 3; and Category 4. Category 1 species are recently introduced and pose a threat to undisturbed sites and are the highest risk to native vegetation, endangered ecosystems and recreational land. Category 2 species are either less competitive than Category 1 species or more easily controlled and moderately threaten native vegetation, endangered ecosystems and recreational land. Category 3 species are effectively controlled by biological control agents and, therefore, are considered non-priority species because they pose minimal threat to native vegetation, endangered ecosystems and recreational land. Category 4 species are currently sufficiently controlled by biological controls agents.

In addition to species listed by the BC *Weed Control Act*, the *FRPA* lists species as prescribed species.

Invasive Plant Councils use additional designations to identify problematic species for management regions. The NWIPC designates weeds as Extremely Invasive, Very Invasive, Invasive, Aggressive or Under Biocontrol. Extremely Invasive species will invade undisturbed sites and will eventually dominate. Very Invasive species will invade undisturbed sites and may form dense patches but usually do not dominate. Invasive species most often rely on disturbance to gain entry into an area and usually do not dominate. Aggressive or Under Biocontrol species can invade undisturbed sites but do so very slowly, rarely dominate sites and often go through population fluctuations (NWIPC 2012).

The FVIPC designates weeds in four categories Prevent, Eradicate, Contain and Control. Prevent species should be eradicated if found; they are not known to occur in the area but if introduced will likely establish themselves. Eradicate species should be eradicated; they are known to occur in limited areas and at lower densities. Contain species should be contained; they are established infestations found in portions of the region. Control species should be controlled in high value areas; these are established infestations with common and widespread dispersal throughout the region (FVIPC 2012).

The ISCMV designates weeds in four categories Prevent, Eradicate, Contain and Control. Prevent species are not yet within Metro Vancouver but live in similar habitats in surrounding jurisdictions. Eradicate species have the potential to be eradicated from the region if action is taken quickly and early. Contain species have a large enough distribution that eradication is unlikely but exist only in isolated populations which can be managed to eliminate the further spread. Control species are unlikely to be

eradicated due to their widespread distribution throughout the region and are only managed in high value areas (ISCMV 2013).

Regional districts and invasive plant councils/committees often work together in collaboration in order to educate, prevent and manage invasive species.

Species nomenclature is determined according to the list of all elements in Alberta (ACIMS 2013b) or the BC Species and Ecosystems Explorer (BC MOE 2013), with more current taxonomic information drawn from NatureServe (2012a), when necessary. Where the *Weed Control Act* nomenclature differs from these sources, the *Weed Control Act* name for the species has been provided in brackets following the BC CDC name.

#### **4.4.1 Edmonton to Hinton Segment**

Stakeholders, including attendees of the Hinton Community Workshop, Edmonton West Community Workshop and Edson Community Workshop as well as representatives of Strathcona County, the City of Edmonton, the City of Spruce Grove, the Town of Stony Plain, the Village of Wabamun, Wabamun Lake Provincial Park, Parkland County and Yellowhead County, were contacted regarding weeds and crop diseases of concern and their associated websites were reviewed.

##### **4.4.1.1 Strathcona County**

Weeds of concern according to the Strathcona County website include creeping thistle (Canada thistle), field scabious, giant hogweed, leafy spurge, ox-eye daisy, perennial sow-thistle, purple loosestrife, scentless chamomile, tall buttercup, common tansy, toad-flax species and bladder campion (white cockle) (Strathcona County 2013). The Agriculture Services Fieldman from Strathcona County has recognized extra vigilance is required for creeping thistle (Canada thistle), scentless chamomile and purple loosestrife in the waterbodies near Wye Road. In addition, clubroot has tested positive in LSD 4-52-23 W4M (Mills pers. comm.). Strathcona County has acknowledged there may be more species included once the Footprint has been confirmed.

##### **4.4.1.2 City of Edmonton**

Weeds of concern according to the City of Edmonton's website include garlic mustard, creeping thistle (Canada thistle), garden bluebell (creeping bellflower), dame's rocket, leafy spurge, perennial sow-thistle and scentless chamomile (City of Edmonton 2013). In addition to these species, all species regulated in the Alberta *Weed Control Act*, all regulated Hawkweed species, all listed knapweed species, common mullein, common tansy, ox-eye daisy, tall buttercup and bladder campion (white cockle) have been identified as high concern (Laubham pers. comm.).

##### **4.4.1.3 Parkland County**

Parkland County has not up-listed any weed species and has not identified any additional weed species of concern. Crop diseases of concern according to Parkland County's website include late blight, clubroot and fusarium head blight (Parkland County 2013). It is strongly recommended that the procedures outlined in the provincial Clubroot Management Plan are followed (Leskiw pers. comm.). Clubroot locations in Parkland County are provided in Table C2.1-1 in Appendix C of the Pipeline EPP of Volume 6B.

##### **4.4.1.4 City of Spruce Grove**

City of Spruce Grove does not acknowledge any additional weed species to the Alberta *Weed Control Act* on their website. As of November 2013, no response has been received from the City of Spruce Grove.

##### **4.4.1.5 Town of Stony Plain**

Prohibited weeds within the Town of Stony Plain include common burdock (lesser burdock), common chickweed, flixweed, foxtail barley, green foxtail, common groundsel, annual hawk's-beard, hemp-nettle, henbit, summer-cypress, lamb's-quarters, red-root pigweed, common plantain, shepherd's-purse, stinkweed, scentless chamomile and Russian-thistle (Zacharias pers. comm.).

#### **4.4.1.6**      *Village of Wabamun*

The Village of Wabamun does not have specific concerns with regard to weeds or crop diseases near the Project (Anderson pers. comm.).

#### **4.4.1.7**      *Yellowhead County*

Weeds of concern in Yellowhead County include ox-eye daisy, tall buttercup, perennial sow-thistle, creeping thistle (Canada thistle), field scabious, common burdock, bladder campion (white cockle), common toadflax (yellow toadflax), common tansy, scentless chamomile, orange hawkweed, meadow hawkweed, mouse-ear hawkweed, Himalayan balsam and bighead knapweed (Pichette pers. comm.).

Clubroot has been confirmed at 54-8 W4M. Yellowhead County does not have specific policies for clubroot prevention, however, they do recommend washing construction equipment (Pichette pers. comm.). Clubroot locations in Yellowhead County are provided in Table C2.1-1 in Appendix C of the Pipeline EPP of Volume 6B.

### **4.4.2**      *Hargreaves to Darfield Segment*

Stakeholders, including attendees of the Clearwater Community Workshop and Kamloops ESA Workshop as well as representatives of the Regional District of Fraser-Fort George (RDFFG), the TNRD, the NWIPC and the SIWMC were contacted regarding weeds of concern and their associated websites were reviewed.

#### **4.4.2.1**      *Fraser-Fort George Regional District and the Northwest Invasive Plant Council*

Regionally-listed weeds in the RDFFG include common burdock and marsh thistle (marsh plume thistle). Weeds of concern within the NWIPC management area include spotted knapweed, common tansy, viper's bugloss (blueweed), chicory and Dalmatian toadflax. The main concern to the NWIPC is the introduction of new infestations and the spread of existing infestations (Eastham pers. comm.). Table 4.4.2-1 provides all of the species of concern within the NWIPC management area along with Invasiveness Class, *Weed Act* Status, General Inventory Information and Site Level Management (NWIPC 2013).

TABLE 4.4.2-1

WEEDS OF CONCERN WITHIN THE NWIPC MANAGEMENT AREA

Common Name	Scientific Name	Invasiveness Class	Weed Act Status <sup>1</sup>	General Inventory Information	Site Level Management
baby's breath	<i>Gypsophila paniculata</i>	Invasive	--	Reported in Valemount in 2008; escaped due to mismanagement of gardens. More information on spread needed.	Containment; risk assessment needed
bachelor's button (cornflower)	<i>Centaurea cyanus</i>	Aggressive or Under Bio-control	--	Growing in waste lots in Telkwa. Likely garden escapes.	Containment; risk assessment needed
bishop's goutweed (goutweed)	<i>Aegopodium podagraria</i>	Invasive	--	Sites reported in Prince George, Smithers and Kitimat areas in 2012; went on target list in 2013. Likely garden escapes and illegal dumping.	--
black knapweed	<i>Centaurea nigra</i>	Extremely Invasive	--	Reported east of Burn's Lake in 1994.	Regional Early Detection Rapid Response (EDRR)
black medic	<i>Medicago lupulina</i>	Aggressive or Under Bio-control	--	Abundant in Smithers area in gravel pits and at the dump.	No action planned
bladder campion	<i>Silene cucubalus</i>	Aggressive or Under Bio-control	--	Present along the railroad track at the Suskwa siding and rail crossing. Commonly confused with white cockle and night flowering catchfly.	--
blueweed (viper's bugloss)	<i>Echium vulgare</i>	Very Invasive	Regional Noxious	First reported in 1992 east of Burn's Lake, however this may have been an ornamental plant of the same family. Well-established population found at Cranberry Junction Campsite on Highway 37 N, in 1994. A single plant was found between Hazelton and Kitwanga in 2007. A single plant was found in Prince George in 2008. Historical infestation treated in Miworth in 2011.	Regional EDRR; risk assessment needed
brown knapweed	<i>Centaurea jacea</i>	Extremely Invasive	--	Sites located westward in the Lakelse Park-Onion Lake area and to the east near Endako found in 2007. Most sites have zero to a few dozen plants appearing per year.	Regional EDRR
bull thistle	<i>Cirsium vulgare</i>	Invasive	--	Found throughout the region. Does not compete well with established plant communities. Has begun to show up along Highway 37 north.	Rehabilitation through biological agent monitoring and dispersal
Canada thistle	<i>Cirsium arvense</i>	Very Invasive	Provincial Noxious	Widely dispersed in the region, particularly along roadsides. In some areas, affecting or threatening to affect forage production on range and pasture. Beginning to show up in the Dease Lake-Cassiar area.	Rehabilitation and containment for the Stikine-Cassiar area
chicory	<i>Cichorium intybus</i>	Very Invasive	--	Several chicory sites reported in the region. Extent and distribution of the weed in northwest and central BC has not been determined. Pulled and dug in Prince George area in 2008.	Regional EDRR; risk assessment needed
comfrey (common comfrey)	<i>Symphytum officinale</i>	Invasive	--	Added to NWIPC list in 2009; added to Invasive Alien Plant Program in 2010. Moving from road rights of way into the forests in the Smithers area and possibly other areas.	Containment; risk assessment needed
common burdock/burdock	<i>Arctium minus</i>	Very Invasive	Regional Noxious	Well dispersed throughout the region and found primarily in moist regions.	Containment
common groundsel	<i>Senecio vulgaris</i>	Aggressive or Under Bio-control	--	Distributed throughout the region. May cause problems in cultivated fields such as vegetable farms.	--
common hops (common hop)	<i>Humulus lupulus</i>	Very Invasive	--	First reported in 2010 in Smithers. Serious invasive species in southern BC.	Containment
common tansy	<i>Tanacetum vulgare</i>	Extremely Invasive	Regional Noxious	Can adapt to a wide range of habitats and is quite aggressive. Abundant between Terrace and Prince Rupert and extensive infestations along Highway 37 from the Kitimat River Bridge to Kitimat. Appears to be heading into the interior districts with numerous reports of large infestations in the Hazelton area.	Containment
curled dock	<i>Rumex crispus</i>	Aggressive or Under Bio-control	--	Seen across the region from Atlin to Valemount. Indications that it can be a problem on acidic soils.	--
cypress spurge	<i>Euphorbia cyparissias</i>	Extremely Invasive	--	Do not spread rapidly but they do progress with a fierce tenacity. Difficult to control because of its extensive rhizomatous roots. Forms dense stands that are a threat to open canopy habitat.	Regional EDRR
dalmatian toadflax	<i>Linaria dalmatica</i>	Very Invasive	Provincial Noxious	First reports received from Lakes District in 1992; likely that infestations in Terrace, Prince George and Vanderhoof predated this report. Numerous sites throughout the region and spreading rapidly. Adapted to a wide range of habitats and quite aggressive on well-drained soils.	Containment and biological control agent releases
diffuse knapweed	<i>Centaurea diffusa</i>	Very Invasive	Provincial Noxious	First reported on three sites in the northwest in 1979. Established around Kitwanga Village and spread along Highways 37 and 16. Scattered sites in various locations including Prince George.	Containment
dog mustard	<i>Erucastrum gallicum</i>	Aggressive or Under Bio-control	--	First collected in 1994 along Telkwa High Road. Likely that it is more widely distributed than currently believed due to the leaves being quite similar to those of tumble mustard.	--
English Holly	<i>Ilex aquifolium</i>	Very Invasive	--	Reported sites confined to Vancouver and Fraser Valley. Can dominate the tall shrub layer in the forest. Used in gardens and cultivate for Christmas trade.	Containment
English ivy	<i>Hedera helix</i>	Extremely Invasive	--	Inventoried by the Cariboo Regional District in 2008.	Containment

TABLE 4.4.2-1 Cont'd

Common Name	Scientific Name	Invasiveness Class	Weed Act Status <sup>1</sup>	General Inventory Information	Site Level Management
evening primrose (common evening-primrose)	<i>Oenothera biennis</i>	Aggressive or Under Bio-control	--	Infestation reported in 1994 along roadsides in Hazelton. Site reported in 1995 east of Burns Lake. Collections have been made in Prince George, but there have not been instructions or a focus on conducting inventories. Concern raised in 2008 about rapid spread.	Containment; risk assessment needed
eyebright (eastern eyebright)	<i>Euphrasia nemorosa</i>	Very Invasive	--	Increase in population being seen. Brought to attention in 2009 by a farmer in the McBride area. Thrives along roadsides and is now getting a foothold in private pasture and crop lands.	Containment; risk assessment needed
field scabious	<i>Knautia arvensis</i>	Extremely Invasive	Regional Noxious	Common in the Stoney Creek area near Vanderhoof, Buck Flats south of Houston, less so in the Fort Fraser area and Prince George. Been in the area for over 50 years and has been spreading. Serious threat to the open canopies and grasslands of the SBS Zone and other open habitats.	Containment
giant hogweed (giant cow-parsnip)	<i>Heracleum mantegazzianum</i>	Extremely Invasive	Provincial Noxious	Currently only in the Lower Mainland, Fraser Valley, Gulf Islands and central south Vancouver Island.	Regional EDRR
giant knotweed	<i>Fallopia sachalinensis</i>	Extremely Invasive	Provincial Noxious	--	Regional EDRR - exception is Haida Gwaii and west of Terrace; containment
goat's-beard (goatsbeard)	<i>Tragopogon dubius</i>	Invasive	--	Abundant along some roadsides and the CNR lines and appears to be spreading quite rapidly in the region. May be spreading off the roads and rail lines onto adjacent rangeland.	Rehabilitation; risk assessment needed
gorse	<i>Ulex europaeus</i>	Extremely Invasive	Provincial Noxious	Five sites treated in NWIPC area in 2008.	Regional EDRR - exception is Moresby Island; Containment
greater knapweed (greater Centaurea)	<i>Centaurea scabiosa</i>	Extremely Invasive	--	Two sites reported east of Burns Lake, and one in Telkwa in 1997; may have been first record of this knapweed in BC.	Regional EDRR
hairy bittercress	<i>Cardamine hirsuta</i>	Very Invasive	--	Reported as a problem in 2009 by the City of Prince George parks staff. Thought to have been brought in on nursery stock and spread rapidly through cultivated beds.	Containment; risk assessment needed
hawkweeds	<i>Hieracium spp.</i>	Extremely Invasive	Regional Noxious	--	Rehabilitation
hedge mustard	<i>Sisymbrium officinale</i>	Aggressive or Under Bio-control	--	--	--
hemp-nettle	<i>Galeopsis tetrahit</i>	Aggressive or Under Bio-control	--	Appears to be quite aggressive and numerous complaints have been received.	--
Himalayan balsam (policeman's helmet)	<i>Impatiens glandulifera</i>	Extremely Invasive	--	Inventory work began in 2006. By 2008, 22 sites inventoried, 71 new sites in 2009, 32 in 2010. Many sites are large and riparian in the Stikine-Skeena Invasive Plant Management Areas. Spread appears to be initially by gardeners dumping refuse in remote sites.	Containment
Himalayan blackberry	<i>Rubus discolor</i>	Extremely Invasive	--	--	Regional EDRR
Himalayan Knotweed	<i>Persicaria wallichii</i>	Extremely Invasive	Provincial Noxious	--	Regional EDRR - exception is Haida Gwaii and west of Terrace; containment
hoary alyssum	<i>Berteroa incana</i>	Extremely Invasive	Regional Noxious	Causing serious problems in environmental degradation and limiting access in southern coastal BC and Pacific Northwest states. Only one reported site in region that is on Haida Gwaii. Additional sites on Haida Gwaii and north coastal areas of NWIPC have not been inventoried.	Regional EDRR
hop-clover (yellow clover)	<i>Trifolium aureum</i>	Aggressive or Under Bio-control	--	Wide dispersal along roadsides.	--
hound's-tongue (common hound's-tongue)	<i>Cynoglossum officinale</i>	Very Invasive	Provincial Noxious	No reported sightings in the region, however, it will likely appear in the future. First appearance will probably be in livestock facilities used for handling cattle from southern BC. Low level economic effect on the livestock industry because of the burs.	Regional EDRR
Japanese Knotweed	<i>Fallopia japonica</i>	Extremely Invasive	Provincial Noxious	--	Regional EDRR - exception is Haida Gwaii and west of Terrace; containment
goosefoot species	<i>Chenopodium spp.</i>	Aggressive or Under Bio-control	--	Common agricultural weed and can be found in many farm yards in the region. Have some forage value but can occasionally cause nitrate poisoning. Has also been found in some isolated spots such as Top Camp on the Turnagain River and above Day's Ranch at Telegraph Creek.	--
leafy spurge	<i>Euphorbia esula</i>	Extremely Invasive	Provincial Noxious	Do not spread rapidly but they do progress with a fierce tenacity. Difficult to control because of its extensive rhizomatous roots. Forms dense stands that are a threat to open canopy habitat.	Regional EDRR
marsh plume thistle (marsh thistle)	<i>Cirsium palustre</i>	Extremely Invasive	Regional Noxious	Prevents germination and limits growth of other plants. Considered aggressive and has invaded and dominated very resistant plant communities. Presents a very serious threat and will dramatically affect riparian, upland range and seral plant communities.	Containment
mossy stone crop (goldmoss stonecrop)	<i>Sedum acre</i>	Very Invasive	--	Several reports submitted in 2010. Numerous sites in Prince George. Has pungent fumes when hit with a string trimmer or mower and is an irritant.	Containment; risk assessment needed
mountain bluet	<i>Centaurea montana</i>	Very Invasive	--	Grown as an ornamental and is showing up along roadsides. Numerous reports from the Burns Lake and Prince George areas. Slowly spreading. Sites found growing under forest canopy. Threat presented has not been assessed but appears to be aggressive.	Containment
mullein (great mullein)	<i>Verbascum thapsus</i>	Aggressive or Under Bio-control	--	Considered a nuisance weed. Alternate host for an apple pest and sometimes controlled for that reason. Found as rare and scattered infestations across the region.	--



TABLE 4.4.2-1 Cont'd

Common Name	Scientific Name	Invasiveness Class	Weed Act Status <sup>1</sup>	General Inventory Information	Site Level Management
narrowleaf hawk's-beard (annual hawkbeard)	<i>Crepis tectorum</i>	Aggressive or Under Bio-control	--	Wide distribution and occurrence in the region. Does not dominate areas when it moves off disturbed sites to adjacent undisturbed areas. Thought to be a nuisance weed that has very wide distribution but not much of a threat.	--
night-flowering catchfly	<i>Silene noctiflora</i>	Invasive	Regional Noxious	Reported in 1993 along the railroad track at Owen Creek Ranch near Smithers. Other sites near Smithers. Site reported at Piniche Lake Campsite north of Fort St. James.	Rehabilitation; risk assessment needed
nodding thistle	<i>Carduus nutans</i>	Aggressive or Under Bio-control	--	First site reported in 1989 on Highway 37 north of Kitwancool. Not thought to present a serious threat to the NWIPC region due to successful biological control.	Containment, monitoring and dispersal of biocontrol agents
oxeye daisy	<i>Chrysanthemum leucanthemum</i> ( <i>Leucanthemum vulgare</i> )	Very Invasive	Regional Noxious	Wide distribution in the region and very abundant in some areas. Some private pastures and crown range are experiencing serious forage losses. Large portions of the Cassiar area are still relatively free and it may be possible and beneficial to develop a containment program.	Rehabilitation with possible containment in the Cassiar and other selected areas to be determined
perennial sow thistle/perennial sow-thistle	<i>Sonchus arvensis</i>	Invasive	Provincial Noxious	Wide distribution in the region particularly along roadsides. Extent of infestation has not been determined. Very common in most areas and has been found as far away as Telegraph Creek Road and at Warm Bay in Atlin. Felt that the weed is cyclic in this region. Populations high in early and late nineties, lower in mid-90s.	Rehabilitation
pineapple weed	<i>Matricaria matricarioides</i> ( <i>Matricaria discoidea</i> )	Aggressive or Under Bio-control	--	Very extensive in the region. Not considered a problem.	--
plumeless thistle	<i>Carduus acanthoides</i>	Very Invasive	Regional Noxious	None reported. Likely to arrive and cause problems in northwest BC in the near future.	Containment
purple foxglove (common foxglove)	<i>Digitalis purpurea</i>	Invasive	--	Requires control at a number of ecologically sensitive sites within the Gwaii Haanas and potentially elsewhere on Haida Gwaii. Particularly invasive in the unique thermal meadows ecosystem of Hotsprings Island. Yearly mechanical control efforts have occurred over the past 10 years with slow but steady success.	Containment; risk assessment needed
purple loosestrife	<i>Lythrum salicaria</i>	Very Invasive	Provincial Noxious	Aquatic invasive plant. One common site documented near the Canfor sawmill in Houston; a 2008 inventory did not find the species.	Regional EDRR
Russian thistle	<i>Salsola kali</i>	Invasive	Regional Noxious	Reported in Prince George in 2007. Tends to prefer and cause problems in areas drier than central and northern BC but further assessment is needed.	Containment; risk assessment needed
scentless chamomile (scentless mayweed)	<i>Matricaria maritima</i> ( <i>Tripleurospermum inodorum</i> )	Very Invasive	Provincial Noxious	Fairly wide distribution and can be found across most of the region and is often abundant. Can cause problems if commercial fine seed production is occurring.	Rehabilitation; risk assessment needed
Scotch Broom	<i>Cytisus scoparius</i>	Extremely Invasive	--	Scotch broom was found in the Prince Rupert area during survey conducted in 2000. It has likely been in the north coast, Haida Gwaii for some time. The infestations are not extensive but the numerous smaller sites are threatening to spread and cause a lot of damage. Broom control days have been organized on Haida Gwaii by BC Parks. The BC MOE commissioned a risk assessment for broom on Haida Gwaii in 2007.	Regional EDRR - exception is Haida Gwaii
small bugloss (European bugloss)	<i>Lycopsis arvensis</i> ( <i>Anchusa arvensis</i> )	Aggressive or Under Bio-control	--	Ornamental garden cultivars and not thought to cause problems.	--
spotted knapweed	<i>Centaurea stoebe</i>	Extremely Invasive	Provincial Noxious	First reported in the region in 1980 west of Terrace. With exception to larger infestations in the Valemount area, most sties are small and attempts are to prevent seeding every year.	Containment
St. John's-wort (common St. John's-wort)	<i>Hypericum perforatum</i>	Aggressive or Under Bio-control	--	A companion with common tansy in the Terrace area. Prevalent along Highway 16 from the Skeena River Bridge west to the A&W in Terrace. Moving east and small infestations are appearing along Highway 16 through to the eastern edge of the region. Moving north towards the region along the CNR line and Highways 5 and 97. Not thought to present a serious threat due to successful biological control.	Rehabilitation through biological agent monitoring and dispersal
stinkweed/pennycress (field pennycress)	<i>Thlaspi arvense</i>	Aggressive or Under Bio-control	--	Appears to have scattered distribution throughout the region. Not considered to be a range weed problem but can be a problem in some agriculture settings. Feed containing excessive amounts of stinkweed seed may be toxic to horses.	--
sulphur cinquefoil	<i>Potentilla recta</i>	Extremely Invasive	Regional Noxious	Site found in the Bulkey Integrated Pest Management Area (IPMA) in Smithers in 2011 and hand pulled. Numerous sites recorded north of Prince George and in the Robson Valley, however, confirmation needed. Region is at serious risk of invasion and the entry path will likely be up the North Thompson River.	Regional EDRR
tansy ragwort	<i>Senecio jacobaea</i>	Very Invasive	Provincial Noxious	One large site reported on Haida Gwaii. Several sites reported in the Prince George and Robson Valley IPMAs in 2006.	Regional EDRR
tarweed (clustered tarweed)	<i>Madia glomerata</i>	Aggressive or Under Bio-control	--	First found in 1992. Distribution not known but appears to be fairly wide spread. Either spreading rapidly or goes through dramatic population cycles. Native to parts of BC, but unlikely that it is native to the northwest.	--
tufted vetch	<i>Vicia cracca</i>	Aggressive or Under Bio-control	--	Reported as extensive in the Terrace area.	--
tumble mustard	<i>Sisymbrium spp.</i>	Aggressive or Under Bio-control	--	Distribution to be determined, but sites reported at Smithers dump, behind the Skeena-Stikine FD Office, Kitwanga village and various roadsides.	--
Western bluebur (bristly stickseed)	<i>Lappula echinata</i> ( <i>Lappula squarrosa</i> )	Aggressive or Under Bio-control	--	--	--
white cockle	<i>Silene latifolia</i>	Aggressive or Under Bio-control	Regional Noxious	Confirmed in 1994 in Telkwa. Considered naturalized in the United States.	--

**TABLE 4.4.2-1 Cont'd**

Common Name	Scientific Name	Invasiveness Class	Weed Act Status <sup>1</sup>	General Inventory Information	Site Level Management
wild buckwheat (black bindweed)	<i>Polygonum convolvulus</i> ( <i>Fallopia convolvulus</i> )	Aggressive or Under Bio-control	--	Common agricultural weed and is found on many grain fields in the region. Not considered a threat to rangelands and is reasonably palatable to grazing animals.	--
wild carrot	<i>Daucus carota</i>	Very Invasive	--	Identified in Prince George at the old weigh scale.	Regional EDRR
wild mustard (corn mustard)	<i>Sinapis arvensis</i>	Aggressive or Under Bio-control	Regional Noxious	Common annual weed and is found in most cultivated fields. If land is cultivated and crop species are not quickly established, wild mustard occupies the site.	--
wormwood/absinthium	<i>Artemisia absinthium</i>	Invasive	--	First noticed in 1998 in Telkwa. Suspected that it is relatively new to the area but is already fairly well distributed as single plants or small clumps along Highway 16 from Houston to Moricetown.	Containment; risk assessment needed
yellow archangel	<i>Lamium galeobdolon</i>	Very Invasive	--	Introduced European forest-edge species that is persistent once established. Noted in forested land on Haida Gwaii in 2008. Reported in 2009 that it was taking over fields in Smithers.	Containment; risk assessment needed
yellow flag iris (yellow iris)	<i>Iris pseudacorus</i>	Extremely Invasive	Provincial Noxious	Sold in garden centres and still available through the horticulture industry. First reported in 2002 on Haida Gwaii. Extremely invasive and could have serious effects on the wetlands of Haida Gwaii. Noted as common in Hartley Bay in 2005, and throughout the Stikine-Skeena IPMA beginning in 2009.	Regional EDRR
yellow toadflax/common toadflax (butter-and-eggs)	<i>Linaria vulgaris</i>	Invasive	Provincial Noxious	Found throughout the region particularly along Highway 16 and the CNR line. Patches range from a few plants to patches over a hectare and some patches fluctuate greatly in size over the years.	Rehabilitation through biological agent monitoring and dispersal

**Note:** 1 Species nomenclature and the status of species as native or not is determined according to the BC Species and Ecosystem Explorer (BC MOE 2013), with more current taxonomic information drawn from NatureServe (2012a), when necessary. Where the NWIPC nomenclature differs from these sources, the BC Species and Ecosystem Explorer name for the species has been provided in brackets following the NWIPC name. Where no species nomenclature is available from the BC Species and Ecosystem Explorer (BC MOE 2013), only the BC *Weed Control Act* name is provided.

#### **4.4.2.2 *Thompson-Nicola Regional District and the Southern Interior Weed Management Committee***

Weeds of concern based on the SIWMC website include regionally-listed weeds, locally invasive plants and possible new invaders. Regionally-listed weed species include viper's bugloss (blueweed), burdock species, field scabious, heart-podded hoary cress (hoary cress), orange-red king devil (orange hawkweed), oxeye daisy, broad-leaved pepper-grass (perennial pepperweed) and sulphur cinquefoil. Locally invasive plants include viper's bugloss (blueweed), bull thistle, Canada thistle, common burdock, diffuse knapweed, Dalmatian toadflax, hoary alyssum, common hound's-tongue, leafy spurge, orange-red king devil (orange hawkweed), spotted knapweed, sulphur cinquefoil and scentless mayweed (scentless chamomile). Possible new invaders include field scabious, marsh thistle (marsh plume thistle), broad-leaved pepper-grass (perennial pepperweed), skeleton-weed (rush skeletonweed), scotch thistle and yellow starthistle (SIWMC 2013).

During the Clearwater Community Workshop knapweed species were identified along with listed and non-listed species as being of concern.

Weeds of concern identified during the Kamloops ESA workshop include common St. John's-wort, orange-red king devil (orange hawkweed), common tansy, sulphur cinquefoil and hoary alyssum around Blackpool. In addition to these weeds of concern the workshop participants also acknowledged that except for knapweed species and viper's bugloss (blueweed) the area around Merritt is fairly weed free and expressed a desire for all locations in the management area to appear similar (Fox pers. comm.).

#### **4.4.3 *Black Pines to Hope Segment***

Stakeholders, including attendees of the Kamloops ESA Workshop, Kamloops Community Workshop, Merritt Community Workshop and Hope Community Workshop as well as representatives of the TNRD, the FVRD, the SIWMC and the FVIPC, were contacted regarding weeds of concern and their associated websites were reviewed.

##### **4.4.3.1 *Thompson-Nicola Regional District and the Southern Interior Weed Management Committee***

Noxious weeds were expressed as a concern during the Kamloops Community Workshop.

During the Merritt Community Workshop, the avoidance of transplanting and spreading of Noxious species in the Merritt area was a concern. In addition knapweed species, toadflax species, thistle species and other existing weeds should be controlled.

During the Hope Community Workshop, concerns of a very toxic weed (likely giant cow-parson) introduced from China was identified in the Hope area and it is recommended that measures be taken to avoid its spread.

#### **4.4.4 *Hope to Burnaby Segment***

Stakeholders, including attendees of the Hope Community Workshop, Abbotsford Community Workshop, Coquitlam Community Workshop and Langley Community Workshop as well as representatives of the FVRD, the GVRD, the FVIPC and the ISCMV, were contacted regarding weeds and crop diseases of concern and their associated websites were reviewed.

##### **4.4.4.1 *Fraser Valley Regional District and the Fraser Valley Invasive Plant Council***

Weeds of concern according to the FVRD website include tansy ragwort, wild chervil, giant hogweed and knotweed species (FVRD 2008).

Weeds of concern in the Prevent category include Russian knapweed, garlic mustard, common bugloss (alkanet), bur chervil, giant reed, flowering-rush, yellow starthistle, Marsh plume thistle (marsh thistle), common crupina, leafy spurge, giant mannagrass, yellow bush lupine (tree lupine), yellow loosestrife (spotted loosestrife), garden loosestrife (yellow loosestrife), wand loosestrife, common reed, curled pondweed, kudzu, carpet burweed, milk thistle, gorse. Weeds of concern in the eradicate category

include Hound's-tongue (common hound's-tongue), spurge laurel/daphne (spurge-laurel), baby's breath, giant hogweed (giant cow-parsnip) and yellow flag-iris (yellow iris). Weeds of concern in the Contain category include wild chervil, hoary alyssum, diffuse knapweed, spotted knapweed, mountain bluet, meadow knapweed, Scotch broom, Japanese knotweed, giant knotweed, Bohemian knotweed, Himalayan knotweed, Dalmatian Toadflax, yellow Toadflax (butter-and-eggs). Weeds of concern in the Control category include butterfly-bush, cheatgrass, wild clematis (traveler's joy), poison-hemlock, morning glory/Bindweed species, English hawthorn (common hawthorn), orchard grass, blueweed (viper's bugloss), Cypress spurge, English ivy, orange hawkweed (orange-red king devil), tall hawkweed, yellow hawkweed (yellow king devil), king devil, flagellate hawkweed, hops (common hop), common St. John's wort, English holly, small touch-me-not, Pacific jewelweed, Himalayan balsam (policeman's helmet), yellow archangel, purple loosestrife, parrot's feather, Eurasian water-milfoil, reed canarygrass, sulphur cinquefoil, Himalayan blackberry, Evergreen blackberry (cutleaf evergreen blackberry), tansy ragwort, scentless chamomile (scentless mayweed), common periwinkle and large periwinkle (FVIPC 2012).

During the Abbotsford Community Workshop, concerns about aquatic and terrestrial weeds species along with Japanese knotweed were expressed.

#### **4.4.4.2 Greater Vancouver Regional District and the Invasive Species Council of Metro Vancouver**

Weeds of concern according to the ISCMV website include scotch broom, policeman's helmet, English ivy and purple loosestrife. English ivy has been targeted for removal and purple loosestrife should be controlled in wetlands (GVRD 2011).

Weeds of concern in the Prevent category include milk thistle, gorse, hoary alyssum, crupina, kudzu, Russian knapweed, alkanet (common bugloss), leafy spurge and yellow starthistle. Weeds of concern in the Eradicate category include garlic mustard, common reed, bur chervil, viper's bugloss (blueweed), Dalmatian toadflax, flowering-rush, mountain bluet, yellow loosestrife, English cordgrass, chicory, poison-hemlock, jimsonweed, Fuller's teasel and carpet burweed. Weeds of concern in the Contain category include wild chervil, butterfly-bush, diffuse knapweed, spotted knapweed, giant hogweed, Himalayan knotweed, meadow knapweed, yellow king devil, small touch-me-not, Eurasian water-milfoil, wild carrot, common foxglove, St. John's-wort, common touch-me-not, prickly lettuce, parrotweed, curled pondweed, sulphur cinquefoil and tufted vetch. Weeds of concern in the Control category include Canada thistle, Scotch broom, Japanese knotweed, Bohemian knotweed, English ivy, English holly, policeman's helmet, yellow iris (yellow flag iris), purple loosestrife, Himalayan blackberry, common tansy, burdock species, periwinkle species, lamium species, purple dead-nettle, cutleaf evergreen blackberry, tansy ragwort, pond water-starwort, lamb's-quarters, wild clematis, morning glory, English hawthorn, orchard grass, hairy cat's-ear, oxeye daisy, scentless mayweed (scentless chamomile), lady's-thumb, reed canarygrass, cherry-laurel, yellow salsify and great mullein (ISCMV 2013).

During the Coquitlam Community Workshop, it was expressed that there are numerous invasive species in the Coquitlam area due to many overlapping construction projects. Stringent care should be taken during construction to avoid weeds and seed mix should be checked rigorously for invasive species.

During the Langley Community Workshop, it was expressed invasive species are a concern especially knotweed and hogweed species. Assessment and remediation are essential.

#### **4.4.5 Burnaby to Westridge Segment**

Stakeholders, including attendees of the Burnaby Community Workshop as well as the GVRD, represented by the ISCMV, were contacted regarding weeds of concern and the associated websites were consulted.

##### **4.4.5.1 Greater Vancouver Regional District and the Invasive Species Council of Metro Vancouver**

Concerns about the spread of weeds during construction due to the numerous construction projects occurring at the same time was expressed during the Burnaby Community Workshop.

#### **4.4.6 Pump Stations and Terminals with No Native Vegetation Disturbance**

The Niton, Wolf, Edson, Jasper, Blue River, Blackpool, Darfield, Kamloops and Sumas pump stations as well as the Edmonton, Burnaby and Westridge Marine Terminal are all located on lands owned or leased by Trans Mountain. These facilities are managed on an ongoing basis for weeds and invasive species in accordance with the Weed Management Plan for KMC Trans Mountain and Express Pipeline Systems (TERA 2011). The plan has been prepared to address long-term weed monitoring and control procedures, decision criteria, accountability and responsibility of Trans Mountain pipeline system and has also been prepared to comply with weed regulations in all applicable jurisdictions crossed by the Trans Mountain pipeline system. Therefore, there will be no surveys for weeds or invasive species at these locations.

#### **4.4.7 Gainford Pump Station**

The Gainford Pump Station is located on lands owned by Trans Mountain in Parkland County. Current land use at this facility site is industrial and the surrounding land is forested. Some treed lands will be disturbed within the existing boundary of the Gainford Pump Station. Refer to Section 4.4.1.3 of this report for stakeholder concerns for the Gainford Pump Station's respective area.

#### **4.4.8 Hinton Pump Station**

The Hinton Pump Station is located on lands owned by Trans Mountain in Yellowhead County. Expansion of the Hinton Pump Station will require acquisition of approximately 0.32 ha of new Crown land to the west of and adjacent to existing Trans Mountain lands. Refer to Section 4.4.1.7 of this report for stakeholder concerns for the Hinton Pump Station's respective area.

#### **4.4.9 Rearguard Pump Station**

The existing Rearguard Pump Station is located on lands owned by Trans Mountain in the RDFFG. The expansion of the Rearguard Pump Station will require the acquisition of approximately 0.7 ha of new Crown land adjacent to and to the east of existing Trans Mountain lands. Refer to Section 4.4.2.1 of this report for stakeholder concerns for the Rearguard Pump Station's respective area.

#### **4.4.10 Black Pines Pump Station**

The proposed new Black Pines Pump Station is a new site located on forested and pasture lands at in the TNRD. The Black Pines Pump Station will require a new land base of approximately 150 m x 150 m (approximately 2.3 ha) for the pump station and substation. The new land is privately-owned, treed and within the Agricultural Land Reserve. A new 138 kV power line approximately 2.2 km long in a 50 m wide right-of-way will also be installed at the proposed Black Pines site. Current land use along the power line is forested. Refer to Section 4.4.3.1 of this report for stakeholder concerns for the Black Pines Pump Station's respective area.

#### **4.4.11 Kingsvale Pump Station**

The existing Kingsvale Pump Station is located on land owned by Trans Mountain within the TNRD. Current land use at this site is industrial. Some forested lands will be disturbed within the existing boundary of the Kingsvale Pump Station. A new 138 kV power line approximately 23.5 km long in a 50 m wide right-of-way will also be installed at the site. Refer to Section 4.4.3.1 of this report for stakeholder concerns for the Kingsvale Pump Station's respective area.

#### **4.4.12 Sumas Terminal**

The existing Sumas Terminal is on lands owned by Trans Mountain in the municipal boundaries of the City of Abbotsford. Current land use at this facility site is industrial and undisturbed forested lands. The proposed activities are within the existing Sumas Terminal property boundary, however, the existing fence line will be moved approximately 20 m north (0.7 ha of new disturbance). Refer to Section 4.4.4.1 of this report for stakeholder concerns for the Sumas Terminal's respective area.

## 5.0 RESULTS OF FIELD DATA COLLECTION/MODELLING

### 5.1 General Information

Details of the TEM and vegetation surveys are summarized below by proposed pipeline segment.

A list of all species observed at the time of survey for each segment of the Project is provided in Appendix B. Species nomenclature is according to the list of all elements in Alberta (ACIMS 2013b) for the Edmonton to Hinton Segment and the BC Species and Ecosystems Explorer (BC MOE 2013) for all BC Segments, with more current taxonomic information drawn from NatureServe (2012a), when necessary.

During rare plant surveys, bryophyte and lichen specimen collections were also conducted and subsequently sent to expert Bryologists and Lichenologists for identification. In addition, from May 15 to 23, 2013 an expert Lichenologist and Bryologist conducted field surveys at selected locations along the proposed pipeline corridor. The intensity of bryophyte and lichen collections during the vegetation surveys is reflected in the list of species for each Project segment provided in Appendix B.

Results of the vegetation TEK collected during field studies for the Project are compiled below and organized according to proposed pipeline segment. Issues and concerns related to vegetation resources as well as proposed mitigation measures and/or response to those issues are provided below. Each Aboriginal community participated in comprehensive reviews of mitigation measures in the context of all the issues they had raised during the field study and results review.

#### 5.1.1 Edmonton to Hinton Segment

Details of the TEM and vegetation surveys for the Edmonton to Hinton Segment are summarized in Table 5.1.1-1.

**TABLE 5.1.1-1**  
**TEM AND VEGETATION SURVEYS BY**  
**NATURAL SUBREGION FOR THE EDMONTON TO HINTON SEGMENT**

Natural Subregion <sup>1</sup>	Mapped Area in the Vegetation RSA <sup>2</sup> (ha)	Area within the Proposed Pipeline Corridor (ha)	Number of TEM Plots <sup>3</sup>		Amount of Rare Plant Survey on the Proposed Pipeline Corridor (Dates/Distance)
			Ground	Visual	
Central Parkland	13,931.7	308.4	1	3	June 7 to 8, 2013 and July 16, 2013 2.3 km
Dry Mixedwood	15,332.0	356.2	16	43	June 8 to 12, 2013 and July 17 to 19, 2013 8.8 km
Central Mixedwood	4,660.5	96.1	1	16	July 20, 2013 1.6 km
Lower Foothills <sup>4</sup>	15,578.1	352.3	41	150	June 12 to 13, 2013, June 18 to 27, 2013, July 21 to 22, 2013 and August 3 to 13, 2013 31.8 km
Upper Foothills <sup>4</sup>	--	--	--	--	-- <sup>5</sup>
Montane <sup>3,4</sup>	--	--	--	--	June 27 to 29, 2013 and August 13 to 14, 2013 7 km

- Note:**
- 1 This table provides TEM data to natural subregion. For ecosite phase level data please refer to the TEM Technical Report in Appendix C, Section 4.2.
  - 2 See Appendix C for TEM limitations and information on areas for which TEM will be included in supplemental filings.
  - 3 TEM field work was completed in 2012 and 2013. In Alberta, field surveys were conducted from August 17 to 21, 2012 and from May 17 to 28, 2013.
  - 4 TEM data is currently not available for the segment between Edson and Hinton, which includes all of the areas in the Vegetation RSA that fall within the Montane and Upper Foothills Natural Subregions as well as some areas within the Lower Foothills Natural Subregion. This data will be provided in a supplemental filing.
  - 5 Denotes a natural subregion that occurs in the Vegetation RSA but does not occur within the proposed pipeline corridor.

**Traditional Ecological Knowledge**

The plants identified and described by participants during TEM and vegetation surveys along the proposed Edmonton to Hinton Segment are listed in Table 5.1.1-2.

**TABLE 5.1.1-2  
 PLANTS IDENTIFIED THROUGH TEK  
 PARTICIPATION ALONG THE EDMONTON TO HINTON SEGMENT**

	Plants <sup>1</sup>		
<b>A</b>	aginuebick alder algae	ananan (in Stoney) arnica flower or heart-leafed arnica arrow-leafed colt's foot	aspen
<b>B</b>	balsam fir balsam poplar bane bean root bearberry bear root bedstraw	birch fungus birch black poplar fungus black poplar black spruce black willow blue clematis	bluebells blueberries buck bean buffalo grass bunch berries burdock root
<b>C</b>	Canada thistle caribou lichen cattail cedar chamomile cherries chokecherries	clematis clover leaf violet club moss colt's foot (sweet colt's foot, palmate colt's foot) comandra (northern bastard toad flax) common plantain	cow parsnip cranberry (high bush cranberry, low bushcranberry, bog cranberry) cream-coloured vetchling creeping cedar creeping juniper creeping vine
<b>D</b>	dandelion dewberry	diamond willow fungus (willow plum or cha-nap-tah) diamond willow	dodosapowe'in dogwood
<b>F</b>	fiddle head ferns	fire weed	fungi
<b>G</b>	gentian giant blue hyssop	golden rod golden seal	gooseberry green dog lichen
<b>H</b>	hawthorn honeysuckle (twinning honeysuckle, bracketed honeysuckle)	hoogoo-too-tong (in Stoney) horse medicine horsetail/scouring rush	huckleberries
<b>I</b>	Indian paint brush	Indian tobacco	
<b>J</b>	Jack pine	juniper berries	juniper;
<b>K</b>	kidney-shaped plant (kah-kay-pah-kwah in Cree)	kidney wart kidney-leaf violet	kinnikinnick
<b>L</b>	Labrador/muskeg tea (muskeg-pah-kwah in Cree)	lichen lilac	lily pads
<b>M</b>	magnoliopsida shrub maing-in-a-na-tip (in Saulteau) maple tree marigold marsh lily marsh marigold	mint mooseberry moose-soh-mihn-nah-tihk (in Cree) moss moth balls mountain ash	mountain flat sage muskee-gwa-tik muskeg tea muskeg moss muskrat roo
<b>N</b>	northern veg straw		
<b>O</b>	ohpuhn	old man tree	old man's beard;
<b>P</b>	papwasis pea vine peanut plant peat moss pepper cress pig weed pin cherries	pit cherry plantain poison ivy poplar (white poplar) prickly wild rose protection plant	puffball/brown puffball/puffer/stink bomb mushroom (robubby in Stoney) purple clematis/vine plant purple lily pussy willow
<b>R</b>	rabbit root rag root raspberry	rat root/bull rush red canary grass red clover	round-leafed medicine plant Russian poplar

**TABLE 5.1.1-2 Cont'd**

Plants <sup>1</sup>			
<b>S</b>	sage/buffalo sage/white buffalo sage salmonberry sarsaparilla saskatoon sedge grass shepherd's purse silver weed	skunk bush snake eye lily snake root snowberry sphagnum moss spruce (white spruce) squirrel tail	star-flowered Solomon's seal stiff club moss stinging nettle strawberry (wild strawberry) sweet pine sweetgrass
<b>T</b>	tall blue lettuce tall lung wart tamarack/larch tree	tansy/tansi thistles three-leafed lily	tobacco twin flower
<b>U</b>	uhps-chin-palnk-sah	uwa	
<b>V</b>	valerian root veiny meadow rev	vetch violet	
<b>W</b>	water cress water sennel weamee tapudabee western duck plant western toad root white birch fungus white birch white buffalo sage white mushroom white poplar fungus	white water lily white willow wild carrot wild clover wild horse radish wild lily of the valley wild mint wild mustard wild onion wild rhubarb	wild rose (prickly wild rose) wild sarsaparilla wild suma willow (red willow, white willow, golden willow, yellow willow) willow fungus witch's hair wolf willow winter green
<b>Y</b>	yarrow	yellow marsh marigold	yellow plant

**Note:** 1 The plant nomenclature provided in the table may not necessarily follow the nomenclature used by ACIMS (2013b).

Medicinal plants and their functions were extensively described by participants along the Edmonton to Hinton Segment. Different clans and communities use medicines in different ways and use of a plant depends on what one's grandparents and Elders taught. Medicine people commune with spirits and to be able to hear the ancestors and spirits is a skill that takes a great deal of experience. Participants related that traditional medicines are much more effective when the person taking them has a traditional diet and that eating processed foods will decrease the effectiveness of traditional medicines. The knowledge of locations and uses of medicinal plants held by the participants is proprietary to the community. Medicinal plants often grow well near wet areas and most barks can be used for medicinal purposes. There are three elevations at which medicinal plants can be found: high ground/mountainous; mid-ground/prairies; and low ground/wetlands. Participants shared that for every species of plant that is medicinal, there are three potentially poisonous plants in likeness. Medicines are harvested when they reach their peak potency which is often the end of June and, at this time, medicines are collected and dried for use throughout the year. Plant gathering is conducted in a way that leaves the plant to regenerate. Participants explained that gathering plant medicine is not trial and error. Traditional knowledge, along with culture, stories and practices, is passed down and shared between the generations. Tobacco or gifts are presented to Elders from whom a person would like to learn. Developing customary knowledge is the work of a lifetime and not enough youths are developing this knowledge. Participants shared that *"there is no book of traditional knowledge, there is only knowledge to be taught and passed down from the Elders"*.

Several plants materials used for utilitarian purposes were also identified by participants during the field studies along the Edmonton to Hinton Segment. Baskets can be made from spruce roots and birch bark, and spruce roots are long and skinny and used to sew birch bark into containers. Birch bark and pitch were also traditionally used to make canoes. Participants shared that during every season there are different food plants to eat. During the summer, berries are available while in the spring and summer, sap can be eaten. Cooked meat can be served or stored briefly on spruce or balsam branches for cleanliness. Other foods can be cooked in black poplar and willow bark. Black poplar bark is thick enough to cook food on over an open fire.

Pine and spruce trees were described as navigational tools in the forest whereby trees are darker and have less branches on the north side for lack of sun. Moss will be higher on the north side of white poplar.



Participants described a type of forest identified called *choba* in the Stoney language. This type of forest has a mixture of birch, white poplar and spruce that provides good habitat for large game like moose, elk, and deer because these forests also support various food sources such as willows, berries, Labrador tea and medicinal plants. The birch is a special tree to Cree people, representing a part of their people and their origin. *Moose-soh-mihn-nah-tihk* is the Cree word for a tree with medicinal uses. The bark of this tree peels around the trunk rather than up and down the trunk. When the bark is removed it turns from brown to red. *Muskee-gwa-tik* is the Saulteau word for a needled tree used for making drums, snowshoes, toboggans and sleds. The wood is very flexible but usually is soaked in water to make it more pliable, bent to shape, covered with hide and dried for about three days before use.

Several tree species were identified along the Edmonton to Hinton Segment. Participants reported that Jack Pine prefers sandy soils and typically grows at higher altitudes and has large needles in comparison to “regular” pine that grows at lower elevations and has smaller needles. Elk are often attracted to Jack Pine stands. Balsam poplars grow to be very tall trees and also provide elk habitat. The balsam poplar can be identified by the lancet-shaped leaf and grows close to water. Sweet pine is a food source for moose and, therefore, an indicator of good moose habitat. Sweet pine is of cultural importance to participants and their communities. Tamarack grows in low-lying areas and muskeg. The buds of tamarack are edible and can be eaten as a survival food. Willow is a common, resistant tree that also prefers muskeg and wet areas. Moose feed on willows during the winter and summer, eating any willow twigs they can reach but preferring the smaller bushy types of willow and young willow tips.

Participants reported that berry plants like blueberries, chokecherries and saskatoon berries are typically abundant in riparian areas since watercourses provide with water and much-needed nutrients. Berries also thrive in shaded areas. Berry plants were described to ripen in the following order: cranberry, gooseberry, strawberry, saskatoon, raspberry, blueberry, cherry, pin cherry, low and high bush cranberry, and finally huckleberry. Bearberries will grow in the Alberta foothills and, while too sour for human consumption, they are eaten by bears. Blackberries grow in mossy areas and are almost always found in the understory of forests. Blackberries are also eaten by bears and harvested by people mid-summer. Bunchberry is common and grows close to water. Participants explained that while blueberries look similar to Labrador tea, they can be distinguished by their white flowers, reporting that blueberries are becoming harder to find. These plants grow well in sandy soils, near Jack pines and on lands less trafficked by animals. Chokecherries are very common, especially in drier lands and can be identified by its spotted bark. Chokecherries are a preferred food source for bears and can be harvested in June and July, and as late as September. Low-bush cranberries are a valued traditional food and are similar in appearance to bearberry, while the fruit is different. Low-bush cranberry plants prefer sandy, rocky soil but can also grow well in moist areas and near peat moss, Jack pine, spruce and muskeg. These berries can be harvested during the winter, even when frozen. Gooseberries are also edible and can be found in treed, damp areas or on moist slopes, but are also common on the prairies. Mooseberry is a common and hardy plant, all parts of which are harvested, and an important plant to local communities. Mooseberry plants grow in well-forested lands where there is shade. Snowberry bushes can grow up to 1 m tall with white flowers turn into white, edible berries having no nutritional value. Participants reported that this plant grows everywhere in Canada.

Participants described characteristics of several other plant species identified during the field studies along the Edmonton to Hinton Segment. The edible fern fiddlehead was noted to grow in and around water, is harvested when young, and is sensitive to pollution. When fiddlehead ferns grow to maturity, they are toxic to humans. Juniper, referred to as “creator root” by participants, and noted to be a common plant in the region. Junipers are often found in muskeg or near spruce trees, and grow well on sunny slopes. The berries are small, hard and blue, and are best harvested in mid-summer. Creeping juniper however, is uncommon and only found near large watercourses. Kinnikinnick, also called bearberry, was noted to be a common plant, often found on high ground or near pine and spruce and in most muskeg or wet areas. Kinnikinnick can be harvested at all times of the year but has different flavours at different times in its life cycle. Labrador tea, also called *muskeg-pah-kwah* in Cree, or muskeg tea, is eaten by moose during the spring, summer and fall. Labrador tea grows in mountainous, wooded, marshy areas and around wetlands and waterbodies and was described as a “winter food”, a good survival food that can be found in the winter.

Mosses, including sphagnum and peat moss, called *seenah* in Stoney, can be easily found in muskeg. A particular moss will grow on the north side of white and black poplar trees since the north side of trees

have more moisture and less sunlight and, participants shared that this purpose assists with navigation in the forest. Rat root typically grows in wetlands and other waterbodies, growing where there are muskrats that rely on this food source. Mountain flat sage grows in muskeg and sage, in general, is often found near sweetgrass or in open places with grasses and few weeds. Sweetgrass is identified by its smell and has purple-red roots, taking about four years to grow to harvestable length. While participants noted that sweetgrass is plentiful, others noted that sweetgrass is hard to find, will not grow in disturbed areas and is not resilient to environmental changes. White lily and wild sarsaparilla were also noted to be sensitive to pollution.

The issues and concerns raised relative to vegetation resources for the Project along the Edmonton to Hinton Segment are provided in Table 5.1.1-3. Concerns related to vegetation resources were addressed by the proposed mitigation measures discussed. Participants have not recommended any mitigation strategies related to vegetation resources additional to those described in the Pipeline and Facilities EPPs (Volumes 6B and 6C). Concerns related to potential effects of spills on the terrestrial environment (Section 3.0 of Volume 5A) are considered within the assessment of various onshore facility spill scenarios provided in Volume 7.

**TABLE 5.1.1-3**

**VEGETATION TEK RECORDED ALONG THE EDMONTON TO HINTON SEGMENT**

Issue/Concern	Location(s)	Proposed Mitigation Measures/Response <sup>1</sup>
Avoid use of chemical weed management	Proposed Pipeline Corridor	<p>Within Alberta, all growing plants designated as Prohibited Noxious and their reproductive mechanisms must be destroyed or rendered non viable. Plants designated as Noxious must be controlled (inhibit growth and spread) or destroyed. In BC, Provincial Noxious plants are those that must be controlled in all regions and Regional Noxious plants are those that must be controlled in the region(s) for which they are listed. Furthermore, plants listed as invasive under the BC Forest and <i>Range Practices Act</i> must be managed to prevent their introduction or spread.</p> <p>Trans Mountain will utilize an Integrated Vegetation Management (IVM) approach to carry out problem vegetation management practices for the Project and to meet the overall objectives of IVM for all Trans Mountain pipelines and facilities.</p> <p>IVM is an adaptive management process involving the use of various methods in a cost effective and responsible manner to reduce the use of herbicides, promote healthy ecosystems, provide measurable results and facilitate better management of problem vegetation. The Weed and Vegetation Management Plan for the Project will address non-chemical, cultural and chemical techniques for problem vegetation management along the construction right-of-way through recommendations of vegetation management procedures, which include timing considerations, select methods and equipment and specific vegetation management procedures based on prevention, identification, monitoring, treatment thresholds, vegetation management options and post-treatment evaluation considerations.</p> <p>Trans Mountain will consult with the appropriate regulatory agencies, public, adjacent landowners and Aboriginal communities affected by the Project regarding problem vegetation management and methods of treatment.</p>
Limit extent of tree clearing for the Project	All treed lands within Proposed Pipeline Corridor	<p>Confine all pre-clearing/mowing and general clearing activities within the staked/flagged construction right-of-way boundaries. Adhere to clearing/mowing restrictions associated with watercourse/wetland/lake boundary sensitive environmental features and buffer areas</p> <p>Avoid creating new disturbances and use of treed areas or native grasslands when selecting sites, to the extent feasible.</p> <p>Restrict root grubbing to the trench line, if feasible, to minimize surface disturbance and encourage resprouting/natural regeneration of deciduous trees and shrubs.</p>
Avoid loss of tree stands	10 m south of RK 65.5 30 m south of RK 131.6 20 m north of RK 189 188 m north RK 192.9	If warranted, site-specific mitigation measures based on location and species will be determined once the Footprint is finalized in accordance with the Rare Ecological Community and Rare Plant Population Management Plan.

**Note:** 1 Detailed mitigation measures are outlined in the Table 6.1-10 and the Project-specific EPPs (Volume 6B).

**5.1.2 Hargreaves to Darfield Segment**

Details of the TEM and vegetation surveys for the Hargreaves to Darfield Segment are summarized in Table 5.1.2-1.

**TABLE 5.1.2-1**

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

BGC Variant <sup>1</sup>	Mapped Area in the Vegetation RSA <sup>1</sup> (ha)	Area Within the Proposed Pipeline Corridor (ha)	Number of TEM Plots <sup>2</sup>		Amount of Rare Plant Survey on the Proposed Pipeline Corridor (Dates/Distance)
			Ground	Visual	
ICHmm	2,492.8	16.7	--	1	August 11, 2013 0.8 km
SBSdh1	8,551.6	231.1	10	32	June 27 to 29, 2013 and August 10 to 13, 2013 23.1 km
ESSFmm1	66.1	--	--	--	... <sup>3</sup>
ICHwk1	8,688.6	178.9	2	2	June 23 to 27, 2013 and August 8 to 10, 2013 20.6 km
ICHvk1	2,460.1	52.6	--	3	June 24 to 25, 2013 and August 9, 2013 5 km
ESSFwc2	9.7	--	--	--	... <sup>3</sup>
ICHmw3	6,792.2	169.1	9	31	June 22 to 23, 2013 and August 6 to 8, 2013 8.8 km
ICHdw3	7,500.1	171.4	18	58	June 19 to 22, 2013 and August 4 to 7, 2013 21.4 km
IDFmw2	14,342.0	343.8	--	15	June 18 to 20, 2013 and August 2 to 6, 2013 20.8 km
IDFmw2b	1,751.3	37.7	--	2	--
ICHmk2	169.3	--	--	--	... <sup>3</sup>
IDFhx2	505.0	--	--	--	... <sup>3</sup>

- Notes:**
- 1 See Appendix C for descriptions of BGC variants and for TEM limitations and information on areas for which TEM will be included in supplemental filings.
  - 2 TEM field work was completed in 2012 and 2013. 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 and from September 30 to October 11, 2013. Field plots from the latter survey will be included in a supplemental filing.
  - 3 Denotes a BGC variant that occurs in the Vegetation RSA but does not occur within the proposed pipeline corridor.

**Traditional Ecological Knowledge**

The plants identified and described by participants during TEM and vegetation surveys along the Hargreaves to Darfield Segment are listed in Table 5.1.2-2.

**TABLE 5.1.2-2**

**PLANTS IDENTIFIED THROUGH TEK  
 PARTICIPATION ALONG THE HARGREAVES TO DARFIELD SEGMENT**

	Plants <sup>1</sup>		
<b>A</b>	alder and/or sitka alder and/or mountain alder alderberry	alfalfa American vetch arboreal lichen	ash aspen and/or trembling aspen
<b>B</b>	balsam fir or subalpine fir band-aid plant bearberry (also called buffalo berry or <i>susmai</i> in Carrier) bedstraw or northern bedstraw birch and/or paper birch bitter root black currant	black thimbleberry black tree lichen (also called <i>weela</i> in Shuswap) blueberry, low bush blueberry and high bush blueberry blueberry bluegrass bogbean (also known as buckbean)	bottle caps bracken fern buckbrush bulrushes bumbleberry bunchberry

**TABLE 5.1.2-2 Cont'd**

	Plants <sup>1</sup>		
<b>C</b>	cattails catnip caribou moss or lichen cedar chickenberry chokecherry	cinquefoil coltsfoot common bluebell common plantain conk	cottonwood and/or black cottonwood cow parsnip (also known as Indian asparagus, Indian celery and Indian rhubarb) cranberry and high bush cranberry
<b>D</b>	dandelion devil's club	dogbane and spreading dogbane dogwood and red ochre dogwood	
<b>E</b>	elderberry and red elderberry	elm	eyebright
<b>F</b>	false mistletoe false morel fern	fiddlehead fern fir and/or Douglas-fir fireweed	foam flower freckle pelt lichen fungus
<b>G</b>	goldenrod gooseberry	great mullein (also called <i>smenxul</i> in Shuswap)	grouseberry
<b>H</b>	hawthorn hazelnut and/or beech hazelnut heal-all plant heart medicine plants	heart-shaped-leaf amica hemlock honeysuckle	hooker's bell (also called hooker's fairybell) horsetail huckleberry
<b>I</b>	Indian paintbrush		
<b>J</b>	juniper		
<b>K</b>	kinnikinnick		
<b>L</b>	Labrador tea lady fern	lichen lodgepole pine	loganberry
<b>M</b>	maple and/or Douglas maple morel moss	moon wart mountain ash	mountain blackberry mountain box plant
<b>N</b>	nagoonberry	nettles	no-leaves plant
<b>O</b>	old man's beard one-leafed wintergreen	oregon grape	oxeye daisy
<b>P</b>	pea vine pearly everlasting pin cherry	pine pine mushrooms poplar	prickly rose princess pine puffball mushroom
<b>Q</b>	queen's cup berry		
<b>R</b>	rattlesnake plantain red cap reed canary	red clover red columbine red stem feather moss	red willow or willow Rocky Mountain juniper
<b>S</b>	sage saskatoon and high bush/tree saskatoon sarsaparilla (also called natural ginseng) scouring rush sedge grass self-heal flower	sitka alder skunk cabbage snowberry (also called common snowberry or spotted snowberry) soapberry (also known as soopolallie, XwU'sum and Hoshum) solomon seal	spruce stinging nettle strawberry sundew sunflower sweet sicily
<b>T</b>	thimbleberry thistle tiger lily	twinberry (also called bearberry) twinflower	twisted stock (also known as clasping twisted stalk)
<b>W</b>	water lily western columbine western yew	white pine wild ginger/ginger wild mint/mint/swamp mint	wild onion wild rhubarb wintergreen
<b>Y</b>	yarrow		

**Note:** 1 The plant nomenclature provided in the table may not necessarily follow the nomenclature used by the BC MOE (2013).

Many tree species were identified by participants during the field studies along the Hargreaves to Darfield Segment including smoking food, for medicinal and ceremonial purposes, food sources, artisanal works, and building of tools and shelters, and the characteristics of several species were described. Alder, or Sitka alder, is a slow-burning hard wood good for smoking meat and salmon. Sitka alder grows in wet and disturbed lands and is considered a nitrogen-fixing plant good for the soil. Sitka alder can be identified by

their small brown or black cones. Cottonwood, birch or paper birch were noted to prefer moist soil whereas pine prefers drier soils. Hawthorn ripens in July and is a favourite food source of bears. Mountain ash is typically found at higher elevations and the berries are also eaten by bears, while the leaves and twigs are eaten by deer and moose.

Several types of berry plants were identified by participants during the field studies along the Hargreaves to Darfield Segment. Berry plants can often be found in disturbed lands and most berries have antioxidant properties and are healthy to eat. Blueberries are harvested in the late summer and early fall, growing in aspen forests, disturbed lands and cleared lands like existing rights-of-way. Pine needles slow forest floor growth allowing blueberries to flourish. Low-growing blackberries are found at higher elevations and the berries are edible, ripening in August. Chokecherries are dark purple when ripe and grow on bushes and trees that grow in hot, dry lands. Participants report that gooseberry is getting harder to find, while typically growing in wetter, cooler lands. Elderberries are good food for moose and deer; the colour in the stalk and stem will darken over time, growing in moist soils. Loganberries grow close to the ground and are red when ripe, similar in appearance to raspberries and growing in wetter soils. Soapberries, also known as *soopalallie*, *XwU'sum*, *nuwus* or *hoshum*, are best picked green and, therefore, less bitter. These plants grow along barriers and are commonly found in dry, well-drained soils on hillsides or on flat land. Wild strawberries are often found in disturbed lands like cutblocks. Thimbleberry bushes are also often found along disturbed lands as well as in dense, treed lands with plenty of moisture, providing ground cover. Participants noted that thimbleberry bushes will re-grow easily following Project construction since the berries produce many seeds. Twinberry, also called bearberry, is eaten by moose and bears, growing in wetter lands and has paired, dark berries. Bears eat twinberries as a preferred food source before winter hibernation.

Lichens, funguses, mosses and mushrooms were identified by participants during the field studies along the proposed Hargreaves to Darfield segment. Arboreal lichen grows on older, more established trees, is long and light green and a good source of food for caribou. Old man's beard lichen and black tree lichen, also called *weela* in Shuswap, are both considered emergency food sources. Participants noted that false morels can grow up to 2 kg each, however, these mushrooms are not very valuable.

Rushes and grasses were also identified by participants during the field studies along the Hargreaves to Darfield Segment. Bluegrass grows mostly in flat lands and is not as common in the mountains. Scouring rush grows in drier soils and are, true to their name, an abrasive rush. Bulrushes grow in wet, marshy lands and green, new shoots are harvested in spring and early summer. Cow parsnip, also known as Indian asparagus, Indian celery and Indian rhubarb, is known as an important food source for bears. It grows well in wet and more northerly areas. Devil's club is plentiful and found near water and marshy lands. Bears are the only animals to eat devil's club, not minding the spines. Horsetail is a common plant eaten by animals and grows in wet soils.

Several other plant species were described by participants during the field studies along the Hargreaves to Darfield Segment. Wild ginger is stronger and more flavourful than store-bought ginger. It has heart-shaped leaves, a hairy, purple flower, a hairy stalk and a long, skinny root that must be carefully dug around when harvesting. The root attaches to the ground with little hairs the same size as the plant's stem. Wild ginger is found in forested areas, near cedar trees or in moist soils. It can be identified by its lemon-ginger odour. It can be harvested all year-round, but the roots will be bigger in the fall. Wintergreen is commonly mistaken for ginger and one-leafed wintergreen is a food source for bears. Fireweed, commonly found in disturbed, low-lying lands with high moisture levels, is a common spring food source for ungulates and bears because it has a high nutrient value and healing properties. It normally blooms by mid-June, but the leaves are best to eat when they are small and tender in the spring. Honeysuckle is also often found in disturbed lands. Juniper is common where fir dominates.

Participants explained that it is important to know what one is harvesting. In general, spring is the best time to harvest medicinal plants. Medicines may be collected by anyone but should be given to the Elders who know their preparations and correct dosages. Many of the plants identified during the field studies along the Hargreaves to Darfield Segment were noted by participants have medicinal properties and their functions were extensively described by participants. The knowledge of locations and uses of medicinal plants held by the participants is proprietary to the community.

The issues and concerns raised relative to vegetation resources for the Project along the Hargreaves to Darfield Segment are provided in Table 5.1.2-3. Concerns related to vegetation resources were addressed by the proposed mitigation measures discussed. Participants have not recommended any mitigation strategies related to vegetation resources additional to those described in the Pipeline and Facilities EPPs (Volume 6B and 6C). Concerns related to potential effects of spills on the terrestrial environment (Section 3.0 of Volume 5A) are considered within the assessment of various onshore facility spill scenarios provided in Volume 7.

**TABLE 5.1.2-3**

**VEGETATION TEK RECORDED ALONG THE HARGREAVES TO DARFIELD SEGMENT**

Issue/Concern	Location	Proposed Mitigation Measures/Response <sup>1</sup>
Cumulative effects of industrial development on plants.	Vegetation RSA	Potential Project-related cumulative effects are mitigated with implementation of the following design and construction measures: align the proposed pipeline corridor to follow existing linear features such as pipelines and disturbed areas such as facilities/clearings to the extent practical; and encourage rapid regeneration of natural vegetation.
Proper vegetation, tree and stump clearing to encourage successful reclamation.	Proposed Pipeline Corridor	Confine all pre-clearing/mowing and general clearing activities within the staked/flagged construction right-of-way boundaries. Adhere to clearing/mowing restrictions associated with watercourse/wetland/lake boundary sensitive environmental features and buffer areas Where grubbing and grading are not necessary, use a mulcher to chip stumps and mow surface vegetation ( <i>i.e.</i> , shrubs, small trees) to ground level to preserve topsoil/root zone material and establish a smooth work surface. Restrict root grubbing to the trench line, if feasible, to minimize surface disturbance and encourage resprouting/natural regeneration of deciduous trees and shrubs.
Spread of invasive species and use of chemical vegetation management.	Proposed Pipeline Corridor	Follow recommendations made in the pre-construction weed survey to limit the risk of spreading weed seeds. Implement weed management ( <i>i.e.</i> , using proper application of chemical, mechanical or manual measures, or a combination of all) at locations identified within the pre-construction weed survey to a level that is consistent with weed management observed adjacent to the eventual construction right-of-way to reduce the potential for weed infestations following construction. Restrict all vehicular traffic to the approved and staked construction right-of-way, workspace and access roads. Ensure equipment arrives at all construction sites clean and free of soil or vegetative debris. Inspect and identify equipment deemed to be acceptable with a suitable marker, such as a sticker. Do not allow any equipment arriving in a dirty condition on site until it has been cleaned. Clean equipment ( <i>i.e.</i> , shovel and sweep, pressurized water or compressed air) involved in topsoil/root zone material handling at weed infested sites prior to leaving the location unless full right-of-way topsoil/root zone material salvage has been conducted. Clean equipment involved in topsoil handling at weed infested sites prior to leaving the location. Trans Mountain will utilize an IVM approach to carry out problem vegetation management practices for the Project and to meet the overall objectives of IVM for all Trans Mountain pipelines and facilities (see Table 5.1.1-3).
Post signage to share Aboriginal traditional plant use knowledge near the Project, excluding medicinal plant use or confidential knowledge.	Proposed Pipeline Corridor	Trans Mountain is committed to continued listening, learning and working with Aboriginal people to ensure that knowledge and advice is fully considered and incorporated in the Project. Trans Mountain will continue to engage Aboriginal communities to identify continued opportunities for sharing of knowledge during all phases of the Project.
Involve Aboriginal people in Project reclamation work.	Proposed Pipeline Corridor	The EPPs (Volumes 6B, 6C and 6D) provide mitigation plans developed in response to issues identified during Project planning, stakeholder consultation, Aboriginal engagement and regulatory discussions. Aboriginal Monitors onsite through the construction of commissioning of the of the Project will work with environmental inspectors to provide traditional knowledge to the construction program to ensure protection of the environment; to discuss upcoming traditional and western science elements with the environmental inspector to insure protection and monitoring; and to monitor mitigation success in protecting the environment. Trans Mountain will continue to engage Aboriginal communities through all phases of the Project. Trans Mountain's commitment to retain Aboriginal Monitors is further described in Volume 6A.
Reclaim Project lands to pre-construction state.	Proposed Pipeline Corridor	Construction reclamation activities are measures conducted as part of the main construction program. The primary goal of reclamation measures is to reduce adverse effects of pipeline construction and return the affected lands to a stable, non-erosive condition that will promote the re-establishment of land productivity. This process involves measures such as: topsoil and root zone material salvage; subsoil conditioning and grade and drainage re-establishment; topsoil and root zone material replacement; installation and maintenance of temporary and permanent erosion and sediment control measures; and revegetation. Trans Mountain will implement the Reclamation Management Plan that includes construction reclamation measures to be implemented prior to, during and following pipeline installation in order stabilize and revegetate affected lands that in time achieve land productivity along the right-of-way equivalent to the adjacent land use and ensuring the ability of the land to support various land uses.
Avoid loss of tree stand.	10 m west RK 734.42	If warranted, site-specific mitigation measures based on location and species will be determined once the Footprint is finalized in accordance with the Rare Ecological Community and Rare Plant Population Management Plan.

**Note:** 1 Detailed mitigation measures are outlined in the Table 6.1-10 and the Project-specific EPPs (Volume 6B).

### 5.1.3 Black Pines to Hope Segment

Details of the TEM and vegetation surveys for the Black Pines to Hope Segment are summarized in Table 5.1.3-1.

**TABLE 5.1.3-1  
TEM AND VEGETATION SURVEYS BY BGC  
VARIANT FOR THE BLACK PINES TO HOPE SEGMENT**

BGC Variant <sup>1</sup>	Mapped Area in the Vegetation RSA <sup>1</sup> (ha)	Area within the Proposed Pipeline Corridor (ha)	Number of TEM Plots <sup>2</sup>		Amount of Rare Plant Survey on the Proposed Pipeline Corridor (Dates/Distance)
			Ground	Visual	
PPxh2	6,156.1	231.1	6	17	May 31 to June 1, 2013, July 23 to 25, 2013, and August 26 to 29, 2013 8.3 km
IDFxh2	2,512.6	32.9	--	1	May 30, 2013 0.2 km
IDFxh2a	4,577.3	103.5	3	8	May 30 to 31, 2013 and July 25, 2013 6.8 km
BGxw1	4,174.1	107.5	12	26	May 30 to June 2, 2013 and July 24 to 25, 2013 10.7 km
BGxh2	2,145.0	50.4	--	--	August 28, 2013 0.5 km
IDFdK1	5,441.0	111.4	2	6	May 31 to June 2, 2013 and July 25, 2013 1.3 km
IDFxh1	2,938.9	74.0	15	25	May 29 to 30, 2013 and July 22 to 23, 2013 8.3 km
IDFdK2	3,630.5	98.1	7	21	May 28 to 29, 2013 and July 21 to 22, 2013 10.5 km
MSdm2	--	--	--	--	July 21, 2013 0.8 km
MSmw1	--	--	--	--	May 28, 2013 and July 19 and 21, 2013 8.3 km
ESSFmw1	587.9	0.3	1	3	July 19, 2013 0.2 km
ESSFmw	231.0	8.6	--	--	July 19, 2013 2 km
MHm2	12.5	--	--	--	July 18, 2013 4.6 km
CMAunp	13.2	--	--	--	... <sup>3</sup>
CWHds1	2,457.6	64.4	7	7	May 23 to 26, 2013 and July 15 to 19, 2013 19.8 km
CWHms1	73.3	--	--	--	May 25 to 27, 2013 and July 17 to 19, 2013 9 km

- Note:**
- 1 See Appendix C for descriptions of BGC variants and for TEM limitations and information on areas for which TEM will be included in supplemental filings.
  - 2 TEM field work was completed in 2012 and 2013. 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 and from September 30 to October 11, 2013. Field plots from the latter survey will be included in a supplemental filing.
  - 3 Denotes a BGC variant that occurs in the Vegetation RSA but does not occur within the proposed pipeline corridor.

Due to land access restrictions on much of the grassland communities in the BG BGC zone, including at Lac du Bois Grasslands Protected Area, surveys were not conducted in 2013. Surveys are expected in 2014.

**Traditional Ecological Knowledge**

The plants identified and described by participants during TEM and vegetation surveys along the proposed Black Pines to Hope Segment are listed in Table 5.1.3-2.

**TABLE 5.1.3-2  
 PLANTS IDENTIFIED THROUGH TEK  
 PARTICIPATION ALONG THE BLACK PINES TO HOPE SEGMENT**

	Plants <sup>1</sup>		
<b>A</b>	alder (red, sitka, slide)		
<b>B</b>	balsam fir balsamroot birch	black currant blackberries boxwood	bulrush bulrush roots
<b>C</b>	cactus cattail	cedar chokecherry	cottonwood (poplar, aspen) cow parsnip
<b>D</b>	dandelion devil's club	dogwood	Douglas-fir
<b>E</b>	elderberry		
<b>F</b>	fern	fireweed	
<b>H</b>	hemlock	horsetail (snake grass)	huckleberries
<b>I</b>	Indian celery (cow parsnip, consumption plant, biscuit root)	Indian hellebore	Indian rhubarb or umbrella plant
<b>J</b>	Jack pine	juniper (Rocky Mountain)	
<b>K</b>	kinnikinnick		
<b>L</b>	Labrador tea (Indian tea, trappers tea, bog tea)	lodgepole pine	
<b>M</b>	maple milkweed	moss mullein	mushrooms (morel, sand, lightning, oyster)
<b>O</b>	ocean spray (ironwood)		
<b>R</b>	raspberries rattlesnake plantain	red Indian flower plant rosehip (rose)	
<b>S</b>	sage salmonberries saskatoon berries shooting star columbine silverberry tree	skunk cabbage snakeberry snowberries soapberries (soopolallie)	spring beauty spruce stinging nettle strawberries
<b>T</b>	tamarack (larch)	thimbleberries	trembling aspen (white poplar)
<b>W</b>	wild onion (wild garlic) wild rye	willow (red and silver) wolf lichen	
<b>Y</b>	yellow pine (PP)		

**Note:** 1 The plant nomenclature provided in the table may not necessarily follow the nomenclature used by the BC MOE (2013).

Several common medicinal plant species were identified during the field studies along the Black Pines to Hope Segment and their functions were extensively described by participants. The knowledge of locations and uses of medicinal plants held by the participants is proprietary to the community. Medicinal plants are harvested in the spring at a time when the plant has an abundance of nutrients. Medicinal plants often have ceremonial uses as well and some are also sources of food.

Certain plants can be used as indicators that fish are present in watercourses. When wild roses are blooming, Kokanee salmon can be fished. When the chokecherry is in bloom, the early Chinook are present. When the salmonberries are ripe, there are salmon present. When ocean spray blossoms are seen, salmon are present in watercourses near Yale, BC.

Participants reported that the vegetation along the Black Pines to Hope Segment serves an important function for wildlife, providing both food and shelter. Trees are used for shelter by many animals and birds, and berry plants are used by animals for food. Bears eat many berry plants, including salmonberries, saskatoon berries, chokecherries, raspberries and huckleberries. Deer, moose and bear also eat raspberry branches. Willow trees provide important wildlife habitat, a food source for moose in



winter and are harvested year-round. Various tree species were identified along the Black Pines to Hope Segment including cedar, firs and pines, cottonwood, willow, alder, birch and aspen. These trees have a variety of customary uses including medicinal, ceremonial, and artisanal and for building all manner of items and structures. Participants noted that trees will grow in unusual shapes in an attempt to reach the sun. Cottonwood trees are often found in clusters and at the base of a cottonwood edible mushrooms are often found. Fir sap can be harvested in spring and summer. Birch trees were noted as common in the region, particularly near water.

Berries, an important food source in the region, are abundant along the Black Pines to Hope Segment. Salmonberries were identified by participants and are reported to grow wild throughout the Fraser Valley. The salmonberry is distinguished by its maple-like leaves. The salmonberry bush grows in the lower canopy where sunlight is available but can grow in shaded conditions as well. Berries are harvested in the spring when red, yellow or purple and are also a good food source for bears. Soapberries are common along this proposed pipeline segment. Huckleberries were reported to have been abundant historically near Hope and Merritt, BC and are identified as a royal purple berry bush distinguishable from saskatoon berries by the brighter purple berry. Huckleberries ripen later in the summer than other berries plants. Raspberry bushes can grow up to 1 m in height and were identified along the length of this proposed pipeline segment.

Edible plants were also identified by participants during field studies along the proposed Black Pines to Hope segment include rosehips, wild rhubarb, yarrow, kinnickinnick, devil's club and mushrooms. Rosehips are harvested in the fall when red. Wild rhubarb grows in damp places close to moisture and optimal time for harvesting is late June or early July when the flesh is tender and before it flowers or seeds. Lightning mushrooms are so named because they are only found on ground that has been struck by lightning, identifiable where the grass is darker and thicker. Lightning mushrooms are rare and only gathered in the spring since they require moisture to grow and this is when most lightning and thunder occurs. Morel and sand mushrooms are found following recent forest fires. Two types of mushroom are harvested near cottonwood trees: cottonwood mushrooms near living trees and tree mushrooms from cottonwood deadfall. Yarrow was described to prefer sandy soil, but can grow in a variety of different conditions and, while often considered a weed, the entire plant can be picked and boiled in the spring and fall. Kinnickinnick is an important food source for bears. Devil's club can be harvested year-round, but is best harvested in the spring when only the root is used also producing a berry on top that grizzly bear will eat.

The issues and concerns raised relative to vegetation resources for the Project along the Black Pines to Hope Segment are provided in Table 5.1.3-3. Concerns related to vegetation resources were addressed by the proposed mitigation measures discussed. Participants have not recommended any mitigation strategies related to vegetation resources additional to those described in the Pipeline and Facilities EPPs (Volumes 6B and 6C). Concerns related to potential effects of spills on the terrestrial environment (Section 3.0 of Volume 5A) are considered within the assessment of various onshore facility spill scenarios provided in Volume 7.

**TABLE 5.1.3-3**

**VEGETATION TEK RECORDED ALONG THE BLACK PINES TO HOPE SEGMENT**

Issue/Concern	Location(s)	Proposed Mitigation Measures/Response <sup>1</sup>
Potential regional effects of Project construction activities on sustainability of huckleberry plants.	Vegetation RSA	Potential Project-related cumulative effects are mitigated with implementation of the following design and construction measures: align the proposed pipeline corridor to follow existing linear features such as pipelines and disturbed areas such as facilities/clearings to the extent practical; and encourage rapid regeneration of natural vegetation.

**TABLE 5.1.3-3 Cont'd**

Issue/Concern	Location(s)	Proposed Mitigation Measures/Response <sup>1</sup>
Avoid use of herbicides near standing trees.	Proposed Pipeline Corridor	The use of herbicides for problem vegetation management along the construction right-of-way within the province of Alberta will be conducted in accordance with the Environmental <i>Code of Practice for Pesticides</i> as part of the Alberta <i>Environmental Protection and Enhancement Act</i> . The use of herbicides for problem vegetation management along the construction right-of-way in BC will be conducted in accordance with Section 58 of the <i>Integrated Pest Management Regulation</i> of BC. Trans Mountain will utilize an IVM approach to carry out problem vegetation ( <i>i.e.</i> , weeds, grasses, sedges, forbs, vines, ferns, brush and trees [deciduous and coniferous]) management practices for the Project and to meet the overall objectives of IVM for all Trans Mountain pipelines and facilities (see Table 5.1.1-3) that includes the establishment of appropriate size buffer zones around various environmental features.
Loss of berry plants through clearing activities.	Proposed Pipeline Corridor	Confine all pre-clearing/mowing and general clearing activities within the staked/flagged construction right-of-way boundaries. Adhere to clearing/mowing restrictions associated with watercourse/wetland/lake boundary sensitive environmental features and buffer areas Where grubbing and grading are not necessary, use a mulcher to chip stumps and mow surface vegetation ( <i>i.e.</i> , shrubs, small trees) to ground level to preserve topsoil/root zone material and establish a smooth work surface. Restrict root grubbing to the trench line, if feasible, to minimize surface disturbance and encourage resprouting/natural regeneration of deciduous trees and shrubs.
Avoid mature tree stands.	At RK 865 At RK 865.4 35 m northwest of RK 893.2 At RK 913.3 At RK 938.9 At RK 949.3 At RK 974.9	If warranted, site-specific mitigation measures based on location and species will be determined once the Footprint is finalized in accordance with the Rare Ecological Community and Rare Plant Population Management Plan.

**Note:** 1 Detailed mitigation measures are outlined in the Table 6.1-10 and the Project-specific EPPs (Volume 6B).

### 5.1.4 Hope to Burnaby Segment

Details of the TEM and vegetation surveys for the Hope to Burnaby Segment are summarized in Table 5.1.4-1.

**TABLE 5.1.4-1**

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

BGC Variant <sup>1</sup>	Mapped Area in the Vegetation RSA <sup>1</sup> (ha)	Area Within the Proposed Pipeline Corridor (ha)	Number of TEM Plots <sup>2</sup>		Amount of Rare Plant Survey on the Proposed Pipeline Corridor (Dates/Distance)
			Ground	Visual	
CWHms1	236.7	--	--	--	... <sup>3</sup>
CWHds1	5,917.0	134.6	9	13	May 22 to 23, 2013 and July 13 to 15, 2013 11.6 km
CWHdm	3,470.0	72.7	2	3	May 7 to 8, 2013, July 13 to 14, 2013 and August 20 and 23, 2013 2.6 km
CWHxm1	12,288.4	279.5	13	6	May, 7, 9, 10 and 22, 2013, July 13 to 14, 2013 and August 19 to 23, 2013 5.3 km

- Note:**
- 1 See Appendix C for descriptions of BGC variants and for TEM limitations and information on areas for which TEM will be included in supplemental filings.
  - 2 TEM field work was completed in 2012 and 2013. 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 and from September 30 to October 11, 2013. Field plots from the latter survey will be included in a supplemental filing.
  - 3 Denotes a BGC variant that occurs in the Vegetation RSA but does not occur within the proposed pipeline corridor.

Traditional Ecological Knowledge

The plants identified and described by participants during TEM and vegetation surveys along the Hope to Burnaby Segment are listed in Table 5.1.4-2.

**TABLE 5.1.4-2**  
**PLANTS IDENTIFIED THROUGH TEK**  
**PARTICIPATION ALONG THE HOPE TO BURNABY SEGMENT**

	Plants <sup>1</sup>		
<b>A</b>	alder	alfalfa	aspen
<b>B</b>	balsam root balsam birch black caps	boysenberries bracket fungus broad-leaf plantain	brown-eyed Susan buckrush Bulrush
<b>C</b>	casacara cedar cherry	consumption plant cork fungus	cottonwood currants
<b>D</b>	dandelion	Devil's club	
<b>E</b>	elderberries		
<b>F</b>	field mint		
<b>G</b>	ghostberries	gooseberries	
<b>H</b>	hazelnut Himalayan blackberries	horsetail huckleberries	
<b>K</b>	Kinnikinnick		
<b>L</b>	Licorice root	lodgepole pine	loose-strife plant
<b>M</b>	maple mariposa lily	morning glory	mushrooms (morels, bracket fungus, pine)
<b>N</b>	nodding onion		
<b>O</b>	Oregon grape berries		
<b>P</b>	pearly everlasting PP	Prickly pear cactus Purple clover	
<b>R</b>	raspberries	red huckleberries	rosehips
<b>S</b>	salmon berries saskatoon berries silverberry bark	Skunk cabbage Soapberries St. John's wort	stinging nettle
<b>T</b>	thimbleberries thistle	touch-me-not trailing blackberries	
<b>W</b>	walnut trees wild blueberries wild celery	wild ginger wild rye grass wild strawberries	wild tea rose willow
<b>Y</b>	yarrow		

**Note:** 1 The plant nomenclature provided in the table may not necessarily follow the nomenclature used by the BC MOE (2013).

The characteristics of several plant species were discussed during field studies along the Hope to Burnaby Segment. Stinging nettle was commonly identified by participants. Stinging nettle can be harvested at any time of year, but it is best to harvest it in the spring. In the late summer the plants get very woody and dry and if later in the year, it must be harvested before the flower blooms since the blooms are poisonous. Devil's club is common in the region and is a year-round plant that grows in shaded, wet environments. Devil's club can be identified by the broad green leaves and thorny stem; it also has red berries that sprout from the top of the stem. This plant is difficult to handle because of its thistle-covered stalk and leaves. When touched, the thistles embed themselves in skin and are difficult to remove. Licorice root is harvested in the spring from lands where maple trees are present. Participants noted that the flowing sap of maple trees make them taste sweeter like licorice. Consumption plant, also called *Comutium nudicaule*, "stsweta" or desert parsley, is an important plant harvested for food. St. John's wort was identified along the segment by participants. Frog's leaf, also called broad-leaf plantain, grows flat leaves close to the ground in grassy areas.

Many types of edible berries were identified by participants along this proposed pipeline segment and participants noted that berry patches are a good indicator of the presence of deer. Huckleberries are favoured for harvesting, and community members will travel long distances to find these plants. Many of these berries are eaten fresh, dried, used to make jams or used in baking. The stems or briars of many of these plants can also be peeled and consumed or used to make tea. Participants shared a story describing the natural cues of connected elements: when the thimble berries are ripe and the cottonwood pollen flies, it means that the salmon run is beginning. The ripening of the salmon berries also coincides with the start of the sockeye salmon run in spring and early summer. Salmon berries are typically found in wet areas and along the banks of watercourses. These plants have a short season and are harvested in the late spring and early summer when turning from red to dark red. Salmon berries require a great deal of sunlight and are usually found in grassy areas and clearings. Huckleberries are identified by round berries that turn red when ripe in August and typically grow in moist, shaded forest. Soapberries are a food source for birds and black bears and are common in the Nicola Valley. Saskatoon berries also grow well in the Nicola Valley and are harvested from mid-June to early September. Saskatoon berries or "schukum" are some of the most abundant berries in the dry climate of this region. Wild tea rose bushes begin to flower in the first two weeks of June, indicating that the spring salmon run is starting in the Fraser River. Rosehips grow in dry soils and are common in the Nicola Valley.

Other edible plants species identified along this proposed pipeline segment include dandelions, wild celery, wild ginger, nodding onion and mariposa lily. Participants also identified morels, bracket fungus and pine mushrooms during the field studies along the Hope to Burnaby Segment. Morel mushrooms grow up to 15 cm tall in sandy soils often under cottonwood trees and are harvested in the spring.

Several trees species were identified participants along this proposed pipeline segment including maple, birch, cottonwood, hazelnut, cherry, alder, aspen, balsam, cascara, willow, cedar and lodgepole pine. Participants reported that birch is becoming increasingly difficult to find and may be more susceptible to development and disturbance than other species of trees. Lodgepole pine is common in this region. This tree can be identified by its bark and needles and harvest time is during the growing season from May to mid-August. Cedar is also common along the Hope to Burnaby Segment. Cedar trees can be identified by the vertical ridges in the bark and by their flat needles. The age of a cedar can be identified by the width of its base.

Medicinal plant species were identified during the field studies along the Hope to Burnaby Segment and their functions were extensively described by participants. The knowledge of locations and uses of medicinal plants held by the participants is proprietary to the community.

The issues and concerns raised relative to vegetation resources for the Project along the Hope to Burnaby Segment are provided in Table 5.1.4-3. Concerns related to vegetation resources were addressed by the proposed mitigation measures discussed. Participants have not recommended any mitigation strategies related to vegetation resources additional to those described in the Pipeline and Facilities EPPs (Volumes 6B and 6C). Concerns related to potential effects of spills on the terrestrial environment (Section 3.0 of Volume 5A) are considered within the assessment of various onshore facility spill scenarios provided in Volume 7.

**TABLE 5.1.4-3**

**VEGETATION TEK RECORDED ALONG THE HOPE TO BURNABY SEGMENT**

Issue/Concern	Location(s)	Proposed Mitigation Measures/Response <sup>1</sup>
Avoid use of chemical weed control.	Proposed Pipe line Corridor	Trans Mountain will utilize an IVM approach to carry out problem vegetation ( <i>i.e.</i> , weeds, grasses, sedges, forbs, vines, ferns, brush and trees (deciduous and coniferous)) management practices for the Project and to meet the overall objectives of IVM for all Trans Mountain pipelines and facilities (see Table 5.1.1-3).
Spread of invasive plant species during construction and operations.	Proposed Pipe line Corridor	<p>Follow recommendations made in the pre-construction weed survey to limit the risk of spreading weed seeds. Implement weed management (<i>i.e.</i>, using proper application of chemical, mechanical or manual measures, or a combination of all) at locations identified within the pre-construction weed survey to a level that is consistent with weed management observed adjacent to the eventual construction right-of-way to reduce the potential for weed infestations following construction.</p> <p>Restrict all vehicular traffic to the approved and staked construction right-of-way, workspace and access roads. Ensure equipment arrives at all construction sites clean and free of soil or vegetative debris. Inspect and identify equipment deemed to be acceptable with a suitable marker, such as a sticker. Do not allow any equipment arriving in a dirty condition on site until it has been cleaned.</p> <p>Clean equipment (<i>i.e.</i>, shovel and sweep, pressurized water or compressed air) involved in topsoil/root zone material handling at weed infested sites prior to leaving the location unless full right-of-way topsoil/root zone material salvage has been conducted. Clean equipment involved in topsoil handling at weed infested sites prior to leaving the location.</p> <p>Trans Mountain will utilize an IVM approach to carry out problem vegetation management practices for the Project and to meet the overall objectives of IVM for all Trans Mountain pipelines and facilities (see Table 5.1.1-3).</p>

**Note:** 1 Detailed mitigation measures are outlined in the Table 6.1-10 and the Project-specific EPPs (Volume 6B).

**5.1.5 Burnaby to Westridge Segment**

Due to land access restriction throughout the Burnaby to Westridge Segment, no TEM or vegetation surveys were conducted during 2013. Surveys are planned for this segment in 2014.

**5.1.6 Gainford Pump Station**

The Gainford Pump Station Footprint was not available until late-season surveys in 2013. Vegetation surveys were conducted on July 18, 2013.

Traditional Ecological Knowledge

TEK for the Gainford Pump Station has been captured under the Edmonton to Hinton Segment where the station is located (Section 5.1.1).

**5.1.7 Hinton Pump Station**

The Hinton Pump Station Footprint was not available until late-season surveys in 2013. Vegetation surveys were conducted on August 13, 2013.

Traditional Ecological Knowledge

TEK for the Hinton Pump Station has been captured under the Edmonton to Hinton Segment where the station is located (Section 5.1.1).

**5.1.8 Rearguard Pump Station**

The Rearguard Pump Station Footprint was not available during 2013 surveys. Surveys at the station are expected to be conducted in 2014.

**5.1.9 Black Pines Pump Station**

The Black Pines Pump Station Footprint was available during late 2013 and was surveyed on August 26, 2013. Due to land access restrictions on the part of the power line on the east bank of the North Thompson River, only the portion on the west bank of the North Thompson River was surveyed. Surveys are planned for the east section of the power line in 2014.

## Traditional Ecological Knowledge

TEK for the Black Pines Pump Station has been captured under the Black Pines to Hope Segment where the station is located (Section 5.1.3).

### **5.1.10 Kingsvale Pump Station**

The Kingsvale Pump Station Footprint was available during late 2013 and was surveyed on July 22, 2013. Due to land access restrictions, the power line was not surveyed in 2013. Surveys are planned for the power line in 2014.

### **5.1.11 Sumas Terminal**

The Sumas Terminal Footprint was not available during 2013 surveys. Surveys at the terminal are planned to be conducted in 2014.

## **5.2 Vegetation Communities of Concern**

A description of the most common communities, least common communities and most affected communities for the Project based on TEM have been compiled and are presented in the following subsections organized according to proposed pipeline corridor segment. Similarly the rare ecological communities observed during surveys is presented and organized by proposed pipeline corridor segment.

For each segment, the most common and least common vegetation communities (*i.e.*, ecosites or variants), according to their total area (ha) within the Vegetation RSA, are listed and described; also described are the vegetation communities most affected by the Project. That is, the ecosites or variants with the greatest proportion of their total area (ha) in the Vegetation RSA that lies within the Footprint. Vegetation communities are examined at the level of ecosites in Alberta and BGC variants in BC. For more detailed vegetation community information refer to Appendix C.

ACIMS and BC CDC-listed rare ecological communities observed during the surveys are summarized in Tables 5.2-1 and 5.2-2, respectively. For BC, additional assessment is necessary to provide final confirmation on the rare ecological communities, however, potential communities observed are described. One rare ecological community designated under the BC IWMS, western redcedar Douglas-fir/vine maple, was potentially observed twice during surveys. Details are summarized in Table 5.2-2.

Differences exist between the number of rare ecological communities noted below and those that are noted in Table J-1 of Appendix J of the Pipeline EPP (Volume 6B). These differences are due to ongoing analysis of data and determination of potential communities which was possible to include in this technical report but due to time constraints, it was not included in the current version of the Pipeline EPP. However, all communities affected by Project construction will be included in future revisions of the Pipeline EPP.

**TABLE 5.2-1**

### **RARE ECOLOGICAL COMMUNITIES OBSERVED ON THE ALBERTA PORTION OF THE PROPOSED PIPELINE CORRIDOR**

Common Name	Scientific Name	Rank <sup>1</sup>	Number of Times Observed
beaked sedge marsh	<i>Carex rostrata</i> marsh	S3?	1
beaked willow/red-osier dogwood	<i>Salix bebbiana</i> / <i>Cornus stolonifera</i>	S3?	1
white birch/stiff club-moss woodland	<i>Betula papyrifera</i> / <i>Lycopodium annotinum</i> woodland	S2?	3

**Note:** 1 Definitions of provincial ranks are summarized in the footnotes of footnotes of Appendix B.

### **5.2.1 Beaked Sedge Marsh (S2)**

Beaked sedge (*Carex rostrata*) marsh is a rare ecological community found in standing water of protected bays. The community has been documented in the Kazan Upland and Boreal SubArctic Subregions, but likely occurs in other Boreal subregions as well. A few other species may be present in the community,

but often beaked sedge is the only species present. There may also be a zone transition with beaked sedge and swamp horsetail growing together, between a beaked sedge and swamp horsetail community (Allen 2013). This community is ranked S2 in Alberta (Appendix E, Plate 1).

### 5.2.2 Beaked Willow/Red-Osier Dogwood (S3?)

Beaked willow/red-osier dogwood (*Salix bebbiana/Cornus stolonifera*) community is commonly found in the riparian areas of the Montane Subregion. It is often associated with moist to wet, dark brown to black Chernozem soils near sprigs and seeps. Beaked willow is the dominant in the tall shrub layer while red-osier dogwood is the dominant understory shrub. A low shrub layer of rosa species is usually present. The forb layer is highly variable and varies from relatively sparse to dense graminoids or herbs (Allen 2013). This community is ranked S3? in Alberta (Appendix E, Plate 2).

### 5.2.3 White Birch/Stiff Club-Moss Woodland (S2?)

White birch/stiff club-moss (*Betula papyrifera/Lycopodium annotinum*) woodland is found at midslopes in locations which are mesic to subhygric or submesotrophic and likely associated with seepage. Soils are exposed but may have a high litter cover. White birch is the dominant tree and forms an open canopy over sparse understory of stiff club-moss. Common species which may be present sporadically include bunchberry, western mountain-ash, oak fern, woodland horsetail and patchy feathermoss cover (Allen 2013). This community is ranked S2? in Alberta (Appendix E, Plate 3).

TABLE 5.2-2

#### POTENTIAL RARE ECOLOGICAL COMMUNITIES OBSERVED ON THE BC PORTION OF THE PROPOSED PIPELINE CORRIDOR

Common Name <sup>1</sup>	Scientific Name	Provincial Designation <sup>2,3</sup>	Number of Times Observed <sup>4</sup>		
			H-D	BP-H	H-B
amabilis fir – western red cedar/devil's club Moist Submaritime	<i>Abies amabilis</i> – <i>Thuja plicata</i> / <i>Oplodanax horridus</i> Moist Submaritime	S3, Blue		2	
Bebb's willow/bluejoint reedgrass	<i>Salix bebbiana</i> / <i>Calamagrostis canadensis</i>	S3, Blue	4		
big sagebrush/bluebunch wheatgrass	<i>Artemisia tridentata</i> / <i>Pseudoregneria spicata</i> community	S2, Red		2	
black cottonwood – red alder/salmonberry	<i>Populus trichocarpa</i> – <i>Alnus rubra</i> / <i>Rubus spectabilis</i> community	S3, Blue			2
common cattail Marsh	<i>Typha latifolia</i> marsh	S3, Blue	7	1	2
Douglas-fir – PP/pinegrass	<i>Pseudotsuga menziesii</i> – <i>Pinus ponderosa</i> / <i>Calamagrostis rubescens</i>	S3, Blue		2	
Douglas-fir – PP/snowbrush	<i>Pseudotsuga menziesii</i> – <i>Pinus ponderosa</i> / <i>Ceanothus velutinus</i>	S3, Blue		1	
Douglas-fir/common snowberry - saskatoon	<i>Pseudotsuga menziesii</i> / <i>Symphoricarpos albus</i> – <i>Amelanchier alnifolia</i>	S2, Red		2	
hard-stemmed bulrush Deep Marsh	<i>Schoenoplectus acutus</i> Deep Marsh	S3, Blue	1		1
hybrid spruce species – Douglas-fir/subalpine fir	<i>Picea hybrid</i> spp – <i>Pseudotsuga menziesii</i> / <i>Abies lasiocarpa</i>	... <sup>5</sup>		1	
lodgepole pine/velvet-leaved blueberry-clad lichens	<i>Pinus contorta</i> / <i>Vaccinium myrtillus</i> – <i>Cladonia</i> spp.	S2S3, Blue	7		
narrow-leaf willow shrubland	<i>Salix exigua</i> shrubland	S2, Red		3	
scrub birch/water sedge	<i>Betula nana</i> / <i>Carex aquatilis</i>	S3, Blue	1		
Sitka willow – Pacific willow/skunk cabbage	<i>Salix sitchensis</i> – <i>Salix lasiandra</i> var. <i>lasiandra</i> / <i>Lysichiton americanus</i>	S2, Red	1		
swamp horsetail – beaked sedge Marsh	<i>Equisetum fluviatile</i> – <i>Carex utriculata</i> Marsh	S3, Blue	3		
western redcedar – Douglas-fir/vine maple	<i>Thuja plicata</i> – <i>Pseudotsuga menziesii</i> / <i>Acer circinatum</i>	S2S3, Blue		1	1
western redcedar – paper birch/oak fern	<i>Thuja plicata</i> – <i>Betula</i> / <i>Gymnocarpium dryopteris</i> community	S3?, Blue	1		
western redcedar – Sitka spruce/skunk cabbage <sup>6</sup>	<i>Thuja plicata</i> – <i>Picea sitchensis</i> / <i>Lysichiton americanus</i> community	S3?, Blue			1

**TABLE 5.2-2 Cont'd**

Common Name <sup>1</sup>	Scientific Name	Provincial Designation <sup>2,3</sup>	Number of Times Observed <sup>4</sup>		
			H-D	BP-H	H-B
western redcedar/sword fern Very Dry Maritime	<i>Thuja plicata/Polystichum munitum</i> Very Dry Maritime	S2S3, Blue			2

- Notes:**
- 1 Potentially observed communities. Communities require confirmation once the Footprint has been finalised. Confirmation may include soil characterization.
  - 2 Definitions of provincial ranks are summarized in the footnotes of Appendix B.
  - 3 BC species and ecological communities are assigned to one of three lists, based on their provincial Conservation Status Rank.  
**Blue-list:** List of ecological communities and indigenous species and subspecies of special concern (formerly vulnerable).  
**Red-list:** List of ecological communities and indigenous species and subspecies that are extirpated, endangered or threatened.
  - 4 Observations are documented as mitigable occurrences.
  - 5 Community is not ranked by the BC CDC but considered unique.
  - 6 This community is listed under the BC IWMS.

The descriptions of rare ecological communities observed in the BC portion of the proposed pipeline corridor are detailed in Table 5.2-3.



TABLE 5.2-3

DESCRIPTIONS OF RARE ECOLOGICAL COMMUNITIES OBSERVED ALONG THE BC PORTION OF THE PROPOSED PIPELINE CORRIDOR

Common Name	Scientific Names	BC Designation	General Description/Location in Landscape	Water Table	Soils/Peat Depth	Dominants Plants	Common Plants	Observed BGC Zones	Photoplate (Appendix E)
amabilis fir – western redcedar devil's club Moist Submaritime	<i>Abies amabilis/Thuja plicata/Oplopanax horridus</i> Moist Submaritime	S3, Blue	Occurs at higher elevations in drainages of the upper Fraser River east and north of Chilliwack.	--	Moist to very moist with rich to very rich soil nutrient regime.	Amabilis fir Western redcedar Devil's club	Western hemlock Oak fern Lady fern	CWH	Plate 4
Bebb's willow/bluejoint reedgrass	<i>Salix bebbiana/Calamagrostis canadensis</i>	S3, Blue	Occur on lake flats, pond margins, fluvial terraces, seasonal creeks and palustrine basins.	Sites have early-season standing water that draws down to very moist conditions by late growing season.	Fine-textured Gleysols, often with veneers of woody peat.	Bebb's willow Bluejoint reedgrass	Mountain alder Common horsetail Leafy mosses	SBS ICH IDF	Plate 5
big sagebrush/bluebunch wheatgrass	<i>Artemisia tridentata/Pseudoroegneria spicata</i>	S2, Red	In arid zone that occurs in the valley bottoms of the Thompson and Nicola River systems.	--	Submesic to mesic with poor to very rich soil nutrient regime.	Big sagebrush Bluebunch wheatgrass	Pasture sage	BG	Plate 6
black cottonwood – red alder/salmonberry	<i>Populus trichocarpa – Alnus rubra/Rubus spectabilis</i>	S3, Blue	Occurs on the south side of the Fraser River as far as Chilliwack.	--	Medium to very rich soil nutrient regime.	Black cottonwood Red alder Salmonberry	--	CWH	Plate 7
common cattail Marsh	<i>Typha latifolia</i> Marsh	S3, Blue	Protected lake bays, potholes, roadside ditches at low elevations.	Water depths may be up to 1 m in spring and the surface remains saturated for most of the growing season.	Well-decomposed organic veneer over Humisols or Humic Gleysols.	Common cattail	Beaked sedge Hard-stemmed bulrush Duckweed	ICH IDF CWH	Plate 8
Douglas-fir – PP/pinegrass	<i>Pseudotsuga menziesii/Pinus ponderosa/Calamagrostis rubescens</i>	S3, Blue	Dry forest that commonly occurs on steep and warm or gentle middle and upper slopes. Mature Douglas-fir typically dominates the forest canopy where ponderosa and lodgepole pine are often present. Seasonal distribution of precipitation is quite variable (for sites that falls under the IDF Cascade Dry Cool Variant).	--	Xeric to subxeric with very poor to medium soil nutrient regime.	Douglas-fir PP Pinegrass	White pussytoes Northwestern sedge Yarrow Wild strawberry	IDF	Plate 9
Douglas-fir – PP/snowbrush	<i>Pseudotsuga menziesii – Pinus ponderosa/Ceanothus velutinus</i>	S3, Blue	Characterized by a warm, dry climatic regime with relatively long growing seasons. Mid-summer soil moisture deficits are common, in particular on south facing aspects.	--	Subxeric with poor to medium soil nutrient regime. Variable soil texture class.	Douglas-fir PP Snowbrush	Bluebunch wheatgrass	IDF	Plate 10
Douglas-fir/common snowberry – saskatoon	<i>Pseudotsuga menziesii/Symphoricarpos albus – Amelanchier alnifolia</i>	S2, Red	Occurs on mesic or moist slopes on morainal or colluvial materials. Douglas-fir dominates forest canopy whereas PP is usually absent.	--	Mesic to subhygric with medium to very rich soil nutrient regime.	Douglas-fir Common snowberry Saskatoon	Pinegrass Bluebunch wheatgrass	PP	Plate 11
hard-stemmed bulrush Deep Marsh	<i>Schoenoplectus acutus</i> Deep Marsh	S3, Blue	Wave-exposed lake bays and grassland potholes with occasional substrate exposure.	Water depths may be up to 1.5 m in spring, with significant growing-season drawdown occurring in potholes.	Gleysols and Humic Gleysols. Occasional Terric Humisols.	Hard-stemmed bulrush	Low plant diversity	IDF CWH	Plate 12
lodgepole pine/velvet-leaved blueberry/clad lichens	<i>Pinus contorta/Vaccinium myrtilloides/Cladonia spp.</i>	S2S3, Blue	Occurs on dry sites with coarse-textured materials, most often on glaciofluvial deposits, occasionally on aeolian materials (inactive sand dunes). Soils are extremely dry and nutrient poor. Prominence of lodgepole pine due to relatively frequent fire history (DeLong 1996).	--	Xeric to subxeric with very poor to poor soil nutrient regime.	Lodgepole pine Velvet-leaved blueberry Clad lichens	Kinnikinnick <i>Peltigera</i> lichens	SBS	Plate 13
narrow-leaf willow Shrubland	<i>Salix exigua</i> Shrubland	S2, Red	Sandy lateral bars along very large river systems at low elevations.	Prolonged flooding by powerful currents during spring.	Sandy Cumulic Regosols.	Narrow-leaf willow	Balsam poplar Scouring rush	BG	Plate 14
scrub birch/water sedge	<i>Betula nanal/Carex aquatilis</i>	S3, Blue	Peatlands that are frequently hummocky, with shrubs taking root on elevated microsites.	Water table fluctuates enough to allow the surface to become aerated by mid-season.	1-4 m peat depths, occasionally occurs on thin organic soil veneers.	Scrub birch Meadow willow Water sedge Beaked sedge Peat mosses	White spruce Black spruce Feather mosses	SBS	Plate 15
Sitka willow – Pacific willow/skunk cabbage	<i>Salix sitchensis – Salix lasiandra var. lasiandra/Lysichiton americanus</i>	S2, Red	Occur between flood-plain forests and marshes of shallow-water habitats in flood-scar depressions of larger rivers.	Surface remains saturated for most of the growing season.	Gleysols with dark peat veneers.	Sitka willow Pacific willow Skunk cabbage	Lady fern Small-flowered bulrush Pacific water-parsley Horsetail species	ICH	Plate 16
swamp horsetail – beaked sedge marsh	<i>Equisetum fluviatile – Carex utriculata</i> marsh	S3, Blue	At lower elevations in back-levee depressions along sediment-laden, low-gradient streams, protected bays of large lakes, flooded fens and tidal reaches of large rivers above saltwater influence. Plant diversity is low.	--	Silty of fine-sandy fluvium, deep limnic deposits or recently flooded peat.	Swamp horsetail Beaked sedge	Pondweed species Water-milfoil species	BWBS ESSF ICH SBS	Plate 17
western redcedar - Douglas-fir/vine maple	<i>Thuja plicata-Pseudotsuga menziesii/Acer circinatum</i>	S2S3, Blue	Occurs at lower elevations in drainages of the upper Fraser River east and north of Chilliwack. Elevation limits range from valley bottom to approximately 650 m.	--	Slightly dry to fresh soil moisture with a rich to very rich nutrient regime.	Western redcedar Douglas-fir Vine maple	Western hemlock Bigleaf maple Sword fern One-leaf foamflower Oak fern	CWH	Plate 18

TABLE 5.2-3 Cont'd

Common Name	Scientific Names	BC Designation	General Description/Location in Landscape	Water Table	Soils/Peat Depth	Dominants Plants	Common Plants	Observed BGC Zones	Photoplate (Appendix E)
western redcedar – paper birch/oak fern	<i>Thuja plicata</i> – <i>Betula papyrifera</i> / <i>Gymnocarpium dryopteris</i>	S2S3, Blue	Occurs on level areas and depressions where the water table is near the surface. Forest canopy is dominated western redcedar.	--	Submesic to mesic with a poor to rich soil nutrient regime.	Western redcedar Paper birch Oak fern	Douglas-fir Falsebox Prince's pine Rattlesnake-plantain	IDF	Plate 19
western redcedar – sitka spruce/skunk cabbage	<i>Thuja plicata</i> – <i>Picea sitchensis</i> / <i>Lysichiton americanus</i>	S3?, Blue	Occurs on the south side of the Fraser River as far as Chilliwack.	--	Wet soil with a medium to very rich soil nutrient regime.	Western redcedar Sitka spruce Skunk cabbage	Western hemlock Red alder Salmonberry Lady fern	CWH	Plate 20
western redcedar/sword fern Very Dry Maritime	<i>Thuja plicata</i> / <i>Polystichum munitum</i> Very Dry Maritime	S2S3, Blue	Occurs on the south side of the Fraser River as far as Chilliwack.	--	Slightly dry to fresh soil moisture (neither moisture deficit nor surplus during growing season) with a rich to very rich nutrient regime.	Western redcedar Sword fern	Douglas-fir Western hemlock Red huckleberry	CWH	Plate 21

Sources: BC Ministry of Forests and Range (BC MOFR) 2007a,b, DeLong 1996, Green and Klinck 1994, Lloyd *et al.* 1990, Lloyd *et al.* 2005, MacKenzie and Moran 2004

In addition to the potential rare ecological communities described in Table 5.2-3, a unique community, hybrid spruce species-Douglas-fir/subalpine fir, was observed along the Black Pines to Hope Segment and is described below.

The hybrid spruce species – Douglas-fir/subalpine fir (*Picea hybrid spp/Pseudotsuga menziesii/Abies lasiocarpa*) community was described by the field botanist as an outstanding example of old growth forest with the largest trees the botanist had observed in the interior in 35 years as a BEC Ecologist (Braumandl pers. comm.). The community was observed at the toe of Kame Terrace with the adjacent slope having a west aspect and the moisture and nutrient regime describes as mesic and medium-rich respectively. It included one Douglas-fir tree of approximately 150 cm diameter at breast height (dbh). The dominant trees included hybrid spruce species and Douglas-fir and to a lesser degree subalpine fir. Dominant understory species included Douglas maple and mosses including *Rhytidiopsis robusta* and *Brachythecium* sp.

The abundance and distribution of the rare ecological communities observed during the surveys are detailed in Appendix F. Maps providing the locations of these rare ecological community observations are provided in Appendix A (Figure 2).

#### **5.2.4 Edmonton to Hinton Segment**

##### General Vegetation Communities

Within the Edmonton to Hinton segment of the Vegetation RSA, the most common vegetation communities are the low-bush cranberry ecosites in the Dry Mixedwood Natural Subregion (DMWd) and the Lower Foothills Natural Subregion (LFe). Both the DMWd and LFe ecosites commonly occur where there is a mesic moisture regime and a medium nutrient regime and are characterised by pioneering deciduous trees such as aspen, balsam poplar and white birch, followed by a climax community of white spruce and balsam fir with an understory rich in mosses (Beckingham *et al.* 1996, Beckingham and Archibald 1996).

The least common vegetation communities within the Edmonton to Hinton Segment of the Vegetation RSA include the marsh ecosites in the Dry Mixedwood Natural Subregion (DMWI) and the Central Mixedwood Natural Subregion (CMWI) and the foxtail barley ecosite in the Central Parkland Natural Subregion (CPj). The DMWI and CMWI ecosites are found in areas where water is above the rooting zone for at least part of the growing season and is dominated by a variety of sedges and rushes (Beckingham and Archibald 1996). The foxtail barley ecosite (CPj) is found in areas with a subhygric moisture regime and a medium to poor nutrient regime and is characterised by a lack of trees and shrubs and the presence of foxtail barley (Burkinshaw *et al.* 2009).

##### Communities Most Affected

Within the Edmonton to Hinton segment, those vegetation communities most affected by the Project, relative to their overall presence within the RSA, are the marsh ecosite in the Lower Foothills Natural Subregion (LFn) and the Labrador tea-mesic ecosite in the Central Mixedwood Natural Subregion (CMWc). The LFn ecosite is found along shorelines of waterbodies and in riparian zones and is dominated by a variety of sedges and rushes (Beckingham *et al.* 1996). The CMWc ecosite occurs on level or upland sites and is commonly characterized by a two-tiered canopy with Jack pine above and white spruce below (Beckingham and Archibald 1996). Approximately 6.4% of the LFn ecosite and 5.6% of the CMWc ecosite in the Vegetation RSA are within the Footprint.

##### Rare Ecological Communities

A total of five ACIMS-listed rare ecological communities were observed during the vegetation surveys. A summary of these rare ecological communities is provided in Table 5.2-1.

#### **5.2.5 Hargreaves to Darfield Segment**

##### General Vegetation Communities

Within the Hargreaves to Darfield segment of the Vegetation RSA, the most common vegetation communities include the Thompson Moist Warm Interior Douglas Fir (IDFmw2), the Wells Gray Wet Cool

Interior Cedar-Hemlock (ICHwk1) and the McLennan Dry Hot Sub-Boreal Spruce (SBSdh1) variants. The IDFmw2 variant occurs at low elevations north of Shuswap Lake and is dominated by successional stands of Douglas-fir, lodgepole pine, paper birch and trembling aspen (Lloyd *et al.* 2005). The ICHwk1 variant occurs at mid-elevations and is generally characterized by a canopy of western hemlock and western redcedar with black huckleberry and falsebox common in the understory (Lloyd *et al.* 2005). The SBSdh1 variant occurs at middle elevations and is dominated by lodgepole pine and Douglas-fir due to an extensive fire history (BC MOFR 2007a).

The least common vegetation communities within the Hargreaves to Darfield segment of the Vegetation RSA include the Northern Monashee Wet Cold ESSF (ESSFwc2) and Raush Moist Mild ESSF (ESSFmm1) variants. The ESSFwc2 variant occurs on upper slopes and moist side drainages. It is dominated by climax stands of Engelmann spruce and subalpine fir, with white-flowered rhododendron and a rich herb layer (Lloyd *et al.* 2005). The ESSFmm1 variant is a subalpine variant characterized by forests of subalpine fir and Engelmann spruce, which become more open at higher elevations (BC MOFR 2007b).

### Communities Most Affected

Within the Hargreaves to Darfield segment, the vegetation community most affected by the Project, relative to overall presence within the RSA, is the MacLennan Dry Hot Sub-Boreal Spruce (SBSdh1). The SBSdh1 variant is characterized by seral stands of lodgepole pine, hybrid white spruce and Douglas-fir with thimbleberry, birch-leaved spirea, black huckleberry and falsebox common in the understory (Lloyd *et al.* 2005). Approximately 2.7% of the SBSdh1 variant in the Vegetation RSA is within the Footprint.

### Rare Ecological Communities

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

A total of 25 potential 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 Table 5.2-2 and descriptions of each community are provided in Table 5.2-3.

## **5.2.6 Black Pines to Hope Segment**

### General Vegetation Communities

Within the Black Pines to Hope segment of the Vegetation RSA, the most common vegetation communities include the Thompson Very Dry Hot PP (PPxh2) and Thompson Dry Cool Interior Douglas-Fir (IDFdk1) variants. The PPxh2 variant occurs in valley bottoms and is characterized by open stands of PP and Douglas-fir, a sparse shrub layer and a well-developed herb layer dominated by bunch grasses (Lloyd *et al.* 1990). The IDFdk1 variant is characterized by climax stands of Douglas-fir and a largely herb based understory dominated by pinegrass (Lloyd *et al.* 1990).

The least common vegetation communities within the Black Pines to Hope segment of the Vegetation RSA include the Leeward Moist Maritime MH (MHmm2), Undifferentiated and Parkland Coastal Mountain-heather Alpine (CMAunp) and Southern Moist Submaritime CWH (CWHms1) variants. The MHmm2 variant occurs at high elevations in subarctic areas of the coast and is characterized by a canopy dominated by MH and amabilis fir, blueberry and huckleberry shrub species and diverse herb and moss layers (Green and Klinka 1994). The CMAunp variant occurs at high elevations throughout BC and is largely occupied by glaciers or recently exposed bare rock (BC MFLNRO 2013). The CWHms1 variant occurs at higher elevations and is dominated by western hemlock, fir species and western redcedar, with blueberry species common in the understory and a well-developed moss layer (Green and Klinka 1994).

### Communities Most Affected

Within the Black Pines to Hope segment, the vegetation community most affected by the Project, relative to overall presence within the RSA is the Moist Warm ESSF (ESSFmw) variant. The ESSFmw variant occurs at high elevations in subcontinental areas and is dominated by Englemann spruce and amabilis fir

with white-flowered rhododendron, Sitka valerian and black huckleberry common in the understory (Lloyd *et al.* 1990). Approximately 3.7% of the ESSFmw variant in the Vegetation RSA is within the Footprint.

### Rare Ecological Communities

One potential BC IWMS-listed community, western redcedar – Douglas-fir/vine maple, was observed along the Black Pines to Hope Segment during TEM surveys.

A total of 15 potential BC CDC-listed rare ecological communities were observed during the vegetation surveys, wetland surveys and TEM surveys conducted along the Black Pines to Hope Segment. A summary of these rare ecological communities is provided in Table 5.2-2.

In addition one unique community, hybrid spruce species – Douglas-fir/subalpine fir, was also observed in the Black Pines to Hope Segment.

## **5.2.7 Hope to Burnaby Segment**

### General Vegetation Communities

Within the Hope to Burnaby segment of the Vegetation RSA, the most common vegetation community is the Eastern Very Dry Maritime CWH (CWHxm1) variant. The CWHxm1 variant occurs at lower elevations along the south side of the Fraser River and is often dominated by subalpine fir and Englemann spruce, with falsebox, black huckleberry and one-sided wintergreen common in the understory (Green and Klinka 1994).

The least common vegetation community within the Hope to Burnaby segment of the Vegetation RSA is the Southern Moist Submaritime CWH (CWHms1) variant. This variant is described in Section 5.2.3.

### Communities Most Affected

Within the Hope to Burnaby segment, those vegetation communities most affected by the Project, relative to their overall presence within the RSA, are the Southern Dry Submaritime CWH (CWHds1) and Eastern Very Dry Maritime CWH (CWHxm1) variants. The CWHds1 variant occurs at lower elevations and is typified by a canopy of western redcedar, Douglas-fir and western hemlock, relatively poorly-developed shrub and herb layers and abundant mosses (Green and Klinka 1994). The CWHxm1 variant is described above. Approximately 2.3% of both the CWHds1 and CWHxm1 variants in the Vegetation RSA are within the Construction Footprint.

### Rare Ecological Communities

One potential BC IWMS-listed community, western redcedar – Douglas-fir/vine maple, was observed along the Hope to Burnaby Segment during TEM surveys.

A total of nine potential BC CDC-listed rare ecological communities were observed during the vegetation surveys, wetland surveys and TEM surveys along the Hope to Burnaby Segment. A summary of these rare ecological communities is provided in Table 5.2-2.

## **5.2.8 Burnaby to Westridge Segment**

Due to lack of land access in 2013, vegetation surveys were not conducted on the Burnaby to Westridge Segment of the proposed pipeline corridor. Vegetation surveys on this segment are expected to be conducted in 2014.

## **5.2.9 Gainford Pump Station**

No ACIMS-listed rare ecological communities were observed at the Gainford Pump Station during the vegetation surveys.

## **5.2.10 Hinton Pump Station**

No ACIMS-listed rare ecological communities were observed at the Hinton Pump Station during the vegetation surveys.

### 5.2.11 Rearguard Pump Station

The Rearguard Pump Station Footprint was not available during 2013 surveys. Surveys at the terminal are expected to be conducted in 2014.

### 5.2.12 Black Pines Pump Station

No BC CDC-listed rare ecological communities were observed at the Black Pump Station or on the west section of the power line during the vegetation surveys. Surveys are planned for the east section of the power line in 2014.

### 5.2.13 Kingsvale Pump Station

No BC CDC-listed rare ecological communities were observed at the Kingsvale Pump Station during the vegetation surveys. Surveys are planned for the power line in 2014.

### 5.2.14 Sumas Terminal

The Sumas Terminal Footprint was not available during 2013 surveys. Surveys at the terminal are planned for 2014.

## 5.3 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 F. Maps providing the locations of these rare plant and lichen observations are provided in Appendix A.

One SARA-listed species, Mexican mosquito fern, was potentially observed. No species designated under the Alberta *Wildlife Act* and/or BC IWMS were observed during the survey. The BC *Wildlife Act*, does not currently list any plant species.

A total of 50 ACIMS-listed rare plant species and 3 ACIMS-listed rare lichen species were observed during the rare plant survey. A summary of these rare plants and lichens is provided in Table 5.3-1.

A total of 113 BC CDC-listed rare plant species and 11 BC CDC-listed rare lichen species were observed during the rare plant survey. A summary of these rare plants and lichens is provided in Table 5.3-2.

### 5.3.1 Observed Plant and Lichen Species of Concern Summaries

TABLE 5.3-1

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

Common Name	Scientific Name	Provincial Designation <sup>1</sup>	Number of Times Observed <sup>2</sup>
<b>Vascular Plants</b>			
capitate sedge	<i>Carex capitata</i>	S3 (W)	3
golden saxifrage	<i>Chrysosplenium iowense</i>	S3?	9
goldthread	<i>Coptis trifolia</i>	S3 (W)	2
linear-leaved pondweed	<i>Potamogeton strictifolius</i>	S2	1
meadow bitter cress	<i>Cardamine pratensis</i>	S3 (W)	1
prairie wedge grass	<i>Sphenopholis obtusata</i>	S2	7
rush species	<i>Juncus species</i>	--	1
saxifrage species	<i>Chrysosplenium species</i>	--	4
scalloped grape fern	<i>Botrychium crenulatum</i>	S1	1
short-tail rush	<i>Juncus brevicaudatus</i>	S2	1
slender naiad	<i>Najas flexilis</i>	S2	1
spatulate grape fern	<i>Botrychium spathulatum</i>	S2	1
tall blue lettuce	<i>Lactuca biennis</i>	S2	1
western oak fern	<i>Gymnocarpium disjunctum</i>	S1	1

**TABLE 5.3-1 Cont'd**

Common Name	Scientific Name	Provincial Designation <sup>1</sup>	Number of Times Observed <sup>2</sup>
<b>Mosses</b>			
Atrichum moss	<i>Atrichum selwynii</i>	S2	1
Sarmenthyphnum moss	<i>Sarmenthyphnum sarmentosum</i>	S2	1
Schistidium moss	<i>Schistidium confertum</i>	Not listed in Alberta	1
<b>Lichens</b>			
Cladonia lichen	<i>Cladonia humilis</i>	S1	1
dragon Cladonia lichen	<i>Cladonia squamosa</i>	S2	1
Physciella lichen	<i>Physciella chloantha</i>	Not listed in Alberta	1
<b>Liverworts</b>			
Anastrophyllum liverwort	<i>Anastrophyllum helleranum</i>	S2	3
Blasia liverwort	<i>Blasia pusilla</i>	S1	1
droplet notchwort	<i>Lophozia guttulata</i>	S2	1
Pellia species	<i>Pellia species</i>	--	2
Riccardia liverwort	<i>Riccardia latifrons</i>	S2	1
snakeskin liverwort	<i>Conocephalum salebrosum</i>	S2	5

- Notes:**
- Definitions of provincial designation are summarized in the footnotes of Appendix B.  
Undescribed = Rank not yet assessed  
SNR = Species Not Ranked  
-- Identification still unconfirmed to species level, therefore, rank not assigned at this time.
  - Observations are documented as mitigable occurrences.

**TABLE 5.3-2**

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

Common Name	Scientific Name	Provincial Designation <sup>1</sup>	Number of Times Observed by Project Component <sup>1,2,3</sup>		
			H-D	BP-H	H-B
<b>Vascular Plants</b>					
Alaska moonwort	<i>Botrychium alaskense</i>	S1S3	1	1	
bald sedge	<i>Carex tonsa</i> var. <i>tonsa</i>	S2S3, Blue	27		
campion species	<i>Silene</i> sp	--		1	
Canada anemone	<i>Anemone canadensis</i>	S2S3, Blue	1		
crested wood fern	<i>Dryopteris cristata</i>	S2S3, Blue	2		
dainty moonwort	<i>Botrychium crenulatum</i>	S2S3, Blue	8		
echo moonwort	<i>Botrychium echo</i>	S1S2, Red	1		
fox sedge	<i>Carex vulpinoidea</i>	S2S3, Blue	1		
golden saxifrage species	<i>Chrysosplenium</i> sp.	--	1		
least moonwort	<i>Botrychium simplex</i> var. <i>compositum</i>	S2S3, Blue	1		
many-headed sedge	<i>Carex sychnocephala</i>	S3, Blue		1	
Mexican mosquito fern <sup>4</sup>	<i>Azolla mexicana</i>	S2, Red	1		
Michigan moonwort	<i>Botrychium michiganense</i> sp. nov. <i>ined.</i>	S1S3, Red	5		
moose moonwort	<i>Botrychium tunux</i>	S1S3, Red	1		
mountain moonwort	<i>Botrychium montanum</i>	S1S2, Red	1		
Pacific waterleaf	<i>Hydrophyllum tenuipes</i>	S2, Red			3
riverbank anemone	<i>Anemone virginiana</i> var. <i>cylindroidea</i>	S3, Blue	1		
silvery sedge	<i>Carex canescens</i> ssp. <i>disjuncta</i>	SU	2		
slender spike rush	<i>Eleocharis nitida</i>	S1, Red		1	
spoon-shaped moonwort	<i>Botrychium spatulatum</i>	S1, Red	1		
stalked moonwort	<i>Botrychium pedunculatum</i>	S2, Red	16		
tender sedge	<i>Carex tenera</i>	S2S3, Blue	3		
upswept moonwort	<i>Botrychium ascendens</i>	S2, Red	2		

**TABLE 5.3-2 Cont'd**

Common Name	Scientific Name	Provincial Designation <sup>1</sup>	Number of Times Observed by Project Component <sup>1,2,3</sup>		
			H-D	BP-H	H-B
<b>Vascular Plants</b>					
western moonwort	<i>Botrychium hesperium</i>	S2S3, Blue	19		
white wintergreen	<i>Pyrola elliptica</i>	S2S3, Blue	1		
<b>Mosses</b>					
montane Dicranum moss	<i>Dicranum montanum</i>	S3, Blue	4		
Racomitrium moss	<i>Racomitrium affine</i>	S2S3, Blue		1	
Syntrichia moss	<i>Syntrichia caninervis</i>	S3?, Blue		1	
whip fork moss	<i>Dicranum flagellare</i>	S3, Blue	2		
<b>Lichens</b>					
birdnest vinyl	<i>Leptogium tenuissimum</i>	S2?, Red		1	
brown-eyed wolf	<i>Letharia columbiana</i>	S3?, Blue		1	
finger ring	<i>Arctoparmelia incurva</i>	S2S3, Blue	1		
mountain candlewax	<i>Ahtiana sphaerosporella</i>	S2S3, Blue		1	
Peltigera lichen	<i>Peltigera conspersa</i>	undescribed	3	1	
Peltigera lichen	<i>Peltigera sp. nov blue</i>	undescribed		1	
spotted beard	<i>Usnea glabrescens</i>	S3, Blue		1	
Usnea lichen	<i>Usnea quasirigida</i>	undescribed		1	
<b>Liverworts</b>					
cut notchwort	<i>Tritomaria exsecta</i>	SNR	1		

- Notes:**
- Definitions of provincial ranks are summarized in the footnotes of Appendix B.  
Undescribed = Rank not yet assessed  
-- Identification still unconfirmed to species level, therefore, rank not assigned at this time.
  - Observations are documented as mitigable occurrences.
  - Project Components are: H-D = Hargreaves to Darfield Segment; BP-H = Black Pines to Hope Segment; and H-B = Hope to Bumaby Segment.
  - Potentially observed species. This species requires confirmation.

**TABLE 5.3-3**

**RARE PLANTS OBSERVED ON OR IN PROXIMITY TO A PROJECT FACILITY**

Common Name	Scientific Name	Provincial Designation <sup>1</sup>	Number of Times Observed by Facility
<b>Black Pines Power Line</b>			
riverbank anemone	<i>Anemone virginiana var. cylindroidea</i>	S3, Blue	1

- Note:**
- Definitions of provincial ranks are summarized in the footnotes of Appendix B.

Differences exist between the number of rare plants and lichens noted in Table 5.3-1, Table 5.3-2, and Appendix F of this report to those that are noted in Table J-1 of Appendix J of the Pipeline and Facilities EPPs (Volumes 6B and 6C). These differences are due to the ongoing confirmation of the identity of potential rare specimens collected. Due to time constraints, rare plant and lichen species requiring further confirmation were not included in the current version of the Pipeline EPP. However, all rare plants and lichens affected by Project construction will be included in future revisions of the EPP.

Confirmation on bryophyte collections is ongoing and any additional rare bryophyte species will be noted in the supplemental report.

Two *Cephaloziella* sp. were collected during vegetation surveys in BC. There are species of this genus that are rare-listed by the BC CDC. However, since the specimens could not be identified to the species level it was not possible to confirm the specimens as rare and we have not included them in our list of observed rare plant species.



### 5.3.2 Observed Plant and Lichen Species of Concern Descriptions

Detailed below are descriptions of the rare plants and lichens observed during vegetation surveys for the proposed pipeline corridor and facilities. Species nomenclature is according to the list of all elements in Alberta (ACIMS 2013b) or the BC Species and Ecosystems Explorer (BC MOE 2013), with more current taxonomic information drawn from NatureServe (2012a), when necessary. Where species were found only in one province, the nomenclature provided is based on the province where it was observed. Where species were observed in both Alberta and BC, the nomenclature and rank is provided first for Alberta followed by that of BC.

#### 5.3.2.1 Alaska Moonwort (S1S3)

Alaska moonwort (*Botrychium alaskense* W.H. Wagner and J.R. Grant) is a relatively new species of moonwort, previously only known in southern Alaska and adjacent Yukon (NatureServe 2012a). The sterile blades (trophophore) of Alaska moonwort are twice-dissected, yellow-green in colour and have a lustrous surface. The sterile blade is distinctly pinnately divided with basal pinnae only slightly larger than the second pair. The fertile blade (sporophore) is ternately divided and is triangular in shape (Farrar 2011a). Alaska moonwort can be found on at low elevations in artificially disturbed meadows, roadsides, riverbars and infrequently mowed lawns. It can also be found at higher elevations in riverine meadows, sandy fields and lightly vegetated scree slopes (Farrar 2011a). It is ranked S1S3 in BC (Appendix E, Plate 22).

#### 5.3.2.2 *Anastrophyllum* Liverwort (S2)

*Anastrophyllum helleranum* (Nees) Schust. is a tiny liverwort whose shoots grow to less than 1 mm wide. Its leaves are sharply two-lobed and less than 0.5 mm long. The gemmae (reproductive structures) are bright red or purple and sit atop tiny, upright shoots. *Anastrophyllum* liverwort typically grows on the lower half of the sides of decaying logs in woodlands (British Bryological Society 2010). *Anastrophyllum helleranum* is ranked S2 in Alberta by ACIMS (Appendix E, Plate 23). Two of the three species collected were identified from a collected specimen by a Bryologist following surveys.

#### 5.3.2.3 *Atrichum* Moss (S2)

*Atrichum* moss (*Atrichum selwynii* Aust.) is a species largely restricted to western North America. The circular and dense arrangement of its leaves makes it appear like tiny roses. It is distinguished by its characteristic leaf border of irregular teeth crowded near the leaf tips and numerous sporophytes per branch (FNA Editorial Committee 1993+). *Atrichum* moss can be found on soil, upturned tree roots, in the woods and roadside banks (Lawton 1999). *Atrichum* moss is ranked S2 in Alberta. *Atrichum selwynii* was identified from a collected specimen by a Bryologist following surveys.

#### 5.3.2.4 Bald Sedge (S2S3, Blue)

Bald sedge (*Carex tonsa* [Fern]. Bickn. var. *tonsa*) is a small (4-16 cm tall), densely tufted, almost stemless perennial herb. The stiff, flat leaves are all basal and grow 5-15 cm long and 2-4 mm wide. Flowers have reddish brown, egg-shaped, pointed scales with a green midrib, and are borne in compact, short-stalked or stalkless clusters. The dry, seed-like fruits (achenes) are enclosed in two-ribbed, short-beaked, hairless perigynia (Kershaw *et al.* 2001). Bald sedge is ranked S2S3 in BC (Appendix E, Plate 24).

#### 5.3.2.5 Birdnest Vinyl Lichen (S2?, Red)

Birdnest vinyl lichen (*Leptogium tenuissimum* [Dicks.] Körb.) is a lichen with a slate-gray to brownish thallus (0.3-2 cm broad). The lobes which grow up to 1 mm wide, divide into narrow terminal branches. Light to dark brown apothecia (reproductive structures) are common on the smooth upper surface. Birdnest vinyl often occurs among mosses on sandy soil, sandstone and bark (J. Hinds and P. Hinds 2007). It is ranked S2? in BC and is on the Red List (Appendix E, Plate 25). This species was identified by a Lichenologist following surveys. *Leptogium tenuissimum* was found occurring with *Peltigera conspersa* and *Peltigera* sp. nov. blue.

### 5.3.2.6 *Blasia Liverwort (S1)*

*Blasia* liverwort (*Blasia pusilla* L.) is a medium-sized, somewhat translucent, dark green non-leafy liverwort. It forms rosettes or mats on disturbed, damp mineral soil on banks and cliffs, especially near watercourses in both open and shaded sites (Schofield 2002). The relatively flat branches, which may be up to 5 mm wide, have regularly lobed and ruffled margins and a faint, pale midrib. Dark green to blackish internal colonies of *Nostoc* (blue-green algae) often dot the upper branch surfaces. Gemmae (vegetative structures) occur in flask-shaped receptacles that are characteristic of *Blasia pusilla*. Sporophytes are uncommon (Damsholt 2002, Paton 1999, Schofield 2002, Schuster 1996-1992). *Blasia pusilla* is ranked S1 in Alberta. This species was identified by a Bryologist following surveys.

### 5.3.2.7 *Brown-Eyed Wolf (S3?, Blue)*

Brown-eyed wolf lichen (*Letharia columbiana* [Nutt.] J. W. Thomson) is a bright yellow to chartreuse branched lichen and the branches have many ridges and pits. Dark brown apothecia (sexual reproductive structures) are fringed with spiny branchlets. Soredia and isidia (asexual reproduction structures) are absent. Brown-eyed wolf lichen occur in tufts (3-15 cm across) on conifers and wood (Brodo *et al.* 2001). It is ranked S3? in BC and is on the Blue List. This species was identified from a collected specimen by a Lichenologist following surveys.

### 5.3.2.8 *Campion Species*

One campion species (*Silene* sp.) was observed along the Black Pines to Hope Segment. This species does not resemble any species on the BC CDC rare plants candidate list. The unidentified campion species was observed on a dry south-facing granite slope. Species confirmation is ongoing.

### 5.3.2.9 *Canada Anemone (S2S3, Blue)*

Canada anemone (*Anemone canadensis*) is a perennial species that grows from rhizomes (below-ground stems) (Klinkenberg 2013). The plant is 15-80 cm tall with hairy stems and deeply palmately divided basal leaves with white flowers. Canada anemone preferentially inhabits moist meadows, thickets and forest openings. Canada anemone is ranked S2S3 in BC (Appendix E, Plate 25).

### 5.3.2.10 *Capitate Sedge (S3)*

Capitate sedge (*Carex capitata* L.) is a tufted perennial herb with wiry stems 10-30 cm tall that arises from short ascending underground stems. The flower clusters are solitary, round to egg-shaped spikes (5-10 mm long), with the uppermost spikes containing the male flowers. Female flowers located at the base of the spikes have scales that are dark brown to tan, oval to nearly round shaped, blunt, with broad, clear edges and are shorter than the perigynia. Perigynia (2-2.5 mm long) are broadly egg-shaped and abruptly contracted to a sharp edge beak (0.4-0.9 mm long). Capitate sedge inhabits wet sites, moist meadows and shrubby open woods (Kershaw *et al.* 2001). It is ranked S3 in Alberta (Appendix E, Plate 26).

### 5.3.2.11 *Cladonia Lichen (S3)*

*Cladonia humilis* is part of the *Cladonia chlorophaea* or mealy pixie-cup group of lichens (J. Hinds and P. Hinds 2007). It is a club lichen, green-grey above and white below, with stalks that are 5-2.5 cm (sometimes 4 cm) tall with terminal cups forming goblets (J. Hinds and P. Hinds 2007). Apothecia are brown and stalked or unstalked on the margins of the cups. It differs from the other members of its group in that the thallus contains bourgeanic acids and fumarprotocetraric acid (resulting in a P+ red spot test) (J. Hinds and P. Hinds 2007). It also differs from the other members of the group by usually having powdery soredia although occasionally can present with granular soredia resembling *C. chlorophaea* (J. Hinds and P. Hinds 2007). This species was identified from a collected specimen by a Lichenologist following surveys. This species is ranked S1 in Alberta.

### 5.3.2.12 *Crested Wood Fern (S2S3, Blue)*

Crested shield fern or crested wood fern (*Dryopteris cristata* [L.] Gray) is a glossy, somewhat leathery herb that grows 30-80 cm tall. In this species, some leaves persist over winter. This is the only shield fern in North America that has distinct sterile and fertile leaves. Fertile leaves are deciduous while sterile

leaves remain through winter. Fertile leaves are larger than sterile leaves and the leaflets are twisted to lie perpendicular to the stalk. Sterile leaves are spreading and shorter than fertile leaves. Spore clusters are located halfway between the midvein and the edge of the leaf and have a kidney shaped covering (Kershaw *et al.* 2001). Crested shield fern is ranked S2S3 in BC (Appendix E, Plate 27).

#### 5.3.2.13 *Cut Notchwort (Rare)*

Cut notchwort (*Tritomaria exsecta* [Schrad.] Loeske) is a leafy liverwort that is known to occur in small abundance on decorticated logs or decaying wood stumps. Leafy shoots grows to 2 mm wide, with leaves up to 1 mm wide and 1.2 mm long. Gemmae are smooth, often ellipsoidal or ovoid and may be sparse to abundant (Paton 1999). The BC CDC does not currently have published ranks for many liverworts, however, they provided preliminary liverwort ranks through personal communication (Penny pers. comm.) and this species is considered rare. This species was identified from a collected specimen by a Lichenologist following surveys.

#### 5.3.2.14 *Dragon Cladonia Lichen (S2)*

Dragon *Cladonia* lichen (*Cladonia squamosa* [Scop.] Hoffm) is a lichen with numerous stalks that are covered with small scales (squamulose) which are finely divided. The pale grayish green to brown nonsorediate stalks are short and squat or tall and slender (to 4-5 cm) (Brodo *et al.* 2001). Dragon *Cladonia* lichen is ranked S2 in Alberta. This species was identified from a collected specimen by a Lichenologist following surveys.

#### 5.3.2.15 *Droplet Notchwort (S2)*

Droplet notchwort (*Lophozia guttulata* [Lindb.] A. Evans) is a leafy, prostrate or ascending liverwort that forms thin mats on moist decaying wood. It ranges in colour from green to reddish brown. Individual plants can grow up to 8 mm long and have longer than wide, bilobed leaves. Gemmae may be sparse to numerous (Paton 1999). Droplet notchwort is ranked S2 in Alberta. This species was identified from a collected specimen by a Lichenologist following surveys.

#### 5.3.2.16 *Echo Moonwort (S1S2, Red)*

Echo moonwort (*Botrychium echo* W.H. Wagner) is one of four twice dissected moonwort species in the southern Rocky Mountains. It has pinnately branching sterile blades (trophophore) and fertile blades (sporophore). The sterile segment is bright green and shiny, is nearly sessile to short-stalked and broadly oblong (2.2 cm long). The pinnae are narrowly attached to slender rachis. The base of the pinnae is subsymmetrical and the laminar margins nearly entire. The basal pinna pair is equal to or about the same length as the adjacent pinna pair. Spores (37 µm in diameter) are irregularly and finely verrucate (W. Wagner and F. Wagner 1983). Echo moonwort occurs in mountain meadows and open woodlands at altitudes above 8,000 ft. It is often found along roadsides and in disturbed habitats (Farrar 2011b). It is ranked S1S2 in BC. This species was identified from a collected specimen by a botanist following surveys.

#### 5.3.2.17 *Finger Ring Lichen (S2S3, Blue)*

Finger ring (*Arctoparmelia incurva* [Pers.] Hale) is a foliose lichen which has a yellowish-green upper surface and tan to brown lower surface. The thallus is closely attached to the substrate, grows in a circular fashion forms concentric bands and has large (4 mm wide), round soralia (reproductive structures) growing from the tips of the interior lobes. Apothecia are rare (J. Hinds and P. Hinds 2007). Finger ring is ranked S2S3 in BC. This species was identified from a collected specimen by a Lichenologist following surveys.

#### 5.3.2.18 *Fox Sedge (S2S3, Blue)*

Fox sedge (*Carex vulpinoidea* Michx.) is a densely clumped perennial herb with stiff, three-sided stems that vary in height from 20-90 cm and are rough to the touch near the top. Generally, there are four or five 2-5 mm wide flat leaves per stem that are slender-pointed and feature red-dotted, horizontally-wrinkled sheaths. Flower clusters are dense, cylindrical, greenish to yellowish or dull brown and range in size from 3-12 mm long and 5-20 mm wide. There are often numerous, stalkless, often compound spikes,

occasionally with lower spikes somewhat separate from the main cluster. Spikes have inconspicuous male flowers at the tips and female flowers below. The lowermost bract is up to 5 cm in length and bristle-like, while the scales are yellowish-brown with a green midvein. Perigynia are straw-coloured to greenish, egg-shaped, rounded on one side and flat on the other, and tapered to a flattened beak that has a saw-toothed edge and two distinct teeth at the tip. Fox sedge grows in swamps and wet meadows, and requires non-saline, non-acidic soils that are permanently wet but have some drainage (Kershaw *et al.* 2001). Fox sedge is ranked S2S3 in BC.

#### 5.3.2.19 *Golden Saxifrage (S3?)*

Golden saxifrage (*Chrysosplenium iowense* Rydb.) is a low (up to 15 cm tall) perennial herb which branches near the top of the plants and features round to kidney-shaped leaves. Its flowers have lobed, greenish-yellow sepals and no petals, and are produced in early to mid-summer. Unlike the similar green saxifrage, golden saxifrage has central flowers that are 3-5 mm (rather than 2-3 mm) broad and the outer pair of sepals is wider than the inner pair. The capsules split to reveal numerous, light chestnut-brown, smooth seeds. Golden saxifrage inhabits moist to marshy ground in shaded areas (Kershaw *et al.* 2001, Moss 1983). It is ranked S3? in Alberta (Appendix E, Plate 28).

#### 5.3.2.20 *Goldthread (S3)*

Goldthread (*Coptis trifolia* [L.] Salisb.) is a low-growing, perennial herb with bright yellow or orange rhizomes (underground stems). It has shiny basal evergreen leaves, which are divided into three leaflets. The leaflets are wedge shaped, shallowly lobed and sharply toothed (Kershaw *et al.* 2001). Each plant has one small flower composed of five to seven white petal-like sepals and five to seven inconspicuous, fleshy, club-shaped petals that are tipped with a nectary. The small pod-like fruits are borne on long stalks, in a whorled cluster at the tip of the stem. Goldthread preferentially inhabits mesic to moist woodlands with a well-established bryophyte layer (Kershaw *et al.* 2001, Moss 1983). Goldthread is ranked S3 and is on the Watch List in Alberta (ACIMS 2013d) (Appendix E, Plate 29).

#### 5.3.2.21 *Least Moonwort (S2S3, Blue)*

Least moonwort (*Botrychium simplex* var. *compositum*) is a small fern-like perennial herb (3-25 cm tall). It has one thin, sterile blade and one fertile blade, which bears yellow spore sacs and is 3-8 times as long as the sterile blade. The sterile blade is usually divided into three segments, which are themselves divided into 2-5 pairs of segments. In this species the basal stalk below the fertile and sterile blades is short or absent. Dwarf grape-fern grows in moist meadows, wetland edges, dry fields and roadside ditches (Kershaw *et al.* 2001). It is ranked S2S3 in BC (Appendix E, Plate 30).

#### 5.3.2.22 *Linear-Leaved Pondweed (S2)*

Upright narrow-leaved pondweed (*Potamogeton strictifolius* A. Benn.) is an aquatic plant with slender, jointed stems that branch near the top of the plant. The leaves are three-veined, linear in shape, and taper to a pointed tip, and remain submersed. The fruiting bodies grow in slender spikes, arranged in three or four ring-like arrangements along the stem (Moss 1983). Upright narrow-leaved pondweed is found in standing water throughout Canada (Moss 1983). It is ranked S2 in Alberta.

#### 5.3.2.23 *Many-Headed Sedge (S3, Blue)*

Many-headed sedge (*Carex sychnocephala* Carey.) is a densely tufted perennial herb that grows to 20-60 cm in height with a dense 2-3 mm long inflorescence consisting of 4-10 spikes. Leaves are soft, broad (2-4 mm), bract-like and dilated at the base. Spikes have female flowers at the tips and male flowers below. The perigynia are lance-subulate, thin, 5-6 mm long tapering to a long slender beak (Moss 1983). Many-headed sedge is ranked S3 in BC (Appendix E, Plate 31).

#### 5.3.2.24 *Meadow Bitter Cress (S3)*

Meadow bitter cress (*Cardamine pratensis* L.) is a 10-40 cm tall perennial herb. It has leaves that are divided into many segments (leaflets). The leaves at the base of the plant are long stalked with round to lance-shaped leaflets. The leaflets of the stem leaves are distinctly stalked (Moss 1983). Meadow bitter cress has flowers with four white to pinkish or purplish petals that are 8-13 mm long. The fruit is a linear

pod that is 20-30 mm long. Meadow bitter cress is found in moist meadows, bogs and swamps. In Alberta, meadow bitter cress is ranked S3 and is on the Watch List (Appendix E, Plate 32).

#### 5.3.2.25 *Mexican Mosquito Fern (S2, Red)*

Mexican mosquito fern (*Azolla mexicana* Schlecht. & Cham. ex K. Presl) is a tiny floating aquatic fern found in wetlands and small wet areas. It is a shade-tolerant species found along the shores or in primarily still-waters of lakes, ponds, streams and other wetlands as well as in ditches. Plants are green or blue-green to dark red and forms extensive green or red mats on water surfaces. Individual plants range in size from 1-2 cm in length. Leaves are tiny and overlap like shingles. Roots are simple and short (Appendix E, Plate 33).

#### 5.3.2.26 *Michigan Moonwort (S1S3, Red)*

Michigan moonwort (*Botrychium michiganense* sp. nov. Ined. Farrar *et al.*) was once considered to be an eastern extension of western moonwort (*B. hesperium*). Michigan moonwort can be differentiated from the western moonwort by its unstalked to short-stalked (< 2 mm) sterile blades (trophophore) and its abrupt transition from the elongated and deeply dissected basal pinnae to the conspicuously smaller and barely dissected second pinnae pair. Young specimens may have more or less linear pinnae, and their basal pinnae may not be elongated and deeply dissected. Michigan moonwort has been observed in sparsely vegetated sand dunes, open canopy woodlands, open meadows and among grasses and forbs (Farrar 2011c). It is ranked S1S3 in BC (Appendix E, Plate 34).

#### 5.3.2.27 *Montane Dicranum Moss (S3, Blue)*

Montane *Dicranum* moss (*Dicranum montanum* Hedw.) is a small, densely tufted, yellowish-green to dark green moss with stems up to 2 cm in length. Its leaves, 2-4 mm long, are crisp when dry. Leaves are lanceolate, acute, concave below and tubulose above. Male plants are as large as female. Inner bracts have a pointed tip. Capsules are erect and straight to slightly inclined and yellowish-brown to brown. Montane *Dicranum* moss grows on soil or soil over rock, rotten wood, tree stumps and bases of trees in the woods (Lawton 1999). This species is ranked S3 in BC. This species was identified from a collected specimen by a Bryologist following surveys.

#### 5.3.2.28 *Moose Moonwort (S1S3, Red)*

Moose moonwort (*Botrychium tunux* Stensvold & Farrar) is a relatively new species of moonwort, previously only known in Southern Alaska and adjacent Yukon (Natureserve 2012a). The shiny, yellow-green, sterile blade has a leathery texture, is taller than or equal in length to the sporophore stalks. The fertile stalks number 4-6, are once or twice-divided and bear the spore clusters (Stensvold *et al.* 2002). Moose moonwort can be found on beach sand deposits sparsely to densely vegetated by bryophytes and herbaceous plants. It can also be found in high mountain habitats on sparsely vegetated erosional slopes and rocky stream terraces (Farrar 2011d). It is ranked S1S3 in BC (Appendix E, Plate 35).

#### 5.3.2.29 *Mountain Candlewax*

Mountain candlewax (*Ahtiana sphaerosporella* [Mull. Arg.] Goward) is a medium-sized, closely appressed, foliose lichen with 2-4 mm wide lobes. The upper surface is yellowish-green and finely wrinkled except near the margins; the lower surface is pale, bearing several holdfasts. The upper surface bears pale brownish disk-like apothecia (sexual reproductive structures) and black dotted pycnidia (asexual reproductive structures). Mountain candlewax can be found growing on conifers, especially whitebark pine in upper forested elevations (Goward *et al.* 1994). It is ranked S2S3 in BC and is on the Blue list. This species was identified from a collected specimen by a Lichenologist following surveys.

#### 5.3.2.30 *Mountain Moonwort (S1S2, Red)*

Mountain moonwort (*Botrychium montanum* W.H. Wagner) has dull, glaucous, grey-green, mostly linear, lobed to once-pinnate sterile blade that is somewhat succulent and appears in late spring to late summer. The pinnae or lobes are in six pairs that are mostly widely separated, variable in outline and feature venation like the ribs of a fan with no midrib. The blade tip is cut into 3-5 lobes and the fertile blade is

once-pinnate with pinnae that are 1.5-4.5 times the length of the sterile blade. Mountain moonwort grows in dark coniferous forests, usually near swamps and streams (FNA Editorial Committee 1993+). It is ranked S1S2 in BC.

#### 5.3.2.31 *Pacific Waterleaf (S2, Red)*

Pacific waterleaf (*Hydrophyllum tenuipes*) is a tall (20-80 cm) perennial herb that grows from a rhizome (underground stem). The leaves are mostly basal, 10-25 cm long and 6-15 cm wide and divided into 5 to 7 hairy, toothed and pointed leaflets. The inflorescence is a moderately compact cluster of funnel-shaped flowers (Klinkenberg 2013). Pacific waterleaf generally occurs in mature mixed, shaded alluvial forests and deciduous forests along trails and at forest edges. There are 15 recorded occurrences of this species in BC (BC CDC 2012b) and is ranked S2 in BC (Appendix E, Plate 36).

#### 5.3.2.32 *Pellia Species*

*Pellia* specimens were collected and sent to a Bryologist for identification, however, the samples could only be identified to the genus. As there are only three *Pellia* liverwort species found in Alberta and are all tracked by ACIMS, mitigation should be implemented for this observed occurrence. *Pellia* liverworts are found in acidic conditions by watercourses, rivers, ditches as well as other moist habitats including wet woodlands, marshes and wet outcrops (British Bryological Society 2010).

#### 5.3.2.33 *Peltigera Conspersa (Undescribed)*

A description for *Peltigera conspersa* has not yet been published (Goward pers. comm.). At the genus level, *Peltigera* lichens are foliose lichens with lobes measuring up to 40 mm wide with their upper surfaces ranging from tomentose to smooth. The underside of the thalli of *Peltigera* lichens usually possess white to black “veins”. The thallus of a *Peltigera* lichen can range from green to brown to grey. They thrive most often on soil or mossy rock as well as some tree trunks in humid habitats (Brodo *et al.* 2001). *Peltigera conspersa* occurred with *Peltigera* sp. nov blue and birdnest vinyl lichen. This species was identified from a collected specimen by a Lichenologist following surveys. *Peltigera conspersa* was collected from BC. This species was identified from a collected specimen by a Lichenologist following surveys.

#### 5.3.2.34 *Peltigera sp. Nov Blue (Undescribed)*

A description for *Peltigera sp. nov blue* has not yet been published (Goward pers. comm.). At the genus level, *Peltigera* lichens are foliose lichens with lobes measuring up to 40 mm wide with their upper surfaces ranging from tomentose to smooth. The underside of the thalli of *Peltigera* lichens usually possess white to black “veins”. The thallus of a *Peltigera* lichen can range from green to brown to grey. They thrive most often on soil or mossy rock as well as some tree trunks in humid habitats (Brodo *et al.* 2001). *Peltigera sp. nov blue* occurred with *Peltigera conspersa* and birdnest vinyl lichen. This species was identified from a collected specimen by a Lichenologist following surveys. *Peltigera sp. nov blue* was collected from BC.

#### 5.3.2.35 *Physciella Lichen (Not Listed in Alberta)*

*Physciella* lichen (*Physciella chloantha* [Ach]. Essl.) is a foliose lichens of pale to dark greenish brownish grey color. The thallus lobes are 0.3-1.5 mm wide with small lip-shaped soralia on the margins and tips of lobes with some scattered soralia on the surface. The underside is white to pale tan with unbranched holdfasts often developing into marginal cilia. Typical habitat is on hardwoods and occasionally rock (Brodo *et al.* 2001, J. Hinds and P. Hinds 2007). This species was identified from a collected specimen by a Lichenologist following surveys. This species is not listed by ACIMS, but is ranked S3 and on the Blue list in BC and is considered rare in Alberta (Goward pers. comm.).

#### 5.3.2.36 *Prairie Wedge Grass (S2)*

Prairie wedge grass (*Sphenopholis obtusata* [Michx.] Scribn.) is a slender, densely tufted, perennial grass. It grows 20-100 cm tall and has flat, 2-6 mm wide leaves that are rough on both sides. The 3-10 cm long inflorescence is dense, erect and spike-like. Prairie wedge grass inhabits moist sites, open woods and shores (Kershaw *et al.* 2001, Moss 1983). It is ranked S2 in Alberta (Appendix E, Plate 37).

### 5.3.2.37 *Racomitrium Moss (S2S3, Blue)*

*Racomitrium* moss (*Racomitrium affine* [Schleich. ex Web. & Mohr] Lindb) typically grows as loose patches on non-calcareous rocks. The shoots are between 2-4 cm long with leaves measuring between 3-4 mm long. The sporophytes of this species typically bear capsules that are over 2 mm long with hair points. *R. affine* is differentiated from *R. heterostichum* by the short hair points and leaves that are unidirectional (British Bryological Society 2010). This species is ranked S2S3 and on the Blue list in BC. This species was identified from a collected specimen by a Bryologist following surveys.

### 5.3.2.38 *Riccardia Liverwort (S2)*

*Riccardia latifrons* (Lindb.) is a pale to dark green non-leafy liverwort that forms prostrate mats on decaying logs and stumps. It typically occurs in moist, shaded areas such as ravines, alongside streams, or in swamps (Damsholt 2002, Schuster 1966-1992). The relatively flat branches are 0.5-1.0 mm wide and up to 15 mm long. The branches are more or less forked or one to two times pinnate (arranged like barbs on a feather) or palmate (arranged like fingers on a hand). In cross-section, the branches are obscurely biconvex to lenticular, and the outer margins are one cell thick and 1-2 cells wide (Damsholt 2002, Paton 1999, Schuster 1966-1992). *Riccardia latifrons* is ranked S2 in Alberta (Appendix E, Plate 23).

### 5.3.2.39 *Riverbank Anemone (S3, Blue)*

Riverbank anemone (*Anemone virginiana* var. *cylindroidea* Boivin) is a 30-100 cm tall perennial herb that occurs in gravel bars, streambanks and forests. The soft, hairy, basal leaves are divided into three segments which are coarsely toothed and lobed. Riverbank anemone also has several leaf-like floral bracts (involucral bracts) with the lower set of bracts often resembling the basal leaves. The flowers are borne on long stalks and have five white to greenish petal-like sepals. The fruits are small achenes with long woolly hairs (not feathery). Long stalked involucral bracts, the presence of a secondary involucre and the type and position of teeth along the leaf margin distinguish riverbank anemone from other similar species (Douglas *et al.* 1998-2002). Riverbank anemone is ranked S3 in BC (Appendix E, Plate 38).

### 5.3.2.40 *Rush Species*

One rush species (*Juncus* sp.) was observed along the Edson to Hinton Segment. This species does not resemble any species on the ACIMS rare plants candidate list. The unidentified rush species was observed to have 4 capsules per head and the seeds were spindled at both ends. The perigynia and capsules were similar in length (3.8-4.0 mm long). The capsules appeared to be 3-chambered. The species was growing on a wet and possibly disturbed habitat.

### 5.3.2.41 *Sarmenthyllum Moss (S2)*

*Sarmenthyllum* moss (*Sarmenthyllum sarmentosum* [Wahlenb.] Tuom. & T. Kop.) is a large moss with a rich purple-red colour. Main branches can extend up to 10 cm or more long and side branches are irregular, often relatively short and abruptly pointed (British Bryological Society 2010). Leaves are 2-2.5 mm long, oblong to egg-shaped with a short abrupt point (British Bryological Society 2010). The leaf midrib extends to the upper part of the leaf. *Sarmenthyllum* moss occurs in mineral-rich springs and on wet, gravelly ground (British Bryological Society 2010). *Sarmenthyllum* moss is ranked S2 in Alberta. This species was identified from a collected specimen by a Bryologist following surveys.

### 5.3.2.42 *Saxifrage Species/Golden Saxifrage Species*

There are two species of saxifrage known to occur in Alberta, green saxifrage (*Chrysosplenium tetrandrum* [Lund] T. Fries) and golden saxifrage (*Chrysosplenium iowense* Rydb.). Both species are small perennial herbs (less than 20 cm tall) that grow in moist shady areas. Both species have round to kidney-shaped leaves, branches below the middle of the plants and flowers that have lobed sepals, and no petals. These species flower early in the year and are distinguished by the number of stamens and slight differences in the dimensions of their sepals. Later in the year, when many of the floral parts have withered, these species cannot always be reliably differentiated. Both species occur throughout the boreal and mountain/foothills. Green saxifrage is ranked S3S4 and is not tracked (*i.e.*, not considered rare) golden saxifrage is ranked S3? and is on the tracking list. Due to a globally rare ranking (G3?), ACIMS

placed this species on its tracking list in 2006 in order to compile data and confirm that it is not rare in Alberta (Kemper pers. comm.). Similarly, there are three species of golden saxifrage known to occur in BC. They include the northern golden-saxifrage (*Chrysosplenium tetrandrum* [Lund] T. Fries) and Iowa golden-saxifrage (*Chrysosplenium iowense* Rydb.) described above and ranked S5 and S1 respectively in BC. The third species is Wright's golden-saxifrage (*Chrysosplenium wrightii* [Franch. & Savigny]) which is ranked S1S3 in BC (BC MOE 2013).

#### 5.3.2.43 *Scalloped Grape Fern (S1)/Dainty Moonwort (S2S3, Blue)*

Dainty moonwort (*Botrychium crenulatum* W.H. Wagner) is a small fleshy perennial herb that grows in wet areas in the mountains. It has a thin yellow-greenish sterile blade that has up to five pairs of spreading, well-separated segments (Kershaw *et al.* 2001). Its fertile blade is once or twice-divided, appears in mid to late spring and dies in late summer. Dainty moonwort is ranked S1 in Alberta and S2S3 in BC (Appendix E, Plate 39).

#### 5.3.2.44 *Schistidium Moss (Not Listed in Alberta)*

*Schistidium moss (Schistidium confertum* [Funck] Bruch & Schimper) is a small, densely compact moss forming cushions up to 1.5 cm tall. The lower leaves are typically 1.75-2 mm long while those at the tips near the capsules are typically 2.5 mm long. The capsules are sheathed by long narrow leaves and are short in comparison to other species; the capsule teeth are orange (British Bryological Society 2010). This species was identified from a collected specimen by a Bryologist following surveys. This species is not listed by ACIMS, but is ranked S1 and on the Red list in BC and is considered rare in Alberta (McIntosh pers. comm.).

#### 5.3.2.45 *Short-Tail Rush (S2)*

Short-tail rush (*Juncus brevicaudatus* Engelm.) is a densely tufted perennial herb that grows 10-50 cm (sometimes up to 70 cm) tall with 2 to 4 leaf blades that are slender and cylindrical. The flower cluster is narrow, branched, 3-12 cm long, and has a few to many, 2 to 7 flowered heads with that are greenish to light brown. Short-tail rush is found on shores and in marshes (Kershaw *et al.* 2001, Moss 1983). It is ranked S2 in Alberta (Appendix E, Plate 40).

#### 5.3.2.46 *Silvery Sedge (SU)*

Silvery sedge (*Carex canescens ssp. disjuncta*) is a perennial herb growing from fibrous roots. It stands 20-60 cm tall and has a rough, sharply triangular stem. Silvery sedge has 5 to 10 spikes in a 3-5 cm long inflorescence with both female and male flowers, with female flowers towards the tip (Klinkenberg 2013). Silvery sedge is ranked SU in BC (Appendix E, Plate 41).

#### 5.3.2.47 *Slender Naiad (S2)*

Slender naiad (*Najas flexilis* (Willd.) Rostk. & Schmidt) is a delicate, stalkless annual aquatic plant with tiny flowers and stems which have many alternate branches. Leaves are 1-3 cm long and crowded at stem tips in sub-opposite pairs with enlarged, clasping bases and slender, tapered tips. Flowers are solitary, occur at the axils of the lower pair of leaves and pollinates underwater. Slender naiad is found on ponds and streams (Kershaw *et al.* 2001). It is ranked S2 in Alberta (Appendix E, Plate 42).

#### 5.3.2.48 *Slender Spike Rush (S1, Red)*

Slender spike-rush (*Eleocharis nitida*) is a medium-sized (2-15 cm) grass-like perennial with reddish to purplish black rhizomes. The leaves are reduced to bladeless sheaths and are reddish purple at the base. Clusters of reduced scale-like flowers are found at the tips of the stem. The flower clusters (spikelets) are oval to egg shaped and are 5-12 mm long. The fruits (achene) are wrinkled or roughened and lack honeycombed ridges (Kershaw *et al.* 2001). Slender spike-rush is found in moist environments such as wet soil and shallow water, as well as peaty or sandy places (Coffin and Pfannmuller 1988). Slender spike-rush is S1 in BC (Appendix E, Plate 43).



#### 5.3.2.49 *Snakeskin Liverwort (S2)*

Snakeskin liverwort (*Conocephalum salebrosum* Szweykowski, Buczkowska & Odrzykoski) is a large (up to 12 mm wide and 20 cm long), leathery, bright green, irregularly branched, thalloid liverwort. The upper surface of the thallus has 4-5 rows of deeply grooved hexagonal air chambers between the midrib and the thallus margin, each with a conspicuous white-ringed pore. The translucent margins of the thallus consist of 1-2 elongated cells (Szweykowski *et al.* 2005). Male receptacles are wine-purple pigmented and occur in late fall to early spring; female receptacles are conic and appear in early spring. Snakeskin liverwort forms extensive mats on damp banks and shady rocks near watercourses, on wet cliffs and in wet depressions in open areas in woodlands (Schofield 2002, Schuster 1966-1992). North American material of this species was formerly known as *Conocephalum conicum*, which is now known only from Europe. *Conocephalum salebrosum* was described as a new species in 2005 and is found throughout much of the northern hemisphere (Szweykowski *et al.* 2005). In Alberta, this liverwort is ranked S2 (Appendix E, Plate 44).

#### 5.3.2.50 *Spatulate Grape Fern (S2)/Spoon-Shaped Moonwort (S1, Red)*

Spatulate grape fern/Spoon-shaped moonwort (*Botrychium spathulatum* W.H. Wagner) is a small, fleshy, perennial herb. The shiny, yellow-green, nearly stalkless sterile blade has a leathery texture, is triangular in outline and is divided into as many as eight widely-spaced pairs of segments. The fertile blade is once or twice-divided and bears the spore clusters. Spatulate grape fern inhabits fields and grassy openings in the mountains (Kershaw *et al.* 2001). It is ranked S2 in Alberta and S1 in BC (Appendix E, Plate 45).

#### 5.3.2.51 *Spotted Beard (S3, Blue)*

Spotted beard (*Usnea glabrescens* [Nyl. ex Vain.] Vain.) is a shrubby, filamentous yellowish-green lichen. Its branches are round or angular in cross section and contain a central cartilaginous cord. The thallus forms short shrubby tufts with a black base and the branching is often dichotomous. It grows on the branches and twigs of deciduous trees and conifers (Brodo *et al.* 2001). Spotted beard lichen is ranked S3 and on the Blue list in BC. This species was identified from a collected specimen by a Lichenologist following surveys.

#### 5.3.2.52 *Stalked Moonwort (S1, Red)*

Stalked moonwort (*Botrychium pedunculosum* W.H. Wagner) is a small, fleshy, perennial herb. The fertile blade is once or twice-divided and bears the spore clusters. It typically inhabits moist to wet meadows and margins of willow thickets (Klinkenberg 2013). Stalked grape fern is ranked S1 in Alberta and ranked S2 in BC (Appendix E, Plate 46).

#### 5.3.2.53 *Syntrichia Moss (S3?, Blue)*

*Syntrichia* moss (*Syntrichia caninervis* Mitten) is a dioecious (separate male and female plants), blackish or olive green moss that grows in tufts. Stems can range from 3-2 mm tall. Its leaves are infolded and imbricate, somewhat twisted around the stem when dry and spread out when moist. Sporophyte stalks are 6-15 mm long and brownish, bearing red capsules that are 2.5-3.2 mm long. *Syntrichia* moss occurs on granite and calcareous rocks (Teresa Gallego *et al.* 2002) and is more common in the colder deserts and steppes of southern North America (FNA Editorial Committee 2007). It is ranked S3? and currently on the Blue list in BC. This species was identified from a collected specimen by a Bryologist following surveys. This species is not considered rare or requiring mitigation and was recently recommended for a down-listing from the Blue to the Yellow list (McIntosh pers. comm.).

#### 5.3.2.54 *Tall Blue Lettuce (S2)*

Tall blue lettuce (*Lactuca biennis* [Moench] Fern.) is a robust, annual or biennial herb that grows 5-20 cm tall. Its 1-4 cm long leaves are arranged alternately along the unbranched stem. Leaves are deeply pinnately lobed, sharply toothed and generally hairless. The bluish-white, 5 mm wide flowers are borne in large, narrow, branched clusters. Tall blue lettuce inhabits moist open woods (Kershaw *et al.* 2001, Moss 1983). It is ranked S2 in Alberta (Appendix E, Plate 47).

### 5.3.2.55 *Tender Sedge (S2S3, Blue)*

Tender (or broad-fruited [Alberta]) sedge (*Carex tenera* Dewey) is a perennial herb that grows in bunches from a very short rootstalk. Stems are slender, erect and often nodding. Flower clusters are comprised of 3 to 8 straw-coloured, ovoid-shaped spikes in a long, loose inflorescence. Tender sedge inhabits moist meadows and open woodlands (Moss 1983). It is ranked S3 in Alberta and S2S3 in BC (Appendix E, Plate 48).

### 5.3.2.56 *Upswept Moonwort (S2, Red)*

Upswept moonwort (*Botrychium ascendens* W.H. Wagner) grows 5-15 cm tall. It has a bright yellow-green leafy, sterile blade with up to five pairs of well-separated leaf lobes with toothed margins. The fertile blade is equal to twice the height of the leafy blade. This species occurs in grassy fields, roadside clearings and wetland meadows from low elevation to the subalpine (Kershaw *et al.* 2001, Williston 2001). Unswept moonwort is ranked S2 in BC (Appendix E, Plate 49).

### 5.3.2.57 *Usnea Quasirigida (Undescribed)*

A description for *Usnea quasirigida* has not yet been published (Goward pers. comm.). At the genus level, *Usnea* lichens are finely branched, are pendent (occur hanging down, usually from tree branches) and are yellowish-green due to the presence of usnic acid. The branches of all *Usnea* lichens have a cartilaginous cord of supporting tissue running through its centre. Often, species of this genus have prominent soredia, frequently with visible isidia. Common habitat is on trees or shrubs but species of this genus have occasionally been observed growing on rocks (Brodo *et al.* 2001). This species was identified from a collected specimen by a Lichenologist following surveys. *Usnea quasirigida* was collected from BC.

### 5.3.2.58 *Western Moonwort (S2S3, Blue)*

Western grape fern (*Botrychium hesperium* [Maxon & Clausen] W.H. Wagner & Lellinger) is a small perennial herb that grows 10-20 cm tall and has an oblong-linear to triangular sterile blade which has up to 6 pairs of ascending crowded segments. This plant appears in early spring and dies in early fall (Kershaw *et al.* 2001). Western grape fern is ranked SU in Alberta (Appendix E, Plate 50).

### 5.3.2.59 *Western Oak Fern (S1)*

Western oak fern (*Gymnocarpium disjunctum* [Ruprecht.] Ching.) is a delicate annual herb that grows 5-50 cm tall. Leaves are 2-3 times pinnately divided. Leaf blades are triangular, glandular-hairy and are 8-24 cm long. Smallest leaflets are pointed instead of blunt-tipped. Spore clusters set in slightly from the edge are round without protective membranes. Western oak fern grows in acidic to neutral rock crevices and slopes, on cliffs and in moistwoods (Kershaw *et al.* 2001). Western oak fern is ranked S1 in Alberta (Appendix E, Plate 51).

### 5.3.2.60 *Whip Fork Moss (S3, Blue)*

Whip fork moss (*Dicranum flagellare* Hedw.) is small, densely tufted, yellowish-green to dark green moss with stems up to 4 cm in length. Its leaves, 3-5 mm long, are crisp when dry. Leaves are lanceolate, acute, concave below and tubulose above. Male plants are as large as female plants. Inner bracts have an acuminate apex. Capsules are erect and straight to slightly inclined, yellowish-brown to brown. Whip fork moss grows on rotten wood or bases of trees in forests, on peaty stream banks, or hummocks in swamps. It can be recognised by the crisped leaves and long, thin, tapering branchlets (Lawton 1999). Whip fork moss is ranked S3 and on the Blue list in BC. This species was identified from a collected specimen by a Bryologist following surveys.

### 5.3.2.61 *White Wintergreen (S2S3, Blue)*

White wintergreen (*Pyrola elliptica*) is a perennial herb that grows from a rhizome (underground stems) and stands 15-25 cm tall. White wintergreen has egg-shaped, leathery evergreen basal leaves that are 3.5-7 cm long (FNA Editorial Committee 1993+). The flowers are white or creamy, rarely pink-tinged with curved styles that are 5-7 mm long. White wintergreen grows in dry to moist forests. It is S2S3 in BC (Appendix E, Plate 52).

### **5.3.3      *Edmonton to Hinton Segment***

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

A total of 53 ACIMS-listed rare plant and lichen species were identified along the proposed pipeline corridor. The observed ACIMS-listed rare species include 34 vascular plants, 3 mosses, 13 liverworts and 3 lichen species (Appendix A Figure 2; Appendix E; Appendix F). A summary of these rare plants and lichens is provided in Table 5.3-1.

### **5.3.4      *Hargreaves to Darfield Segment***

One COSEWIC and SARA-listed species, Mexican mosquito-fern, was potentially observed along the Hargreaves to Darfield Segment during the vegetation surveys. This species is currently listed as Threatened under both COSEWIC and SARA. A survey will be conducted to confirm this identification. No species designated under the BC IWMS were observed during the vegetation surveys.

A total of 107 BC CDC-listed rare plant and lichen species were identified along the proposed pipeline corridor. The observed BC CDC-listed rare species include 96 vascular plants, 6 mosses, 1 liverwort and 4 lichen species (Appendix A Figure 2; Appendix E; Appendix F). A summary of these rare plants and lichens is provided in Table 5.3-2.

### **5.3.5      *Black Pines to Hope Segment***

No COSEWIC or SARA-listed species were observed along the Black Pines to Hope Segment during the vegetation surveys. No species designated under the BC IWMS were observed during the vegetation surveys.

A total of 13 BC CDC-listed rare plant and lichen species were identified along the proposed pipeline corridor. The observed BC CDC-listed rare species include 4 vascular plants, 2 mosses and 7 lichen species (Appendix A Figure 2; Appendix E; Appendix F). A summary of these rare plants and lichens is provided in Table 5.3-2.

### **5.3.6      *Hope to Burnaby Segment***

No COSEWIC or SARA-listed species were observed along the Hope to Burnaby Segment during the vegetation surveys. No species designated under the BC IWMS were observed during the vegetation surveys.

One BC CDC-listed rare plant, Pacific waterleaf, was observed three times during the vegetation surveys (Appendix A Figure 2; Appendix E; Appendix F). One occurrence was observed approximately 200 m southwest of the Sumas Terminal

### **5.3.7      *Burnaby to Westridge Segment***

Due to lack of land access in 2013, vegetation surveys were not conducted on the Burnaby to Westridge Segment. Vegetation surveys on this segment are planned in 2014.

### **5.3.8      *Gainford Pump Station***

No COSEWIC or SARA-listed species were observed at the Gainford Pump Station during the vegetation surveys. No ACIMS-listed rare plant or lichen species were observed during the surveys.

### **5.3.9      *Hinton Pump Station***

No COSEWIC or SARA-listed species were observed at the Hinton Pump Station during the vegetation surveys. No ACIMS-listed rare plant or lichen species were observed during the surveys.

### **5.3.10 Rearguard Pump Station**

The Footprint for the Rearguard Pump Station was not available during 2013 surveys. Vegetation surveys at this location are planned for 2014.

### **5.3.11 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 and no BC CDC-listed species were observed during the pump station vegetation surveys.

One BC CDC-listed rare plant, riverbank anemone, was observed during the vegetation surveys conducted along the Black Pines power line on the west side of the North Thompson River (Appendix A Figure 2; Appendix E; Appendix F).

Due to land access restrictions the power line on the east side of the North Thompson River was not surveyed in 2013. Surveys are planned on the east side power line in 2014.

### **5.3.12 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 and no BC CDC-listed species were observed at the Kingsvale Pump Station.

Due to land access restrictions the power line was not surveyed in 2013. Surveys are planned for the power line in 2014.

### **5.3.13 Sumas Terminal**

The Sumas Terminal Footprint was not available during 2013 surveys. Surveys at the terminal are planned in 2014.

## **5.4 Provincial Weed Species and Other Invasive Non-Native Species of Concern**

A list of all species observed at the time of survey, including weeds, is provided in Appendix D. Where Alberta and BC *Weed Control Act* nomenclature differs from the ACIMS list of all elements (ACIMS 2013b) or the BC Species and Ecosystems Explorer (BC MOE 2013), the *Weed Control Act* name for the species has been provided in brackets following the BC CDC name. Listed and non-listed weed species identified during consultation and observed during vegetation surveys are presented below.

As of November 2013, no response has been received from TNRD, FVRD and GVRD regarding weeds of concern. Representatives from the Jasper Pump Station area have not yet been consulted, however, consultation will be conducted prior to initiating weed surveys.

### **5.4.1 Clubroot**

No visible symptoms of clubroot infestation were noted at the areas where vegetation surveys were conducted in 2013, although clubroot sampling was not an objective of the vegetation survey. Known clubroot occurrences are provided in Table C2.1-1 in Appendix C of the Pipeline EPP (Volume 6B).

### **5.4.2 Edmonton to Hinton Segment**

Weed species of low to high abundance were observed along the proposed pipeline corridor. Prohibited Noxious, Noxious and non-listed weed species identified during stakeholder consultation and vegetation surveys for the Edmonton to Hinton Segment are provided in Table 5.4.2-1.

TABLE 5.4.2-1

**PROHIBITED NOXIOUS, NOXIOUS AND NON-LISTED  
WEED SPECIES IDENTIFIED DURING STAKEHOLDER  
CONSULTATION AND VEGETATION SURVEYS FOR THE EDMONTON TO HINTON SEGMENT**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
absinthe wormwood	<i>Artemisia absinthium</i>	--	--	Yes	Pasture.
alfalfa	<i>Medicago sativa</i>	--	--	Yes	Cultivation, roadsides, fencelines and waste areas.
alsike clover	<i>Trifolium hybridum</i>	--	--	Yes	Lawns, waste areas and abandoned fields.
annual bluegrass	<i>Poa annua</i>	--	--	Yes	Lawns, golf courses and waste areas.
annual hawk's-beard	<i>Crepis tectorum</i>	--	Yes	Yes	Forage crops, pastures, roadsides and waste areas.
awnless brome	<i>Bromus inermis</i>	--	--	Yes	Cultivation and pasture.
bighead knapweed	<i>Centaurea macrocephala</i>	Prohibited Noxious	Yes	--	Garden escape in meadows and grassy clearings.
bird's-foot trefoil	<i>Lotus corniculatus</i>	--	--	Yes	Moist to dry roadsides, waste places, pastures and lawns.
black medick	<i>Medicago lupulina</i>	--	--	Yes	Lawns, gardens, roadsides and pastures.
bull thistle	<i>Cirsium vulgare</i>	--	--	Yes	Mesic to dry roadsides, fields, pastures and disturbed areas.
Canada (creeping) thistle	<i>Cirsium arvense</i>	Noxious	Yes	Yes	Cultivation.
caraway	<i>Carum carvi</i>	--	--	Yes	Fields and waste places.
cicer milk vetch	<i>Astragalus cicer</i>	--	--	Yes	Mesic to dry roadsides.
cleavers	<i>Galium aparine</i>	--	--	Yes	Cultivation, gardens and roadsides.
common burdock	<i>Arctium minus</i>	Noxious	Yes	--	Fencelines, river banks and waste areas.
common chickweed	<i>Stellaria media</i>	--	Yes	Yes	Moist to mesic waste places, fields and gardens.
common dandelion	<i>Taraxacum officinale</i>	--	Yes	Yes	Lawns and pasture.
common goat's-beard	<i>Tragopogon dubius</i>	--	--	Yes	Cultivation, roadsides and waste areas.
common groundsel	<i>Senecio vulgaris</i>	--	Yes	--	Cultivation.
common knotweed	<i>Polygonum arenastrum</i>	--	--	Yes	Waste areas and cultivation.
common mouse-ear chickweed	<i>Cerastium vulgatum</i>	--	--	Yes	Pasture.
common mullein	<i>Verbascum thapsus</i>	Noxious	Yes	--	Pasture.
common plantain	<i>Plantago major</i>	--	Yes	Yes	Cultivation, lawns, roadsides and waste areas.
common tansy	<i>Tanacetum vulgare</i>	Noxious	Yes	Yes	Pasture.
corn spurry	<i>Spergula arvensis</i>	--	--	Yes	Cultivation.
creeping bellflower	<i>Campanula rapunculoides</i>	Noxious	Yes	--	Gardens, fencelines and cultivation.
creeping wild rye	<i>Elytrigia repens</i>	--	--	Yes	Cultivation.
crested wheatgrass	<i>Agropyron cristatum</i>	--	--	Yes	Dry to mesic roadsides, fields and waste places.
dame's rocket	<i>Hesperis matronalis</i>	Noxious	Yes	--	Ditches, fencelines and orchards.
dog mustard	<i>Erucastrum gallicum</i>	--	--	Yes	Cultivation, orchards, railways, roadsides and disturbed ground.
field scabious	<i>Knautia arvensis</i>	Noxious	Yes	--	Pasture.
flattened spike-rush	<i>Eleocharis compressa</i> var. <i>borealis</i>	--	--	Yes	Lakeshores, streamsides and wet meadows.
flixweed	<i>Descurainia sophia</i>	--	Yes	--	Cultivation.
foxtail barley	<i>Hordeum jubatum</i>	--	Yes	--	Pasture.
Galinsoga species	<i>Galinsoga</i> sp.	--	--	Yes	Various habitats.
garlic mustard	<i>Alliaria petiolata</i>	Prohibited Noxious	Yes	--	Mesic to dry disturbed sites and waste places.

TABLE 5.4.2-1 Cont'd

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
giant hogweed	<i>Heracleum mantegazzianum</i>	Prohibited Noxious	Yes	--	Habitat wet to moist disturbed areas.
green foxtail	<i>Setaria viridis</i>	--	Yes	--	Cultivation, gardens and roadsides.
hare's-ear mustard	<i>Conringia orientalis</i>	--	--	Yes	Mesic to dry roadsides, fields and waste places.
hemp nettle	<i>Galeopsis tetrahit</i>	--	Yes	Yes	Cultivation, pasture, roadsides and waster areas.
henbit	<i>Lamium amplexicaule</i>	--	Yes	--	Row crops and gardens.
himalayan balsam	<i>Impatiens glandulifera</i>	Prohibited Noxious	Yes	--	Riparian.
lady's-thumb	<i>Polygonum persicaria</i>	--	--	Yes	Mesic to dry roadsides, ditches, fields and waste places.
lamb's quarters	<i>Chenopodium album</i>	--	Yes	Yes	Cultivation.
leafy spurge	<i>Euphorbia esula</i>	Noxious	Yes	Yes	Pastures, rangeland and roadsides.
low cudweed	<i>Gnaphalium uliginosum</i>	--	--	Yes	Cultivation, roadside ditches and the banks of irrigation canals.
matrimony vine	<i>Lycium halimifolium</i>	--	--	Yes	Dry waste places and roadsides.
mayweed species	<i>Anthemis</i> sp.	--	--	Yes	Various habitats.
meadow hawkweed	<i>Hieracium caespitosum</i>	Prohibited Noxious	Yes	Yes	Mesic to dry roadsides, disturbed areas and waste places.
orange hawkweed	<i>Hieracium aurantiacum</i>	Prohibited Noxious	Yes	Yes	Lawns. pastures and roadsides.
orchard grass	<i>Dactylis glomerata</i>	--	--	Yes	Mesic meadows, pastures, roadsides and disturbed sites.
ox-eye daisy	<i>Chrysanthemum leucanthemum</i>	Noxious	Yes	Yes	Pasture.
perennial sow thistle	<i>Sonchus arvensis</i>	Noxious	Yes	Yes	Cultivation.
pineappleweed	<i>Matricaria matricarioides</i>	--	--	Yes	Farmyards, waste areas and roadsides.
prickly annual sow-thistle	<i>Sonchus asper</i>	--	--	Yes	Cultivation, gardens and roadsides.
prickly lettuce	<i>Lactuca serriola</i>	--	--	Yes	Dry roadsides, fields and waste places.
purple loosestrife	<i>Lythrum salicaria</i>	Prohibited Noxious	Yes	--	Wetlands, canals and rivers.
rape species	<i>Brassica</i> sp.	--	--	Yes	Various habitats.
red clover	<i>Trifolium pratense</i>	--	--	Yes	Lawns, waste areas and abandoned fields.
redtop	<i>Agrostis stolonifera</i>	--	--	Yes	Mesic to wet lawns, fields, ditches, pond margins, lakeshores and salt marshes.
red-root pigweed	<i>Amaranthus retroflexus</i>	--	Yes	--	Cultivation.
rough cinquefoil	<i>Potentilla norvegica</i>	--	--	Yes	Pastures, roadsides, gardens and row crops.
rough-fruited cinquefoil	<i>Potentilla recta</i>	Prohibited Noxious	--	Yes	Dry to moist, disturbed open ground, waste places, roadsides, pastures and overgrazed grasslands.
Russian-thistle	<i>Salsola kali</i>	--	Yes	Yes	Roadsides, railways and dry open areas.
sainfoin	<i>Onobrychis viciifolia</i>	--	--	Yes	Mesic to dry fields, clearings, roadsides and waste places.
scentless chamomile	<i>Matricaria perforata</i>	Noxious	Yes	Yes	Cultivation and pasture.
shepherd's purse	<i>Capsella bursa-pastoris</i>	--	Yes	Yes	Cultivation, row crops, gardens, and waste areas.
Siberian wheatgrass	<i>Agropyron fragile</i>	--	--	Yes	Dry roadsides, fields and waste places.
Sierra hare sedge	<i>Carex leporinella</i>	--	--	Yes	Moist meadows.
silvery cinquefoil	<i>Potentilla argentea</i>	--	--	Yes	Dry open ground and waste places.

**TABLE 5.4.2-1 Cont'd**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
smooth perennial sow-thistle	<i>Sonchus uliginosus</i>	--	--	Yes	Mesic to dry ditches, roadsides, disturbed areas and gardens.
stinkweed	<i>Thlaspi arvense</i>	--	Yes	Yes	Cultivation, row crops, gardens and waste areas.
summer-cypress	<i>Kochia scoparia</i>	--	Yes	Yes	Cultivation.
tall buttercup	<i>Ranunculus acris</i>	Noxious	Yes	Yes	Pastures.
timothy	<i>Phleum pratense</i>	--	--	Yes	Mesic fields, roadsides, waste areas and disturbed sites.
tufted vetch	<i>Vicia cracca</i>	--	--	Yes	Mesic fields, clearings, thickets and open forests.
tumbling mustard	<i>Sisymbrium altissimum</i>	--	--	Yes	Mesic to dry fields and waste places.
white clover	<i>Trifolium repens</i>	--	--	Yes	Mesic to dry roadsides, fields, lawns, meadows and waste places.
white cockle (bladder campion)	<i>Silene pratensis</i>	Noxious	Yes	Yes	Cultivation and pasture.
white sweet-clover	<i>Melilotus alba</i>	--	--	Yes	Roadsides and waste areas.
wild buckwheat	<i>Polygonum convolvulus</i>	--	--	Yes	Cultivation.
wild oat	<i>Avena fatua</i>	--	--	Yes	Cultivation.
yellow toadflax (common toadflax)	<i>Linaria vulgaris</i>	Noxious	Yes	Yes	Cultivation and pasture.
yellow clover	<i>Trifolium aureum</i>	--	--	Yes	Mesic to dry roadsides, fields and waste places.
yellow sweet-clover	<i>Melilotus officinalis</i>	--	--	Yes	Roadsides and waste areas.

**Note:** - Species nomenclature is determined according to the list of all elements in Alberta (ACIMS 2013b), with more current taxonomic information drawn from NatureServe (2012a), when necessary. Where the Alberta *Weed Control Act* nomenclature differs from these sources, the *Weed Control Act* name for the species has been provided in brackets following the ACIMS name.

### 5.4.3 Hargreaves to Darfield Segment

Weed species of low to high abundance were observed along the proposed pipeline corridor. Noxious and non-listed weed species identified during stakeholder consultation and vegetation surveys for the Hargreaves to Darfield Segment are provided in Table 5.4.3-1.

TABLE 5.4.3-1

NOXIOUS AND NON-LISTED WEED SPECIES IDENTIFIED DURING STAKEHOLDER CONSULTATION AND VEGETATION SURVEYS FOR THE HARGREAVES TO DARFIELD SEGMENT

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
alfalfa	<i>Medicago sativa ssp. falcata</i>	--	--	Yes	Cultivation, roadsides, fencelines and waste areas.
alsike clover	<i>Trifolium hybridum</i>	--	--	Yes	Lawns, waste areas and abandoned fields.
annual bluegrass	<i>Poa annua</i>	--	--	Yes	Lawns, golf courses and waste areas.
annual hawksbeard	<i>Crepis tectorum</i>	Aggressive or Under Biocontrol (NWIPC)	--	Yes	Forage crops, pastures, roadsides and waste areas.
annual knawel	<i>Scleranthus annuus</i>	--	--	Yes	Roadsides, fields and waste areas.
birds-foot trefoil	<i>Lotus corniculatus</i>	--	--	Yes	Moist to dry roadsides, waste areas, pastures and lawns.
black bindweed	<i>Fallopia convolvulus</i>	--	--	Yes	Moist to mesic waste areas and fields.
black medic	<i>Medicago lupulina</i>	Aggressive or Under Biocontrol (NWIPC)	--	Yes	Lawns, gardens, roadsides and pastures.
bladder campion	<i>Silene vulgaris</i>	--	--	Yes	Cultivation and pasture.
blue forget-me-not	<i>Myosotis stricta</i>	--	--	Yes	Mesic to dry meadows, ditches and disturbed areas.
blue water speedwell	<i>Veronica anagallis-aquatica</i>	--	--	Yes	Wet meadows, ditches, edges of streams and lakes and shallow water.
blunt broom sedge	<i>Carex tribuloides</i>	--	--	Yes	Moist to wet sites.
box-elder	<i>Acer negundo</i>	--	--	Yes	Mesic to dry sites.
bristly stickseed	<i>Lappula squarrosa</i>	Aggressive or Under Biocontrol (NWIPC)	--	Yes	Dry to mesic grasslands, shrublands, forest openings and disturbed areas.
bull thistle	<i>Cirsium vulgare</i>	Prescribed Invasive Species (FRPA) Category 4 Invasive (TNRD) Invasive (NWIPC)	--	Yes	Mesic to dry roadsides, fields, pastures and disturbed areas.
butter-and-eggs	<i>Linaria vulgaris</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Category 3 Invasive (TNRD) Invasive (NWIPC)	--	Yes	Cultivation and pasture.
Canada bluegrass	<i>Poa compressa</i>	--	--	Yes	Dry to moist areas, roadsides and meadows.
Canada thistle	<i>Cirsium arvense</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD) Very Invasive (NWIPC)	Yes	Yes	Cultivation.
Canadian goldenrod	<i>Solidago canadensis</i>	--	--	Yes	Moist to mesic meadows, grasslands, shrublands, ditches, cultivation, roadsides and forest openings.
Canadian wild lettuce	<i>Lactuca canadensis</i>	--	--	Yes	Mesic to dry roadsides, fields and waste areas.
catnip	<i>Nepeta cataria</i>	--	--	Yes	Mesic to dry waste areas.
cheatgrass	<i>Bromus tectorum</i>	--	--	Yes	Dry to mesic roadsides, disturbed sites, waste areas, meadows, grasslands and shrublands.
chicory	<i>Cichorium intybus</i>	Very Invasive (NWIPC)	--	Yes	Mesic to dry roadsides and waste areas.
cleavers	<i>Galium aparine</i>	--	--	Yes	Cultivation, gardens and roadsides.
colonial bentgrass	<i>Agrostis capillaris</i>	--	--	Yes	Mesic to dry lawns, fields, roadsides and meadows.
common burdock	<i>Arctium minus</i>	Regional Noxious Prescribed Invasive Species (FRPA) Category 3 Invasive (TNRD) Very Invasive (NWIPC)	--	Yes	Fencelines, river banks and waste areas.
common chickweed	<i>Stellaria media</i>	--	--	Yes	Moist to mesic waste areas, fields and gardens.



TABLE 5.4.3-1 Cont'd

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
common dandelion	<i>Taraxacum officinale</i>	--	--	Yes	Lawns and pasture.
common dwarf snapdragon	<i>Chaenorhinum minus</i>	--	--	Yes	Roadsides and waste places.
common evening-primrose	<i>Oenothera biennis</i>	--	--	Yes	Mesic to dry disturbed areas.
common hound's-tongue	<i>Cynoglossum officinale</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD) Very Invasive (NWIPC)	Yes	Yes	Dry disturbed areas.
common knotweed	<i>Polygonum aviculare</i>	--	--	Yes	Waste areas and cultivation.
common lilac	<i>Syringa vulgaris</i>	--	--	Yes	Vacant lots, roadsides, thickets, and areas around abandoned dwellings.
common orache	<i>Atriplex patula</i>	--	--	Yes	Mesic roadsides, waste areas and gardens.
common plantain	<i>Plantago major</i>	--	--	Yes	Cultivation, lawns, roadsides and waste areas.
common purslane	<i>Portulaca oleracea</i>	--	--	Yes	Fields and waste areas.
common speedwell	<i>Veronica officinalis</i>	--	--	Yes	Mesic to dry fields, roadsides and open forests.
common St. John's-wort	<i>Hypericum perforatum</i>	Prescribed Invasive Species (FRPA) Category 4 Invasive (TNRD) Aggressive or Under Biocontrol (NWIPC)	--	Yes	Mesic to dry fields, roadsides and disturbed areas.
common stork's-bill	<i>Erodium cicutarium</i> ssp. <i>cicutarium</i>	--	--	Yes	Mesic to dry fields, woodlands and waste areas.
common sunflower	<i>Helianthus annuus</i>	--	--	Yes	Moist to dry waste places and disturbed areas.
common tansy	<i>Tanacetum vulgare</i>	Regional Noxious	--	Yes	Pasture.
common timothy	<i>Phleum pratense</i>	--	--	Yes	Mesic fields, roadsides, waste areas and disturbed sites.
common vetch	<i>Vicia sativa</i> var. <i>sativa</i>	--	--	Yes	Mesic roadsides, clearings and waste areas.
common watercress	<i>Nasturtium officinale</i>	--	--	Yes	Shallow streams and ponds.
corn brome	<i>Bromus squarrosus</i>	--	--	Yes	Dry to mesic fields, roadsides, disturbed areas and waste places.
creeping bentgrass	<i>Agrostis stolonifera</i>	--	--	Yes	Mesic to wet lawns, fields, ditches, pond margins, lakeshores and salt marshes.
creeping buttercup	<i>Ranunculus repens</i>	--	--	Yes	Moist to wet lawns, clearings, fields, roadsides and ditches.
crested wheatgrass	<i>Agropyron cristatum</i> ssp. <i>pectinatum</i>	--	--	Yes	Dry to mesic roadsides, fields and waste areas.
cultivated apple	<i>Malus pumila</i>	--	--	Yes	Mesic to moist forest edges, thickets, clearings and waste areas.
curled dock	<i>Rumex crispus</i>	--	--	Yes	Moist to mesic roadsides, ditches and disturbed sites.
cursed buttercup	<i>Ranunculus sceleratus</i> var. <i>sceleratus</i>	--	--	Yes	Wet to moist ponds, shores, mudflats and marshes.
Dalmatian toadflax	<i>Linaria genistifolia</i> ssp. <i>dalmatica</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD) Very Invasive (NWIPC)	Yes	Yes	Roadsides and waste areas.
diffuse knapweed	<i>Centaurea diffusa</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD) Very Invasive (NWIPC)	Yes	Yes	Dry roadsides, disturbed areas, overgrazed grasslands and shrublands.
dovefoot geranium	<i>Geranium molle</i>	--	--	Yes	Mesic fields, lawns and waste areas.

TABLE 5.4.3-1 Cont'd

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
dwarf mallow	<i>Malva neglecta</i>	--	--	Yes	Mesic to dry roadsides and waste areas.
eastern eyebright	<i>Euphrasia nemorosa</i>	Very Invasive (NWIPC)	--	Yes	Mesic to dry fields, clearings, roadsides and waste areas.
European bush-cranberry	<i>Viburnum opulus var. opulus</i>	--	--	Yes	Moist streambanks and lakesides.
European forget-me-not	<i>Myosotis scorpioides</i>	--	--	Yes	Moist to wet meadows, ditches, pond margins and swamps.
European mountain-ash	<i>Sorbus aucuparia</i>	--	--	Yes	Mesic to moist, open forests, fields and roadsides.
European rush	<i>Juncus effusus ssp. effusus</i>	--	--	Yes	Moist to wet disturbed places, pastures, fields, ditches, clearings, forest margins, marshes and peat bogs.
European water-plantain	<i>Alisma plantago-aquatica</i>	--	--	Yes	Stream margins.
field filago	<i>Logfia arvensis</i>	--	--	Yes	Dry roadsides, waste areas and overgrazed grasslands and shrublands.
field forget-me-not	<i>Myosotis arvensis</i>	--	--	Yes	Moist to mesic roadsides and waste areas.
field pennycress	<i>Thlaspi arvense</i>	--	--	Yes	Mesic to dry fields and waste places.
field wood-rush	<i>Luzula campestris</i>	--	--	Yes	Moist lawns.
flagellate hawkweed	<i>Hieracium flagellare ssp. flagellare</i>	--	--	Yes	Mesic to dry roadsides and waste areas.
flixweed	<i>Descurainia sophia</i>	--	--	Yes	Cultivation.
French hawksbeard	<i>Crepis nicaeensis</i>	--	--	Yes	Mesic to dry roadsides and disturbed areas.
garden asparagus	<i>Asparagus officinalis</i>	--	--	Yes	Mesic to dry fields, flood plain thickets, orchards, roadsides and ditches.
giant-hyssop	<i>Agastache foeniculum</i>	--	--	Yes	Dry to mesic open forests and clearings.
grass-leaved starwort	<i>Stellaria graminea</i>	--	--	Yes	Mesic to dry roadsides, gardens, lawns and disturbed areas.
great burdock	<i>Arctium lappa</i>	Regional Noxious Category 3 Invasive (TNRD)	--	Yes	Dry roadsides, disturbed areas and pastures.
great mullein	<i>Verbascum thapsus</i>	--	--	Yes	Dry roadsides, gravel pits, fields and waste places.
green sorrel	<i>Rumex acetosa ssp. acetosa</i>	--	--	Yes	Moist to mesic meadows, streambanks, thickets and forest openings.
hairy cat's-ear	<i>Hypochaeris radicata</i>	--	--	Yes	Mesic to dry roadsides, lawns, pastures and waste places.
hairy wheatgrass	<i>Thinopyrum intermedium ssp. barbulatum</i>	--	--	Yes	Dry roadsides and forests.
hard fescue	<i>Festuca trachyphylla</i>	--	--	Yes	Mesic to dry disturbed areas.
hemp-nettle	<i>Galeopsis tetrahit</i>	Aggressive or Under Biocontrol (NWIPC)	--	Yes	Cultivation, pasture, roadsides and waster areas.
hoary Alyssum	<i>Berteroa incana</i>	Regional Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD) Extremely Invasive (NWIPC)	--	Yes	Dry fields and waste places.
horseweed	<i>Conyza canadensis</i>	--	--	Yes	Mesic to dry roadsides and disturbed areas.
intermediate cinquefoil	<i>Potentilla intermedia</i>	--	--	Yes	Dry to moist disturbed ground, roadsides and waste places.
Italian ryegrass	<i>Lolium multiflorum</i>	--	--	Yes	Mesic to moist pastures, fields, meadows, roadsides and disturbed areas.
knotted clover	<i>Trifolium striatum</i>	--	--	Yes	Disturbed places.
lady's-thumb	<i>Persicaria maculosa</i>	--	--	Yes	Mesic to dry roadsides, ditches, fields and waste places.

**TABLE 5.4.3-1 Cont'd**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
lamb's-quarters	<i>Chenopodium album</i> ssp. <i>album</i>	Aggressive or Under Biocontrol (NWIPC)	--	Yes	Cultivation.
lemon thyme	<i>Thymus pulegioides</i>	--	--	Yes	Cultivation, roadsides, clearings, lawns and disturbed places.
Loesel's tumble-mustard	<i>Sisymbrium loeselii</i>	--	--	Yes	Mesic to dry fields and wastes places.
madwort	<i>Asperugo procumbens</i>	--	--	Yes	Dry to moist disturbed areas and waste places.
meadow brome	<i>Bromus commutatus</i>	--	--	Yes	Mesic to dry disturbed sites, meadows and open forests.
meadow buttercup	<i>Ranunculus acris</i>	--	--	Yes	Moist to mesic meadows, pastures, clearings, fields and roadsides.
meadow fescue	<i>Schedonorus pratensis</i>	--	--	Yes	Moist to mesic pastures, fields, meadows, roadsides and disturbed areas.
meadow salsify	<i>Tragopogon pratensis</i>	--	--	Yes	Dry roadsides and waste places.
mottled hawkweed	<i>Hieracium maculatum</i>	--	--	Yes	Mesic to dry roadsides, gravelly riverbeds, forest openings, waste areas and disturbed areas.
mouse-ear chickweed	<i>Cerastium fontanum</i> ssp. <i>triviale</i>	--	--	Yes	Mesic to dry roadsides, waste places, gardens and fields.
mouse-ear hawkweed	<i>Hieracium pilosella</i>	Prescribed Invasive Species (FRPA)	--	Yes	Dry roadsides, lawns and waste places.
night-flowering catchfly	<i>Silene noctiflora</i>	Regional Noxious	--	Yes	Mesic to dry waste places and cultivated fields.
oak-leaved goosefoot	<i>Chenopodium glaucum</i> var. <i>glaucum</i>	--	--	Yes	Mesic to dry roadsides, waste places and saline or alkaline flats.
orange hawkweed (orange-red king devil)	<i>Hieracium aurantiacum</i>	Regional Noxious Prescribed Invasive Species (FRPA) Category 1 Invasive (TNRD) Extremely Invasive (NWIPC)	--	Yes	Lawns, pastures and roadsides.
orchard grass	<i>Dactylis glomerata</i>	--	--	Yes	Mesic meadows, Garry oak woodlands, pastures, roadsides and disturbed sites.
Oriental false wheatgrass	<i>Eremopyrum orientale</i>	--	--	Yes	Moist to mesic alkaline meadows.
oval-leaved knotweed	<i>Polygonum arenastrum</i>	--	--	Yes	Mesic to dry disturbed sites, roadsides and waste places.
oxeye daisy	<i>Leucanthemum vulgare</i>	Regional Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD) Very Invasive (NWIPC)	--	Yes	Pasture.
perennial sow-thistle	<i>Sonchus arvensis</i> ssp. <i>arvensis</i>	Provincial Noxious	--	Yes	Cultivation.
prickly lettuce	<i>Lactuca serriola</i>	--	--	Yes	Dry roadsides, fields and waste places.
prickly sow-thistle	<i>Sonchus asper</i>	--	--	Yes	Cultivation, gardens and roadsides.
purslane speedwell	<i>Veronica peregrina</i> var. <i>peregrina</i>	--	--	Yes	Moist to wet roadsides, ditches, streambanks, vernal pools, meadows and clearings.
quackgrass	<i>Elymus repens</i>	Regional Noxious	--	Yes	Mesic to dry roadsides, fields, gardens and disturbed sites.
rattlesnake grass	<i>Bromus briziformis</i>	--	--	Yes	Dry meadows, roadsides and waste places.
red clover	<i>Trifolium pratense</i>	--	--	Yes	Lawns, waste areas and abandoned fields.
red fescue	<i>Festuca rubra</i> ssp. <i>rubra</i>	--	--	Yes	Wet to mesic beaches, tidal marshes, streambanks, meadows, gravelly sites and dry disturbed areas, roadsides and fields.
red sand-spurry	<i>Spergularia rubra</i>	--	--	Yes	Dry to mesic disturbed areas and waste places.

**TABLE 5.4.3-1 Cont'd**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
redtop	<i>Agrostis gigantea</i>	--	--	Yes	Dry to mesic roadsides, fields and waste places.
ribwort plantain	<i>Plantago lanceolata</i>	--	--	Yes	Mesic to dry lawns, fields and waste places.
Robert's geranium	<i>Geranium robertianum</i>	--	--	Yes	Mesic, open forests and woodlands.
rough pigweed	<i>Amaranthus retroflexus</i>	--	--	Yes	Moist to dry fields, disturbed areas and waste places.
Russian knapweed	<i>Acroptilon repens</i>	Regional Noxious Prescribed Invasive Species (FRPA) Category 3 Invasive (TNRD)	--	Yes	Dry roadsides and disturbed areas.
scentless mayweed (scentless chamomile)	<i>Tripleurospermum inodorum</i>	Provincial Noxious	Yes	Yes	Cultivated and pasture.
shepherd's purse	<i>Capsella bursa-pastoris</i>	--	--	Yes	Cultivation, row crops, gardens and waste areas.
silvery cinquefoil	<i>Potentilla argentea</i>	--	--	Yes	Dry open ground and waste places.
small mallow	<i>Malva rotundifolia</i>	--	--	Yes	Mesic to dry roadsides and waste places.
soft brome	<i>Bromus hordeaceus</i> ssp. <i>hordeaceus</i>	--	--	Yes	Dry to mesic fields, roadsides, disturbed sites, open forests, lakeshores and dry salt marshes.
spotted knapweed	<i>Centaurea stoebe</i> ssp. <i>micranthos</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Category 1 Invasive (TNRD) Extremely Invasive (NWIPC)	Yes	Yes	Dry roadsides and fields.
spotted medic	<i>Medicago arabica</i>	--	--	Yes	Mesic to dry fields and waste places.
stinging nettle	<i>Urtica dioica</i> ssp. <i>dioica</i>	--	--	Yes	Moist to mesic streamsides, deciduous woodlands, thickets, avalanche tracks and alluvial flood plains.
sulphur cinquefoil	<i>Potentilla recta</i>	Regional Noxious	--	Yes	Dry to moist, disturbed open ground, waste places, roadsides, pastures and overgrazed grasslands.
sweet vernalgrass	<i>Anthoxanthum odoratum</i>	--	--	Yes	Mesic to dry lawns, fields, waste areas, rocky outcrops and meadows.
tall fescue	<i>Schedonorus arundinaceus</i>	--	--	Yes	Dry to wet seepages, pastures, fields, meadows, roadsides and disturbed areas.
tall tumble-mustard	<i>Sisymbrium altissimum</i>	--	--	Yes	Mesic to dry fields and waste places.
thyme-leaved sandwort	<i>Arenaria serpyllifolia</i>	--	--	Yes	Dry roadsides and disturbed areas.
thyme-leaved speedwell	<i>Veronica serpyllifolia</i> var. <i>serpyllifolia</i>	--	--	Yes	Mesic to wet meadows, fields, streambanks, tickets, open forest and waste places.
trailing cinquefoil	<i>Potentilla anglica</i>	--	--	Yes	Banks, roadsides and woodlands.
tufted vetch	<i>Vicia cracca</i> ssp. <i>cracca</i>	--	--	Yes	Mesic fields, clearings, thickets and open forests.
turnip	<i>Brassica napus</i>	--	--	Yes	Mesic to dry fields and waste places.
viper's bugloss	<i>Echium vulgare</i>	Regional Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD) Very Invasive (NWIPC)	--	Yes	Dry roadsides and waste places.
wall lettuce	<i>Mycelis muralis</i>	--	--	Yes	Moist to mesic forests.
wall speedwell	<i>Veronica arvensis</i>	--	--	Yes	Dry to mesic lawns, fields and waste places.
water meadow-foxtail	<i>Alopecurus geniculatus</i>	--	--	Yes	Wet to mesic shores, meadows, ditches and roadsides.
water mint	<i>Mentha aquatica</i>	--	--	Yes	Wet to moist riverbanks and shorelines.
white clover	<i>Trifolium repens</i>	--	--	Yes	Lawns, waste areas and abandoned fields.

**TABLE 5.4.3-1 Cont'd**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
white cockle	<i>Silene latifolia ssp. alba</i>	Regional Noxious	--	Yes	Cultivation and pasture.
white sweet-clover	<i>Melilotus alba</i>	--	--	Yes	Roadsides and waste areas.
wild basil savory	<i>Clinopodium vulgare</i>	--	--	Yes	Dry to wet disturbed areas.
wild carrot	<i>Daucus carota</i>	Very Invasive (NWIPC)	--	Yes	Roadsides, fields, and waste places.
wild marjoram	<i>Origanum vulgare</i>	--	--	Yes	Mesic to dry roadsides and waste places.
wool-grass	<i>Scirpus atrocinctus</i>	--	--	Yes	Swamps and wet meadows.
wormwood	<i>Artemisia absinthium</i>	Invasive (NWIPC)	--	Yes	Dry roadsides and disturbed areas.
yellow bristlegrass	<i>Setaria pumila ssp. pumila</i>	--	--	Yes	Mesic to dry fields, roadsides and waste areas.
yellow clover	<i>Trifolium aureum</i>	--	--	Yes	Mesic to dry roadsides, fields and waste places.
yellow king devil	<i>Hieracium caespitosum</i>	Category 1 Invasive (TNRD) Extremely Invasive (NWIPC)	--	Yes	Mesic to dry roadsides, disturbed areas and waste places.
yellow salsify	<i>Tragopogon dubius</i>	--	--	Yes	Dry roadsides, fields and waste places.
yellow sweet-clover	<i>Melilotus officinalis</i>	--	--	Yes	Roadsides and waste areas.

**Note:** - Species nomenclature and the status of species as native or not is determined according to the BC Species and Ecosystem Explorer (BC MOE 2013), with more current taxonomic information drawn from NatureServe (2012a), when necessary. Where the BC *Weed Control Act* nomenclature differs from these sources, the *Weed Control Act* name for the species has been provided in brackets following the BC CDC name. Where no species nomenclature is available from the BC Species and Ecosystem Explorer (BC MOE 2013), only the BC *Weed Control Act* name is provided.

#### **5.4.4      *Black Pines to Hope Segment***

Weed species of low to high abundance were observed along the proposed pipeline corridor. Noxious and non-listed weed species identified during stakeholder consultation and vegetation surveys for the Black Pines to Hope Segment are provided in Table 5.4.4-1.

TABLE 5.4.4-1

NOXIOUS AND NON-LISTED WEED SPECIES IDENTIFIED DURING STAKEHOLDER CONSULTATION AND VEGETATION SURVEYS FOR THE BLACK PINES TO HOPE SEGMENT

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
alfalfa	<i>Medicago sativa</i> ssp. <i>falcata</i>	--	--	Yes	Cultivation, roadsides, fencelines and waste areas.
alsike clover	<i>Trifolium hybridum</i>	--	--	Yes	Lawns, waste areas and abandoned fields.
American black nightshade	<i>Solanum americanum</i>	--	--	Yes	Mesic to dry waste places.
annual bluegrass	<i>Poa annua</i>	--	--	Yes	Lawns, golf courses and waste areas.
annual hawksbeard	<i>Crepis tectorum</i>	--	--	Yes	Forage crops, pastures, roadsides and waste areas.
barren fescue	<i>Vulpia bromoides</i>	--	--	Yes	Mesic to dry outcrops, bluffs, open forest, roadsides and disturbed areas.
birds-foot trefoil	<i>Lotus corniculatus</i>	--	--	Yes	Moist to dry roadsides, waste areas, pastures and lawns.
black cherry	<i>Prunus serotina</i>	--	--	Yes	Mesic to moist clearings, forest edges and open forest.
black medic	<i>Medicago lupulina</i>	--	--	Yes	Lawns, gardens, roadsides and pastures.
black mustard	<i>Brassica nigra</i>	--	--	Yes	Mesic fields and waste places.
bull thistle	<i>Cirsium vulgare</i>	Prescribed Invasive Species (FRPA) Category 4 Invasive (TNRD)	--	Yes	Mesic to dry roadsides, fields, pastures and disturbed areas.
butter-and-eggs	<i>Linaria vulgaris</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Category 3 Invasive (TNRD) Priority Species - Containment (FVIPC)	--	Yes	Cultivation and pasture.
Canada bluegrass	<i>Poa compressa</i>	--	--	Yes	Dry to moist areas, roadsides and meadows.
Canada thistle	<i>Cirsium arvense</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD)	Yes	Yes	Cultivation.
Canadian goldenrod	<i>Solidago canadensis</i>	--	--	Yes	Moist to mesic meadows, grasslands, shrublands, ditches, cultivation, roadsides and forest openings.
catnip	<i>Nepeta cataria</i>	--	--	Yes	Mesic to dry waste areas.
cheatgrass	<i>Bromus tectorum</i>	Priority Species - Control (FVIPC)	--	Yes	Dry to mesic roadsides, disturbed sites, waste areas, meadows, grasslands and shrublands.
Chewing's fescue	<i>Festuca rubra</i> ssp. <i>commutata</i>	--	--	Yes	Wet to mesic beaches, tidal marshes, streambanks, meadows, gravelly sites and dry disturbed areas, roadsides and fields.
chicory	<i>Cichorium intybus</i>	--	--	Yes	Mesic to dry roadsides and waste areas.
clasping-leaved pepper-grass	<i>Lepidium perfoliatum</i>	--	--	Yes	Dry roadsides and waste places.
cleavers	<i>Galium aparine</i>	Regional Noxious	--	Yes	Cultivation, gardens and roadsides.
common burdock	<i>Arctium minus</i>	Regional Noxious Prescribed Invasive Species (FRPA) Category 3 Invasive (TNRD)	--	Yes	Fencelines, river banks and waste areas.
common chickweed	<i>Stellaria media</i>	--	--	Yes	Moist to mesic waste areas, fields and gardens.
common dandelion	<i>Taraxacum officinale</i>	--	--	Yes	Lawns and pasture.
common dodder	<i>Cuscuta epithymum</i>	Provincial Noxious Category 3 Invasive (TNRD)	--	Yes	Parasitic on legumes.
common draba	<i>Draba verna</i>	--	--	Yes	Dry disturbed areas and waste areas.

**TABLE 5.4.4-1 Cont'd**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
common evening-primrose	<i>Oenothera biennis</i>	--	--	Yes	Mesic to dry disturbed areas.
common foxglove	<i>Digitalis purpurea</i>	--	--	Yes	Moist to mesic, roadsides, fields, clearings and forest edges.
common groundsel	<i>Senecio vulgaris</i>	--	--	Yes	Mesic to dry roadsides, disturbed areas and gardens.
common hound's-tongue	<i>Cynoglossum officinale</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD) Priority Species - Eradication (FVIPC)	Yes	Yes	Dry disturbed areas.
common mugwort	<i>Artemisia vulgaris</i>	--	--	Yes	Wet to dry intertidal river banks, roadsides and waste places.
common plantain	<i>Plantago major</i>	--	--	Yes	Cultivated, lawns, roadsides and waste areas.
common purslane	<i>Portulaca oleracea</i>	--	--	Yes	Fields and waste areas.
common sow-thistle	<i>Sonchus oleraceus</i>	Provincial Noxious	--	Yes	Mesic to dry roadsides, disturbed areas and gardens.
common speedwell	<i>Veronica officinalis</i>	--	--	Yes	Mesic to dry fields, roadsides and open forests.
common St. John's-wort	<i>Hypericum perforatum</i>	Prescribed Invasive Species (FRPA) Category 4 Invasive (TNRD) Priority Species - Control (FVIPC)	--	Yes	Mesic to dry fields, roadsides and disturbed areas.
common stork's-bill	<i>Erodium cicutarium</i> ssp. <i>cutarium</i>	--	--	Yes	Mesic to dry fields, woodlands and waste areas.
common tansy	<i>Tanacetum vulgare</i>	Regional Noxious,	--	Yes	Pasture.
common timothy	<i>Phleum pratense</i>	--	--	Yes	Mesic fields, roadsides, waste areas and disturbed sites.
common velvet-grass	<i>Holcus lanatus</i>	--	--	Yes	Mesic to dry lawns, fields, roadsides, railways and waste areas.
common vetch	<i>Vicia sativa</i> var. <i>sativa</i>	--	--	Yes	Mesic roadsides, clearings and waste areas.
common watercress	<i>Nasturtium officinale</i>	--	--	Yes	Shallow streams and ponds.
compact rush	<i>Juncus conglomeratus</i>	--	--	Yes	Wet disturbed sites and pastures.
corn brome	<i>Bromus squarrosus</i>	--	--	Yes	Dry to mesic fields, roadsides, disturbed areas and waste places.
corn-spurry	<i>Spergula arvensis</i>	--	--	Yes	Mesic to dry fields and waste places.
creeping bentgrass	<i>Agrostis stolonifera</i>	--	--	Yes	Mesic to wet lawns, fields, ditches, pond margins, lakeshores and salt marshes.
creeping buttercup	<i>Ranunculus repens</i>	--	--	Yes	Moist to wet lawns, clearings, fields, roadsides and ditches.
creeping yellowcress	<i>Rorippa sylvestris</i>	--	--	Yes	Gardens, nurseries, park lawns, roadsides, waste ground, ditches, and river banks beside arable ground.
crested wheatgrass	<i>Agropyron cristatum</i> ssp. <i>pectinatum</i>	--	--	Yes	Dry to mesic roadsides, fields and waste areas.
curled dock	<i>Rumex crispus</i>	--	--	Yes	Moist to mesic roadsides, ditches and disturbed sites.
Dalmatian toadflax	<i>Linaria genistifolia</i> ssp. <i>Dalmatica</i> ( <i>Linaria dalmatica</i> )	Provincial Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD) Priority Species - Containment (FVIPC)	Yes	Yes	Roadsides and waste areas.
Deptford pink	<i>Dianthus armeria</i>	--	--	Yes	Lawns, waste places and fields.
desert alyssum	<i>Alyssum desertorum</i>	--	--	Yes	Dry disturbed areas and waste places.
diffuse knapweed	<i>Centaurea diffusa</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD) Priority Species - Containment (FVIPC)	Yes	Yes	Dry roadsides, disturbed areas, overgrazed grasslands and shrublands.



**TABLE 5.4.4-1 Cont'd**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
early hairgrass	<i>Aira praecox</i>	--	--	Yes	Vernally moist to dry gravelly or rocky bluffs and grassy meadows.
eastern cottonwood	<i>Populus deltoides</i> ssp. <i>deltoides</i>	--	--	Yes	Mesic to dry fields and disturbed sites.
eastern eyebright	<i>Euphrasia nemorosa</i>	--	--	Yes	Mesic to dry fields, clearings, roadsides and waste areas.
Elm species	<i>Ulmus</i> spp.	--	--	Yes	Numerous habitats.
European bittersweet	<i>Solanum dulcamara</i> var. <i>dulcamara</i>	--	--	Yes	Moist to mesic waste places.
European field bittercress	<i>Cardamine pratensis</i> ssp. <i>pratensis</i>	--	--	Yes	Wet to moist streambanks, meadows, flood plains and open woods.
European hawkweed	<i>Hieracium lachenalii</i>	--	--	Yes	Mesic to dry roadsides, gravelly riverbeds, forest openings and waste areas.
European rush	<i>Juncus effusus</i> ssp. <i>effusus</i>	--	--	Yes	Moist to wet disturbed places, pastures, fields, ditches, clearings, forest margins, marshes and peat bogs.
European water-plantain	<i>Alisma plantago-aquatica</i>	--	--	Yes	Stream margins.
falseflax	<i>Camelina sativa</i>	--	--	Yes	Mesic to dry roadsides, fields and waste places.
field filago	<i>Logfia arvensis</i>	--	--	Yes	Dry roadsides, waste areas and overgrazed grasslands and shrublands.
field forget-me-not	<i>Myosotis arvensis</i>	--	--	Yes	Moist to mesic roadsides and waste areas.
field hedge-nettle	<i>Stachys arvensis</i>	--	--	Yes	Waste places and cultivated areas.
field pennycress	<i>Thlaspi arvense</i>	--	--	Yes	Mesic to dry fields and waste places.
field wood-rush	<i>Luzula campestris</i>	--	--	Yes	Moist lawns.
flagellate hawkweed	<i>Hieracium flagellare</i> ssp. <i>flagellare</i>	Priority Species - Control (FVIPC)	--	Yes	Mesic to dry roadsides and waste areas.
flixweed	<i>Descurainia sophia</i>	--	--	Yes	Cultivation.
great burdock	<i>Arctium lappa</i>	Regional Noxious Category 3 Invasive (TNRD)	--	Yes	Dry roadsides, disturbed areas and pastures.
great mullein	<i>Verbascum thapsus</i>	--	--	Yes	Dry roadsides, gravel pits, fields and waste places.
green sorrel	<i>Rumex acetosa</i> ssp. <i>acetosa</i>	--	--	Yes	Moist to mesic meadows, streambanks, thickets and forest openings.
hairy bittercress	<i>Cardamine hirsuta</i>	--	--	Yes	Mesic to dry waste places, roadsides and open woods.
hairy cat's-ear	<i>Hypochaeris radicata</i>	--	--	Yes	Mesic to dry roadsides, lawns, pastures and waste places.
hairy vetch	<i>Vicia villosa</i> ssp. <i>villosa</i>	--	--	Yes	Mesic to dry roadsides, fields, clearings and waste places.
hairy wheatgrass	<i>Thinopyrum intermedium</i> ssp. <i>barbulatum</i>	--	--	Yes	Dry roadsides and forests.
hard fescue	<i>Festuca trachyphylla</i>	--	--	Yes	Mesic to dry disturbed areas.
hare's-foot clover	<i>Trifolium arvense</i>	--	--	Yes	Mesic to dry roadsides, fields and waste places.
hedge mustard	<i>Sisymbrium officinale</i>	--	--	Yes	Mesic to dry fields and waste places.
hemp-nettle	<i>Galeopsis tetrahit</i>	--	--	Yes	Cultivation, pasture, roadsides and waster areas.
hoary alyssum	<i>Berteroa incana</i>	Regional Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD) Priority Species - Containment (FVIPC)	--	Yes	Dry fields and waste places.
homseed buttercup	<i>Ranunculus testiculatus</i>	--	--	Yes	Dry disturbed clearings and sagebrush slopes.
horseweed	<i>Conyza canadensis</i>	--	--	Yes	Mesic to dry roadsides and disturbed areas.

**TABLE 5.4.4-1 Cont'd**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
interrupted apera	<i>Apera interrupta</i>	--	--	Yes	Dry waste areas.
Japanese brome	<i>Bromus japonicus</i>	--	--	Yes	Dry fields and waste places.
Kentucky bluegrass	<i>Poa pratensis</i> ssp. <i>pratensis</i>	--	--	Yes	Moist to dry meadows, shrublands, open forest and disturbed sites.
king devil	<i>Hieracium praealtum</i>	Priority Species - Control (FVIPC)	--	Yes	Mesic to dry roadsides and waste places.
kingdevil hawkweed	<i>Hieracium floribundum</i>	--	--	Yes	Meadows, prairies, pastures and lawns.
lamb's-quarters	<i>Chenopodium album</i> ssp. <i>album</i>	--	--	Yes	Cultivation.
lance-leaved violet	<i>Viola lanceolata</i> ssp. <i>lanceolata</i>	--	--	Yes	Moist woodlands and peaty fields.
large barnyard-grass	<i>Echinochloa crusgalli</i>	--	--	Yes	Moist to dry ditches, disturbed sites, clearings and fields.
littlepod flax	<i>Camelina microcarpa</i>	--	--	Yes	Dry roadsides, fields and waste places.
Loesel's tumble-mustard	<i>Sisymbrium loeseli</i>	--	--	Yes	Mesic to dry fields and wastes places.
madwort	<i>Asperugo procumbens</i>	--	--	Yes	Dry to moist disturbed areas and waste places.
marsh cudweed	<i>Gnaphalium uliginosum</i>	--	--	Yes	Moist to mesic streambanks, lakeshores and waste places.
meadow buttercup	<i>Ranunculus acris</i>	--	--	Yes	Moist to mesic meadows, pastures, clearings, fields and roadsides.
moth mullein	<i>Verbascum blattaria</i>	--	--	Yes	Mesic to moist roadsides, fields and waste places.
mouse-ear chickweed	<i>Cerastium fontanum</i> ssp. <i>triviale</i>	--	--	Yes	Mesic to dry roadsides, waste places, gardens and fields.
mouse-ear hawkweed	<i>Hieracium pilosella</i>	Prescribed Invasive Species (FRPA)	--	Yes	Dry roadsides, lawns and waste places.
narrow-leaved everlasting peavine	<i>Lathyrus sylvestris</i>	--	--	Yes	Mesic to dry thickets, clearings, roadsides and waste places.
night-flowering catchfly	<i>Silene noctiflora</i>	Regional Noxious	--	Yes	Mesic to dry waste places and cultivated fields.
nipplewort	<i>Lapsana communis</i>	--	--	Yes	Mesic to dry roadsides, fields and waste places.
oak-leaved goosefoot	<i>Chenopodium glaucum</i> var. <i>glaucum</i>	--	--	Yes	Mesic to dry roadsides, waste places and saline or alkaline flats.
orange hawkweed (orange-red king devil)	<i>Hieracium aurantiacum</i>	Regional Noxious Prescribed Invasive Species (FRPA) Category 1 Invasive (TNRD) Extremely Invasive (NWIPC) Priority Species - Control (FVIPC)	--	Yes	Lawns. Pastures and roadsides.
orchard grass	<i>Dactylis glomerata</i>	Priority Species - Control (FVIPC)	--	Yes	Mesic meadows, Garry oak woodlans, pastures, roadsides and disturbed sites.
oval-leaved knotweed	<i>Polygonum arenastrum</i>	--	--	Yes	Mesic to dry disturbed sites, roadsides and waste places.
perennial sow-thistle	<i>Sonchus arvensis</i> ssp. <i>arvensis</i>	Provincial Noxious	--	Yes	Cultivation.
prickly lettuce	<i>Lactuca serriola</i>	--	--	Yes	Dry roadsides, fields and waste places.
prickly sow-thistle	<i>Sonchus asper</i>	--	--	Yes	Cultivation, gardens and roadsides.
rattail fescue	<i>Vulpia myuros</i>	--	--	Yes	Mesic to dry fields, open areas, rocky ground, roadsides and waste areas.
red clover	<i>Trifolium pratense</i>	--	--	Yes	Lawns, waste areas and abandoned fields.
red sand-spurry	<i>Spergularia rubra</i>	--	--	Yes	Dry to mesic disturbed areas and waste places.
ribwort plantain	<i>Plantago lanceolata</i>	--	--	Yes	Mesic to dry lawns, fields and waste places.
rigid sunflower	<i>Helianthus rigidus</i> var. <i>subrhomboideus</i>	--	--	Yes	Dry open, places.

**TABLE 5.4.4-1 Cont'd**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
Robert's geranium	<i>Geranium robertianum</i>	--	--	Yes	Mesic, open forests and woodlands.
Russian olive	<i>Elaeagnus angustifolia</i>	--	--	Yes	Moist to dry roadsides and waste places.
Russian thistle	<i>Salsola tragus</i>	Regional Noxious	--	Yes	Dry roadsides, fields and waste places.
sainfoin	<i>Onobrychis vicifolia</i>	--	--	Yes	Mesic to dry fields, clearings, roadsides and waste places.
salad burnet	<i>Sanguisorba minor</i> ssp. <i>muricata</i>	--	--	Yes	Mesic to dry roadsides, grassy meadows and waste places.
scentless mayweed (scentless chamomile)	<i>Tripleurospermum inodorum</i> ( <i>Matricaria maritima</i> )	Provincial Noxious	Yes	--	Cultivated and pasture.
Scotch broom	<i>Cytisus scoparius</i>	Prescribed Invasive Species (FRPA) Target Species (ISCMV) Priority Species - Containment (FVIPC)	--	Yes	Mesic to dry fields, rocky slopes, roadsides and powerline rights-of-way.
sheep sorrel	<i>Rumex acetosella</i>	--	--	Yes	Mesic to dry gardens, fields, roadsides and waste places.
shepherd's purse	<i>Capsella bursa-pastoris</i>	--	--	Yes	Cultivation, row crops, gardens, and waste areas.
silvery cinquefoil	<i>Potentilla argentea</i>	--	--	Yes	Dry open ground and waste places.
small touch-me-not	<i>Impatiens parviflora</i>	Priority Species - Control (FVIPC)	--	Yes	Moist disturbed areas.
smooth cat's-ear	<i>Hypochaeris glabra</i>	--	--	Yes	Roadsides, pastures and waste areas.
spotted knapweed	<i>Centaurea stoebe</i> ssp. <i>micranthos</i> ( <i>Centaurea maculosa</i> )	Provincial Noxious Prescribed Invasive Species (FRPA) Category 1 Invasive (TNRD) Priority Species - Containment (FVIPC)	Yes	Yes	Dry roadsides and fields.
sticky chickweed	<i>Cerastium glomeratum</i>	--	--	Yes	Mesic to dry roadsides, waste places, lawns and pastures.
stinging nettle	<i>Urtica dioica</i> ssp. <i>dioica</i>	--	--	Yes	Moist to mesic streambanks, deciduous woodlands, thickets, avalanche tracks and alluvial flood plains.
stinking chamomile	<i>Anthemis cotula</i>	--	--	Yes	Dry roadsides and disturbed sites.
sulphur cinquefoil	<i>Potentilla recta</i>	Regional Noxious	--	Yes	Dry to moist, disturbed open ground, waste places, roadsides, pastures and overgrazed grasslands.
summer-cypress	<i>Kochia scoparia</i>	Regional Noxious	--	Yes	Dry waste places.
sweet rocket	<i>Hesperis matronalis</i>	--	--	Yes	Mesic to dry roadsides, fields and disturbed areas.
sweet vernalgrass	<i>Anthoxanthum odoratum</i>	--	--	Yes	Mesic to dry lawns, fields, waste areas, rocky outcrops and meadows.
tall tumble-mustard	<i>Sisymbrium altissimum</i>	--	--	Yes	Mesic to dry fields and waste places.
tansy ragwort	<i>Senecio jacobaea</i>	Provincial Noxious	--	Yes	Mesic to dry fields, clear-cuts and pastures.
tomatillo	<i>Physalis philadelphica</i>	--	--	Yes	Cultivation.
tufted vetch	<i>Vicia cracca</i> ssp. <i>cracca</i>	--	--	Yes	Mesic fields, clearings, thickets and open forests.
turnip	<i>Brassica napus</i>	--	--	Yes	Mesic to dry fields and waste places.
tutsan	<i>Hypericum androsaemum</i>	--	--	Yes	Moist meadows, ditches and thickets.
umbellate chickweed	<i>Holosteum umbellatum</i>	--	--	Yes	Dry disturbed areas.
viper's bugloss	<i>Echium vulgare</i>	Regional Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD) Priority Species - Control (FVIPC)	--	Yes	Dry roadsides and waste places.
water meadow-foxtail	<i>Alopecurus geniculatus</i>	--	--	Yes	Wet to mesic shores, meadows, ditches and roadsides.
weeping alkaligrass	<i>Puccinellia distans</i>	--	--	Yes	Saline or alkaline flats, lakeshores, coastal strands and disturbed sites.

**TABLE 5.4.4-1 Cont'd**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
white clover	<i>Trifolium repens</i>	--	--	Yes	Lawns, waste areas and abandoned fields.
white cockle	<i>Silene latifolia</i> ssp. <i>alba</i>	Regional Noxious	--	Yes	Cultivation and pasture.
white mignonette	<i>Reseda alba</i>	--	--	Yes	Mesic to dry fields and waste places.
white sweet-clover	<i>Mellilotus alba</i>	--	--	Yes	Roadsides and waste areas.
wild marjoram	<i>Origanum vulgare</i>	--	--	Yes	Mesic to dry roadsides and waste places.
woolgrass	<i>Scirpus cyperinus</i>	--	--	Yes	Swamps and wet meadows.
wormwood	<i>Artemisia absinthium</i>	--	--	Yes	Dry roadsides and disturbed areas.
yellow clover	<i>Trifolium aureum</i>	--	--	Yes	Mesic to dry roadsides, fields and waste places.
yellow salsify	<i>Tragopogon dubius</i>	--	--	Yes	Dry roadsides, fields and waste places.
yellow sweet-clover	<i>Mellilotus officinalis</i>	--	--	Yes	Roadsides and waste areas.

**Note:** - Species nomenclature and the status of species as native or not is determined according to the BC Species and Ecosystem Explorer (BC MOE 2013), with more current taxonomic information drawn from NatureServe (2012a), when necessary. Where the BC *Weed Control Act* nomenclature differs from these sources, the *Weed Control Act* name for the species has been provided in brackets following the BC CDC name. Where no species nomenclature is available from the BC Species and Ecosystem Explorer (BC MOE 2013), only the BC *Weed Control Act* name is provided.

#### **5.4.5      *Hope to Burnaby Segment***

Weed species of low to high abundance were observed along to the proposed application corridor. Noxious and non-listed weed species identified during stakeholder consultation and vegetation surveys for the Hope to Burnaby Segment are provided in Table 5.4.5-1

TABLE 5.4.5-1

NOXIOUS AND NON-LISTED WEED SPECIES IDENTIFIED DURING  
STAKEHOLDER CONSULTATION AND VEGETATION SURVEYS FOR THE HOPE TO BURNABY SEGMENT

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
alfalfa	<i>Medicago sativa</i> ssp. <i>falcata</i>	--	--	Yes	Cultivation, roadsides, fencelines and waste areas.
alsike clover	<i>Trifolium hybridum</i>	--	--	Yes	Lawns, waste areas and abandoned fields.
American black nightshade	<i>Solanum americanum</i>	--	--	Yes	Mesic to dry waste places.
annual knawel	<i>Scleranthus annuus</i>	--	--	Yes	Roadsides, fields and waste areas.
barren fescue	<i>Vulpia bromoides</i>	--	--	Yes	Mesic to dry outcrops, bluffs, open forest, roadsides and disturbed areas.
birds-foot trefoil	<i>Lotus corniculatus</i>	--	--	Yes	Moist to dry roadsides, waste areas, pastures and lawns.
black medic	<i>Medicago lupulina</i>	--	--	Yes	Lawns, gardens, roadsides and pastures.
bladder campion	<i>Silene vulgaris</i>	Not listed	--	Yes	Cultivation and pasture.
bull thistle	<i>Cirsium vulgare</i>	Prescribed Invasive Species (FRPA)	--	Yes	Mesic to dry roadsides, fields, pastures and disturbed areas.
butterfly-bush	<i>Buddleja davidii</i>	--	--	Yes	Mesic to dry disturbed areas and rocky slopes.
Canada bluegrass	<i>Poa compressa</i>	--	--	Yes	Dry to moist areas, roadsides and meadows.
Canadian goldenrod	<i>Solidago canadensis</i>	--	--	Yes	Moist to mesic meadows, grasslands, shrublands, ditches, cultivation, roadsides and forest openings.
Canada thistle	<i>Cirsium arvense</i>	Provincial Noxious Prescribed Invasive Species (FRPA)	Yes	Yes	Cultivation.
cheatgrass	<i>Bromus tectorum</i>	Priority Species - Control (FVIPC)	--	Yes	Dry to mesic roadsides, disturbed sites, waste areas, meadows, grasslands and shrublands.
Chewing's fescue	<i>Festuca rubra</i> ssp. <i>commutata</i>	--	--	Yes	Wet to mesic beaches, tidal marshes, streambanks, meadows, gravelly sites and dry disturbed areas, roadsides and fields.
chicory	<i>Cichorium intybus</i>	--	--	Yes	Mesic to dry roadsides and waste areas.
cleavers	<i>Galium aparine</i>	Regional Noxious	--	Yes	Cultivation, gardens and roadsides.
clustered dock	<i>Rumex conglomeratus</i>	--	--	Yes	Mesic to dry roadsides, waste places, ditches and shorelines.
common burdock	<i>Arctium minus</i>	Regional Noxious Prescribed Invasive Species (FRPA)	--	Yes	Fencelines, river banks and waste areas.
common chickweed	<i>Stellaria media</i>	--	--	Yes	Moist to mesic waste areas, fields and gardens.
common dandelion	<i>Taraxacum officinale</i>	--	--	Yes	Lawns and pasture.
common evening-primrose	<i>Oenothera biennis</i>	--	--	Yes	Mesic to dry disturbed areas.
common forget-me-not	<i>Myosotis discolor</i>	--	--	Yes	Moist to mesic roadsides, ditches and disturbed areas.
common foxglove	<i>Digitalis purpurea</i>	--	--	Yes	Moist to mesic, roadsides, fields, clearings and forest edges.
common hawthorn	<i>Crataegus monogyna</i>	Priority Species - Control (FVIPC)	--	Yes	Moist to mesic disturbed places, thickets, forest margins and open forests.
common plantain	<i>Plantago major</i>	--	--	Yes	Cultivated, lawns, roadsides and waste areas.
common reed	<i>Phragmites australis</i> ssp. <i>australis</i>	Provincial Noxious	--	Yes	Marshes, ponds, lakeshores and ditches.
common sow-thistle	<i>Sonchus oleraceus</i>	Provincial Noxious	--	Yes	Mesic to dry roadsides, disturbed areas and gardens.
common St. John's-wort	<i>Hypericum perforatum</i>	Prescribed Invasive Species (FRPA) Priority Species - Control (FVIPC)	--	Yes	Mesic to dry fields, roadsides and disturbed areas.
common tansy	<i>Tanacetum vulgare</i>	Regional Noxious	--	Yes	Pasture.

TABLE 5.4.5-1 Cont'd

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
common timothy	<i>Phleum pratense</i>	--	--	Yes	Mesic fields, roadsides, waste areas and disturbed sites.
common velvet-grass	<i>Holcus lanatus</i>	--	--	Yes	Mesic to dry lawns, fields, roadsides, railways and waste areas.
common vetch	<i>Vicia sativa</i> var. <i>sativa</i>	--	--	Yes	Mesic roadsides, clearings and waste areas.
creeping bentgrass	<i>Agrostis stolonifera</i>	--	--	Yes	Mesic to wet lawns, fields, ditches, pond margins, lakeshores and salt marshes.
creeping buttercup	<i>Ranunculus repens</i>	--	--	Yes	Moist to wet lawns, clearings, fields, roadsides and ditches.
curled dock	<i>Rumex crispus</i>	--	--	Yes	Moist to mesic roadsides, ditches and disturbed sites.
cutleaf evergreen blackberry	<i>Rubus laciniatus</i>	--	--	Yes	Moist to wet waste places, ditches and roadsides.
cut-leaved geranium	<i>Geranium dissectum</i>	--	--	Yes	Mesic to dry roadsides, fields and waste places.
Deptford pink	<i>Dianthus armeria</i>	--	--	Yes	Lawns, waste places and fields.
dovefoot geranium	<i>Geranium molle</i>	--	--	Yes	Mesic fields, lawns and waste areas.
early hairgrass	<i>Aira praecox</i>	--	--	Yes	Vernally moist to dry gravelly or rocky bluffs and grassy meadows.
eastern eyebright	<i>Euphrasia nemorosa</i>	--	--	Yes	Mesic to dry fields, clearings, roadsides and waste areas.
English holly	<i>Ilex aquifolium</i>	Target Species (ISCMV) Priority Species - Control (FVIPC)	--	Yes	Mesic forests and disturbed areas.
English ivy	<i>Hedera helix</i>	Priority Species - Control (FVIPC)	--	Yes	Moist to mesic disturbed areas and forest floors and trees.
European bittersweet	<i>Solanum dulcamara</i> var. <i>dulcamara</i>	--	--	Yes	Moist to mesic waste places.
European hawkweed	<i>Hieracium lachenalii</i>	--	--	Yes	Mesic to dry roadsides, gravelly riverbeds, forest openings and waste areas.
European rush	<i>Juncus effusus</i> ssp. <i>effusus</i>	--	--	Yes	Moist to wet disturbed places, pastures, fields, ditches, clearings, forest margins, marshes and peat bogs.
field forget-me-not	<i>Myosotis arvensis</i>	--	--	Yes	Moist to mesic roadsides and waste areas.
fortune meadowsweet	<i>Spiraea japonica</i> var. <i>fortunei</i>	--	--	Yes	Disturbed areas, meadows and forest openings.
goutweed	<i>Aegopodium podagraria</i>	--	--	Yes	Mesic to dry roadsides and waste places.
great mullein	<i>Verbascum thapsus</i>	--	--	Yes	Dry roadsides, gravel pits, fields and waste places.
green sorrel	<i>Rumex acetosa</i> ssp. <i>acetosa</i>	--	--	Yes	Moist to mesic meadows, streambanks, thickets and forest openings.
ground-ivy	<i>Glechoma hederacea</i>	--	--	Yes	Mesic waste places, lawns, and open forests.
hairy bittercress	<i>Cardamine hirsuta</i>	--	--	Yes	Mesic to dry waste places, roadsides and open woods.
hairy cat's-ear	<i>Hypochaeris radicata</i>	--	--	Yes	Mesic to dry roadsides, lawns, pastures and waste places.
hard fescue	<i>Festuca trachyphylla</i>	--	--	Yes	Mesic to dry disturbed areas.
hedge false bindweed	<i>Calystegia sepium</i> ssp. <i>sepium</i>	--	--	Yes	Moist streamsides, river bottoms and shorelines.
helleborine	<i>Epipactis helleborine</i>	--	--	Yes	Moist to dry waste places, forests and fields.
hemp-nettle	<i>Galeopsis tetrahit</i>	--	--	Yes	Cultivation, pasture, roadsides and waste areas.
Himalayan blackberry	<i>Rubus armeniacus</i>	--	--	Yes	Moist to wet waste places, roadsides, ditches and fencerows.
hoary plantain	<i>Plantago media</i>	--	--	Yes	Mesic to dry lawns, fields and waste places.
Japanese knotweed	<i>Fallopia japonica</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Target Species (ISCMV) Priority Species - Containment (FVIPC)	Yes	Yes	Moist to mesic ditches and disturbed sites.
king devil	<i>Hieracium praealtum</i>	Priority Species - Control (FVIPC)	--	Yes	Mesic to dry roadsides and waste places.
kingdevil hawkweed	<i>Hieracium floribundum</i>	--	--	Yes	Roadsides and fields.
lady's-thumb	<i>Persicaria maculosa</i>	--	--	Yes	Mesic to dry roadsides, ditches, fields and waste places.

**TABLE 5.4.5-1 Cont'd**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
large barnyard-grass	<i>Echinochloa crusgalli</i>	--	--	Yes	Moist to dry ditches, disturbed sites, clearings and fields.
Loesel's tumble-mustard	<i>Sisymbrium loeseli</i>	--	--	Yes	Mesic to dry fields and wastes places.
meadow buttercup	<i>Ranunculus acris</i>	--	--	Yes	Moist to mesic meadows, pastures, clearings, fields and roadsides.
meadow fescue	<i>Schedonorus pratensis</i>	--	--	Yes	Moist to mesic pastures, fields, meadows, roadsides and disturbed areas.
mountain bluet	<i>Centaurea montana</i>	Priority Species - Containment (FVIPC)	--	Yes	Mesic roadsides and waste places.
musk mallow	<i>Malva moschata</i>	--	--	Yes	Mesic to dry roadsides and waste places.
night-flowering catchfly	<i>Silene noctiflora</i>	Regional Noxious	--	Yes	Mesic to dry waste places and cultivated fields.
orange hawkweed (orange-red king devil)	<i>Hieracium aurantiacum</i>	Regional Noxious Prescribed Invasive Species (FRPA) Target Species (ISCMV) Priority Species - Control (FVIPC)	--	Yes	Lawns, pastures and roadsides.
orchard grass	<i>Dactylis glomerata</i>	Priority Species - Control (FVIPC)	--	Yes	Mesic meadows, Garry oak woodlands, pastures, roadsides and disturbed sites.
oxeye daisy	<i>Leucanthemum vulgare</i>	Regional Noxious Prescribed Invasive Species (FRPA)	--	Yes	Pasture.
perennial ryegrass	<i>Lolium perenne</i>	--	--	Yes	Mesic to moist pastures, fields, meadows, roadsides and disturbed areas.
perennial sow-thistle	<i>Sonchus arvensis</i> ssp. <i>arvensis</i>	Provincial Noxious	--	Yes	Cultivation.
poison-hemlock	<i>Conium maculatum</i>	Priority Species - Control (FVIPC)	--	Yes	Wet to mesic ditches and disturbed sites.
policeman's helmet	<i>Impatiens glandulifera</i>	Target Species (ISCMV) Priority Species - Control (FVIPC)	--	Yes	Moist to mesic streambanks, meadows, roadsides and waste places.
pond water-starwort	<i>Callitriche stagnalis</i>	--	--	Yes	Slow-moving streams and ponds.
prickly lettuce	<i>Lactuca serriola</i>	--	--	Yes	Dry roadsides, fields and waste places.
prickly sow-thistle	<i>Sonchus asper</i>	--	--	Yes	Cultivation, gardens and roadsides.
purple loosestrife	<i>Lythrum salicaria</i>	Provincial Noxious	--	Yes	Wet meadows, marshes and ditches.
quackgrass	<i>Elymus repens</i>	Regional Noxious	--	Yes	Mesic to dry roadsides, fields, gardens and disturbed sites.
rabbitfoot polypogon	<i>Polypogon monspeliensis</i>	--	--	Yes	Wet to dry waste areas, ditches and vernal pools.
rattail fescue	<i>Vulpia myuros</i>	--	--	Yes	Mesic to dry fields, open areas, rocky ground, roadsides and waste areas.
red clover	<i>Trifolium pratense</i>	--	--	Yes	Lawns, waste areas and abandoned fields.
red fescue	<i>Festuca rubra</i> ssp. <i>rubra</i>	--	--	Yes	Wet to mesic beaches, tidal marshes, streambanks, meadows, gravelly sites and dry disturbed areas, roadsides and fields.
ribwort plantain	<i>Plantago lanceolata</i>	--	--	Yes	Mesic to dry lawns, fields and waste places.
Robert's geranium	<i>Geranium robertianum</i>	--	--	Yes	Mesic, open forests and woodlands.
Scotch broom	<i>Cytisus scoparius</i>	Not listed Prescribed Invasive Species (FRPA) Target Species (ISCMV) Priority Species - Containment (FVIPC)	--	Yes	Mesic to dry fields, rocky slopes, roadsides and powerline rights-of-way.
self-heal	<i>Prunella vulgaris</i> ssp. <i>vulgaris</i>	--	--	Yes	Mesic to dry roadsides, waste places, lawns, fields and open forests.
silver hairgrass	<i>Aira caryophylla</i>	--	--	Yes	Vernally moist to dry, gravelly or rocky, open sites.
small touch-me-not	<i>Impatiens parviflora</i>	Priority Species - Control (FVIPC)	--	Yes	Moist disturbed areas.
soft brome	<i>Bromus hordeaceus</i> ssp. <i>hordeaceus</i>	--	--	Yes	Dry to mesic fields, roadsides, disturbed sites, open forests, lakeshores and dry salt marshes.



**TABLE 5.4.5-1 Cont'd**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Observed During Field Work	Management Issues
spotted knapweed	<i>Centaurea stoebe</i> ssp. <i>micranthos</i> ( <i>Centaurea maculosa</i> )	Provincial Noxious Prescribed Invasive Species (FRPA) Priority Species - Containment (FVIPC)	Yes	Yes	Dry roadsides and fields.
spotted St. John's-wort	<i>Hypericum maculatum</i> ssp. <i>obtusiusculum</i>	--	--	Yes	Moist waste places, ditches and forest margins.
sticky chickweed	<i>Cerastium glomeratum</i>	--	--	Yes	Mesic to dry roadsides, waste places, lawns and pastures.
stinging nettle	<i>Urtica dioica</i> ssp. <i>dioica</i>	--	--	Yes	Moist to mesic streambanks, deciduous woodlands, thickets, avalanche tracks and alluvial flood plains.
sulphur cinquefoil	<i>Potentilla recta</i>	Regional Noxious	--	Yes	Dry to moist, disturbed open ground, waste places, roadsides, pastures and overgrazed grasslands.
sweet cherry	<i>Prunus avium</i>	--	--	Yes	Mesic to moist forest edges and fields.
sweet vernalgrass	<i>Anthoxanthum odoratum</i>	--	--	Yes	Mesic to dry lawns, fields, waste areas, rocky outcrops and meadows.
tall oatgrass	<i>Arrhenatherum elatius</i>	--	--	Yes	Mesic to dry meadows, rock outcrops, fields and disturbed sites.
tansy ragwort	<i>Senecio jacobaea</i>	Provincial Noxious	Yes	Yes	Mesic to dry fields, clear-cuts and pastures.
thyme-leaved speedwell	<i>Veronica serpyllifolia</i> var. <i>serpyllifolia</i>	--	--	Yes	Mesic to wet meadows, fields, streambanks, tickets, open forest and waste places.
tufted vetch	<i>Vicia cracca</i> ssp. <i>cracca</i>	--	--	Yes	Mesic fields, clearings, thickets and open forests.
upright hedge-parsley	<i>Torilis japonica</i>	--	--	Yes	Mesic disturbed sites or open forests.
wall lettuce	<i>Mycelis muralis</i>	--	--	Yes	Moist to mesic forests.
water meadow-foxtail	<i>Alopecurus geniculatus</i>	--	--	Yes	Wet to mesic shores, meadows, ditches and roadsides.
weedy sunburst	<i>Xanthoria parietina</i>	--	--	Yes	Nitrogen rich tress, rocks and manmade substrates.
white bedstraw	<i>Galium mollugo</i>	--	--	Yes	Mesic to dry fields, roadsides and disturbed sites.
white clover	<i>Trifolium repens</i>	--	--	Yes	Lawns, waste areas and abandoned fields.
white sweet-clover	<i>Mellilotus alba</i>	--	--	Yes	Roadsides and waste areas.
wild chervil	<i>Anthriscus sylvestris</i>	Regional Noxious Priority Species - Containment (FVIPC)	--	Yes	Wet to moist disturbed sites, fields and margins of woods.
wood bittercress	<i>Cardamine flexuosa</i>	--	--	Yes	Disturbed areas, fields, nurseries, plantations, gardens, flower beds, lawns and roadsides.
wood forget-me-not	<i>Myosotis sylvatica</i>	--	--	Yes	Mesic grasslands, shrublands, disturbed areas and open forests.
wood groundsel	<i>Senecio sylvaticus</i>	--	--	Yes	Mesic to dry roadsides, clear-cuts and disturbed areas.
yellow archangel	<i>Lamium galeobdolon</i>	--	--	Yes	Forests and shady hedgerows.
yellow clover	<i>Trifolium aureum</i>	--	--	Yes	Mesic to dry roadsides, fields and waste places.
yellow loosestrife	<i>Lysimachia vulgaris</i>	Priority Species - Prevention (FVIPC)	--	Yes	Wet roadsides.

**Note:** - Species nomenclature and the status of species as native or not is determined according to the BC Species and Ecosystem Explorer (BC MOE 2013), with more current taxonomic information drawn from NatureServe (2012a), when necessary. Where the BC *Weed Control Act* nomenclature differs from these sources, the *Weed Control Act* name for the species has been provided in brackets following the BC CDC name. Where no species nomenclature is available from the BC Species and Ecosystem Explorer (BC MOE 2013), only the BC *Weed Control Act* name is provided.

### 5.4.6 Burnaby to Westridge Loop

Due to land access restriction throughout the Burnaby to Westridge Segment, no vegetation surveys were conducted during 2013. Surveys are expected for this segment in 2014.

### 5.4.7 Pump Stations and Terminals with No Native Vegetation Disturbance

Refer to Section 4.4.6 for weed management at the Niton, Wolf, Edson, Jasper, Blue River, Blackpool, Darfield, Kamloops, Sumas Pump Stations as well as the Edmonton, Burnaby and Westridge Marine Terminal.

### 5.4.8 Gainford Pump Station

Prohibited Noxious, Noxious, and Non-listed weed species identified during stakeholder consultation and observed during the vegetation surveys at the Gainford Pump Station are provided in Table 5.4.8-1. Pre-construction weed surveys will be conducted closer to the date of construction.

TABLE 5.4.8-1

**PROHIBITED NOXIOUS, NOXIOUS AND NON-LISTED WEED SPECIES IDENTIFIED DURING STAKEHOLDER CONSULTATION AND VEGETATION SURVEYS FOR THE GAINFORD PUMP STATION**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Management Issues
alsike clover	<i>Trifolium hybridum</i>	--	--	Lawns, waste areas and abandoned fields.
annual bluegrass	<i>Poa annua</i>	--	--	Lawns, golf courses and waste areas.
annual hawk's-beard	<i>Crepis tectorum</i>	--	Yes	Forage crops, pastures, roadsides and waste areas.
Canada (creeping) thistle	<i>Cirsium arvense</i>	Noxious	Yes	Cultivation.
common dandelion	<i>Taraxacum officinale</i>	--	Yes	Lawns and pasture.
common plantain	<i>Plantago major</i>	--	Yes	Cultivation, lawns, roadsides and waste areas.
common tansy	<i>Tanacetum vulgare</i>	Noxious	Yes	Pasture.
creeping wild rye	<i>Elytrigia repens</i>	--	--	Cultivation.
hemp nettle	<i>Galeopsis tetrahit</i>	--	Yes	Cultivation, pasture, roadsides and waster areas.
low cudweed	<i>Gnaphalium uliginosum</i>	--	--	Cultivation, roadside ditches and the banks of irrigation canals.
meadow hawkweed	<i>Hieracium caespitosum</i>	Prohibited Noxious	Yes	Mesic to dry roadsides, gravelly riverbeds, forest openings, waste areas and disturbed areas.
ox-eye daisy	<i>Chrysanthemum leucanthemum</i>	Noxious	Yes	Pasture.
perennial sow thistle	<i>Sonchus arvensis</i>	Noxious	Yes	Cultivation.
pineappleweed	<i>Matricaria matricarioides</i>	--	--	Farmyards, waste areas and roadsides.
prickly annual sow-thistle	<i>Sonchus asper</i>	--	--	Cultivation, gardens and roadsides.
red clover	<i>Trifolium pratense</i>	--	--	Lawns, waste areas and abandoned fields.
smooth perennial sow-thistle	<i>Sonchus uliginosus</i>	--	--	Mesic to dry ditches, roadsides, disturbed areas and gardens.
tall buttercup	<i>Ranunculus acris</i>	Noxious	Yes	Pasture.
timothy	<i>Phleum pratense</i>	--	--	Mesic fields, roadsides, waste areas and disturbed sites.

**Notes:** - Species nomenclature is determined according to the list of all elements in Alberta (ACIMS 2013b), with more current taxonomic information drawn from NatureServe (2012a), when necessary. Where the Alberta *Weed Control Act* nomenclature differs from these sources, the *Weed Control Act* name for the species has been provided in brackets following the ACIMS name.

### 5.4.9 Hinton Pump Station

Prohibited Noxious, Noxious and Non-Listed weed species identified during stakeholder consultation and observed during vegetation surveys at the Hinton Pump Station are provided in Table 5.4.9-1. Pre-construction weed surveys will be conducted closer to the date of construction.

**TABLE 5.4.9-1**

**PROHIBITED NOXIOUS, NOXIOUS AND NON-LISTED WEED SPECIES IDENTIFIED DURING STAKEHOLDER CONSULTATION AND VEGETATION SURVEYS FOR THE HINTON PUMP STATION**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Management Issues
alsike clover	<i>Trifolium hybridum</i>	--	--	Lawns, waste areas and abandoned fields.
Canada (creeping) thistle	<i>Cirsium arvense</i>	Noxious	Yes	Cultivation.
common dandelion	<i>Taraxacum officinale</i>	--	Yes	Lawns and pasture.
ox-eye daisy	<i>Chrysanthemum leucanthemum</i>	Noxious	Yes	Pasture.
perennial sow thistle	<i>Sonchus arvensis</i>	Noxious	Yes	Cultivation.
red clover	<i>Trifolium pratense</i>	--	--	Lawns, waste areas and abandoned fields.
rough cinquefoil	<i>Potentilla norvegica</i>	--	--	Pastures, roadsides, gardens and row crops.
timothy	<i>Phleum pratense</i>	--	--	Mesic fields, roadsides, waste areas and disturbed sites.
tufted vetch	<i>Vicia cracca</i>	--	--	Mesic fields, clearings, thickets and open forests.
white sweet-clover	<i>Mellilotus alba</i>	--	--	Roadsides and waste areas.

**Note:** - Species nomenclature is determined according to the list of all elements in Alberta (ACIMS 2013b), with more current taxonomic information drawn from NatureServe (2012a), when necessary. Where the Alberta *Weed Control Act* nomenclature differs from these sources, the *Weed Control Act* name for the species has been provided in brackets following the ACIMS name.

### 5.4.10 Rearguard Pump Station

The Rearguard Pump Station Footprint was not available during 2013 surveys. Weed species will be assessed concurrently with vegetation surveys expected to be conducted in 2014. Pre-construction weed surveys will also be conducted closer to the date of construction.

### 5.4.11 Black Pines Pump Station

Noxious and Non-Listed weed species identified during stakeholder consultation and observed at the Black Pines Pump Station and associated power line during vegetation surveys are provided in Table 5.4.11-1. Pre-construction weed surveys will be conducted closer to the date of construction.

**TABLE 5.4.11-1**

**NOXIOUS AND NON-LISTED WEED SPECIES IDENTIFIED DURING STAKEHOLDER CONSULTATION AND VEGETATION SURVEYS FOR THE BLACK PINES PUMP STATION**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Management Issues
alfalfa	<i>Medicago sativa</i>	--	--	Cultivation, roadsides, fencelines and waste areas.
alsike clover	<i>Trifolium hybridum</i>	--	--	Lawns, waste areas and abandoned fields.
bull thistle	<i>Cirsium vulgare</i>	Prescribed Invasive Species (FRPA) Category 4 Invasive (TNRD)	--	Mesic to dry roadsides, fields, pastures and disturbed areas.
chicory	<i>Cichorium intybus</i>	--	--	Mesic to dry roadsides and waste areas.
common burdock	<i>Arctium minus</i>	Regional Noxious Prescribed Invasive Species (FRPA) Category 3 Invasive (TNRD)	--	Fencelines, river banks and waste areas.
common plantain	<i>Plantago major</i>	--	--	Cultivation, lawns, roadsides and waste areas.

**TABLE 5.4.11-1 Cont'd**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Management Issues
common timothy	<i>Phleum pratense</i>	--	--	Mesic fields, roadsides, waste areas and disturbed sites.
flixweed	<i>Descurainia sophia</i>	--	--	Cultivation.
great mullein	<i>Verbascum thapsus</i>	--	--	Dry roadsides, gravel pits, fields and waste places.
hoary alyssum	<i>Berteroa incana</i>	Regional Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD)	--	Dry fields and waste places.
lamb's-quarters	<i>Chenopodium album ssp. album</i>	--	--	Cultivation.
night-flowering catchfly	<i>Silene noctiflora</i>	Regional Noxious	--	Mesic to dry waste places and cultivated fields.
orchard grass	<i>Dactylis glomerata</i>	--	--	Mesic meadows, Garry oak woodlands, pastures, roadsides and disturbed sites.
prickly lettuce	<i>Lactuca serriola</i>	--	--	Dry roadsides, fields and waste places.
self-heal	<i>Prunella vulgaris ssp. vulgaris</i>	--	--	Mesic to dry roadsides, waste places, lawns, fields and open forests.
smooth brome	<i>Bromus inermis</i>	--	--	Moist to dry disturbed sites, fields, grassy slopes, meadows and forest edges.
summer-cypress	<i>Kochia scoparia</i>	Regional Noxious	--	Dry waste places.
tall tumble-mustard	<i>Sisymbrium altissimum</i>	--	--	Mesic to dry fields and waste places.
white sweet-clover	<i>Mellilotus alba</i>	--	--	Roadsides and waste areas.
yellow salsify	<i>Tragopogon dubius</i>	--	--	Dry roadsides, fields and waste places.
yellow sweet-clover	<i>Mellilotus officinalis</i>	--	--	Roadsides and waste areas.

**Note:** - Species nomenclature and the status of species as native or not is determined according to the BC Species and Ecosystem Explorer (BC MOE 2013), with more current taxonomic information drawn from NatureServe (2012a), when necessary. Where the BC *Weed Control Act* nomenclature differs from these sources, the *Weed Control Act* name for the species has been provided in brackets following the CDC name. Where no species nomenclature is available from the BC Species and Ecosystem Explorer (BC MOE 2013), only the BC *Weed Control Act* name is provided.

### 5.4.12 Kingsvale Pump Station

Noxious and Non-Listed weed species identified during stakeholder consultation and observed during vegetation surveys at the Kingsvale Pump Station are provided in Table 5.4.12-1. Pre-construction weed surveys will also be conducted closer to the date of construction.

**TABLE 5.4.12-1**

#### **NOXIOUS AND NON-LISTED WEED SPECIES IDENTIFIED DURING STAKEHOLDER CONSULTATION AND VEGETATION SURVEYS FOR THE KINGSVALE PUMP STATION**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Management Issue s
alfalfa	<i>Medicago sativa ssp. falcata</i>	--	--	Cultivation, roadsides, fencelines and waste areas.
black medic	<i>Medicago lupulina</i>	--	--	Lawns, gardens, roadsides and pastures.
bulbous bluegrass	<i>Poa bulbosa ssp. vivipara</i>	--	--	Dry to mesic grassy meadows and waste areas.
Canada bluegrass	<i>Poa compressa</i>	--	--	Dry to moist areas, roadsides and meadows.
Canada thistle	<i>Cirsium arvense</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD)	Yes	Mesic to dry roadsides, fields and disturbed areas.
cheatgrass	<i>Bromus tectorum</i>	--	--	Dry to mesic roadsides, disturbed sites, waste areas, meadows, grasslands and shrublands.
common dandelion	<i>Taraxacum officinale</i>	--	--	Lawns and pasture.

**TABLE 5.4.12-1 Cont'd**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Management Issue s
common timothy	<i>Phleum pratense</i>	--	--	Mesic fields, roadsides, waste areas and disturbed sites.
crested wheatgrass	<i>Agropyron cristatum</i> <i>ssp. pectinatum</i>	--	--	Dry to mesic roadsides, fields and waste areas.
curled dock	<i>Rumex crispus</i>	--	--	Moist to mesic roadsides, ditches and disturbed sites.
Dalmatian toadflax	<i>Linaria genistifolia</i> <i>ssp. dalmatica</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD)	Yes	Roadsides and waste areas.
field filago	<i>Logfia arvensis</i>	--	--	Dry roadsides, waste areas and overgrazed grasslands and shrublands.
great mullein	<i>Verbascum thapsus</i>	--	--	Dry roadsides, gravel pits, fields and waste places.
hairy wheatgrass	<i>Thinopyrum intermedium</i> <i>ssp. barbulatum</i>	--	--	Dry roadsides and forests.
interrupted apera	<i>Apera interrupta</i>	--	--	Dry waste areas in the lowland.
Kentucky bluegrass	<i>Poa pratensis</i>	--	--	Moist to dry meadows, shrublands, open forests and disturbed sites.
kingdevil hawkweed	<i>Hieracium praealtum</i>	--	--	Mesic to dry roadsides and waste places.
knotweed species	<i>Polygonum</i> sp.	--	--	Various habitats.
oxeye daisy	<i>Leucanthemum vulgare</i>	Regional Noxious Prescribed Invasive Species (FRPA) Category 2 Invasive (TNRD)	--	Pasture.
perennial sow-thistle	<i>Sonchus arvensis</i>	Provincial Noxious	--	Cultivation.
red clover	<i>Trifolium pratense</i>	--	--	Lawns, waste areas and abandoned fields.
scentless mayweed (scentless chamomile)	<i>Tripleurospermum inodorum</i>	Provincial Noxious	Yes	Cultivation and pasture.
sheep sorrel	<i>Rumex acetosella</i>	--	--	Mesic to dry gardens, fields, roadsides and waste places.
silvery cinquefoil	<i>Potentilla argentea</i>	--	--	Dry open ground and waste places.
spotted knapweed	<i>Centaurea stoebe</i> <i>ssp. micranthos</i>	Provincial Noxious Prescribed Invasive Species (FRPA) Category 1 Invasive (TNRD)	Yes	Dry roadsides and fields.
tall tumble-mustard	<i>Sisymbrium altissimum</i>	--	--	Mesic to dry fields and waste places.
yellow salsify	<i>Tragopogon dubius</i>	--	--	Dry roadsides, fields and waste places.

**Note:** - Species nomenclature and the status of species as native or not is determined according to the BC Species and Ecosystem Explorer (BC MOE 2013), with more current taxonomic information drawn from NatureServe (2012a), when necessary. Where the BC *Weed Control Act* nomenclature differs from these sources, the *Weed Control Act* name for the species has been provided in brackets following the CDC name. Where no species nomenclature is available from the BC Species and Ecosystem Explorer (BC MOE 2013), only the BC *Weed Control Act* name is provided.

### 5.4.13 Sumas Terminal

The Sumas Terminal Footprint was not available during 2013 surveys. Weed species will be assessed concurrently with vegetation surveys expected to be conducted in 2014. Pre-construction weed surveys will also be conducted closer to the date of construction.

### 5.4.14 Westridge Marine Terminal

Noxious and Non-listed weed species identified during stakeholder consultation and observed during vegetation surveys at the Westridge Marine Terminal are provided in Table 5.4.14-1. Pre-construction weed surveys will also be conducted closer to the date of construction.

**TABLE 5.4.14-1**

**NOXIOUS AND NON-LISTED WEED SPECIES IDENTIFIED DURING STAKEHOLDER CONSULTATION AND VEGETATION SURVEYS FOR THE WESTRIDGE MARINE TERMINAL**

Common Name	Scientific Name	Provincial Status	Stakeholder Concern	Management Issues
Canadian goldenrod	<i>Solidago canadensis</i>	--	--	Moist to mesic meadows, grasslands, shrublands, ditches, fields, roadsides and forest openings.
English holly	<i>Ilex aquifolium</i>	--	--	Mesic forests and disturbed areas.
Himalayan blackberry	<i>Rubus armeniacus</i> <i>Rubus discolor</i>	--	--	Moist to wet waste places, roadsides, ditches and fence rows.
Morning glory species	<i>Convolvulus</i> sp.	--	--	Various habitats.
ribwort plantain	<i>Plantago lanceolata</i>	--	--	Mesic to dry lawns, fields and waste places.
Scotch Broom	<i>Cytisus scoparius</i>	--	--	Mesic to dry fields, rocky slopes, roadsides and powerline rights-of-way.
Thistle species	<i>Cirsium</i> sp.	possibly	--	Various habitats.

**Note:** - Species nomenclature and the status of species as native or not is determined according to the BC Species and Ecosystem Explorer (BC MOE 2013), with more current taxonomic information drawn from NatureServe (2012a), when necessary. Where the BC *Weed Control Act* nomenclature differs from these sources, the *Weed Control Act* name for the species has been provided in brackets following the CDC name. Where no species nomenclature is available from the BC Species and Ecosystem Explorer (BC MOE 2013), only the BC *Weed Control Act* name is provided.

## 6.0 DISCUSSION AND MITIGATION RECOMMENDATIONS

### 6.1 Pipeline

Pipeline construction, operation and maintenance activities have the potential to result in alteration of the composition of native vegetation, alteration or disturbance of plant and lichen species of concern and weed introduction and spread. Project mitigation has been developed to reduce disturbance to vegetation resources. Vegetation post-construction monitoring (PCM) will identify any areas where remedial measures should be implemented to assist with the recovery of vegetation resources. The potential effects on vegetation associated with the construction of the proposed pipeline are described in Section 7.2.9 of Volume 5A.

#### 6.1.1 Supplemental Studies

A comprehensive vegetation program was conducted in 2012 and 2013, including TEM field verification and vegetation surveys. For this report, where access was not available, desktop studies, literature reviews, information available as a result of 60 years of operation and data gathered from adjacent lands as well as professional judgement were used to make predictions. Based on the above, and the fact that the effects of pipelines and available mitigation and environmental protection measures are well-known, TERA is confident in the predictions about the potential effects of construction, operation and maintenance activities. In order to confirm the effects assessment conclusions and gather site-specific information for the implementation of mitigation from the Project-specific EPPs, additional studies will be conducted on those areas where access was not available.

In addition to locations where access was not in place, supplemental surveys are planned in areas identified during the 2013 surveys as requiring revisits (e.g., for a species collected or seen in 2013 that needs field-based confirmation).

As well, further desktop review will be conducted of any changes to the proposed pipeline corridor since the completion of the 2013 field surveys to determine whether additional vegetation surveys are warranted based on the vegetation type in the area and/or high potential to support rare plants, lichens or rare ecological communities (the desktop review process is detailed in Section 3.5). Due to their site-specific nature, vegetation surveys can only be conducted on the known proposed pipeline corridor and their results cannot necessarily be extrapolated to realignments and additions made after the surveys have been conducted.

Vegetation surveys were completed during the growing season in 2013 for over 25% of the proposed pipeline corridor. This is considered to be equal to or above the industry-accepted best practices for vegetation surveys on a large project, where it is not practical to survey the entire Project length. No published provincial standards exist for the percentage of a Project that should be surveyed for vegetation.

Following 2014, information from supplemental vegetation surveys and rare plant revisits will refine and augment site-specific environmental protection planning. The goal of the supplemental vegetation surveys will be to visit unique and representative habitats not visited during the 2013 surveys. Supplemental rare plant revisits will have two objectives:

- to confirm identification, population size and extent of observed rare plant or lichen populations; and
- to identify site-specific rare plant and rare lichen populations and rare ecological communities that have the potential to be affected by the Project, once the proposed Construction Footprint have been finalized.

Additional information gathered during ongoing engagement with potentially affected Aboriginal communities will be incorporated into Project planning, including the EPPs and the Environmental Alignment Sheets, as appropriate.

The supplemental vegetation survey methodology will be the same as studies completed to date and is based on the guidelines described in the ANPC *Guidelines for Rare Plant Surveys in Alberta* (ANPC 2012) and the BC CDCs and E-Flora BCs Protocols for Rare Plant Surveys (Penny and Klinkenberg

2012), and is provided in Section 3.6. Specific information collected will include plant and lichen species, incidental weed observations, UTM coordinates and species distributions.

### **6.1.2 General Recommendations**

Potential effects associated with the construction and operations of the proposed pipeline on vegetation indicators are listed in Table 6.1-1. These interactions are based on the results of the: literature review; desktop analysis; field work; TEM; TEK; engagement with Aboriginal communities, landowners, regulatory authorities and other stakeholders (Section 2.0); and the professional experience of the assessment team.

A summary of key mitigation measures selected to reduce effects to vegetation resources is provided in Table 6.1-1. These measures were principally developed in accordance with Trans Mountain standards as well as industry and regulatory guidelines, and include, but are not limited to, the following:

- Environmental Handbook for Pipeline Construction (AENV 1988);
- Guide for Pipelines Pursuant to the *Environmental Protection and Enhancement Act and Regulations* (AENV 1994a);
- *Environmental Protection Guidelines for Pipelines: Conservation and Reclamation* Information Letter, C&R/IL/94-5 (AENV 1994b);
- Best Management Practices for Pipeline Construction in Native Prairie Environments (AENV 2003b);
- *Weeds on Industrial Development Sites: Regulations and Guidelines*, R&R/03-4 (AENV 2003a);
- *Recommended Land Use Guidelines for Protection of Selected Wildlife Species and Habitat within Grassland and Parkland Natural Regions of Alberta* (ASRD 2011);
- Information Bulletin 2010-17 Preventing Spread of Invasive Plants and Noxious Weeds (BC Oil and Gas Commission [BC OGC] 2010);
- *Environmental Protection and Management Guidelines* (BC OGC 2013);
- *OGAA Environmental Protection and Management Regulation* (BC Reg. 200/2010);
- Environmental Assessment Best Practice Guide for Wildlife at Risk in Canada (CWS 2004);
- *Best Management Guidelines for the Enhanced Approval Process* (Government of Alberta 2011);
- *Integrated Standards and Guidelines: Enhanced Approval Process* (Government of Alberta 2013); and
- *Guidelines for Translocation of Plant Species at Risk in BC* (Maslovat 2009).

The mitigation measures presented in Table 6.1-1 have either already been incorporated into Project planning and/or are otherwise recommended as site-specific measures to reduce potential environmental effects to vegetation resources during construction and operation of the Project. Additional mitigation measures are provided in the Pipeline EPP (Volume 6B). The recommended mitigation measures provided were principally developed in accordance with industry and regulatory guidelines, including relevant recommendations in land use planning documents, as well as consultation with provincial regulatory authorities (Table 2.2-1).



**TABLE 6.1-1**

**POTENTIAL EFFECTS AND RECOMMENDED  
 MITIGATION MEASURES - PIPELINE CONSTRUCTION AND OPERATIONS**

Potential Effect	Pipeline Segment(s)	Spatial Boundary <sup>1</sup>	Key Recommendations/Mitigation Measures [EPP Reference] <sup>2</sup>
1.1 Loss or alteration of native vegetation	All	Footprint	<ul style="list-style-type: none"> <li>• Confine all pre-clearing/mowing and general clearing activities within the staked/flagged construction right-of-way boundaries. Adhere to clearing/mowing restrictions associated with watercourses, wetlands, sensitive environmental features and buffer areas (at watercourse and wetland crossings) in addition to those areas outlined in the resource-specific mitigation tables [Appendices E through Q].</li> <li>• Maintain low vegetation or vegetated ground mat within the riparian buffer zone of watercourses and the vegetated buffer zone of wetlands, to the extent practical, by clearing only trees, walking-down low vegetation so low-lying vegetation remains intact. Limit grubbing of cleared/mowed trees/shrubs only to the trench line and work side area needed for the vehicle crossing to protect riparian areas [Section 8.1].</li> <li>• Use hand clearing methods where directed by Trans Mountain's Lead Environmental Inspector and Environmental Inspector(s) to avoid or reduce disturbance to the ground surface on sensitive terrain [Section 8.1].</li> <li>• Restrict root grubbing to the trench line, if feasible, and restrict root grubbing in wet areas, where practical, to avoid creation of bog holes, minimize surface disturbance and encourage re-sprouting/natural regeneration of deciduous trees and shrubs. See additional clearing and grubbing measures in Section 8.1 of the Pipeline EPP (Volume 6B).</li> <li>• Determine the extent of disturbance to native grasslands (e.g., compaction, rutting) and prepare the surface prior to seeding as per discussions with Trans Mountain's Lead Environmental Inspector and Environmental Inspector(s) [Section 8.6].</li> <li>• Use natural recovery as the preferred method of reclamation on wetlands [Section 8.6].</li> <li>• Place erosion control blankets or coir matting [Erosion Control Matting Drawing in Appendix R], woody slash or log diversions [Rollback Drawing in Appendix R] along the right-of-way on erodible soils or wind exposed sites to provide micro-habitat and support plant establishment [Brush Wind Barrier Drawing and Staked Logs for Erosion Control Drawing in Appendix R] [Section 7.0 of Appendix C].</li> <li>• Within the vicinity of the construction right-of-way, collect dormant woody plant material (deciduous stakes/brush) and select suitably sized transplants (small conifer/deciduous trees/shrubs) from a suitable donor site following approval from the applicable Land Manager [Section 7.0 of Appendix C].</li> <li>• Use a grass cover crop and/or native grass seed mix that has been developed for use at riparian areas to support the establishment of installed and naturally regenerating native woody plant material and plants and to provide erosion protection in the short-term [Section 7.0 of Appendix C].</li> <li>• Implement plant protection measures (e.g., soil mounds and berms, wind fencing and rollback) that work to minimize environmental stresses (i.e., wind exposure, low soil moisture stress [desiccation]), to the extent feasible [Section 7.0 of Appendix C].</li> <li>• Seed disturbed lands with land uses that support native and non-native plant communities with native and non-native grass mixtures and rates, respectively, as identified in the Reclamation Management Plan as per results of the vegetation field surveys [Appendix C] [Section 8.6].</li> <li>• For native seed, the highest seed grade available will be obtained. Do not accept seed lots that contain any Prohibited Noxious or Noxious weeds as identified in the Certificate of Analysis. Retain the Certificates of Analysis obtained for both agronomic and native seed for future documentation. The Certificates of Analysis will be presented to the landowner/Crown land authority upon request [Section 8.6].</li> <li>• Minimize foot traffic on newly seeded areas until grass establishment has taken place. Vehicle traffic will be avoided on seeded areas until the sod is re-established [Section 8.6] [Section 10.0 of Appendix C].</li> <li>• Plant native shrub/tree species, where warranted, depending on the site-specific objectives [Section 14.0 of Appendix C].</li> <li>• Remove problem vegetation (i.e., weeds or invasive species) when adjacent to or crossing a wetland or watercourse and replace it with compatible, low-growing plant species that will out-compete problem vegetation [Section 14.0 of Appendix C].</li> </ul>

**TABLE 6.1-1 Cont'd**

Potential Effect	Pipeline Segment(s)	Spatial Boundary <sup>1</sup>	Key Recommendations/Mitigation Measures [EPP Reference] <sup>2</sup>
1.1 Loss or alteration of native vegetation (cont'd)	See above	See above	<ul style="list-style-type: none"> <li>Refer to the Problem Vegetation Management Plan [Sections 14 of Appendix C] for management of non-native or invasive species.</li> <li>Refer to potential effect 3.1 of this table for mitigation regarding non-native or invasive species during construction and operations.</li> <li>Monitor the effectiveness of revegetation efforts during the PCM of the construction rights-of-way. Conduct additional remedial work, where warranted.</li> </ul>
1.2 Loss or alteration of the most affected vegetation communities	Edmonton to Hinton <sup>3</sup> RK 0.5 to RK 2 RK 59 to RK 66 RK 80 to RK 83 RK 118.5 to RK 133.5 RK 126 to RK 127 RK 133 to RK 134 RK 152 to RK 165 RK 175 to RK 176.5 RK 207 to RK 207.5 Hargreaves to Darfield <sup>3</sup> RK 491 to RK 554 Black Pines to Hope <sup>3</sup> RK 981 to RK 1000	Footprint	<ul style="list-style-type: none"> <li>See potential effect 1.1 of this table for mitigation regarding alteration of native vegetation.</li> <li>Conduct a pre-construction weed survey and record problem vegetation (designated weeds) infestations on and immediately adjacent to the construction right-of-way [Section 6.0] [Section 14.0 of Appendix C].</li> <li>Reduce grubbing of roots in shrubby communities within temporary workspace areas, where feasible [Section 6.0 of Appendix C].</li> <li>Minimize grubbing of plant roots and stumps at non-graded areas, to the extent feasible, to promote re-sprouting of cleared/brushed deciduous vegetation and germination of the undisturbed soil seed bank to optimize the potential for the natural regeneration of vegetation and reduce the potential for terrain instability or soil erosion by wind or water at these sites [Section 7.0 of Appendix C].</li> <li>Mow or walk down rather than wholly remove shrubs, where feasible [Section 6.0 of Appendix C].</li> <li>Clear woody vegetation only to the extent warranted to reduce the loss of forest values and minimize the potential for terrain instability and erosion [Section 7.0 of Appendix C].</li> <li>Use protective matting and/or snow during the winter to mat over the vegetation community where it occurs and other areas where surface disturbance is not required, to protect communities from scraping and compacting [Section 6.0 of Appendix C].</li> <li>Monitor the amount of mulch (wood chips) produced during mulching of un-grubbed tree stumps where minimum disturbance construction techniques are used on the construction right-of-way (grubbing and topsoil salvage over the trench only) so as to maintain soil nutrients at levels (i.e., maintain a suitable Carbon:Nitrogen ratio) that can support vegetation re-establishment following construction activities [Section 7.0 of Appendix C].</li> <li>Consider employing appropriate salvage, propagation and transplant techniques for component species [Section 6.0 of Appendix C].</li> <li>Manage all problem vegetation along the construction right-of-way during all pipeline construction phases (i.e., pre-construction, construction, PCM) and the operational phase [Section 14.0 of Appendix C].</li> <li>Monitor the effectiveness of revegetation efforts during the PCM of the construction rights-of-way. Conduct additional remedial work, where warranted.</li> </ul>
1.3 Loss or alteration of grasslands in the BG BGC Zone	<u>Black Pines to Hope</u> RK 829.4 to RK 848.8 RK 849.7 to RK 850.8 RK 896.8 to RK 897.0 RK 897.5 to RK 898.5 RK 899.0 to RK 899.1 RK 918.5 to RK 921.4 RK 922.7 to RK 933.0	LSA	<ul style="list-style-type: none"> <li>See potential effect 1.1 of this table for mitigation regarding alteration of native vegetation.</li> <li>Supplemental vegetation and rare plant surveys will be conducted prior to construction. See Section 9.0 of Volume 5A for details.</li> <li>Conduct a pre-construction weed survey and record problem vegetation (designated weeds) infestations on and immediately adjacent to the construction right-of-way [Section 6.0] [Section 14.0 of Appendix C].</li> <li>Avoid environmentally sensitive areas, such as areas likely to have rare ecological communities. Where avoidance is impractical, develop site-specific mitigation measures in accordance with the Rare Ecological Community and Rare Plant Population Management Plan [Section 6.0 of Appendix C].</li> <li>Avoid creating new disturbances and use of treed areas or native grasslands when selecting ancillary sites, to the extent feasible [Section 12.0].</li> <li>Consider employing appropriate salvage, propagation and transplant techniques for component species [Section 6.0 of Appendix C].</li> <li>Retain sod and the vegetation mat on all lands if a competent sod layer exists. In these areas, grade only where safety considerations dictate in order to reduce disturbance to sod and the vegetation mat. Grading of well-sodded lands will not be permitted on level terrain [Section 8.2].</li> <li>Reduce the topsoil/root zone material salvage width at localized sensitive areas as shown on the Environmental Alignment Sheets or as directed by the Lead Environmental Inspector and Environmental Inspector(s) [Section 8.2].</li> </ul>

**TABLE 6.1-1 Cont'd**

Potential Effect	Pipeline Segment(s)	Spatial Boundary <sup>1</sup>	Key Recommendations/Mitigation Measures [EPP Reference] <sup>2</sup>
1.3 Loss or alteration of grasslands in the BG BGC Zone (cont'd)	See above	See above	<ul style="list-style-type: none"> <li>• Minimize trench width on native grasslands during trenching, to the extent feasible, in order to limit spoil storage requirements and sod disturbance [Section 8.3].</li> <li>• Backfill the trench as soon as practical [Section 8.4].</li> <li>• Conduct straw crimping on disturbed agricultural or native grassland soils where wind erosion may be problematic. Prior to spreading and crimping of straw, confirm that approval from the landowner or appropriate regulatory authority is in place, where warranted. Straw used will be obtained from: the landowner where the straw will be spread; a Certified seed grower; or fields or bales that have been inspected to be free of weeds [Section 8.6].</li> <li>• Employ a subsoiler plow (e.g., Paratiller) along segments of the construction right-of-way adjacent to the ditchline where topsoil salvage did not occur and subsoil compaction is severe. Do not use a subsoiler plow on native grasslands [Section 8.6].</li> <li>• Avoid scalping of the vegetation mat/sod layer during topsoil/root zone material replacement on cleared/ungrubbed riparian vegetation, native grasslands, hay and tame pasture. Use specialized equipment (e.g., clean-up bucket) that limits the risk of scalping during the final pass of topsoil/root zone material replacement and is approved by Trans Mountain's Environmental Inspector(s) [Section 8.6].</li> <li>• Determine the extent of disturbance to native grasslands (e.g., compaction, rutting) and prepare the surface prior to seeding as per discussions with Trans Mountain's Lead Environmental Inspector and Environmental Inspector(s) [Section 8.6].</li> <li>• Manage all problem vegetation along the construction right-of-way during all pipeline construction phases (i.e., pre-construction, construction, PCM) and the operational phase [Section 14.0 of Appendix C].</li> <li>• Limit vehicle travel through problem vegetation infested areas [Section 14.0 of Appendix C].</li> <li>• Refer to potential effect 3.1 of this table for mitigation regarding non-native or invasive species and herbicide use during construction and operations.</li> <li>• Monitor the effectiveness of revegetation efforts during the PCM of the construction rights-of-way. Conduct additional remedial work, where warranted.</li> </ul>
1.4 Loss or alteration of rare ecological communities	<p><u>Edmonton to Hinton</u>                      beaked sedge marsh (S2)                      RK 257.07                      beaked willow/red-osier dogwood (S3?)                      RK 100.92 to RK 100.98                      white birch/stiff club-moss woodland (S2?)                      RK 141.61 to RK 141.65                      RK 141.79 to RK 141.82                      RK 141.87 to RK 141.92  <u>Hargreaves to Darfield</u>                      common cattail marsh (S3, Blue)</p>	LSA	<ul style="list-style-type: none"> <li>• See potential effect 1.1 of this table for mitigation regarding alteration of native vegetation.</li> <li>• Adhere to applicable clearing guidelines for the protection of streams and wetlands provided in the Forest Practices Code, Riparian Management Area Guidebook in BC (AESRD 2012, BC MOF 1995), where riparian management zones (widths) are identified based on stream or wetland class [Section 8.1].</li> <li>• Protect vegetation mat from construction disturbance. Any temporary workspace located within the boundary of a wetland must be approved by Trans Mountain's Environmental Inspector(s) [Section 7.0].</li> <li>• Reduce the removal of vegetation in wetlands to the extent practical. Conduct ground level cutting, mowing or mulching or walking-down of wetland vegetation instead of grubbing. The method of removal of wetland vegetation is subject to approval by Trans Mountain [Section 7.0].</li> <li>• Narrow down the area of disturbance and protect the wetland by using fencing. Clearly mark the wetland boundaries using signage, flagging or fencing and limit traffic in the vicinity of the flagged/fenced off area [Section 7.0].</li> <li>• Salvage flagged or fenced live trees or shrubs from the banks of wetlands if requested by Trans Mountain's Environmental Inspector(s) or noted on the Environmental Alignment Sheets. Store salvaged trees and shrubs along the side of the construction right-of-way in a manner such that they do not dry out before replanting during final clean-up [Section 7.0].</li> <li>• Prohibit clearing of extra temporary workspace within the riparian buffer, only the trench and temporary workspace areas will be cleared. Ensure staging areas for watercourse/wetland crossing construction, grade/borrow areas for wetland ramps and spoil storage areas are located a minimum of 10 m from the banks of watercourses/wetland/lake boundaries. See additional clearing measures in Section 8.1 of the Pipeline EPP.</li> <li>• Pre-clear or pre-mow at wetlands with limited habitat potential outside of the migratory bird or species-specific timing window/restricted activity period to discourage nesting on the construction right-of-way if spring/summer construction is scheduled [Section 8.1].</li> <li>• Avoid pre-clearing or pre-mowing wetlands deemed to have high quality wildlife habitat, schedule construction at these wetlands outside of the migratory bird timing constraint/restricted activity period [Section 8.1].</li> </ul>

**TABLE 6.1-1 Cont'd**

Potential Effect	Pipeline Segment(s)	Spatial Boundary <sup>1</sup>	Key Recommendations/Mitigation Measures [EPP Reference] <sup>2</sup>
1.4 Loss or alteration of rare ecological communities (cont'd)	See above	See above	<ul style="list-style-type: none"> <li>• Restrict root grubbing in wet areas, where practical, to avoid creation of bog holes [Section 8.1].</li> <li>• Restrict root grubbing to the area located outside of the vegetated riparian buffer adjacent to watercourses, wetlands and lakes. Do not grub within vegetated buffers adjacent to watercourses, wetland and lakes except along the trench line and, where warranted, at vehicle crossing areas. See additional grubbing measures in Section 8.1 of the Pipeline EPP.</li> <li>• Allow wetlands to recover naturally (i.e., do not seed wetland areas) [Section 8.6].</li> <li>• Spread mulch to a depth of no more than 5 cm along the construction right-of-way in areas classified as treed peatlands [Section 8.6].</li> <li>• Replant salvaged trees/shrubs along the disturbed riparian margins of the wetland as directed by Trans Mountain's Environmental Inspector(s) and as identified in the resource-specific mitigation tables for vegetation and wetlands provided in Appendices J and K, respectively [Section 8.7.4].</li> <li>• Maintain drainage across the construction right-of-way during all phases of construction [Section 7.0].</li> <li>• Grade away from watercourses and wetlands to reduce the risk of introduction of soil and organic debris. Do not place windrowed or fill material in watercourses or wetlands during grading. Keep wetland soils separate from upland soils [Section 8.2].</li> <li>• Do not dewater any wetland. Water will not be permanently removed from any wetlands. Options for trench dewatering within wetlands will be discussed with the Trans Mountain's Lead Environmental Inspector and Environmental Inspector(s) and the appropriate regulatory authority in order to develop the appropriate plans [Section 8.3].</li> <li>• Ensure that wetlands are reclaimed to their pre-construction profile. Remove all corduroy and ramps through sloughs or wetlands, in all circumstances [Section 8.4].</li> <li>• Leave a trench crown during clean-up of peatlands and non-peat wetlands to allow for settlement of backfilled material within the trench [Section 8.6.3].</li> <li>• Re-establish surface drainage patterns in wetlands/peatlands to as close to the pre-construction contours as practical during reclamation. Leave frequent breaks in the trench crown in any areas identified as peatland to reduce the risk of ponding water and to re-establish drainage connectivity across the wetland [Section 8.6.3].</li> <li>• Excavate the trench with wide pad, low-ground-pressure equipment or operate standard equipment from mats [Section 8.7.4].</li> <li>• Install a temporary sediment barrier (e.g., sediment fences), where warranted, to eliminate the flow of sediment from spoil piles and disturbed areas into nearby waterbodies including wetlands (see Sediment Fence Drawing in Appendix R) [Section 8.7.1].</li> <li>• Implement the Wet/Thawed Soils Contingency Plan (see Appendix B) during wet/thawed soil conditions when wet or thawed soils are encountered during construction [Section 8.2].</li> <li>• Avoid rutting and admixing of wetland soils during non-frozen soil conditions. Install appropriate ramps using mats (e.g., swamp mats) or geotextile and spoil ramps [Section 8.7.4].</li> <li>• Do not dispose of upland woody debris in mineral wetland [Section 8.1].</li> <li>• Salvage surface material in unsaturated wetlands, giving extra attention to maintaining dormant root stocks for replacement, where feasible. Salvage a maximum of 40 cm of surface soil if the peat is deeper than 40 cm or to the depth of colour change where there is less than 40 cm of surface material. Ensure a minimum of 15 cm of surface and subsoil is stripped if peat is less than 15 cm [Section 8.2].</li> <li>• Salvage the upper layer of root zone material (maximum of 0.5 m) over the trench area and retain for use in capping the trench following backfilling [Section 8.7.4].</li> <li>• Backfill peat and mineral soils in the appropriate order such that peat material rather than the underlying mineral soils remain at the surface so that future drainage through the shallow peat material is not impeded [Section 8.7.4].</li> <li>• Replace any remaining salvaged upper soil (root zone) material over the trench area. Reclaim the wetland to as close as feasible to its pre-construction profile and ensure no permanent trench crown is left following trench crown subsidence [Section 8.7.4].</li> </ul>

**TABLE 6.1-1 Cont'd**

Potential Effect	Pipeline Segment(s)	Spatial Boundary <sup>1</sup>	Key Recommendations/Mitigation Measures [EPP Reference] <sup>2</sup>
1.4 Loss or alteration of rare ecological communities (cont'd)	RK 728.75 to RK 728.77 lodgepole pine/velvet-leaved blueberry/clad lichens (S2S3, Blue) RK 509.4 RK 509.8 to RK 509.85 RK 510.49 to RK 510.59 RK 523.36 to RK 523.53 RK 534.83 to RK 535.14 RK 546.68 to RK 546.86 western redcedar - paper birch/oak fern (S2S3, Blue) RK 749.71 to RK 749.81 <u>Black Pines to Hope</u> amabilis fir - western redcedar/devil's club (S3, Blue) RK 1007.91 RK 1013.19 big sagebrush/bluebunch wheatgrass (S2, Red) RK 927.29 to RK 927.54 hybrid spruce species – Douglas-fir/subalpine fir (unique community) RK 978.12 narrow-leaf willow shrubland (S2, Red) RK 847.11 to RK 847.17 RK 847.26 to RK 847.27 <u>Hope to Burnaby</u> black cottonwood –red alder/salmonberry (S3, Blue) RK 1142.54 to RK 1142.76 RK 1145.62 to RK 1145.64 common cattail marsh (S3, Blue) RK 1116.58 to RK 1116.61 western redcedar – Sitka spruce/skunk cabbage (S3?, Blue) RK 1142.9 to RK 1143.03	LSA	<ul style="list-style-type: none"> <li>• Supplemental vegetation and rare plant surveys will be conducted prior to construction.</li> <li>• See Section 9.0 of Volume 5A for details.</li> <li>• Avoid environmentally sensitive areas, such as areas likely to have rare plant species or rare ecological communities. Where avoidance is impractical, develop site-specific mitigation measures in accordance with the Rare Ecological Community and Rare Plant Population Management Plan [Section 6.0 of Appendix C].</li> <li>• Conduct native seed collection for use in revegetation efforts at the site [Section 6.0 of Appendix C].</li> <li>• Consider employing appropriate salvage, propagation and transplant techniques for component species [Section 6.0 of Appendix C].</li> <li>• If previously unidentified occurrences of vegetation communities of concern are found during supplemental rare plant surveys, mitigation will be determined using the Rare Ecological Community and Rare Plant Population Management Plan [Section 6.0 of Appendix C].</li> <li>• Site-specific mitigation will include avoidance, narrowing the construction right-of-way, fencing or protecting [Section 6.0 of Appendix C, Appendix J].</li> <li>• Flag or fence-off resource-specific environmental features (e.g., rare plant species, rare ecological communities) prior to commencing construction in the vicinity of the resource site. See additional mitigation in Section 6.0 of the Pipeline EPP (Volume 6B).</li> <li>• Implement the resource-specific mitigation measures associated with vascular and non-vascular plant species of concern as well as rare and unique plant communities on or adjacent to the staked construction boundaries as outlined in the environmental resource-specific mitigation tables for rare plant/rare ecological communities provided in Appendix J and as shown in the Environmental Alignment Sheets [Section 6.0].</li> <li>• Suspend activity if previously unidentified rare ecological communities are found on or adjacent to the construction right-of-way. Implement the Rare Ecological Communities or Rare Plant or Species Discovery Contingency Plan [Section 7.0 of Appendix B].</li> <li>• Fence-off the area where the rare plant community is traversed [Narrow Down Fencing Drawing in Appendix R] [Section 6.0 of Appendix C].</li> <li>• Water down construction sites and access roads, when warranted, to reduce or avoid the potential for dust emissions. Increase the frequency of watering roads and sites during periods of high risk (e.g., high winds). Implement additional dust abatement measures (e.g., covering topsoil windrows, installing sediment fences, applying a tackifier) will be implemented, when warranted, during clearing and construction activities. See additional measures to control dust in Section 8.2 of the Pipeline EPP (Volume 6B).</li> <li>• Place erosion control blankets or coir matting [Erosion Control Matting Drawing in Appendix R], woody slash or log diversions [Rollback Drawing in Appendix R] along the right-of-way on erodible soils or wind exposed sites to provide micro-habitat and support plant establishment [Brush Wind Barrier Drawing and Staked Logs for Erosion Control Drawing in Appendix R] [Section 7.0 of Appendix C].</li> <li>• Conduct straw crimping on disturbed agricultural or native grassland soils where wind erosion may be problematic [Section 8.6].</li> <li>• Seed disturbed erodible soils on non-cultivated land with a mixture of approved agronomic or native seed and cover crop seed such as fall rye if seeding in late summer or annual oats if seeding in the winter, spring or early summer [Section 8.6].</li> <li>• Implement plant protection measures (e.g., soil mounds and berms, wind fencing and rollback) that work to minimize environmental stresses (i.e., wind exposure, low soil moisture stress [desiccation]), to the extent feasible [Section 7.0 of Appendix C].</li> <li>• Recontour the landscape to pre-construction conditions [Section 7.0 of Appendix C].</li> <li>• Restrict the application of herbicide within 30 m of known rare plant populations or rare ecological communities. Spot spraying, wicking, mowing or hand-picking are acceptable weed control measures in proximity to rare plants, rare lichens and vegetation communities of concern [Section 7.0].</li> </ul>

**TABLE 6.1-1 Cont'd**

Potential Effect	Pipeline Segment(s)	Spatial Boundary <sup>1</sup>	Key Recommendations/Mitigation Measures [EPP Reference] <sup>2</sup>
1.4 Loss or alteration of rare ecological communities (cont'd)	See above	See above	<ul style="list-style-type: none"> <li>Monitor the effectiveness of revegetation efforts during the PCM of the construction rights-of-way. Conduct additional remedial work, where warranted.</li> </ul>
2.1 Loss or alteration of rare plant and/or lichen occurrences	All (See Table J-1 of Appendix J of the Pipeline EPP [ Volume 6B] for detailed locations)	LSA	<ul style="list-style-type: none"> <li>Supplemental vegetation and rare plant surveys will be conducted prior to construction in 2014. See Section 9.0 of Volume 5A for details.</li> <li>See potential effect 1.4 of this table for mitigation applicable to the loss or alteration of rare ecological communities.</li> <li>Flag or fence-off resource-specific environmental features (e.g., rare plant species, rare ecological communities) prior to commencing construction in the vicinity of the resource site. See additional measures in Section 6.0 of the Pipeline EPP (Volume 6B).</li> <li>Apply only water or non-toxic and non-persistent chemical products as approved to access roads for dust control at park locations or sensitive areas including agricultural crop production areas, especially berries [Section 9.0].</li> <li>Water down construction sites and access roads, when warranted, to reduce or avoid the potential for dust emissions. Increase the frequency of watering roads and sites during periods of high risk (e.g., high winds). Implement additional dust abatement measures (e.g., covering topsoil windrows, installing sediment fences, applying a tackifier) will be implemented, when warranted, during clearing and construction activities. See additional measures to control dust in Section 8.2 of the Pipeline EPP (Volume 6B).</li> <li>Recontour the landscape to pre-construction conditions [Section 7.0 of Appendix C].</li> <li>Monitor the effectiveness of revegetation efforts during the PCM of the construction rights-of-way. Conduct additional remedial work, where warranted.</li> </ul>
3.1 Weed introduction and spread	All	RSA	<ul style="list-style-type: none"> <li>Conduct a pre-construction weed survey and record problem vegetation (designated weeds) infestations on and immediately adjacent to the construction right-of-way [Section 6.0] [Section 14.0 of Appendix C].</li> <li>Implement weed management (i.e., using proper application of chemical, mechanical or manual measures, or a combination of all) at locations identified within the pre-construction weed survey to a level that is consistent with weed management observed adjacent to the eventual construction right-of-way to reduce the potential for weed infestations following construction [Section 6.0]. Also refer to the Weed and Vegetation Management Plan [Section 14.0 of Appendix C].</li> <li>Ensure equipment arrives at all construction sites clean and free of soil or vegetative debris. Do not allow any equipment arriving in a dirty condition on site until it has been cleaned [Section 7.0].</li> <li>Power wash and misting stations will be established, where required, to clean equipment used during clearing and topsoil handling activities [Appendix F]. Basic shovel and sweep cleaning will be conducted on clearing and topsoil handling equipment before moving equipment off of cultivated fields. In addition, shovel and compressed air cleaning stations for topsoil handling equipment will be established at selected locations to prevent the spread of weeds [Appendix J] [Section 5.2].</li> <li>Restrict all vehicular traffic to the approved and staked construction right-of-way, workspace and access roads [Section 6.0].</li> <li>Monitor the topsoil and other soil piles for weed growth frequently during the growing season. Direct the Contractor when warranted to take proactive measures to control weed growth [Section 7.0].</li> <li>Consider placing mats (i.e., construction mats or swamp mats) over infested areas to reduce construction equipment transporting weed or plant material. Where mats are used, ensure they are free of soil, vegetation and debris prior to removing from the site [Section 7.0].</li> <li>Consider salvaging topsoil from the full construction right-of-way during non-frozen conditions if localized weed infestations are encountered, as outlined in the Weed and Vegetation Management Plan [Section 7.0] [Section 14.0 of Appendix C].</li> <li>Clean equipment (i.e., shovel and sweep, pressurized water or compressed air) involved in topsoil/root zone material handling at weed-infested sites prior to leaving the location unless full right-of-way topsoil/root zone material salvage has been conducted. Clean equipment involved in topsoil handling at weed-infested sites prior to leaving the location [Section 7.0].</li> </ul>

**TABLE 6.1-1 Cont'd**

Potential Effect	Pipeline Segment(s)	Spatial Boundary <sup>1</sup>	Key Recommendations/Mitigation Measures [EPP Reference] <sup>2</sup>
3.1 Weed introduction and spread (cont'd)	See above	See above	<ul style="list-style-type: none"> <li>• Conduct straw crimping on disturbed agricultural or native grassland soils where wind erosion may be problematic. Prior to spreading and crimping of straw, confirm that approval from the landowner or appropriate regulatory authority is in place, where warranted. Straw used will be obtained from: the landowner where the straw will be spread; a Certified seed grower; or fields or bales that have been inspected to be free of weeds [Section 8.6].</li> <li>• Use only Certified Canada No. 1 or the best available agronomic seed. For native seed, the highest seed grade available will be obtained. Do not accept seed lots that contain any Prohibited Noxious or Noxious weeds as identified in the Certificate of Analysis. Retain the Certificates of Analysis obtained for both agronomic and native seed for future documentation. The Certificates of Analysis will be presented to the landowner/Crown land authority upon request [Section 8.6].</li> <li>• Limit vehicle travel through problem vegetation infested areas [Section 14.0 of Appendix C].</li> <li>• The Weed and Vegetation Management Plan consists of vegetation management measures to be implemented in the short-term, during the pre-construction, construction and PCM phases of Project construction and the long-term, during the regular operations and maintenance phase of the Project. Vegetation management measures to be implemented during both short-term and long-term periods [Section 14.0 of Appendix C].</li> <li>• The use of herbicides for problem vegetation management along the construction right-of-way during construction and operations within the province of Alberta will be conducted in accordance with the Environmental Code of Practice for Pesticides as part of the Alberta Environmental Protection and Enhancement Act, and in BC will be conducted in accordance with the Integrated Pest Management Regulation of BC as part of the BC Integrated Pest Management Act [Section 14.0 of Appendix C].</li> <li>• Monitor the effectiveness of revegetation efforts during the PCM of the construction rights-of-way. Conduct additional remedial work, where warranted.</li> <li>• During regular maintenance and operations activities, incidental ground inspections for problem vegetation along the construction right-of-way may be conducted to determine the extent (percent cover, composition, distribution, location of infestations, etc.) of problem vegetation (i.e., presence of mature brush and trees, and weeds). Areas of new infestations, recommended treatment sites and adjacent landowner concerns will also be identified and documented during monitoring. To assist monitoring efforts, the baseline data collected during the pre-construction weed survey and the results of the PCM Program will assist in establishing thresholds and determining if objectives of the Weed and Vegetation Management Plan are being met [Section 14.0 of Appendix C].</li> </ul>

- Notes:
- 1 LSA = Vegetation LSA, RSA = Vegetation RSA.
  - 2 Detailed mitigation measures are outlined in the Pipeline EPP (Volume 6B).
  - 3 All locations are approximations based on TEM.

### 6.1.3 Traditional Ecological Knowledge

A comprehensive review of the recommended mitigation measures provided in Table 6.1-1 and of all the issues raised by participating Aboriginal communities was conducted with each community during the field surveys and during results review (Section 5.0). Concerns related to vegetation resources were addressed by the proposed mitigation measures discussed. Participants have not recommended any mitigation strategies related to vegetation resources additional to those described in the Project-specific EPPs to be implemented for the Project.

### 6.1.4 Post-Construction Monitoring

The objective of the vegetation monitoring component of the PCM is to collect sufficient information to determine the effectiveness of mitigation, identify need for adaptive measures, and detect changes in vegetation communities resulting from the Project. The vegetation monitoring will use baseline data, collected prior to construction, as a basis for comparison of construction and PCM data. PCM will be

conducted at intervals over a 5 year period (e.g., years 1, 3 and 5 following completion of reclamation). Vegetation PCM will be conducted as per NEB Certificate Conditions.

The vegetation PCM will include the following information.

- A review of mitigation measures implemented and issues identified by the Environmental Inspector(s) during construction and recommendations to address any unresolved issues.
- Details on PCM protocols specific to vegetation. Locations selected for PCM will be based in part on consultation with regulators and the results of the pre-construction field surveys. Likely locations for monitoring include: rare plant and lichen species occurrences; rare ecological community locations; and high value habitats (e.g., select wetlands, sensitive areas, locations where there is high potential for vegetation species at risk). Appropriately timed vegetation surveys, similar to those conducted during pre-construction surveys, will be conducted at these locations.

Vegetation monitoring will be designed to detect changes in vegetation community composition, rare plant or lichen occurrences, rare ecological community composition and relative non-native or invasive species abundance compared to pre-construction conditions. An adaptive management component will be included in the vegetation PCM 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.

## **6.2 Pump Stations**

Activities that require clearing of land have the potential to affect vegetation. The Project includes five pump station locations that will require clearing of previously undisturbed land (*i.e.*, Gainford, Hinton, Rearguard, Black Pines and Kingsvale). The Gainford, Hinton, Rearguard and Kingsvale pump stations will require minimal clearing of existing trees and are located adjacent to several other disturbances such as roads and existing rights-of-way. The Black Pines and Kingsvale pump stations will have an additional associated power line which will require clearing and, therefore, have the potential to affect vegetation. The introduction and spread of weeds has the potential to occur during any anthropogenic disturbance and, therefore, is considered with all pump stations.

### **6.2.1 Supplemental Studies**

A comprehensive vegetation program was conducted in 2012 and 2013, including TEM field verification and vegetation surveys. For this report, where access was not available, desktop studies, literature reviews, information available as a result of 60 years of operation and data gathered from adjacent lands as well as professional judgement were used to make predictions. Based on the above, and the fact that the effects of facilities and available mitigation and environmental protection measures are well-known, TERA is confident in the predictions about the potential effects of construction, operation and maintenance activities. In order to confirm the effects assessment conclusions and gather site-specific information for the implementation of mitigation from the Project-specific EPPs, additional studies will be conducted on those areas where access was not available.

The supplemental rare plant survey methodology will be the same as studies completed to date and is based on the guidelines described in the ANPC *Guidelines for Rare Plant Surveys in Alberta* (ANPC 2012) and the BC CDCs and E-Flora BCs Protocols for Rare Plant Surveys (Penny and Klinkenberg 2012), and is provided in Section 3.6. Specific information collected will include plant and lichen species, incidental weed observations, UTM coordinates and species distributions.

Supplemental vegetation surveys will be completed at pump station locations and associated facilities that warrant new lands or rights-of-way.

### **6.2.2 General Recommendations**

Potential effects associated with the construction and operations of the proposed pipeline on vegetation indicators are listed in Table 6.2-1. These interactions are based on the results of the: literature review; desktop analysis; field work; TEM; TEK; engagement with Aboriginal communities, landowners, regulatory



authorities and other stakeholders (Section 2.0); and the professional experience of the assessment team.

A summary of key mitigation measures selected to reduce effects to vegetation resources is provided in Table 6.2-1. These measures were developed with the standards and guidelines as outlined in Section 6.1.2.

The mitigation measures presented in Table 6.2-1 have either already been incorporated into Project planning and/or are otherwise recommended as site-specific measures to reduce potential environmental effects to vegetation resources during construction and operations of the Project. Additional mitigation measures are provided in the Facilities EPP (Volume 6C). The recommended mitigation measures provided were principally developed in accordance with industry and regulatory guidelines, including relevant recommendations in land use planning documents, as well as consultation with provincial regulatory authorities (Table 2.2-1).

**TABLE 6.2-1**

**POTENTIAL EFFECTS AND RECOMMENDED  
 MITIGATION MEASURES - PUMP STATION CONSTRUCTION AND OPERATION**

Potential Effect	Pump Station Facilities	Spatial Boundary <sup>1</sup>	Key Recommendations/Mitigation Measures [EPP Reference] <sup>2</sup>
<b>1. Vegetation Indicator – Vegetation Communities of Concern</b>			
1.1 Alteration of native vegetation	Gainford Hinton Rearguard Black Pines (including power line) Kingsvale (including power line)	Footprint	<ul style="list-style-type: none"> <li>The proposed pump station facilities have been sited to utilize existing disturbances as much as practical and the Footprint will be kept to a minimum to reduce loss of native vegetation to the maximum extent feasible.</li> <li>Confine all pre-clearing/mowing and general clearing activities within the staked/flagged facility construction boundaries. Adhere to clearing restrictions associated with special environmental features and buffer areas in addition to those areas outlined in the resource-specific mitigation tables [Appendices E to Q] [Section 8.1].</li> <li>Use hand clearing methods where directed by the Environmental Inspector to avoid or reduce disturbance to the ground surface on sensitive terrain [Section 8.1].</li> <li>Restrict root grubbing in wet areas, where practical, to avoid creation of bog holes [Section 8.1].</li> <li>Install temporary erosion control on exposed moderately to highly erodible soils where there is potential for water or wind erosion prior to re-establishment of vegetation [Section 8.4]</li> <li>Seed the topsoil/root zone material immediately with a cereal grass cover crop species [see Section 8.4], unless otherwise directed by the Lead Activity Inspector and the Environmental Inspector, to reduce the risk of erosion [Section 11].</li> <li>Schedule construction on native grasslands to occur when ground conditions are dry, where feasible [Section 11.0].</li> </ul>
1.2 Alteration of rare ecological communities	Gainford Hinton Rearguard Black Pines (including power line) Kingsvale (including power line)	LSA	<ul style="list-style-type: none"> <li>Vegetation surveys were conducted at Gainford, Hinton, Black Pines, and Kingsvale pump stations. See Section 9.0 of Volume 5A for details regarding supplemental surveys.</li> <li>See potential effect 1.1 of this table for mitigation regarding alteration of native vegetation.</li> <li>Ensure temporary workspace does not encroach within vegetated buffers at waterbodies or wetlands unless approved by the appropriate regulatory authority [Section 6.0].</li> <li>Narrow down the proposed area of disturbance and protect the wetland by using fencing. Clearly mark the wetland boundaries using signage, flagging or fencing and limit traffic in the vicinity of the flagged/fenced off area, if feasible [Section 7.0].</li> <li>Protect vegetation mat from construction disturbance, to the extent feasible. Any temporary workspace located within the boundary of a wetland must be approved by Trans Mountain's Environmental Inspector(s) [Section 7.0].</li> <li>Locate all additional work areas (such as graded areas or additional topsoil/root zone material storage areas) a minimum of 10 m from wetland boundaries except where adjacent upland is cultivated or hay land, or disturbed land, unless otherwise approved. Ensure landowner/land authority approvals are in place for all additional temporary workspace prior to use [Section 7.0].</li> <li>Conduct ground level cutting, mowing and/or mulching of wetland vegetation instead of grubbing. The method of removal of wetland vegetation is subject to approval by Trans Mountain's Environmental Inspector(s) [Section 7.0].</li> <li>Prevent ground disturbance by using a protective layer such as frost packing, snow, ice or matting between wetland vegetation mat/seedbed and construction equipment [Section 7.0].</li> <li>Allow wetlands to recover naturally (<i>i.e.</i>, do not seed wetland areas) [Section 7.0].</li> </ul>

**TABLE 6.2-1 Cont'd**

Potential Effect	Pump Station Facilities	Spatial Boundary <sup>1</sup>	Key Recommendations/Mitigation Measures [EPP Reference] <sup>2</sup>
1.2 Alteration of rare ecological communities (cont'd)	See above	See above	<ul style="list-style-type: none"> <li>• Restrict root grubbing in wet areas, where practical, to avoid creation of bog holes [Section 8.1].</li> <li>• Align new access roads or extensions of existing roads to avoid wetlands and peatlands, to the extent feasible [Section 9.0].</li> <li>• Maintain sediment fences in place at non-peat wetland boundaries, where warranted, until a vegetation cover has stabilized the adjacent construction areas [Section 7.0].</li> <li>• Adhere to the measures outlined in the Wet/Thawed Soils Contingency Plan (see Appendix B) during wet/thawed soil conditions [Section 7.0 and 8.2].</li> <li>• In consultation with the Environmental Inspector, postpone construction, suspend equipment travel or utilize construction alternatives in the event of wet or thawed soils in order to reduce terrain disturbance and soil structure damage [Section 7.0].</li> <li>• Install erosion and sediment control structures and materials (e.g., subsoil berm or sediment fencing) and implement, as warranted, erosion control measures outlined in the Soil Erosion and Sediment Control Contingency Plan (see Appendix B) to ensure that sediments in surface water draining from the facility site do not adversely affect the surrounding terrain or waterbodies. In particular, control erosion on grade cuts adjacent to the development zone at facility sites [Section 7.0].</li> <li>• Ensure that hydrovac slurry will not be pumped into or allowed to flow into a waterbody [Section 8.1].</li> <li>• Do not apply dust control suppressants to roads during windy conditions or within 300 m of a stream or waterbody [Section 9.0].</li> <li>• Store mixtures of snow and soil in a manner that prevents sedimentation of waterbodies when the snow melts [Section 11.1].</li> <li>• Isolate work areas in the vicinity of waterbodies to ensure water does not experience an increase in alkalinity beyond ambient conditions during construction [Section 11.2].</li> <li>• Upon discovery of a rare ecological community, refer to the mitigation provided in Rare Ecological Community and Rare Plant Population Management Plan [Appendix C, Section 4.0].</li> <li>• Review mitigation measures of rare plants/rare ecological communities with Trans Mountain's Environmental Inspector(s) in advance of construction to ensure there is full understanding of the procedures involved [Section 7.0].</li> <li>• Refer to environmental resource-specific mitigation tables for rare plants/rare ecological communities provided in Appendix J of the Facilities EPP (Volume 6C) and as shown on the Facility Environmental Drawings.</li> </ul>
<b>2. Vegetation Indicator – Plant and Lichen Species of Concern</b>			
2.1 Loss or alteration of rare plant and/or lichen occurrences	Gainford Hinton Rearguard Black Pines (including power line) Kingsvale (including power line)	LSA	<ul style="list-style-type: none"> <li>• Vegetation surveys were conducted at Gainford, Hinton, Black Pines, and Kingsvale pump stations. See Section 9.0 of Volume 5A for details regarding supplemental surveys.</li> <li>• See potential effect 1.1 of this table for mitigation regarding alteration of native vegetation.</li> <li>• Flag or fence-off resource-specific environmental features (e.g., rare plant species, rare ecological communities) prior to commencing construction in the vicinity of the resource site [Section 6.0]. See additional measures in Section 8.6 of the Pipeline EPP (Volume 6B).</li> <li>• Water down construction sites and access roads, when warranted, to reduce or avoid the potential for dust emissions. Increase the frequency of watering roads and sites during periods of high risk (e.g., high winds). Implement additional dust abatement measures (e.g., covering topsoil windrows, installing sediment fences, applying a tackifier) will be implemented, when warranted, during clearing and construction activities. See additional measures to control dust in Section 8.1 of the Facilities EPP (Volume 6C).</li> <li>• Recontour the landscape to pre-construction conditions during decommissioning [Section 6.0 of Appendix C].</li> </ul>

**TABLE 6.2-1 Cont'd**

Potential Effect	Pump Station Facilities	Spatial Boundary <sup>1</sup>	Key Recommendations/Mitigation Measures [EPP Reference] <sup>2</sup>
<b>3. Vegetation Indicator – Presence of Infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern</b>			
3.1 Weed introduction and spread	All	RSA	<ul style="list-style-type: none"> <li>Follow recommendations made in the pre-construction weed survey to limit the risk of spreading weed seeds [Section 6.0].</li> <li>Implement weed management (i.e., using proper application of herbicides, mowing, or a combination of both) at locations identified within the pre-construction weed survey to a level that is consistent with weed management observed adjacent to the facility site to reduce the potential for weed infestations following construction. Refer to the Weed and Vegetation Management Plan provided in Appendix C of the Facilities EPP (Volume 6C) [Section 6.0].</li> <li>Ensure equipment arrives at all construction sites clean and free of soil or vegetative debris. Inspect and identify equipment deemed to be in appropriate condition with a suitable marker, such as a sticker. Any equipment arriving in a dirty condition will not be allowed on-site until it has been cleaned [Section 7.0].</li> <li>Consider implementing the Weed and Vegetation Management Plan as necessary (see Appendix C of the Facilities EPP [Volume 6C]) [Section 7.0].</li> </ul>

- Notes:**
- 1 LSA = Vegetation LSA, RSA = Vegetation RSA.
  - 2 Detailed mitigation measures are outlined in the Facilities EPP (Volume 6C).

### 6.2.3 Traditional Ecological Knowledge

A comprehensive review of the recommended mitigation measures provided in Table 6.2-1 and of all the issues raised by participating Aboriginal communities was conducted with each community during the field surveys and during results review (Section 5.0). Concerns related to specific pump station facilities were not explicitly provided and instead were considered as components of the adjacent pipeline sections. Concerns related to vegetation resources were addressed by the proposed mitigation measures discussed. Participants have not recommended any mitigation strategies related to vegetation resources additional to those described in the Project-specific EPPs to be implemented for the Project.

## 6.3 Terminals

Activities that require clearing of previously undisturbed lands have the potential to affect native vegetation. Project activities at the Edmonton Terminal and the Burnaby Terminal will not involve clearing of previously undisturbed lands and, therefore, are not expected to have an effect on native vegetation. Project activities at the Sumas Terminal will require clearing of undisturbed lands and, therefore, have the potential to affect native vegetation. The introduction and spread of weeds has the potential to occur during any anthropogenic disturbance.

### 6.3.1 Supplemental Studies

A comprehensive vegetation program was conducted in 2012 and 2013, including TEM field verification and vegetation surveys. For this report, where access was not available, desktop studies, literature reviews, information available as a result of 60 years of operation and data gathered from adjacent lands as well as professional judgement were used to make predictions. Based on the above, and the fact that the effects of facilities and available mitigation and environmental protection measures are well-known, TERA is confident in the predictions about the potential effects of construction, operation and maintenance activities. In order to confirm the effects assessment conclusions and gather site-specific information for the implementation of mitigation from the Project-specific EPPs, additional studies will be conducted on those areas where access was not available.

The supplemental rare plant survey methodology is based on the guidelines described in the ANPC *Guidelines for Rare Plant Surveys in Alberta* (ANPC 2012) and the BC CDCs and E-Flora BC's Protocols for Rare Plant Surveys (Penny and Klinkenberg 2012), and is provided in Section 3.6. Specific information collected will include plant and lichen species, incidental weed observations, UTM coordinates and species distributions.

Supplemental vegetation surveys will be completed at terminal locations that warrant new lands or rights-of-way.

### 6.3.2 General Recommendations

Potential effects associated with the construction and operations of the proposed pipeline on vegetation indicators are listed in Table 6.3-1.

These measures were developed with the standards and guidelines as outlined in Section 6.1.2. The mitigation measures presented in Table 6.3-1 have either already been incorporated into Project planning and/or are otherwise recommended as site-specific measures to reduce potential environmental effects on vegetation resources during construction and operations of the Project. Additional mitigation measures are provided in the Facilities EPP (Volume 6C).

**TABLE 6.3-1**

#### POTENTIAL EFFECTS AND RECOMMENDED MITIGATION MEASURES - TERMINAL LOCATIONS

Potential Effect	Terminal	Spatial Boundary <sup>1</sup>	Key Recommendations/Mitigation Measures [EPP Reference] <sup>2</sup>
<b>1. Vegetation Indicator – Vegetation Communities of Concern</b>			
1.1 Loss or alteration of native vegetation	Sumas	Footprint	See recommended mitigation measures outlined in Table 6.2-2.
1.2 Loss or alteration of rare ecological communities	Sumas	LSA	See recommended mitigation measures outlined in Table 6.2-2.
<b>2. Vegetation Indicator – Plant and Lichen Species of Concern</b>			
2.1 Loss or alteration of rare plant or lichen occurrences	Sumas	LSA	See recommended mitigation measures outlined in Table 6.2-2.
<b>3. Vegetation Indicator – Presence of Infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern</b>			
3.1 Weed introduction and spread	All	RSA	See recommended mitigation measures outlined in Table 6.2-2.

- Notes:**
- 1 LSA = Vegetation LSA, RSA = Vegetation RSA.
  - 2 Detailed mitigation measures are outlined in the Facilities EPP (Volume 6C).

### 6.3.3 Traditional Ecological Knowledge

A comprehensive review of the recommended mitigation measures provided in Table 6.3-1 and of all the issues raised by participating Aboriginal communities was conducted with each community during the field surveys and during results review (Section 5.0). Concerns related to specific terminal locations were not explicitly provided, and instead were considered as components of the adjacent pipeline sections. Concerns related to vegetation resources were addressed by the proposed mitigation measures discussed. Participants have not recommended any mitigation strategies related to vegetation resources additional to those described in the Project-specific EPPs to be implemented for the Project.

## 6.4 Westridge Marine Terminal

Activities that require clearing of previously undisturbed lands have the potential to affect native vegetation. Project activities at the Westridge Marine Terminal will not involve clearing of previously undisturbed lands and, therefore, are not expected to have an effect on native vegetation. The introduction and spread of weeds has the potential to occur during any anthropogenic disturbance.

### 6.4.1 Supplemental Studies

Since no clearing of native vegetation will occur at the Westridge Marine Terminal, no supplemental studies are planned for this location.

### 6.4.2 General Recommendations

Potential effects associated with the construction and operations of the proposed pipeline on vegetation indicators are listed in Table 6.4-1.

A summary of key mitigation measures selected to reduce effects to vegetation resources is provided in Table 6.4-1. These measures were developed with the standards and guidelines as outlined in Section 6.1.2.

The mitigation measures presented in Table 6.4-1 have either already been incorporated into Project planning and/or are otherwise recommended as site-specific measures to reduce potential environmental effects to vegetation resources during construction and operations of the Project. Additional mitigation measures are provided in the Westridge Marine Terminal EPP (Volume 6D).

**TABLE 6.4.1**  
**POTENTIAL EFFECTS AND RECOMMENDED**  
**MITIGATION MEASURES - WESTRIDGE MARINE TERMINAL EXPANSION**

Potential Effect	Spatial Boundary <sup>1</sup>	Key Recommendations/Mitigation Measures [EPP Reference] <sup>2</sup>
<b>1. Vegetation Indicator – Presence of Infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern</b>		
1.1 Weed introduction and spread	RSA	See recommended mitigation measures outlined in Table 6.2-2.

- Notes:**
- 1 LSA = Vegetation LSA, RSA = Vegetation RSA.
  - 2 Detailed mitigation measures are outlined in the Westridge Marine Terminal EPP (Volume 6D).

### 6.4.3 Traditional Ecological Knowledge

A comprehensive review of the recommended mitigation measures provided in Table 6.4-1 and of all the issues raised by participating Aboriginal communities was conducted with each community during the field surveys and during results review (Section 5.0). Concerns related to the Westridge Marine Terminal were not explicitly provided, and instead were considered as a component of the adjacent pipeline section. Concerns related to vegetation resources were addressed by the proposed mitigation measures discussed. Participants have not recommended any mitigation strategies related to vegetation resources additional to those described in the Project-specific EPPs to be implemented for the Project.

### 6.5 Terrestrial Ecosystem Mapping

TEM has been completed for 73.2% of the total Vegetation RSA in Alberta, amounting to 49,502 ha within four Natural Subregions. TEM has been completed for 81.6% of the total Vegetation RSA in BC, amounting to 110,191 ha within 27 BGC subzone variants. A summary of TEM results to date and field work conducted within these areas is provided in Table 4.1 of Appendix C. A supplemental filing will provide results for TEM (including field work, which was completed in 2012 and 2013) in an additional two Natural Subregions (the Upper Foothills and the Montane) and three BCG subzone variants (IMAunp, MSdm2 and MSmw1), as well as additional areas within some of the Natural Subregions and BGC subzone variants included in Appendix C that form part of the proposed pipeline corridor refinement areas added on August 23, 2013. Some polygons in areas where TEM was completed had to be deleted from the dataset due to attribution which requires changes. These polygons will be re-attributed and also added to the supplemental filing.summary

## 7.0 SUMMARY

The vegetation program conducted for the Project was comprehensive. The following provides a summary of the vegetation and TEM surveys conducted for the proposed pipeline corridor and facilities.

- A desktop review of federal and provincial rare plant, rare lichen and rare ecological communities with the potential to occur along the entire proposed pipeline corridor and at facilities was conducted.
- 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.
- The 2012 and 2013 surveys were conducted where land access was available and focused on the proposed pipeline segments and the new or existing facilities that require clearing of native vegetation.
- In Alberta, a total of 52 km (15.2% of the Alberta component; 5.2% of the total proposed pipeline corridor) of the proposed pipeline corridor and two facilities were surveyed. Field surveys resulted in the observation of 5 rare ecological community occurrences and 53 rare plant and lichen species were observed, all along the proposed pipeline corridor. Weed species, including Prohibited Noxious and Noxious, were also observed ranging from low to high abundance along the proposed pipeline corridor.
- TEM was conducted for approximately 49,502 ha of the Vegetation RSA in Alberta and identified 87 unique ecosite phases within 4 natural subregions. The most affected vegetation communities in Alberta were the marsh ecosite in the Lower Foothills Natural Subregion (LFn) and the Labrador tea-mesic ecosite in the Central Mixedwood Natural Subregion (CMWc).
- In BC, a total of 211 km (32.4% of the total BC component; 21.3% of the total proposed pipeline corridor) and two facilities were surveyed. Field surveys resulted in the observation of 49 potential rare ecological community occurrences and 124 rare plant and lichen occurrences. All but one occurred along the proposed pipeline corridor, with the exception occurring along the Black Pines power line. In addition, one observation along the proposed pipeline corridor included a potential SARA-listed species, Mexican mosquito fern, which will require confirmation during 2014 surveys if it is in proximity to the construction footprint. Weed species, including provincially and regionally Noxious, were also observed ranging from low to high abundance along the proposed pipeline corridor.
- TEM was conducted for approximately 110,270 ha of the Vegetation RSA in BC and identified 188 unique site series within 27 BGC variants. In BC, the most affected vegetation communities were the MacLennan Dry Hot SBS (SBSdh1) variant on the Hargreaves to Darfield segment, the Moist Warm ESSF (ESSFmw) variant on the Black Pines to Hope segment and the Southern Dry Submaritime CWH (CWHds1) and Eastern Very Dry Maritime CWH (CWHxm1) variants for the Hope to Burnaby segment.

Effects on vegetation due to the proposed pipeline corridor, facilities and power lines construction will be reduced by implementing the Rare Ecological Community and Rare Plant Population Management Plan (Section 6.0 of Appendix C of the Pipeline EPP [Volume 6B]).

For this report, where access was not available, desktop studies, literature reviews, information available as a result of 60 years of operation and data gathered from adjacent lands as well as professional judgement were used to make predictions. Based on the above, and the fact that the effects of pipelines and available mitigation and environmental protection measures are well-known, TERA is confident in the predictions about the potential effects of construction, operation and maintenance activities. In order to confirm the effects assessment conclusions and gather site-specific information for the implementation of mitigation from the Project-specific EPPs, additional studies will be conducted on those areas where access was not available.

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

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**APPENDIX A**  
**FIGURES**

**FIGURE 1.1**  
**PROJECT OVERVIEW**  
**ALBERTA AND BRITISH COLUMBIA**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**

- Kilometre Post (KP)
- Reference Kilometre Post (RK)
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Terminal
- Pump Station (Pump Additions, Station Modifications and/or Scraper Facilities)
- New Pump Station (Proposed)
- Pump Station (Reactivated)
- Existing Pump Station
- Highway
- Railway
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- National Park
- Provincial Park
- Protected Area / Natural Area / Provincial Recreation Area / Wilderness Provincial Park / Conservancy Area
- Provincial Boundary
- International Boundary

Projection: LCC Modified. Routing: Baseline TMPL & Facilities: provided by KMC, 2012; Proposed Pipeline Corridor V6: provided by UPI, Aug. 23, 2013; Transportation: IHS Inc., 2013; BC Forests, Lands and Natural Resource Operations, 2012 & Natural Resources Canada, 2012; Geopolitical Boundaries: Natural Resources Canada, 2003, Altalis, 2013; IHS Inc., 2011; BC FLNRO, 2007 & ESRI, 2005; First Nation Lands: Government of Canada, 2013, Altalis, 2010 & IHS Inc., 2011; Hydrology: Natural Resources Canada, 2007 & BC Crown Registry and Geographic Base Branch, 2008; Parks and Protected Areas: Natural Resources Canada, 2012, Altalis, 2012 & BC FLNRO, 2008; ATS Grid: Altalis, 2009; Edmonton TUC: Alberta Infrastructure, 2011; Canadian Hillshade: TERA Environmental Consultants, 2008; US Hillshade: Copyright: © 2009 ESRI.

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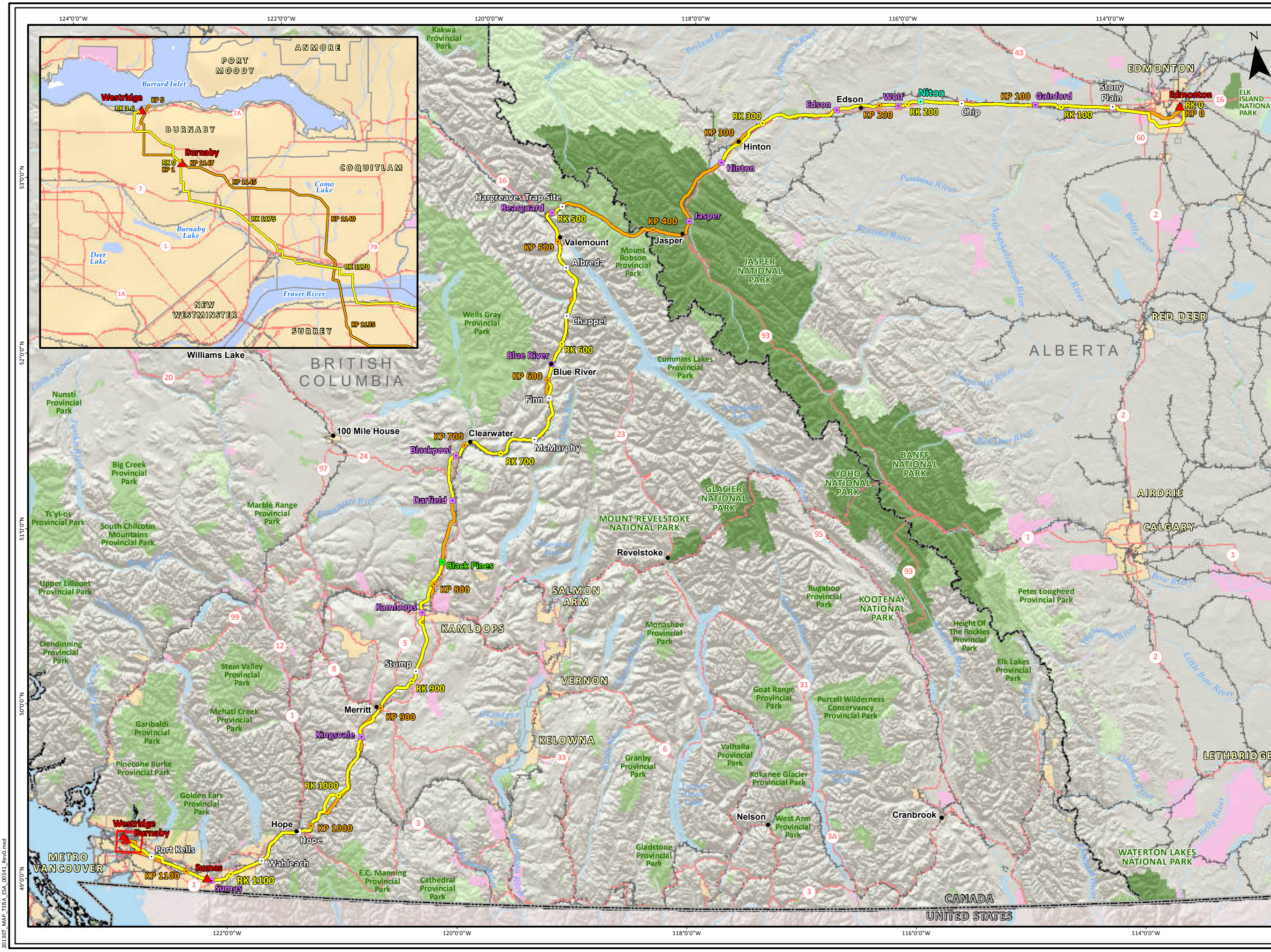


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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 1 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophite or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
- Municipal / District Boundary

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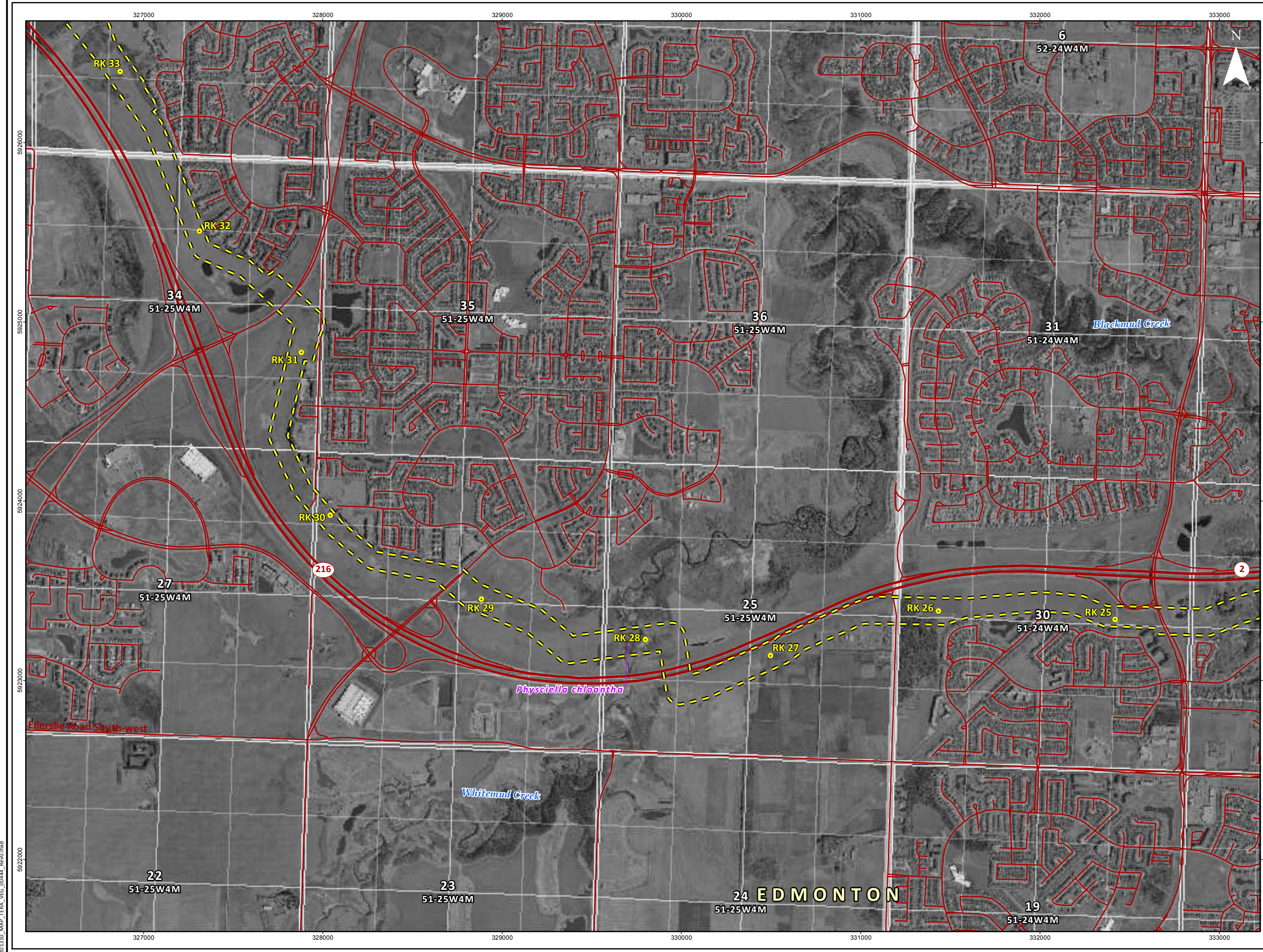
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201310\_MAP\_TERA\_VEG\_00444\_REV0.mxd

**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 2 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
- Municipal / District Boundary

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Projection: NAD 1983 UTM Zone 12N. Baseline TMPL & Facilities: provided by KMC, 2012; Proposed Pipeline Corridor VEG: provided by UPI, Aug. 23, 2013; Facilities, S/W & Colour Imagery: 2005-2011 provided by KMC, 2012; Existing Infrastructure: IHS Inc., 2013; Transportation: IHS Inc., 2013; Natural Resources Canada, 2011; BC FLNRO 2012; Geopolitical Boundaries: Natural Resources Canada, 2003; AtlasS, 2012; IHS Inc., 2013; BC FLNRO 2007, ESRI, 2005; First Nation Lands: Government of Canada, 2013; AtlasS, 2010; IHS Inc., 2011; Parks and Protected Areas: Natural Resources Canada, 2012; AtlasS, 2012; BC FLNRO 2008; Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

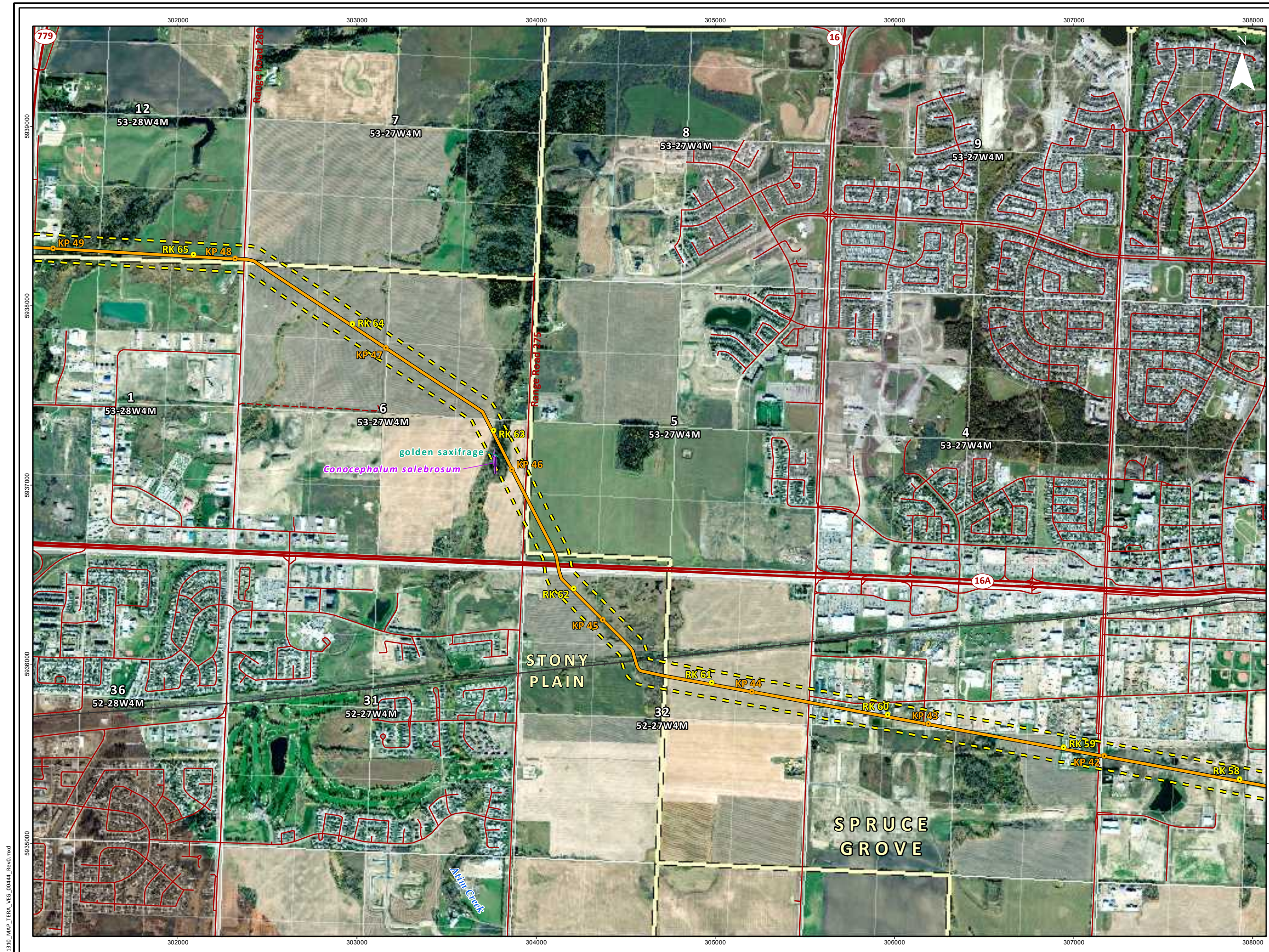


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MAP NUMBER	201310_MAP_TERA_VEG_00444_REV0	PAGE	SHEET 2 OF 71
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SCALE	1:20,000	REVISION	0
DRAWN	SES	CHECKED	TGG
		DESIGN	TGG

0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE



201310\_MAP\_TERA\_VEG\_00444\_REV0.mxd

**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 3 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
- Municipal / District Boundary

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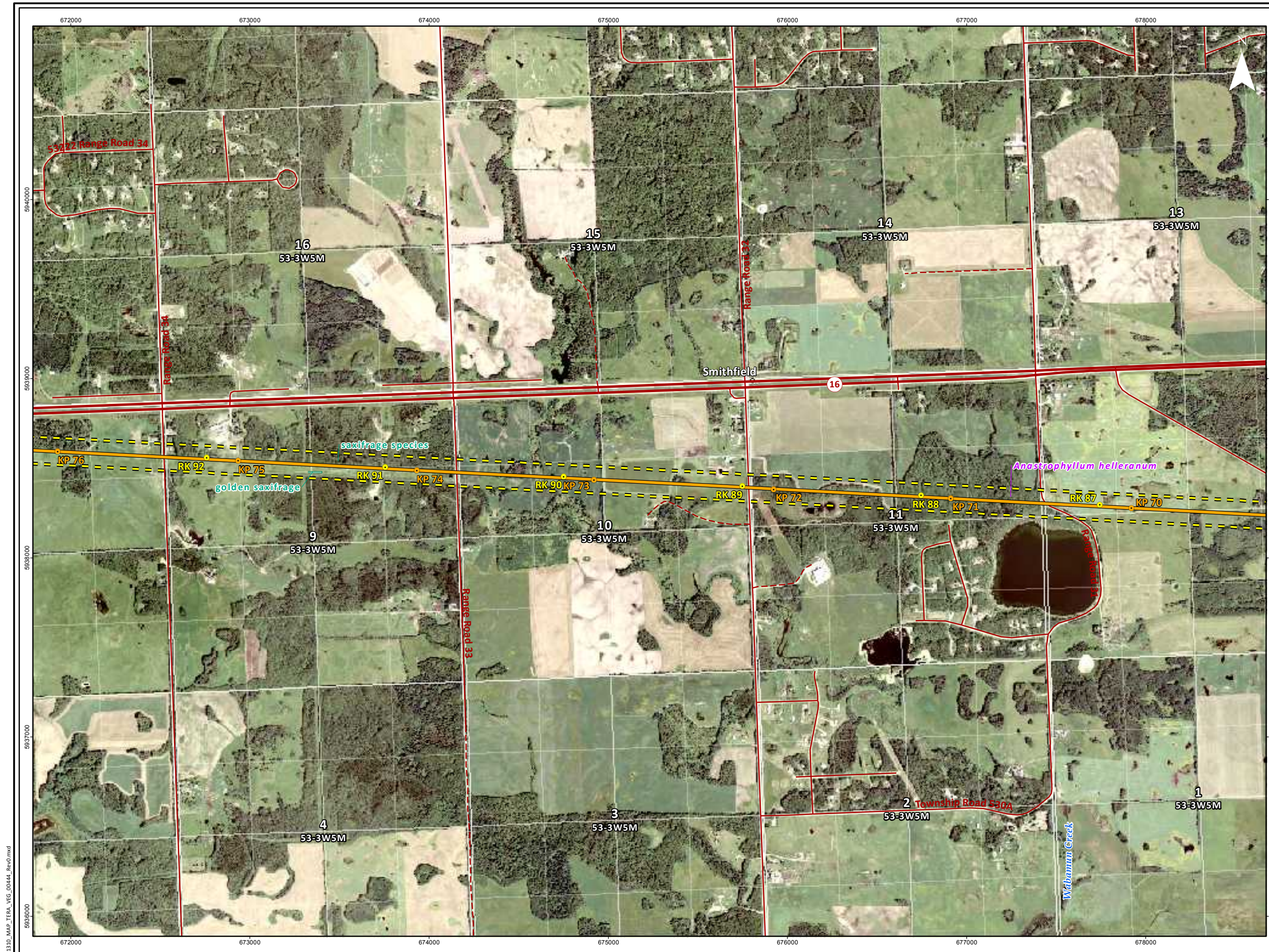


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MAP NUMBER 201310_MAP_TERA_VEG_00444_REV0		PAGE SHEET 3 OF 71	
DATE December 2013	TERA REF. 7894	REVISION 0	
SCALE 1:20,000	PAGE SIZE 11x17	DISCIPLINE VEG	
DRAWN SES	CHECKED TGG	DESIGN TGG	

0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE



201310\_MAP\_TERA\_VEG\_00444\_REV0.mxd

**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 4 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
- Municipal / District Boundary

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Projection: NAD 1983 UTM Zone 11N. Baseline TMPL & Facilities: provided by KMC, 2012; Proposed Pipeline Corridor V6: provided by UPI, Aug. 23, 2013; Facilities, SW & Colour Imagery: 2005-2011 provided by KMC, 2012; Existing Infrastructure: IHS Inc., 2013; Transportation: IHS Inc., 2013; Natural Resources Canada, 2011; BC FLNRO 2012; Geopolitical Boundaries: Natural Resources Canada, 2009; Atlas, 2012; IHS Inc., 2013; BC FLNRO, 2007; ESRI, 2005; First Nation Lands: Government of Canada, 2013; Atlas, 2010; IHS Inc., 2011; Parks and Protected Areas: Natural Resources Canada, 2012; Atlas, 2012; BC FLNRO 2010; Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



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DESIGN	TGG		



201310\_MAP\_TERA\_VEG\_00444\_REV0.mxd

**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 5 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
- Municipal / District Boundary

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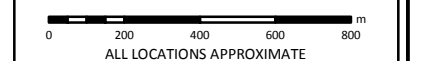
Projection: NAD 1983 UTM Zone 11N. Baseline TMPL & Facilities: provided by KMC, 2012; Proposed Pipeline Corridor V&V: provided by UPI, Aug. 23, 2013; Facilities, S/W & Colour Imagery: 2005-2011 provided by KMC, 2012; Existing Infrastructure: IHS Inc., 2013; Transportation: IHS Inc., 2013; Natural Resources Canada, 2011, BC FLNRO 2012; Geopolitical Boundaries: Natural Resources Canada, 2009, AtlasS, 2012, IHS Inc., 2013, BC FLNRO, 2007, ESRI, 2005; First Nation Lands: Government of Canada, 2013, AtlasS, 2010, IHS Inc., 2011; Parks and Protected Areas: Natural Resources Canada, 2012, AtlasS, 2012, BC FLNRO 2010; Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aergrid, IGN, IGP, swisstopo, and the GIS User Community



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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 6 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
- Municipal / District Boundary

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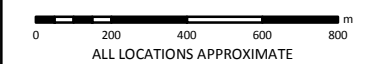
Projection: NAD 1983 UTM Zone 11N. Baseline TMPL & Facilities: provided by KMC, 2012; Proposed Pipeline Corridor VEG: provided by UPI, Aug. 23, 2013; Facilities, B/W & Colour Imagery: 2005-2011 provided by KMC, 2012; Existing Infrastructure: IHS Inc., 2013; Transportation: IHS Inc., 2013; Natural Resources Canada, 2011; BC FLNRO 2012; Geopolitical Boundaries: Natural Resources Canada, 2009; Atlas, 2012; IHS Inc., 2013; BC FLNRO 2007, ESRI, 2005; First Nation Lands: Government of Canada, 2013; Atlas, 2010; IHS Inc., 2011; Parks and Protected Areas: Natural Resources Canada, 2012; Atlas, 2012; BC FLNRO 2008; Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



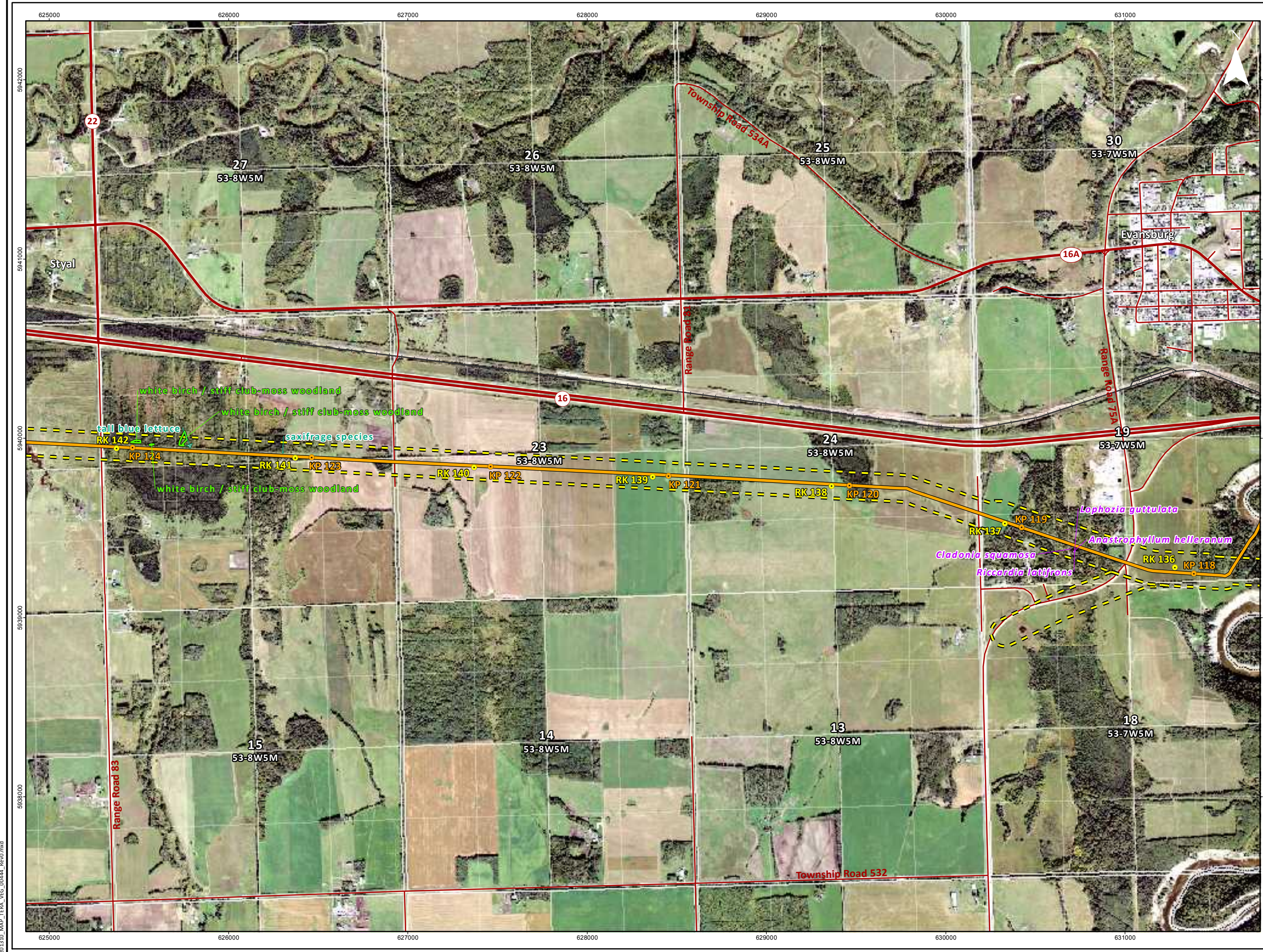
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	DESIGN TGG

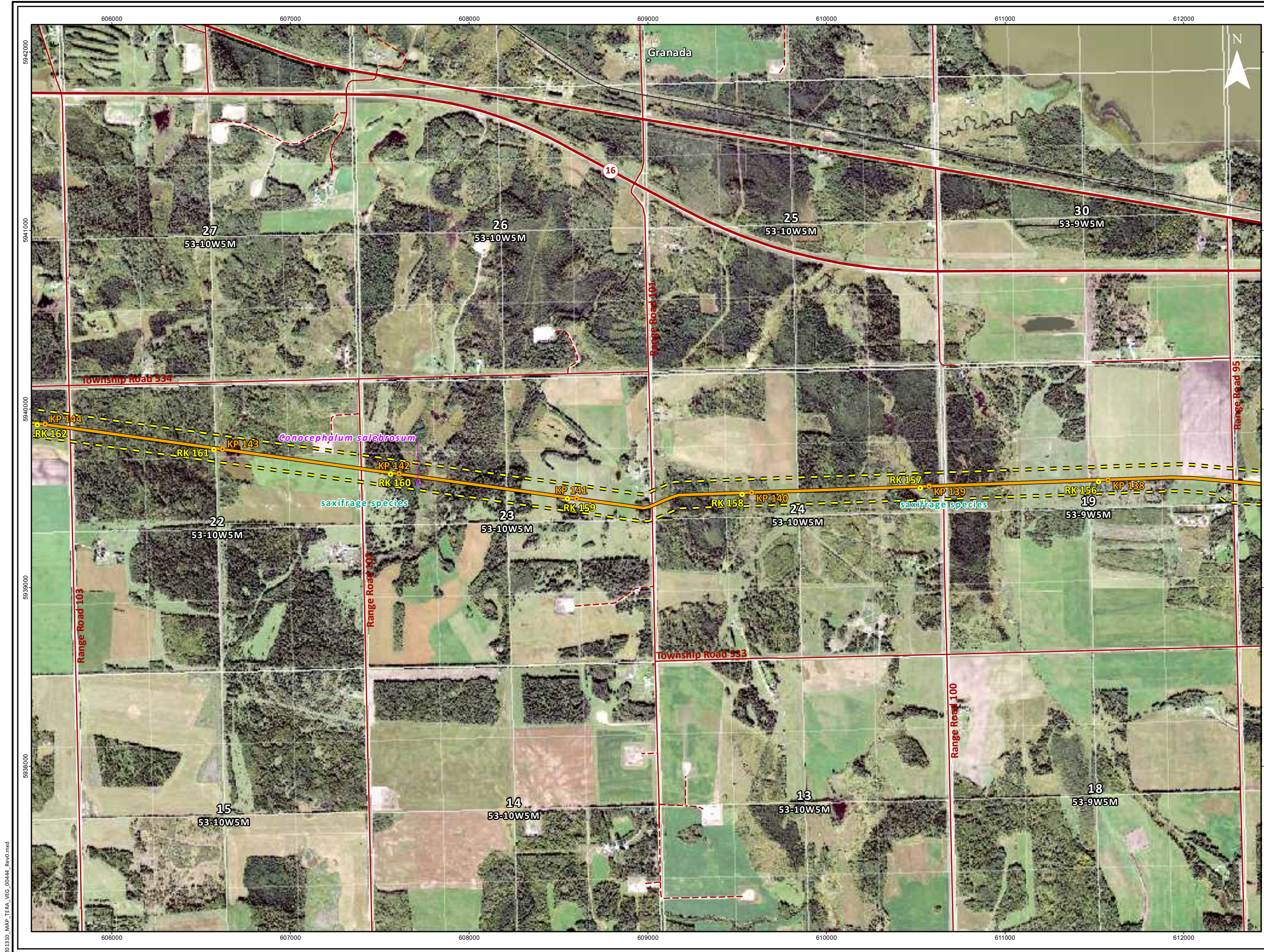


ALL LOCATIONS APPROXIMATE



201310\_MAP\_TERA\_VEG\_00444\_REV0.mxd





**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 7 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- - - Reference Kilometre Post (RK)
- - - Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- ▨ Rare Bryophyte or Lichen
- ▨ Rare Vascular Plant
- ▨ Rare Ecological Community
- 1 Highway
- Paved Road
- - - Resource Road
- + — Railway
- Village / Hamlet
- ▭ City / Town
- ▭ Indian Reserve / Métis Settlement
- ▭ Facility Footprint
- ▭ National / Provincial Park
- ▭ Park / Protected Area
- - - Municipal / District Boundary

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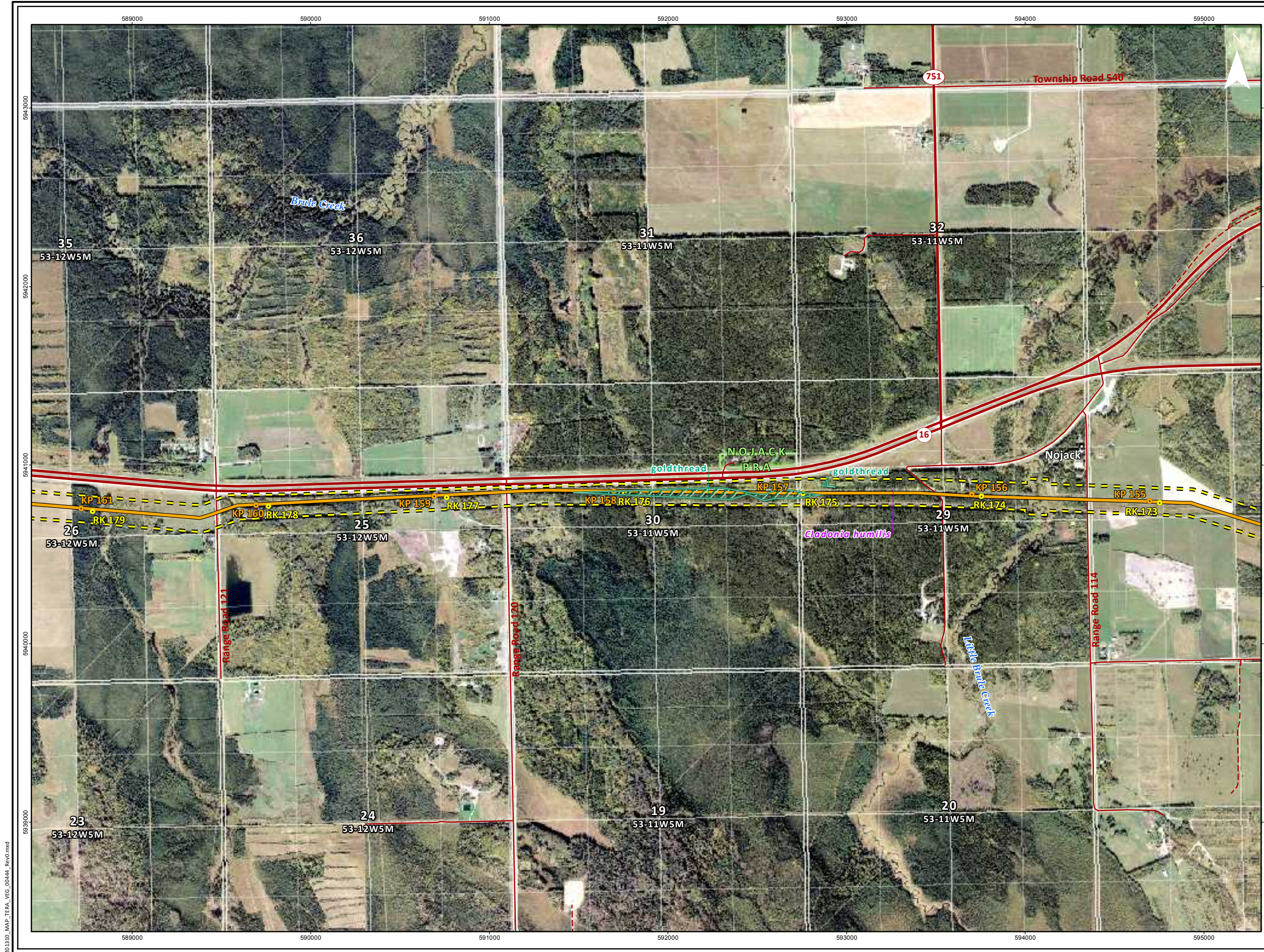


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	DESIGN TGG

0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE



**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 8 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
- Municipal / District Boundary

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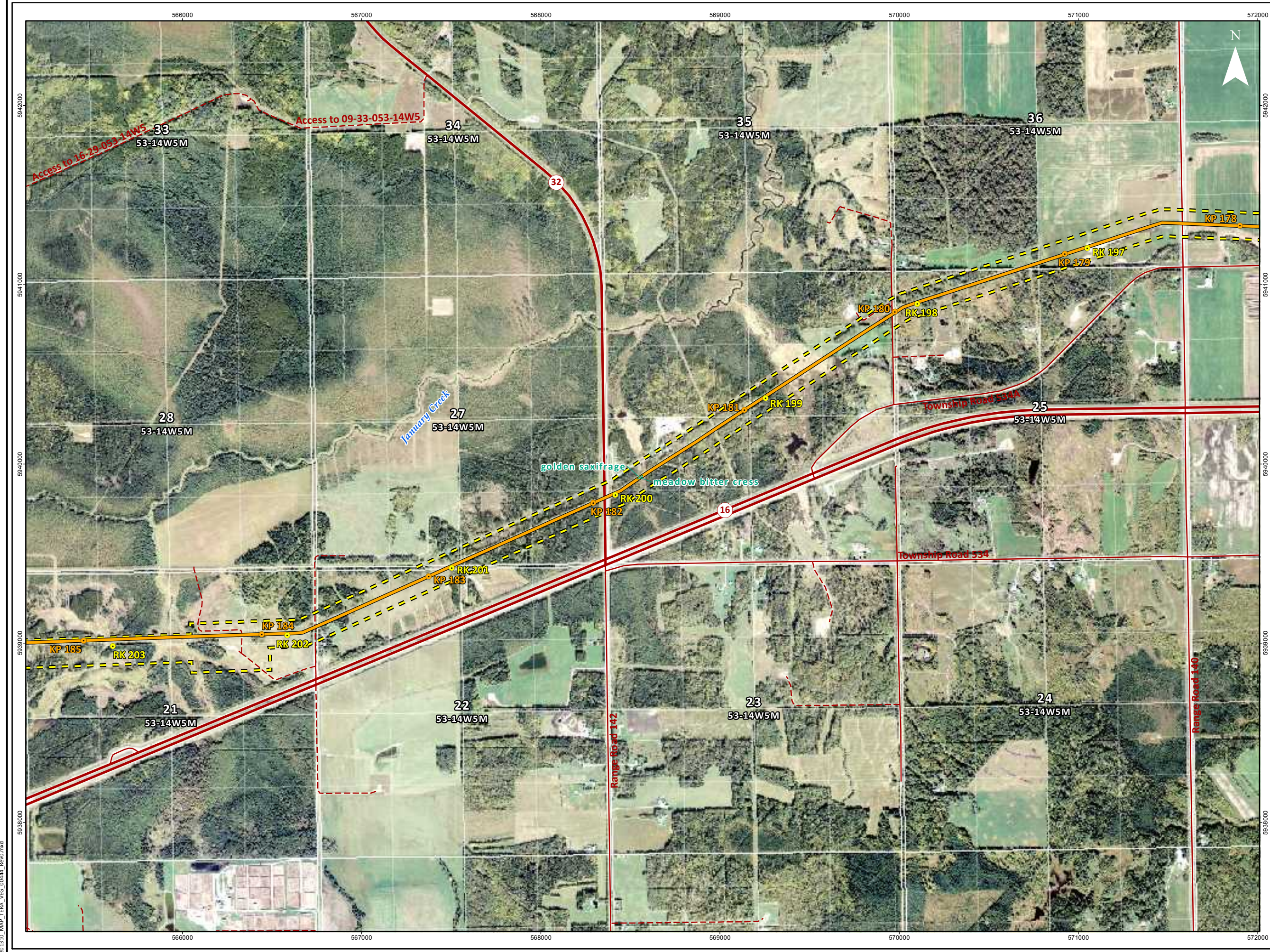


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0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE



**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 9 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
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0 200 400 600 800 m  
ALL LOCATIONS APPROXIMATE

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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 10 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
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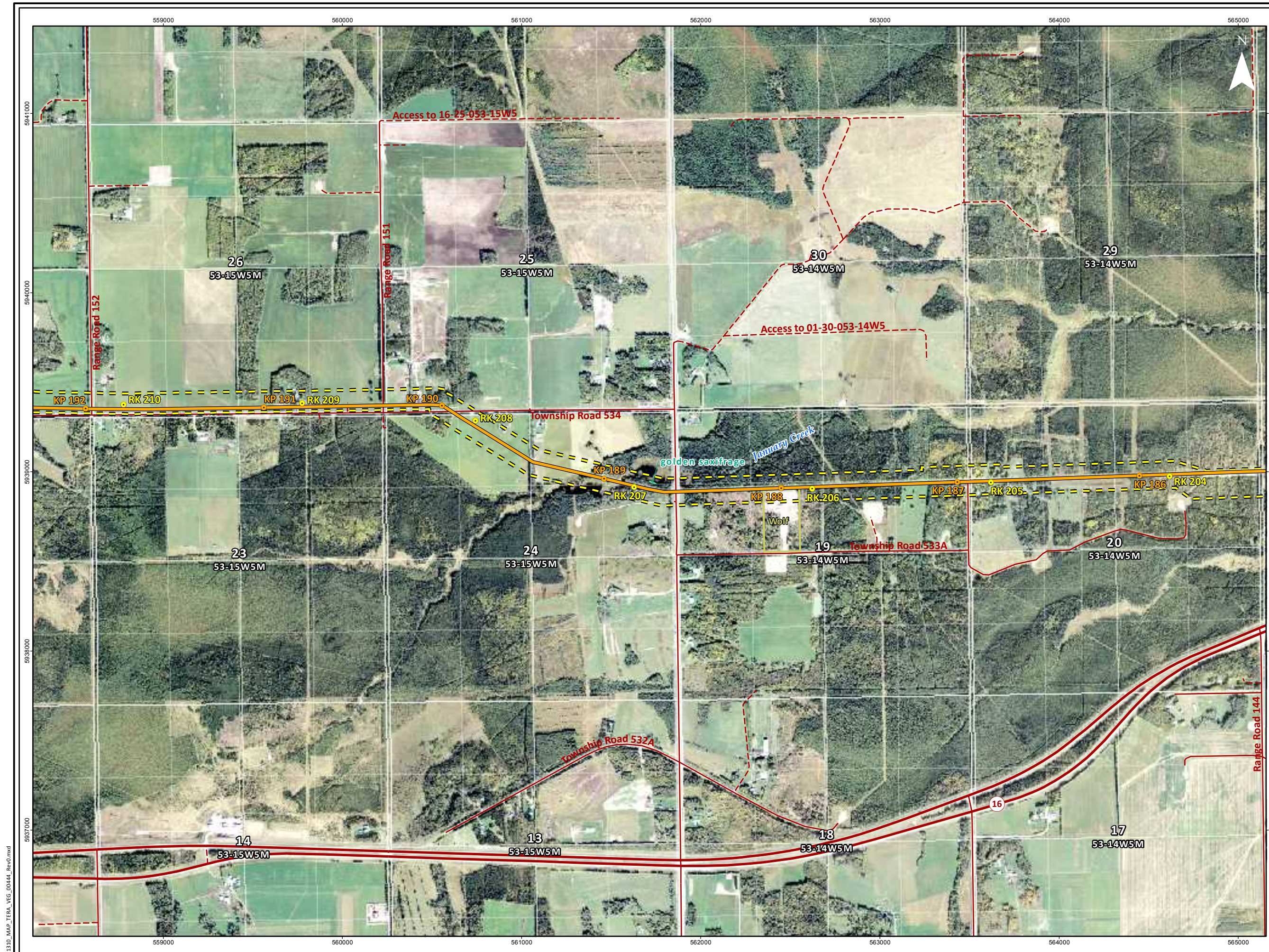
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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 11 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
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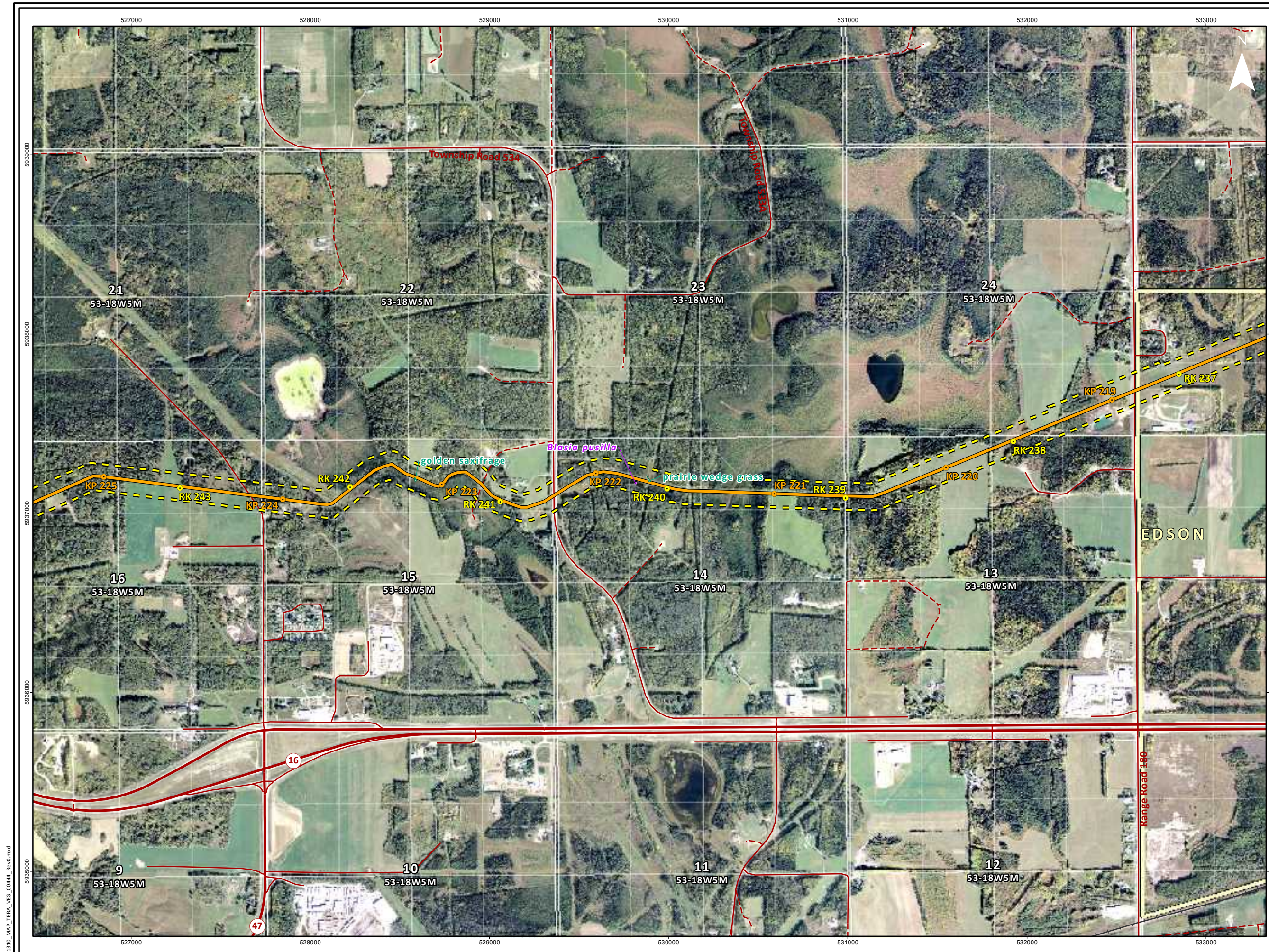


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0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE



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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 12 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
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- Municipal / District Boundary

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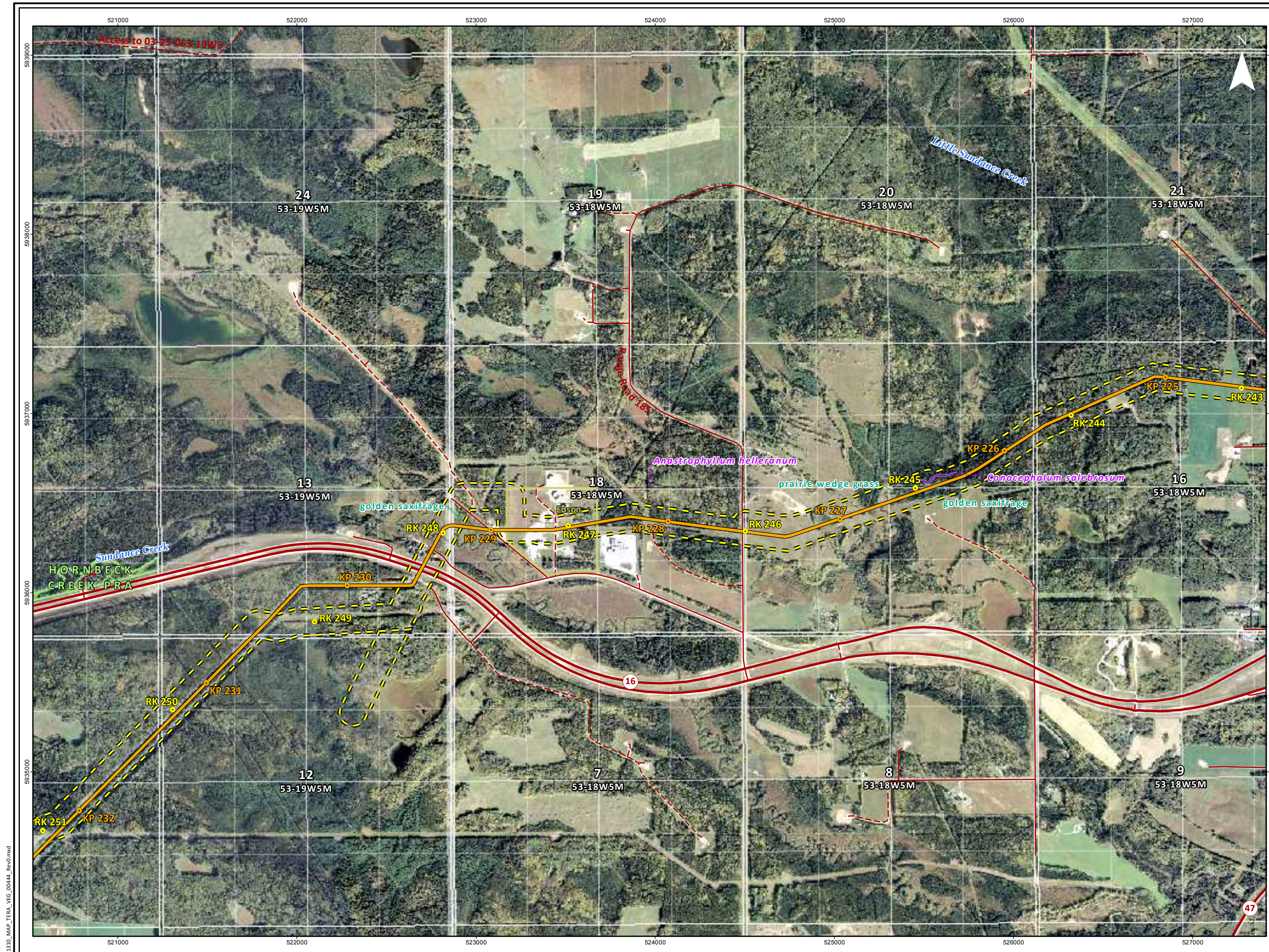


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MAP NUMBER	201310_MAP_TERA_VEG_00444_REV0	PAGE	SHEET 12 OF 71
DATE	December 2013	TERA REF.	7894
SCALE	1:20,000	REVISION	0
DRAWN	SES	PAGE SIZE	11x17
CHECKED	TGG	DISCIPLINE	VEG
DESIGN	TGG		

0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE



201310\_MAP\_TERA\_VEG\_00444\_REV0.mxd

**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 13 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
- Municipal / District Boundary

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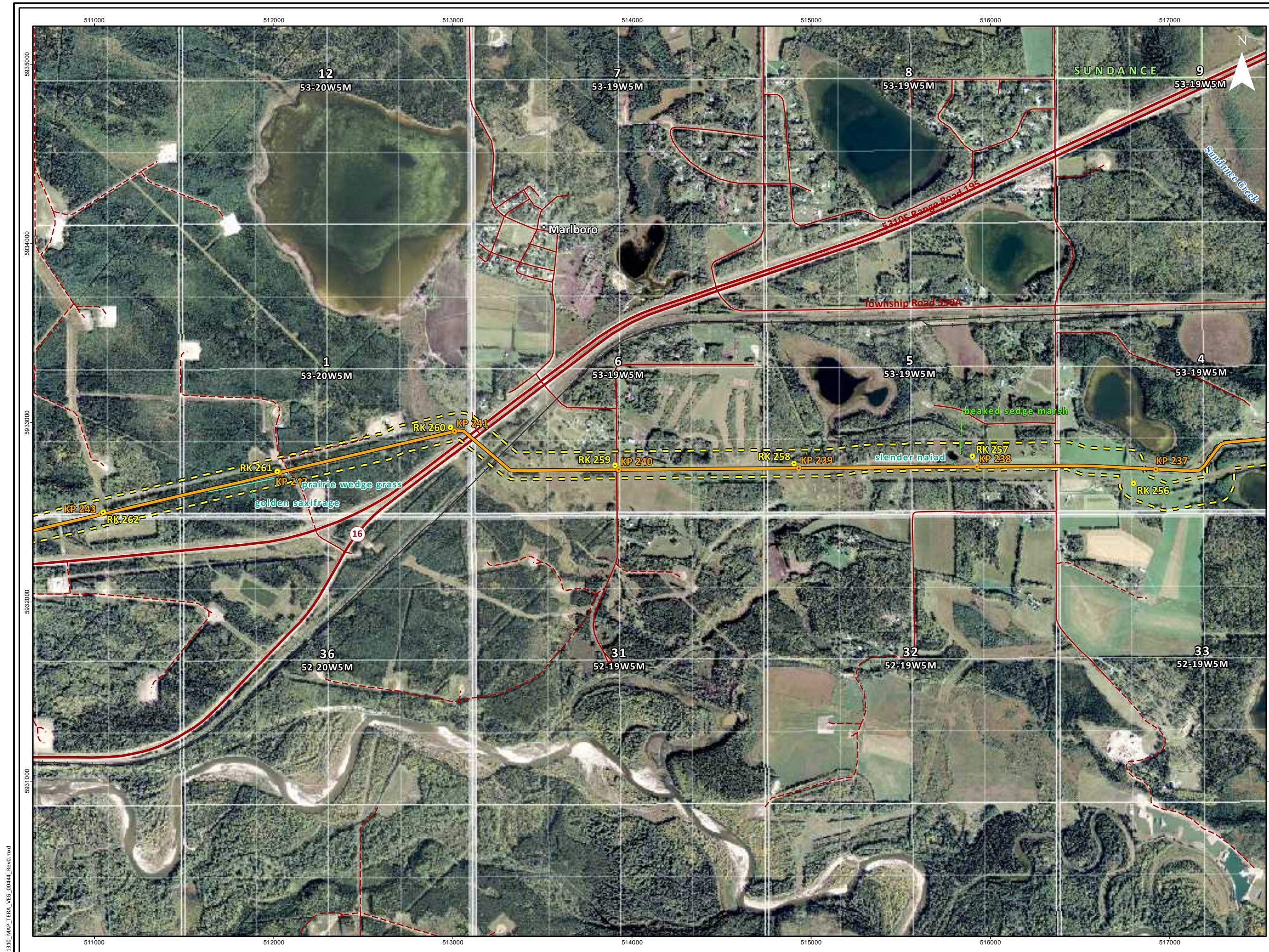


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DATE December 2013	TERA REF. 7894
SCALE 1:20,000	REVISION 0
DRAWN SES	CHECKED TGG
	DESIGN TGG

0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE



201310\_MAP\_TERA\_VEG\_00444\_REV0.mxd

**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 14 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
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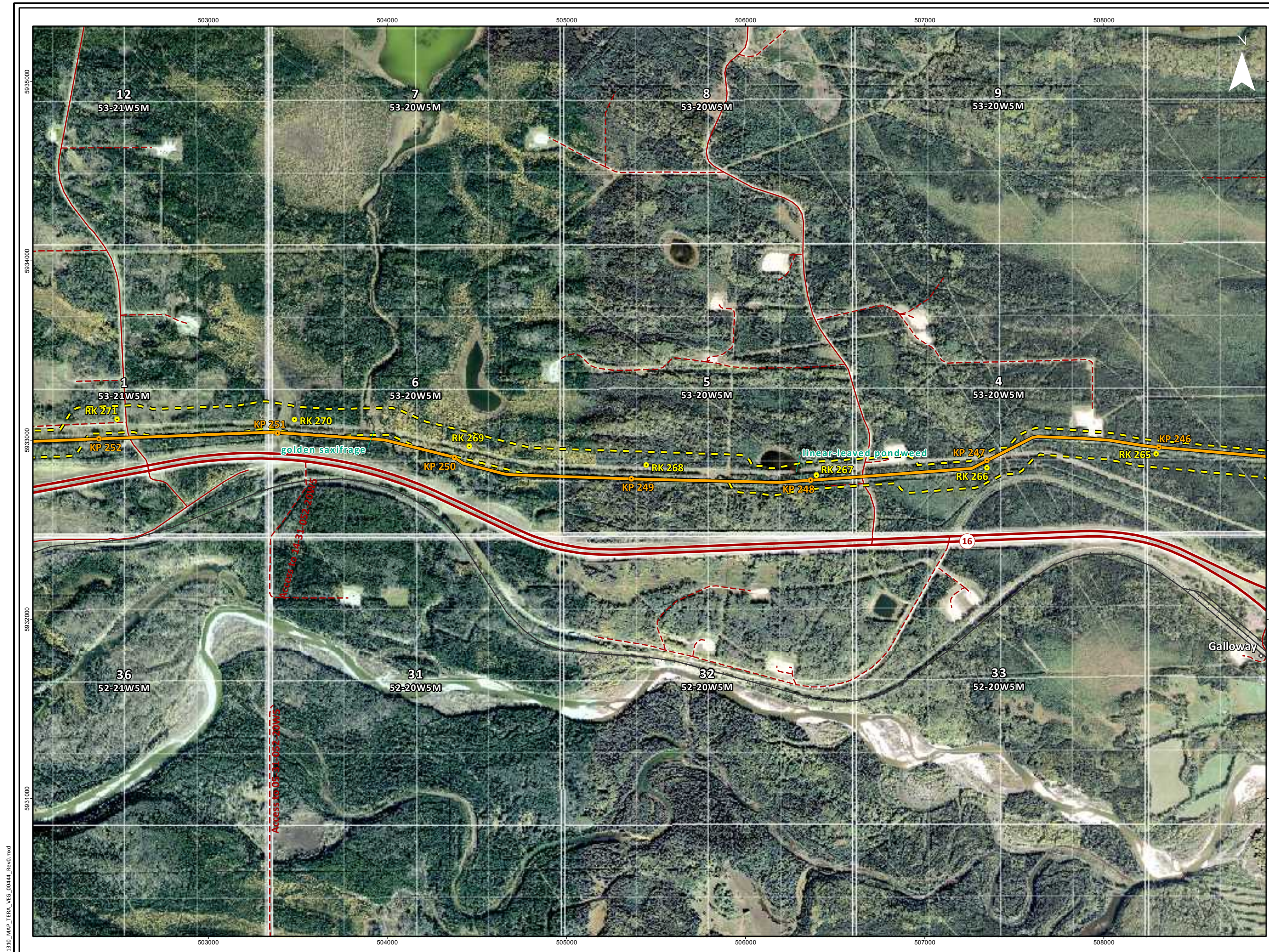
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		DESIGN	TGG



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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 15 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
- Municipal / District Boundary

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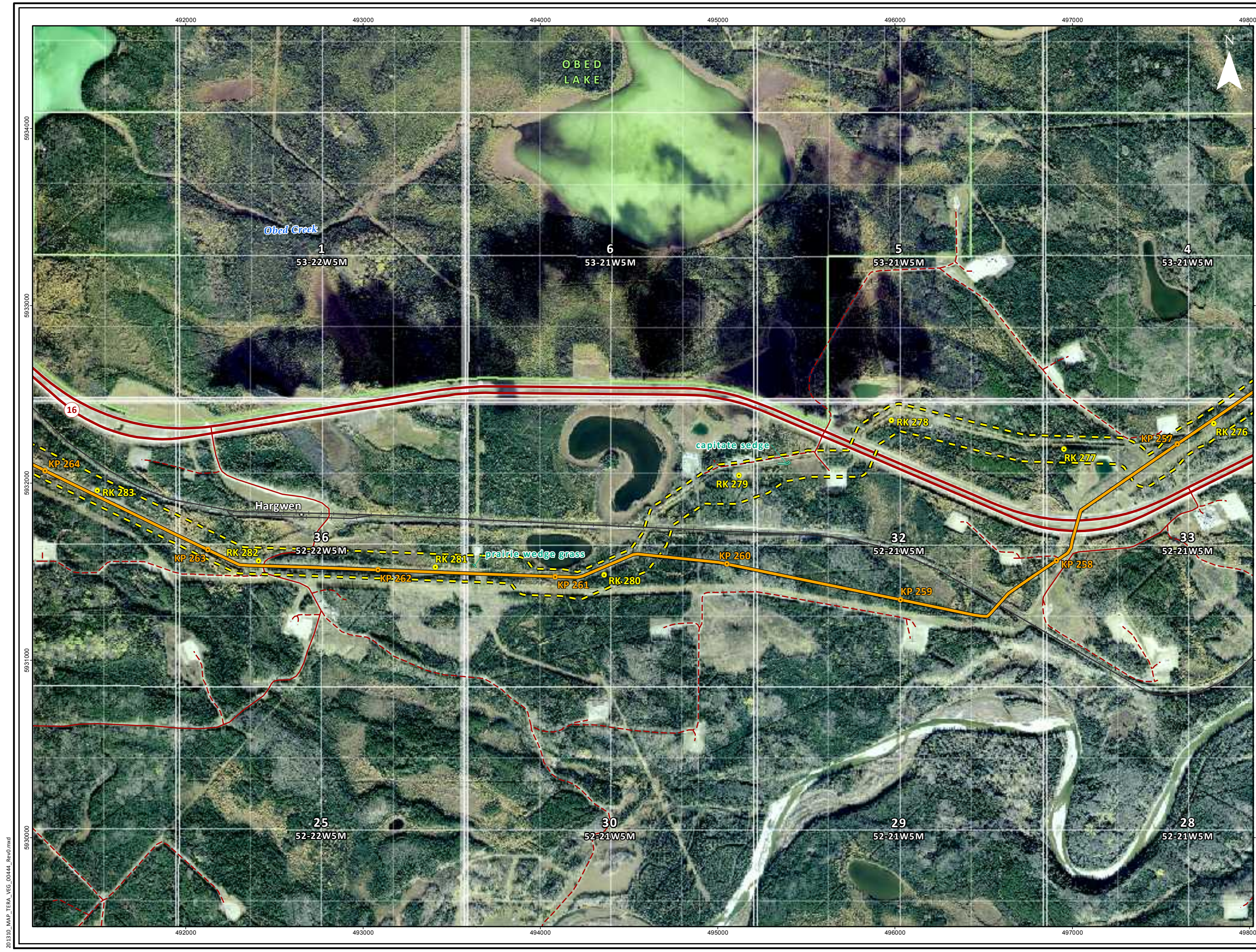


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MAP NUMBER 201310_MAP_TERA_VEG_00444_REV0	PAGE SHEET 15 OF 71
DATE December 2013	TERA REF. 7894
SCALE 1:20,000	REVISION 0
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DESIGN TGG	

0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE



201310\_MAP\_TERA\_VEG\_00444\_REV0.mxd

**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 16 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
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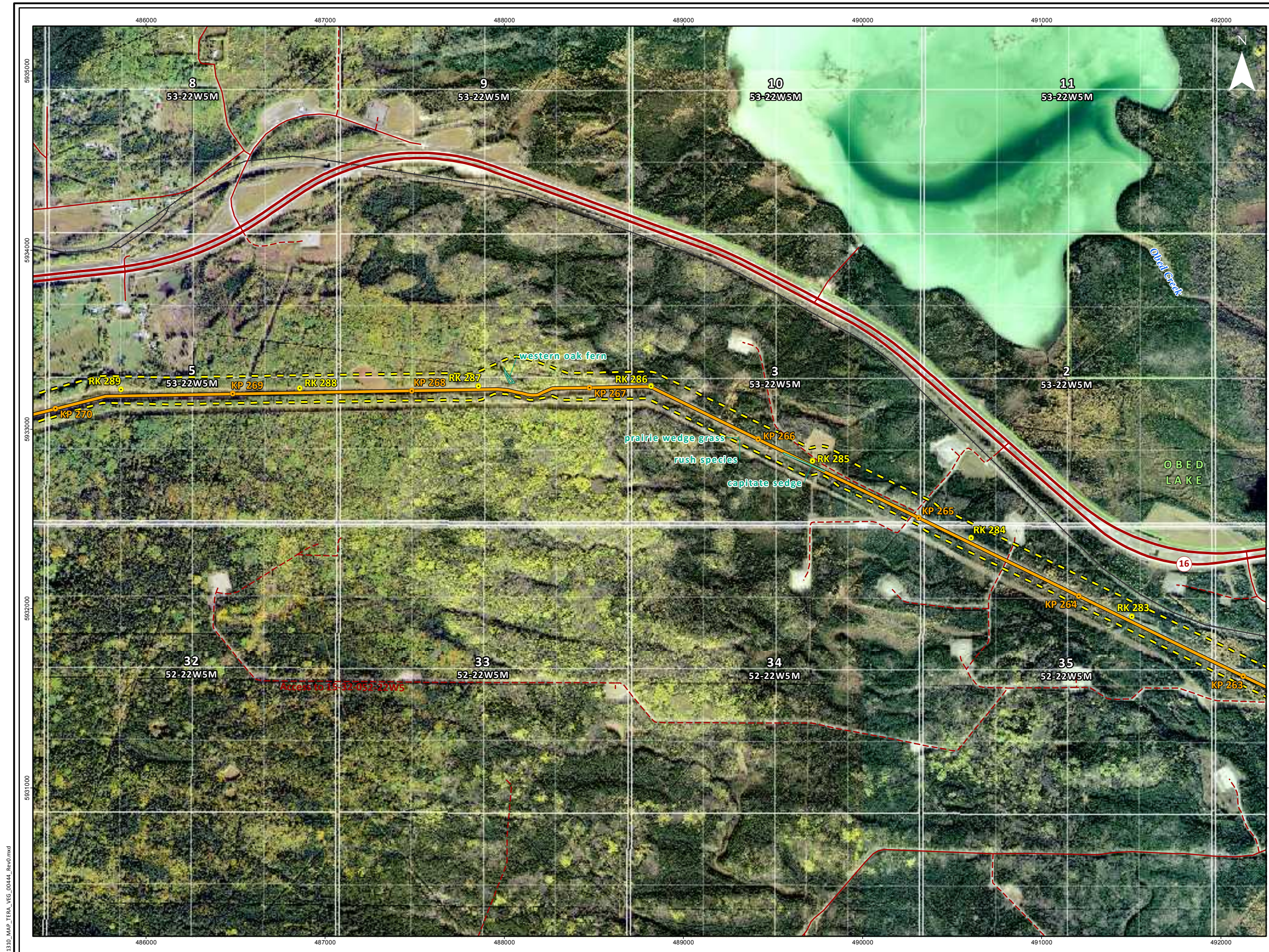


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DATE December 2013	TERA REF. 7894
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0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE



201310\_MAP\_TERA\_VEG\_00444\_REV0.mxd

**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 17 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
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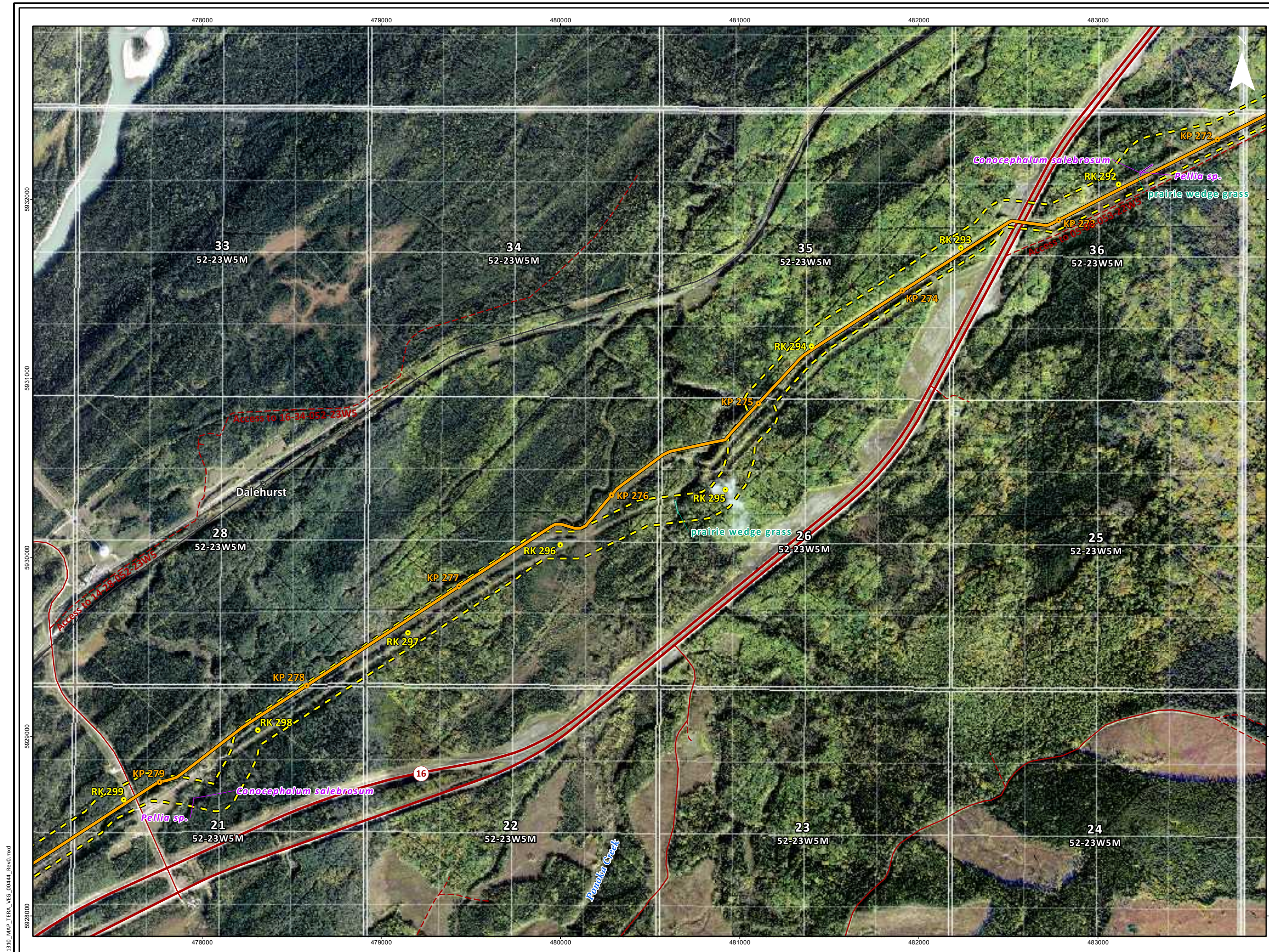


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DATE December 2013	TERA REF. 7894
SCALE 1:20,000	REVISION 0
DRAWN SES	CHECKED TGG
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0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE



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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 18 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
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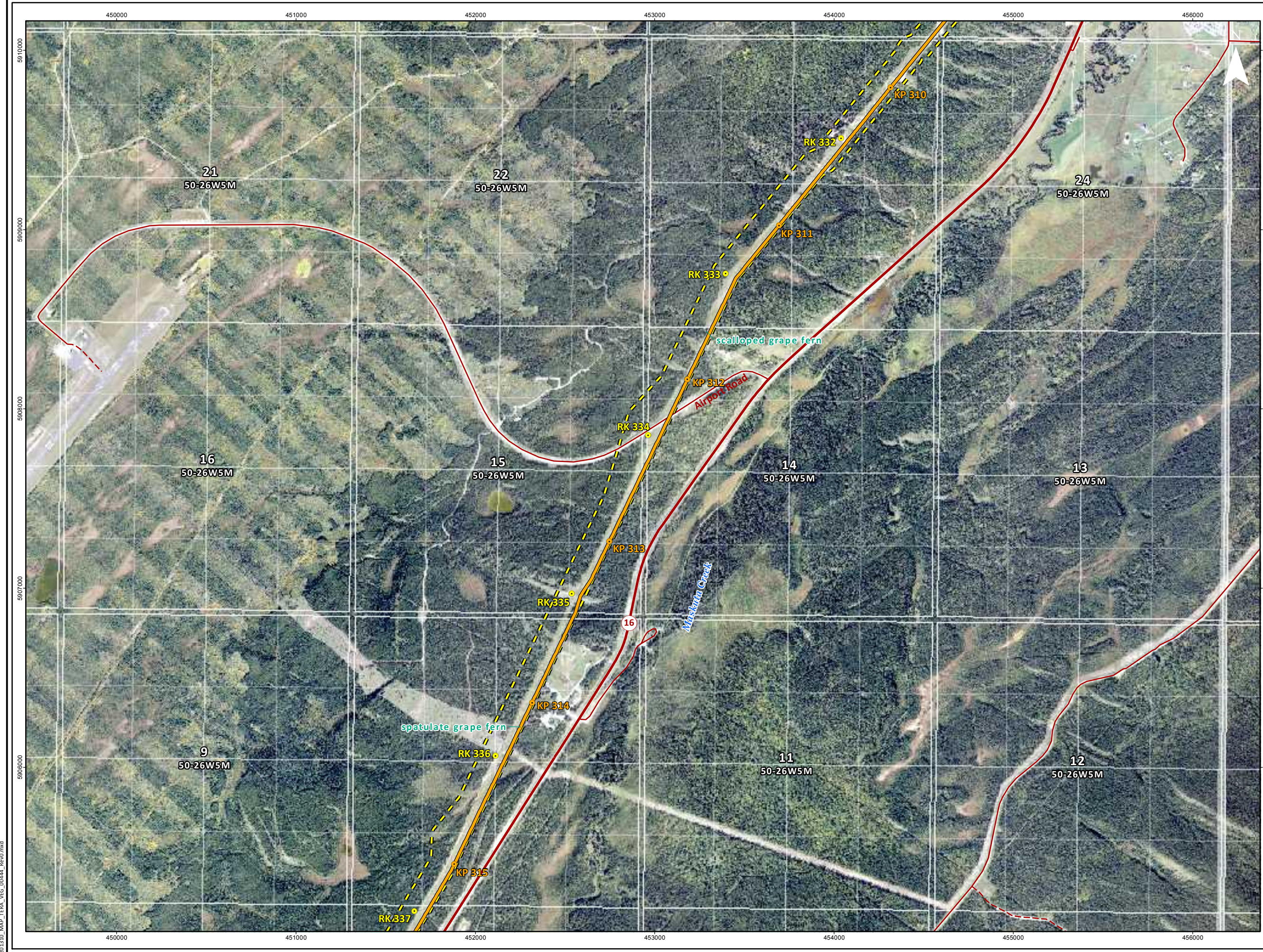
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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 19 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
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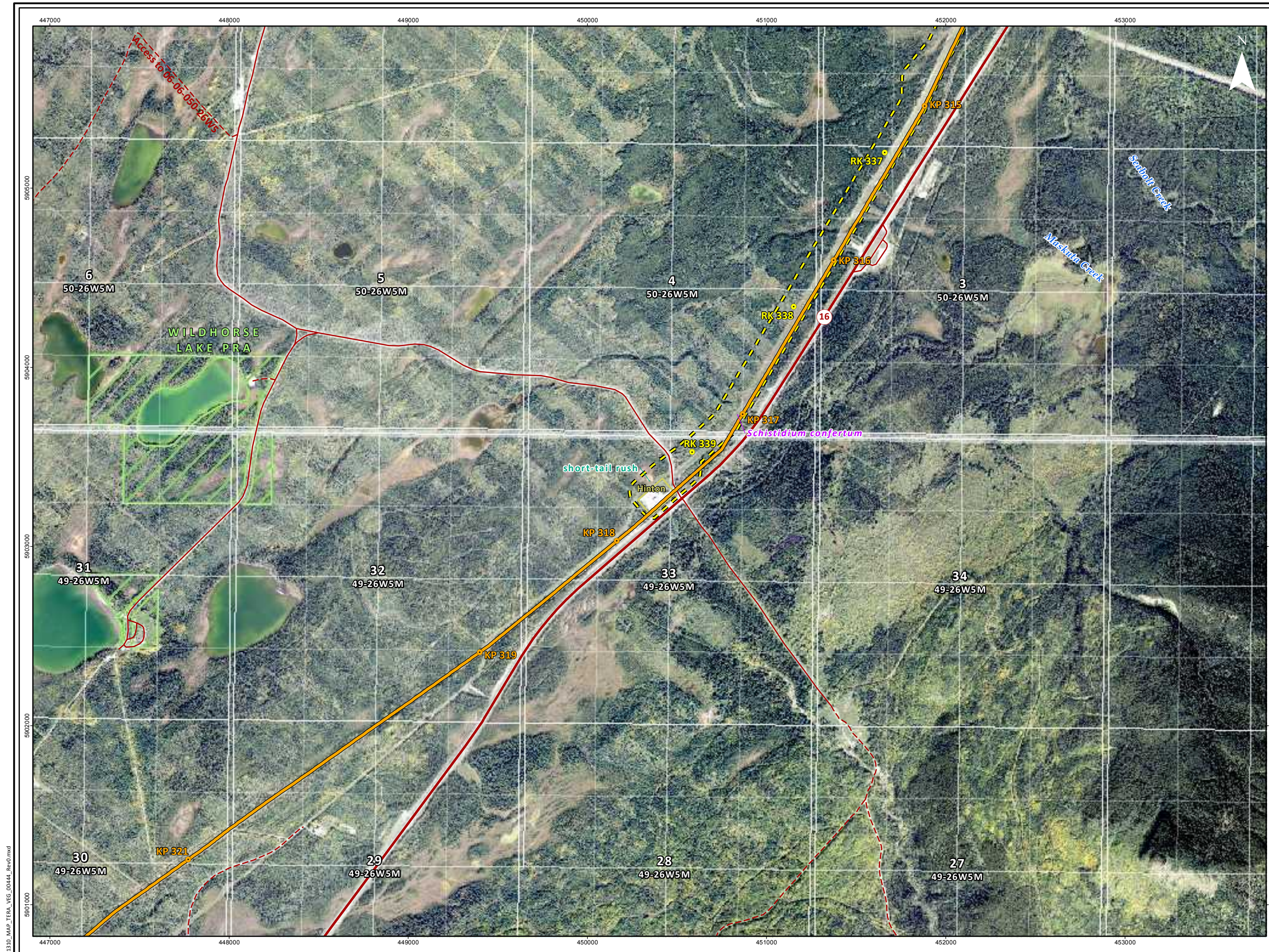
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SCALE 1:20,000	REVISION 0
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201310\_MAP\_TERA\_VEG\_00444\_REV0.mxd

**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 20 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
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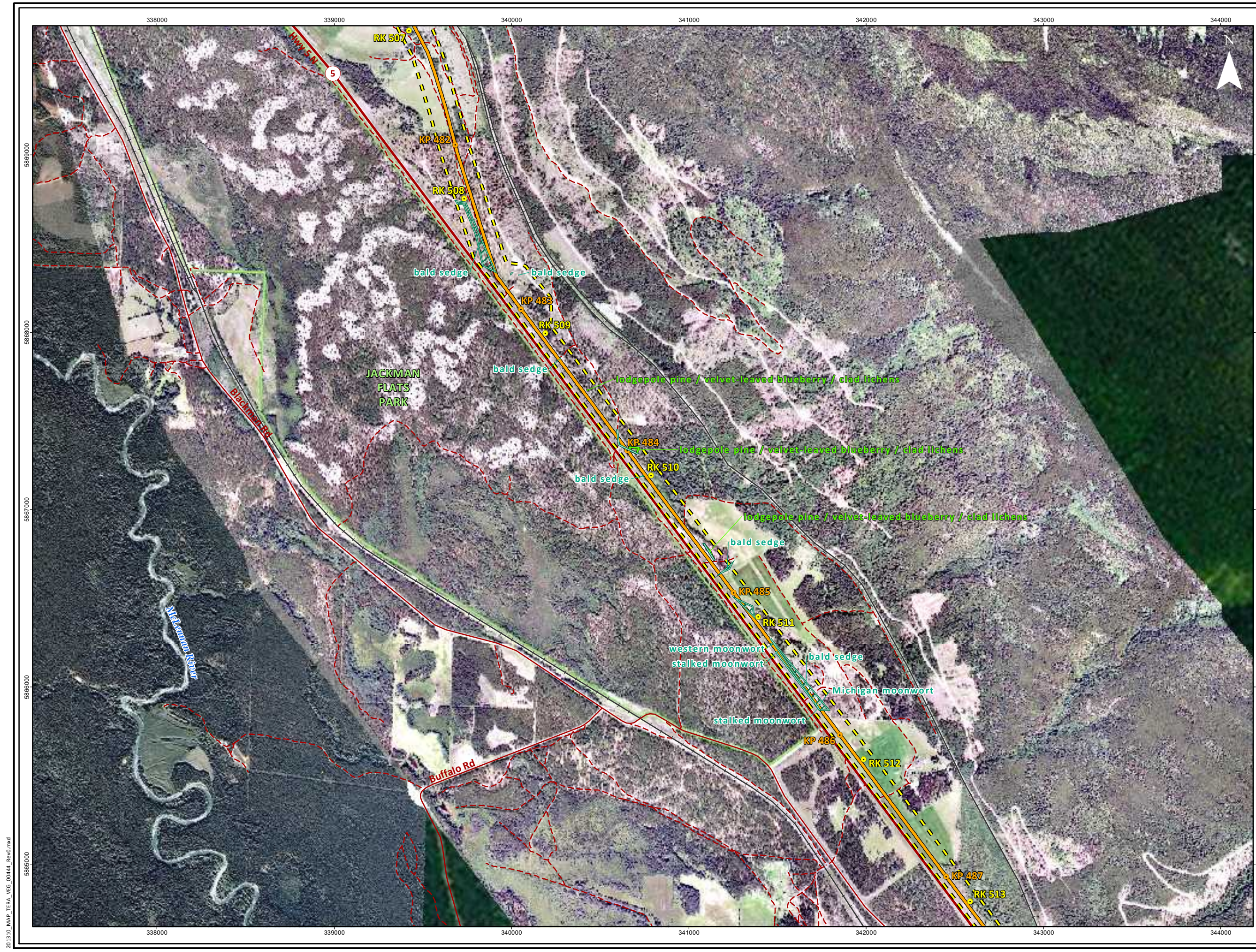


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MAP NUMBER 201310_MAP_TERA_VEG_00444_REV0	PAGE SHEET 20 OF 71
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0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE



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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 21 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
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- Village / Hamlet
- City / Town
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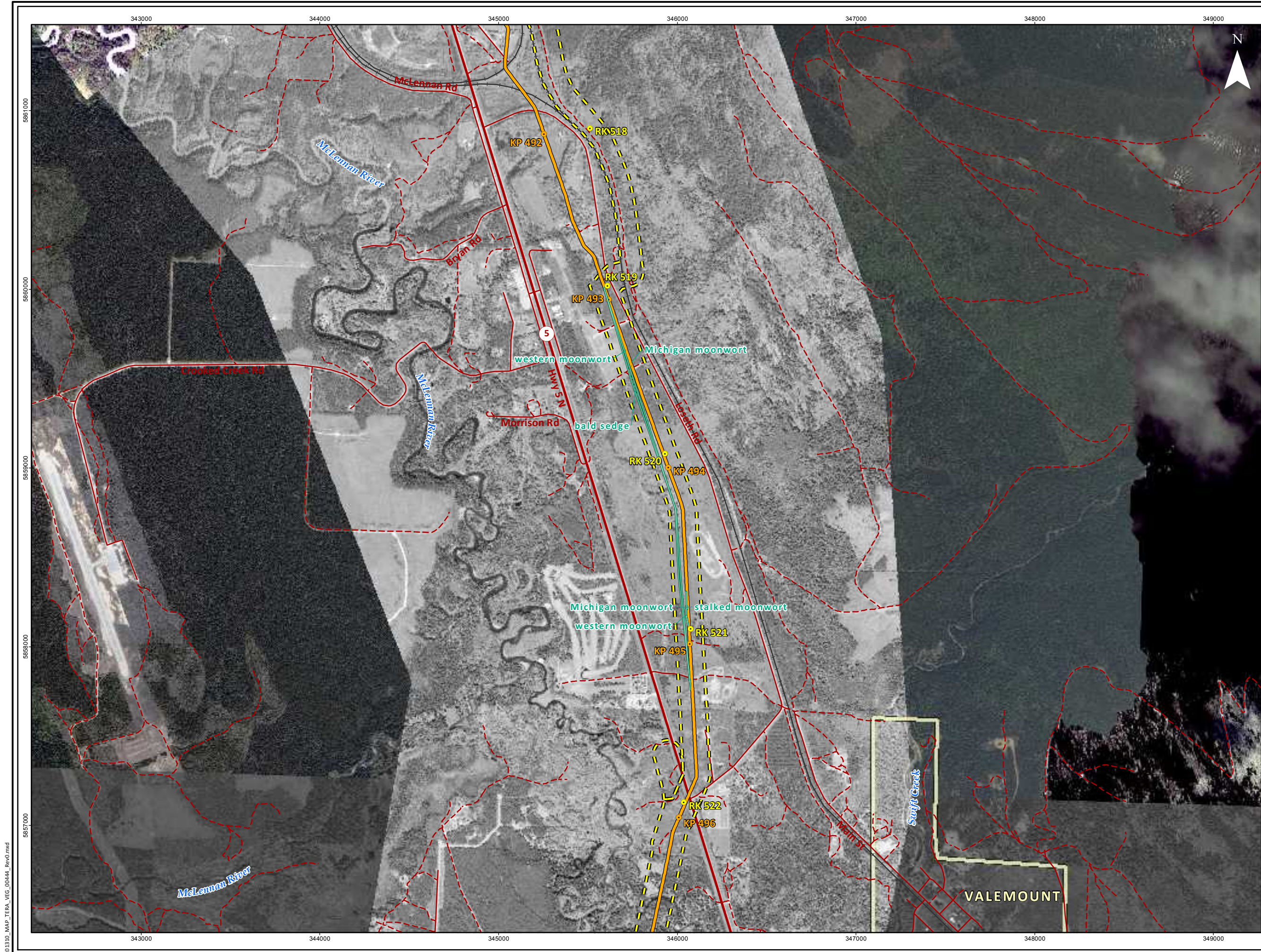
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ALL LOCATIONS APPROXIMATE

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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 22 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
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- Village / Hamlet
- City / Town
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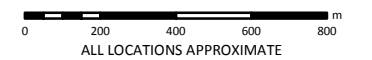
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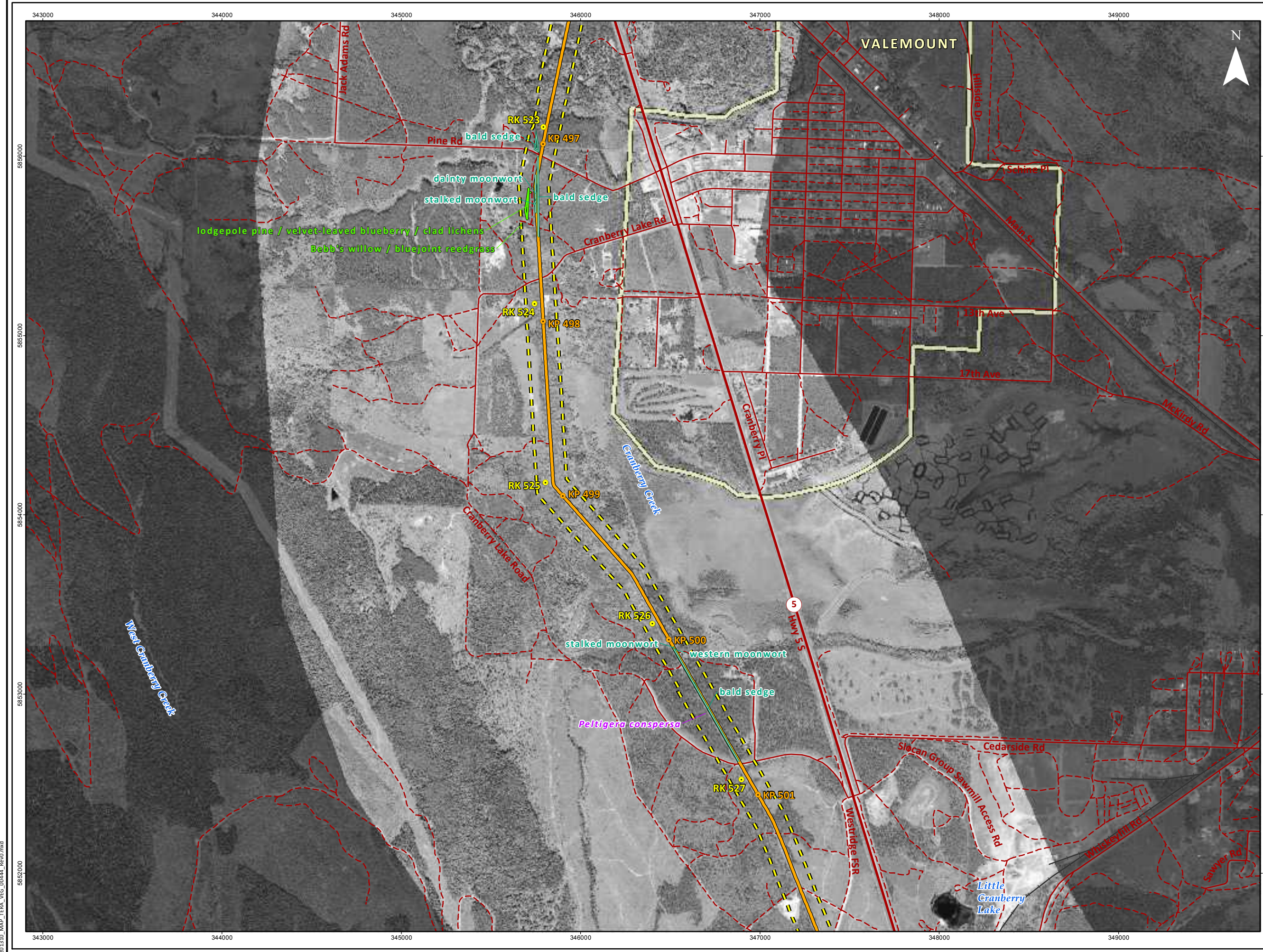


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	DESIGN TGG



ALL LOCATIONS APPROXIMATE





**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 23 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
- Municipal / District Boundary

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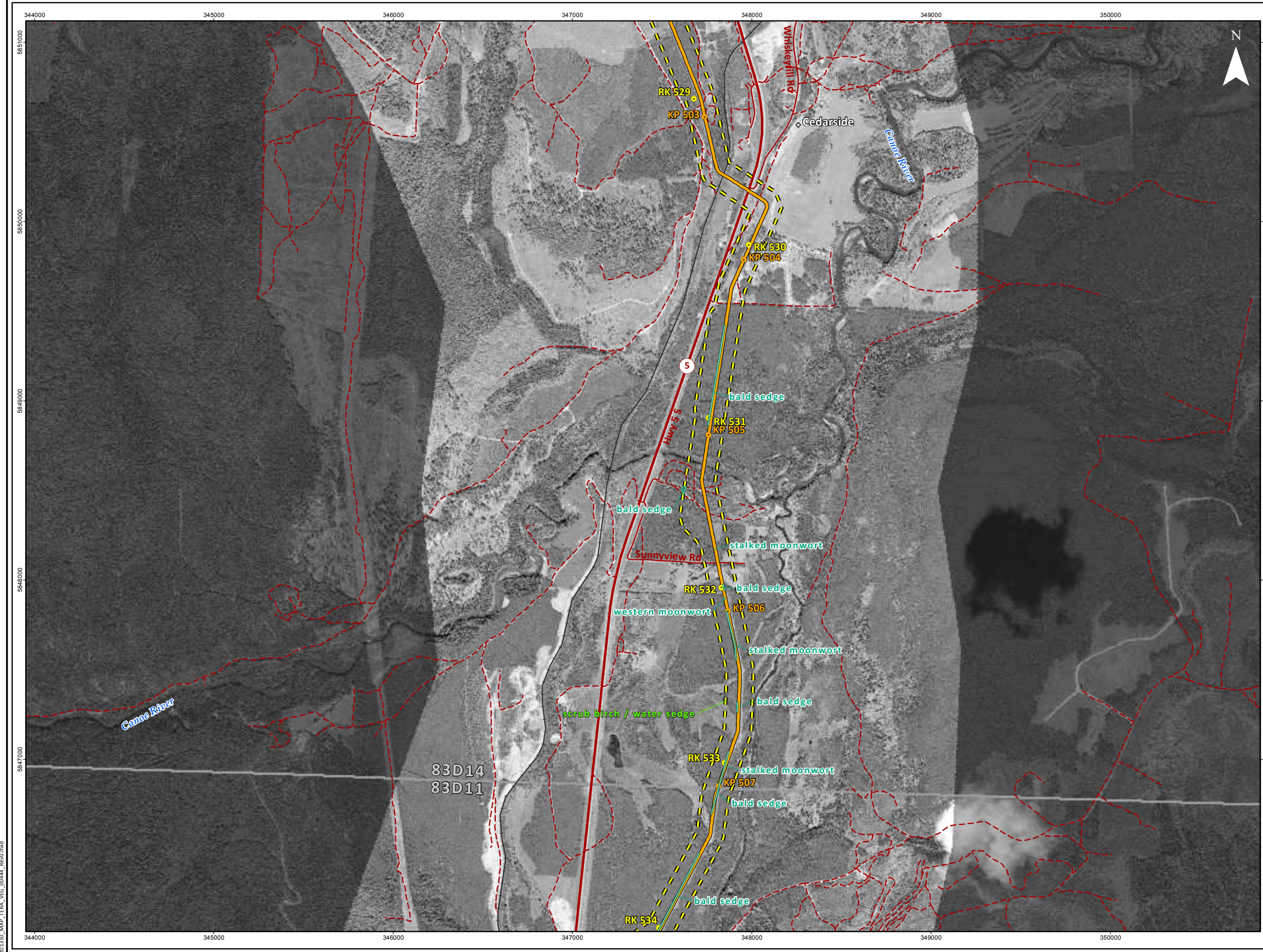
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MAP NUMBER 201310_MAP_TERA_VEG_00444_REV0	PAGE SHEET 23 OF 71
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	DESIGN TGG

0 400 600 800 m  
ALL LOCATIONS APPROXIMATE

201310\_MAP\_TERA\_VEG\_00444\_REV0.mxd



**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 24 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
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- Resource Road
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- City / Town
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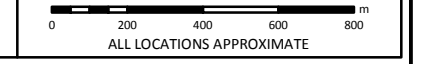
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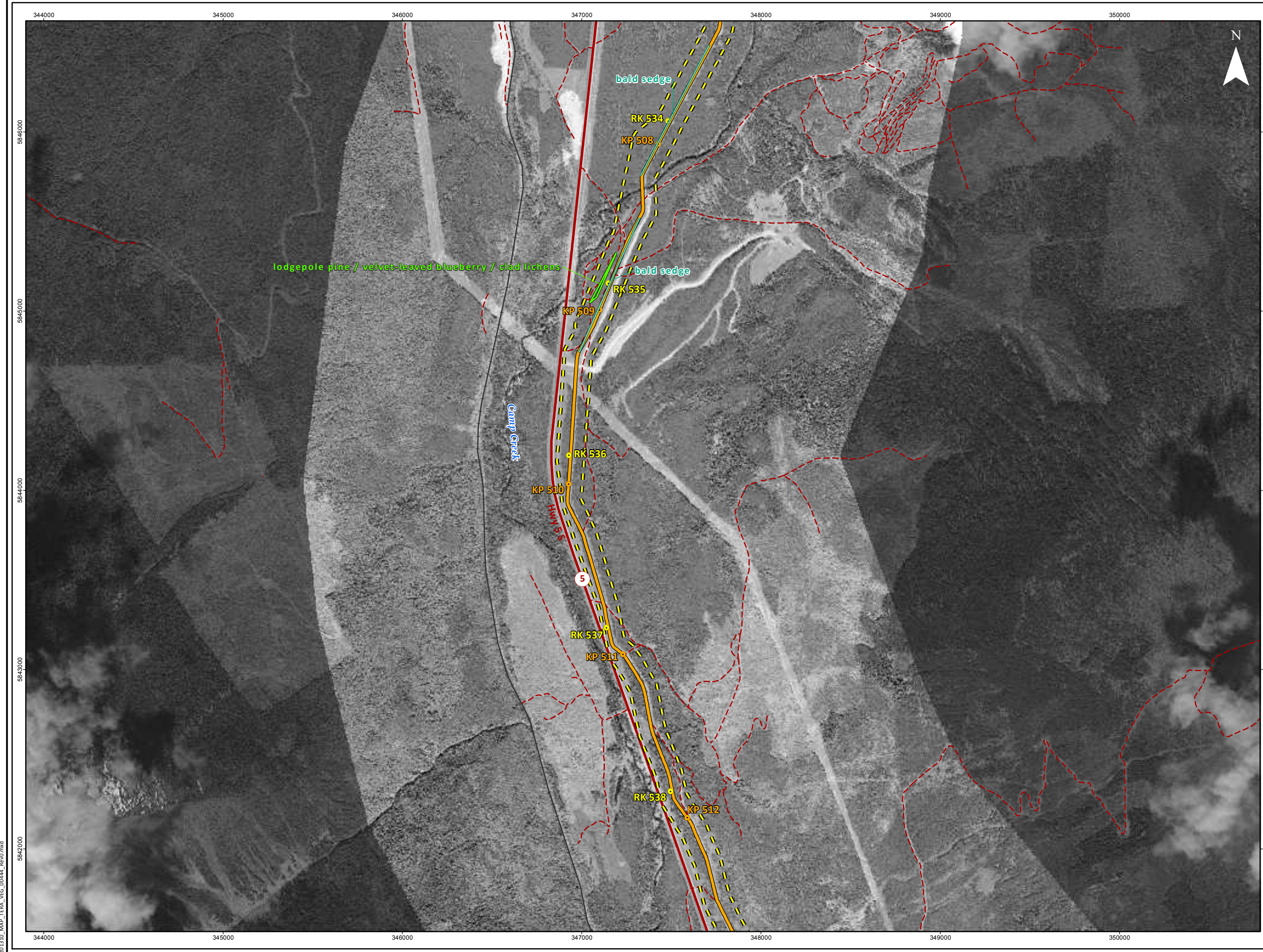
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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 25 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophite or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
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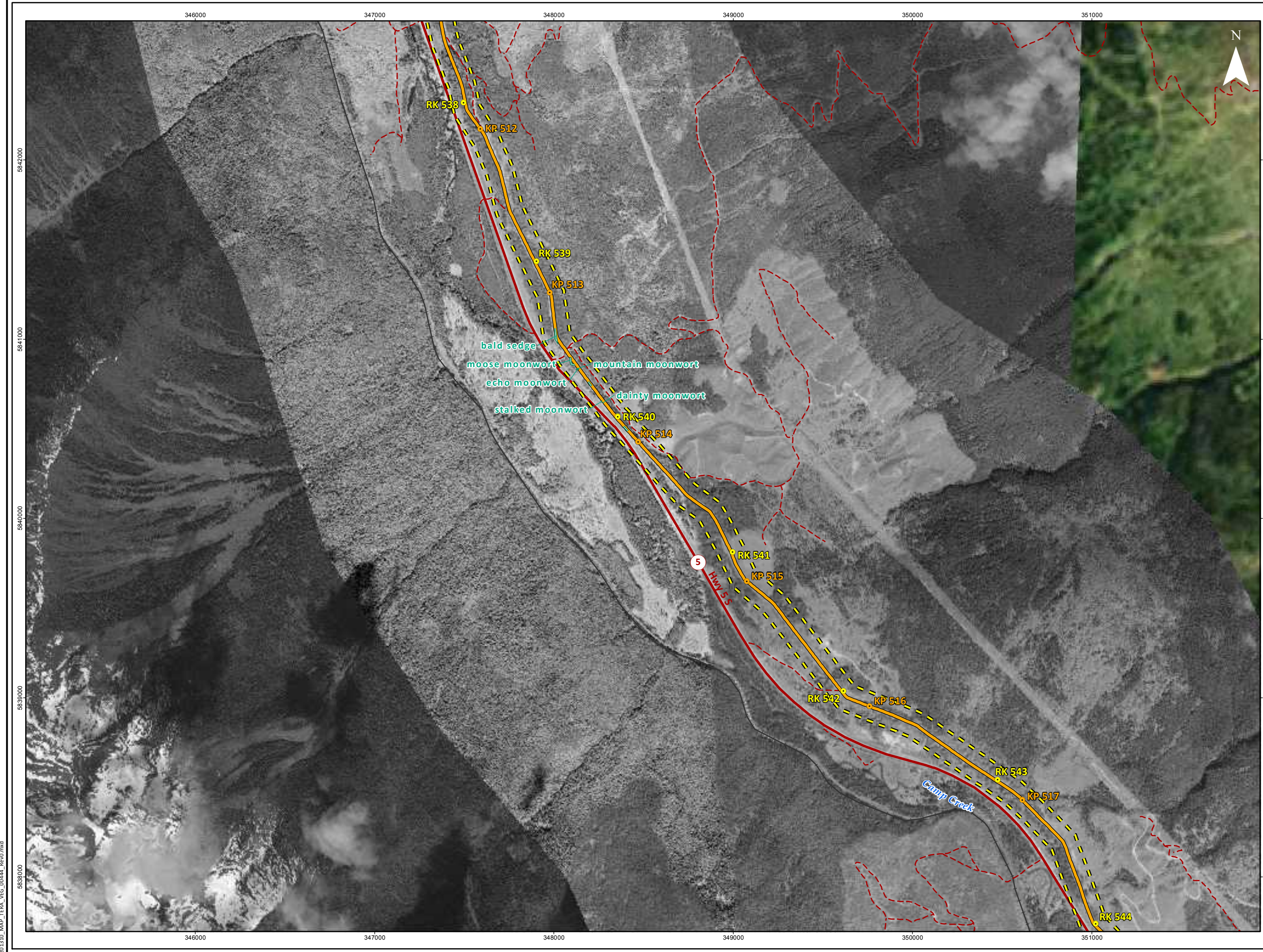
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ALL LOCATIONS APPROXIMATE

201310\_MAP\_TERA\_VEG\_00444\_REV0.mxd



**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 26 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
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0 200 400 600 800 m  
ALL LOCATIONS APPROXIMATE

201310\_MAP\_TERA\_VEG\_00444\_REV0.mxd

**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 27 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
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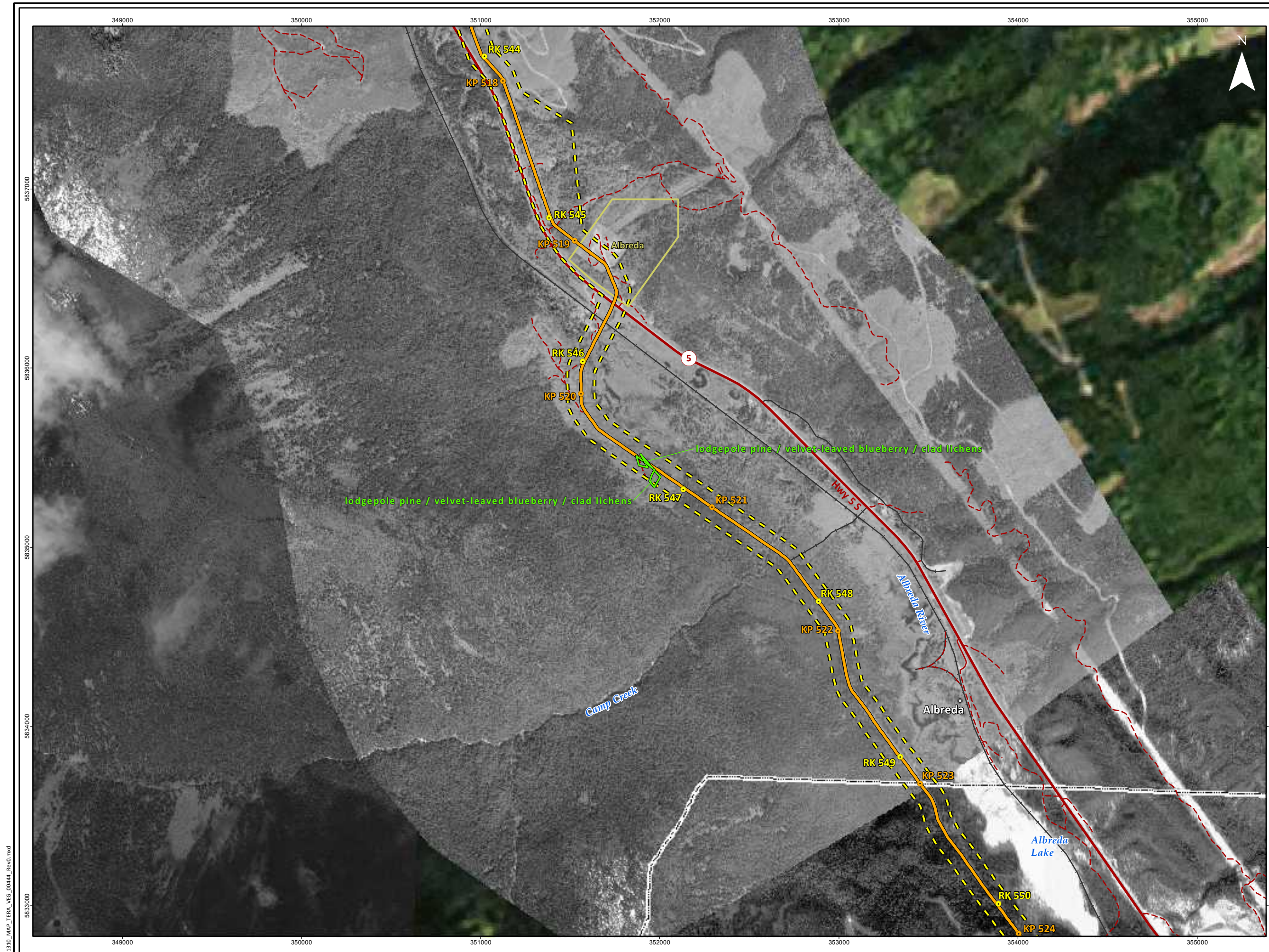
Projection: NAD 1983 UTM Zone 11N. Baseline TMPL & Facilities: provided by KMC, 2012; Proposed Pipeline Corridor V&S: provided by UPI, Aug. 23, 2013; Facilities, S/W & Colour Imagery: 2005-2011 provided by KMC, 2012; Existing Infrastructure: IHS Inc., 2013; Transportation: IHS Inc., 2013; Natural Resources Canada, 2011; BC FLNRO 2012; Geopolitical Boundaries: Natural Resources Canada, 2009, Atlas, 2012; IHS Inc., 2013; BC FLNRO 2007, ESRI, 2005; First Nation Lands: Government of Canada, 2013, Atlas, 2010, IHS Inc., 2011; Parks and Protected Areas: Natural Resources Canada, 2012, Atlas, 2012; BC FLNRO 2008; Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



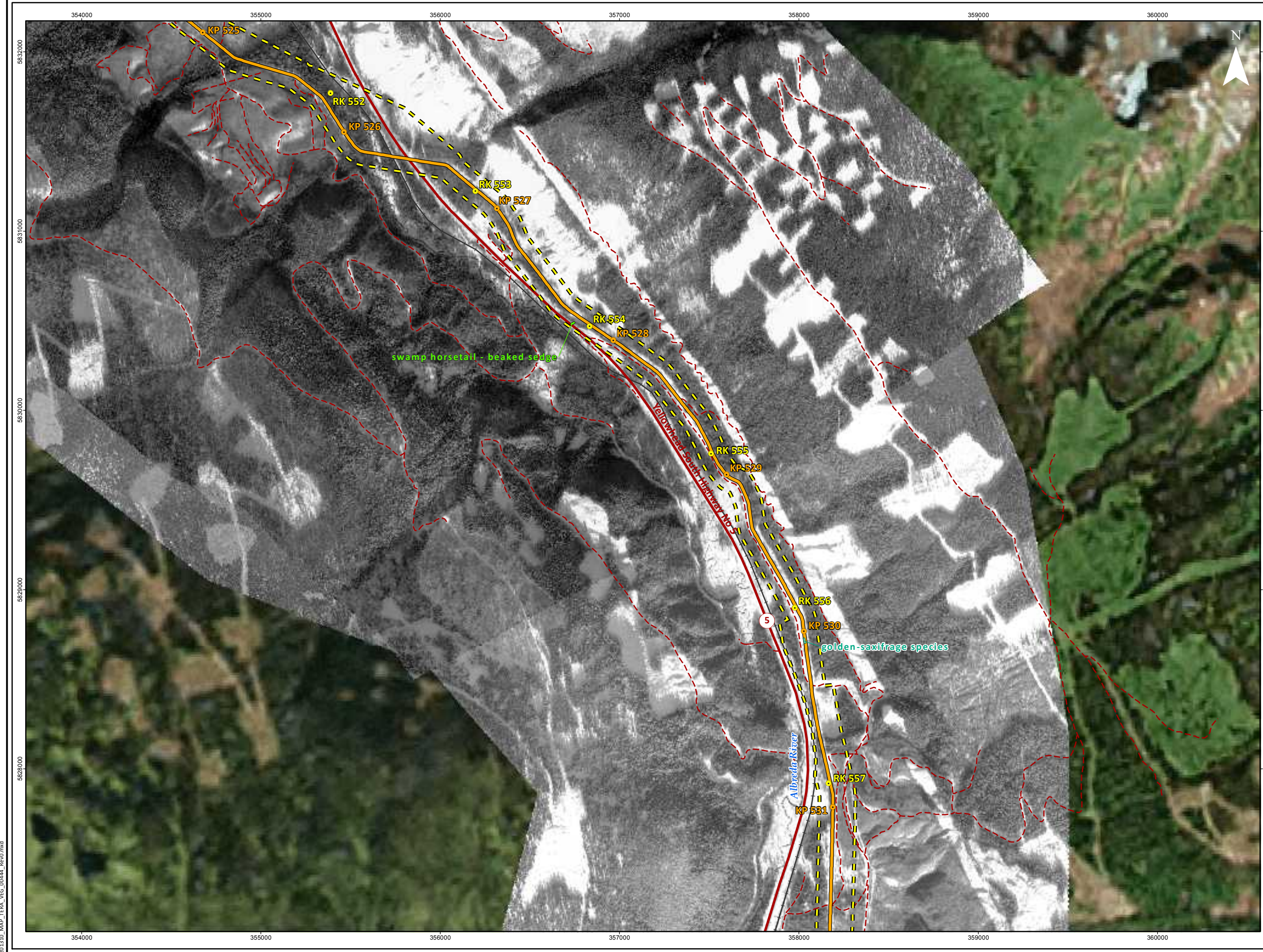
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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 28 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
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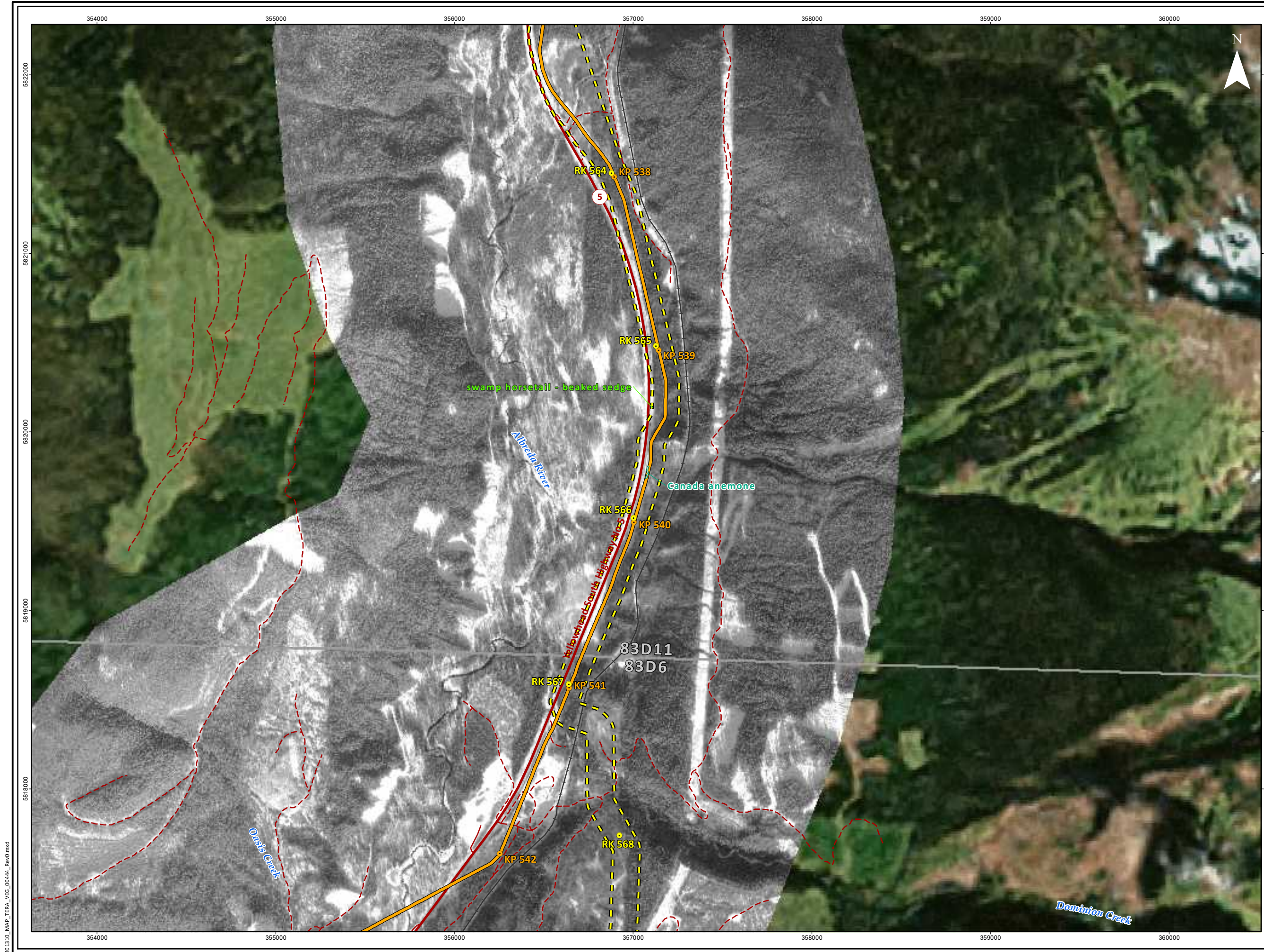
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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 29 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
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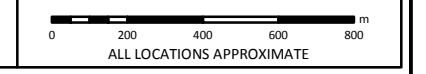
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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 30 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
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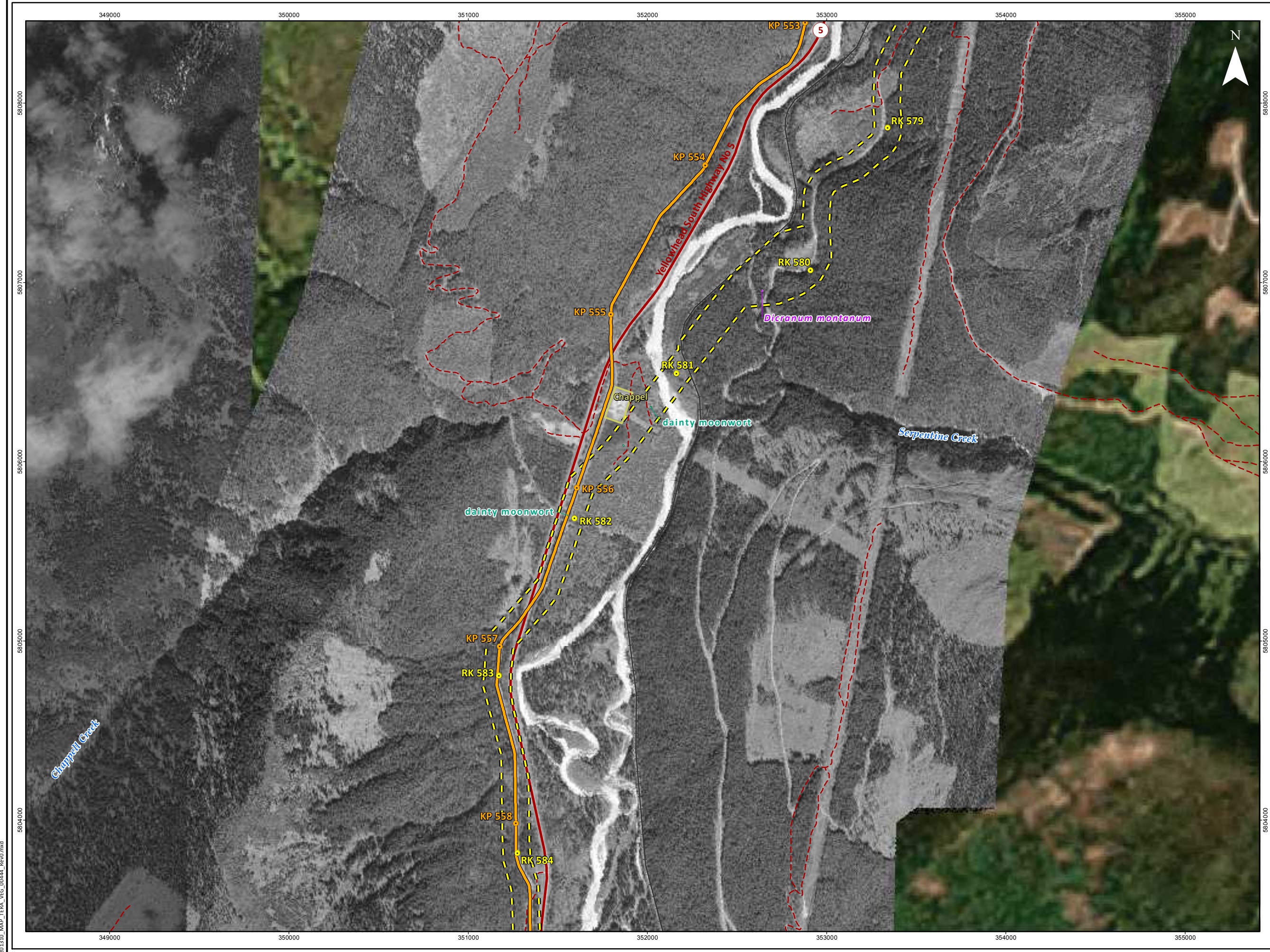
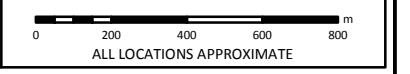
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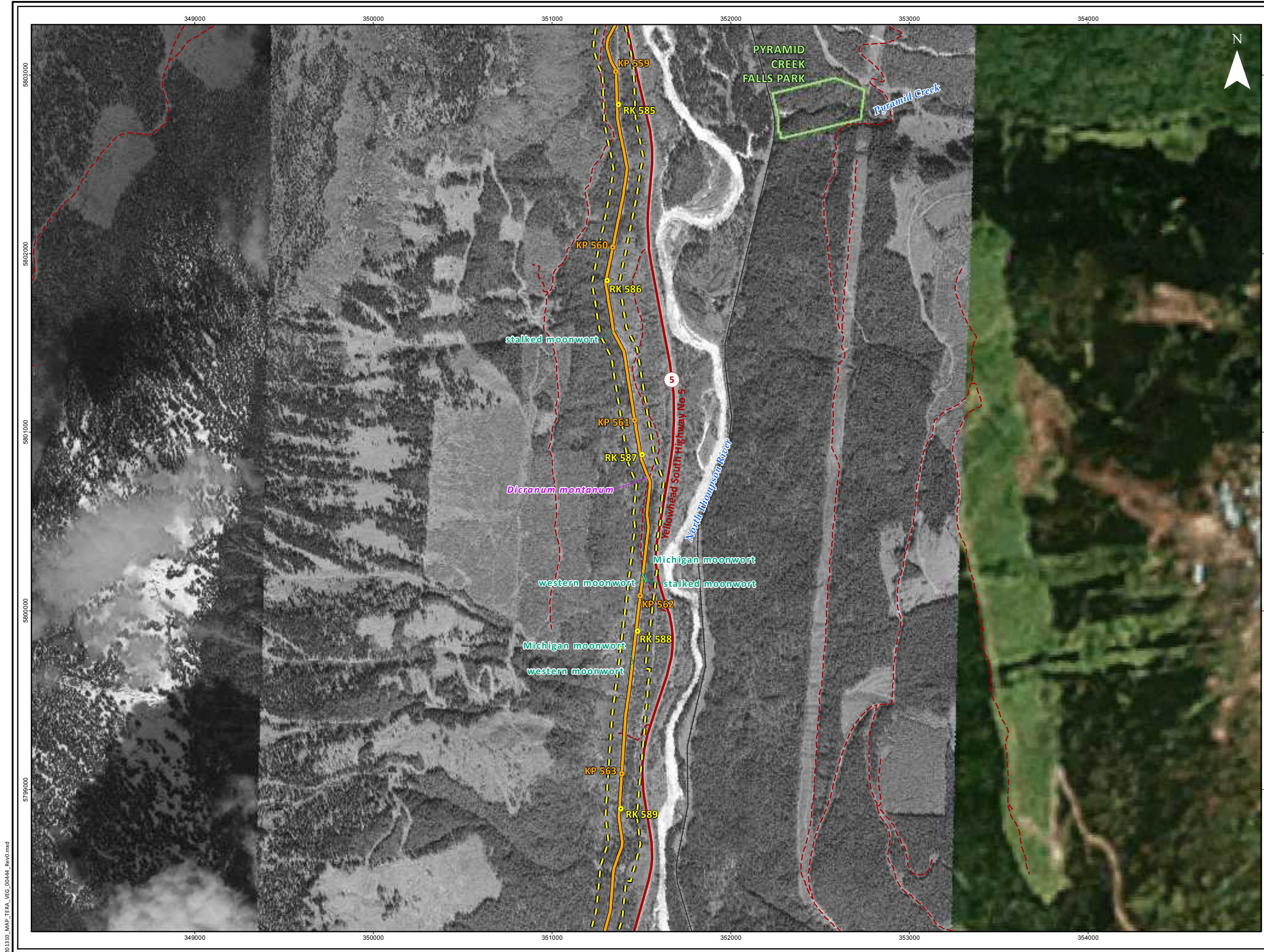


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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 31 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
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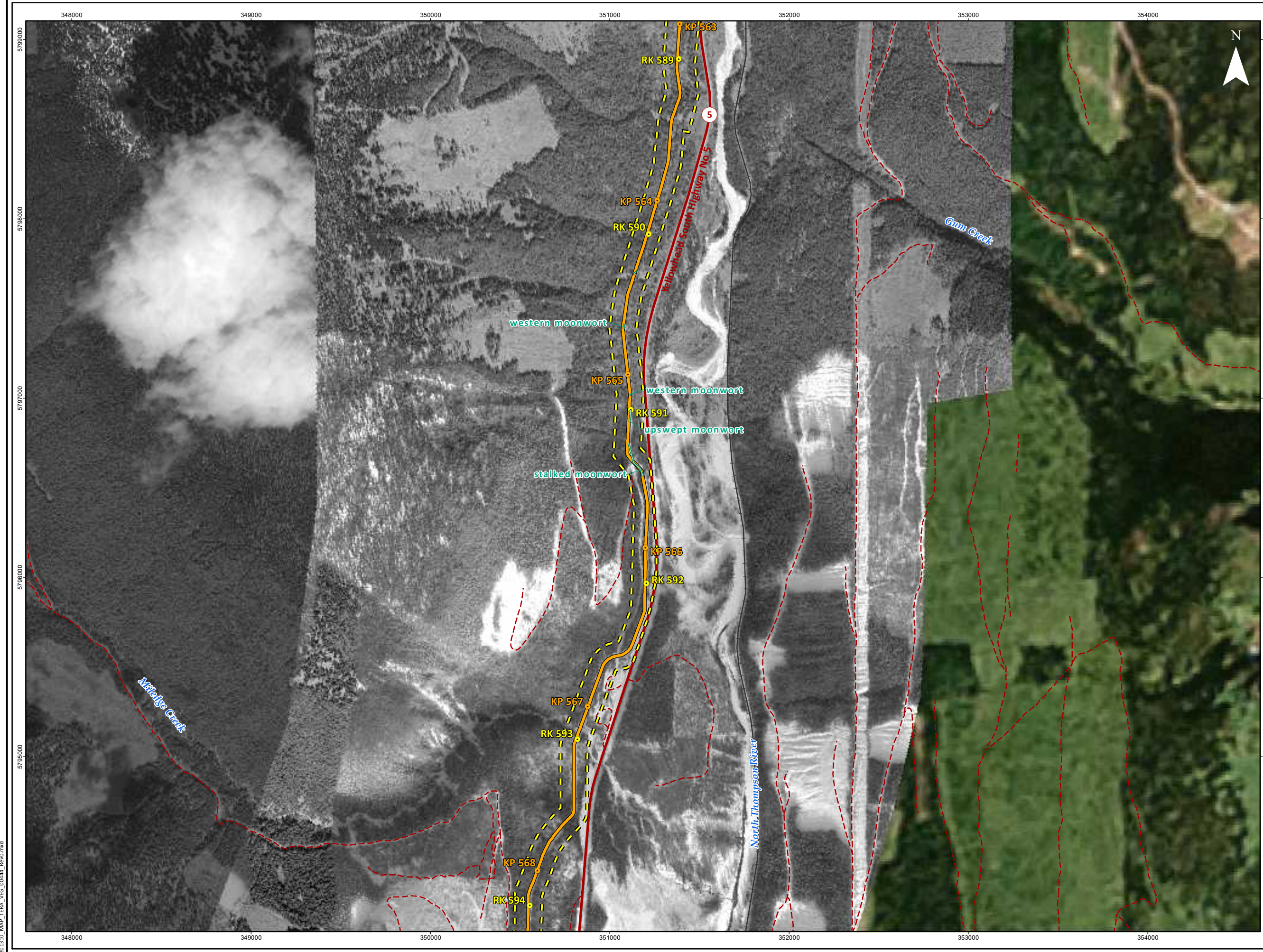


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0 200 400 600 800 m  
ALL LOCATIONS APPROXIMATE



**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 32 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
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- Municipal / District Boundary

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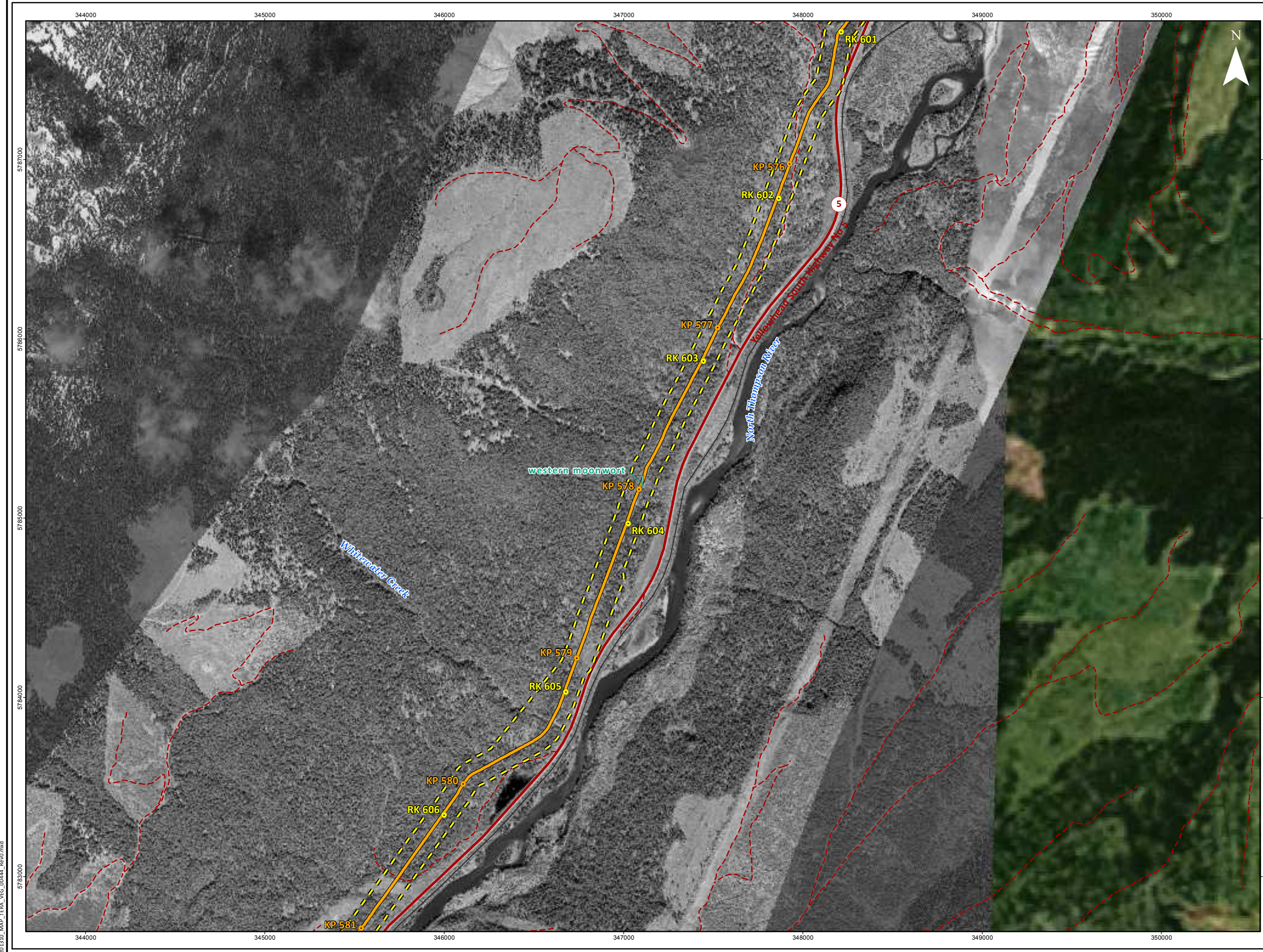


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ALL LOCATIONS APPROXIMATE



**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 33 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
- Facility Footprint
- National / Provincial Park
- Park / Protected Area
- Municipal / District Boundary

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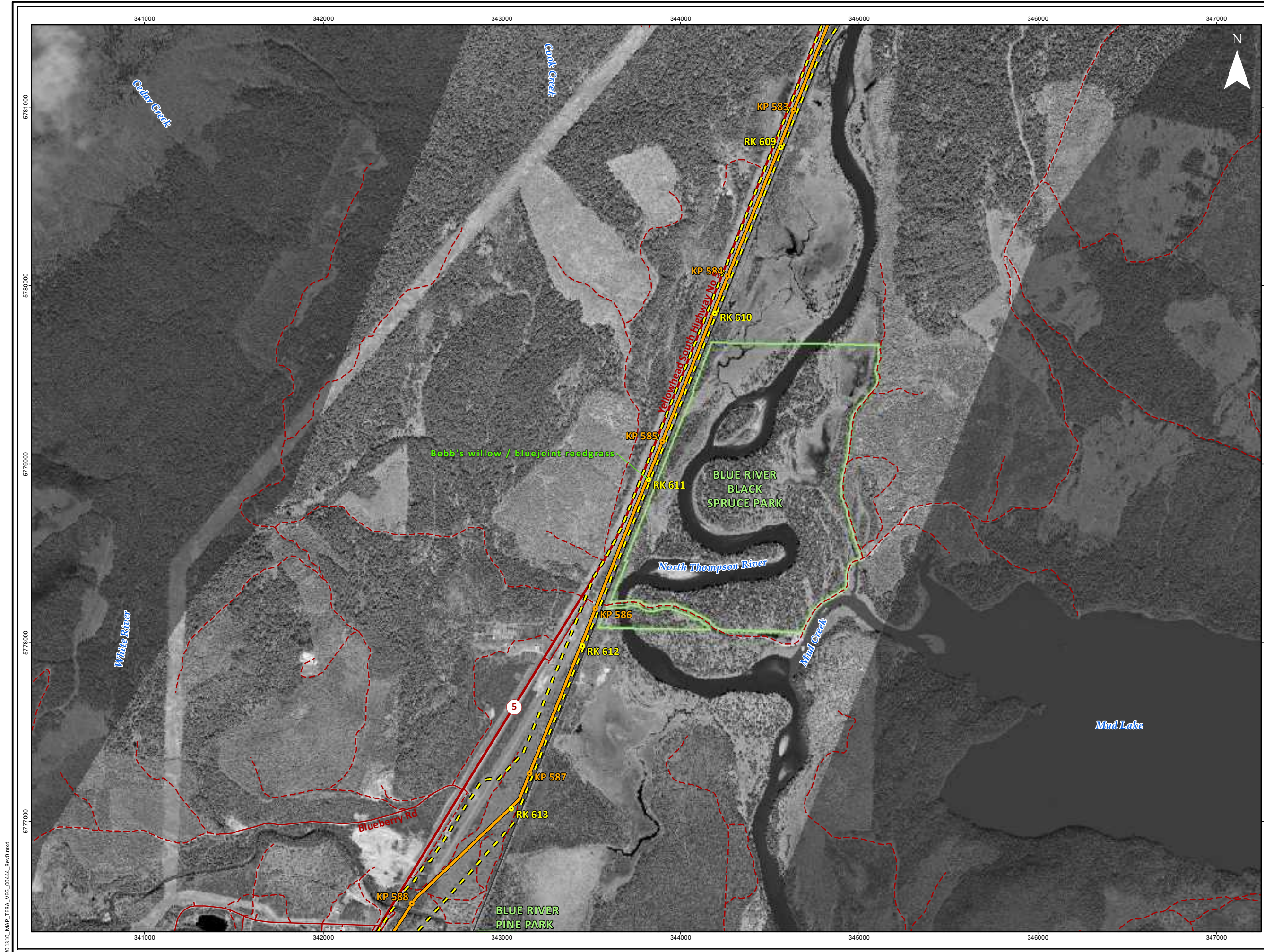
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0 200 400 600 800 m  
ALL LOCATIONS APPROXIMATE

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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 34 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
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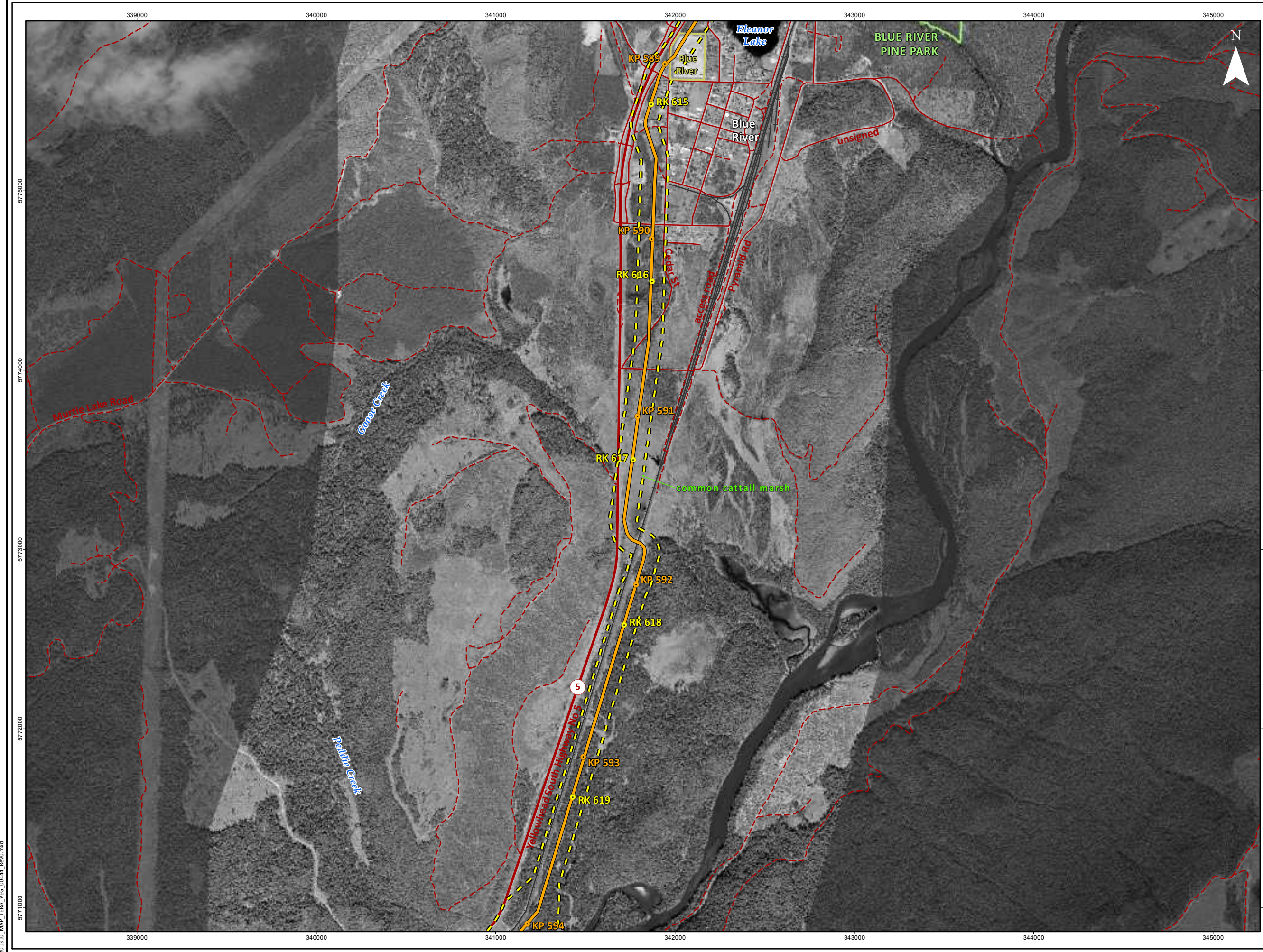


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0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE



**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 35 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
- Rare Ecological Community
- Highway
- Paved Road
- Resource Road
- Railway
- Village / Hamlet
- City / Town
- Indian Reserve / Métis Settlement
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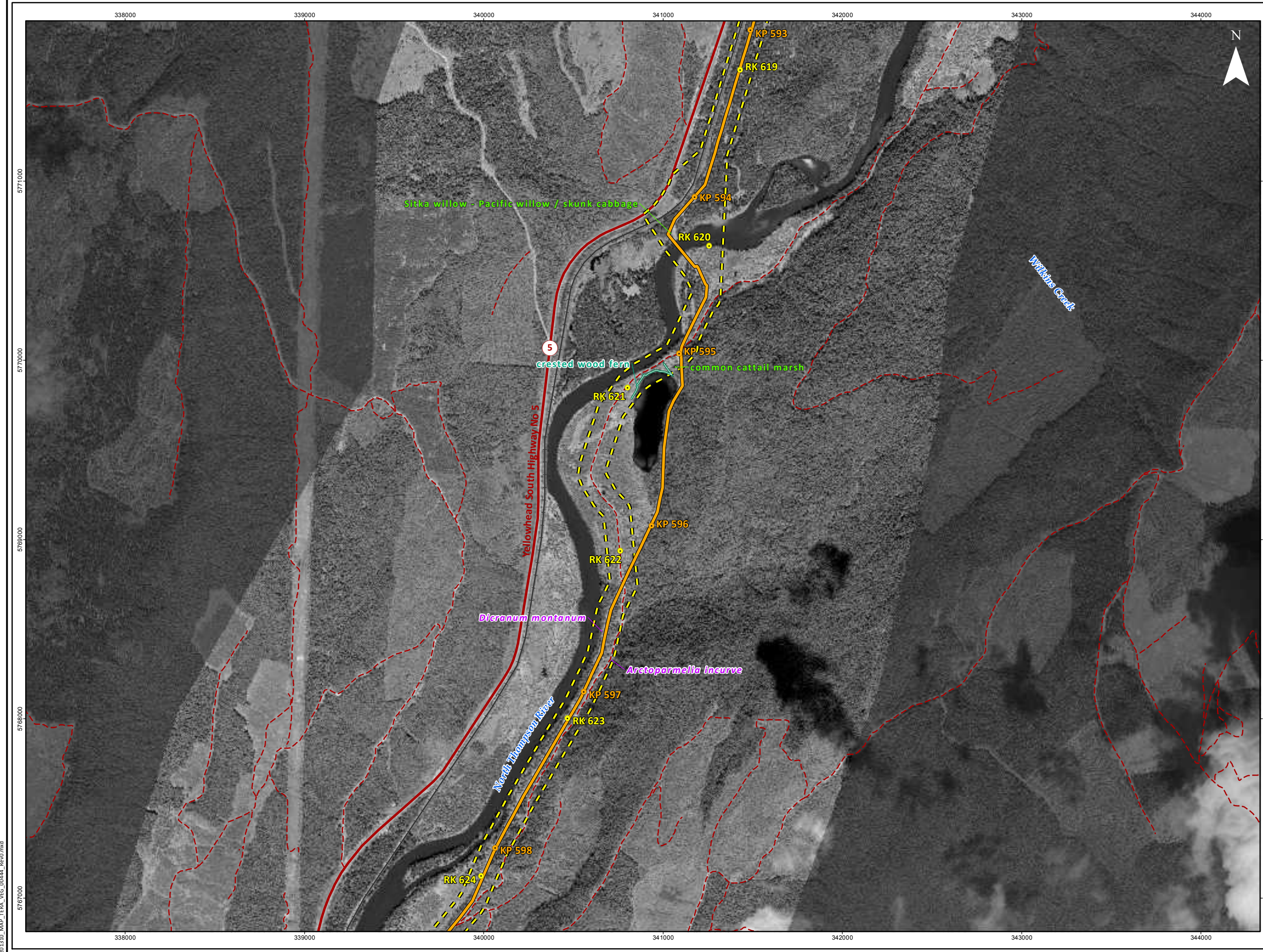
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0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE

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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 36 OF 71**

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
- Rare Vascular Plant
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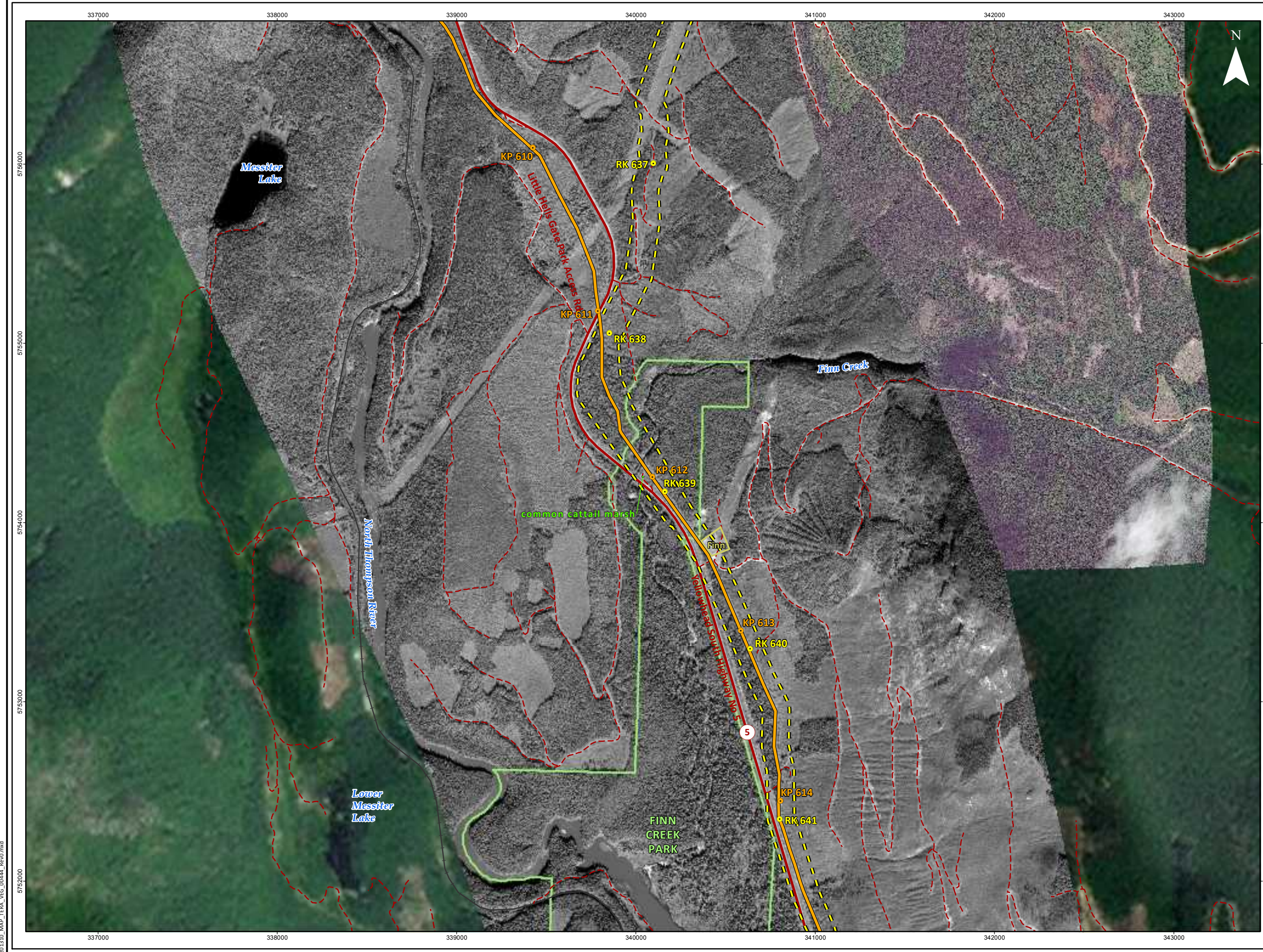
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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 37 OF 71**

- Kilometre Post (KP)
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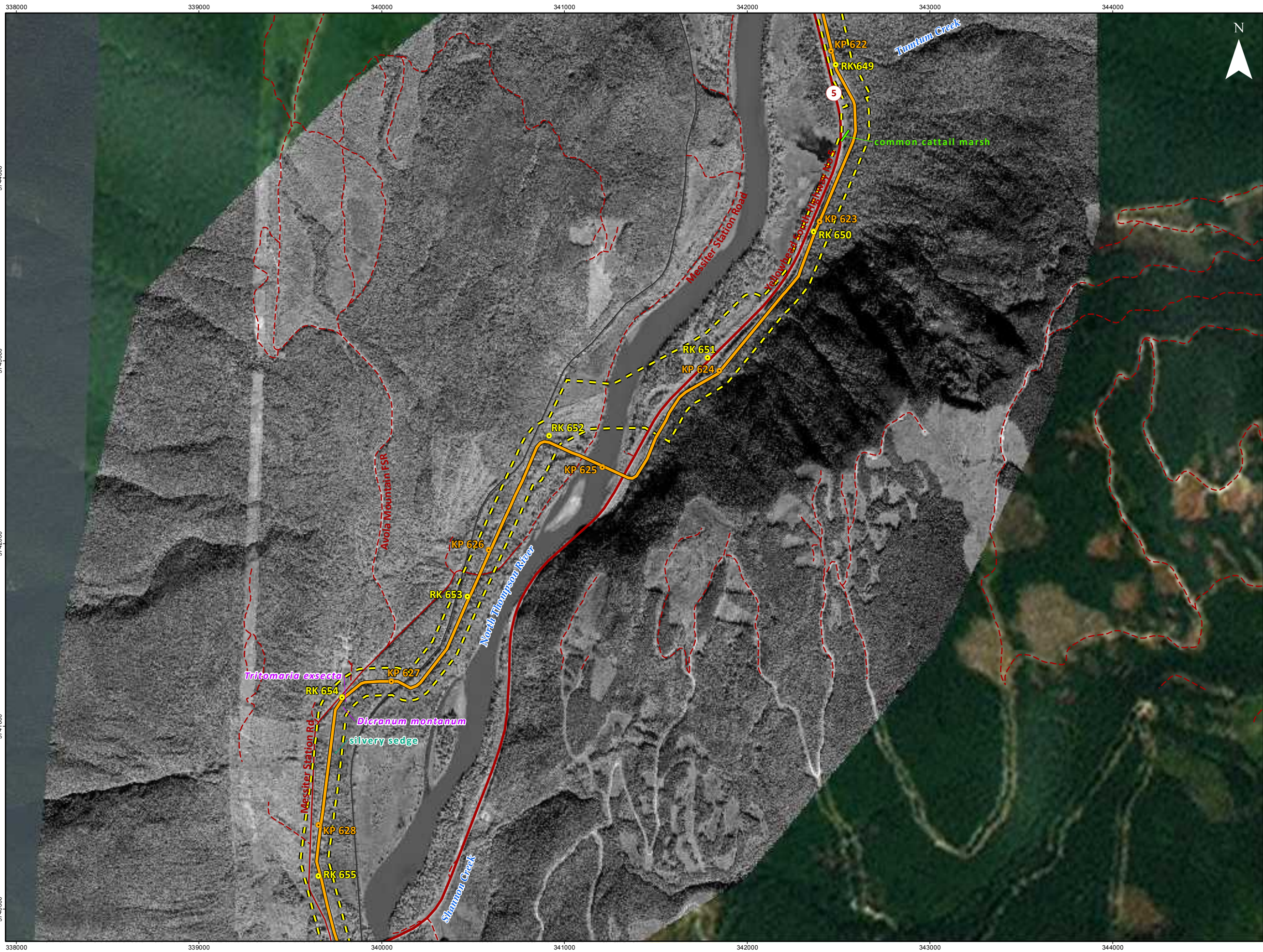
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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 38 OF 71**

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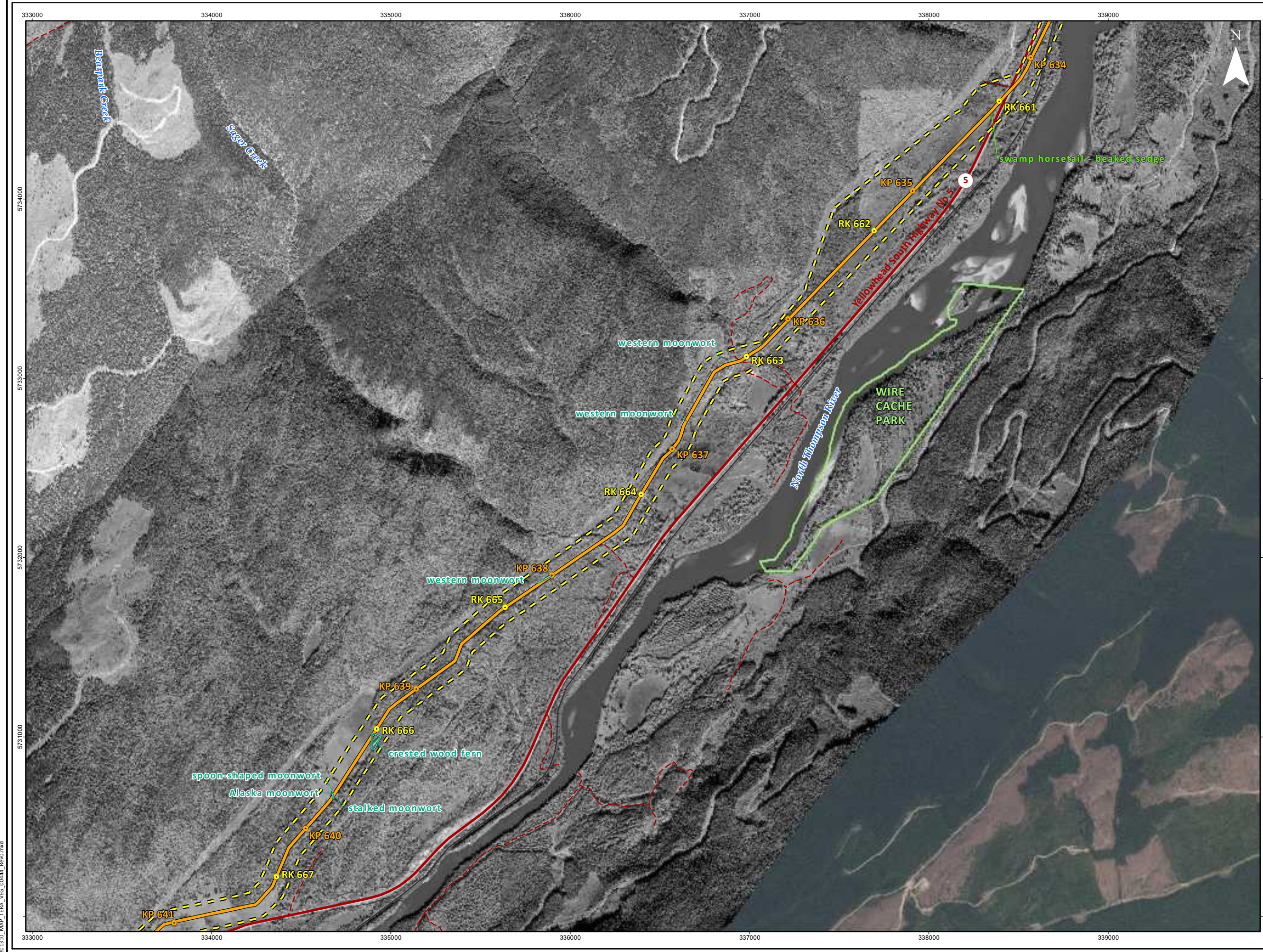


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0 200 400 600 800 m  
 ALL LOCATIONS APPROXIMATE

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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 39 OF 71**

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- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
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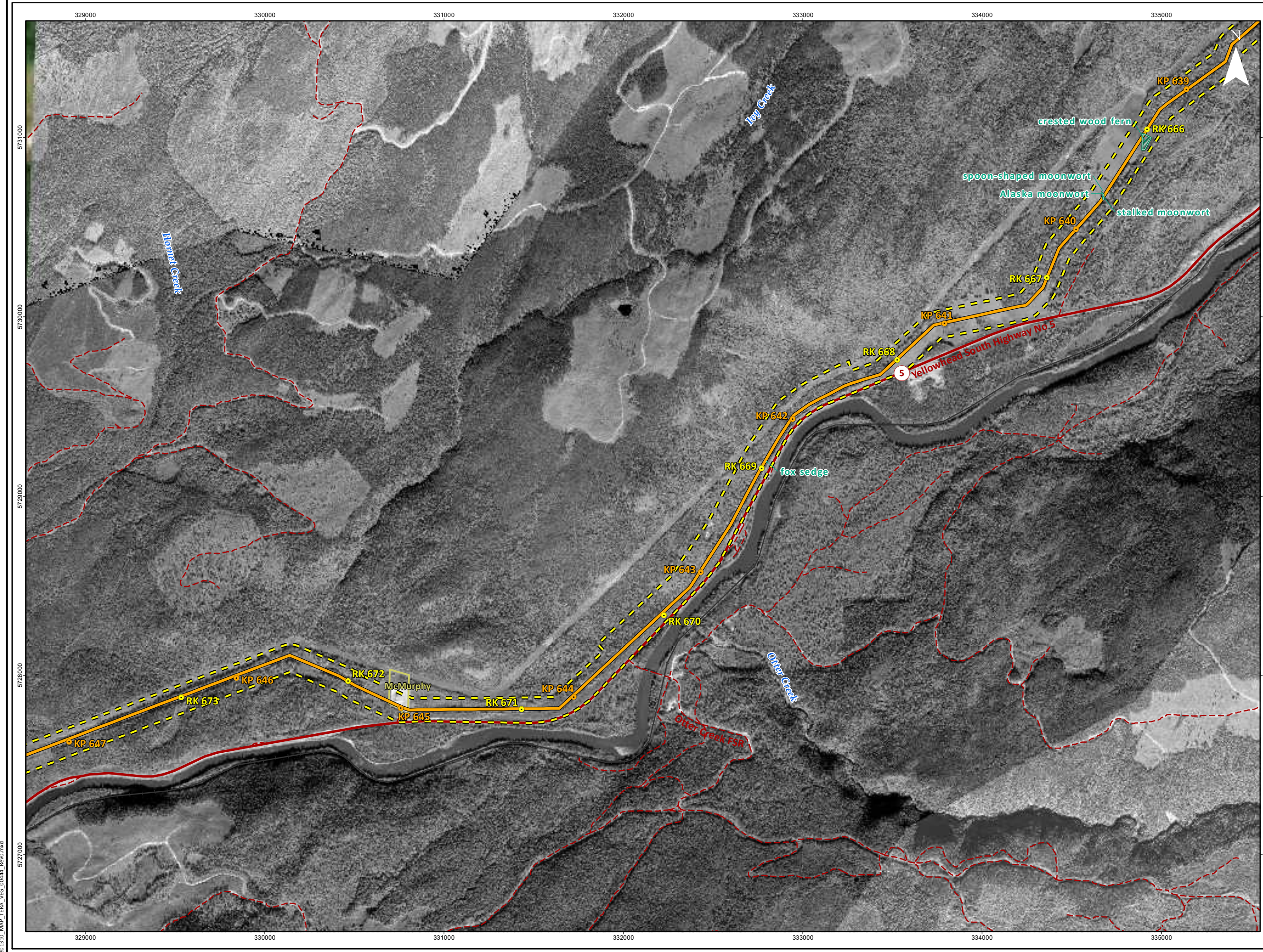
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0 200 400 600 800 m  
ALL LOCATIONS APPROXIMATE

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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 40 OF 71**

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- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
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**FIGURE 2**  
**RARE PLANT, LICHEN AND ECOLOGICAL**  
**COMMUNITY OBSERVATIONS**  
**TRANS MOUNTAIN**  
**EXPANSION PROJECT**  
**SHEET 41 OF 71**

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- Trans Mountain Pipeline (TMPL)
- Reference Kilometre Post (RK)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Proposed Power Line
- Rare Bryophyte or Lichen
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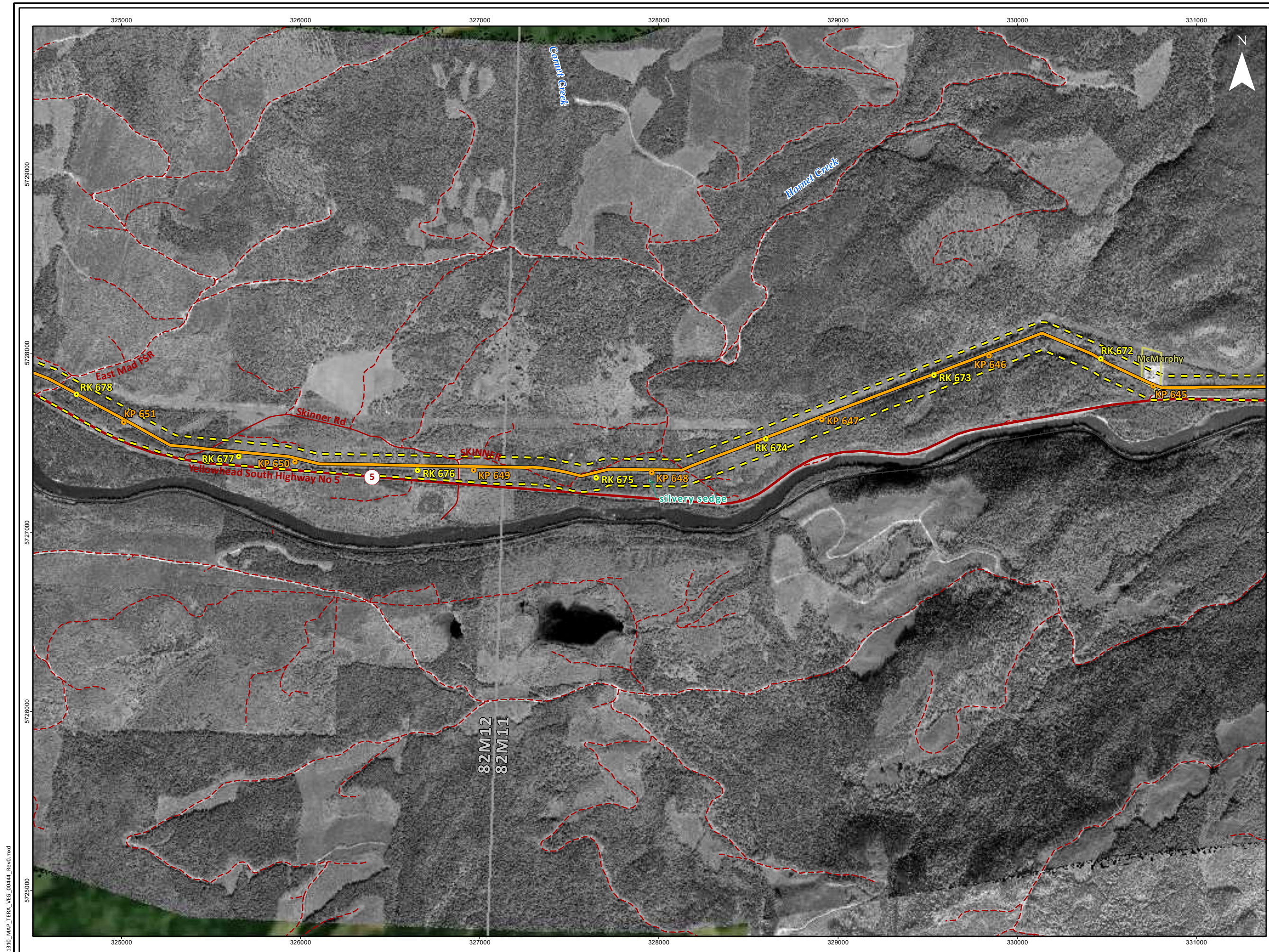
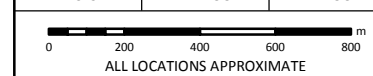
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