



Pacific Trail Pipelines Project

Application to Amend Environmental Assessment Certificate No. E08-01

Final Report

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Rev 2.0

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SUMMARY

Pacific Trail Pipelines Limited Partnership (PTP) is developing the Pacific Trail Pipelines Project (PTP Project). The approximately 466.2 km, pipeline will provide natural gas transmission service from an interconnect with the Spectra Energy Transmission system near Summit Lake to Kitimat, British Columbia.

PTP is requesting an amendment to the Environmental Assessment Certificate (EAC) #E08-01 pursuant to the *British Columbia Environmental Assessment Act (BCEAA)* to include:

- changing the location of the compressor station from the Burns Lake area to Summit Lake,
- a temporary stockpile site south of Houston B.C. at KM 298, and a temporary stockpile site north east of Kitimat at KM 426, and
- pipeline route modifications to avoid potential geotechnical hazards, to comply with land-owner and First Nations requests, and to avoid impacts to wildlife, vegetation, and aquatics. The route modifications are:
 - twenty (20) route refinements, and
 - twenty-seven (27) minor route adjustments.

Environmental effects of the Project were identified in the Environmental Assessment Certificate Application for the Kitimat – Summit Lake Natural Gas Pipeline Looping Project, October 2007 (2007 EAC Application).¹

The environmental effects assessment, like the effects assessment contained in the original 2007 EAC Application is a sustainability-based environmental assessment that considers five interconnected and interdependent “pillars” including environment, economy, social, cultural/heritage, and health.

Rationale for amendments

As would be expected for any linear development project (*e.g.*, a powerline, pipeline, road), the initial project design for the PTP Project provided the basis for addressing the majority of geotechnical, terrain stability, environmental, and social issues that may result from the construction and operation of the project. Through the application of site-specific studies during the advanced design phase of the project, revisions to the project design have been identified in order to improve the PTP project on the basis of engineering design as well as to reduce potential adverse environmental effects. In the case of the PTP Project, the likelihood of these revisions was anticipated during the review of the 2007 EAC Application as well as in the approval documents. Accordingly, several project commitments specify that PTP will

¹ The project is now called the Pacific Trail Pipelines or “PTP” Project.

undertake post-certificate, site-specific investigations and would be able to make any necessary route refinements and minor route adjustments.

For example, one of the commitments that form part of the Environmental Assessment Certificate for the PTP Project states: “PTP commits to undertake additional terrain stability investigations and geotechnical work as part of the project design following certification. Should areas of instability be identified, they will be subject to further geotechnical investigations, which may lead to engineering design solutions or local route adjustments.”

Summit Lake compressor station

When the original purpose of the PTP Project was to transport natural gas from an LNG import facility at Kitimat to the Spectra Energy Transmission pipeline facilities at Summit Lake, the design called for the installation of a mid-point compressor station to enable the required throughput of natural gas. This compressor station was sited at the hydraulic mid-point of the pipeline. The location of the compressor station in 2007 was south of Burns Lake and just east of Highway 35.

Now that the PTP Project is designed to move natural gas from Summit Lake to Kitimat, or east to west, a compressor station is required at Summit Lake rather than at the hydraulic mid-point of the pipeline. The new Summit Lake compressor station is required in order to increase the pressure of the natural gas from where it is sourced at the Spectra Energy Transmission pipeline facilities.

Environmental (including air quality and noise) studies, land use studies and public consultation work has been completed for the Summit Lake compressor station site. An assessment of the effects concluded that there are no material changes to the assessment of adverse effects by relocating the compressor station from the Burns Lake area to Summit Lake.

Temporary stockpile sites

During the advanced design work that has been undertaken for the project, two additional temporary stockpile sites have been identified. They are located near the pipeline route in the vicinity of KM 298 and KM 426. These temporary facilities are required along the pipeline route for the purpose of storing pipe prior to transporting it to the right-of-way as well as for the temporary storage of equipment and materials required for the construction of the project.

Studies completed for the temporary stockpile sites in 2011 concluded that no residual effects were identified.

Route refinements and minor route adjustments

Pipeline routing changes are driven by numerous factors including avoiding environmentally sensitive areas, meeting landowner, First Nations, or tenure holder requests, avoiding geotechnical hazards, and ensuring long-term pipeline integrity and safety.

Changes to pipeline routing from the approved corridor are identified as:

- **Route Refinements (RRs)** are changes to the pipeline route that deviate from the approved corridor by over 100 m, and that may cross a different landform or land use type than the originally approved route. Any routing changes that affect the approved corridor for major watercourse crossings are also considered to be a route refinement.
- **Minor Route Adjustments (MRAs)** are small changes associated with detailed engineering of the pipeline route. These adjustments are within 100 m of the approved pipeline corridor, have similar landforms and land uses as the approved corridor, and do not require any changes from the approved corridor at watercourse crossings.

The methods used to assess the effects of the changes to the project description contained in this amendment document are identical to the approach to impact assessment and impact assessment methodology used for the original 2007 EAC Application.

The PTP pipeline route is in the asserted traditional territory of fifteen First Nations and two tribal organizations. These First Nations groups have been informed about the relocation of the compressor station, additional temporary stockpile sites, and most of the requested pipeline route refinements. PTP will continue to engage First Nations to make them aware of recent route refinements and route adjustments to the pipeline route.

An open house was held on September 28, 2011 at Summit Lake to inform the public about the proposed compressor station. PTP is developing a program to notify members of the public whose interests may be affected by the PTP Project. Individual tenure holders and landowners will be contacted in 2011 and 2012.

All requested amendments have been field reviewed and assessed by the team of professionals who conducted the 2007 studies and prepared the PTP Environmental Assessment Certificate Application.

A 100 m wide study corridor was approved for the PTP Project in 2008. The 18 m wide statutory right-of-way and the 38 m wide temporary workspace for pipeline construction are located in the study corridor.

The requested amendments contained in this application have been identified in response to project commitments contained in the 2008 EAC. Most of the environmental effects identified in the 2007 EAC Application have not changed with the relocation of the compressor station, the addition of two temporary stockpile sites, and the requested route modifications. The requested 20 route refinements and 27 minor route adjustments outlined in this application will not substantially change the project footprint (PF) or the effects of the project on the environment. There are several wildlife habitat, geotechnical, and land use improvements expected if the pipeline route modifications are adopted.

The route refinements and minor route adjustments add approximately 1.1 km and 0.1 km, respectively, to the overall length of the approved pipeline route, and no adverse effects were identified for the requested EAC amendments.

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LIST OF ABBREVIATIONS

AIA	Archaeological Impact Assessment
ATOR	Approved Terms of Reference
BC CDC	British Columbia Centre for Disease Control
BCEAA	<i>British Columbia Environmental Assessment Act</i>
CEA	Cumulative Effects Assessment
<i>CEA Act</i>	<i>Canadian Environmental Assessment Act</i>
CEAA	Canadian Environmental Assessment Agency
CEPA	Canadian Environmental Protection Agency
CFP	Chance Find Procedure
CLI	Canada Land Inventory
CMT	culturally modified tree
CSTC	Carrier Sekani Tribal Council
CWHws1	Coastal Western Hemlock Submontane Wet Submaritime
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
EAC	Environmental Assessment Certificate
EAO	Environmental Assessment Office
EMP	Environmental Management Plan
EOG	EOG Resources Canada Inc.
FSR	Forest Service Road
GHGs	green house gases
HCA	<i>Heritage Conservation Act</i>
HDD	horizontal directional drilling
IPMP	Invasive Plant Management Plan
KM	kilometre mark
KM LNG	Kitimat Liquefied Natural Gas Facility
KSL	Kitimat – Summit Lake
LNG	liquefied natural gas
LSA	Local Study Area
MFLNRO	Ministry of Forests, Lands, and Natural Resource Operations
MRA	minor route adjustment
OGMA	Old Growth Management Area
PAH	polycyclic aromatic hydrocarbons
PF	Project Footprint
PNG	Pacific Northern Gas
PTP	Pacific Trail Pipelines
RA	Responsible Authorities
ROW	right-of-way
RR	route refinement

RSA	Regional Study Area
SBSdk	Sub-Boreal Spruce
TC	Transport Canada
VEC	Valued Ecosystem Component
VOCs	volatile organic compound
VSC	Valued Social Component
WRG	Westland Resource Group

GLOSSARY OF TERMS

Approved Terms of Reference (ATOR)	Scope and Requirements of the Environmental Assessment for the Kitimat to Summit Lake Natural Gas Pipeline Looping Project.
Archaeological Impact Assessment (AIA)	A field visit involving archaeological potential assessment, surface examination, subsurface testing (if deemed appropriate), and archaeological site recording as necessary. An AIA is intended to identify the potential for physical archaeological evidence of past human activity protected under the HCA (pre-1846). It does not address traditional land use or other heritage concerns of the First Nations people with traditional territories in the study area(s).
Baseline condition	A baseline condition is the current state of an environmental setting for a particular component of the project. This environmental reference point will aid in determining potential environmental effects and will be used when comparing future environmental conditions and potential project effects.
Chance Find Procedure (CFP)	A document detailing the types of archaeological artefacts and features which are common to the culture area as well as the procedures to follow should these materials be uncovered during development. This document would be distributed to all contractors responsible for ground-disturbing activities in the vicinity of an archaeological site and should be kept on-hand during development.
Compressor station	A facility that pressurizes natural gas to facilitate throughput in a pipeline.
Cumulative effects	Cumulative effects are changes to the environment caused by an action, including projects or activities, combined with human actions of the past, present, and future.
Environmental effect	In respect of a project: <ul style="list-style-type: none"> a) any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the <i>Species at Risk Act</i>, b) any effect of any change referred to in paragraph (a) on <ul style="list-style-type: none"> - health and socio-economic conditions, - physical and cultural heritage, - the current use of lands and resources for traditional purposes by aboriginal persons, or - any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, or

	<p>c) any change to the project that may be caused by the environment, whether any such change or effect occurs within or outside Canada. [<i>Canadian Environmental Assessment Act s.2</i>]</p>
Kilometre mark (KM)	Location reference points spaced approximately one kilometre apart. KMs follow the flow of the product, with KMs increasing from Summit Lake to Kitimat.
Local Study Area (LSA)	The Local Study Area (LSA) consists of a 2 km buffer centred on the pipeline right-of-way. The LSA captures most direct and indirect effects of Project activities and facilities. This is the zone of influence within which plants (50 m), animals (500 m), and humans (500 to 800 m) are most likely to be affected by project construction and operation. The width of the LSA may vary somewhat depending on the specific resource in question. For example, wildlife studies will expand to a 50 km buffer where necessary to ensure potential effects on elements such as grizzly bear movement are captured or a larger downstream area may be studied at major river crossings to assist with mitigation/compensation planning.
Map review	Map review or archaeological review is an office based map and document review to assess predicted archaeological potential.
Mitigation	In respect of a project, 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. [<i>Canadian Environmental Assessment Act s.2</i>]
Old Growth Management Area (OGMA)	A spatially identified area that is subject to old growth management objectives.
Pipeline	A line that is used for the transmission of natural gas or any other commodity.
Project	Project means <ul style="list-style-type: none"> a) in relation to physical work, any proposed construction, operation, modification, decommissioning, abandonment or other undertaking in relation to that physical work, or b) any proposed physical activity not relating to a physical work that is prescribed or is within a class of physical activities that is prescribed pursuant to regulations made under paragraph 59(b). [<i>Canadian Environmental Assessment Act s.2</i>]
Project Footprint (PF)	The Project Footprint (PF) study area (approximately 40 m wide) is made up of the area directly disturbed by clearing, construction and clean-up activities,

	including associated physical works and activities (<i>i.e.</i> permanent right-of-way, temporary workspace, temporary access routes, temporary stockpile sites, temporary staging areas, construction work camp, off-load areas, borrow pits, facility sites).
Proponent	In respect of a project, means the person, body, federal authority, or government that proposes the project. [<i>Canadian Environmental Assessment Act</i> s.2]
Regional Study Area (RSA)	The Regional Study Area (RSA) includes relevant portions of the Traditional Territories of affected First Nations as well as local communities most likely to experience socio-economic effects of the Project (<i>e.g.</i> Kitimat, Terrace, Houston, Burns Lake, Fraser Lake, Vanderhoof, Summit Lake, and Prince George). The RSA for the CEA is approximately 15 km on both sides of the pipeline centreline (total width 30 km). For the socio-community topics, the RSA will include municipalities where Project effects on employment, services, housing, and infrastructure might be felt (<i>e.g.</i> Prince George, Vanderhoof, Fraser Lake, Burns Lake, Smithers, Terrace, and Kitimat).
Residual effects	Residual effects remain after mitigation is applied.
Responsible Authority (RA)	In relation to a project, a federal authority that is required pursuant to subsection 11(1) of the <i>Canadian Environmental Assessment Act</i> to ensure that an environmental assessment of a project is conducted. [<i>Canadian Environmental Assessment Act</i> s.2]
Right-of-way (ROW)	Land in which the pipeline owner has permanent, but limited rights to construct, operate and maintain the pipeline.
Riparian	Pertaining to anything connected with or immediately adjacent to the banks of a stream or other body of water.
Significant residual effect	A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically mitigated or economically compensated.
Species at risk	An extirpated, endangered, or threatened species or a species of special concern. [<i>Species at Risk Act</i> s.2]
Stockpile site	A land area used for storing pipe and construction materials.
Temporary workspace	Land where the pipeline owner has obtained a limited right of use for pipeline construction purposes and where the right will expire after a specified period of time, or by a specific date.
Topsoil	Uppermost layer of soil, containing the highest concentration of organic matter and microorganisms.

Viewshed	An area of land, water, and other environmental elements that is visible from a fixed vantage point.
Wetland	Land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activities that are adapted to a wet environment (National Wetlands Working Group definition).
Wildlife tree	A standing live or dead tree with special characteristics that provide valuable habitat for the conservation or enhancement of wildlife.

1.0 INTRODUCTION AND PURPOSE

Pacific Trail Pipelines Limited Partnership (PTP) is requesting an amendment to the Environmental Assessment Certificate (EAC) #E08-01 pursuant to the *British Columbia Environmental Assessment Act (BCEAA)* to include the following:

- a change in the location of the compressor station from the Burns Lake area to Summit Lake,
- a temporary stockpile site south of Houston near KM 298 and a temporary stockpile site north east of Kitimat near KM 426, and
- pipeline route modifications to address potential geotechnical issues, land-owner requested changes and reduce or avoid adverse effects to wildlife, vegetation, and aquatic resources including:
 - twenty (20) route refinements, and
 - twenty-seven (27) minor route adjustments.

Environmental effects of the Project were identified in the Environmental Assessment Certificate Application for the Kitimat – Summit Lake Natural Gas Pipeline Looping Project, October 2007 (2007 EAC Application).²

This environmental assessment, like the effects assessment contained in the original 2007 EAC Application, is a sustainability-based environmental assessment that considers the following five interconnected and interdependent “pillars”:

- environment,
- economy,
- social,
- cultural/heritage, and
- health.

The following sections of the Application for an EAC Amendment provide a detailed description of the requested amendments to the originally certified project. This report also includes an assessment of the effects of the requested amendments on valued ecosystem components and valued social components during the construction, operations, and decommissioning phases of the Project.

This application is presented in 15 sections. Section 2 contains an updated project description. The requested amendments are presented in Section 3.

² The project is now called the Pacific Trail Pipelines or “PTP Project”.

The PTP Project commitments contained in the 2007 EAC Application are reviewed in light of the requested amendments in Section 4. Section 5 contains information on the scope of the effects assessment and the Environmental Assessment (EA) methods are contained in Section 6. Consultation information is provided in Section 7 (First Nations) and Section 8 (Public consultation).

An assessment of the effects of the Summit Lake compressor station and temporary stockpile sites are contained in sections 9 and 10 respectively, and an assessment of the potential effects of the 20 pipeline route refinements and 27 minor route adjustments are presented in Section 11. A summary of potential effects of minor route adjustments is provided in Section 12. A cumulative effects assessment (CEA) is provided in Section 13 and a summary of the effects assessment is presented in Section 14. References are provided in Section 15 and the appendices are found at the end of this application.

2.0 UPDATED PROJECT DESCRIPTION

2.1 Background

PTP is developing the Pacific Trail Pipelines Project (PTP Project). The approximately 466.3 km, pipeline will provide natural gas transmission service from an interconnect with the Spectra Energy Transmission system near Summit Lake, British Columbia to the KM LNG Operating General Partnership (KM LNG) proposed pipeline near Kitimat B.C. included as part of the liquefied natural gas (LNG) export terminal facilities. The 14 km pipeline will transport the gas from the terminus of the PTP Project to the export terminal at Bisch Cove, British Columbia. Figure 1 provides a general map of the PTP Project.

Apache Canada Ltd. (Apache Canada), EOG Resources Canada Inc., and Encana purchased the PTP Project from Pacific Northern Gas Ltd. (PNG) in the spring of 2011. PNG will potentially operate and maintain the planned pipeline under a seven-year operating agreement with provisions for five-year renewals. Apache Canada is the operator of the PTP Project and managing operator of the Kitimat LNG facility.

PTP and its engineering consultants are currently in the process of preparing detailed design elements for the PTP Project for the purpose of preparing construction bid documents. This process will also assist PTP in making the necessary investment decisions for the Project.

The advanced design work has resulted in a number of minor changes to the Project design that have occurred since the granting of the Environmental Assessment Certificate by the BC Environmental Assessment Office and the issuing of the Federal Screening Report by Fisheries and Oceans Canada (DFO) and Transport Canada (TC).



Figure 1. Location of the PTP Project

2.2 Change in proponent contact information and project name

The project is now referred to as the Pacific Trail Pipelines Project (“PTP” Project) and not the Kitimat – Summit Lake (KSL) Natural Gas Pipeline Looping Project (as per 2007 EAC Application). In addition, PNG is no longer involved in the development of the PTP Project.

Apache Canada, as the operator of PTP, is responsible for the execution of the PTP Project and can be contacted as follows:

Pacific Trail Pipelines Limited Partnership
c/o Apache Canada Ltd.
#1000, 700 – 9th Avenue S.W.
Calgary, Alberta T2P 3V4

Attention: Steve Franklin, P.Eng.
Telephone: 403-531-8119
Email: steve.franklin@apachecorp.com

2.3 Changes to the project description

The original description identified the Project as a “loop” of the existing PNG natural gas pipeline system. As outlined in the EAC Application, the project was designed to enable the bi-directional flow of natural gas (west to east as well as east to west).

The PTP Project is no longer considered a pipeline loop, but rather an independent pipeline system that will be used to transport natural gas from a tie in point at the Spectra Energy Transmission System to the proposed LNG export terminal near Kitimat. The PTP pipeline will be fully located within a designated 18 m wide right-of-way.

The pipeline diameter is 914.4 mm outside diameter (OD) (36 inch) as outlined in the 2007 EAC Application although PTP may possibly increase the diameter to 1066.8mm (42 inch) OD. If the decision is made to change the pipeline diameter, PTP will provide notification to the EAO.

For ease of reference and to acknowledge the direction of natural gas flow, the geographic markers referred to as KPs (kilometre posts) in the 2007 EAC Application have been reversed so that the commencement point for the Project is now Summit Lake. In order to differentiate from the previous system, the new geographic markers are referred to as KMs (kilometre marks). Figure 1 illustrates the KMs along the pipeline route.

2.4 Pipeline route changes

As a result of additional engineering work and geotechnical/slope stability studies and discussions with effected property owners and First Nations, 20 route refinements (RRs) and 27 minor route adjustments (MRAs) have been identified for the PTP Project. It is possible that additional route refinements may be identified during detailed engineering design and as a result of further contact with property owners and First Nations. In that event, PTP will inform the EAO and determine the appropriate process that would be needed to incorporate these project improvements.

The identified route refinements and minor route adjustments would add approximately 1.1 km and 0.1 km, respectively, to the overall length of the pipeline route if they are all ultimately incorporated into the project design.

3.0 REQUESTED AMENDMENTS

PTP is requesting an amendment to Environmental Assessment Certificate No. E08-01 to:

- change the location of the compressor station from Burns Lake area to Summit Lake,
- add two temporary stockpile sites, and
- adjust the 2008 approved pipeline route to avoid geohazards, respond to land owner and First Nations' requests, and further reduce adverse effects to aquatic resources, vegetation, and wildlife impacts.

The locations and characteristics of the route refinements and minor route adjustments are presented in Table 1 and Table 2. Orthophoto maps of each route refinement and minor route adjustment are contained in Section 11 and Section 12. These orthophoto maps show the 2008 EAO approved pipeline route and the 2011 requested route modifications.

3.1 Rationale for amendments

As would be expected for any linear development project (*e.g.*, a powerline, pipeline, road), the initial project design for the PTP Project provided the basis for addressing the majority of geotechnical, terrain stability, environmental, and social issues that may result from the construction and operation of the Project. Through the application of site-specific studies during the advanced design phase of the Project, revisions to the project design have been identified in order to improve the PTP project on the basis of engineering design and to reduce potential adverse environmental effects. In the case of the PTP Project, the likelihood of these revisions was anticipated in the approval documents. Accordingly, several project commitments specify that PTP will undertake post-certificate, site-specific investigations and would be able to make any necessary route refinements and minor route adjustments.

For example, one of the commitments that forms part of the Environmental Assessment Certificate for the PTP Project states: "PTP commits to undertake additional terrain stability investigations and geotechnical work as part of the project design following certification. Should areas of instability be identified, they will be subject to further geotechnical investigations, which may lead to engineering design solutions or local route adjustments (B.C. EAO pp. 9, 2008)".

3.1.1 Summit Lake compressor station

When the original purpose of the PTP Project was to transport natural gas from an LNG import facility at Kitimat to the Spectra Energy Transmission pipeline facilities at Summit Lake, the design called for the installation of a mid-point compressor station to enable the required throughput of natural gas. This compressor station was sited at the hydraulic mid-point of the pipeline. The location of the compressor station in 2007 was south of Burns Lake and just east of Highway 35.

Now that the PTP Project is designed to move natural gas from Summit Lake to Kitimat, or east to west, a compressor station is required at Summit Lake rather than at the hydraulic mid-point of the pipeline. The new Summit Lake compressor station is required in order to increase the pressure of the natural gas from where it is sourced at the Spectra Energy Transmission pipeline facilities.

3.1.2 Temporary stockpile sites

During the advanced design work that has been undertaken for the project, two additional temporary stockpile sites have been identified. They are located north of the pipeline route near KM 298 and KM 426. These temporary facilities are required along the pipeline route for the purpose of storing pipe prior to transporting it to the right-of-way and for the temporary storage of equipment and materials required for the construction of the project.

3.1.3 Route refinements and minor route adjustments

A total of 20 route refinements (RRs) and 27 minor route adjustments (MRAs) have been identified for the PTP Project since the EAC was issued for the Project in 2008. The RRs and MRAs add approximately 1.1 km and 0.1 km, respectively, to the overall length of the pipeline route.

Pipeline routing changes are driven by numerous factors including avoiding environmentally sensitive areas, meeting landowner, First Nations, or tenure holder requests, avoiding geotechnical hazards, and ensuring long-term pipeline integrity and safety. Changes to pipeline routing from the approved corridor are identified as:

- **Route Refinements (RRs)** are changes to the pipeline route that deviate from the approved corridor by over 100 m, or that may cross a different landform or land use type than the originally approved route. Routing changes that move a major watercourse crossing outside of the approved corridor are also considered to be a route refinement.
- **Minor Route Adjustments (MRAs)** are small changes associated with detailed engineering of the pipeline route. These adjustments are within 100 m of the approved pipeline corridor, have similar landforms and land uses as the approved corridor, and do not require any changes from the approved corridor at watercourse crossings.

A flow diagram used to determine whether a pipeline route is considered to be a route refinement or a minor route adjustment is presented in Figure 2.

All RRs and MRAs have been fully reviewed by the same qualified environmental professional who conducted the 2007 baseline studies and impact assessment work for the Project. All of the requested route amendments are proposed to minimize adverse environmental or land use effects. Each RR and MRA has a unique name and is identified by KMs along the pipeline route in Table 1 and Table 2.

The tables present the rationale for the requested amendment and the net change in length between the approved pipeline route and the requested amended route. The First Nations Traditional Territory that the RR or MRA is found in is also identified.

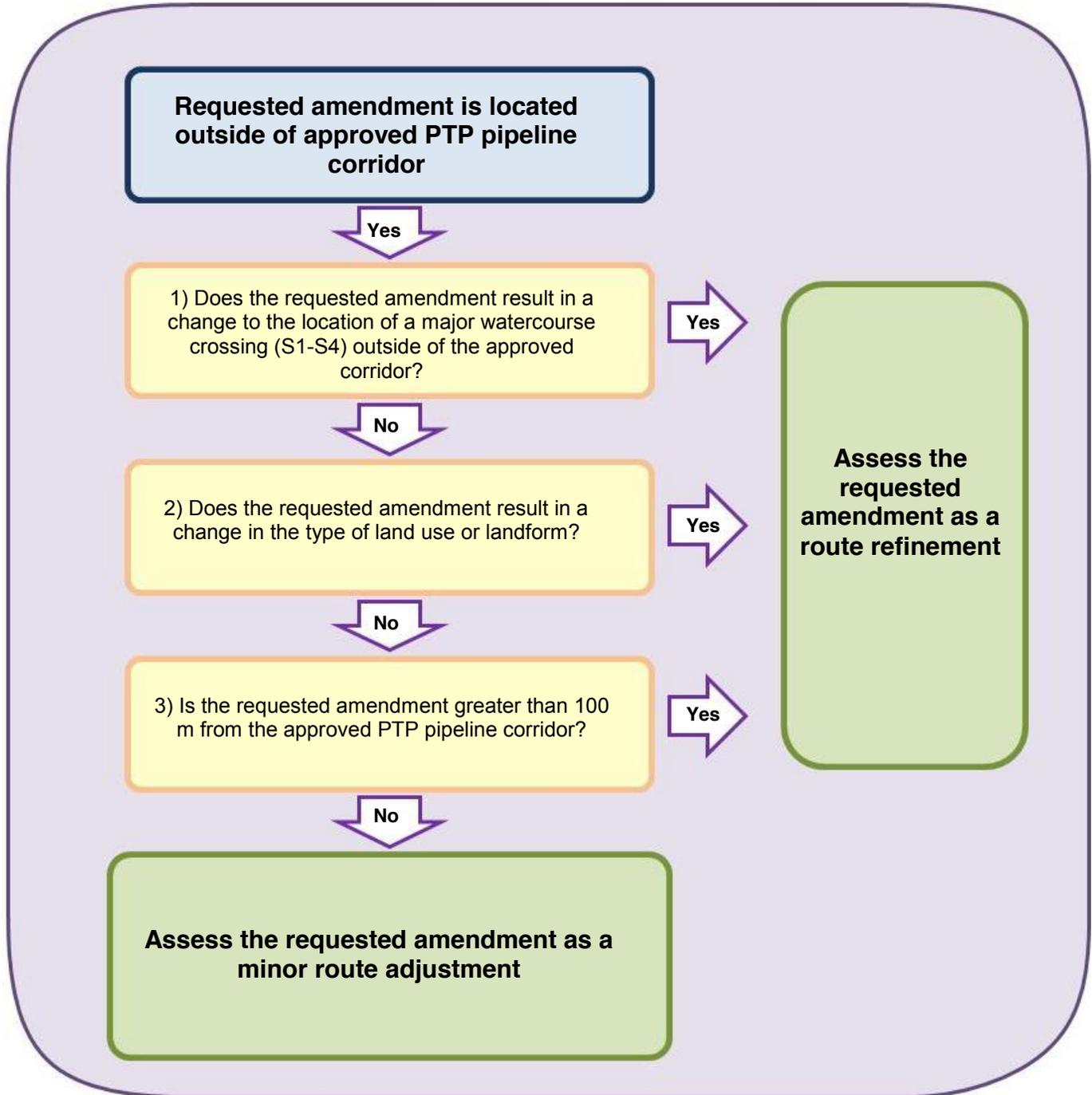


Figure 2. Flow diagram of the PTP route amendment classification and decision criteria

Table 1. Name, location, and rationale for route refinements

Name	Location	Length difference from approved route (m)	First Nation Traditional Territory	Rationale for route refinement
Thorps	KM 1.9 to KM 2.8	-32	McLeod Lake, West Moberly	Route refinement to avoid new Summit Lake community sewage treatment facility.
Crocker	KM 35.7 to KM 36.8	+39	Lheidli T'enneh	Route refinement to avoid wet area on north bank of Crocker Creek and minimize erosion risk.
Road 51.5	KM 89.4 to KM 89.8	-74	Carrier Sekani	Route refinement to remain adjacent to PNG ROW.
Layton	KM 111.8 to KM 113.8	+6	Carrier Sekani	Route refinement to avoid a private residence on south side of PNG ROW.
Nine Mile cabin	KM 127.3 to KM 128.6	-49	Carrier Sekani	Route refinement to comply with landowner request to avoid new cabin and remain adjacent to PNG ROW. New align also improves crossing of Nine Mile Creek.
Dog Creek FSR	KM 130.8 to KM 134.0	+1	Carrier Sekani	Route refinement to north side PNG ROW to avoid drainage and to parallel creek channel. Landowner request to increase offset from residence.
Sub-Station	KM 165.5 to KM 166.3	+69	Carrier Sekani, Nee Tahí Buhn	Route refinement to move outside of BC Hydro sub-station property.
Road 51.4	KM 198.3 to KM 198.9	-66	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs	Route refinement to avoid steep side slope.
Seven Mile FSR	KM 214.3 to KM 215.2	-47	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee	Route refinement to avoid wetland complex.
Buck	KM 277.3 to KM 278.1	-10	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee	Route refinement to avoid geotechnical hazard and follow existing logging road.
Owen	KM 295.2 to KM 299.3	+353	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee	Route refinement to avoid relic slide (geohazard) and unstable slope near Owen Creek.

Name	Location	Length difference from approved route (m)	First Nation Traditional Territory	Rationale for route refinement
Fenton	KM 301.7 to KM 303.8	+167	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee	Route refinement to avoid geotechnical hazards.
Gosnell	KM 348.5 to KM 354.6	-66	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee	Route refinement to improve location for Gosnell Creek crossing, improve feasibility for use of horizontal directional drilling techniques, and avoid crossing two side channels.
Burnie	KM 364.2 to KM 365.5	+100	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee	Route refinement to avoid slope stability concerns west of the Burnie River.
Hoult	KM 379.7 to KM 389.4	+351	Carrier Sekani, Skin Tyee, Kitselas	Route refinement to avoid slope stability concerns.
Floodplain	KM 402.4 to KM 403.2	+92	Kitselas	Route refinement requested by Kitselas First Nation to move pipeline route to upper side of Kitimat FSR, farther from Kitimat River side channel.
Ursus	KM 406.6 to KM 407.7	+90	Kitselas	Route refinement request by Kitselas First Nation to avoid grizzly bear habitat in riparian area.
Cecil	KM 433.2 to KM 439.0	-90	Kitselas, Haisla	Route refinement to avoid marine clay and forestry sample plots.
Iron Mountain	KM 440.5 to KM 442.3	+192	Kitselas, Haisla, Metlakatla, Lax Kw'alaams	Route refinement to avoid marine clay concerns.
Clay	KM 454.5 to KM 455.7	+33	Kitselas, Haisla	Route refinement to avoid marine clay concerns.

Table 2. Name, location, and rationale for requested minor route adjustments

Name	Location	Length difference from approved route (m)	First Nation Traditional Territory	Rationale for minor route adjustments
Miller	KM 0.3 to KM 0.5	+6	McLeod Lake, West Moberly	Minor route adjustment to improve drainage management near PNG ROW and new Summit Lake compressor station.
Echo	KM 8.5 to KM 10.3	-31	McLeod Lake, West Moberly	Minor route adjustment to avoid a creek and wetland adjacent to the south side of the PNG ROW. Route adjustment also improves constructability by minimizing grading on steep side slope.
Salmon	KM 21.7 to KM 21.8	-15	McLeod Lake, West Moberly, Lheidli T'enneh	Minor route adjustment to minimize drainage concerns.
Chief Lake FSR	KM 39.6 to KM 40.1	+12	Lheidli T'enneh	Minor route adjustment to avoid road side drainages.
Davidson	KM 75.1 to KM 76.5	-39	Carrier Sekani	Minor route adjustment to increase separation from a small waterbody located on the north side of the PNG ROW.
Baker	KM 204.8 to KM 205.2	+63	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs	Minor route adjustment to abut nearby road and reduce impacts on creek bank.
Outcrop	KM 207.8 to KM 208.1	+31	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs	Minor route adjustment to avoid geotechnical hazards.
Allin	KM 245.3 to KM 246.6	+21	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee	Minor route adjustment to avoid geotechnical hazards.
Sam	KM 263.6 to KM 263.9	+10	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee	Minor route adjustment to avoid geotechnical hazard and follow existing logging road.
Parrott	KM 284.5 to KM 285.4	+37	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee	Minor route adjustment to avoid extreme side slope and drainage.
Morice	KM 330.2 to KM 330.6	+20	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee	Minor route adjustment to avoid geotechnical hazards.
Bench	KM 344.1 to KM 344.4	-9	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee	Minor route adjustment to avoid geotechnical hazards.
Nimbus 1	KM 366.4 to KM 366.8	+22	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee	Minor route adjustment to minimize grade and address slope stability concerns.

Name	Location	Length difference from approved route (m)	First Nation Traditional Territory	Rationale for minor route adjustments
Nimbus 2	KM 368.9 to KM 369.2	-54	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee	Minor route adjustment to minimize grade and address slope stability concerns.
Nimbus 3	KM 372.6 to KM 373.0	-38	Carrier Sekani, Nee Tahí Buhn, Wet'suwet'en Chiefs, Skin Tyee, Kitselas	Minor route adjustment to minimize grade and address slope stability concerns.
Nimbus 4	KM 375.2 to KM 375.5	+34	Carrier Sekani, Skin Tyee, Kitselas	Minor route adjustment to minimize grade and address slope stability concerns.
Nimbus 5	KM 375.7 to KM 376.2	-22	Carrier Sekani, Skin Tyee, Kitselas	Minor route adjustment to minimize grade and address slope stability concerns.
Clore	KM 377.5 to KM 379.5	+56	Carrier Sekani, Skin Tyee, Kitselas	Minor route adjustment to avoid slope stability concerns.
Road 17	KM 398.3 to KM 399.0	-3	Kitselas	Minor route adjustment to minimize grade and improve construction safety.
Kitimat main	KM 412.2 to KM 412.4	-16	Kitselas	Minor route adjustment to avoid extreme side slope.
KM Road 15	KM 415.3 to KM 415.4	-34	Kitselas	Minor route adjustment to avoid geotechnical and drainage concerns.
McKay	KM 418.5 to KM 418.8	-8	Kitselas	Minor route adjustment to avoid geotechnical hazards.
Kitimat FSR	KM 421.9 to KM 422.1	+10	Kitselas, Haisla	Minor route adjustment to avoid a wetland adjacent to the Kitimat FSR.
Chist	KM 423.2 to KM 424.3	+14	Kitselas, Haisla	Minor route adjustment to move out of intermittent drainage and avoid marine clay concerns.
Onion	KM 430.8 to KM 431.5	+6	Kitselas, Haisla	Minor route adjustment to avoid forestry sample plot.
Road 3	KM 445.3 to KM 446.1	+53	Kitselas, Haisla, Metlakatla, Lax Kw'alaams	Minor route adjustment to avoid geotechnical hazards, improve construction safety, and use an existing logging route.
Trout	KM 449.8 to KM 450.9	-13	Kitselas, Haisla, Metlakatla, Lax Kw'alaams	Minor route adjustment to avoid geotechnical hazards and improve construction safety.

4.0 IMPLICATIONS FOR PROJECT COMMITMENTS IN THE ENVIRONMENTAL ASSESSMENT CERTIFICATE

A total of 536 specific commitments have been made by PTP for various phases of the Project. Compliance with these commitments is a condition of the EAC. The requested amendments do not change or diminish PTP's project-related commitments.

Most of the request amendments contained in this application have been identified in response to project commitments contained in the 2007 EAC Application. For example, PTP made the following commitment to conduct additional geotechnical investigations during the Detailed Design and Permitting Phase of the Project to avoid glaciomarine clays and areas of geotechnical instability.

"PTP commits to undertake additional terrain stability investigations and geotechnical work as part of the project design following certification. Should areas of instability be identified, they will be subject to further geotechnical investigations, which may lead to engineering design solutions or local route adjustments"(EAC Commitment No. 1.2 and No. 3.68).

The following amendments are requested in response to geotechnical commitments in the EAC.

Route refinements:

- Road 51.4 (KM 198.3 to KM 198.9)
- Buck (KM 277.3 to KM 278.1)
- Owen (KM 295.2 to KM 299.3)
- Fenton (KM 301.7 to KM 303.8)
- Burnie (KM 364.2 to KM 365.5)
- Hoult (KM 379.7 to KM 389.4)
- Cecil (KM 433.2 to KM 439.0)
- Iron Mountain (KM 440.5 to KM 442.3)
- Clay (KM 454.5 to KM 455.7)

Minor route adjustments:

- Echo (KM 8.5 to KM 10.3)
- Outcrop (KM 207.8 to KM 208.1)
- Allin (KM 245.3 to KM 246.6)
- Sam (KM 263.6 to KM 263.9)
- Parrott (KM 284.5 to KM 285.4)
- Morice (KM 330.2 to KM 330.6)
- Bench (KM 344.1 to KM 344.4)
- Nimbus 1 (KM 366.4 to KM 366.8)
- Nimbus 2 (KM 368.9 to KM 369.2)
- Nimbus 3 (KM 372.6 to KM 373.0)
- Nimbus 4 (KM 375.2 to KM 375.5)
- Nimbus 5 (KM 375.7 to KM 376.2)
- Clore (KM 377.5 to KM 379.5)
- Road 17 (KM 398.3 to KM 399.0)
- Kitimat main (KM 412.2 to KM 412.4)
- KM Road 15 (KM 415.3 to KM 415.4)
- McKay (KM 418.5 to KM 418.8)
- Chist (KM 423.2 to KM 424.3)
- Road 3 (KM 445.3 to KM 446.1)
- Trout (KM 449.8 to KM 450.9)

Several other requested amendments have been made in response to the EAC commitments. These include the following:

“PTP commits to, where necessary, reroute the Project to avoid existing forest research plots.” The MRA identified as “Onion” (KM 430.8 to KM 431.5) is requested in response to this EAC commitment.

“PTP will realign the route of the pipeline in the Hunter creek area to substantially reduce impacts to grizzly bear habitat and is committed to other protection measures during construction in order to avoid impacts to grizzly bears and their habitat.” The following amendments are requested in response to this grizzly bear habitat protection EAC commitment:

- Floodplain (KM 402.4 to KM 403.2)
- Ursus (KM 406.6 to KM 407.7)

“PTP commits to minimize the removal of vegetation and the disturbance to wetlands and to conduct grading adjacent to wetlands away from the wetland to extent practical to reduce the risk of sediment and other material entering the wetland.” The following amendments are requested in response to wetlands, drainage, and potential sedimentation commitments in the EAC.

Route refinements:

- Crocker (KM 35.7 to KM 36.8)
- Dog Creek FSR (KM 130.8 to KM 134.0)
- Seven Mile FSR (KM 214.3 to KM 215.2)
- Gosnell (KM 348.5 to KM 354.6)

Minor route adjustments:

- Miller (KM 0.3 to KM 0.5)
- Salmon (KM 21.7 to KM 21.8)
- Chief Lake FSR (KM 39.6 to KM 40.1)
- Davidson (KM 75.1 to KM 76.5)
- Baker (KM 204.8 to KM 205.2)
- Kitimat FSR (KM 421.9 to KM 422.1)

The following route refinements are requested to comply with land owner requests and to avoid potential adverse land use-related issues:

Route refinements:

- Thorps (KM 1.9 to KM 2.8)
- Road 51.5 (KM 89.4 to KM 89.8)

- Layton (KM 111.8 to KM 113.8)
- Nine Mile Cabin (KM 127.3 to KM 128.6)
- Sub-Station (KM 165.5 to KM 166.3)

5.0 SCOPE OF ENVIRONMENTAL ASSESSMENT

The 2007 EAC Application describes the scope of the Environmental Assessment for the PTP Project. The scope of the assessment for the Project, as defined in the Section 11 order, included consideration of the potential for adverse environmental, social, economic, culture, and heritage, and health effects of the Project. The 2007 EAC Application and this application for an amendment to the EAC include an assessment of potential direct, indirect, and cumulative effects of the Project on Valued Ecosystem and Social Components (VECs and VSCs), as defined in the 2007 EAC Application Approved Terms of Reference (ATOR).

The methods used to assess the effects of the change in compressor station location, the addition of two temporary stockpile sites, and the route refinements and minor route adjustments are described in Section 6 of this application. PTP has conducted a sustainability-based evaluation, which assesses how the proposed changes to the project interact with the effects assessment categories and valued components.

Most of the environmental effects identified in the 2007 EAC Application would not change with the new location of the compressor station at Summit Lake, the addition of two temporary stockpile sites, and the route amendments. The requested amendments will not substantially change the project footprint (PF) or the effects of the project on the environment. It is expected that the proposed route amendments will result in improvements to wildlife habitat, geotechnical conditions, and land use if they are approved.

6.0 METHODS OF ENVIRONMENTAL ASSESSMENT

The methods used to assess the effects of the changes to the project description contained in this amendment document are identical to the approach to impact assessment and impact assessment methodology used for the 2007 EAC Application. The assessment criteria used for the evaluation of significance for this assessment are outlined in Table 3.

A sustainability-based five pillar effects assessment was conducted to determine if the requested amendments are beneficial, neutral, or adverse when compared to the 2008 approved Project. Valued ecosystem and social components are broken up into social, economic, cultural/heritage, and health categories for evaluation. Table 4 presents the five pillar approach.

A 100 m wide study corridor was approved for the PTP Project in 2008, which includes an 18 m wide statutory right-of-way and a 38 m workspace for pipeline construction (Figure 3).

The environmental assessments of the Summit Lake compressor station, two temporary stockpile sites, the RRs and MRAs are provided in Section 9, 10, and 11.

Table 3. Assessment criteria used for the evaluation of significance of environmental effects

Assessment criteria		Definition
Spatial context – location of effect		
Project Footprint	The Project Footprint (PF) for the Project is the land area directly disturbed by assessment, construction, and clean-up activities, including associated physical works and activities (<i>i.e.</i> permanent ROW, temporary construction workspace, temporary access route, temporary stockpile site, temporary staging area, facility sites).	
Local	The Local Study Area (LSA) is defined as a 2 km buffer centered on the pipeline ROW (the 2 km buffer will be widened depending on the resource in question). The LSA is based on the typical ‘indirect footprint’ of pipeline facilities and activities (<i>i.e.</i> the zone of influence in which plants (50 m), animals (500 m), and humans (500 m to 800 m) are most likely to be affected by Project construction and operation. For the compressor the air quality local study area will be a 22 km by 22 km area centered on the station.	
Regional	The Regional Study Area (RSA) is broad enough to include those communities in the study region that may be affected economically (<i>e.g.</i> jobs, accommodation) or socially (<i>e.g.</i> hospitals, police).	
Temporal context – of the event and residual effect		
Duration (interval of the event causing the residual effect)	Immediate	Event duration is limited to less than or equal to two days.
	Short-term	Event duration is longer than two days but less than or equal to one year.
	Medium-term	Event duration of is longer than one year but less than or equal to five years.

Assessment criteria		Definition
	Long-term	Event duration extends longer than five years.
Frequency (how often would the event that caused the residual effect is anticipated to occur)	Accidental	Event occurs rarely over assessment period and does not occur under normal conditions.
	Isolated	Event is confined to a specific period (<i>e.g.</i> construction period; less than or equal to <10% of the assessment period).
	Occasional	Event occurs intermittently and sporadically (<i>e.g.</i> animal mortalities on road ways, and ground disturbance from unscheduled maintenance; estimated 10-15% of the assessment period).
	Periodic	Event occurs intermittently but repeatedly over the construction and operations period (<i>e.g.</i> mowing during routine maintenance activities; routine aerial patrols; estimated >15% but <80% of the assessment period).
	Continuous	Event occurs continually over the assessment period (<i>e.g.</i> noise at compressor station; estimated >80% of the assessment period).
Reversibility (period of time over which the residual effect extends)	Immediate	Residual effect is alleviated in less than or equal to two days.
	Short-term	Greater than two days but less than or equal to one year to reverse residual effect.
	Medium-term	Greater than one year but less than or equal to five years to reverse residual effect.
	Long-term	Greater than five years to reverse residual effect.
	Permanent	Residual effect is irreversible.
Magnitude – of the residual effect		
Negligible	Residual effect is not detectable.	
Low	Potential residual effect is detectable but well below established or derived environmental standards or thresholds.	
Medium	Potential residual effect is detectable but in established or derived environmental and/or regulatory standards or thresholds.	
High	Potential residual effect is beyond established or derived environmental standards or thresholds, or management plans for the indicator are being considered.	
Probability of occurrence – likelihood of residual effect happening		
High	Is expected to occur.	
Low	Is not expected to occur.	
Level of confidence – degree of certainty related to significance evaluation		
Low	Determination of significance based on incomplete understanding of cause-effect relationships and or incomplete data pertinent to the Project area.	
Moderate	Determination of significance based on good understanding of cause-effect relationships using data from outside the Project area or incompletely understood cause-effect relationships using data pertinent to the Project area.	

Assessment criteria	Definition
High	Determination of significance based on good understanding of cause-effect relationships and data pertinent to the Project area.
Significance – of the residual effect³	
Significant	A high probability of occurrence of residual effect that cannot be avoided or mitigated, having a combination of characteristics that render it unacceptable to the public, regulators, other interests, or that exceeds standards or contravenes legal requirements.
Less than significant	All other impacts.

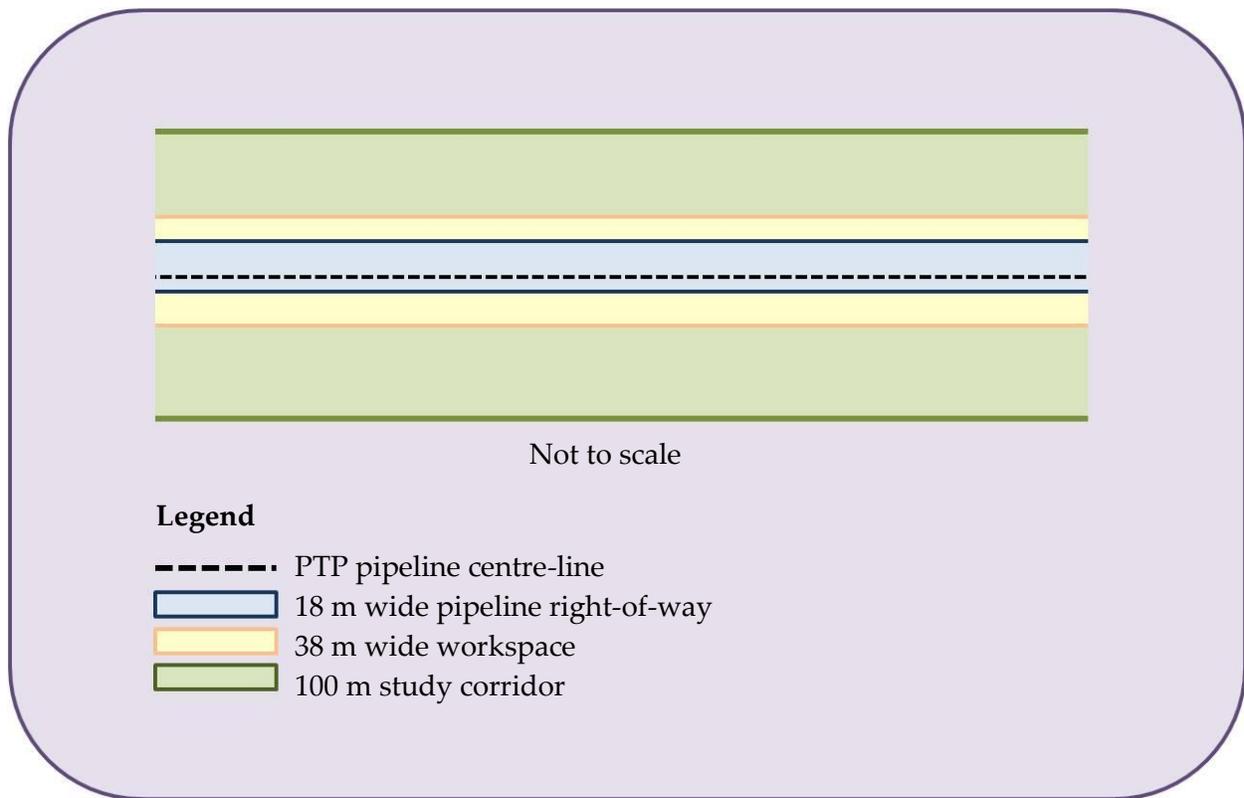


Figure 3. Schematic drawing of PTP pipeline route in the EAO approved study corridor

³In consideration of magnitude, there are no environmental standards, guidelines, or objectives for many of the construction/operation issues under evaluation. Therefore, the determination of magnitude of the residual effect often entails professional judgment and an historical consideration of the assessment of magnitude made by regulators, land authorities, lessees, other stakeholders, and the assessment team to adverse effects. PTP will make a determination of impact significance, however it is understood that the BC EAO and federal RAs have the responsibility of determining significance under the BC EA Act and the CEA Act.

Table 4. The five pillars of impact effects assessment

Environmental	Social	Economic	Cultural/heritage	Health
Valued ecosystem components	Valued social components	Valued economic components	Valued archaeological and heritage components	Valued health and safety components
<ul style="list-style-type: none"> • Geophysical environment • Atmospheric environment • Aquatic environment • Terrestrial environment (vegetation, wildlife, and wildlife habitat) • Species and ecosystems at risk 	<ul style="list-style-type: none"> • First Nations community • Navigable waters • Aesthetics and viewsheds • Community and regional infrastructure and services 	<ul style="list-style-type: none"> • Land and resource use • Employment and economy • Recreation and tourism 	<ul style="list-style-type: none"> • Archaeological resources • Heritage resources 	<ul style="list-style-type: none"> • Human health • Ecosystem health • Safety

7.0 FIRST NATIONS CONSULTATION

The PTP Project is within the asserted traditional territories of fifteen First Nations and two Tribal organizations. The following First Nations have been consulted prior to project approval and provided with project updates since the granting of the 2008 EAC:

- Lheidli T'enneh First Nation,
- McLeod Lake Indian Band,
- West Moberly First Nations,
- Nakazdli First Nation,
- Saik'uz First Nation,
- Nadleh Whut'en First Nation,
- Stelat'en First Nation,
- Ts'il Kaz Koh First Nation,
- Wet'suwet'en First Nation,
- Carrier Sekani Tribal Council,
- Nee Tahi Buhn First Nation,
- Skin Tyee Nation,
- Office of the Hereditary Chiefs of the Wet'suwet'en,
- Kitselas First Nation,
- Lax Kw'alaams First Nation,
- Metlakatla First Nation, and
- Haisla Nation.

In addition, PTP is now consulting, or making all reasonable efforts to consult, with one of the 13 Wet'suwet'en Houses as a discrete entity. PTP was informed in February 2011 that Chief Knedebeas's House, the Dark House, was no longer part of the Office of the Wet'suwet'en although the latter still maintains responsibility for the welfare of all Wet'suwet'en lands and resources. Consultation that took place prior to this year with the Office of the Wet'suwet'en included consultation with the Dark House. PTP has been diligent in seeking to consult with the Dark House since April 2011. The spokesperson for Chief Knedebeas of the Dark House, Freda Huson, states that she also represents a group called Unist'ot'en.

PTP has, and will continue to discuss with First Nations specific Aboriginal Interests or Treaty Rights, potential environmental, economic, social, heritage and health effects from this application for an amendment to the EAC with a view to finding mutually satisfactory measures of avoiding, mitigating or, where appropriate, otherwise addressing or accommodating any potential negative effects.

The principles on which PTP's consultation program with First Nations will be based for this application are the same as those described in the First Nations Consultation Overview of the 2007 EAC Application (Section 2.1.2).

The objectives used to guide PTP's engagement with First Nations will also be the same. PTP's First Nations consultation principles are:

- develop or maintain good relationships with First Nations whose territories are crossed by the PTP Project,
- learn how aboriginal rights and title may be affected by the Amendments,
- learn which cultural, heritage, social, and economic interests could be affected,
- find ways to not only avoid harmful effects or mitigate them, but also to produce net beneficial effects for First Nations,
- provide funding, where necessary, to First Nations for "capacity building" to enable First Nations to engage in the environmental assessment of the amendments,
- maintain a flow of information, and
- ensure that members of the PTP Project team are available to meet with aboriginal organizations to address their enquiries.

PTP is now implementing a short-term and long-term economic Benefits Agreement with the First Nations Limited Partnership and hopes that the Wet'suwet'en Chiefs may also decide to take advantage of them.

Starting on August 25, 2005 until July, 2007 when PTP applied for an Environmental Assessment Certificate, PTP engaged in comprehensive consultation with these groups about the potential effects of the Project on their interests and aboriginal rights. Section 2.4 of Chapter 2 of the 2007 EAC Application contains records of communications with First Nation organizations during that time and tables showing the issues that were raised and the responses given.

During the review of the 2007 EAC Application between July 2007 and July 2008, PTP complied with the consultation plan as required by the Section 11 Order of the *Environmental Assessment Act*. In compliance with that order, PTP sent a summary of communications cited above and a plan for further communication and consultation to each First Nation. All issues identified during this stage as well as previously addressed issues, both verbal and written, are summarized in Part E of the Kitimat-Summit Lake Pipeline Looping Project Assessment Report (BC EAO 2008). Issues raised by First Nations as part of the Working group are identified in Appendix D of the EAO Assessment Report (BC EAO 2008).

7.1 Consultation plan

The consultation plan for this EAC Amendment Application will comprise the following:

- recognition that the consultation process for the review of the Amendment needs to be flexible so that the parties can engage in processes which maximize collaborative problem solving,
- timely opportunity for all First Nations to conduct a review of the Amendment and provide comments to the BCEAO and PTP,
- opportunity for all First Nations and/or their representatives to meet with representatives of PTP to continue to build respect and understanding between the parties, to discuss the Amendment and identify the options to maximize opportunities and minimize differences. Within 30 days following the acceptance of the Application by the EAO, PTP will contact the First Nation to schedule an initial meeting. At this meeting the parties will work together to:
 - ensure understanding of the Application and the review process,
 - agree upon a process for continued communication,
 - establish meeting dates for a minimum of two meetings to discuss the Application, and
 - arrange community meetings to provide and exchange information with the community on the Application and the associated Benefits Agreement if this step is also desired by the First Nation.

7.2 Communications between First Nations and PTP in 2011

After the issuance of the EAC in July 2008, Benefit Agreements between both PTP and the Provincial Crown with fifteen of the affected First Nations were signed. The Office of the Wet'suwet'en and its Chiefs were not signatories to the Agreements.

Amongst many provisions of the agreements, there was one that pledged the support of the fifteen First Nations for the PTP project. The following summaries provide some detail of continuing discussions with the affected First Nations.

7.2.1 The Fifteen Signatories of the Agreements

Letters were sent to the chiefs of all the First Nation organizations with which the Project is consulting on November 16, 2011. The generic text of these letters was as follows:

*Dear Chief x,
I am writing to inform you that PTP will be applying to the Environmental Assessment Office for an amendment to the Environmental Assessment Certificate that was given to the KSL Pipeline Looping Project on June 26, 2008. The application will be for thirty-two (32) route modifications, two temporary material storage areas (temporary stockpile sites), and the compressor station at Summit Lake.*

Please find enclosed hard-copy maps of the route refinements in the traditional territories of your Nation's territory. The compressor station is east of Summit Lake and one of the two temporary stockpile sites is near KM 426 in the Kitimat Valley. The other is near KM 298, west of Fenton Creek and south of the Morice River. You can find a folder showing the changes digitally under your Nation's name at this FTP site: <ftp://ftp.westland.com/>.

Please note that a camp/stockpile site at KM 335 (KP 126 on early maps) was approved by the EAO in 2008. It was one of four changes to the original KSL Application filing. These changes were presented to the EAO in an application for amendment to the EAC in January 2008. This amendment application was filed during the 180 day review period, before the EA Certificate was issued. Therefore the four changes were included in the EAC.

We understand that the EAO may contact you to let you know of a time frame for review of these applications and of a process for that review. We at PTP, however, would appreciate the opportunity to consult directly with you about these amendments. To arrange a meeting, would you please call Julian Wake at 250-961-9875 or email him at Julian.Wake@apachecorp.com.

Yours sincerely,

Hard copies of appropriate map sheets had been hand-delivered before the letters were sent to some First Nations with the message that PTP looked forward to discussing the perspectives of those First Nations on the modifications.

7.2.2 Lheidli T'enneh, McLeod Lake, and West Moberly

Hard copies of the route refinement maps were hand-delivered to representatives of the Lheidli T'enneh on September 30 and to the West Moberly and McLeod Lake representatives on September 29. The latter were also told about the plan for the Summit Lake compressor station and were assured that meetings would be held, in consonance with the EAO Review process, to discuss that plan as well.

PTP anticipates consultation with these three First Nations in accordance with the consultation plan during the next four months.

7.2.3 CSTC and Nak'azdli

By Band Council Resolutions in 2006, the six members of the CSTC that are affected by the Project delegated consultation with them to the Carrier Sekani Tribal Council. These six members are the Nak'azdli, Saik'uz, Nadleh Whut'en, Stelat'en, Ts'il Kaz Koh, and Wet'suwet'en First Nations. This understanding continues but is supplemented by an understanding that the Nak'azdli First Nation will directly be informed of all planned activities in its traditional territory and that PTP will discuss with them any issues that arise for their members.

Hard copies of the route refinement maps were hand-delivered to Tribal Chief David Luggi on September 30 and to Chief Sam of the Nak'azdli First Nation on October 25. The letters to them drew their attention to the proposed temporary stockpile site at KM 298.

PTP anticipates consultation with the CSTC and Nak'azdli in accordance with the consultation plan during the next four months.

7.2.4 Nee Tahi Buhn and Skin Tyee

Hard copies of the route refinement maps were sent to Chief Morris of the Nee Tahi Buhn and to Chief Skin of the Skin Tyee Nation on November 16, 2011 with letters that drew their attention to the proposed temporary stockpile site at KM 298.

Chief Morris has informed PTP of a representative resident in Fort St John with whom PTP should conduct detailed consultations.

PTP plans to raise issues that are documented as commitments to the Skin Tyee at the same time as they meet about the amendment application. PTP anticipates consultation with the Skin Tyee and Nee Tahi Buhn in accordance with the consultation plan during the next four months.

7.2.5 Kitselas, Lax Kw'alaams, Metlaktla, and Haisla

Hard copies of the route refinement maps were sent to Chief Gerow of the Kitselas First Nation, Chief Reece of the Lax Kw'alaams, Chief Leighton of Metlaktla, and Chief Ross of the Haisla Nation on November 16, 2011 with letters that drew their attention to the proposed temporary stockpile site at KM 426.

PTP anticipates consultation with all four of these First Nations in accordance with the consultation plan during the next four months.

7.2.6 The Office of the Wet'suwet'en

The Office of the Wet'suwet'en (OW) informed PTP in 2006 that the proposed pipeline route might infringe on the LRMP process that was underway at that time and expressed unease that the route might contradict preferred options for protecting values within the Chiefs' territories. The Environmental Assessment Certificate was issued in the midst of the larger land planning process and the protected area declared thereafter.

In April, 2010, the OW informed the proponents that it would continue to engage with PTP on an "operational basis", but it could not make any guarantees that the Chiefs would support the Project. Staff of the OW had attended the "Trade and Finance Group" of First Nations that eventually became the First Nations Limited Partnership with signed agreements about the Project with both PTP and the Crown.

Amongst the reasons it gave for not joining the FNLP was its objection to the language of an “energy corridor” through Wet’suwet’en traditional territory. This is not a concept that PTP has espoused, nor is it one that PTP can address.

Hard copies of the route refinement maps were sent to the Office of the Wet’suwet’en on November 16, 2011 with letters that drew their attention to the proposed temporary stockpile site at KM 298.

Attached to the maps was a letter to the OW that read as follows:

*Debbie Pierre, Executive Director,
Office of the Wet’suwet’en*

I am writing to inform you that PTP will be applying to the Environmental Assessment Office for an amendment to the Environmental Assessment Certificate that was given to the KSL Pipeline Looping Project on June 26, 2008. The application will be for thirty-two (32) route modifications, two temporary material storage areas (temporary stockpile sites), and the compressor Station at Summit Lake.

Please find enclosed hard-copy maps of the route refinements in the traditional territories of your Chiefs. The compressor station is east of Summit Lake and one of the two stockpile sites is near KM 426 in the Kitimat Valley. The other is near KM 298, west of Fenton Creek and south of the Morice River. You can find a folder showing the changes digitally under Office of the Wet’suwet’en at this FTP site: <ftp://ftp.westland.com/>.

We have referred in meetings to a camp/stockpile site at KM 335 (KP 126 on early maps). This was approved by the EAO back in 2008. It was one of four changes to the original KSL Application filing. These changes were presented to the EAO in an application for amendment to the EAC in January 2008. This amendment application was filed during the 180 day review period, before the EA Certificate was issued. Therefore the four changes were included in the EAC.

We understand that the EAO may contact you to let you know of a time frame for review of these applications and of a process for that review. We at PTP, however, would appreciate the opportunity to consult directly with you about these amendments. To arrange a meeting, would you please call Julian Wake at 250-961-9875 or email him at Julian.Wake@apachecorp.com.

*Yours sincerely,
Terry Joubert*

cc Rachel Shaw, Project Director, BC Environmental Assessment Office.

PTP anticipates consultation with the Office of the Wet’suwet’en in accordance with the consultation plan during the next four months.

7.2.7 The Dark House

On February 11, 2011, PTP's First Nation liaison contractor was contacted by Freda Huson, spokesperson for the "Unist'ot'en chiefs", who include Chief Knedebeas (Warner Williams) of the "Dark" House whose specific territories include a tract that extends to the Gosnell River.

On July 26, PTP was informed by the OW that the Unistot'en had separated from the OW and should therefore be consulted separately. In consequence of uncertainty of where the Dark House territories may be, draft copies the Environmental Management Plan, the Restoration Plan, and the Access Management Plan with maps that show all the roads that might be built or reactivated during construction were also hand-delivered to Freda Huson, spokesperson for Knedebeas, in her office in the Moricetown Administration Office on July 26. Despite several telephone messages and emails to Freda Huson in order to arrange meetings and initiate a dialogue with the House, PTP has not yet been successful in having any discussions with this House about any aspect of the Project.

Hard copies of the route refinement maps were sent to Freda Huson on November 16, 2011 with a letter to draw her attention to the proposed temporary stockpile site at KM 298. The following letter was included:

*Freda Huson,
Spokesperson for Wet'suwet'en Chief Knedebeas, The Dark House*

I am writing to inform you that PTP will be applying to the Environmental Assessment Office for an amendment to the Environmental Assessment Certificate that was given to the KSL Pipeline Looping Project on June 26, 2008. The application will be for thirty-two (32) route modifications, two temporary material storage areas (temporary stockpile sites), and the compressor Station at Summit Lake.

Please find enclosed hard-copy maps of the route refinements in the traditional territories of your Chief. The compressor station is east of Summit Lake and one of the two stockpile sites is near KM 426 in the Kitimat Valley. The other is near KM 298, west of Fenton Creek and south of the Morice River. You can find a folder showing the changes digitally under Office of the Wet'suwet'en at this FTP site: <ftp://ftp.westland.com/>.

Please note that a camp/stockpile site at KM 335 (KP 126 on early maps) was approved by the EAO in 2008. It was one of four changes to the original KSL Application filing. These changes were presented to the EAO in an application for amendment to the EAC in January 2008. This amendment application was filed during the 180 day review period, before the EA Certificate was issued. Therefore the four changes were included in the EAC.

We understand that the EAO may contact you to let you know of a time frame for review of these applications and of a process for that review. We at PTP, however, would appreciate the

opportunity to consult directly with you about these amendments. To arrange a meeting, would you please call Julian Wake at 250-961-9875 or email him at Julian.Wake@apachecorp.com.

Yours sincerely,

Terry Joubert

cc Rachel Shaw, Project Director, BC Environmental Assessment Office.

PTP will continue to seek consultation with the Dark House in accordance with the plan during the next four months.

8.0 PUBLIC CONSULTATION

8.1 Pre-EAC public consultation

PTP initiated a consultation and engagement program in 2006. The public consultation program continued throughout the 2007 Project planning and assessment process and during the EAC Application review in order to:

- identify all interested parties as early as possible in order to inform them about the Project and to provide opportunities for input,
- engage all affected communities in a manner that they determined is appropriate,
- enable input at an early stage so that the information could be considered in Project design and routing decisions,
- provide numerous communication channels that will be used to make information available to First Nations peoples and the general public, and
- meet or exceed the requirements and expectations for communication and consultation outlined by the BCEAO and the CEA Agency.

The consultation program identified the following stakeholders:

- landowners on the proposed pipeline route,
- local community area residents,
- elected officials in the District of Kitimat and the three Regional Districts crossed by the pipeline,
- local MLAs and MPs,
- federal, provincial, and local government technical staff, and
- companies and individuals having land tenure (*e.g.*, forestry companies, trappers, guide outfitters).

Consultation methods included direct one-on-one contact, a number of Open Houses, Working Group meetings, the establishment of a toll-free line, newspaper advertisements, and a web site.

Public consultation for the project has been an on-going process and PTP has and continues to work with individuals, organizations, local/regional/provincial/federal levels of government, and landowners to provide up-to-date project information and to answer questions that are raised. This process has enabled PTP to identify and respond to environmental and social issues and concerns in a timely manner that meets the interests of the parties concerned.

8.2 Post-EAC consultation

On September 28, 2011, PTP held a public open house, between 4 pm and 7 pm, at the Summit Lake Community Hall (1140 Adams Road). This open house was planned to ensure that the community and key stakeholders were informed and able to give feedback on the Summit Lake compressor station. Seven PTP representatives were present to answer stakeholder questions and give the 20 attending community members updates on the Project.

During the open house, the following information was provided to the public:

- a project overview, including intended milestones (Appendix A), display boards, and maps of the intended PTP pipeline route,
- details on the proposed Summit Lake compressor station (Appendix B),
- a Summit Lake specific community update (Appendix C) and current PTP and Kitimat LNG newsletters,
- half-page invitations published in the Prince George Citizen newspaper on September 15 and 22, 2011 (Appendix D),
- email invitations sent to the Regional District of Fraser Fort George Planners, and
- a postal drop of a project update and invitation to the open house sent to the 74 addresses in the postal code V0J 2S0.

PTP's analysis of the Summit Lake open house results are listed below:

- The mood at the open house was positive and welcoming.
- Stakeholders were very pleased that PTP was holding an open house in their community.
- No opposition was expressed, and in general people were looking forward to seeing the Project proceed.
- The community was informed and knowledgeable about compressors and pipelines.

PTP representatives answered the following questions from the public:

- Regarding the pipeline and employment:
 - Where is the pipeline running?
 - Why will the new pipeline deviate from the existing one?
 - What is the pipeline made of?
- Regarding the Summit Lake compressor station:
 - Will the Summit Lake compressor station make more noise than the existing compressor stations?

9.0 ENVIRONMENTAL ASSESSMENT OF THE SUMMIT LAKE COMPRESSOR STATION

9.1 Baseline conditions

The proposed Summit Lake compressor station footprint is located approximately 400 m south of the existing PNG Summit Lake compressor station and 150 m south of Miller Creek (Figure 4). An access road will be built from the existing PNG Summit Lake compressor station south across Miller Creek to the proposed compressor station. Miller Creek is classified as an S3 stream and has a maximum channel width of 1.6 m. Fisheries surveys for Miller Creek had no fish captures or observations during fall surveys, while Brassy Minnow and Northern Squawfish were detected during spring-summer surveys.

An air quality study was conducted for the Summit Lake compressor station site in 2011. This work was conducted by RWDI Air Inc., consulting engineers and scientists (RWDI, 2011).

A noise impact assessment for the Summit Lake compressor station was conducted in 2010 (Matrix Projects Limited, 2010). This report is presented in Appendix E. This baseline noise survey revealed that the nearest residence is about 1250 m from the existing PNG and Spectro Energy compressor station and 950 m from the proposed PTP compressor station.

Field surveys and assessments were completed in the area of the proposed Summit Lake compressor station footprint to identify any potential environmental effects from compressor station construction and operation activities. Fisheries, vegetation, and wildlife occurrence data for the area were gathered from several sources, including: extensive literature and website reviews; British Columbia Conservation Data Centre (BC CDC) data; field surveys between 2005 and 2010; and discussions and interviews with local authorities and residents. Geotechnical surveys of the Summit Lake compressor station site were completed in 2011.

The proposed Summit Lake compressor station footprint occurs in the SBSmk1 biogeoclimatic subzone and covers an area of mature upland forest with some old forest characteristics and structure. Forest stands in the area are predominantly coniferous and consist of hybrid white spruce and subalpine-fir with some paper birch and trembling aspen components. The forest canopy, in the construction footprint, is multi-storied and wildlife trees are present. Coarse woody debris occurs on much of the forest floor. Elevation of the site varies from 715 m to 750 m.

BGC Engineering Inc. conducted geotechnical investigations and terrain mapping for the Summit Lake compressor station site in September 2011. The BGC investigation concluded the site to be suitable for a compressor station. No geohazards were identified that could affect the site. The terrain is generally well drained and planar to gently sloping (0% to 26% slope angles) and the soils in the first 1 m depth are generally compact to dense silty sands and gravels.

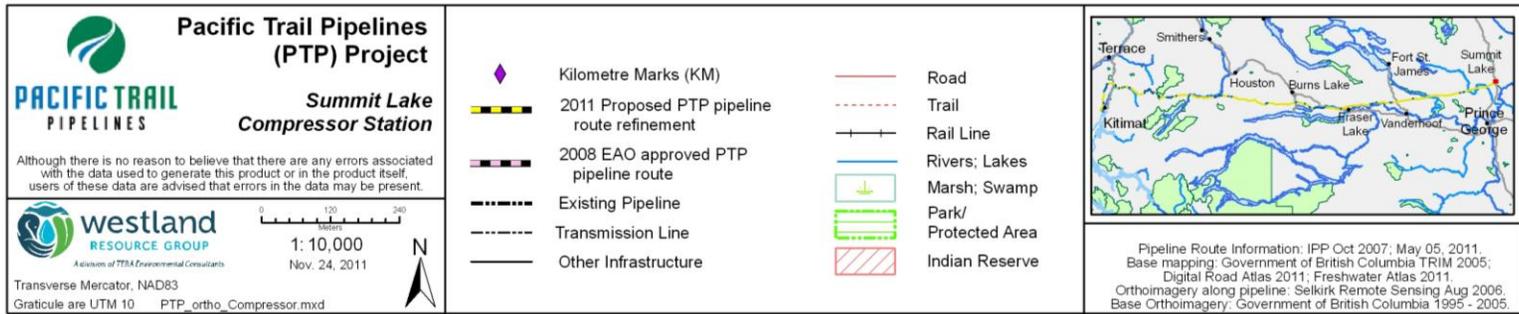
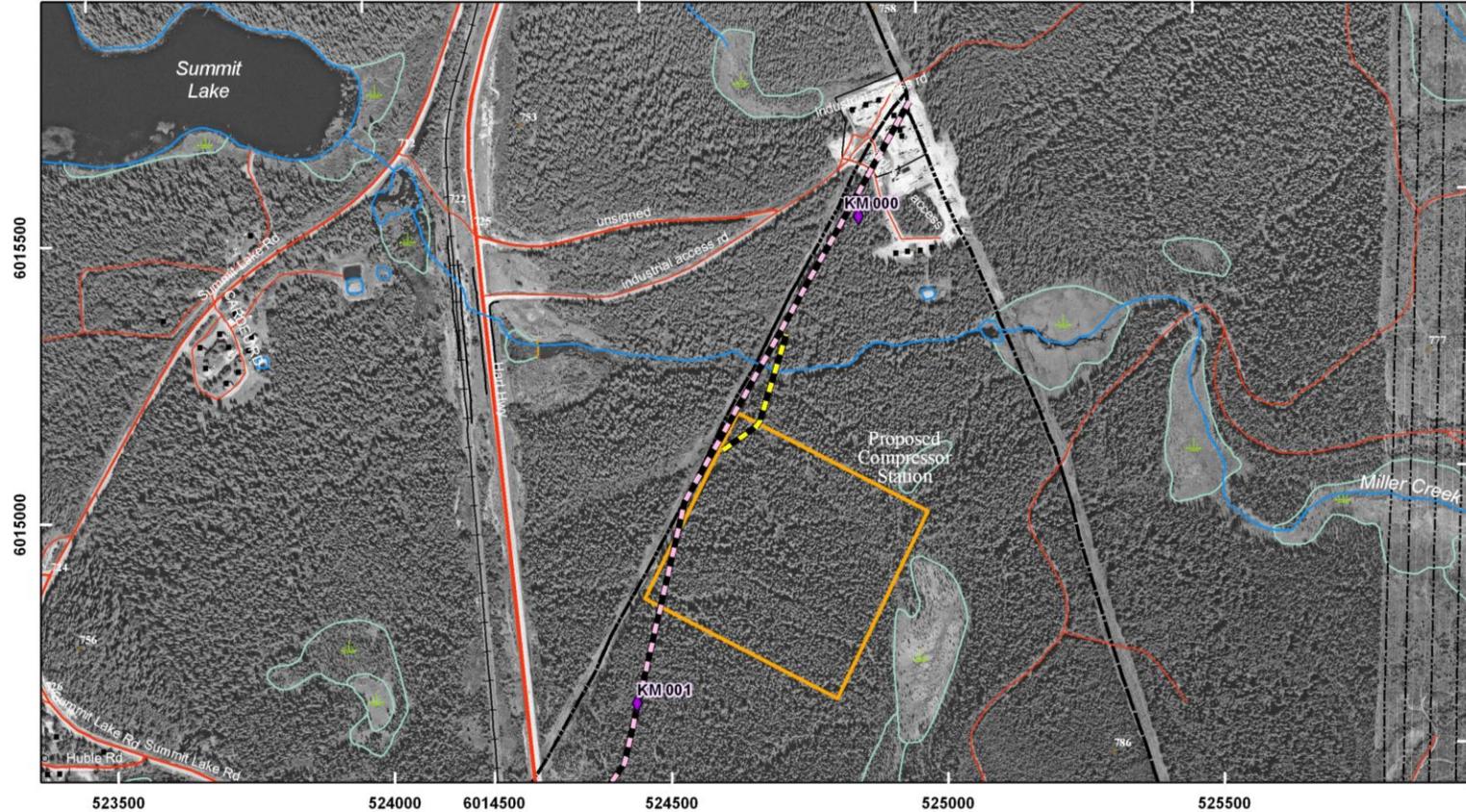


Figure 4. Summit Lake compressor station

These soils are expected to extend several metres in depth and the compact to dense soils on site are suitable for supporting spread footings. A site grading and drainage management plan will be included in the final design of the compressor station to level the site and address seasonal surface water and groundwater flows in and out of the small wet depressions and minor drainages on the site.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences. Field surveys identified small wetlands to the northeast and southeast of the proposed Summit Lake compressor station footprint. No Wildlife Habitat Areas, Old Growth Management Areas (OGMAs), Ungulate Winter Ranges, Parks, or Protected Areas overlap with the proposed Summit Lake compressor station footprint. No important seasonal ranges that support critical periods of the life history of wildlife have been identified for the proposed Summit Lake compressor station footprint. No BC CDC occurrence data for species-at-risk were found for the proposed Summit Lake compressor station footprint.

The Archaeological Impact Assessment (AIA) performed on September 28, 2011 with the assistance of Wendy Jael from the Lheidli T'enneh Band, found that no archaeological resources were known to be in conflict with the requested amendment.

9.2 Impact assessment

The change in location of the Summit Lake compressor station is not expected to materially change the number and type of equipment used to construct the pipeline component of the PTP Project and therefore construction emissions are not included in this revised air quality assessment. The following criteria air contaminants, Canadian Environmental Protection Agency (CEPA) Schedule 1 substances and greenhouse gases, which would be emitted by the proposed Summit Lake compressor station during operations, were assessed:

- criteria air contaminants, including carbon monoxide (CO), nitrogen dioxide (NO₂), particulate matter with diameter less than 10µm (PM_{2.5}),
- volatile organic compounds (VOCs), including benzene (C₆H₆), formaldehyde (CH₂O), acetaldehyde (C₂H₄O), and polycyclic aromatic hydrocarbons (PAH), and
- greenhouse gases (GHGs), including carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O).

Emissions of each contaminant were estimated based on manufacturer specifications and published emission factors, and subsequently modelled using the CALPUFF dispersion model.

The scope of the assessment was based on a scenario where three (3) 35 MW units operate continuously at the proposed PTP Summit Lake compressor station, and the installed compressor units (two at each station) at both the existing PNG and Spectra Energy stations are also operating continuously.

Model results show that the maximum predicted concentrations for both the Project effects and cumulative effects cases within a 20 km LSA are less than the most stringent objectives. Thus, the addition of the PTP Summit Lake compressor station would result in emissions of criteria air contaminants and CEPA Schedule 1 substances that are well within acceptable guidelines set out by the Province of British Columbia and the Government of Canada, based on the analysis of three 35MW units.

Estimated Project GHG emissions are less than 1% of provincial totals and less than 0.1% of national totals and are consistent with the industry profile. Residual and cumulative effects were rated less than significant for all contaminants.

Since the compressor turbines will be fuelled by sweet natural gas, sulphur dioxide was not assessed.

The access road to the proposed Summit Lake compressor station that crosses Miller Creek may have the following potential effects on fish and fish habitats:

- direct and indirect mortality of fish,
- loss or degradation of riparian and instream fish habitat,
- loss or degradation of fish habitat connectivity, and
- interbasin transfer of aquatic organisms.

The following potential noise issues were considered in the assessment of the impact of the proposed PTP compressor station on noise levels outside the compressor station site property line:

- low frequency noise
- continuous plant operational noise, and
- construction noise.

Operational noise from the compressor station will be continuous, and long-term in duration. The 2010 noise study concluded that the residential impacts of the proposed Summit Lake compressor station operational noise will be in compliance with the British Columbia Noise Control Guidelines. This conclusion is based on the determination of cumulative noise levels for a scenario where all seven compressor units in the area (two existing PNG units, two existing Spectra units and three new PTP units) are running simultaneously – although this is very unlikely to occur.

Construction noise and low-frequency noise impacts for the Summit Lake compressor station will be the same as the impacts contained in the 2007 EAC Application.

Field assessments for Miller Creek identified the stream as having low fish sensitivity and low overall fish habitat potential. Project construction and operations would have a low impact on fish populations (see the 2007 EAC Application for further details).

The area of land required for the Summit Lake compressor station is approximately 16 ha. However, not all of this area of land will be cleared for Project construction. The proposed Summit Lake compressor station footprint may have following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area of the Summit Lake compressor station can be found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2010, specifically for the proposed Summit Lake compressor station footprint, have also been considered in this effects assessment.

The small wetland areas to the northeast and southeast of the Summit Lake compressor station footprint will be avoided during construction activities and will not be affected by the Project.

Effects to wildlife, wildlife habitat, and vegetation from the construction and operation of the compressor station at Summit Lake are assessed to be low and will result in no material change to the assessment of significant adverse effects for these VECs.

The AIA found that no archaeological resources were identified.

No material change to the assessment of adverse effects will result from relocating the PTP compressor station from the Burns Lake area to Summit Lake.

9.3 Mitigation

Specific mitigation measures for minimizing potential effects on fish and fish habitat that will be adopted for the Miller Creek access road crossing are detailed in Section 7.2.3 of the 2007 EAC Application. These mitigation measures and plans are detailed in the Environmental Management Plan (EMP), which was submitted to regulators for review in August, 2011. The EMP describes how environmental risks to fish and fish habitats will be mitigated during construction. Proper work management and procedures that will be followed to limit any environmental effects in the event of an incident are also detailed in the EMP.

Mitigation measures for minimizing potential effects on vegetation, wildlife, and wildlife habitats will be adopted for construction and operation activities for the Summit Lake compressor station footprint and are detailed in Section 7.2.4 of the 2007 EAC Application.

Mitigation measures for vegetation, wildlife, and wildlife habitat are summarized below and are detailed in the EMP.

The composite noise level at 100 m from the property line will be calculated post-construction to determine if it is in compliance with the British Columbia Noise Control Guidelines. If compliance is not achieved further noise mitigation measures will be installed until the acoustical objectives are realized. In addition, construction noise guidelines will be implemented by PTP to mitigate the effects of noise from equipment and construction activities.

PTP will implement mitigation measures to minimize disturbance to vegetation clearing for the Summit Lake compressor station site. An Invasive Plant Management Plan (IPMP) will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. The Summit Lake compressor station area will be fenced and gated to minimize human-wildlife conflicts. No site clearing activities will occur during the migratory bird nesting period (May 1 and July 31).

Following the AIA, no further work is recommended or required.

9.4 Residual environmental effects

The following section describes the potential residual effects that have been identified for the Summit Lake compressor station.

A summary of the ratings of the residual air quality effects is presented in Table 5. The overall significance of the effects is considered less than significant for all criteria air contaminants and CEPA scheduled substances due to the low or negligible magnitude (RWDI, 2011).

The proposed noise mitigation measures are expected to achieve the acoustical objectives for the station and no new residual effects were identified.

For fish and fish habitat related to the access road crossing of Miller Creek, located approximately 150 m north of the Summit Lake compressor station site, the following residual effects have been identified:

- potential fish mortalities from instream construction activities, and
- potential loss of fish food inputs from riparian areas adjacent to fish-bearing watercourses.

By implementing fish salvaging programs and recognizing that the loss of food inputs is expected to be temporary, these residual effects on fish and fish habitats are considered less than significant.

The following residual effects have been identified for vegetation, wildlife, and wildlife habitats:

- up to 16 ha of coniferous upland forest habitat will be cleared,
- potential for the introduction of invasive plant species following construction,
- the risk of wildlife vehicle collisions may increase during construction, and
- filling and grading of small seasonally wet depressions and minor drainages.

By implementing mitigation measures as outlined in the EMP, the potential residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

9.5 Monitoring

Stack testing after commissioning will be done to compare observed pollution emission rates with predicted pollutant emission rates.

Noise monitoring will be undertaken to check for compliance once the Summit Lake compressor station is in full operation.

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements as outlined in the EMP and Post-Construction Monitoring Program will be followed for any incidents that may detrimentally affect the environment.

Table 5. Summary of Project effects on air quality

Potential Project effect	Spatial extent	Temporal extent			Magnitude	Probability of occurrence	Level of confidence	Significance
		Duration	Frequency	Reversibility				
Effect of NO ₂ emissions	Local	Long-term	Periodic	Long-term	Low	High	High	Less than significant
Effect of PM ₁₀ emissions	Local	Long-term	Periodic	Long-term	Low	High	High	Less than significant
Effect of PM _{2.5} emissions	Local	Long-term	Periodic	Long-term	Low	High	High	Less than significant
Effect of CO emissions	Local	Long-term	Periodic	Long-term	Low	Low	High	Less than significant
Effect of VOC emissions	Local	Long-term	Periodic	Long-term	Low	High	High	Less than significant
Effect of benzene emissions	Local	Long-term	Occasional	Long-term	Negligible	Low	Moderate	Less than significant
Effect of formaldehyde emissions	Local	Long-term	Periodic	Long-term	Low	High	Moderate	Less than significant
Effect of acetaldehyde emissions	Local	Long-term	Periodic	Long-term	Low	High	Moderate	Less than significant
Effect of PAH emissions	Local	Long-term	Periodic	Long-term	Low	High	Moderate	Less than significant
Effect of GHG emissions	Global	Long-term	Continuous	Long-term	Medium	High	Moderate	Less than significant

10.0 ENVIRONMENTAL ASSESSMENT OF TEMPORARY STOCKPILE SITES

A total of six temporary stockpile sites were approved for the Project in the 2008 EAC. Two additional temporary stockpile sites will be required for the storage of pipe prior to transporting it to the worksite, as well as for temporary storage of equipment and materials required for construction of the Project. Both new temporary stockpile sites are planned in previously disturbed areas. The sites are at KM 298 and KM 426 (Figure 5 and Figure 6).

Site preparation work will include the following activities:

- Brushing the area of the stockpile. Topsoil and duff will be salvaged and stored in a designated area for use during restoration of the site, the surface graded, and any surface drainage improvements will be made (ditches will be installed as required). If the sub-soil is unsuitable for heavy vehicle traffic, the area will be surfaced with aggregate material.
- Access roads, internal roads, and temporary roads will be upgraded to make them suitable for construction traffic, as required.
- Fuel, if required, will be stored in double-lined tanks or have some other form of secondary containment.
- The temporary stockpile sites will be rehabilitated by re-contouring, re-establishing previous damage conditions, and replanting tree species approved by the Ministry of Forests, Lands, and Natural Resource Operations (MFLNRO).

Field studies were completed for the two temporary stockpile sites in 2011. The following sections address the findings of the baseline studies for these sites.

Baseline studies completed for the 2007 EAC Application were also used to describe the environmental conditions and for the assessment of residual effects.

10.1 Temporary stockpile site near KM 298

10.1.1 Baseline conditions

The temporary stockpile site is situated approximately 3 km north of KM 298 on the PTP alignment (Figure 5). The 54 ha temporary stockpile site is located in a reforested clear cut with a southern aspect located approximately 100 m from the south western boundary of the Morice River Ecological Reserve. The second growth conifers on the cut block are mainly 20 year old lodgepole pine, approximately 5 m to 7 m high. The site will be accessed from the Chisholm Forest Service Road (FSR).

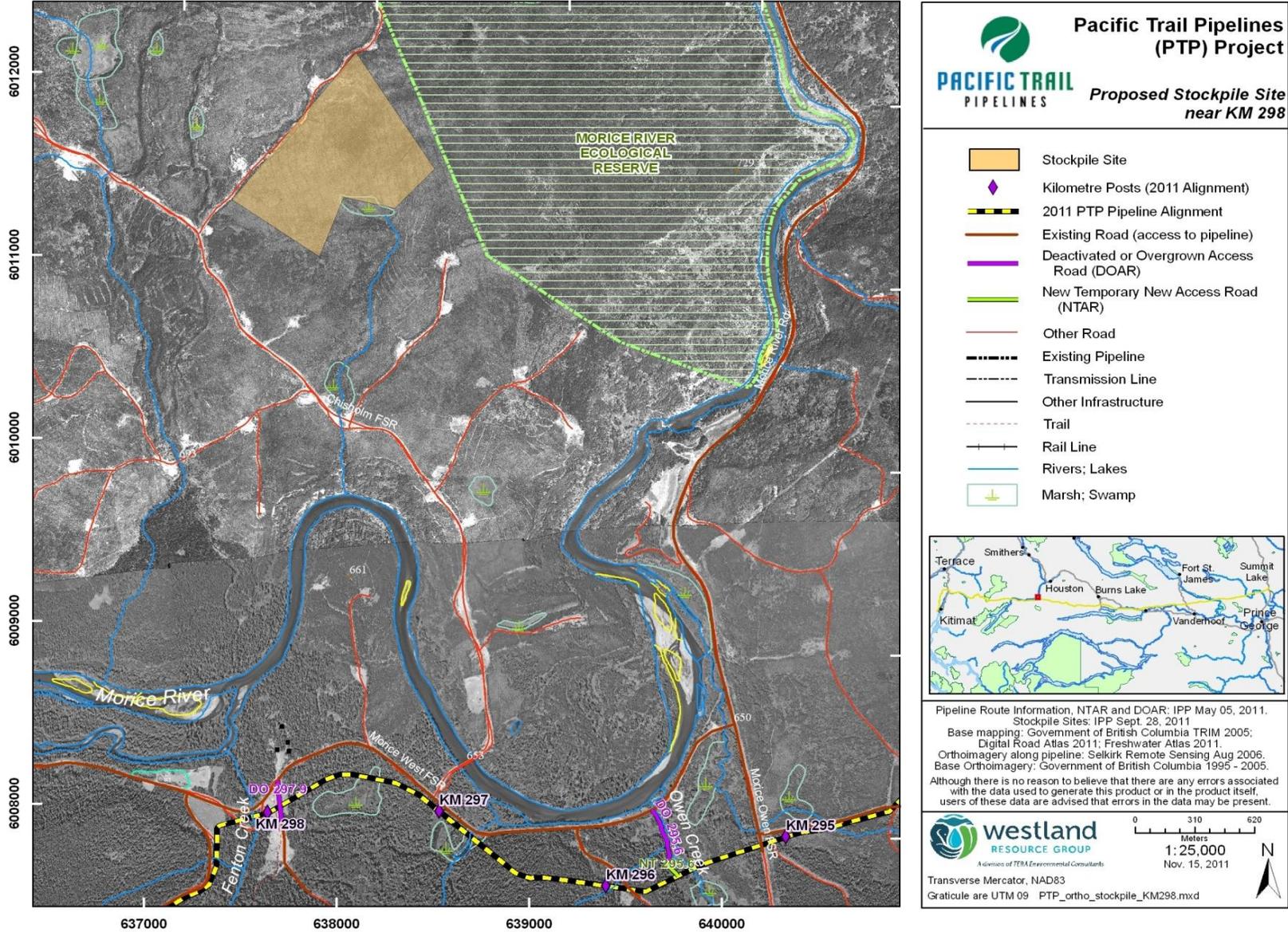


Figure 5. Proposed temporary stockpile site near KM 298

An existing branch road runs adjacent to the northwest boundary of the temporary stockpile site. A small wetland is located outside of the southern edge of the site.

Geotechnical

The temporary stockpile site is located on a subdued upland and is underlain by compact glacial till. The soil is a silty gravel with 20% to 35% gravel, 10% cobbles, 25% to 40% sand (mostly fine sand), and 20% to 40% silt. Clay may be present as a minor component up to 10% of volume. Fines have no or low plasticity. The site slopes with 2% to 8% towards the south west. The site is well drained due to its upland setting and south western aspect. Surface drainage channels are rare or absent. The forest floor was partially destroyed by wildfire approximately 25 years ago.

The proposed site is located at 775 m to 785 m elevation, 70 m higher than the thick glaciolacustrine silts that flank the Morice River 1.5 km due south of the site.

A small wetland exists along the south edge of the site. This wetland is a sedge- dominated fen with few scattered stunted pine. No open water areas or channels exist. The fen drains subsurface through accumulated peat towards the east into a non-classified drainage.

The silty and silty sandy soils are moderately sensitive to surface erosion, particularly after disturbance (*e.g.*, grading and traffic use). In its undisturbed state, the site is dry with no signs of surface erosion. With proper water- and sediment control measures in place, fine sediment is unlikely to reach the wetland at the head of the tributary to the Morice River. The wetland is likely to act as an additional sediment trap for any fine sediment.

The site is moderately sensitive to rutting by heavy equipment. Surfacing with aggregate and water and sediment control measures will be required in areas of heavy traffic and year-round use.

Excavated material will likely be unsuitable for fill in high traffic areas for the first year, until the silty soil is re-consolidated.

Vegetation

The site is located in the Dry, Cool Sub-Boreal Spruce (SBSdk) biogeoclimatic zone of the Bulkley Basin Ecoregion. Based on the 2006 baseline vegetation surveys of the Project there are no plant species or ecological communities at risk identified at the site.

Wildlife

The area of land crossed by the PTP pipeline route south of the temporary stockpile site has been rated by the Canada Land Inventory (CLI) for ungulate productivity. This area of the Project is rated as having high value winter range for moose and deer. The lands have slight

limitations to the production of ungulates due to snow depth reducing mobility and access to food.

The site is located approximately 10 km southeast of the Telkwa caribou management area and the site is located in the Bulkley to Morice River moose and black bear wildlife movement corridor.

Fish

Based on a fall 2011 baseline aquatic study of the area, there is no fish habitat located at the site.

Archaeology

The archaeological review, performed on November 1, 2011, found that no archaeological resources were known to be in conflict with the requested amendment.

10.1.2 Impact assessment

An effects assessment of the temporary stockpile site near KM 298 is presented in Table 6. No material change to the assessment of adverse effects will result from the addition of this site.

10.1.3 Mitigation

A project wide restoration plan has been developed and will apply to the temporary stockpile sites. Specific measures that will be used to rehabilitate the temporary stockpile site include:

- salvaging, storing, and subsequently replacing separately the topsoil or root zone material from subsoil wherever grading occurs.
- developing native seed mixtures to suit local site conditions.
- revegetating disturbances with an appropriate seed mix and approved cover crop to minimize erosion potential and rapidly establish a vegetative cover, to support invasive plant establishment.
- planting previously forested areas with tree species approved by British Columbia MFLNRO and forest licensees.

Additional mitigation measures are provided in the 2007 EAC Application in the sections noted in Table 6.

Following the archaeological review, no further work is recommended and no mitigation is required.

10.1.4 Residual environmental effects

The residual effects of the development and use of the temporary stockpile site near KM 298 are summarized in Table 6 and the proponent's assessment of the significance of residual effects is

presented in Table 7. In all cases, the significance of the residual effects is assessed to be less than significant.

10.1.5 Monitoring

To monitor the efficacy of mitigation measures and site rehabilitation activities, PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species control and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

10.2 Temporary stockpile site near KM 426

10.2.1 Baseline conditions

The temporary stockpile site is located approximately 26 km north of Kitimat and 1 km north of KM 426 on the PTP alignment (Figure 6). The site is a level reforested cut block bordered by forestry roads. The timber on the cutblock is a mix of hemlock, lodge pole pine, and amabilis fir aged about 38 years with a height range of 14 m to 19 m. Two secondary forest roads are connected to the site. The North Kitimat FSR borders the south edge of the site.

Geotechnical

The site is located on the expansive surface of a raised glaciofluvial terrace at the eastern edge of the Kitimat Trench. A thick (tens of metres) sand and gravel deposit underlies the near-level surface. A short scarp rises to a slightly higher terrace level about 50 m to 75 m north of the north-west corner of the site. A longer and steeper scarp descends to Chist Creek about 1 km south-east of the site. The sands and gravel are highly permeable and well drained. There are no surface water features in close proximity to the site; the groundwater table is expected to be at considerable depth. The likelihood of any significant development-related erosion occurring on this terrain is considered to be very low.

Vegetation

The site is located in the Coastal Western Hemlock Submontane Wet Submaritime (CWHws 1) biogeoclimatic zone of the Nass Mountain Ecosection. Based on the 2006 baseline vegetation surveys of the Project and a 2011 field review, there are no plant species or ecological communities at risk identified at the site.

Wildlife

The CLI rates surrounding area of the site as having moderately severe limitations to the production of ungulates, including moose and deer. The limitations relate to excessive snow depth reducing mobility and access to food, and climate affecting production and survival.

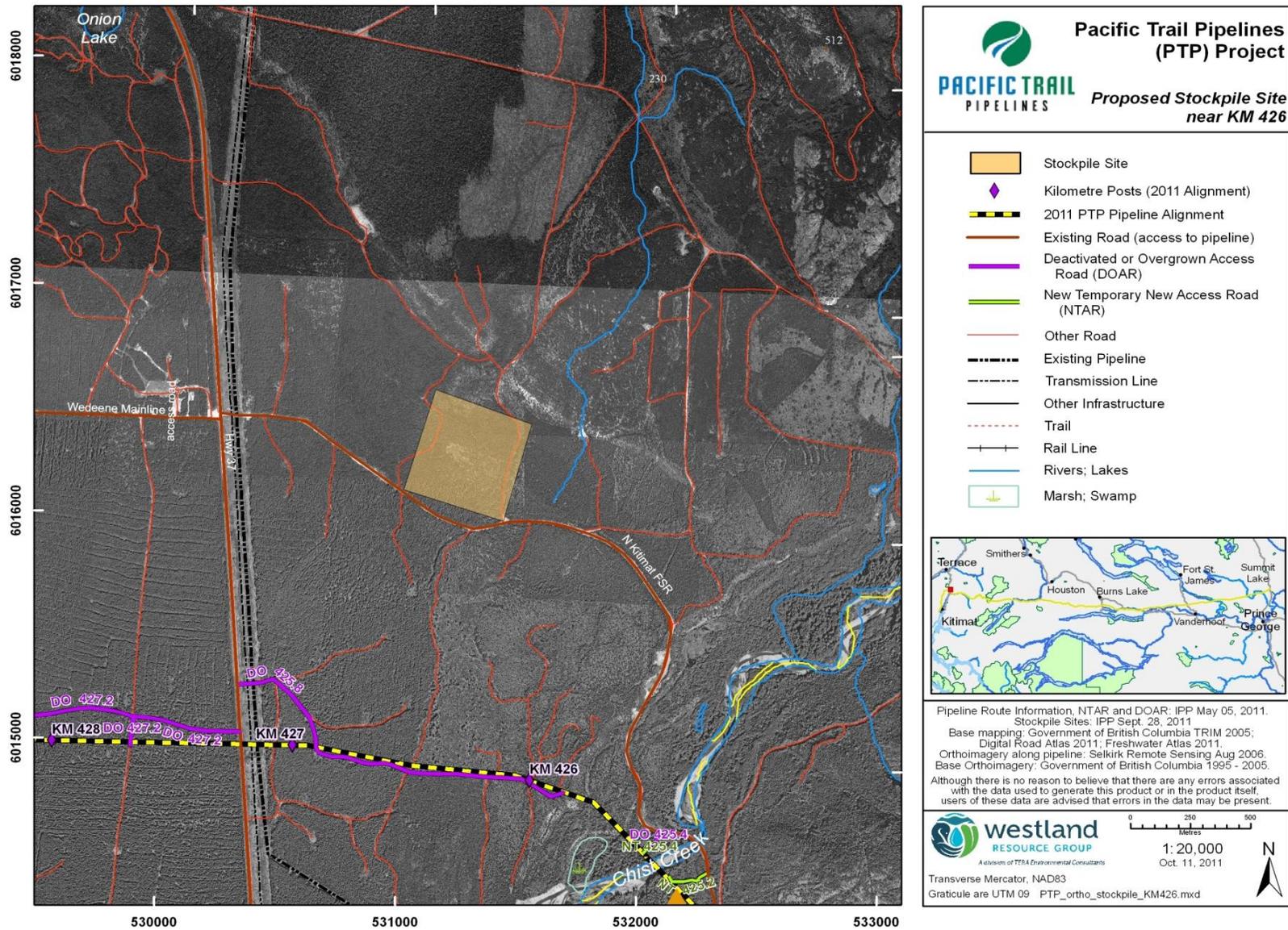


Figure 6. Proposed temporary stockpile site near KM 426

The site is located in a wide grizzly bear and moose wildlife movement corridor in the main Kitimat river valley, 2.5 km west of the site between Chist Creek and Cecil Creek.

No wildlife habitat features were observed at the site during the 2011 field review.

Fish

There is no fish habitat located at the temporary stockpile site.

Archaeology

The review, performed on November 1, 2011, found that no archaeological resources were known to be in conflict with the requested amendment.

10.2.2 Impact assessment

An effects assessment of the stockpile site is presented in Table 6. No material change to the assessment of adverse effects will result from the addition of a temporary stockpile site near KM 426.

10.2.3 Mitigation

A project wide restoration plan has been developed and will apply to the temporary stockpile sites. Specific measures that will be used to rehabilitate the temporary stockpile site include:

- salvaging, storing, and subsequently replacing separately the topsoil or root zone material from subsoil wherever grading occurs.
- developing native seed mixtures to suit local site conditions.
- revegetating disturbances with an appropriate seed mix and approved cover crop to minimize erosion potential and rapidly establish a vegetative cover, to support invasive plant establishment.
- planting previously forested areas with tree species approved by British Columbia MFLNRO and forest licensees.

Additional mitigation measures are provided in the 2007 EAC Application in the sections noted in Table 6.

10.2.4 Residual environmental effects

The residual effects of the development and use of the temporary stockpile site near KM 426 are summarized in Table 6 and the proponent's assessment of the significance of the potential residual effects is presented in Table 7. In all cases, the significance of the residual effects is assumed to be less than significant.

10.2.5 Monitoring

To monitor the efficacy of mitigation measures and site rehabilitation activities, PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species control and habitat restoration efforts.

Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

Table 6. Effects assessment – temporary stockpile sites near KM 298 and KM 426

Valued component/ potential effect	Description	Location	Mitigation measures	Residual effect
Geophysical environment				
<ul style="list-style-type: none"> Increase in soil erosion and slope instability 	Stockpile sites and access road improvements	Project Footprint	<ul style="list-style-type: none"> Implement measures outlined in Table 7.2-1 in the 2007 EAC Application 	<ul style="list-style-type: none"> Potential minor loss of topsoil expected until a vegetated cover is established.
<ul style="list-style-type: none"> Mixing of topsoil or root zone material with subsoil 	Stockpile sites and access road improvements	Project Footprint	<ul style="list-style-type: none"> Implement measures outlined in Table 7.2-1 of the 2007 EAC Application 	<ul style="list-style-type: none"> Potential minor mixing of topsoil or root zone material with subsoil will likely occur.
Terrestrial environment, wildlife and wildlife habitat, vegetation				
<ul style="list-style-type: none"> Introduction and acceleration of the spread of invasive plants (noxious weeds) 	Stockpile sites and access road improvements	Project Footprint	<ul style="list-style-type: none"> Implement measures outlined in Table 7.2-13 of the 2007 EAC Application 	<ul style="list-style-type: none"> The introduction of invasive plant species to previously undisturbed areas along new access roads.
<ul style="list-style-type: none"> Alteration of wildlife habitat 	Stockpile sites and access road improvements	Project Footprint	<ul style="list-style-type: none"> Implement measures outlined in Table 7.2-13 of the 2007 EAC Application 	<ul style="list-style-type: none"> Potential alteration of seasonal movement patterns of wildlife.
<ul style="list-style-type: none"> Direct and indirect wildlife mortality 	Stockpile sites and access road improvements	Project Footprint	<ul style="list-style-type: none"> Implement measures outlined in Table 7.2-13 of the 2007 EAC Application 	<ul style="list-style-type: none"> Increased risk of wildlife-vehicle collisions on new access roads.
<ul style="list-style-type: none"> Sensory disturbances during important wildlife life cycle events. 	Stockpile sites and access road improvements	Project Footprint	<ul style="list-style-type: none"> Implement measures outlined in Table 7.2-13 of the 2007 EAC Application 	<ul style="list-style-type: none"> No residual effects have been identified.
Species and ecosystems at risk				
<ul style="list-style-type: none"> Effects on plants, plant communities, and wildlife species at risk 	Stockpile sites and access road improvements	Project Footprint	<ul style="list-style-type: none"> Implement measures outlined in Table 7.2-17 of the 2007 EAC Application 	<ul style="list-style-type: none"> No residual effects have been identified.
Archaeological and heritage resources				

Valued component/ potential effect	Description	Location	Mitigation measures	Residual effect
<ul style="list-style-type: none"> Effects to archaeological resources 	Stockpile sites and new road improvements	Project Footprint	<ul style="list-style-type: none"> No mitigation required 	<ul style="list-style-type: none"> No residual effects have been identified.
First Nations communities and land use				
<ul style="list-style-type: none"> Effect on historic and current use and occupation of lands and resources 	Stockpile sites and access road improvements	Project Footprint	<ul style="list-style-type: none"> Implement measures outlined in Table 7.2-23 of the 2007 EAC Application 	<ul style="list-style-type: none"> No residual effects have been identified.
<ul style="list-style-type: none"> Effects on areas or sites of significance 	Stockpile sites and access road improvements	Project Footprint	<ul style="list-style-type: none"> Implement measures outlined in Table 7.2-23 of the 2007 EAC Application 	<ul style="list-style-type: none"> No residual effects have been identified.
<ul style="list-style-type: none"> Effects on future use of lands 	Stockpile sites and access road improvements	Project Footprint	<ul style="list-style-type: none"> Implement measures outlined in Table 7.2-23 of the 2007 EAC Application 	<ul style="list-style-type: none"> No residual effects have been identified.
Land and resource use				
<ul style="list-style-type: none"> Effect on current use of land and resources 	Stockpile sites and access road improvements	Local Study Area	<ul style="list-style-type: none"> Implement measures outlined in Table 7.2-27 of the 2007 EAC Application Refer to the PTP Access Management Plan 	<ul style="list-style-type: none"> No residual effects have been identified.

Table 7. Effects assessment of the significance of residual effects – temporary facilities

Potential residual effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Minor loss of topsoil or rootzone material	Project Footprint	Short-term	Isolated	Medium-term	Low	High	High	Less than significant
Minor mixing of topsoil or rootzone material with subsoil	Project Footprint	Short-term	Isolated	Short-term	Low	High	High	Less than significant
Introduction of invasive plant species (noxious weeds)	Local Study Area	Medium-term	Isolated	Medium-term	Low	High	Moderate	Less than significant
Alteration of seasonal movement patterns of wildlife	Regional Study Area	Medium-term	Isolated	Medium-term	Low	High	Moderate	Less than significant
Increased risk of wildlife-vehicle collisions	Regional Study Area	Medium-term	Occasional	Short-term	Medium	High	Moderate	Less than significant

11.0 ENVIRONMENTAL ASSESSMENT OF ROUTE REFINEMENTS

This section contains an assessment of 20 pipeline Route Refinements (RRs). All RRs are requested to meet PTP's 2008 EAC commitments. These include the avoidance of geohazards, improved watercourse crossing, avoidance of important wildlife habitats, avoidance of wetlands, and to respond to land owner and First Nation requests.

11.1 Thorps Route Refinement (KM 1.9 to KM 2.8)

The Thorps Route Refinement is requested to avoid the new Summit Lake community sewage treatment facility.

11.1.1 Baseline conditions

The Thorps Route Refinement is located between KM 1.9 and KM 2.8 (Figure 7). No streams are crossed by this requested amendment.

The Summit Lake to Crooked River Movement Corridor is typically used by bears and ungulates in the spring and fall and occurs between KM 1.9 and KM 2.8.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. However, the route refinement is adjacent to the edge of the small wetland (W095) located near KM 2.7. No BC CDC occurrence data for species-at-risk were found. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Ranges, Parks, or Protected Areas overlap with the route refinement. No important seasonal ranges or wildlife movement corridors were identified.

No geohazards were identified for the route refinement.

The AIA, performed on September 29, 2011 with the assistance of Wendy Jael from the Lheidli T'enneh Band, found that no archaeological resources were known to be in conflict with the route refinement.

11.1.2 Impact assessment

Detailed vegetation and wildlife survey methods and results for the area are described in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the Thorps Route Refinement have been incorporated into this effects assessment.

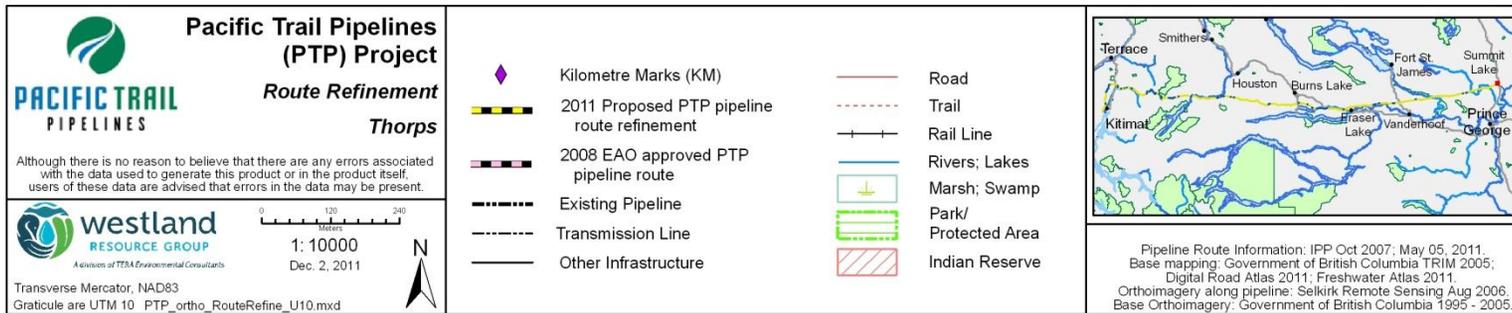
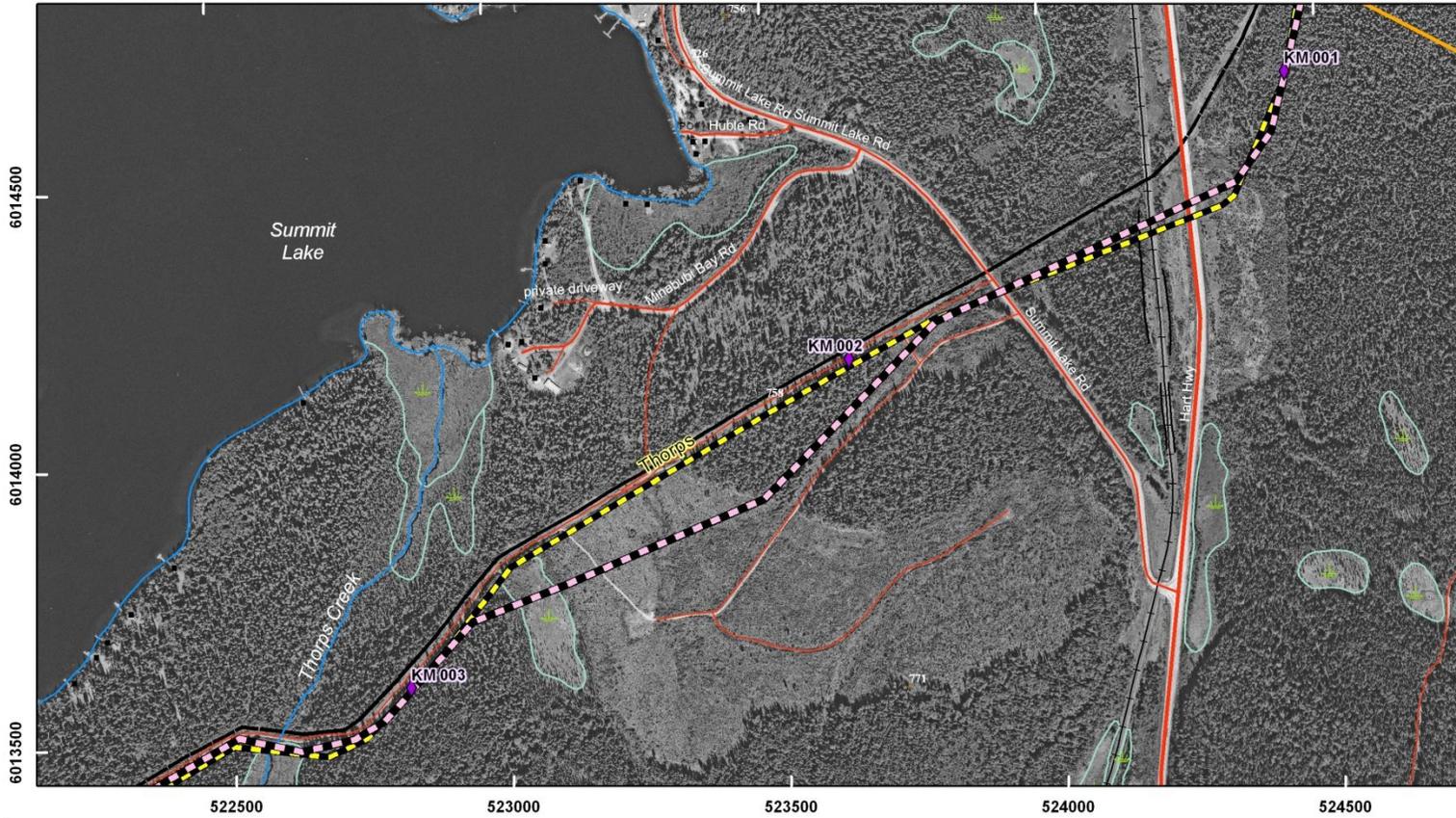


Figure 7. Thorps Route Refinement (KM 1.9 to KM 2.8)

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

The approved pipeline route crossed the wetland (W095) located near KM 2.7. The route refinement is adjacent to the edge of the wetland and will have less affect on the wetland than the approved pipeline route.

No geohazards were identified for the route refinement.

The AIA results indicated that no archaeological resources were identified.

The route refinement is considered to be an improvement compared to the approved pipeline route from an environmental, social, and economic perspective because the route refinement avoids the newly constructed Summit Lake community sewage treatment facility and a small wetland.

11.1.3 Mitigation

Mitigation measures for minimizing potential effects on vegetation, wildlife, and wildlife habitats that will be adopted for construction and operation activities for the Thorps Route Refinement are detailed in Section 7.2.4 of the 2007 EAC Application. The mitigation measures for vegetation, wildlife, and wildlife habitat are summarized below and are detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction work will be completed expeditiously to maintain a tight construction spread to minimize potential barriers and hazards to wildlife in movement corridor areas. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. No clearing activities will occur during the migratory bird nesting period (May 1 and July 31).

A typical geotechnical design is sufficient for the route refinement alignment to adequately incorporate all geotechnical issues identified during the 2011 assessment. No further geotechnical analysis is required for this route refinement.

Following the AIA, no further work is recommended and no mitigation is required.

11.1.4 Residual environmental effects

The following residual effects are identified for vegetation, wildlife, and wildlife habitats:

- introduction of invasive plant species following pipeline construction may occur,
- alteration of seasonal movement patterns of wide-ranging species such as bears and ungulates may occur during construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these potential residual effects to vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the Thorps Route Refinement.

11.1.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program affected by the Project. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.2 Crocker Route Refinement (KM 35.7 to KM 36.8)

The Crocker Route Refinement is proposed to avoid a wet area on north bank of Crocker Creek and minimize erosion risk.

11.2.1 Baseline conditions

The Crocker Route Refinement is located between KM 35.7 and KM 36.8 (Figure 8). The route refinement crosses the fish-bearing (S2) Crocker Creek at KM 36.3, approximately 250 m downstream of the approved pipeline route crossing. Fisheries surveys conducted in 2011 detected the occurrence of Rainbow Trout, Red-sided Shiner, and Burbot in the creek.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. However, the route refinement crosses approximately 300 m of mature and riparian forest between KM 36.2 and KM 36.5. No BC CDC occurrence data for species-at-risk were found for the route refinement.

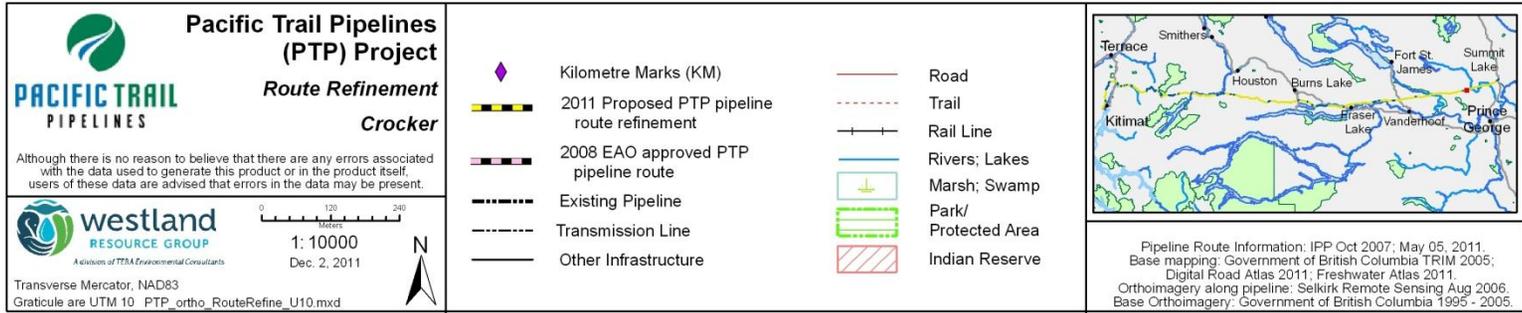
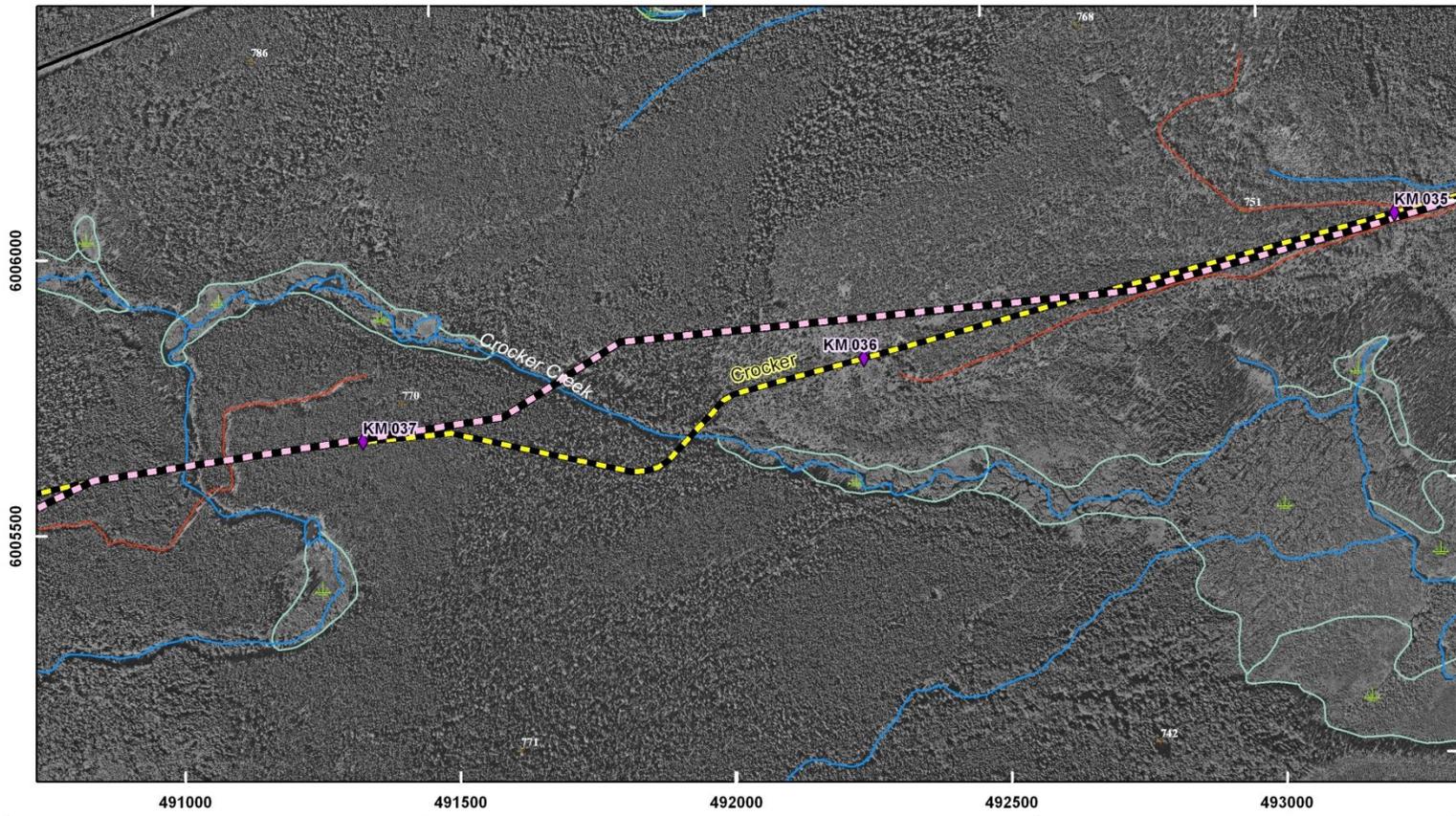


Figure 8. Crocker Route Refinement (KM 35.7 to KM 36.8)

No Wildlife Habitat Areas, OGMAs, Ungulate Winter Range, Parks, or Protected Areas overlap with the route refinement. No important seasonal ranges or wildlife movement corridors were identified.

Geotechnical assessments identified a minor geohazard at the Crocker Creek crossing between KM 36.2 and KM 36.7. The west bank is a short moderate till slope with fine textured glaciolacustrine and fluvial sediments and the eastern till slope appears to be a seepage-receiving area.

The AIA performed on October 4, 2011, with the assistance of Wendy Jael from the Lheidli T'enneh Band, found that no archaeological resources were known to be in conflict with the Crocker Route Refinement.

11.2.2 Impact assessment

The route refinement crosses the fish-bearing Crocker Creek at KM 36.3 and may have the following effects on fish and fish habitat:

- direct and indirect mortality of fish,
- loss or degradation of riparian and instream fish habitat,
- loss or degradation of fish habitat connectivity, and
- interbasin transfer of aquatic organisms.

Field assessments for Crocker Creek identified the stream as having moderate fish sensitivity. The stream was also crossed by the approved pipeline route (see the 2007 EAC Application for further details).

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The route refinement location was selected to avoid a wetland and a springs area on the north bank of Crocker Creek that would have been disturbed by the approved pipeline route. This area will now be avoided by the route refinement. The forested habitat crossed by the route

refinement will be affected to the same level as with the approved pipeline route (see Section 7.2.4 of the 2007 EAC Application for further details).

The AIA results indicated that no archaeological resources were identified.

The route refinement is considered to be an improvement compared to the approved pipeline route in this segment because the erosion potential at the Crocker Creek crossing is reduced and there will be no change in fish habitat potential.

11.2.3 Mitigation

Specific mitigation measures for minimizing potential effects on fish and fish habitat that will be adopted for the watercourse crossing are detailed in Section 7.2.3 of the 2007 EAC Application. In-stream work windows to protect fish are contained in the EMP. Proper work management and procedures that will be followed to limit any environmental effects in the event of an incident are also detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce potential project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (May 1 and July 31).

A typical crossing design for minor crossings that includes buoyancy control and an erosion control plan will be used for the Crocker Creek watercourse crossing between KM 36.2 and KM 36.7.

Following the AIA, no further work is recommended and no mitigation is required.

11.2.4 Residual environmental effects

The following residual effects have been identified for fish and fish habitat:

- increased fish mortalities from instream construction activities, and
- loss of fish food inputs from riparian areas adjacent to fish-bearing watercourses.

By implementing fish salvaging programs and recognizing that the loss of food inputs is expected to be temporary, these residual effects on fish and fish habitats are considered less

than significant (see Section 7.2.3 of the 2007 EAC Application for detailed residual effect assessments for fish and fish habitat).

The following residual effects have been identified for vegetation, wildlife, and wildlife habitats:

- areas of mature and riparian forest habitats will be cleared,
- potential for the introduction of invasive plant species following construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for fisheries, vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.2.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.3 Road 51.5 Route Refinement (KM 89.4 to KM 89.8)

The Road 51.5 Route Refinement is proposed to locate the pipeline route adjacent to the existing PNG right-of-way.

11.3.1 Baseline conditions

The Road 51.5 Route Refinement is located between KM 89.4 and KM 89.8 (Figure 9). The route refinement crosses an unnamed fish-bearing (S3) stream at KM 89.7, approximately 150 m upstream of the approved pipeline route. Fisheries surveys conducted in 2011 detected the occurrence of Rainbow Trout in the unnamed watercourse. Two non-fish-bearing watercourses will also be crossed by the route refinement; both streams would have been crossed by the approved pipeline route.

The route refinement crosses approximately 600 m of mature and riparian forest between KM 89.5 and KM 90.1. These forest types are also crossed by the approved pipeline route.

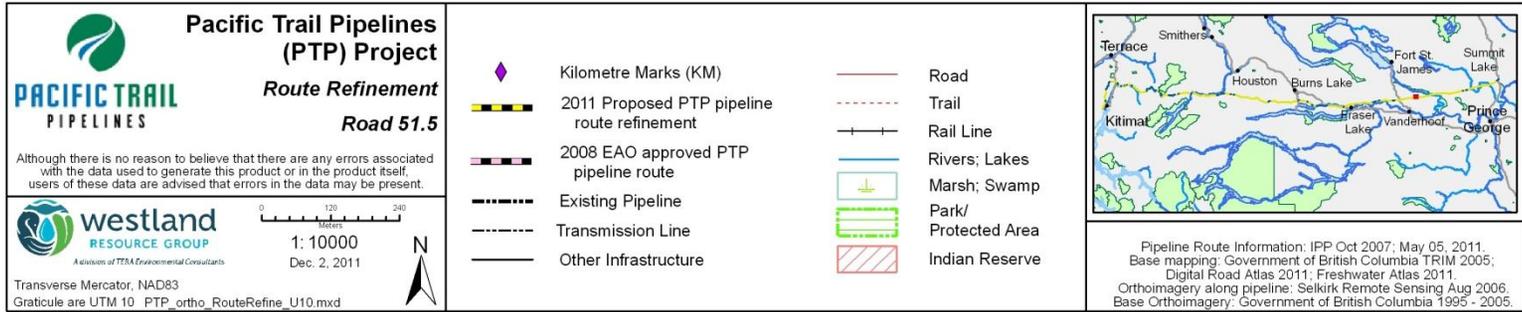
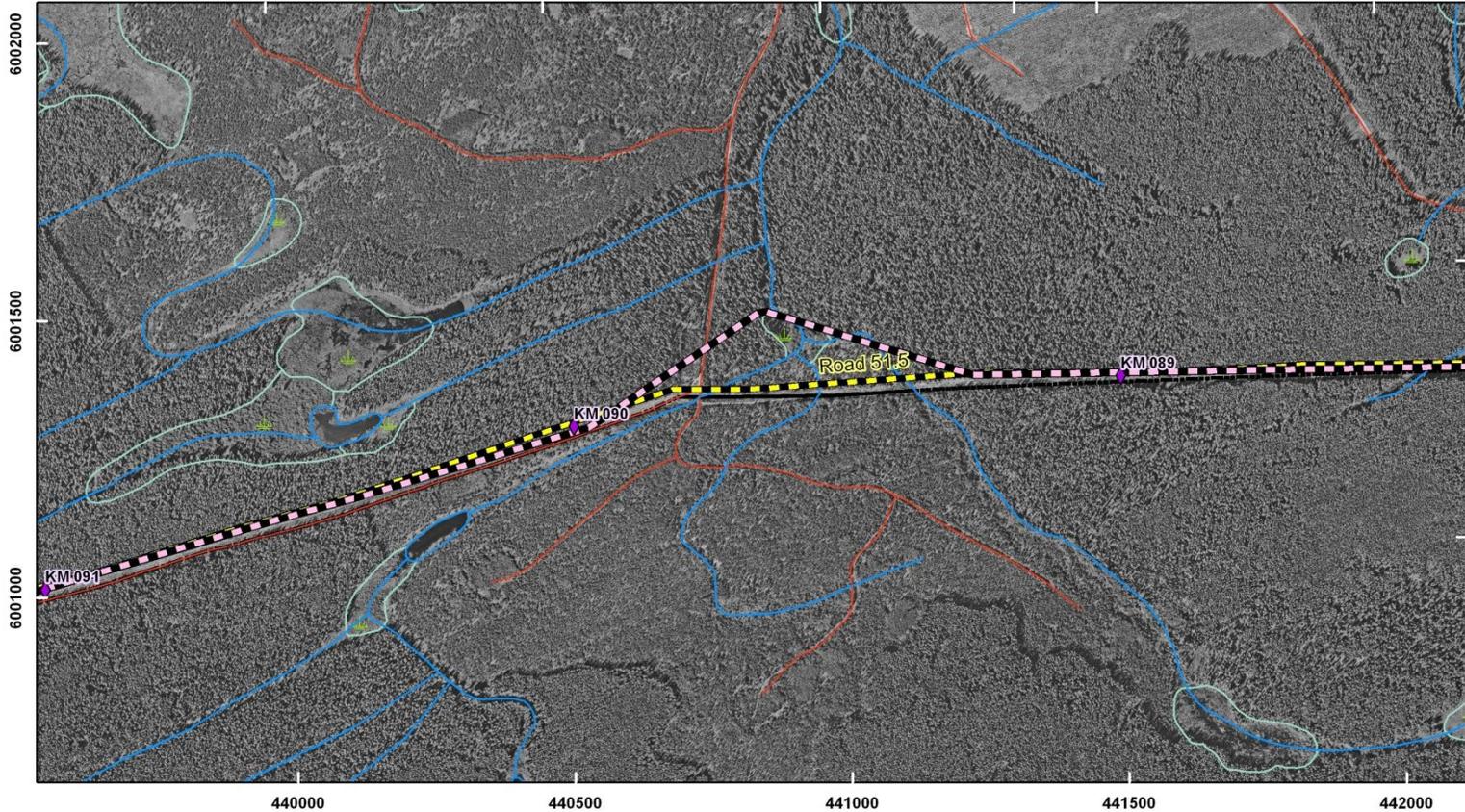


Figure 9. Road 51.5 Route Refinement (KM 89.4 to KM 89.8)

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. However, the route refinement runs within 50 m of a small wetland (W072) located near KM 89.6. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Range, Parks, or Protected Areas are crossed by the route refinement. No important seasonal ranges or wildlife movement corridors were identified for the route refinement.

No geohazards were identified.

The AIA performed on October 6, 2011, with assistance from Ricky Sam from the Nak'Azdli Band and CSTC, found that no archaeological resources were known to be in conflict with the route refinement.

11.3.2 Impact assessment

The route refinement crosses the unnamed fish-bearing creek at KM 89.7 and may have the following potential effects on fish and fish habitat:

- direct and indirect mortality of fish,
- loss or degradation of riparian and instream fish habitat,
- loss or degradation of fish habitat connectivity, and
- interbasin transfer of aquatic organisms.

Field assessments for the unnamed creek identified the stream as having moderate fish sensitivity. The stream was also crossed by the approved pipeline route and no change in fish habitat potential was identified at the requested crossing site (see the 2007 EAC Application for further details).

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The approved pipeline route is adjacent to the edge of a wetland (W072). The route refinement has a 50 m setback from the wetland and will likely affect the wetland less than the approved pipeline route. The approved pipeline route affected approximately 600 m of forested habitat,

while the route refinement will affect approximately 500 m of forested habitat (see Section 7.2.4 of the 2007 EAC Application for further details).

The AIA results found that no archaeological resources were identified.

The route refinement is considered to be similar to the approved pipeline route and no material change to the assessment of adverse effects was identified.

11.3.3 Mitigation

Specific mitigation measures for minimizing potential effects on fish and fish habitat that will be adopted for the watercourse crossing are detailed in Section 7.2.3 of the 2007 EAC Application. In-stream work windows to protect fish are contained in the EMP and the EMP describes how environmental risks to fish and fish habitats will be mitigated during construction. Proper work management and procedures that will be followed to limit any environmental effects in the event of an incident are also detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (May 1 and July 31).

Following the results of the AIA, no further work is recommended and no mitigation is required.

11.3.4 Residual environmental effects

The following residual effects were identified for fish and fish habitat:

- increased fish mortalities from instream construction activities, and
- loss of fish food inputs from riparian areas adjacent to fish-bearing watercourses.

By implementing fish salvaging programs and recognizing that the loss of food inputs is expected to be temporary, these residual effects on fish and fish habitats are considered less than significant (see Section 7.2.3 of the 2007 EAC Application the 2007 EAC Application for detailed residual effect assessments for fish and fish habitat).

The following residual effects were identified for vegetation, wildlife, and wildlife habitats:

- areas of forest habitats may be cleared,
- potential for the introduction of invasive plant species following construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for fisheries, vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.3.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.4 Layton Route Refinement (KM 111.8 to KM 113.8)

The Layton Route Refinement is proposed to avoid a private residence on the south side of the PNG right-of-way.

11.4.1 Baseline conditions

The Layton Route Refinement is located between KM 111.8 and KM 113.8 (Figure 10). No fish-bearing watercourses are crossed by this route refinement. Two non-fish-bearing watercourses will be crossed by this route refinement. Both streams were also crossed by the approved pipeline route. The new watercourse crossings are located approximately 75 m further upstream from where they were originally proposed.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Ranges, Parks, or Protected Areas overlap with the route refinement. No important seasonal ranges or wildlife movement corridors were identified for the route refinement.

No geohazards were identified for the Layton Route Refinement.

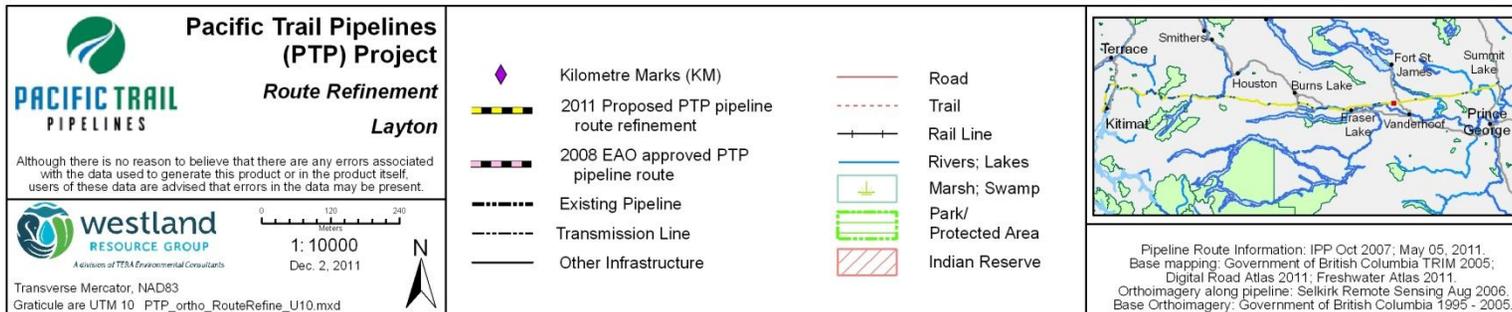
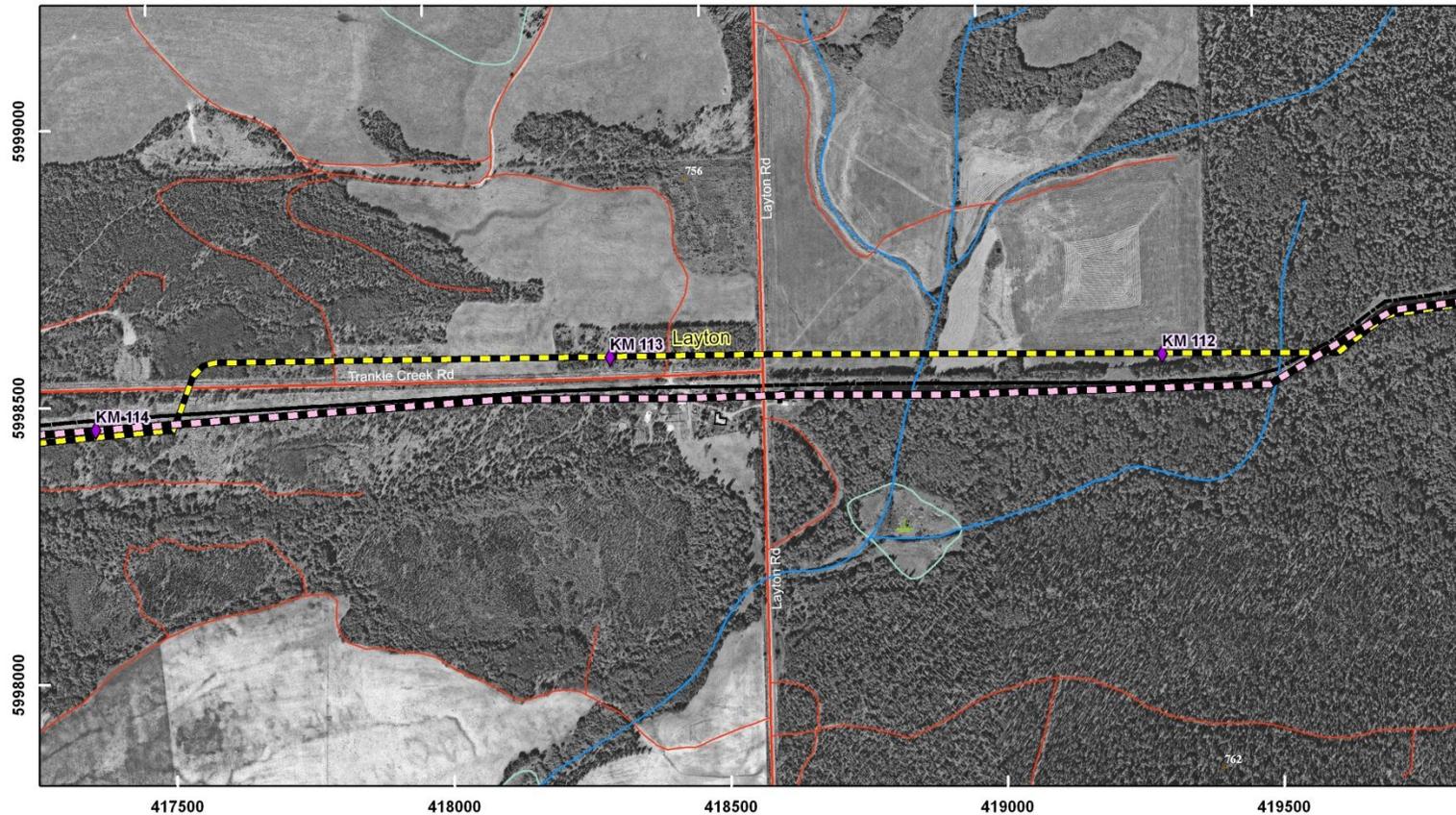


Figure 10. Layton Route Refinement (KM 111.8 to KM 113.8)

The AIA, performed on October 7, 2011, with the assistance of Ricky Sam from the Nak'Azdli Band and CSTC, found that no archaeological resources were known to be in conflict with the route refinement.

11.4.2 Impact assessment

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The route refinement occurs in agricultural land between KM 112.0 and KM 113.5; previously, the approved pipeline route crossed forested land in this segment.

No geohazards were identified.

The AIA results indicated that no archaeological resources were identified.

The route refinement is considered to be beneficial compared to the approved pipeline route, from a land use perspective, because it avoids a potential land use conflict and is presented to comply with a land owner's request.

11.4.3 Mitigation

Mitigation measures for minimizing potential effects on vegetation, wildlife, and wildlife habitats will be adopted for construction and operation activities for the route refinement and are detailed in Section 7.2.4 of the 2007 EAC Application.

Mitigation measures for vegetation, wildlife, and wildlife habitat are summarized below and are detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features.

Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (May 1 and July 31).

Following the AIA, no further work is recommended and no mitigation is required.

11.4.4 Residual environmental effects

The following residual effects are identified for vegetation, wildlife, and wildlife habitats:

- potential for the introduction of invasive plant species following construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.4.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.5 Nine Mile Cabin Route Refinement (KM 127.3 to KM 128.6)

The Nine Mile Cabin Route Refinement is requested to comply with a landowner request to avoid a new cabin and to locate the pipeline route adjacent to the existing PNG right-of-way. The route refinement also improves the crossing of Nine Mile Creek.

11.5.1 Baseline conditions

The Nine Mile Cabin Route Refinement is located between KM 127.3 and KM 128.6 (Figure 11). The route refinement crosses the fish-bearing (S2) stream Nine Mile Creek at KM 127.8, approximately 125 m upstream of the approved pipeline route crossing. Fisheries surveys conducted in 2011 detected the occurrence of Rainbow Trout and Chinook Salmon in Nine Mile Creek.

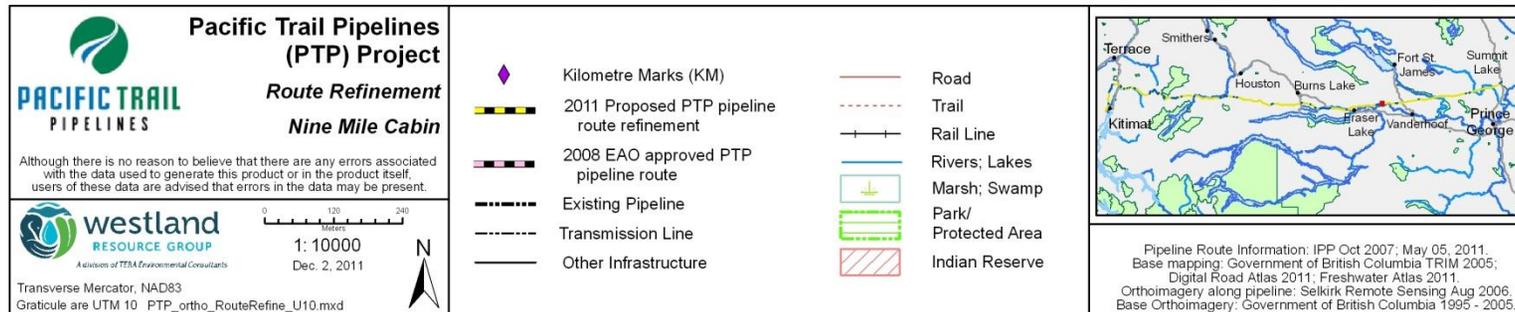
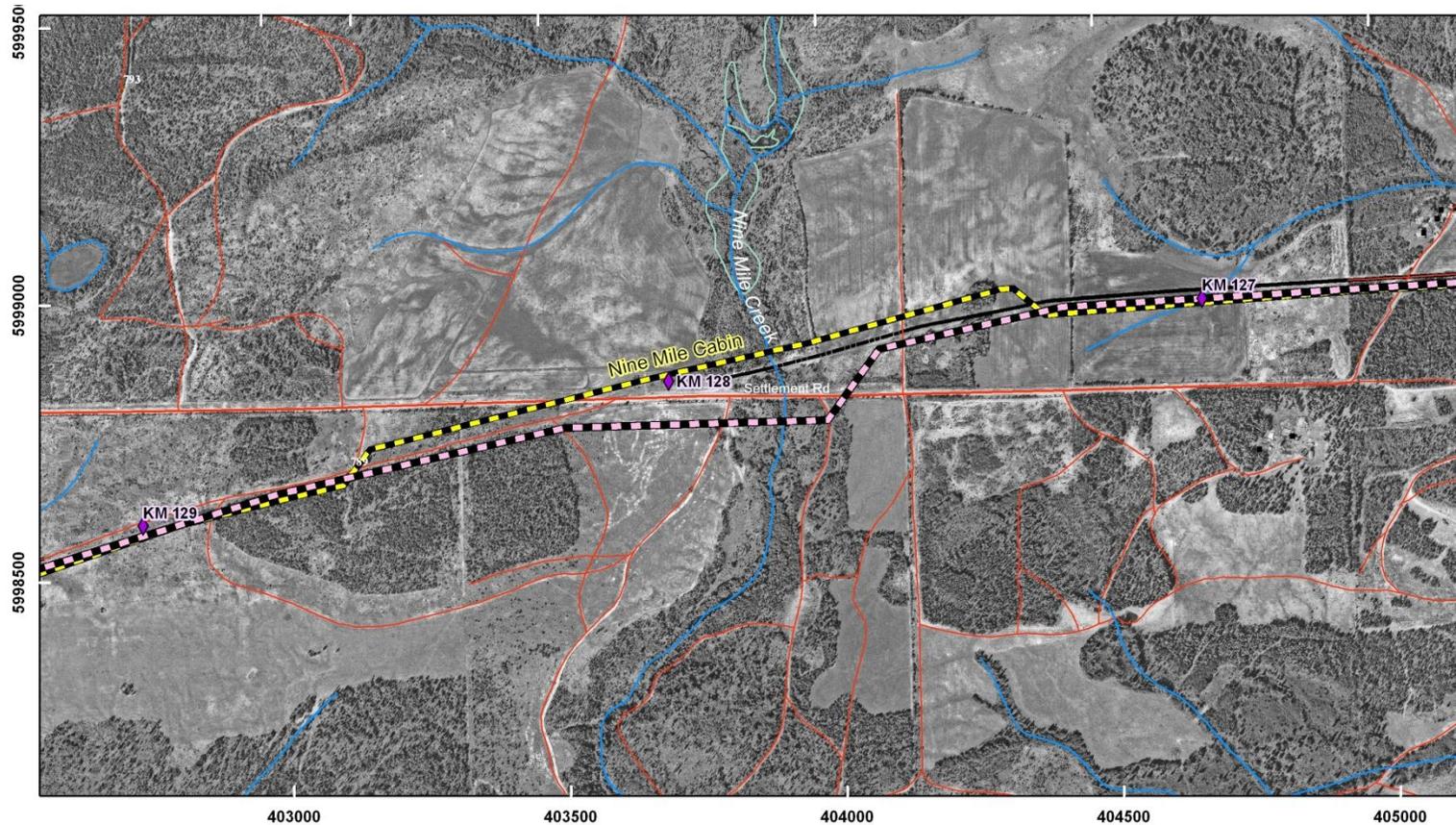


Figure 11. Nine Mile Cabin Route Refinement (KM 127.3 to KM 128.6)

The Nautley to Nechako River Lake Movement Corridor occurs between KM 127.6 and KM 128.8. This corridor is typically used by bears and ungulates in the spring and fall.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Range, Parks, or Protected Areas overlap with the route refinement.

No geohazards were identified for the Nine Mile cabin Route Refinement.

The AIA, performed on October 7, 2011 with assistance from Ricky Sam from the Nak'Azdli Band and CSTC, found that no archaeological resources were known to be in conflict with the Nine Mile Cabin Route Refinement.

11.5.2 Impact assessment

The route refinement crosses a fish-bearing, Nine Mile Creek, and may have the following effects on fish and fish habitat:

- direct and indirect mortality of fish,
- loss or degradation of riparian and instream fish habitat,
- loss or degradation of fish habitat connectivity, and
- interbasin transfer of aquatic organisms.

Field assessments for Nine Mile Creek identified the creek as having high fish sensitivity. Nine Mile Creek was to be crossed by the approved pipeline route. The route refinement was assessed to have no change in habitat potential of the watercourse crossing when compared to the approved pipeline route (see the 2007 EAC Application for further details).

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). The wildlife movement corridor will be affected to the same level as with the approved pipeline route.

No geohazards were identified.

The AIA results indicated that one historic homestead or small settlement was noted. However, no archaeological resources were identified.

The route refinement is considered to be an improvement compared to the approved pipeline route from a land use perspective because a new cabin will be avoided.

11.5.3 Mitigation

Specific mitigation measures for minimizing potential effects on fish and fish habitat that will be adopted for the watercourse crossing are detailed in Section 7.2.3 of the 2007 EAC Application. In-stream work windows to protect fish are contained in the EMP. Proper work management and procedures that will be followed to limit any environmental effects in the event of an incident are also detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction work will be completed expeditiously to maintain a tight construction spread to minimize potential barriers and hazards to wildlife in movement corridor areas. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (May 1 and July 31).

Following the AIA results, no further archaeological work is recommended. These recommendations pertain to protected archaeological sites which predate 1846 only. There are no requirements for further work at historic sites (such as cabins) under the *Heritage Conservation Act*. However, it would be advisable to contact First Nations communities regarding the management of historic resources.

11.5.4 Residual environmental effects

The following residual effects have been identified for fish and fish habitat:

- increased fish mortalities from instream construction activities, and
- loss of fish food inputs from riparian areas adjacent to fish-bearing watercourses.

By implementing fish salvaging programs and recognizing that the loss of food inputs is expected to be temporary, these residual effects on fish and fish habitats are considered less than significant (see Section 7.2.3 of the 2007 EAC Application for detailed residual effect

assessments for fish and fish habitat).

The following residual effects have been identified for vegetation, wildlife, and wildlife habitats:

- potential for the introduction of invasive plant species following construction,
- alteration of seasonal movement patterns of wide-ranging species such as bears and ungulates may occur during construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for fisheries, vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.5.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.6 Dog Creek FSR Route Refinement (KM 130.8 to KM 134.0)

The Dog Creek FSR Route Refinement is requested to move the pipeline route to the north side of the PNG right-of-way to avoid drainage and to parallel a creek channel. A landowner also requested this route amendment to increase the offset from their residence.

11.6.1 Baseline conditions

The Dog Creek FSR Route Refinement is located between KM 130.8 and KM 134.0 (Figure 12). The route refinement crosses Tatsutnai Creek and an unnamed fish-bearing stream. The route refinement crosses the fish-bearing (S2) Tatsutnai Creek at KM 131.6, approximately 35 m upstream of the approved pipeline route crossing. Fisheries surveys conducted in 2011 detected the occurrence of Rainbow Trout in Tatsutnai Creek. The unnamed fish-bearing (S3) stream at KM 131.9 had occurrence detections for Rainbow Trout. Two unnamed non-fish-bearing watercourses are crossed by the route refinement; however, these streams were also crossed by the approved pipeline route.

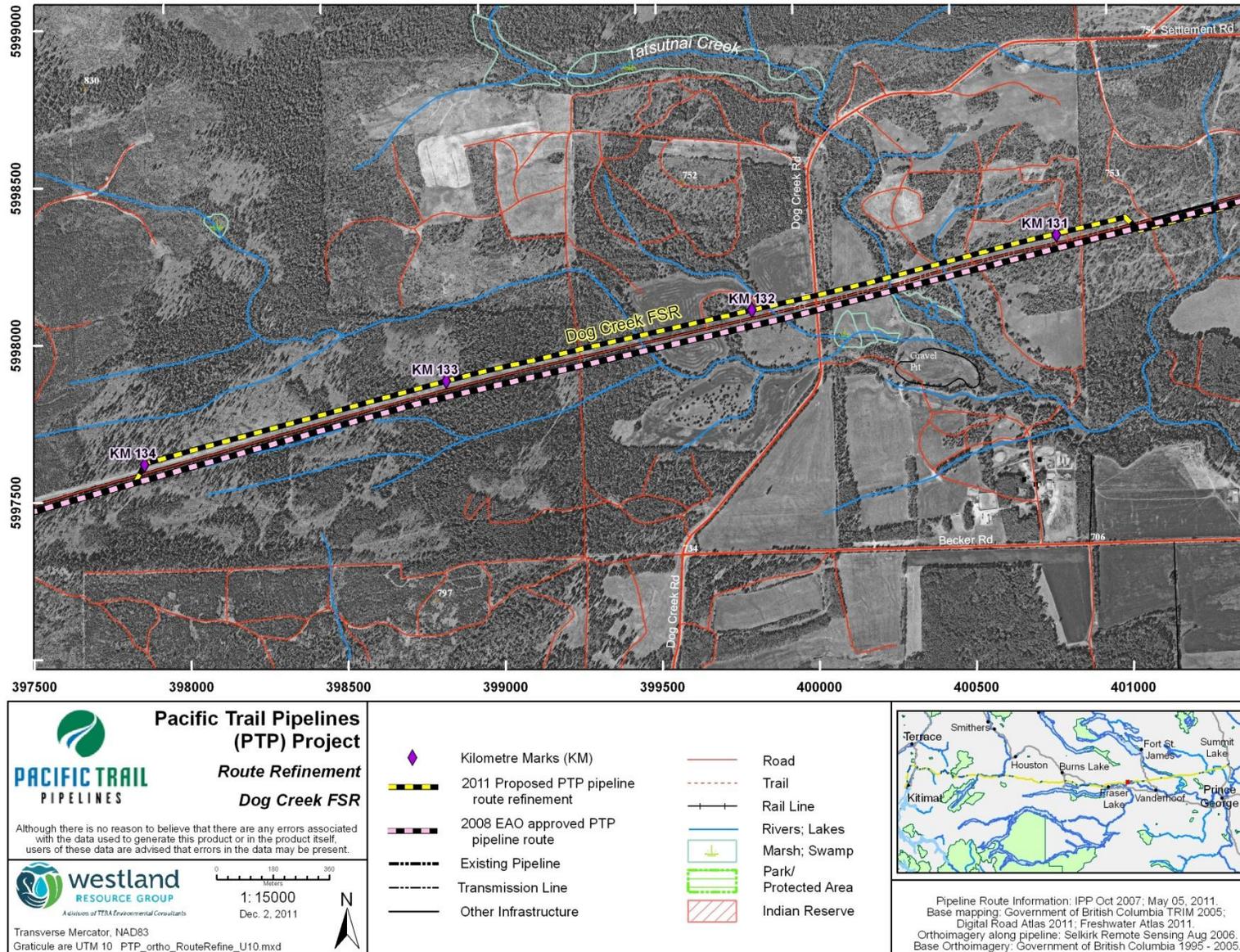


Figure 12. Dog Creek FSR Route Refinement (KM 130.8 to KM 134.0)

The Nautley to Nechako River Lake Movement Corridor is typically used by bears and ungulates in the spring and fall and occurs between KM 130.9 and KM 134.1.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. However, the route refinement crosses approximately 1.7 km of forest land between KM 132.4 and KM 134.1. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Range, Parks, or Protected Areas overlap with the route refinement.

No geohazards were identified for this route refinement.

The AIA, performed on October 18-21 and November 8-9, 2011 with the assistance of Ricky Sam and Darren Sutherland from the Nak'Azdli Band and Carrier Sekani Tribal Council (CSTC), found that no archaeological resources were known to be in conflict with the Dog Creek FSR Route Refinement.

11.6.2 Impact assessment

The following potential effects have been identified for fish and fish habitat:

- direct and indirect mortality of fish,
- loss or degradation of riparian and instream fish habitat,
- loss or degradation of fish habitat connectivity, and
- interbasin transfer of aquatic organisms.

Field assessments for Tatsutnai Creek and the unnamed fish-bearing stream identified that both streams have moderate fish sensitivity. Both Tatsutnai Creek and the unnamed stream were crossed by the approved pipeline route and both route refinement crossings were assessed to have no change in habitat potential compared to the approved pipeline route.

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment. The wildlife movement corridor and forest land habitat will be affected to relatively the same level as the approved pipeline route.

No geohazards were identified for this route refinement.

The AIA results indicated that one archaeological site (a lithic scatter) was recorded in the 100 m wide study corridor. In addition, one historic homestead or small settlement was noted.

The route refinement is considered to be an improvement compared to the approved pipeline route because the route refinement will increase the offset from a residence and improve drainage management options.

11.6.3 Mitigation

Specific mitigation measures for minimizing potential effects on fish and fish habitat that will be adopted for the route refinement are detailed in Section 7.2.3 of the 2007 EAC Application. In-stream work windows to protect fish are contained in the EMP. Proper work management and procedures that will be followed to limit any environmental effects in the event of an incident are also detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction work will be completed expeditiously to maintain a tight construction spread to minimize potential barriers and hazards to wildlife in movement corridor areas. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (May 1 and July 31).

No geohazards were identified and no further geotechnical analysis is required for the route refinement.

Following the AIA, it is recommended that any ground-disturbing activities within the boundaries of an archaeological site must be undertaken under the authority of a site alteration permit pursuant to S.12 of the *HCA*. It is further recommended that a Chance Find Procedure (CFP) be in place during pipeline construction activities in the vicinity of, the recorded archaeological site. These recommendations pertain to the protected archaeological site which predates 1846 only. There are no requirements for further work at historic sites (such as cabins) under the *HCA*. However, it would be advisable to contact the relevant First Nations communities regarding the management of historic resources.

11.6.4 Residual environmental effects

The following residual effects have been identified for fish and fish habitat:

- increased fish mortalities from instream construction activities, and
- loss of fish food inputs from riparian areas adjacent to fish-bearing watercourses.

By implementing fish salvaging programs and recognizing that the loss of food inputs is expected to be temporary, these residual effects on fish and fish habitats are considered less than significant (see Section 7.2.3 of the 2007 EAC Application for detailed residual effect assessments for fish and fish habitat).

The following residual effects have been identified for vegetation, wildlife, and wildlife habitats:

- areas of forest land and riparian areas will be cleared,
- potential for the introduction of invasive plant species following construction,
- alteration of seasonal movement patterns of wide-ranging species such as bears and ungulates may occur during construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and archaeology are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for fisheries, vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.6.5 Monitoring

PTP will obtain a site alteration permit and have a qualified archaeologist on site to monitor work in the boundaries of the identified archaeological site. PTP will undertake a Post-Construction Monitoring Program.

Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.7 Sub-Station Route Refinement (KM 165.5 to KM 166.3)

The Sub-Station Route Refinement is proposed to move the pipeline ROW outside of the BC Hydro sub-station property boundaries.

11.7.1 Baseline conditions

The Sub-Station Route Refinement is located between KM 165.5 and KM 166.3 (Figure 13). No fish-bearing watercourses are crossed by this route refinement. Two non-fish-bearing watercourses will be crossed by this route refinement; however, the streams were also crossed by the approved pipeline route.

The new crossings on the non-fish-bearing watercourses are now located approximately 50 m and 125 m further downstream from where they were originally proposed.

The Tchesinkut to Fraser Lake Wildlife Movement Corridor is typically used by bears and ungulates year round and occurs between KM 165.6 and KM 166.4.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Ranges, Parks, or Protected Areas are crossed by the route refinement.

Geotechnical assessments identified two creeks incised in glaciolacustrine fine sediments separated by a narrow ridge between KM 165.8 and KM 166.2. The creeks are located in a narrow, wetland area with beaver ponds. The easternmost bank is a gentle slope; the other banks are moderate to moderately steep scarps. This location is expected to be sensitive to construction-related disturbance and the drainages are connected to the Endako River. A minor scour hazard and bank erosion hazard was identified in this section of the route refinement.

The AIA, performed on October 22 and November 7, 2011, found that no archaeological resources were known to be in conflict with the route refinement.

11.7.2 Impact assessment

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The AIA results indicate that one cluster of historic (post-1846) CMTs was noted in the 100 m wide study corridor. However, no archaeological resources that predate 1846 were identified.

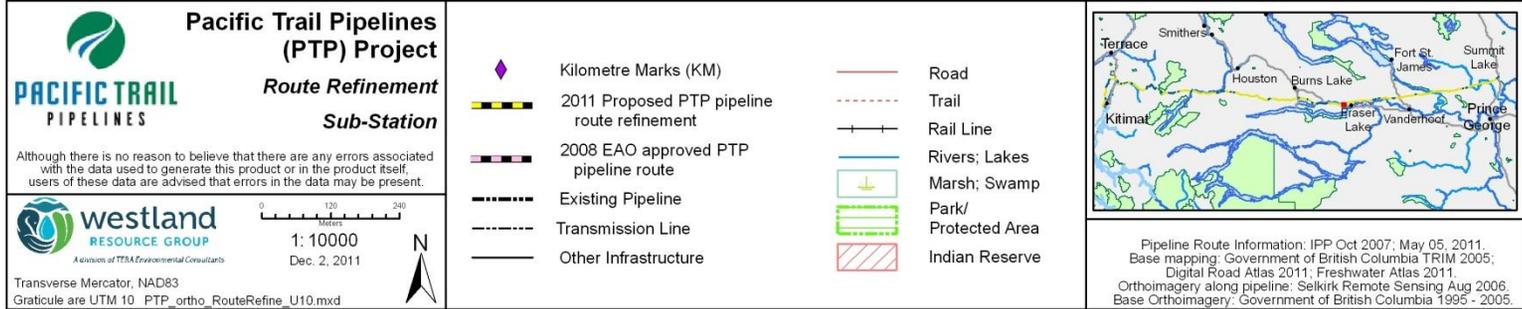
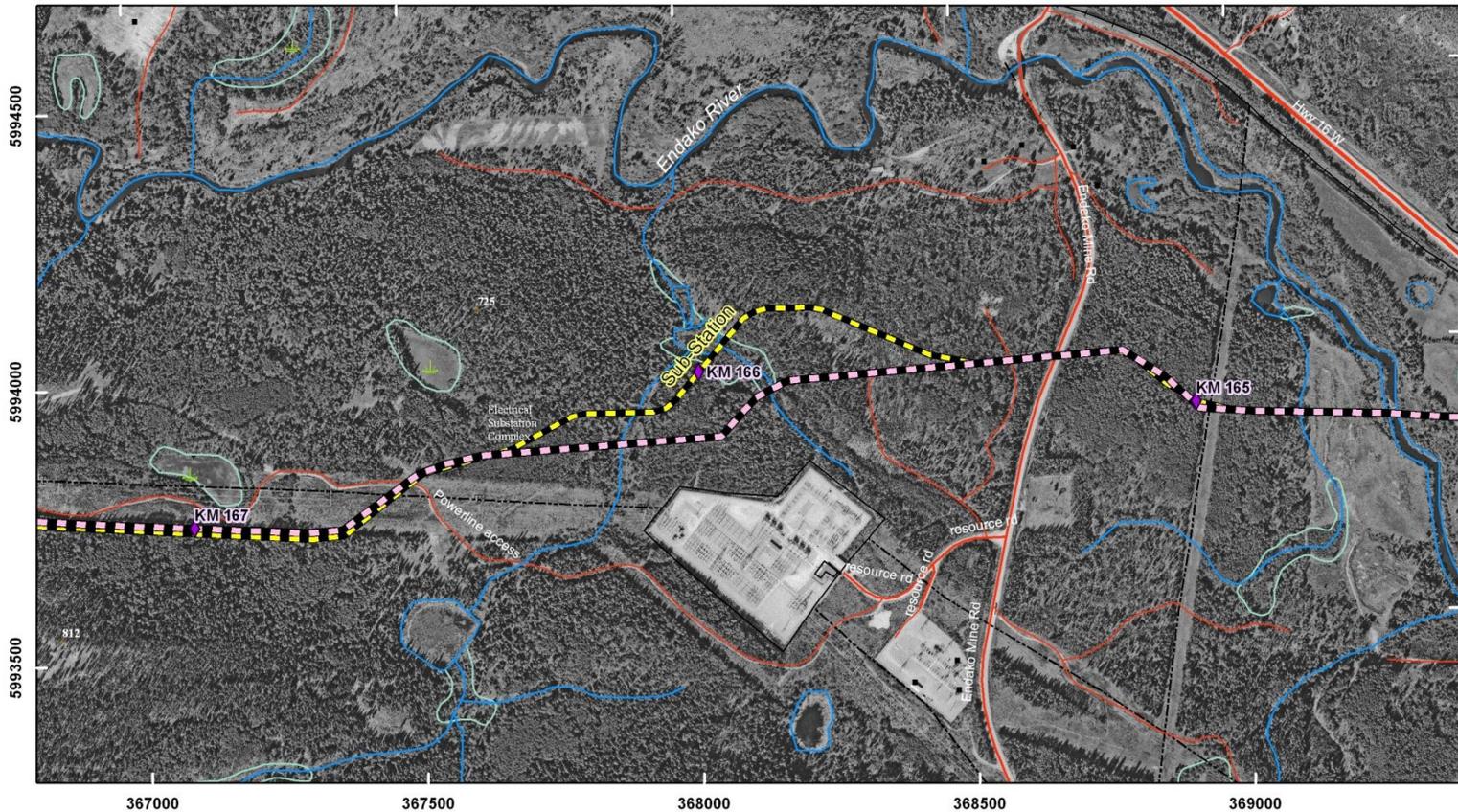


Figure 13. Sub-Station Route Refinement (KM 165.5 to KM 166.3)

The route refinement is considered to be an improvement compared to the approved pipeline route because it avoids the B.C. Hydro Sub-station property.

11.7.3 Mitigation

Mitigation measures for minimizing potential effects on vegetation, wildlife, and wildlife habitats will be adopted for construction and operation activities for the route refinement and are detailed in Section 7.2.4 of the 2007 EAC Application. Mitigation measures for vegetation, wildlife, and wildlife habitat are summarized below and are detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction work will be completed expeditiously to maintain a tight construction spread to minimize potential barriers and hazards to wildlife in movement corridor areas. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (May 1 and July 31).

A typical crossing design for minor watercourse crossings that includes buoyancy control and a spoil management plan will be prepared for the route refinement between KM 165.8 and KM 166.2.

No further work is recommended and no mitigation is required. These recommendations pertain to protected archaeological sites that predate 1846 only. For those historic features such as CTMs noted within the study corridor, there are no requirements for further work under the HCA. However, it would be advisable to contact the relevant First Nations communities regarding the management of these historic resources.

11.7.4 Residual environmental effects

The following residual effects are identified for vegetation, wildlife, and wildlife habitats:

- potential for the introduction of invasive plant species following construction,
- alteration of seasonal movement patterns of wide-ranging species such as bear and ungulates may occur during construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on

vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.7.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.8 Road 51.4 Route Refinement (KM 198.3 to KM 198.9)

The Road 51.4 Route Refinement is requested to avoid a steep side slope.

11.8.1 Baseline conditions

The Road 51.4 Route Refinement is located between KM 198.3 and KM 198.9 (Figure 14). No fish-bearing watercourses are crossed by this route refinement. Two non-fish-bearing watercourses will be crossed by this route refinement; however, one of these streams was also crossed by the approved pipeline route. The new crossing on the non-fish-bearing stream is now located approximately 290 m further upstream from where it was originally proposed.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Ranges, Parks, or Protected Areas overlap with the route refinement. No important seasonal ranges or wildlife movement corridors were identified for the route refinement.

No geohazards were identified for the Road 51.4 Route Refinement.

The AIA, performed on October 22, 2011, found that no archaeological resources were known to be in conflict with the Road 51.4 Route Refinement.

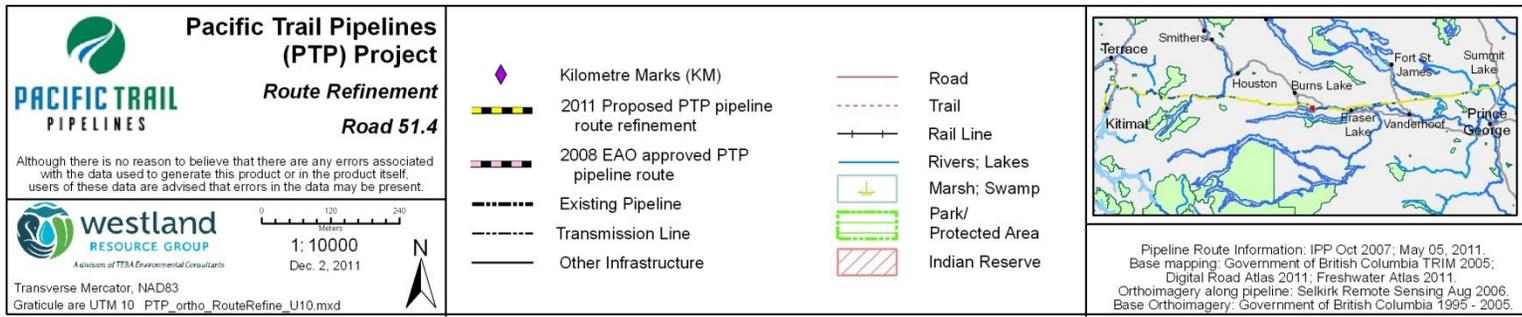
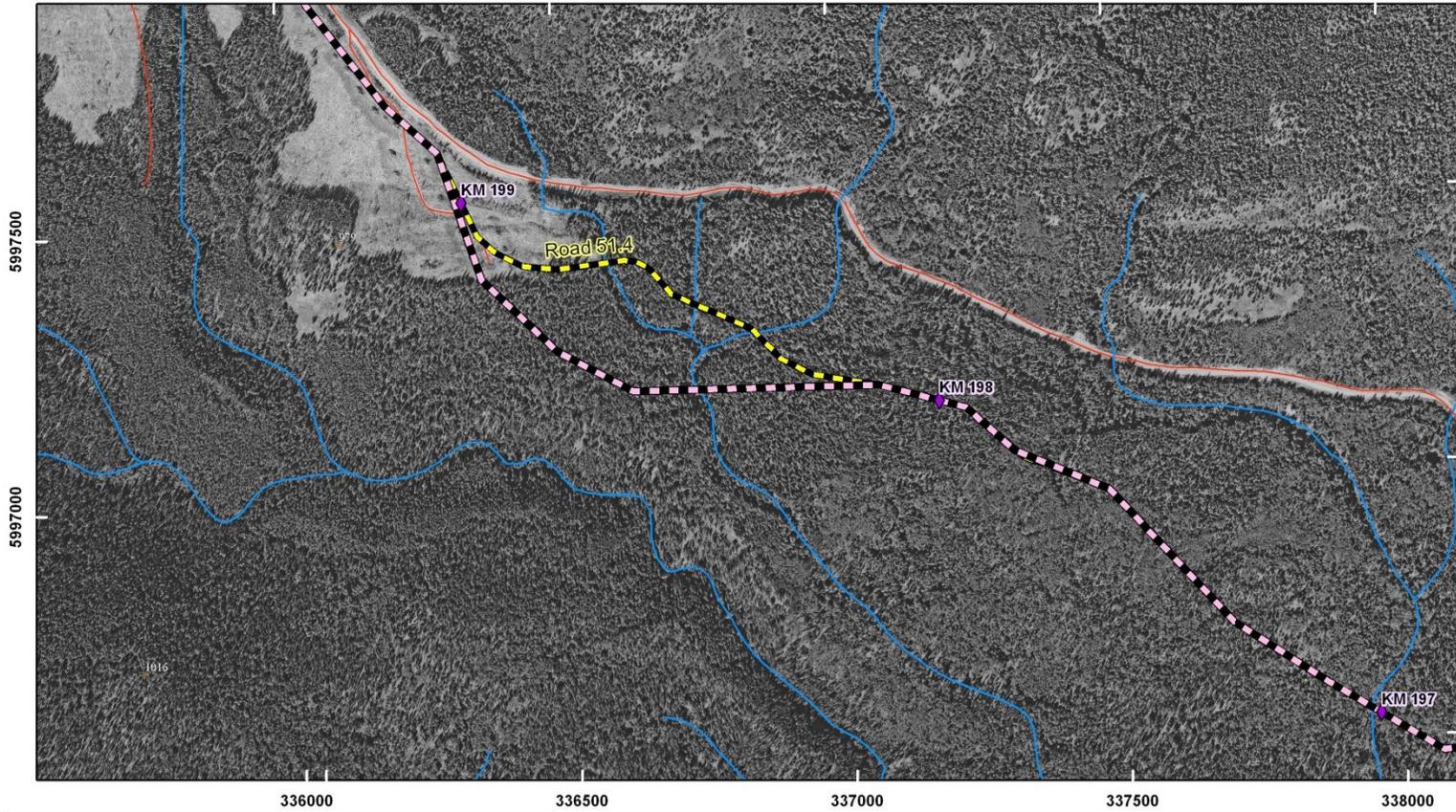


Figure 14. Road 51.4 Route Refinement (KM 198.3 to KM 198.9)

11.8.2 Impact assessment

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The results of the AIA indicated that no archaeological resources were identified.

The route refinement is considered to be an improvement compared to the approved pipeline route from an environmental, geotechnical, and construction safety perspective.

11.8.3 Mitigation

Mitigation measures for minimizing potential effects on vegetation, wildlife, and wildlife habitats will be adopted for construction and operation activities for the route refinement and are detailed in Section 7.2.4 of the 2007 EAC Application. Mitigation measures for vegetation, wildlife, and wildlife habitat are summarized below and are detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland.

An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (May 1 and July 31).

No further geotechnical analysis is required for the route refinement.

Following the AIA results, no further work is recommended and no mitigation is required.

11.8.4 Residual environmental effects

The following residual effects are identified for vegetation, wildlife, and wildlife habitats:

- potential for the introduction of invasive plant species following construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.8.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.9 Seven Mile FSR Route Refinement (KM 214.3 to KM 215.2)

The Seven Mile FSR Route Refinement is requested to avoid a wetland complex.

11.9.1 Baseline conditions

The Seven Mile FSR Route Refinement is located between KM 214.3 and KM 215.2 (Figure 15). No fish-bearing watercourses are crossed by this route refinement.

One non-fish-bearing watercourse will be crossed by this route refinement. This watercourse would have been crossed by the approved pipeline route. The new watercourse crossing is located approximately 355 m further upslope from where it was originally proposed.

The route refinement crosses approximately 300 m of forest land (KM 214.5 and KM 214.6) and (KM 214.9 and KM 215.1).

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. However, the route refinement occurs 50 m to the south of a small wetland (W050) located near KM 214.6. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Ranges, Parks, or Protected Areas overlap with the route refinement.

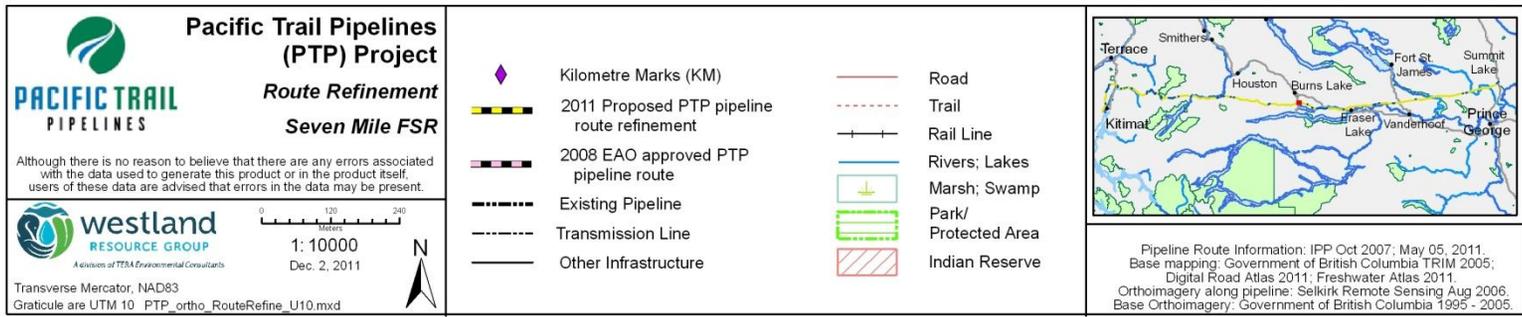
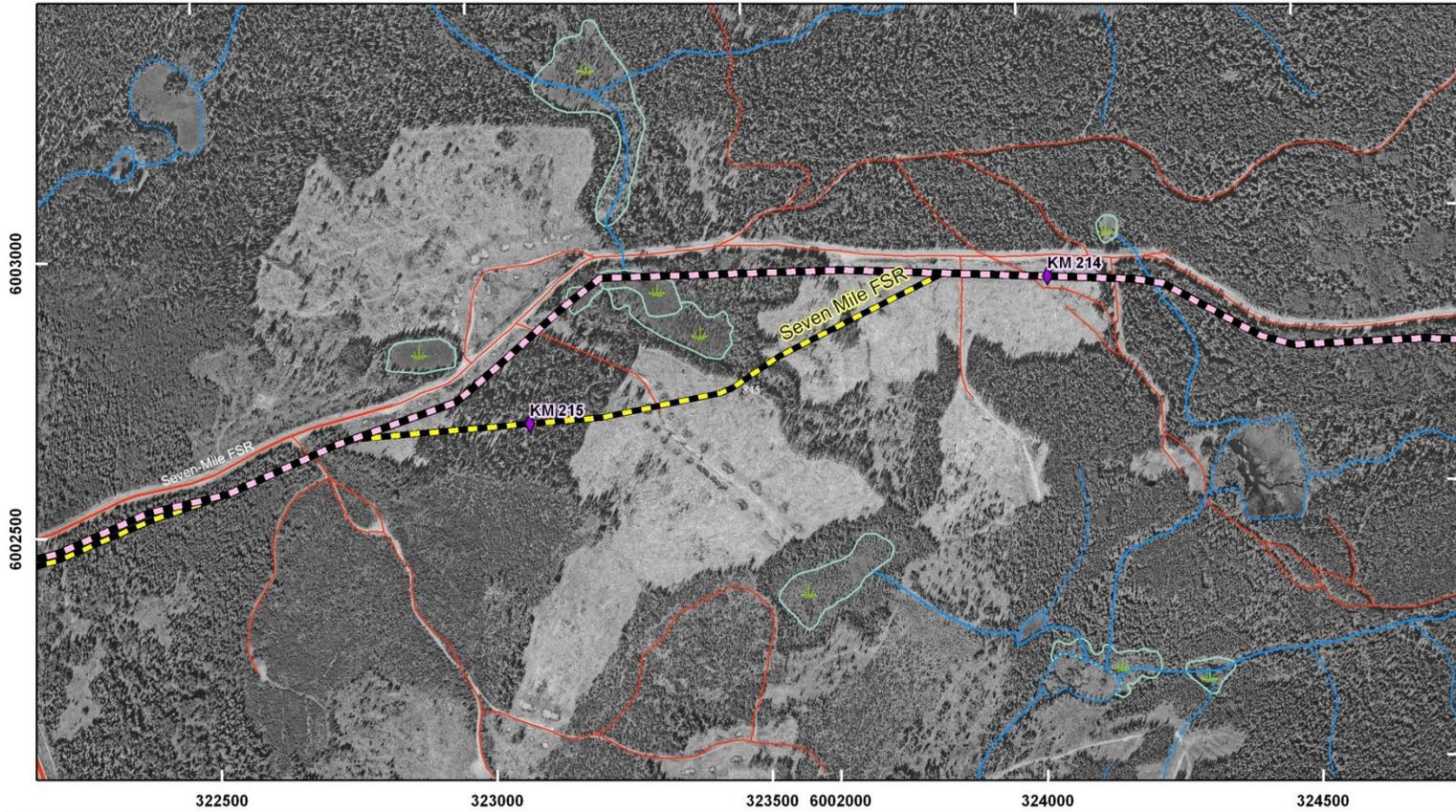


Figure 15. Seven Mile FSR Route Refinement (KM 214.3 to KM 215.2)

No important seasonal ranges or wildlife movement corridors were identified for the route refinement.

No geohazards were identified for the Seven Mile FSR Route Refinement.

The AIA, performed on October 26, 2011, found that no archaeological resources were known to be in conflict with the Seven Mile FSR Route Refinement.

11.9.2 Impact assessment

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The route refinement was realigned through some existing clearcuts, which reduces the amount of affected forest habitat compared to the approved pipeline route from 600 m to 300 m between KM 214.4 and KM 215.0. The wetland (W050) located near KM 214.6 would have been disturbed by the approved pipeline route, while the route refinement is located 50 m away from this wetland.

The AIA found that no archaeological resources were identified.

The route refinement is considered to be an improvement compared to the approved pipeline route from an environmental perspective because a wetland area and less forested habitat will be avoided.

11.9.3 Mitigation

Mitigation measures for minimizing potential effects on vegetation, wildlife, and wildlife habitats will be adopted for construction and operation activities for the route refinement and are detailed in Section 7.2.4 of the 2007 EAC Application. Mitigation measures for vegetation, wildlife, and wildlife habitat are summarized below and are detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be

developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (May 1 and July 31).

A typical geotechnical design is sufficient for the route refinement alignment to adequately incorporate all geotechnical issues identified during the 2011 assessment. No further geotechnical analysis is required for the route refinement.

Following the results of the AIA, no further work is recommended and no mitigation is required.

11.9.4 Residual environmental effects

The following residual effects were identified for vegetation, wildlife, and wildlife habitats:

- areas of mature and riparian forest habitats may be cleared,
- potential for the introduction of invasive plant species following construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.9.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.10 Buck Route Refinement (KM 277.3 to KM 278.1)

The Buck Route Refinement is requested to avoid geotechnical hazards and follow an existing logging road.

11.10.1 Baseline conditions

The Buck Route Refinement is located between KM 277.3 to KM 278.1 (Figure 16). No fish-bearing watercourses are crossed by the route refinement. One non-fish-bearing stream will be crossed; however, the stream was also crossed by the approved pipeline route. The crossing is located approximately 60 m further downstream from where it was originally proposed.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Ranges, Parks, or Protected Areas overlap with the route refinement. No important seasonal ranges or wildlife movement corridors were identified for the route refinement.

No geohazards were identified for the Buck Route Refinement.

The AIA, performed on October 26, 2011, found that no archaeological resources were known to be in conflict with the route refinement.

11.10.2 Impact assessment

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The AIA found that no archaeological resources were identified.

The Route Refinement is considered to be an improvement from the approved pipeline route because the route refinement avoids a geohazard and generally occurs adjacent to a previously disturbed area (*i.e.*, logging road).

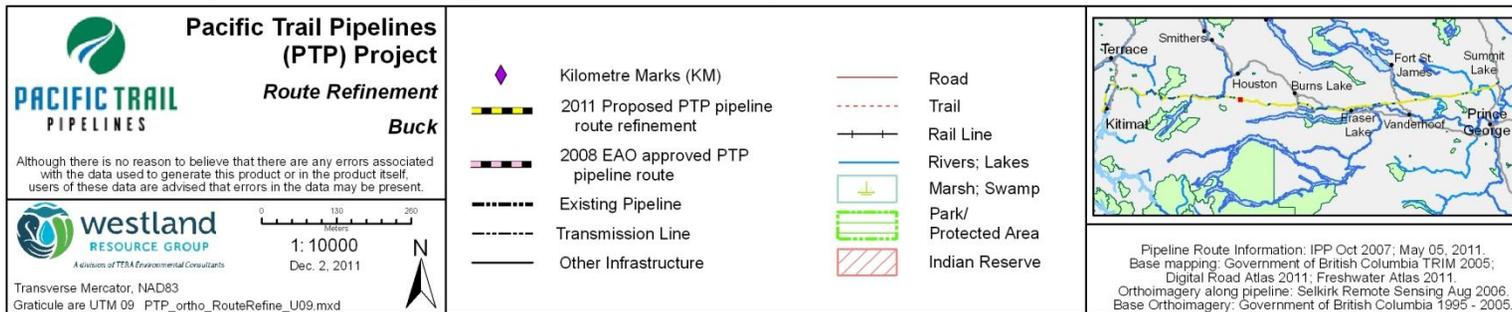
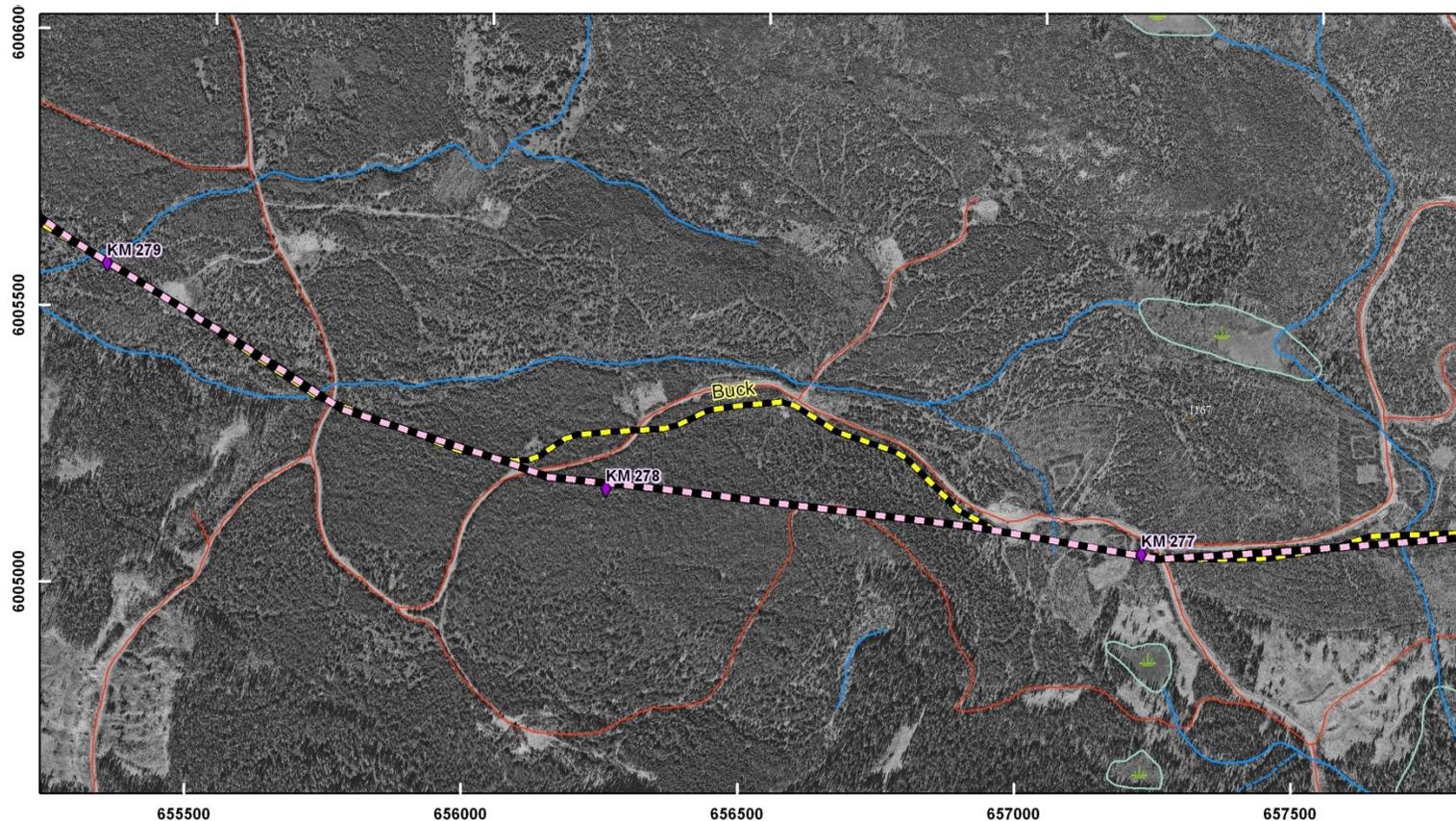


Figure 16. Buck Route Refinement (KM 277.3 to KM 278.1)

11.10.3 Mitigation

Mitigation measures for minimizing potential effects on vegetation, wildlife, and wildlife habitats will be adopted for construction and operation activities for the route refinement and are detailed in Section 7.2.4 of the 2007 EAC Application. Mitigation measures for vegetation, wildlife, and wildlife habitat are summarized below and are detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (May 1 and July 31).

No further geotechnical analysis is required for the route refinement.

Following the AIA results, no further work is recommended and no mitigation is required.

11.10.4 Residual environmental effects

The following residual effects are identified for vegetation, wildlife, and wildlife habitats:

- potential for the introduction of invasive plant species following construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.10.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting

requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.11 Owen Route Refinement (KM 295.2 to KM 299.3)

The Owen Route Refinement is requested to avoid a relic slide (geohazard) and an unstable slope near Owen Creek.

11.11.1 Baseline conditions

The Owen Route Refinement is located between KM 295.2 and KM 299.3 (Figure 17). The route refinement crosses two fish-bearing watercourses and one fish-bearing pond. The route refinement crosses the fish-bearing (S2) Owen Creek at KM 295.5, approximately 355 m upstream of the approved pipeline route crossing. Fisheries surveys detected the occurrence of Rainbow Trout, Mountain Whitefish, Chinook Salmon, and lamprey in Owen Creek. The route refinement crosses the fish-bearing (S3) Fenton Creek at KM 298.0, approximately 390 m downstream of the approved pipeline route crossing. Fisheries surveys conducted in 2011 detected the occurrence of Rainbow Trout, Chinook Salmon, Dolly Varden, and Coho Salmon. The unnamed fish-bearing W1 pond may be affected by the route refinement at KM 296.8 and had occurrence detections of what was likely Rainbow Trout. Two unnamed non-fish-bearing watercourses are crossed by the route refinement at KM 294.8 and KM 296.0.

The Bulkley to Morice River Movement Corridor is typically used by bears and moose year round occurs between KM 296 and KM 299.6.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. However, the route refinement crosses approximately 2.2 km of forest land (KM 295.1 and KM 296.8) and (KM 298.7 and KM 299.2) and crosses a large wetland (Wc033) between KM 295.5 and KM 295.7. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Range, Parks, or Protected Areas overlap with the route refinement.

Geotechnical assessments identified a moderately steep slope between KM 296.5 and KM 296.7. The slope has partly a bedrock-controlled blanket of fine-textured till, but closer to the crest the till overlies glaciolacustrine silt-fine sand. Dormant debris slide scars occur in the general area and debris slide geohazard was identified at this location. There is no evidence that the geohazard has been active within the last year, but trigger frequency appears to be high.

Between KM 295.6 and KM 296.1 a glaciolacustrine terrace with medium sand to silty sand occurs at the surface and silt at depth. The scarp (KM 295.6 to KM 295.7) is moderate to moderately steep below the crest with a gentler toe slope where it is more silty. There is no obvious evidence of active instability on the scarps near the route refinement; there is potential for construction-related instability and erosion.

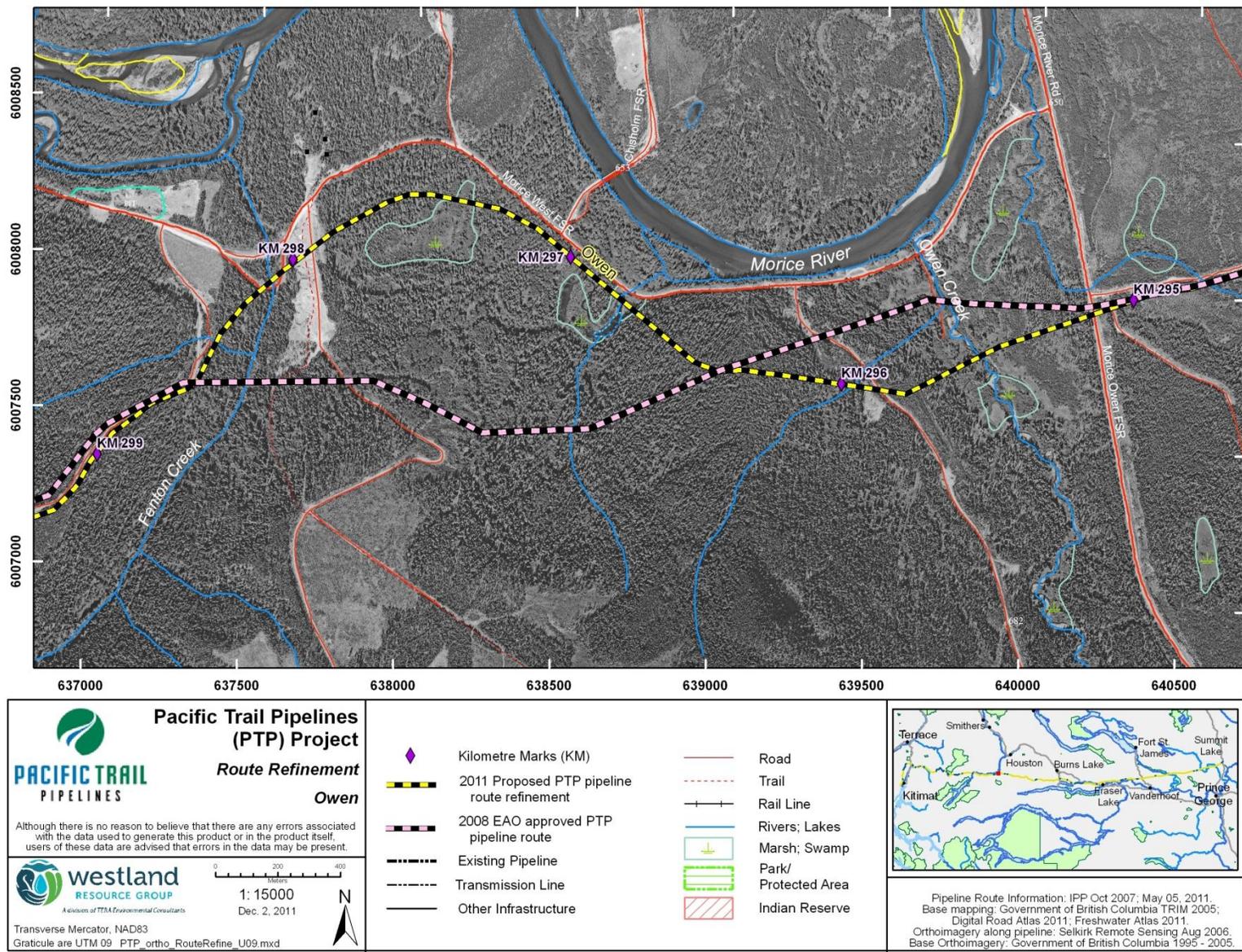


Figure 17. Owen Route Refinement (KM 295.2 to KM 299.3)

Between KM 295.1 and KM 295.5 glaciolacustrine terrace with clayey silt occurs to the surface. The scarp (KM 295.35 to KM 295.45) is moderate gradient below the crest with a gentler toe slope. There is no obvious evidence of active instability on the scarps in the vicinity of the proposed pipeline location; there is potential for construction-related instability/erosion as seen in a road cut just north of KM 295.05.

The AIA, performed between November 1 and 5, 2011, found that no archaeological resources were known to be in conflict with the route refinement.

11.11.2 Impact assessment

The route refinement crosses fish-bearing Owen and Fenton creeks and one unnamed fish-bearing pond and may have the following effects on fish and fish habitat:

- direct and indirect mortality of fish,
- loss or degradation of riparian and instream fish habitat,
- loss or degradation of fish habitat connectivity, and
- interbasin transfer of aquatic organisms.

Field assessments for Owen and Fenton Creeks identified the creeks as having high fish sensitivity. These creeks were also crossed by the approved pipeline route (see the 2007 EAC Application for further details). The unnamed fish-bearing W1 pond located near KM 296.8 was rated as having moderate fish sensitivity.

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The wildlife movement corridor and wetland wildlife habitat will be affected to the same level as with the approved pipeline route (see Section 7.2.4 of the 2007 EAC Application for further details).

The route refinement avoids approximately 1.9 km of forest land between KM 296.8 and KM 298.7 that previously would have been disturbed by the approved pipeline route. As a result, only 2.2 km of forest are likely to be affected by the route refinement.

Geotechnical assessments found that the likelihood of Project construction triggering erosion or slope instability between (KM 296.5 and KM 296.7), (KM 295.6 and KM 296.1) and (KM 295.1 and KM 295.5) in the route refinement workspace as being high.

The AIA found and noted three clusters of historic (post-1846) culturally modified trees (CMTs) in the 100 m wide study corridor. However, no archaeological resources that predate 1846 were identified.

The route refinement is considered to be an improvement compared to the approved pipeline route because a geohazard (slide area) and an unstable slope near Owen Creek will be avoided.

11.11.3 Mitigation

Specific mitigation measures for minimizing potential effects on fish and fish habitat that will be adopted for the watercourse crossing are detailed in Section 7.2.3 of the 2007 EAC Application. In-stream work windows to protect fish are contained in the EMP. Proper work management and procedures that will be followed to limit any environmental effects in the event of an incident are also detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction work will be completed expeditiously to maintain a tight construction spread to minimize potential barriers and hazards to wildlife in movement corridor areas. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (May 1 and July 31).

A site-specific erosion control plan will be prepared for the route refinement between (KM 296.5 and KM 296.7), (KM 295.6 and KM 296.1), and (KM 295.1 and KM 295.5).

Following the results of the AIA, no further archaeological work is recommended. These recommendations pertain to protected archaeological sites which predate 1846 only. For those historic features such as CMTs noted within the study corridor, there are no requirements for further work under the *Heritage Conservation Act (HCA)*. However, it would be advisable to contact the relevant First Nations communities regarding the management of these historic resources.

11.11.4 Residual environmental effects

The following residual effects have been identified for fish and fish habitat:

- increased fish mortalities from instream construction activities, and
- loss of fish food inputs from riparian areas adjacent to fish-bearing watercourses.

By implementing fish salvaging programs and recognizing that the loss of food inputs is expected to be temporary, these residual effects on fish and fish habitats are considered less than significant (see Section 7.2.3 of the 2007 EAC Application for detailed residual effect assessments for fish and fish habitat).

The following residual effects have been identified for vegetation, wildlife, and wildlife habitats:

- areas of forest land and riparian areas will be cleared,
- potential for the introduction of invasive plant species following construction,
- alteration of seasonal movement patterns of wide-ranging species such as grizzly bear and moose may occur during construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for fisheries, vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.11.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.12 Fenton Route Refinement (KM 301.7 to KM 303.8)

The Fenton Route Refinement is requested to avoid geotechnical hazards.

11.12.1 Baseline conditions

The Fenton Route Refinement is located between KM 301.7 and KM 303.8 (Figure 18). No fish-bearing watercourses are crossed by this route refinement. One non-fish-bearing stream will be crossed by the route refinement; however, the stream was also crossed by the approved pipeline route. The new crossing is located approximately 50 m further downstream from where it was originally proposed.

The Bulkley to Morice River Movement Corridor is typically used by bears and moose year round and occurs between KM 302.2 and KM 303.6.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Ranges, Parks, or Protected Areas overlap with the route refinement.

Geotechnical assessments identified a steeply incised creek tributary to Morice River between KM 303.0 and KM 303.2. Near the centreline the banks are uniform, moderately steep with glaciofluvial sand and gravel overlying compact till. Upstream the banks are more irregular and there is bedrock at creek level in places. Downstream the scarps are higher and steeper with more bedrock control and evidence of old debris slides in the till and gravel crest. Potential for construction-related instability and erosion, but the channel appears to be of too low a gradient for a debris flow to occur. A minor hydro-degradation hazard was identified in this section of the route refinement.

Between KM 302.2 and KM 302.4 the proposed pipeline is located on a subdued, upland surface underlain by thick till and glaciofluvial sediment. The proposed alignment crosses within 100 m to 200 m south of the crest of a highly dissected scarp (suspected to be fine-textured glaciolacustrine underlying thick till) that borders the floodplain of Morice River. Shallow, small melt water channels drain toward the gullied scarp. Construction-related disturbance, particularly concentrating surface runoff, onto the scarp would likely cause erosion and instability in the gullies and could affect the floodplain.

The archaeological review, performed on November 10, 2011, found that no archaeological resources were known to be in conflict with the route refinement.

11.12.2 Impact assessment

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

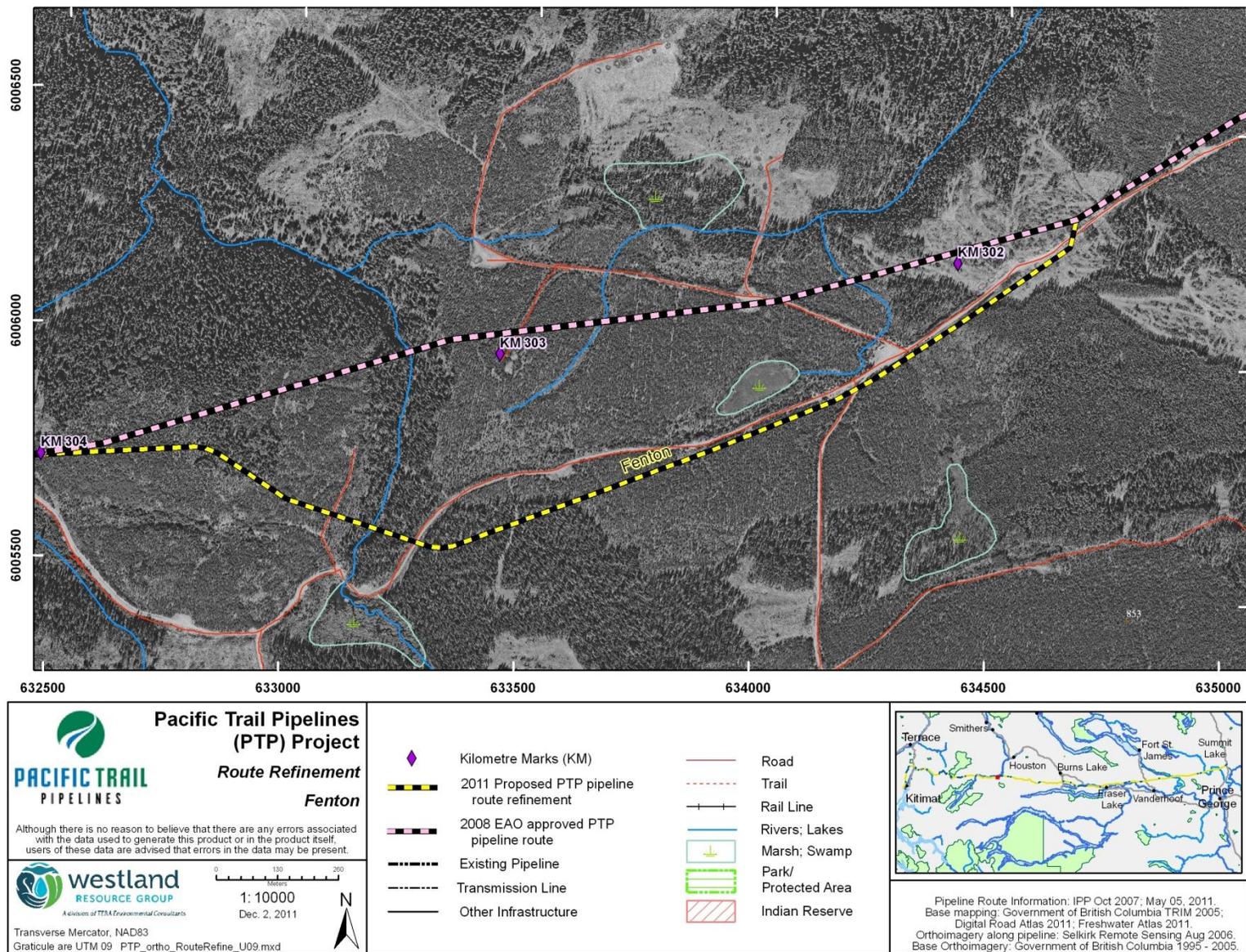


Figure 18. Fenton Route Refinement (KM 301.7 to KM 303.8)

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The wildlife movement corridor will be affected to the same level as with the approved pipeline route (see Section 7.2.4 of the 2007 EAC Application for further details).

Geotechnical assessments found that the likelihood of Project construction triggering erosion or slope instability between KM 303.0 and KM 303.2 within the route refinement workspace as being high and outside of the workspace as being moderate and between KM 302.2 and KM 302.4 within the route refinement workspace as being low and outside of the workspace as being high.

The archaeological review found that archaeological potential is predicted to be low based on a review of available maps and documents.

The route refinement is considered to be an improvement compared to the approved pipeline route because several geotechnical hazards are avoided.

11.12.3 Mitigation

Mitigation measures for minimizing potential effects on vegetation, wildlife, and wildlife habitats will be adopted for construction and operation activities for the route refinement and are detailed in Section 7.2.4 of the 2007 EAC Application. Mitigation measures for vegetation, wildlife, and wildlife habitat are summarized below and are detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction work will be completed expeditiously to maintain a tight construction spread to minimize potential barriers and hazards to wildlife in movement corridor areas. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (May 1 and July 31).

A site-specific erosion control plan is recommended for the route refinement between KM 302.2 and KM 302.4. Avoid concentrating drainage downslope of the alignment in the gully.

Following the results of the archaeological review, no further work is recommended and no mitigation is required.

11.12.4 Residual environmental effects

The following residual effects are identified for vegetation, wildlife, and wildlife habitats:

- potential for the introduction of invasive plant species following construction,
- alteration of seasonal movement patterns of wide-ranging species, such as grizzly bear and moose may occur during construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.12.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.13 Gosnell Route Refinement (KM 348.5 to KM 354.6)

The Gosnell Route Refinement is requested to improve the location for the Gosnell Creek crossing, improve feasibility for the use of horizontal directional drilling techniques, and to avoid crossing two side channels.

11.13.1 Baseline conditions

The Gosnell Route Refinement is located between KM 348.5 and KM 354.6 (Figure 19). The route refinement crosses the fish-bearing (S1) Gosnell Creek and five unnamed fish-bearing watercourses. The route refinement will cross the mainstem of Gosnell Creek at KM 351.6, approximately 1.5 km upstream of the approved pipeline route, which crossed two smaller side channels of Gosnell Creek. Fisheries surveys conducted in 2011 detected the occurrence of Coho Salmon, Rainbow Trout, and Bull Trout/Dolly Varden in Gosnell Creek.

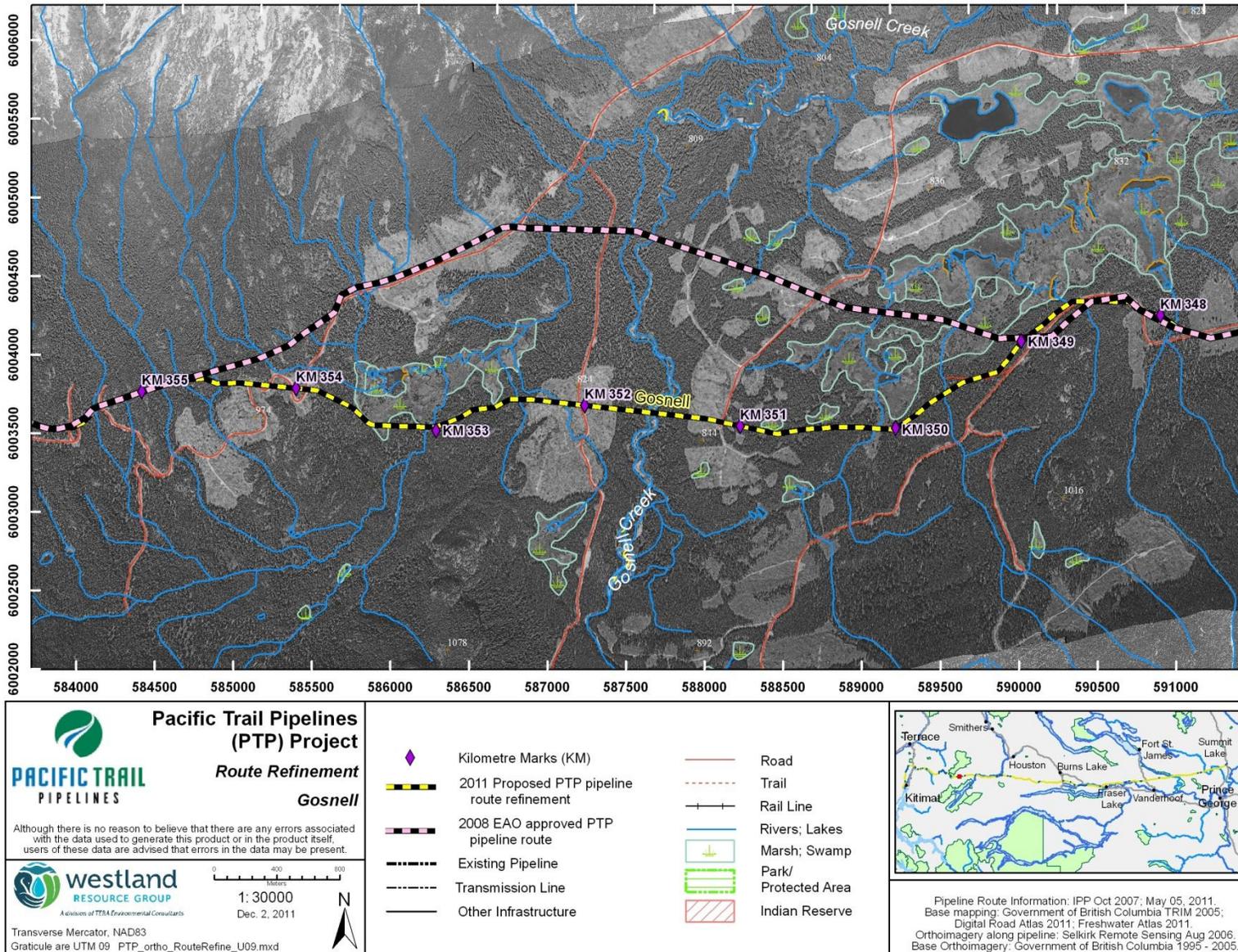


Figure 19. Gosnell Route Refinement (KM 348.5 and KM 354.6)

The unnamed fish-bearing (S3) stream crossed by the route refinement at KM 349.6 had occurrence detections for Rainbow Trout and Dolly Varden. The unnamed fish-bearing (S3) stream crossed at KM 349.9 had occurrence detections for Bull Trout/Dolly Varden. The unnamed fish-bearing (S3) stream crossed at KM 350.1 had occurrence detections for Dolly Varden, Cutthroat Trout, and Chinook Salmon. The unnamed fish-bearing (S2) streams crossed at KM 352.4 and KM 353.1 had occurrence detections for Dolly Varden.

An area of grizzly bear feeding habitat that is typically used between early spring and fall was identified between KM 347.9 and KM 351.8. The Gosnell to Holland Lakes Movement Corridor is typically used by bears, moose, and wolves in spring and fall occurs between KM 348 and KM 351.

The route refinement crosses approximately 3.4 km of forest land between KM 347.9 and KM 351.8.

A large 288 ha wetland wildlife habitat is crossed by the route refinement at two locations between (KM 340.0 and KM 350.2) and (KM 350.6 and KM 350.9).

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. However, the route refinement crosses approximately 3.4 km of forest land between KM 347.9 and KM 351.8 and a large 288 ha fen wetland (Wc019) between (KM 350.0 and KM 350.2) and (KM 350.6 and KM 350.9). No BC CDC occurrence data for species-at-risk were found for the route refinement.

No Wildlife Habitat Areas, OGMAs, Ungulate Winter Range, Parks, or Protected Areas overlap with the route refinement.

No geohazards were identified for the Gosnell Route Refinement.

The archaeological review, performed on November 10, 2011, found that no archaeological resources were known to be in conflict with the route refinement.

11.13.2 Impact assessment

The route refinement crosses Gosnell Creek and the five unnamed fish-bearing watercourses and may have the following effects on fish and fish habitat:

- direct and indirect mortality of fish,
- loss or degradation of riparian and instream fish habitat,
- loss or degradation of fish habitat connectivity, and
- interbasin transfer of aquatic organisms.

Field assessments for Gosnell Creek, located near KM 351.6, identified the creek as having high fish sensitivity. Gosnell Creek was also crossed by the approved pipeline route.

The new crossing location is on the creek mainstream, which was assessed as having a more uniform run and a better location to cross than the original crossing location at two of Gosnell Creek's side channels (see the 2007 EAC Application for further details). The other five unnamed fish-bearing watercourses that will be crossed by the route refinement vary from low to high fish sensitivity. Due to the alignment of the route refinement, these streams were not crossed by the approved pipeline route, however, four different unnamed fish-bearing watercourses were crossed by the approved pipeline route. Of the seven unnamed non-fish-bearing watercourses that were to be crossed by the approved pipeline route; only four will be crossed by the route refinement.

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The wildlife movement corridor and areas of forest, grizzly bear feeding habitat will be affected to the same level for the route refinement as with the approved pipeline route (see Section 7.2.4 of the 2007 EAC Application for further details).

Three small areas of low suitability mountain goat bluff habitat that were respectively 50 m, 200 m, and 400 m distance from the approved pipeline route will be affected less by the route refinement. These three areas of mountain goat habitat are now respectively 300 m, 1200 m, and 500 m distance from the route refinement due to its realignment.

Wetland (Wc019) will be less affected by the route refinement. The approved pipeline route crossed the centre of the wetland for a distance of 970 m. The route refinement skirts the southern edge of the wetland, affecting approximately 400 m of the wetland.

The archaeological review results indicated that archaeological potential is predicted to be low based on a review of available maps and documents.

The route refinement is considered to be an improvement compared to the approved pipeline route because fish and wildlife effects will be lower along the route refinement than the approved pipeline route.

11.13.3 Mitigation

Specific mitigation measures for minimizing potential effects on fish and fish habitat that will be adopted for the watercourse crossing are detailed in Section 7.2.3 of the 2007 EAC Application. In-stream work windows to protect fish are contained in the EMP. Proper work management and procedures that will be followed to limit any environmental effects in the event of an incident are also detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction work will be completed expeditiously to maintain a tight construction spread to minimize potential barriers and hazards to wildlife in movement corridor areas. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (April 1 and July 31).

A typical geotechnical design is sufficient for the route refinement alignment to adequately incorporate all geotechnical issues identified during the 2011 assessment. No further geotechnical analysis is required for the route refinement.

Following the results of the archaeological review, no further work is recommended and no mitigation is required.

11.13.4 Residual environmental effects

The following residual effects have been identified for fish and fish habitat:

- increased fish mortalities from instream construction activities, and
- loss of fish food inputs from riparian areas adjacent to fish-bearing watercourses.

By implementing fish salvaging programs and recognizing that the loss of food inputs is expected to be temporary, these residual effects on fish and fish habitats are considered less than significant (see Section 7.2.3 of the 2007 EAC Application for detailed residual effect assessments for fish and fish habitat).

The following residual effects have been identified for vegetation, wildlife, and wildlife habitats:

- areas of forest land and riparian areas will be cleared,
- potential for the introduction of invasive plant species following construction,
- alteration of seasonal movement patterns of wide-ranging species such as grizzly bear, moose and wolves may occur during construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for fisheries, vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.13.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.14 Burnie Route Refinement (KM 364.2 to KM 365.5)

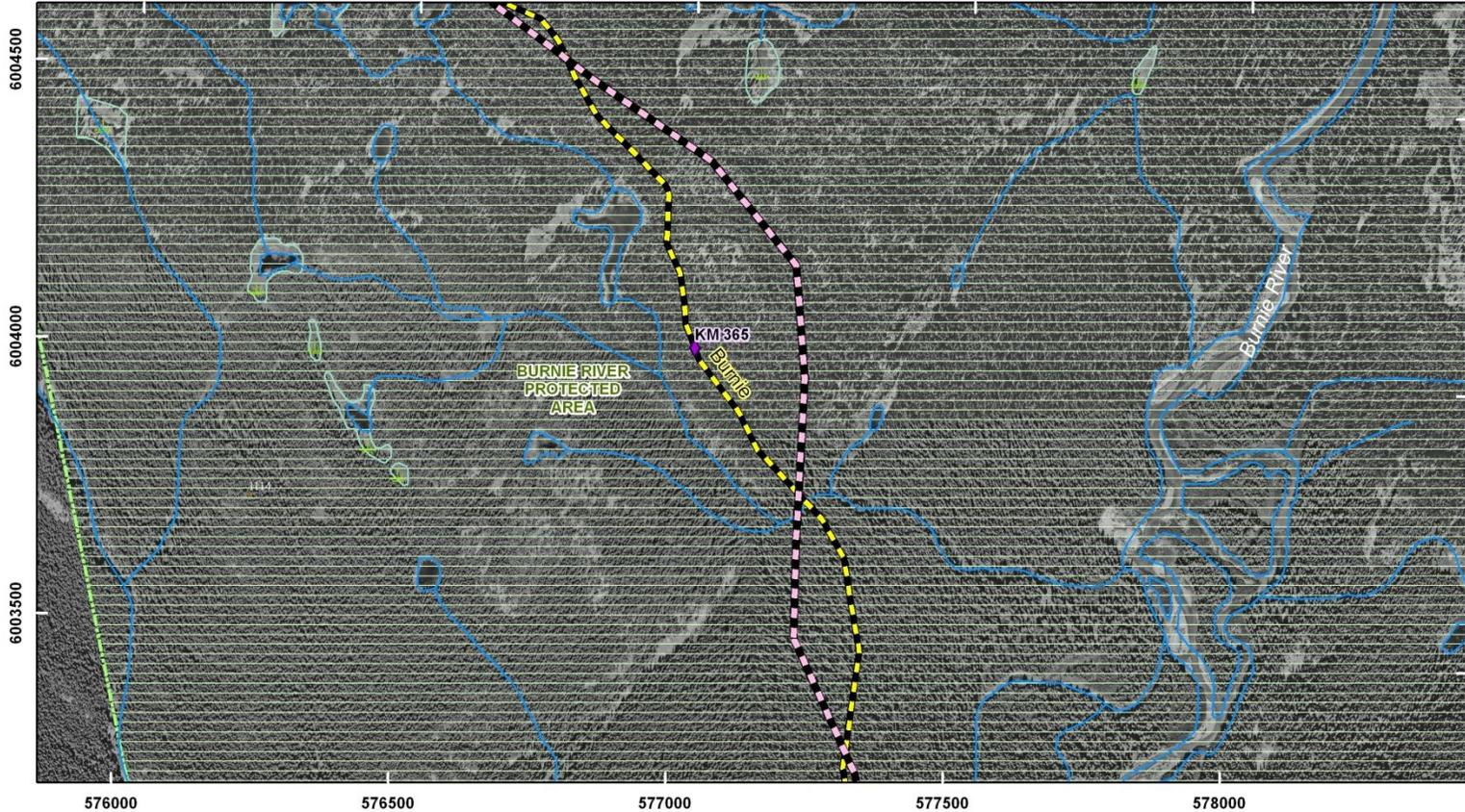
The Burnie Route Refinement is requested to avoid slope stability concerns west of the Burnie River.

11.14.1 Baseline conditions

The Burnie Route Refinement is located between KM 364.2 to KM 365.5 (Figure 20). No fish-bearing watercourses will be crossed by this route refinement. One non-fish-bearing stream will be crossed by this route refinement at the same location as the approved pipeline route.

An area of grizzly bear denning habitat that is typically used between late fall and spring occurs between KM 364.1 and KM 366.8. The Burnie to Atna Movement Corridor is typically used by bears and ungulates in the fall to spring and occurs between KM 364.1 and KM 364.8.

An area of medium suitability mountain goat bluff habitat will be crossed by the route refinement between KM 364.6 and KM 365.0.



 <p>Pacific Trail Pipelines (PTP) Project <i>Route Refinement</i> Burnie</p> <p>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</p>  <p>westland RESOURCE GROUP <small>A Division of TTA Environmental Consultants</small></p> <p>Transverse Mercator, NAD83 Graticule are UTM 09_PTP_ortho_RouteRefine_U09.mxd</p>	<p>0 100 200 Meters</p> <p>1: 10000 Dec. 2, 2011</p> 	<p> Kilometre Marks (KM)</p> <p> 2011 Proposed PTP pipeline route refinement</p> <p> 2008 EAO approved PTP pipeline route</p> <p> Existing Pipeline</p> <p> Transmission Line</p> <p> Other Infrastructure</p>	<p> Road</p> <p> Trail</p> <p> Rail Line</p> <p> Rivers; Lakes</p> <p> Marsh; Swamp</p> <p> Park/ Protected Area</p> <p> Indian Reserve</p>	 <p>Pipeline Route Information: IPP Oct 2007; May 05, 2011. Base mapping: Government of British Columbia TRIM 2005; Digital Road Atlas 2011; Freshwater Atlas 2011. Orthoimagery along pipeline: Selkirk Remote Sensing Aug 2006, Base Orthoimagery: Government of British Columbia 1995 - 2005.</p>
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Figure 20. Burnie Route Refinement (KM 364.2 to KM 365.5)

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. However, the route refinement crosses two areas of old-growth forest that totals approximately 1.5 km between (KM 364.1 and KM 364.7) and (KM 365.9 and KM 366.8) and one fen wetland (W016) approximately 250 m distance from the route refinement located near KM 365.5. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, or Ungulate Winter Ranges overlap with the route refinement. The route refinement occurs in the Burnie River Protected Area.

No geohazards were identified for the Burnie Route Refinement.

The archaeological review, performed on November 10, 2011, found no archaeological resources in the area were known to be in conflict with the Burnie Route Refinement.

11.14.2 Impact assessment

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The approved pipeline route crossed an area of the blue-listed rare plant community (whitebark pine/clad lichen's – curly heron's-bill moss) near KM 364.7. However, the route refinement avoids this area and the rare plant community will not be affected by the route refinement.

The areas of old forest, grizzly bear denning habitat, and mountain goat bluff habitat along the route refinement will be affected to the same level as with the approved pipeline route (see Section 7.2.4 of the 2007 EAC Application for further details).

Wetland (W016) will be less affected by the route refinement. The approved pipeline route is adjacent to the edge of the wetland for approximately 70 m. The route refinement is now located approximately 250 m from the wetland.

The archaeological review found that archaeological potential is predicted to be low based on a review of available maps and documents.

The route refinement is considered to be an improvement compared to the approved pipeline route because geohazards (slope stability) are reduced in the Burnie River Protected Area on the west side of the Burnie River.

11.14.3 Mitigation

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction work will be completed expeditiously to maintain a tight construction spread to minimize potential barriers and hazards to wildlife in movement corridor areas. PTP has made a commitment not to conduct clearing or construction activities within 200 m of mountain goat winter habitat between October 15 and May 15. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (April 1 and July 31).

A typical geotechnical design is sufficient for the route refinement alignment to adequately incorporate all geotechnical issues identified during the 2011 assessment. No further geotechnical analysis is required for the route refinement.

Following the results of the archaeological review, no further work is recommended and no mitigation is required.

11.14.4 Residual environmental effects

The following residual effects are identified for vegetation, wildlife, and wildlife habitats:

- forested habitats will be cleared,
- potential for the introduction of invasive plant species following construction,
- alteration of seasonal movement patterns of wide-ranging species, such as grizzly bear and mountain goat may occur during construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for fisheries, vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.14.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.15 Hoult Route Refinement (KM 379.7 to KM 389.4)

The Hoult Route Refinement is requested to avoid slope stability concerns.

11.15.1 Baseline conditions

The Hoult Route Refinement is located between KM 379.7 and KM 389.4 (Figure 21, Figure 22, and Figure 23). The route refinement crosses the same 21 unnamed minor drainages as the approved pipeline route. No fish-bearing watercourses occur along the route refinement.

Potential grizzly bear denning and late summer grizzly bear habitat was identified between KM 379 and KM 389.2. An old grizzly bear den was found during field assessments approximately 700 m north of KM 384. The Clore to Zymoetz wildlife movement corridor used by bears and ungulates in the spring and fall and occurs between KM 378 and KM 380.

The route refinement crosses approximately 5 km of medium suitability mountain goat bluff habitat between KM 382.5 and KM 387.5. A mountain goat was observed in this area (KM 385) during an early September 2011 field investigation.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. However, the route refinement crosses four areas of old-growth forest and one area of mature forest. In total, the route refinement crosses approximately 3.9 km of old-growth forest and 0.5 km of mature forest. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Ranges, Parks, or Protected Areas overlap with the route refinement.

Geotechnical assessments indicated that the centreline climbs/descends a high gully sidewall scarp of mainly thick till between KM 379.6 and KM 379.7.

There is evidence of some fluvial sediment movement but not of any recent debris flow activity. A minor hydro-degradation and scour hazard was identified for this section of the route refinement.

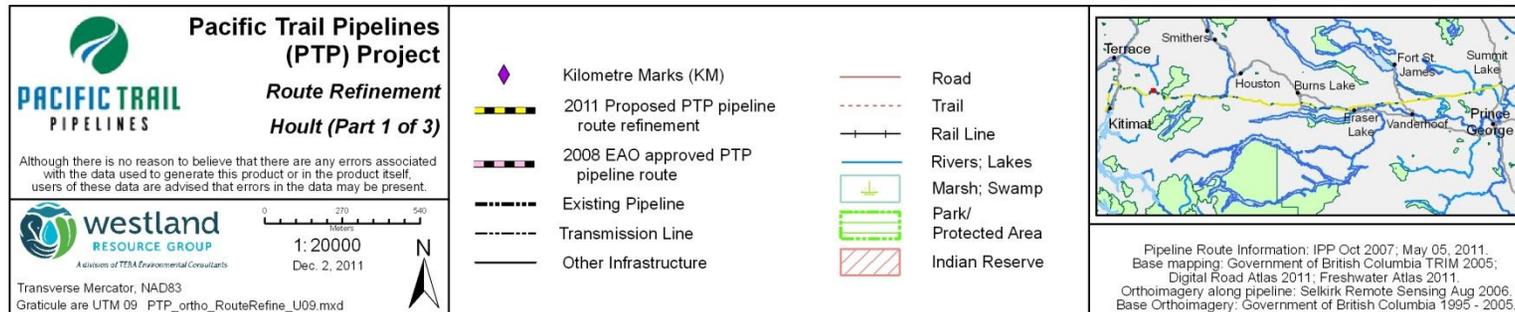
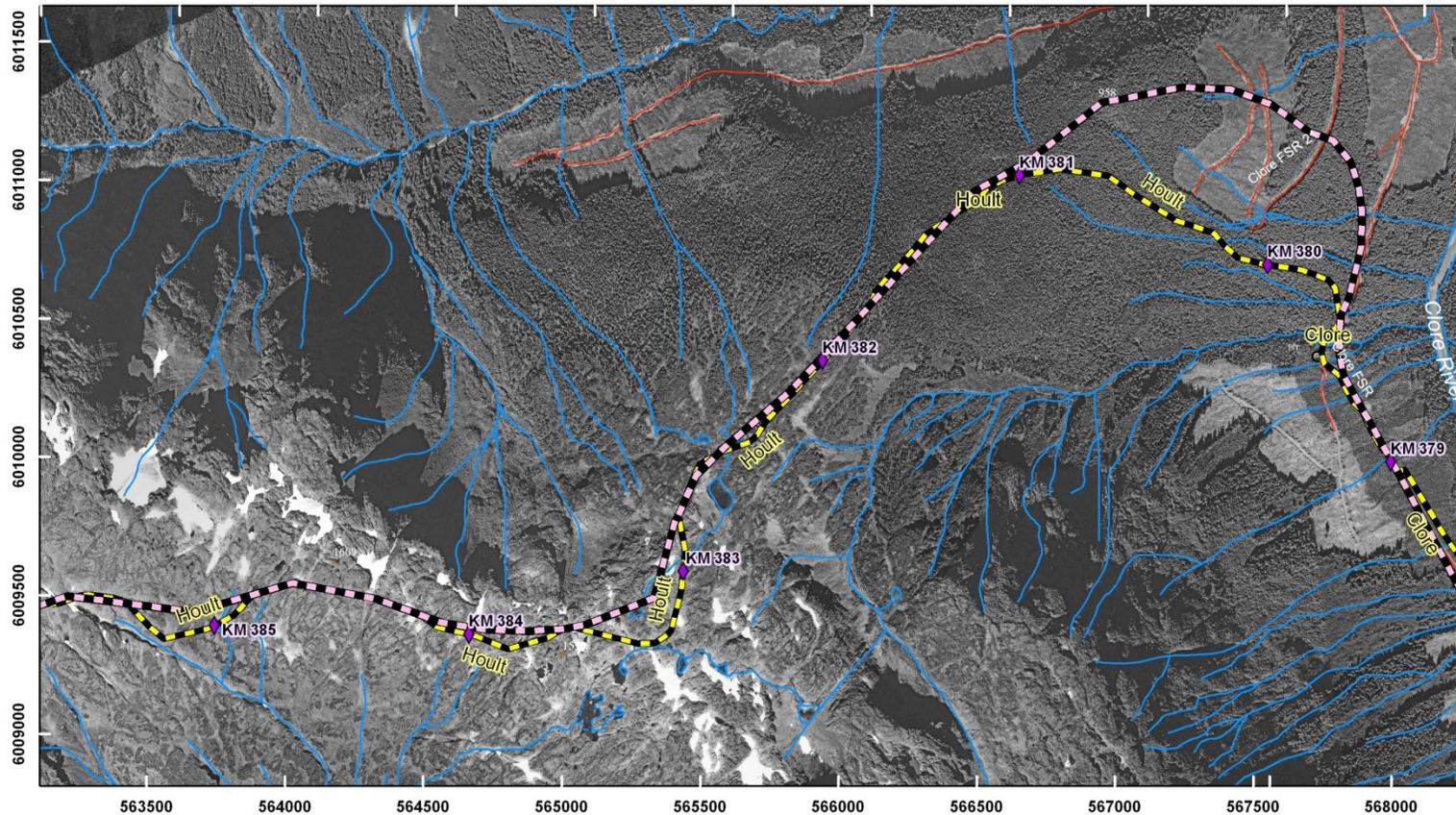


Figure 21. Hault Route Refinement (KM 379.7 to KM 389.4)

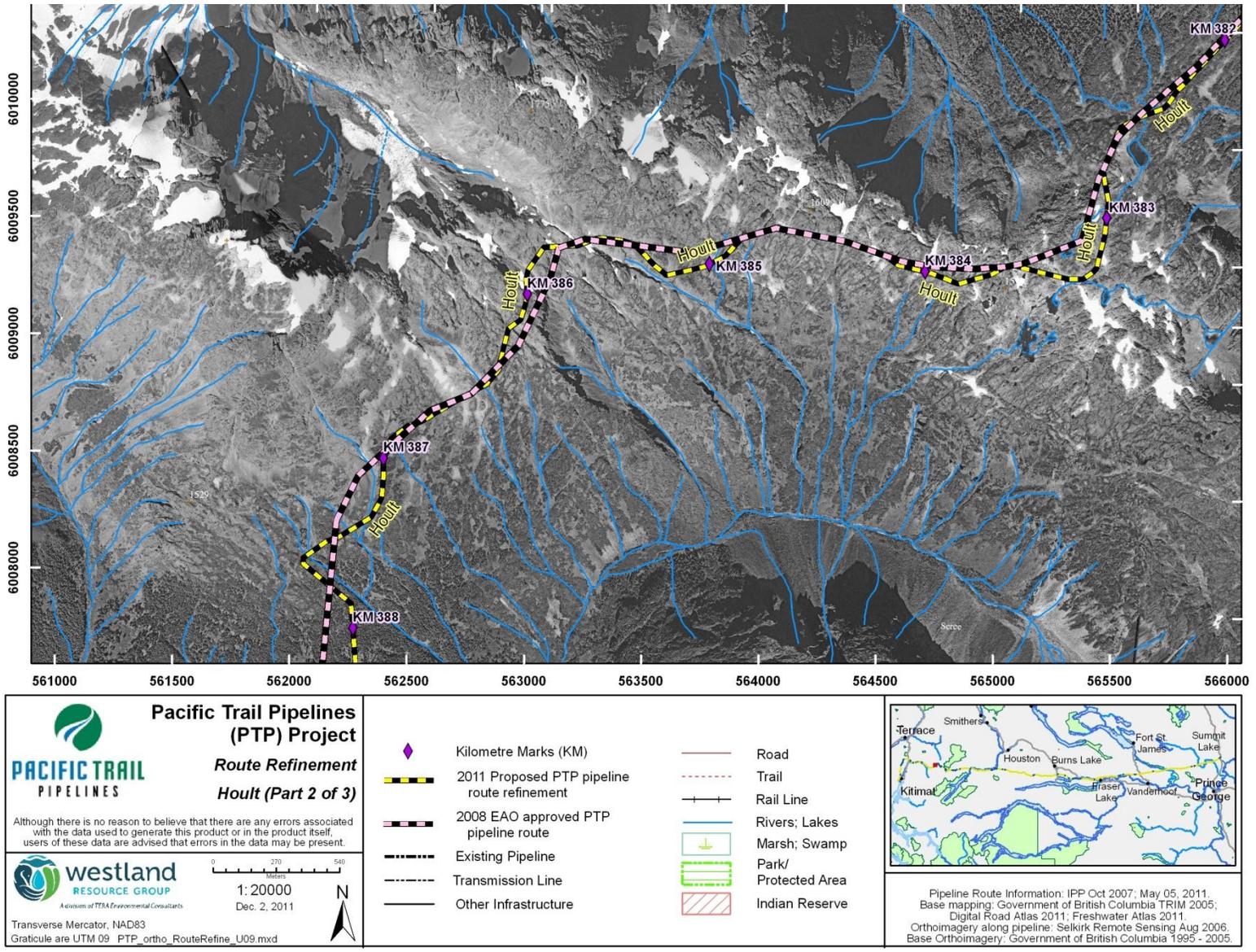


Figure 22. Hault Route Refinement (KM 379.7 to KM 389.4)

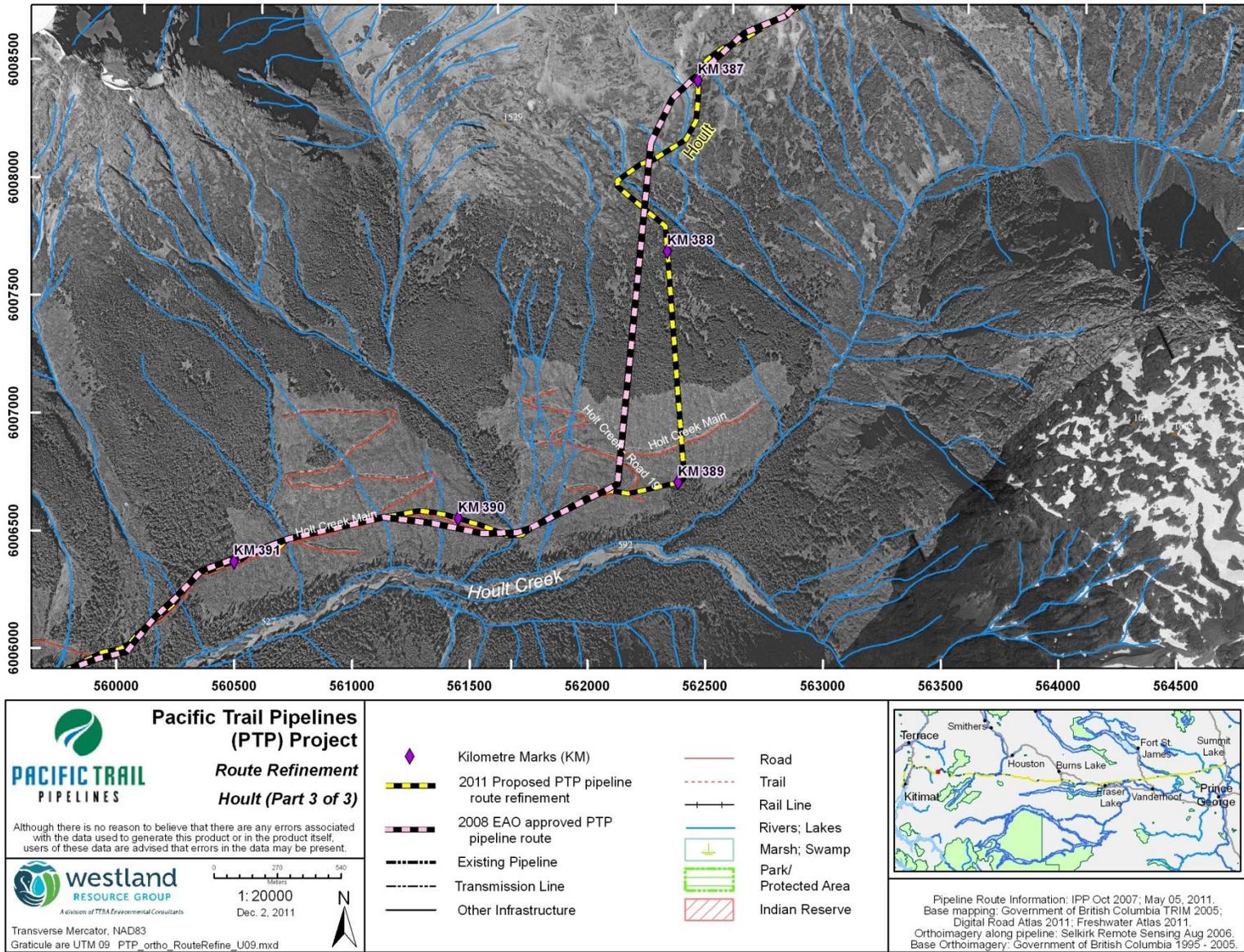


Figure 23. Hout Route Refinement (KM 379.7 to KM 389.4)

Between KM 378.5 and KM 378.9 a gentle slope occurs that is covered by thick till with some gravelly veneer. Further downslope is a steep, high scarp bordering Clore River that shows evidence of recurrent debris slides.

Between KM 377.9 and KM 378.5 moderate to gentle slopes occur that are mainly covered by variable thicknesses of gravelly (some blocks) sandy colluvium and loose glaciofluvial gravelly sand over bedrock and some basal till. Snow avalanches reach the road every 1 to 5 years.

Further downslope is a steep, high scarp bordering Clore River that shows evidence of recurrent debris slides. There is evidence of active snow avalanches at this location.

The archaeological review, performed on October 4, 2011, found that no archaeological resources were known to be in conflict with the route refinement.

11.15.2 Impact assessment

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The wildlife movement corridor and areas of forest, grizzly bear denning habitat, and mountain goat bluff habitat along the route refinement will be affected to the same level as with the approved pipeline route (see Section 7.2.4 of the 2007 EAC Application for further details).

A section of the route refinement will avoid an area of old growth that would be disturbed by the pipeline construction along the approved pipeline route.

Geotechnical assessments found that the likelihood of Project construction triggering erosion or slope instability between KM 379.6 and KM 379.7 within the route refinement workspace as being high and outside of the workspace as being moderate.

The archaeological review found that archaeological potential is predicted to be low based on a review of available maps and documents.

The route refinement is considered to be an improvement compared to the approved pipeline route because slope stability risks are reduced and mature forest habitat types are avoided.

11.15.3 Mitigation

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction work will be completed expeditiously to maintain a tight construction spread to minimize potential barriers and hazards to wildlife in movement corridor areas. PTP has made a commitment not to conduct clearing or construction activities within 200 m of mountain goat winter habitat between October 15 and May 15. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (April 1 and July 31).

A site-specific erosion control plan will be prepared for the route refinement between KM 379.6 and KM 379.7.

Following the archaeological review, no further work is recommended and no mitigation is required.

11.15.4 Residual environmental effects

The following residual effects are identified for vegetation, wildlife, and wildlife habitats:

- areas of forest land and riparian areas will be cleared,
- potential for the introduction of invasive plant species following construction,
- alteration of seasonal movement patterns of wide-ranging species such as grizzly bear and mountain goat may occur during construction,
- areas of mountain goat winter habitat may be altered by the pipeline route, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for fisheries, vegetation, wildlife, and wildlife habitats

that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.15.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.16 Floodplain Route Refinement (KM 402.4 to KM 403.2)

The Floodplain Route Refinement is requested by Kitselas First Nation to shift the pipeline route to the upper side of Kitimat FSR, farther from the Kitimat River side channel.

11.16.1 Baseline conditions

The Floodplain Route Refinement is located between KM 402.4 to KM 403.2 (Figure 24). This route refinement crosses the same two drainages as the approved pipeline route.

A fish-bearing watercourse (S5) is located along the route refinement at KM 402.9. This watercourse has low fish habitat value. The unnamed channel located at KM 402.4 is a non-fish bearing (S6) watercourse.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Ranges, Parks, or Protected Areas are crossed by the route refinement. No important seasonal ranges or wildlife movement corridors were identified for the route refinement.

Geotechnical assessments identified thin colluvium and glaciofluvial sediment over bedrock with some cliff outcrops between KM 402.6 and KM 402.8. This area has variable thicknesses of poorly sorted glaciofluvial material between areas of rock outcrops.

The AIA, performed on October 7, 2011, found that no archaeological resources were known to be in conflict with the route refinement.

11.16.2 Impact assessment

The route refinement was selected to protect grizzly bear habitat in riparian areas that may have been disturbed by the approved pipeline route. This potential effect will be avoided if the route refinement is approved.

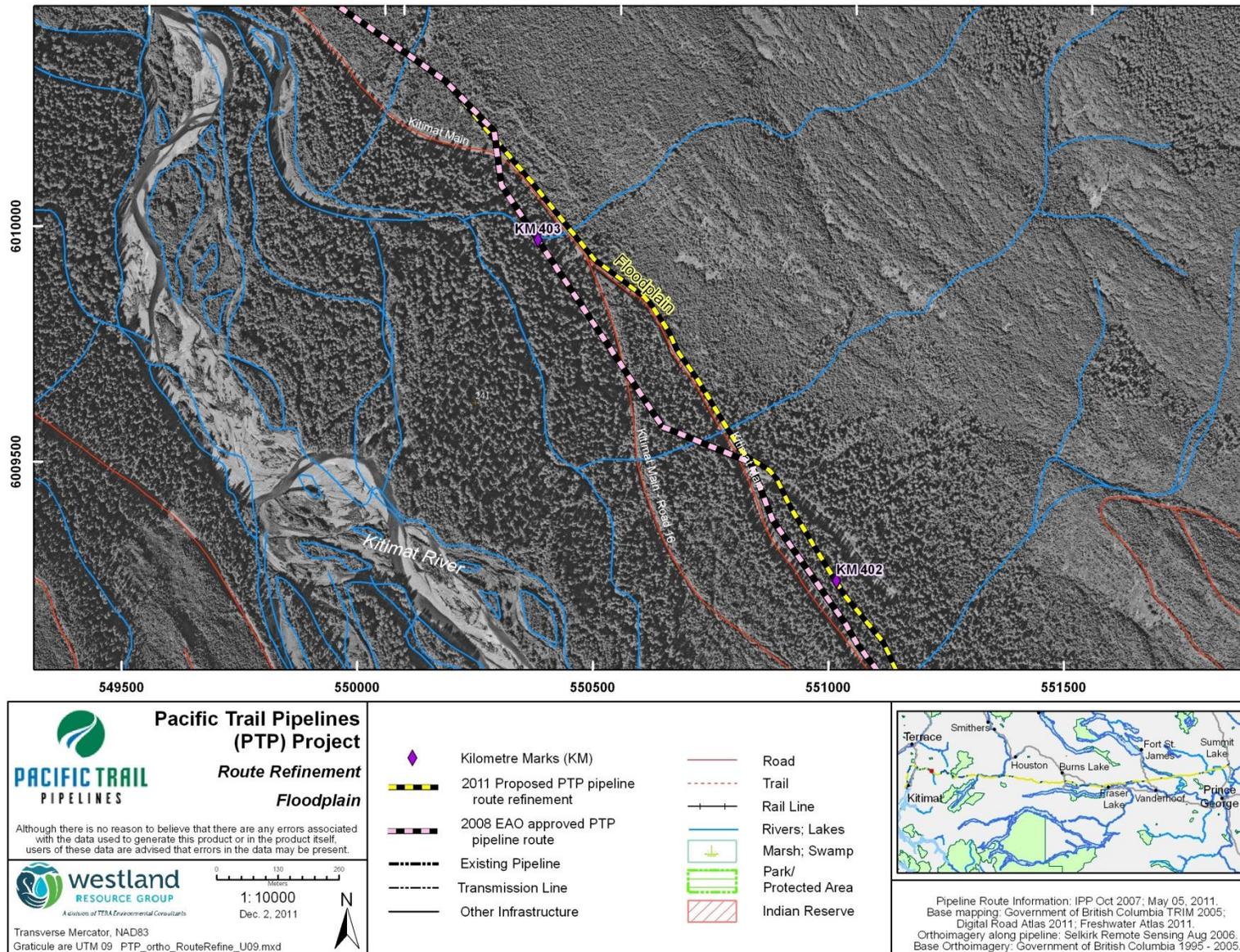


Figure 24. Floodplain Route Refinement (KM 402.4 to KM 403.2)

The route refinement may have minor effects on vegetation, wildlife, and wildlife habitat:

- increase the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

Geotechnical assessments found that the likelihood of Project construction triggering erosion or slope instability between (KM 402.6 and KM 402.8) on the route refinement workspace as being low.

The AIA results indicated that no archaeological resources were identified.

The route refinement is considered to be an improvement compared to the approved pipeline route because sensitive grizzly bear habitat in the riparian area south of the Kitimat FSR will be avoided.

11.16.3 Mitigation

Specific mitigation measures for minimizing potential effects on fish and fish habitat that will be adopted for the watercourse crossing are detailed in Section 7.2.3 of the 2007 EAC Application. In-stream work windows to protect fish are contained in the EMP. Proper work management and procedures that will be followed to limit any environmental effects in the event of an incident will also be detailed in the EMP.

Mitigation measures for minimizing potential effects on vegetation, wildlife, and wildlife habitats will be adopted for construction and operation activities for the route refinement and are detailed in Section 7.2.4 of the 2007 EAC Application. Mitigation measures for vegetation, wildlife, and wildlife habitat are summarized below and are detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to

minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (April 1 and July 31).

Following the AIA, no further work is recommended and no mitigation is required.

11.16.4 Residual environmental effects

The following residual effects have been identified for fish and fish habitat:

- increased fish mortalities from instream construction activities, and
- loss of fish food inputs from riparian areas adjacent to fish-bearing watercourses.

By implementing fish salvaging programs and recognizing that the loss of food inputs is expected to be temporary, these residual effects on fish and fish habitats are considered less than significant (see Section 7.2.3 of the 2007 EAC Application for detailed residual effect assessments for fish and fish habitat).

The following residual effects have been identified for vegetation, wildlife, and wildlife habitats:

- potential for the introduction of invasive plant species following construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for fisheries, vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.16.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.17 Ursus Route Refinement (KM 406.6 to KM 407.7)

The Ursus Route Refinement was requested by Kitselas First Nation to avoid grizzly bear habitat in a riparian area.

11.17.1 Baseline conditions

The Ursus Route Refinement is located between KM 406.6 and KM 407.7 (Figure 25). The route refinement crosses the same unnamed fish-bearing stream as the approved pipeline route, but the crossing will be located approximately 120 m further upstream. The unnamed creek at KM 406.8 is classified as an S2 stream and has a maximum channel width of 6.2 m. Fisheries surveys conducted in 2011 detected the occurrence of Coastal Cutthroat Trout during spring/summer surveys.

The unnamed creeks located near KM 406.7 and KM 407.7 crossed by the route refinement were field rated as having medium suitability for Pacific tailed frog.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. However, an area of the red-listed rare plant community Sitka spruce/salmonberry occurs 30 m to 250 m downslope of the route refinement between KM 407.6 and KM 407.8 and a wetland (W007) occurs approximately 250 m downslope of the route refinement between KM 406.7 and KM 407.1. These areas will not be crossed by the route refinement.

No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Ranges, Parks, or Protected Areas overlap with the route refinement. No important seasonal ranges or wildlife movement corridors were identified for the route refinement.

Geotechnical assessments identified thin colluvium and glaciofluvial sediment over moderately steep bedrock with some cliff outcrops between KM 407.7 and KM 407.8. There is evidence of gully erosion at this location. Between KM 406.7 and KM 407.6 an irregular, moderate to moderately steep, bedrock-controlled slope was identified. This slope has variable thicknesses of poorly sorted glaciofluvial material between areas of rock outcrops.

The AIA, performed on October 7, 2011, found that no archaeological resources were known to be in conflict with the route refinement.

11.17.2 Impact assessment

The approved pipeline route crossed two non-fish-bearing watercourses; the route refinement crosses only one non-fish-bearing stream, an unnamed S2 stream located at KM 406.8. The following effects may occur on fish and fish habitat:

- direct and indirect mortality of fish,
- loss or degradation of riparian and instream fish habitat,
- loss or degradation of fish habitat connectivity, and
- interbasin transfer of aquatic organisms.

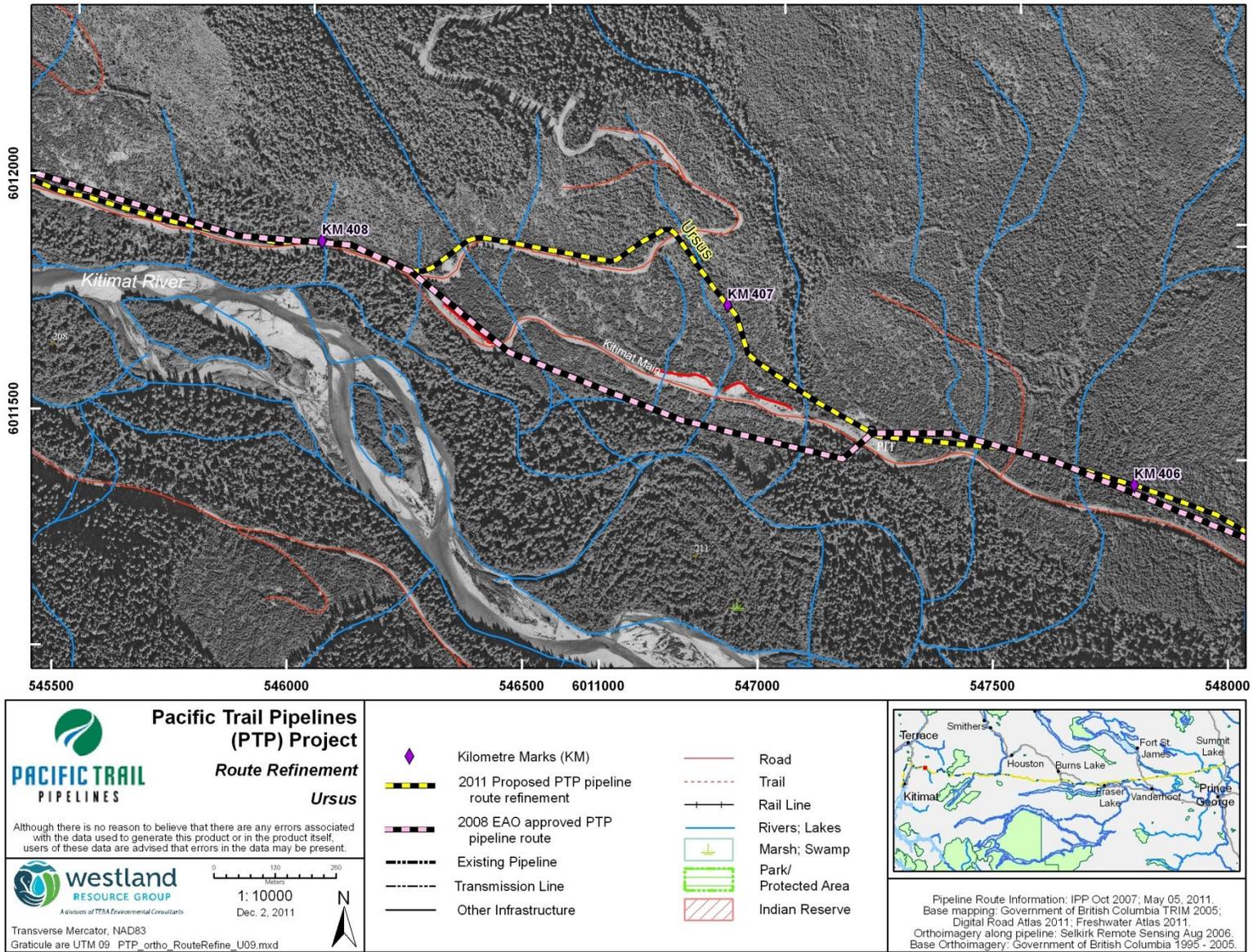


Figure 25. Ursus Route Refinement (KM 406.6 to KM 407.7)

Field assessments for the unnamed S2 stream identified the creek as having low fish sensitivity (see the 2007 EAC Application for further details). This stream was crossed by the approved pipeline route and the new crossing location was assessed as being located within a reach of low habitat potential. A second fish-bearing stream was crossed by the approved pipeline route; however, this stream is avoided by the route refinement.

The proposed route was selected to protect grizzly bear habitat in riparian areas that may have been disturbed by the approved pipeline route. This potential effect will be avoided if the route refinement is approved.

The following effects may occur on vegetation, wildlife, and wildlife habitat:

- increase the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The two unnamed creeks located near KM 406.7 and KM 407.7 that were field rated as medium suitability for Pacific tailed frog were both crossed by the approved pipeline route.

Geotechnical assessments found that the likelihood of Project construction triggering erosion or slope instability between (KM 407.7 and KM 407.8) and (KM 406.7 and KM 407.6) within the route refinement workspace as being low and outside of the workspace as being high.

The AIA results indicated that no archaeological resources were identified.

The route refinement is considered to be an improvement compared to the approved pipeline route in this segment because important grizzly bear habitat located on the south side of the Kitimat FSR will be avoided if the route refinement is adopted.

11.17.3 Mitigation

Specific mitigation measures for minimizing potential effects on fish and fish habitat that will be adopted for the watercourse crossing are detailed in Section 7.2.3 of the 2007 EAC Application. In-stream work windows to protect fish are contained in the EMP. Proper work management and procedures that will be followed to limit any environmental effects in the event of an incident will also be detailed in the EMP.

Mitigation measures for minimizing potential effects on vegetation, wildlife, and wildlife habitats will be adopted for construction and operation activities for the route refinement and

are detailed in Section 7.2.4 of the 2007 EAC Application. Mitigation measures for vegetation, wildlife, and wildlife habitat are summarized below and are detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (April 1 and July 31).

The grubbing of the work area within 10 m of stream banks and the removal of shrubs within 30 m of all streams that provide suitable habitat for Pacific tailed frog will be minimized to the greatest extent practicable.

Following the AIA, no further work is recommended and no mitigation is required.

11.17.4 Residual environmental effects

The following residual effects have been identified for fish and fish habitat:

- increased fish mortalities from instream construction activities, and
- loss of fish food inputs from riparian areas adjacent to fish-bearing watercourses.

By implementing fish salvaging programs and recognizing that the loss of food inputs is expected to be temporary, these residual effects on fish and fish habitats are considered less than significant (see Section 7.2.3 of the 2007 EAC Application for detailed residual effect assessments for fish and fish habitat).

The following residual effects have been identified for vegetation, wildlife, and wildlife habitats:

- potential for the introduction of invasive plant species following construction,
- the suitability of streams used by Pacific tailed frogs may be reduced, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4

of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for fisheries, vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement.

11.17.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.18 Cecil Route Refinement (KM 433.2 to KM 439.0)

The Cecil Route Refinement is requested to avoid marine clay and forestry sample plots.

11.18.1 Baseline conditions

The Cecil Route Refinement is located between KM 433.2 and KM 439.0 (Figure 26, Figure 27, and Figure 28). The route refinement crosses Cecil Creek, the same fish-bearing stream that was crossed by the approved pipeline route. The new crossing of Cecil Creek will be located approximately 466 m further downstream from the original crossing location. Cecil Creek is classified as an S2 stream and is crossed at KM 433.8 and has a maximum channel width of 12.8 m. Fisheries surveys conducted in 2011 detected the occurrence of Coho Salmon, Dolly Varden, and Coastal Cutthroat Trout in the watercourse.

A grizzly bear movement corridor was identified between KM 432 and KM 434. The Lakelese to Hirsch Creek Movement Corridor is typically used by grizzly bear from spring through fall as animals move between feeding and breeding sites.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. No BC CDC occurrence data for species-at-risk were found for the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Ranges, Parks, or Protected Areas overlap with the route refinement.

Geotechnical assessments indicated that the south bank of Cecil Creek located near KM 433.7 is more than 50 m long and overall steep scarp consisting of glaciofluvial pebbly sands. Evidence of small, old (probably logging-related) sidewall instability and erodible material was found.

A debris slide geohazard was identified at this location; however, there is no evidence that the geohazard has been active within the last year, but trigger frequency appears to be high.

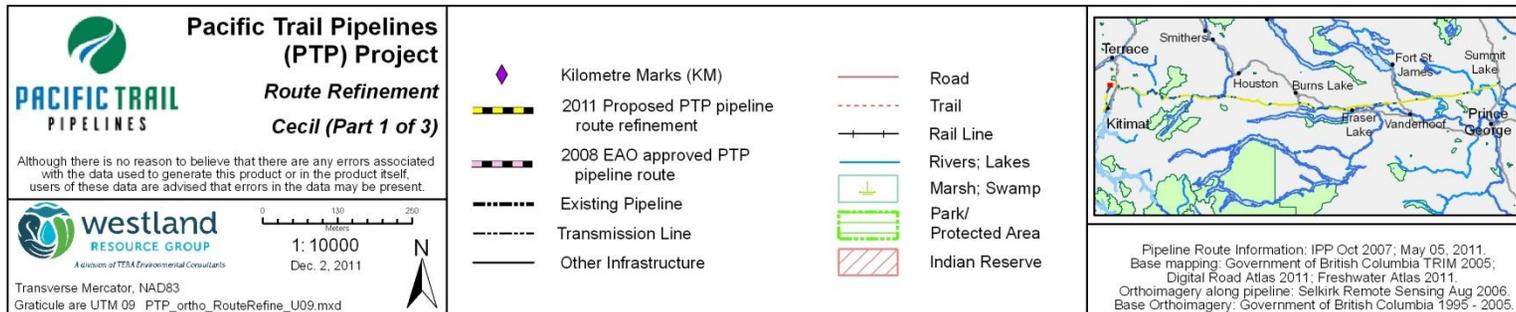
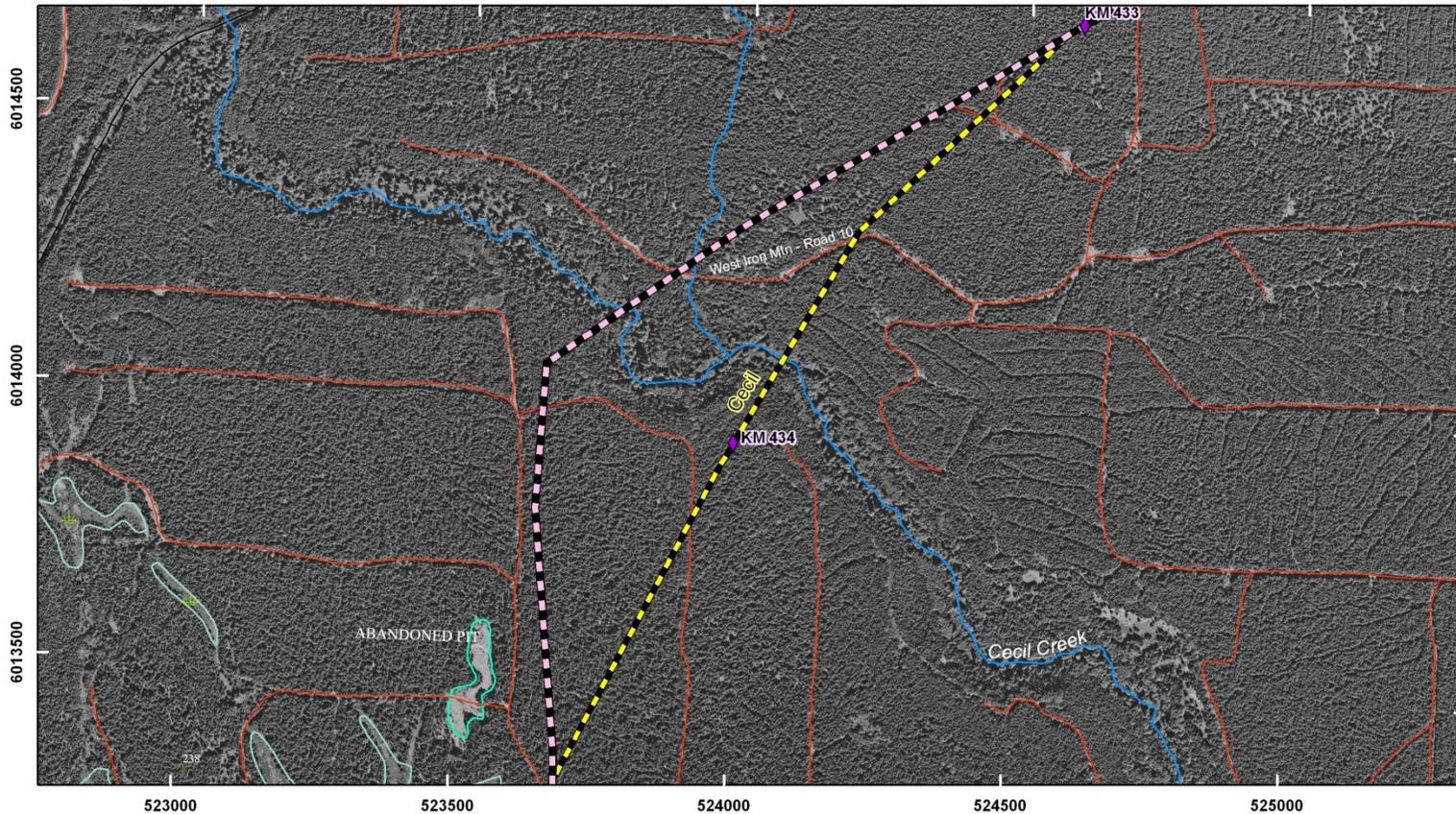


Figure 26. Cecil Route Refinement (KM 433.2 and KM 439.0)

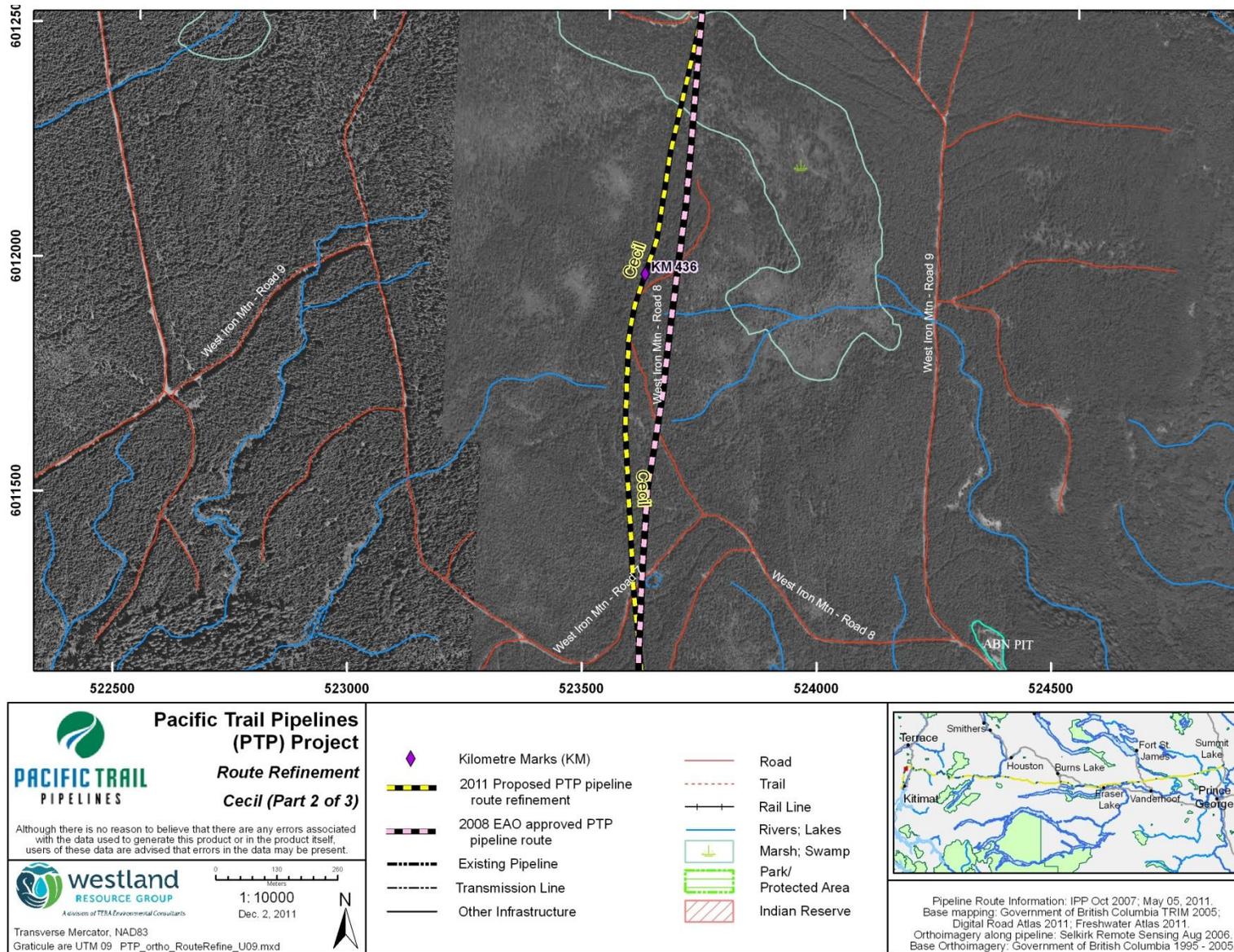


Figure 27. Cecil Route Refinement (KM 433.2 and KM 439.0)

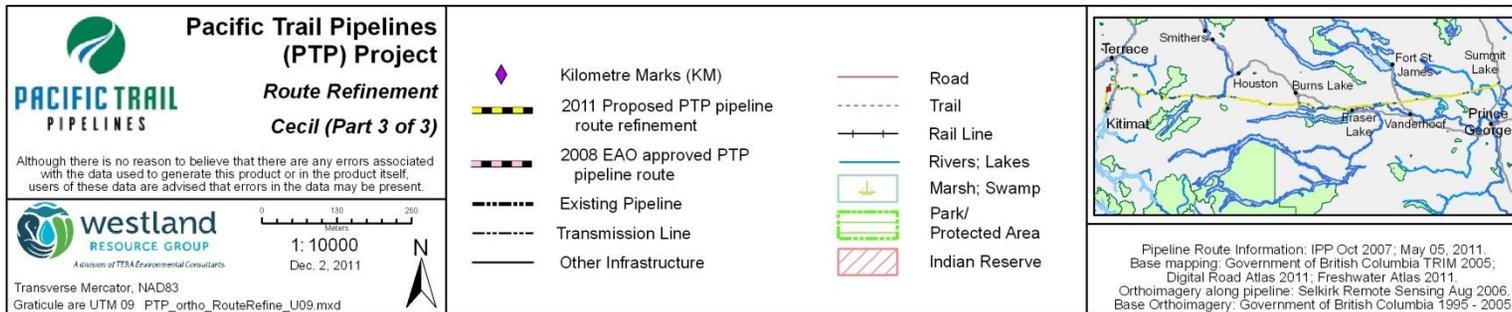
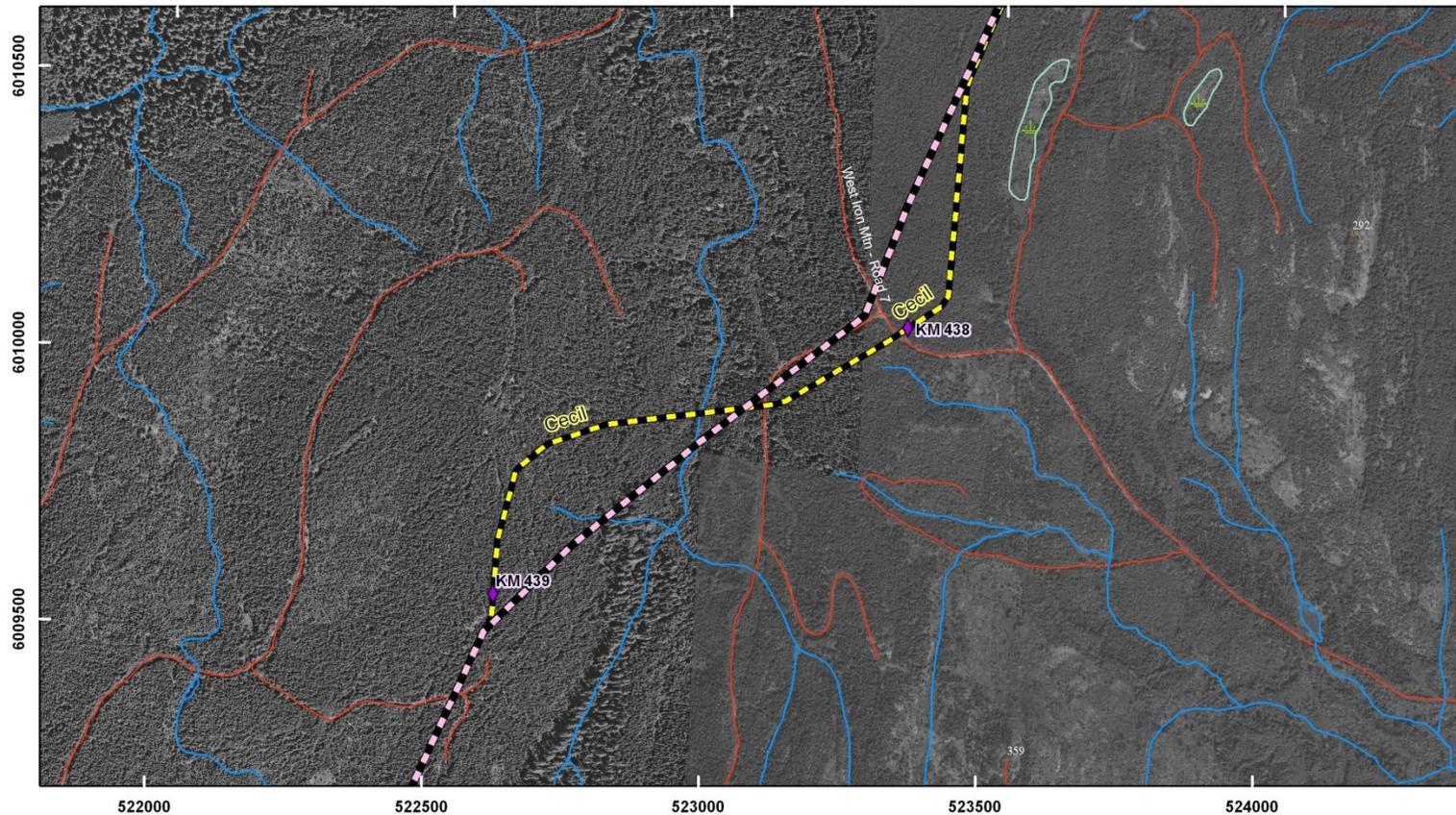


Figure 28. Cecil Route Refinement (KM 433.2 and KM 439.0)

The creek crossing between KM 438.4 and KM 438.7 occurs above the glaciomarine clay elevation limit. Evidence of glaciofluvial and/or till scarps with bank sloughing/ravelling was also present and a minor scour hazard was identified at this location.

The AIA, performed on October 4, 2011, found that no archaeological resources were known to be in conflict with the route refinement.

11.18.2 Impact assessment

The route refinement crosses Cecil Creek at KM 433.8 and may have the following effects on fish and fish habitat:

- direct and indirect mortality of fish,
- loss or degradation of riparian and instream fish habitat,
- loss or degradation of fish habitat connectivity, and
- interbasin transfer of aquatic organisms.

Field assessments for Cecil Creek identified the creek as having high fish sensitivity (see the 2007 EAC Application for further details). This creek was crossed by the approved pipeline route. The new watercourse crossing location was assessed as having the same potential effects as the original crossing location.

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

Geotechnical assessments found that the likelihood of Project construction triggering erosion or slope instability near KM 433.7 and between KM 438.4 and KM 438.7 within the route refinement workspace as being high and outside of the workspace as being low.

The AIA found that no archaeological resources were identified.

The route refinement is considered to be an improvement compared to the approved pipeline route because it avoids a forestry research plot and there will be no change in fish habitat potential.

11.18.3 Mitigation

Specific mitigation measures for minimizing potential effects on fish and fish habitat that will be adopted for the watercourse crossing are detailed in Section 7.2.3 of the 2007 EAC Application. These mitigation measures are detailed in the EMP. The EMP describes how environmental risks to fish and fish habitats will be mitigated during construction. Proper work management and procedures that will be followed to limit any environmental effects in the event of an incident are detailed in the EMP.

Mitigation measures for minimizing potential effects on vegetation, wildlife, and wildlife habitats will be adopted for construction and operation activities for the route refinement and are detailed in Section 7.2.4 of the 2007 EAC Application. Mitigation measures for vegetation, wildlife, and wildlife habitat are summarized below and are detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include the avoidance of important wildlife habitats, movement corridors, or habitat features. Construction work will be completed expeditiously to maintain a tight construction spread to minimize potential barriers and hazards to wildlife in movement corridor areas. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (April 1 and July 31).

Following the AIA, no further work is recommended and no mitigation is required.

11.18.4 Residual environmental effects

The following residual effects have been identified for fish and fish habitat:

- increased fish mortalities from instream construction activities, and
- loss of fish food inputs from riparian areas adjacent to fish-bearing watercourses.

By implementing fish salvaging programs and recognizing that the loss of food inputs is expected to be temporary, these residual effects on fish and fish habitats are considered less than significant (see Section 7.2.3 of the 2007 EAC Application for detailed residual effect assessments for fish and fish habitat).

The following residual effects have been identified for vegetation, wildlife, and wildlife habitats:

- potential for the introduction of invasive plant species following construction, and
- alteration of seasonal movement patterns of wide-ranging predators such as grizzly bear may occur during construction.

The risk of wildlife vehicle collisions may increase during construction. By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for fisheries, vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement. The route refinement is considered to be a lower risk alignment from a geotechnical perspective and meets PTP's commitment to avoid an established forestry research plot.

11.18.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.19 Iron Mountain Route Refinement (KM 440.5 to KM 442.3)

The Iron Mountain Route Refinement is requested to avoid marine clay concerns.

11.19.1 Baseline conditions

The Iron Mountain Route Refinement is located between KM 440.5 and KM 442.3 (Figure 29). The route refinement crosses only one of the two fish-bearing watercourses that were crossed by the approved pipeline route. The new crossing on Bannock Creek at KM 440.7 will be located approximately 1.0 km further upstream from where it was originally proposed. Bannock Creek is classified as an S2 stream. Fisheries surveys conducted in 2011 detected the occurrence of Chinook Salmon, Coho Salmon, Dolly Varden, Coastal Cutthroat Trout, and lamprey in the creek.

The unnamed watercourse located near KM 441.0 crossed by the route refinement is rated as having high suitability for Pacific tailed frog. An adult Pacific tree frog was observed in moist, shaded regenerating forest dominated by hemlock near KM 441.1 and two adult western toads were observed during field assessments approximately 300 m west of KM 441.0.

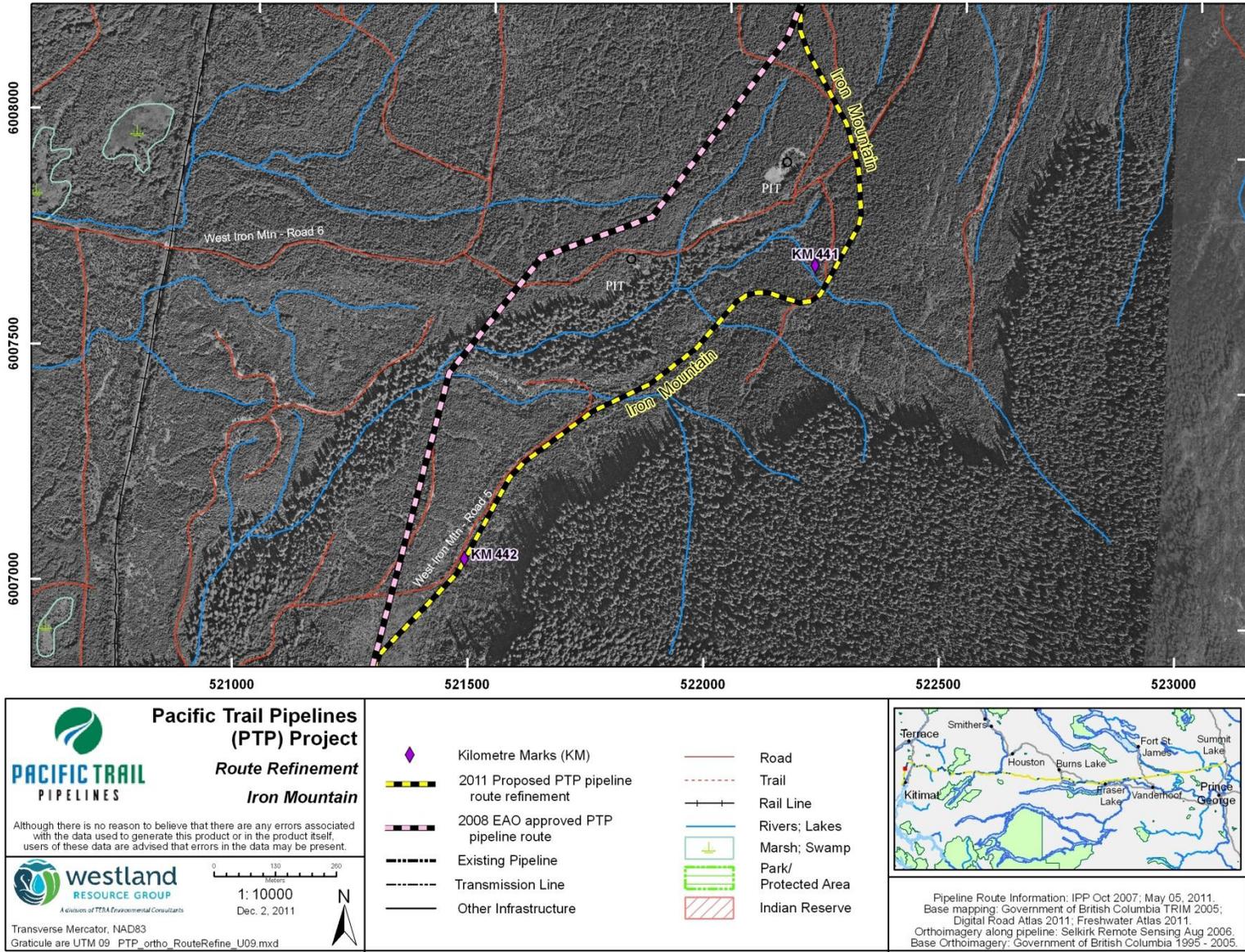


Figure 29. Iron Mountain Route Refinement (KM 440.5 to KM 442.3)

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. No BC CDC occurrence data for species-at-risk were found for the route refinement.

No Wildlife Habitat Areas, OGMAs, Ungulate Winter Ranges, Parks, or Protected Areas overlap with the route refinement. No important seasonal ranges or wildlife movement corridors were identified for the route refinement.

Geotechnical assessments found glaciomarine clay in the area. Old landslide scars were identified immediately downslope (west) and gullied terrain (glaciofluvial and/or glaciofluvial over glaciomarine) was observed east and south from KM 441.0 to KM 441.4.

Possible construction-related landslide/erosion hazards exist and an earth flow geohazard was identified. There is no evidence that this geohazard has been active within the last year, but trigger frequency appears to be high.

The AIA, performed on October 3, 2011, found that no archaeological resources were known to be in conflict with the route refinement.

11.19.2 Impact assessment

The route refinement crosses Bannock Creek at KM 440.7 and may have the following effects on fish and fish habitats:

- direct and indirect mortality of fish,
- loss or degradation of riparian and instream fish habitat,
- loss or degradation of fish habitat connectivity, and
- interbasin transfer of aquatic organisms.

Field assessments for Bannock Creek identified the creek as having high fish sensitivity (see the 2007 EAC Application for further details). This creek was crossed by the approved pipeline route. The new crossing location was assessed as being located along a reach of the stream with lower fish habitat potential. A second unnamed fish-bearing stream that was crossed by the approved pipeline route will be avoided if the new route refinement is approved.

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The route refinement will now avoid an area of mature riparian habitat along Bannock Creek that would have been disturbed by the approved pipeline route.

The unnamed creek located near KM 441.0 that was rated as high suitability for Pacific tailed frog would also be crossed by the approved pipeline route.

Geotechnical assessments revealed slope instability between KM 441.0 and KM 441.4 in the project footprint of the route refinement.

The AIA found that no archaeological resources were identified.

The route refinement is considered to be an improvement compared to the approved pipeline route because a fish-bearing watercourse and marine clay geohazards will be avoided.

11.19.3 Mitigation

Specific mitigation measures for minimizing potential effects on fish and fish habitat that will be adopted for the watercourse crossing are detailed in Section 7.2.3 of the 2007 EAC Application. In-stream work windows to protect fish are contained in the EMP. Proper work management and procedures that will be followed to limit any environmental effects in the event of an incident are also detailed in the EMP.

Mitigation measures for minimizing potential effects on vegetation, wildlife, and wildlife habitats will be adopted for construction and operation activities for the route refinement and are detailed in Section 7.2.4 of the 2007 EAC Application. Mitigation measures for vegetation, wildlife, and wildlife habitat are summarized below and are detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include ensuring that the alignment does not adversely affect movement corridors or habitat features. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (April 1 and July 31).

The grubbing of the work area within 10 m of stream banks and the removal of shrubs within 30 m of all streams that provide suitable habitat for Pacific tailed frog will be minimized to the greatest extent practicable.

A site-specific erosion control plan and spoil management plan will be prepared for the route refinement between KM 441.0 and KM 441.4.

Consider setting the pipeline centerline up to 500 m east from the current centerline to avoid the glaciomarine soils on the side slope and place route in glaciofluvial sands and gravels and rock.

Following the AIA, no further work is recommended and no mitigation is required.

11.19.4 Residual environmental effects

The following residual effects have been identified for fish and fish habitat:

- increased fish mortalities from instream construction activities, and
- loss of fish food inputs from riparian areas adjacent to fish-bearing watercourses.

By implementing fish salvaging programs and recognizing that the loss of food inputs is expected to be temporary, these residual effects on fish and fish habitats are considered less than significant (see Section 7.2.3 of the 2007 EAC Application for detailed residual effect assessments for fish and fish habitat).

The following residual effects have been identified for vegetation, wildlife, and wildlife habitats:

- potential for the introduction of invasive plant species following construction, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for fisheries, vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement. The route refinement is considered to be a lower risk alignment from a geotechnical perspective.

11.19.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting

requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

11.20 Clay Route Refinement (KM 454.5 to KM 455.7)

The Clay Route Refinement is requested to avoid marine clay concerns.

11.20.1 Baseline conditions

The Clay Route Refinement is located between KM 454.5 and KM 455.7 (Figure 30). The route refinement crosses the same two unnamed fish-bearing watercourses as with the approved pipeline route, but the crossings are now located approximately 100 m to 135 m further upstream. The unnamed creek located near KM 454.6 is classified as an S3 stream and has a maximum channel width of 4.2 m. Fisheries surveys detected the occurrence of Dolly Varden and Coastal Cutthroat Trout during spring-summer surveys. The unnamed creek located near KM 455.2 is classified as an S3 stream and has a maximum channel width of 4.2 m. Fisheries surveys conducted in 2011 detected the occurrence of Coho Salmon, Chinook Salmon, and Coastal Cutthroat Trout during spring-summer surveys.

The unnamed creek located near KM 454.6 crossed by the route refinement was rated as having medium suitability for Pacific tailed frog.

Vegetation and wildlife surveys conducted in 2011 found no plant communities or species-at-risk occurrences along the route refinement. There are CDC element occurrence data for Regel's rush and bog adder's-mouth orchid for the area, but field assessments did not find any occurrences along the route refinement. No Wildlife Habitat Areas, OGMAs, Ungulate Winter Ranges, Parks, or Protected Areas overlap with the route refinement. No important seasonal ranges or wildlife movement corridors were identified for the route refinement.

Geotechnical assessments found glaciomarine sediments at relatively shallow depths below sandy fluvial sediment along the route refinement. Dissected glaciomarine scarp occurs between KM 454.7 and KM 455.4. The possibility of an earth flow geohazard is currently not present, but the contributing factors and triggers for the geohazard are present.

The AIA, performed on October 1, 2011 with assistance from Fraser Windsor of the Haisla Nation, found that no archaeological resources were known to be in conflict with the route refinement.

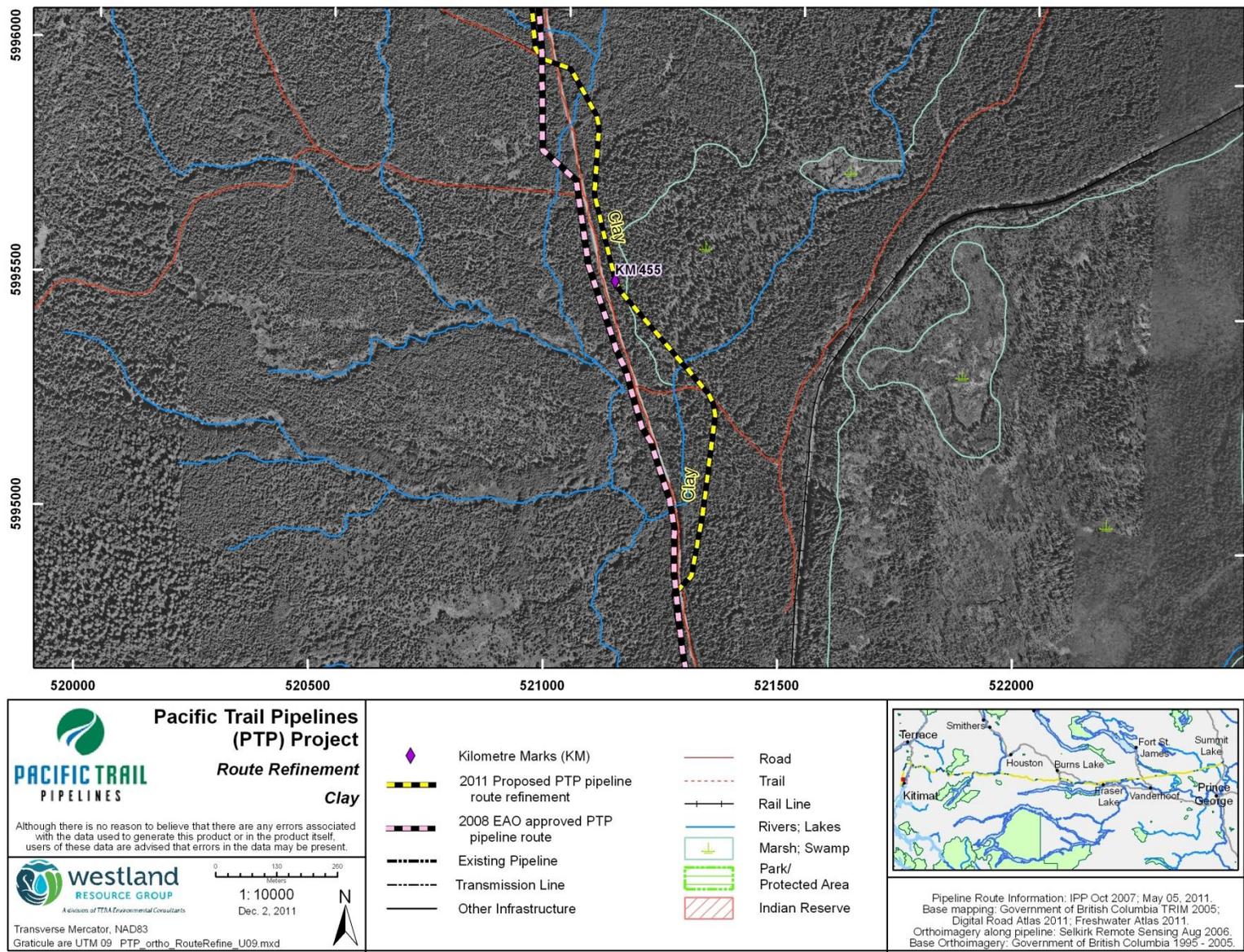


Figure 30. Clay Route Refinement (KM 454.5 and KM 455.7)

11.20.2 Impact assessment

The route refinement crosses two unnamed S3 streams at KM 454.6 and KM 455.2 and may have the following effects on fish and fish habitats:

- direct and indirect mortality of fish,
- loss or degradation of riparian and instream fish habitat,
- loss or degradation of fish habitat connectivity, and
- interbasin transfer of aquatic organisms.

Field assessments for the two unnamed S3 streams identified the creeks as having high fish sensitivity (see the 2007 EAC Application for further details for both streams). Both of these streams were crossed by the approved pipeline route and their new proposed crossing locations were assessed as having the same potential effects as the original crossing locations.

The route refinement may have the following potential effects on vegetation, wildlife, and wildlife habitat:

- terrestrial vegetation resulting from the spread of invasive plant species,
- alteration of wildlife habitat, and
- sensory disturbances to wildlife.

Detailed vegetation and wildlife survey methods and results for the area are found in the 2007 EAC Application (WRG 2007b and 2007c). Results from supplemental field assessments completed in 2011 specifically for the route refinement have also been incorporated into this effects assessment.

The unnamed creek located near KM 454.6 that was field rated as medium suitability for Pacific tailed frog was also crossed by the approved pipeline route.

Geotechnical assessments found that the likelihood of Project construction triggering erosion or slope instability between KM 454.7 and KM 455.4 within the route refinement workspace as being moderate and the pipeline route will have fewer geohazards if this route is approved because marine clays would be avoided.

The AIA found that no archaeological resources were identified.

The route refinement is considered to be an improvement compared to the approved pipeline route because the marine clay geohazard will be avoided.

11.20.3 Mitigation

Specific mitigation measures for minimizing potential effects on fish and fish habitat that will be adopted for the watercourse crossing are detailed in Section 7.2.3 of the 2007 EAC Application.

In-stream work windows to protect fish are contained in the EMP. Proper work management and procedures that will be followed to limit any environmental effects in the event of an incident are also detailed in the EMP.

Mitigation measures for minimizing potential effects on vegetation, wildlife, and wildlife habitats will be adopted for construction and operation activities for the route refinement and are detailed in Section 7.2.4 of the 2007 EAC Application mitigation measures for vegetation, wildlife, and wildlife habitat are summarized below and are detailed in the EMP.

PTP will implement mitigation measures to minimize disturbance to vegetation and facilitate rapid and successful restoration of disturbed natural areas and farmland. An IPMP will be developed prior to clearing and construction to minimize the introduction and spread of any noxious weeds during Project construction activities.

Mitigation measures to reduce any project effects on wildlife and wildlife habitats include the avoidance of important wildlife habitats, movement corridors, or habitat features. Construction traffic will be managed to minimize the potential of any direct wildlife mortality related to traffic use. Access control measures will be implemented along the alignment, following construction, to minimize human-wildlife conflicts. No clearing activities will occur during the migratory bird nesting period (April 1 and July 31).

The grubbing of the work area within 10 m of stream banks and the removal of shrubs within 30 m of all streams that provide suitable habitat for Pacific tailed frog will be minimized to the greatest extent practicable.

Following the AIA, no further work is recommended and no mitigation is required.

11.20.4 Residual environmental effects

The following residual effects have been identified for fish and fish habitat:

- increased fish mortalities from instream construction activities, and
- loss of fish food inputs from riparian areas adjacent to fish-bearing watercourses.

By implementing fish salvaging programs and recognizing that the loss of food inputs is expected to be temporary, these residual effects on fish and fish habitats are considered less than significant (see Section 7.2.3 of the 2007 EAC Application for detailed residual effect assessments for fish and fish habitat).

The following residual effects have been identified for vegetation, wildlife, and wildlife habitats:

- potential for the introduction of invasive plant species following construction,
- the suitability of streams used by Pacific tailed frogs may be reduced, and
- the risk of wildlife vehicle collisions may increase during construction.

By implementing mitigation measures as outlined in the EMP, these residual effects on vegetation, wildlife, and wildlife habitats are considered less than significant (see Section 7.2.4 of the 2007 EAC Application for detailed residual effect assessments for vegetation, wildlife, and wildlife habitats).

No new or additional residual effects for fisheries, vegetation, wildlife, and wildlife habitats that were not previously identified along the approved pipeline route have been identified for the route refinement. The route refinement is considered to be an improvement from a geotechnical perspective.

11.20.5 Monitoring

PTP will undertake a Post-Construction Monitoring Program. Post-construction monitoring will assess the efficacy of invasive plant species controls, site-specific habitat feature installations, and habitat restoration efforts. Emergency procedures and reporting requirements, as outlined in the EMP and Post-Construction Monitoring Program, will be followed for any incidents that may detrimentally affect the environment.

12.0 ENVIRONMENTAL ASSESSMENT OF MINOR ROUTE ADJUSTMENTS

This section contains an assessment of the effects of 27 Minor Route Adjustments (MRA). All MRAs are less than 100 m lateral distance from the approved PTP study corridor (see Figure 3). Most MRAs are requested to avoid geotechnical hazards, avoid potential drainage issues, and improve constructability.

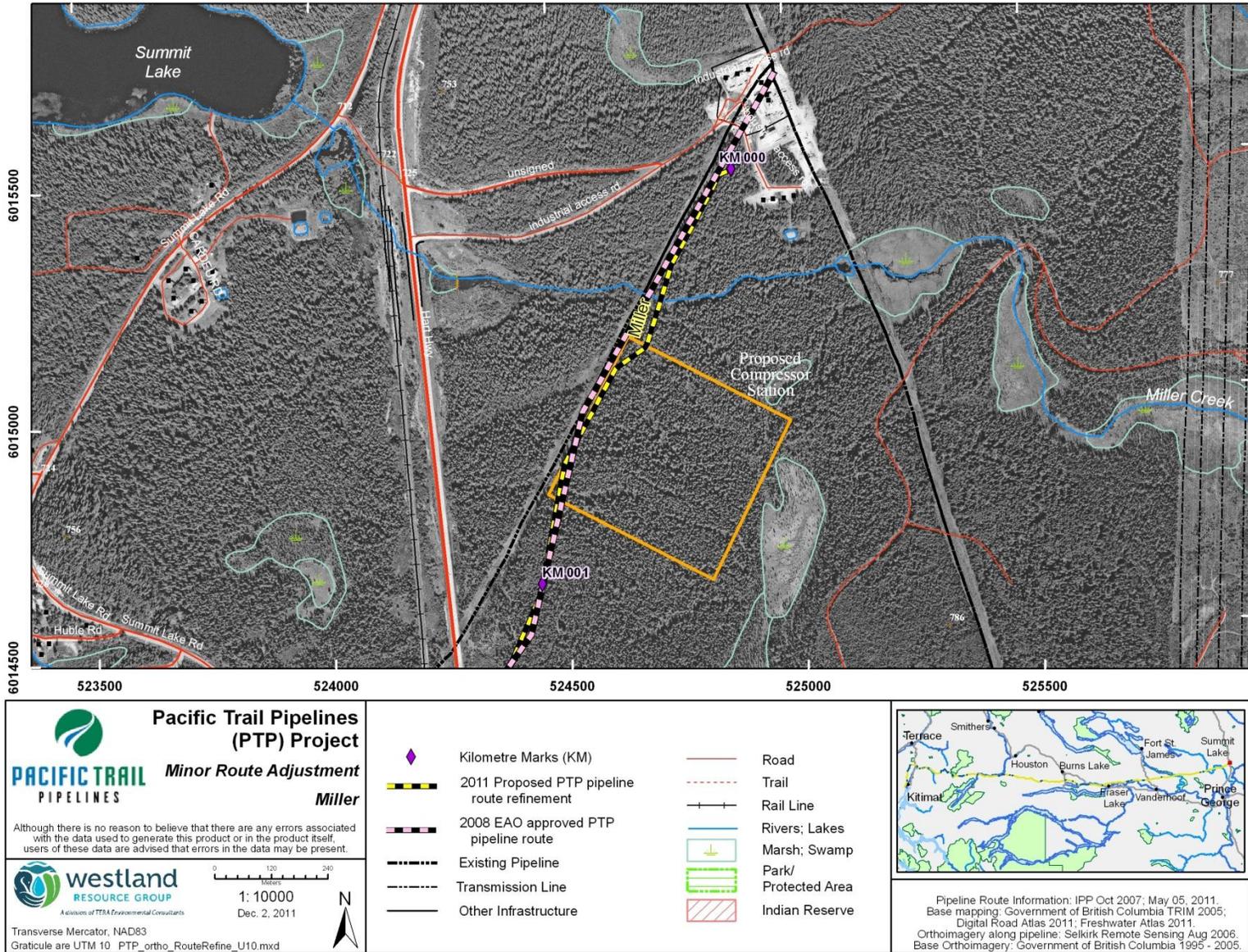
The effects of MRAs are summarized in Table 8 and the orthophoto maps are provided in Figure 31 to Figure 57.

Table 8. Summary of environmental effects of minor route adjustment

Name	Location	Rationale for minor route adjustment	Offset distance from approved study corridor	Effects assessment
Miller	KM 0.3 to KM 0.5	Minor route adjustment to improve drainage management near PNG ROW and new Summit Lake compressor station.	50 m offset	No material change to the assessment of significant adverse effects.
Echo	KM 8.5 to KM 10.3	Minor route adjustment to avoid a creek and wetland adjacent to the south side of the PNG ROW. Route adjustment also improves constructability by minimizing grading on steep side slope.	50 m offset	No material change to the assessment of significant adverse effects.
Salmon	KM 21.7 to KM 21.8	Minor route adjustment to minimize drainage concerns.	20 m offset	No material change to the assessment of significant adverse effects.
Chief Lake FSR	KM 39.6 to KM 40.1	Minor route adjustment to avoid road side drainages.	5 m offset	No material change to the assessment of significant adverse effects.
Davidson	KM 75.1 to KM 76.5	Minor route adjustment to increase separation from a small waterbody located on the north side of the PNG ROW.	50 m offset	No material change to the assessment of significant adverse effects.
Baker	KM 204.8 to KM 205.2	Minor route adjustment to abut nearby road and reduce impacts on creek bank.	20 m offset	No material change to the assessment of significant adverse effects.
Outcrop	KM 207.8 to KM 208.1	Minor route adjustment to avoid geotechnical hazards.	20 m offset	No material change to the assessment of significant adverse effects.

Name	Location	Rationale for minor route adjustment	Offset distance from approved study corridor	Effects assessment
Allin	KM 245.3 to KM 246.6	Minor route adjustment to avoid geotechnical hazards.	15 m offset	No material change to the assessment of significant adverse effects.
Sam	KM 263.6 to KM 263.9	Minor route adjustment to avoid geotechnical hazard and follow existing logging road.	25 m offset	No material change to the assessment of significant adverse effects.
Parrott	KM 284.5 to KM 285.4	Minor route adjustment to avoid extreme side slope and drainage.	60 m offset	No material change to the assessment of significant adverse effects.
Morice	KM 330.2 to KM 330.6	Minor route adjustment to avoid geotechnical hazards.	60 m offset	No material change to the assessment of significant adverse effects.
Bench	KM 344.1 to KM 344.4	Minor route adjustment to avoid geotechnical hazards.	20 m offset	No material change to the assessment of significant adverse effects.
Nimbus 1	KM 366.4 to KM 376.2	Minor route adjustment to minimize grade and address slope stability concerns.	< 60 m offset	No material change to the assessment of significant adverse effects.
Nimbus 2	KM 368.9 to KM 369.2	Minor route adjustment to minimize grade and address slope stability concerns.	< 60 m offset	No material change to the assessment of significant adverse effects.
Nimbus 3	KM 372.6 to KM 373.0	Minor route adjustment to minimize grade and address slope stability concerns.	< 60 m offset	No material change to the assessment of significant adverse effects.
Nimbus 4	KM 375.2 to KM 375.5	Minor route adjustment to minimize grade and address slope stability concerns.	< 60 m offset	No material change to the assessment of significant adverse effects.
Nimbus 5	KM 375.7 to KM 376.2	Minor route adjustment to minimize grade and address slope stability concerns.	< 60 m offset	No material change to the assessment of significant adverse effects.
Clore	KM 377.5 to KM 379.5	Minor route adjustment to avoid slope stability concerns.	< 60 m offset	No material change to the assessment of significant adverse effects.
Road 17	KM 398.3 to KM 399.0	Minor route adjustment to minimize grade and improve construction safety.	< 60 m offset	No material change to the assessment of significant adverse effects.
Kitimat main	KM 412.2 to KM 412.4	Minor route adjustment to avoid extreme side slope.	50 m offset	No material change to the assessment of significant adverse effects.

Name	Location	Rationale for minor route adjustment	Offset distance from approved study corridor	Effects assessment
KM Road 15	KM 415.3 to KM 415.4	Minor route adjustment to avoid geotechnical and drainage concerns.	20 m offset	No material change to the assessment of significant adverse effects.
McKay	KM 418.5 to KM 418.8	Minor route adjustment to avoid geotechnical hazards.	20 m offset	No material change to the assessment of significant adverse effects.
Kitimat FSR	KM 421.9 to KM 422.1	Minor route adjustment to avoid a wetland adjacent to the Kitimat FSR.	25 m offset	No material change to the assessment of significant adverse effects.
Chist	KM 423.2 to KM 424.3	Minor route adjustment to move out of intermittent drainage and avoid marine clay concerns.	10 m offset	No material change to the assessment of significant adverse effects.
Onion	KM 430.8 to KM 431.5	Minor route adjustment to avoid forestry sample plot.	20 m offset	No material change to the assessment of significant adverse effects.
Road 3	KM 445.3 to KM 446.1	Minor route adjustments to avoid geotechnical hazards, improve construction safety, and use an existing logging route.	50 m offset	No material change to the assessment of significant adverse effects.
Trout	KM 449.8 to KM 450.9	Minor route adjustment to avoid geotechnical hazards and improve construction safety.	20 m offset	No material change to the assessment of significant adverse effects.



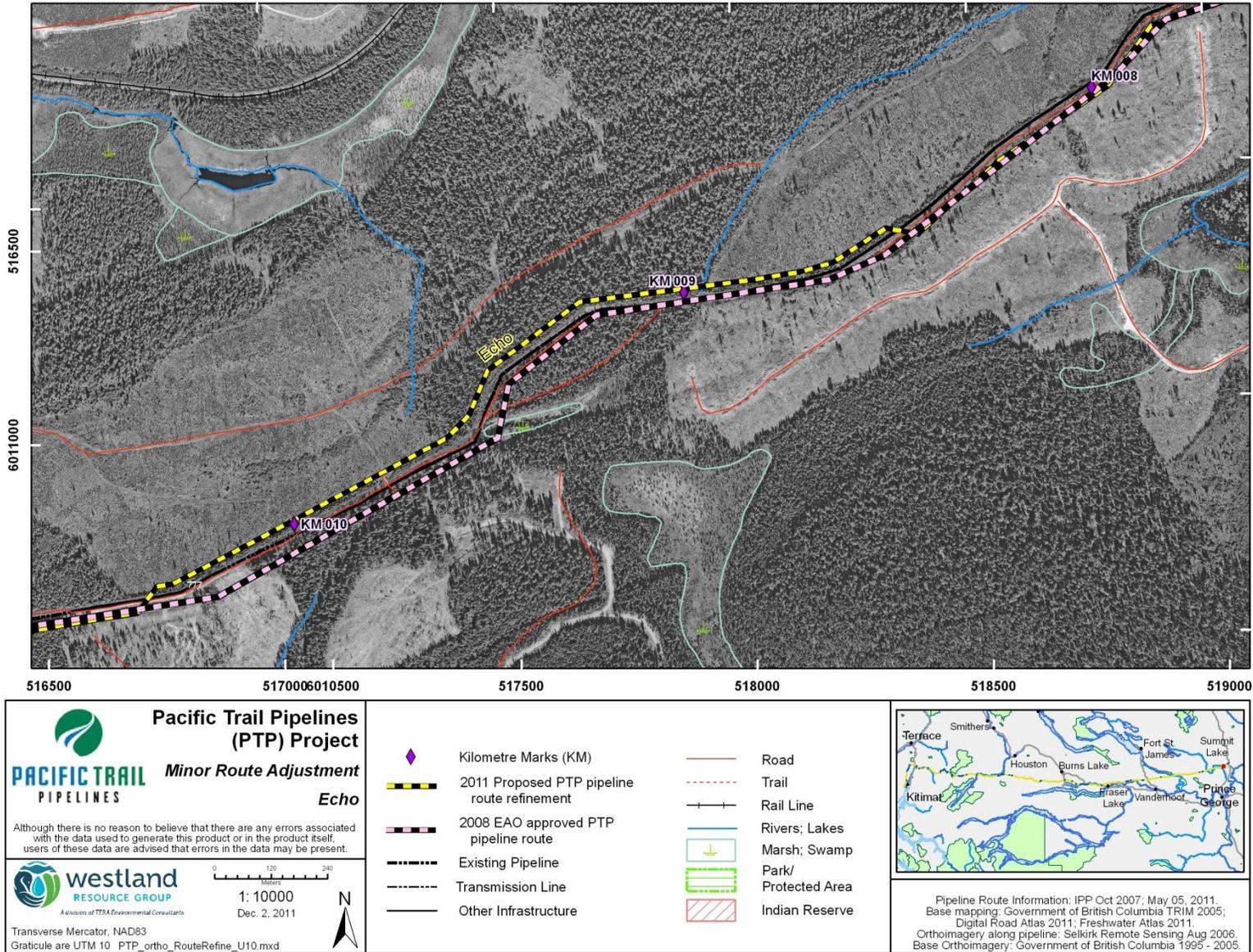


Figure 32. Echo Minor Route Adjustment (KM 8.5 to KM 10.3)

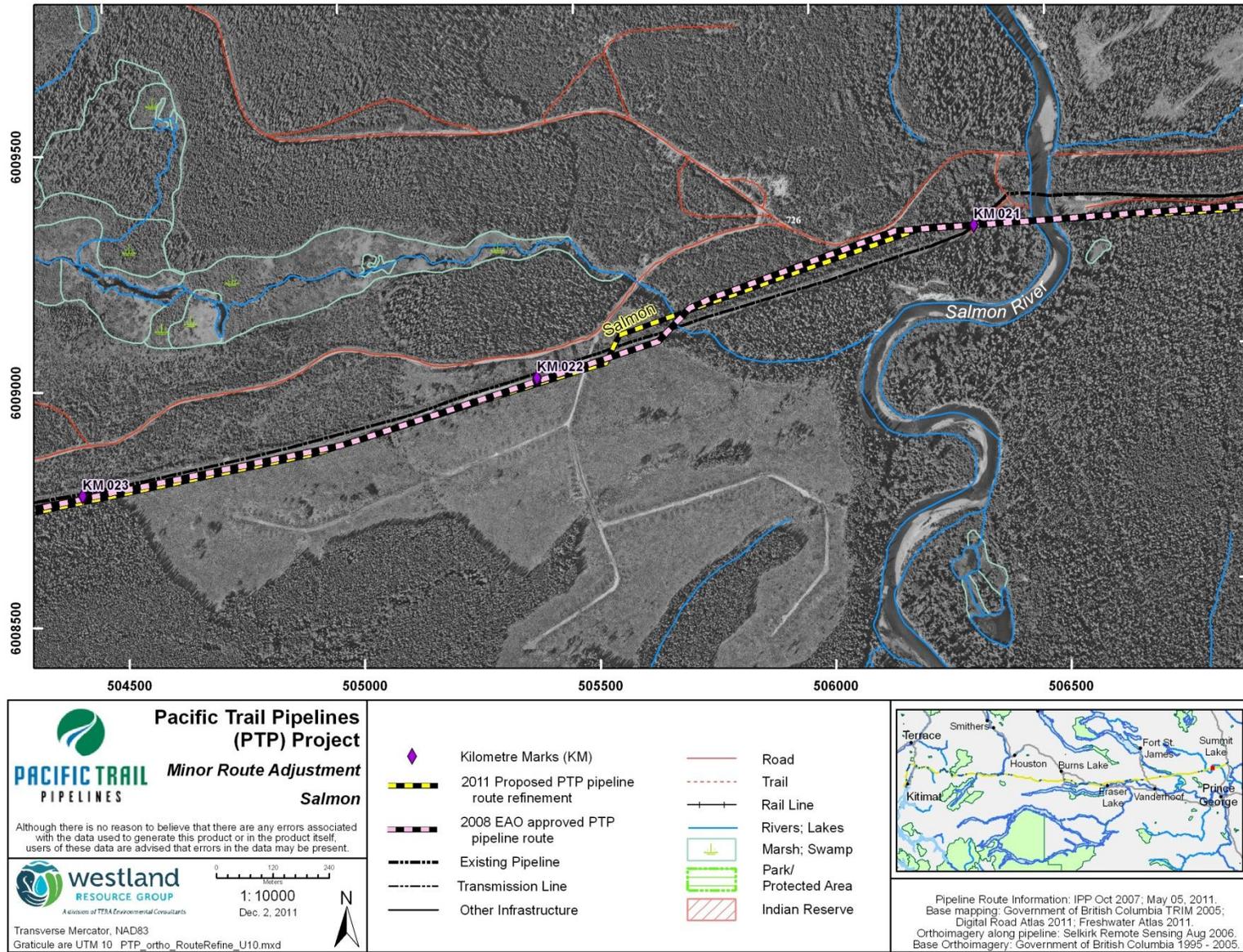


Figure 33. Salmon Minor Route Adjustment (KM 21.7 to KM 21.8)

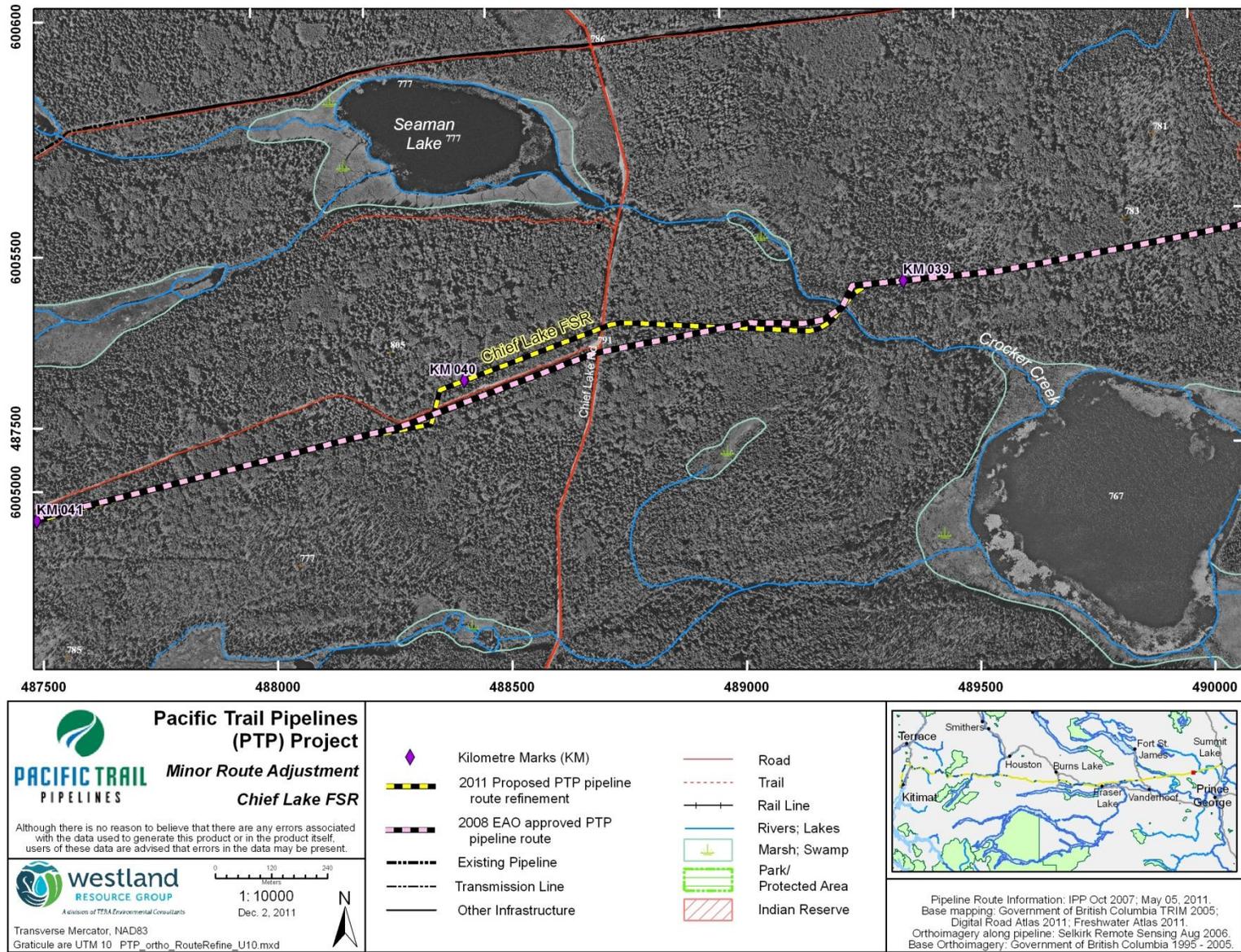


Figure 34. Chief Lake FSR Minor Route Adjustment (KM 39.6 to KM 40.1)

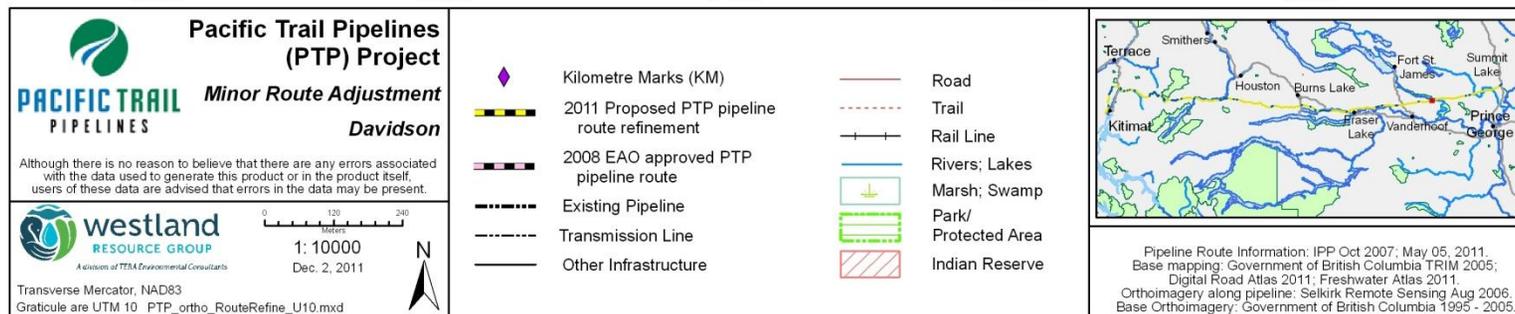


Figure 35. Davidson Minor Route Adjustment (KM 75.1 to KM 76.5)

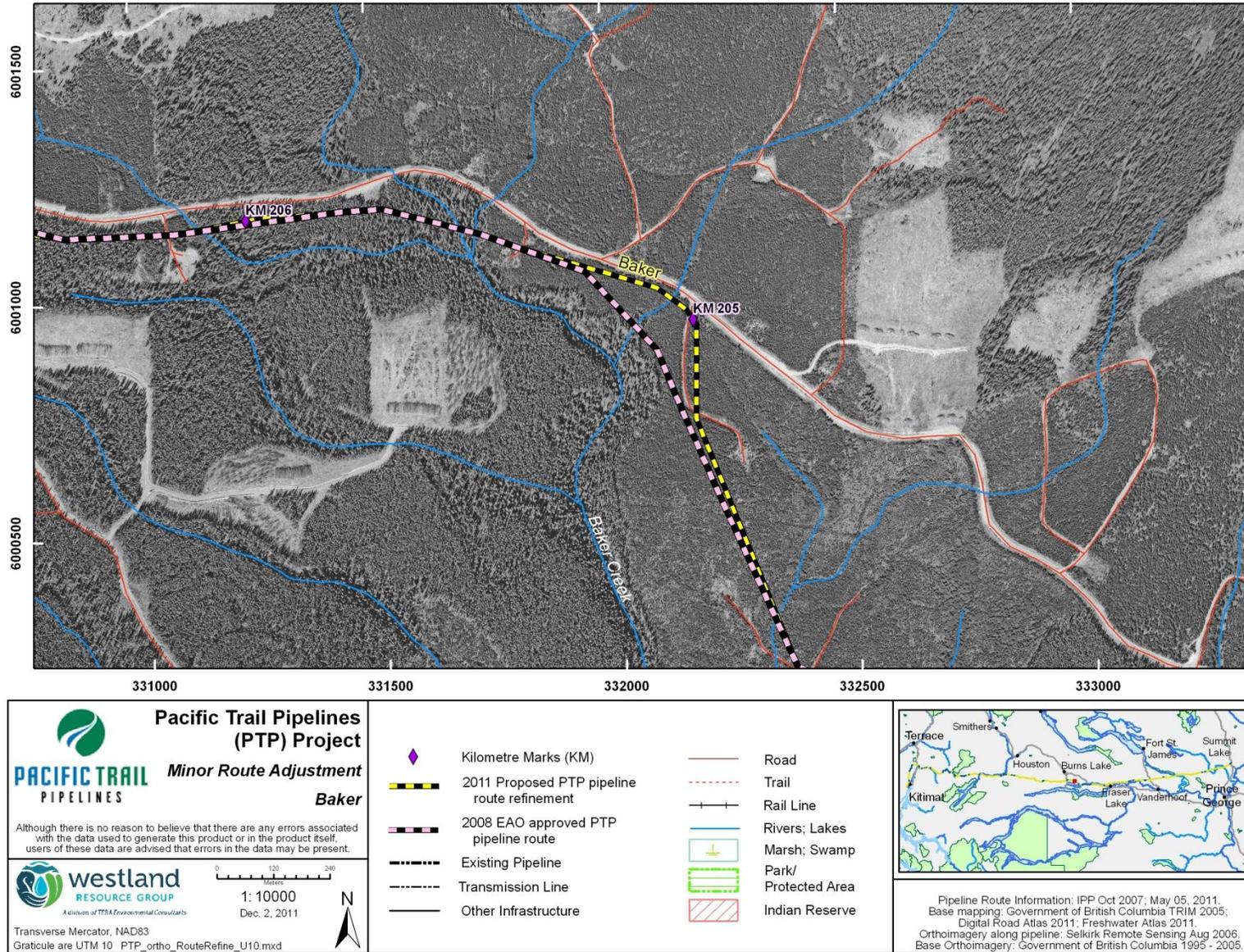


Figure 36. Baker Minor Route Adjustment (KM 204.8 to KM 205.2)

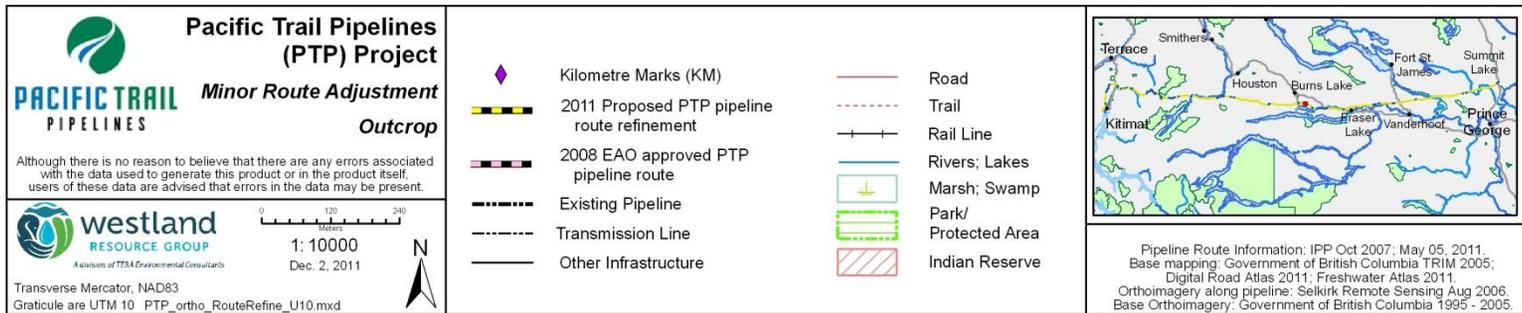
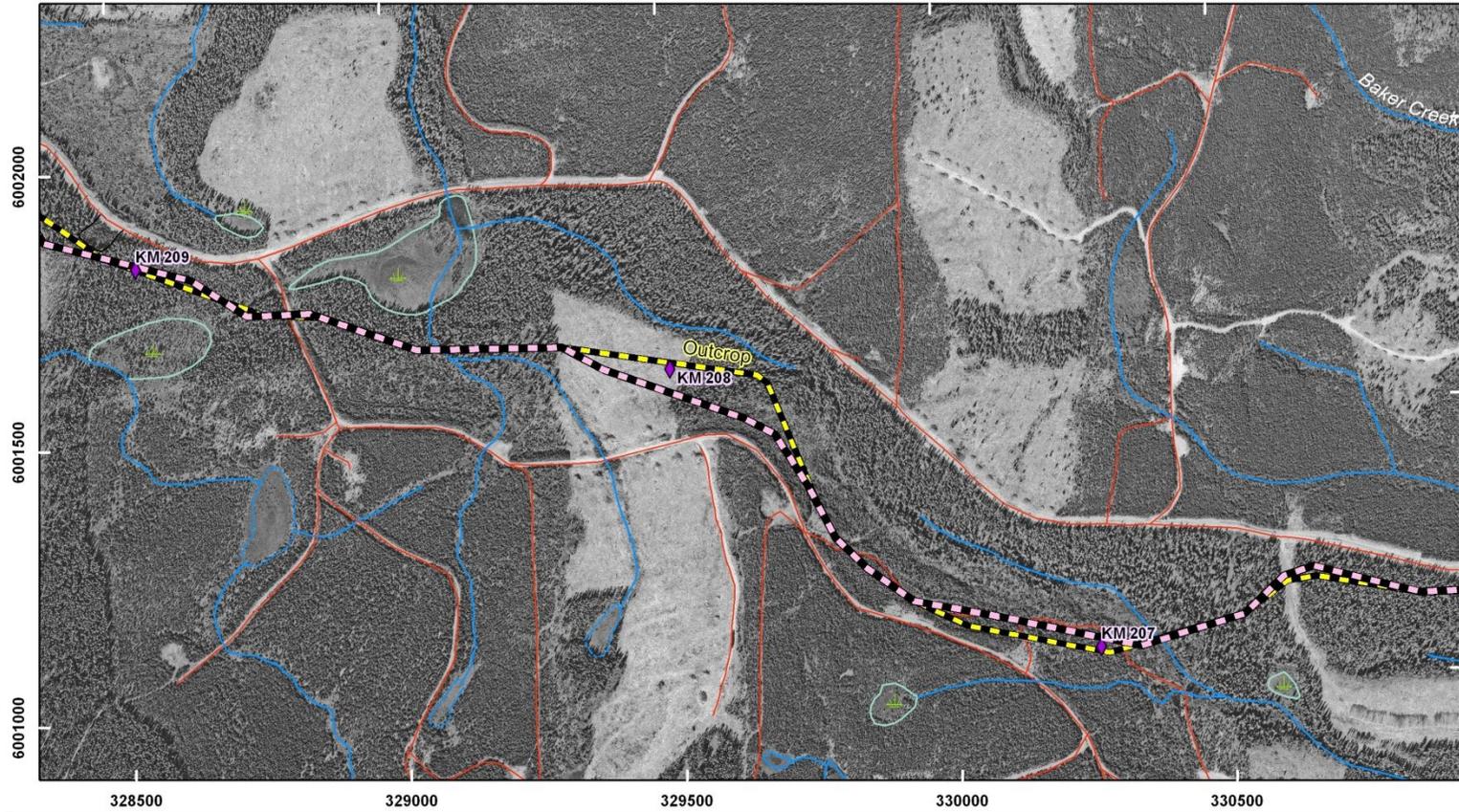


Figure 37. Outcrop Minor Route Adjustment (KM 207.8 to KM 208.1)

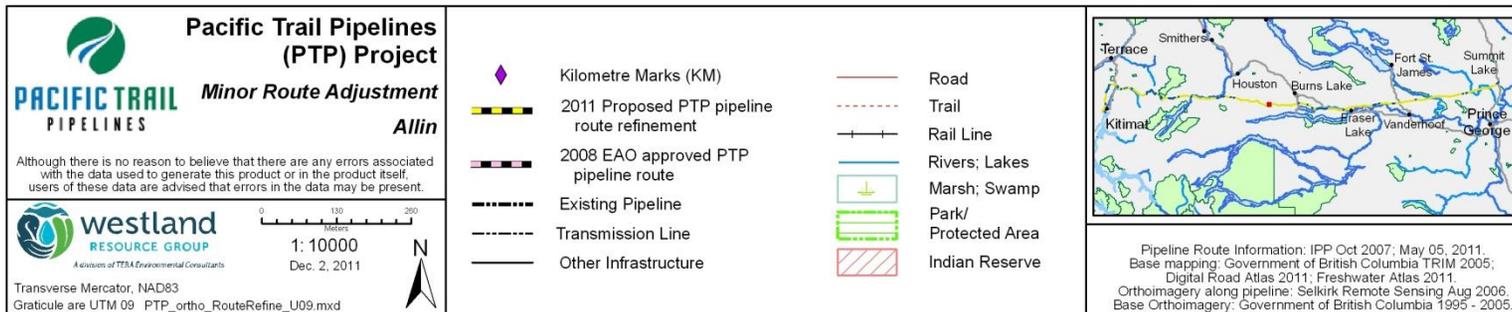
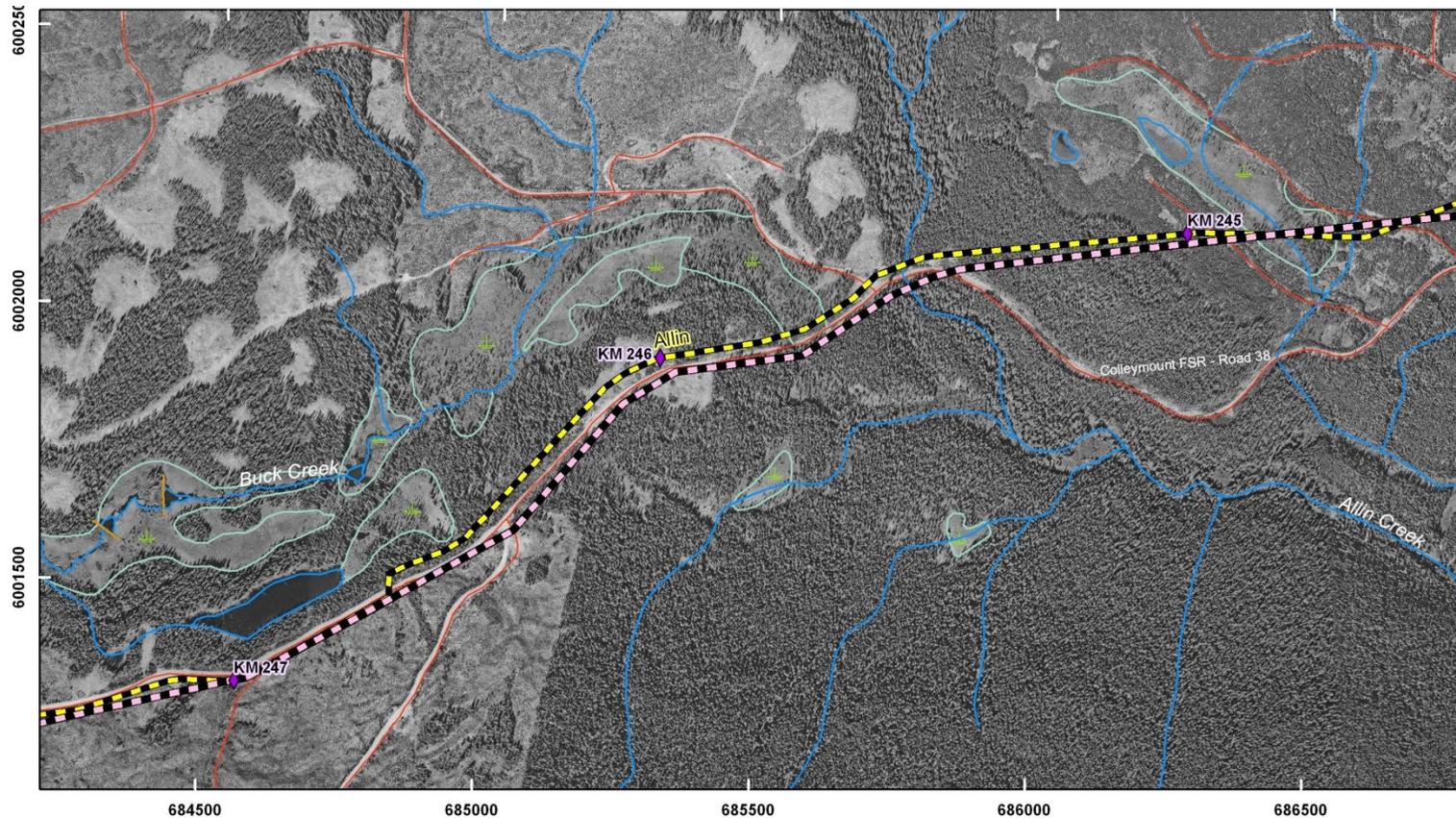
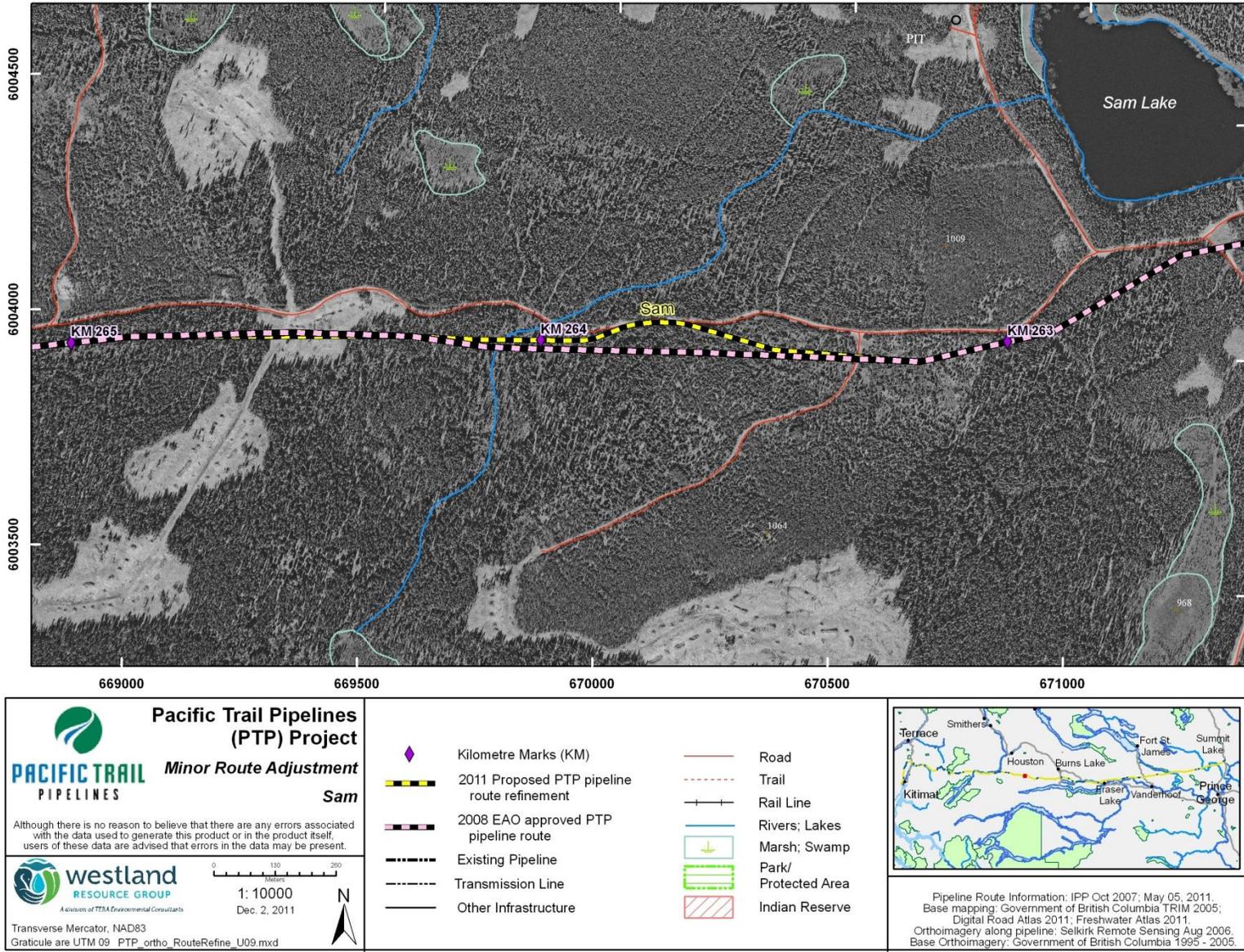


Figure 38. Allin Minor Route Adjustment (KM 245.3 to KM 246.6)



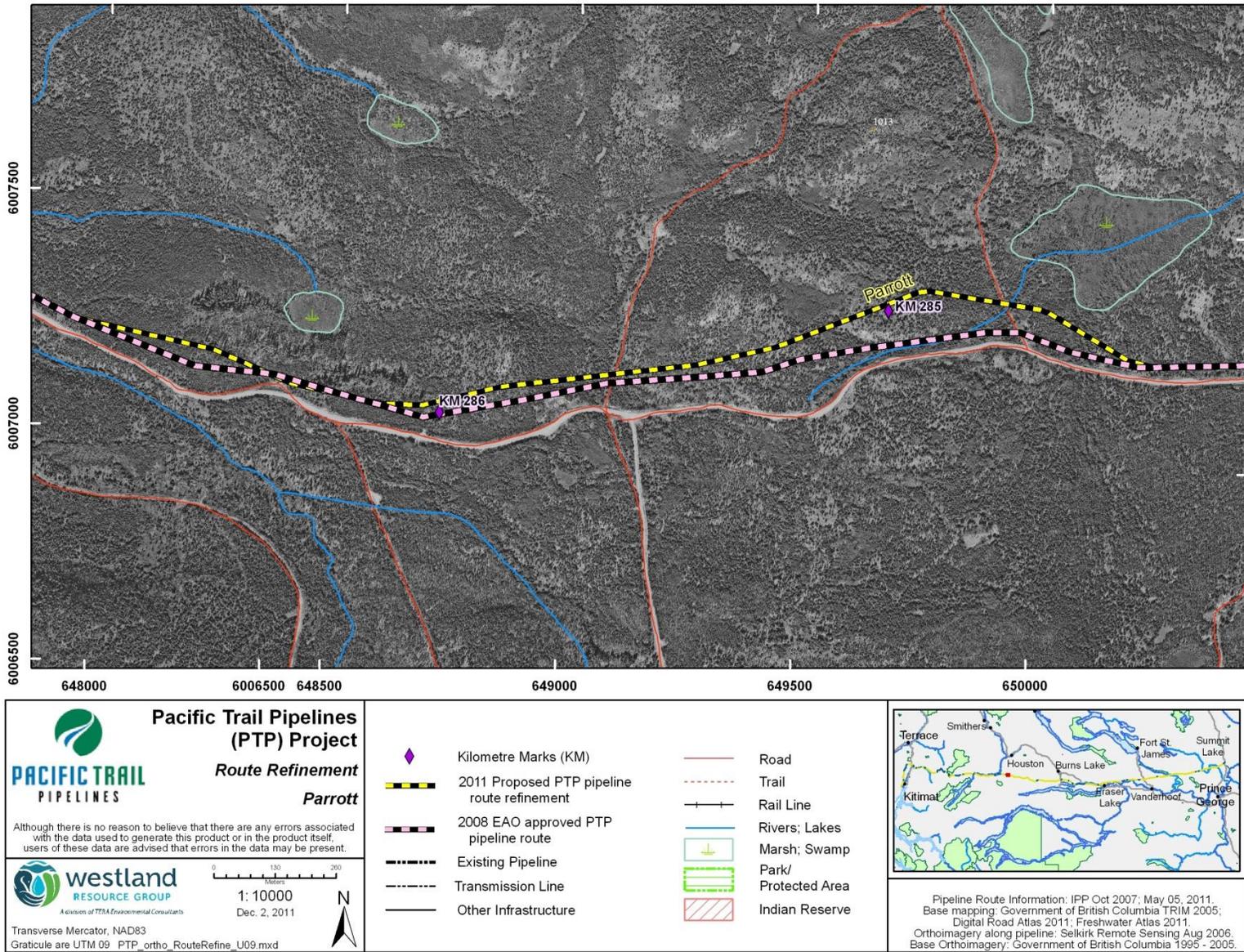


Figure 40. Parrott Minor Route Adjustment (KM 284.5 to KM 285.4)

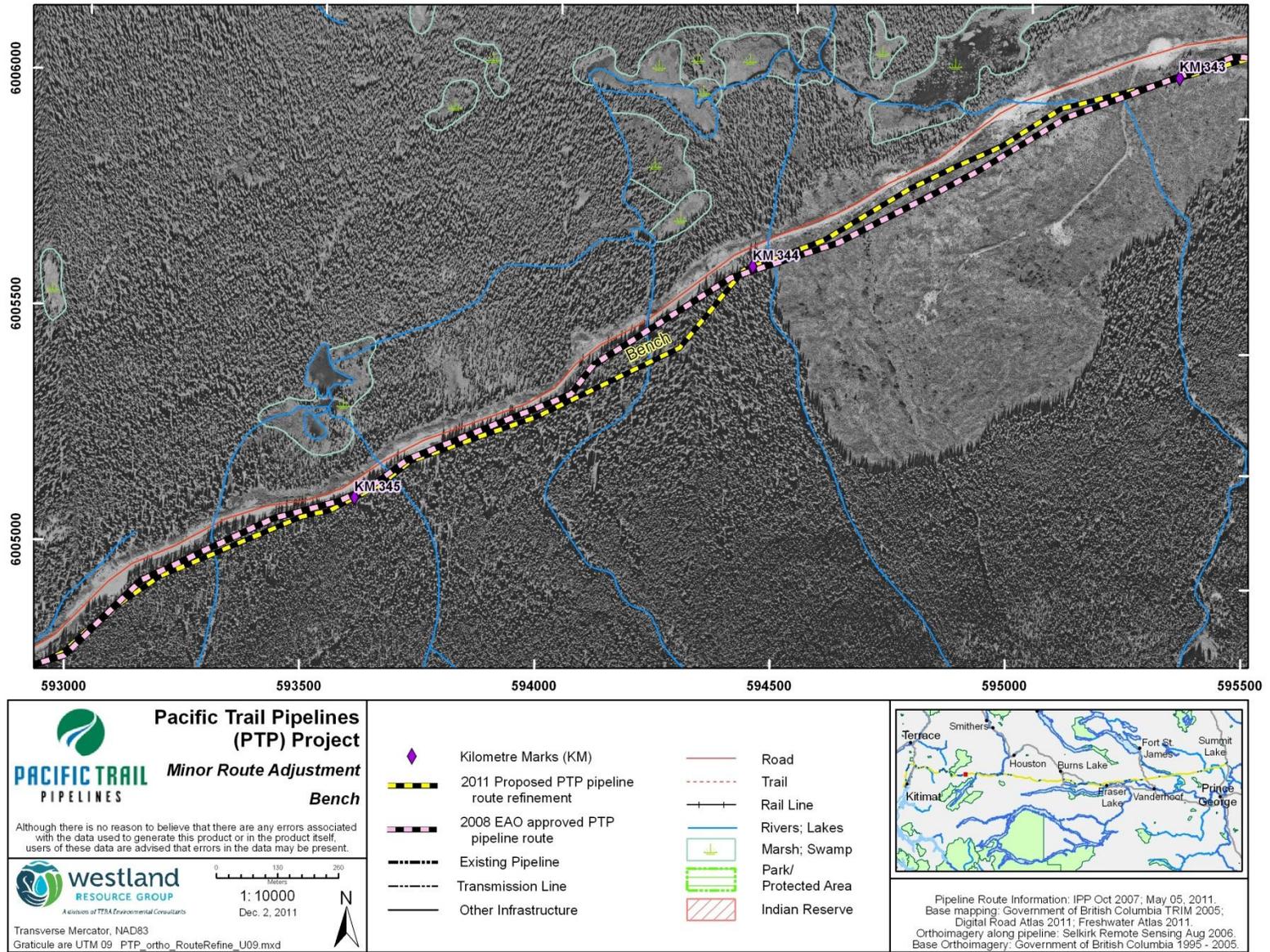
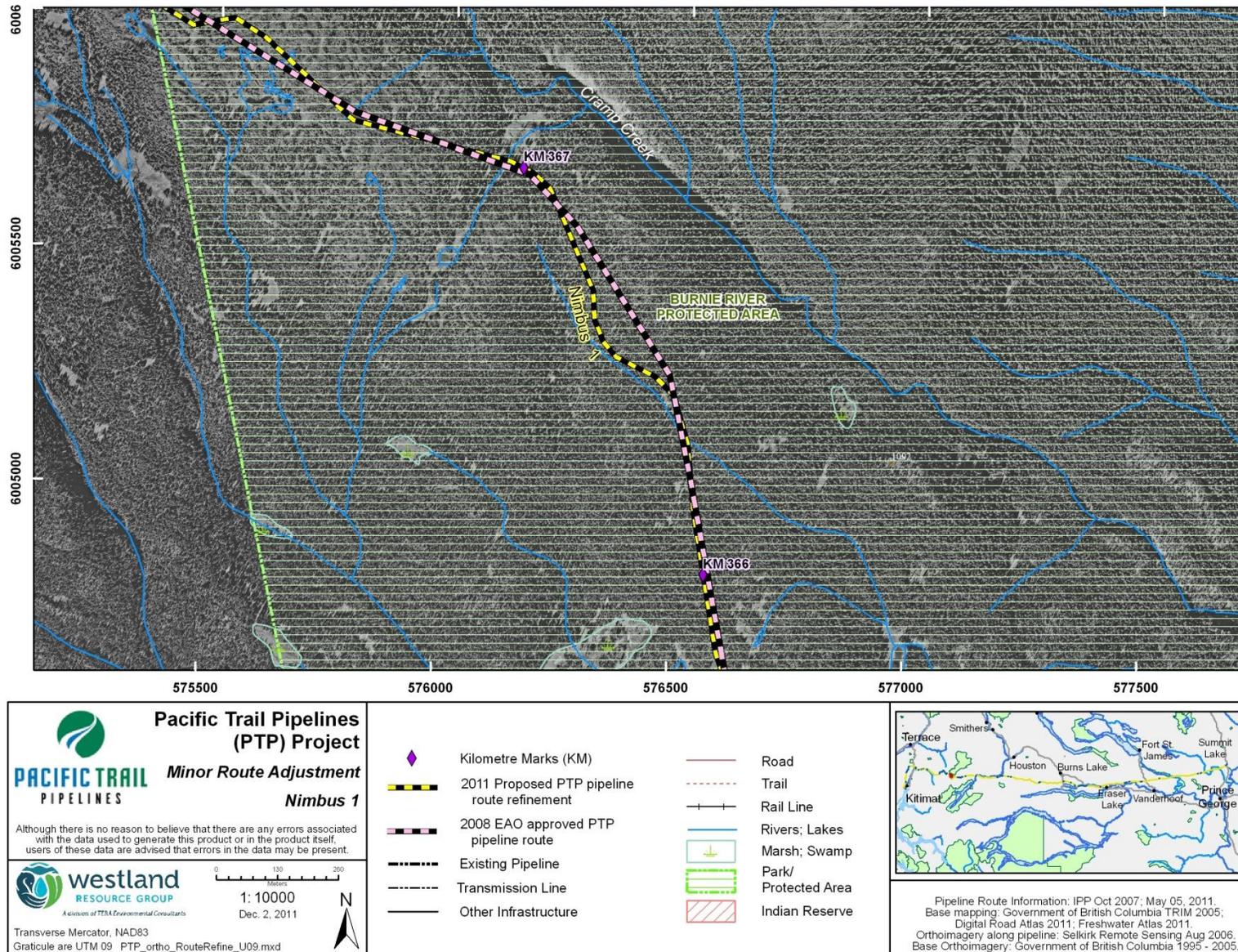


Figure 42. Bench Minor Route Adjustment (KM 344.1 to KM 344.4)



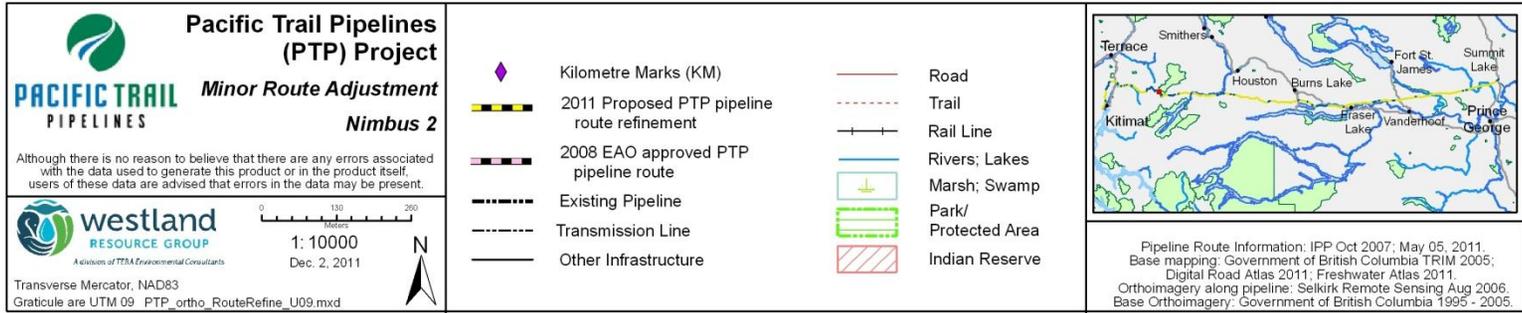
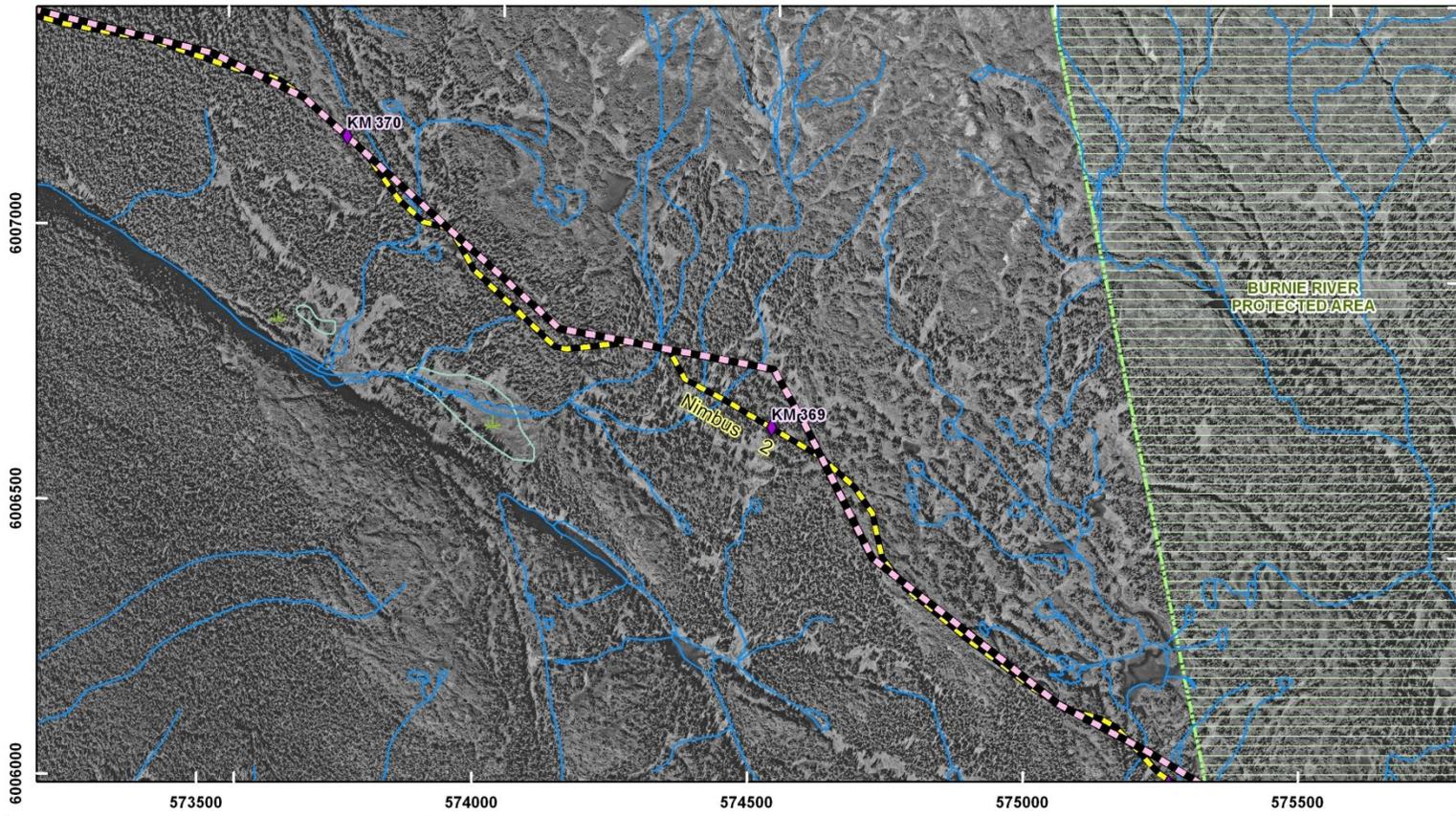


Figure 44. Nimbus 2 Minor Route Adjustment (KM 368.9 to KM 369.2)

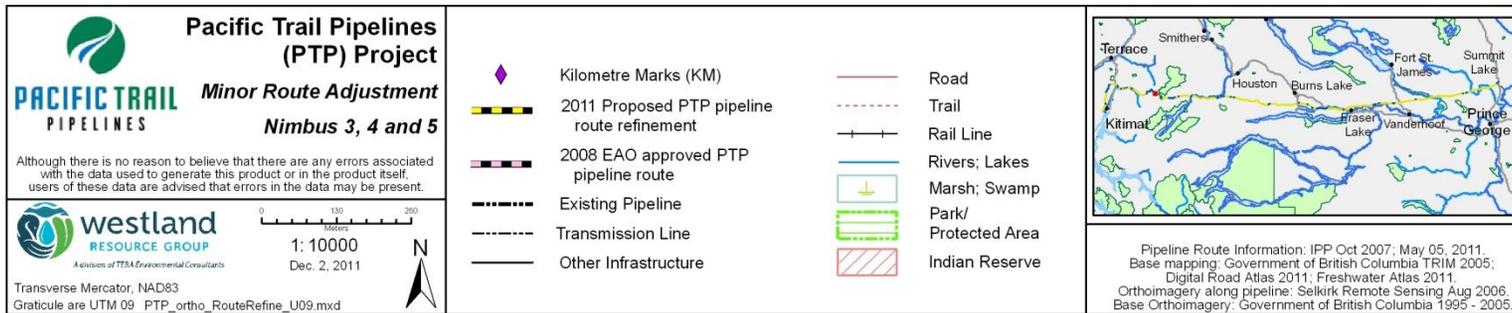
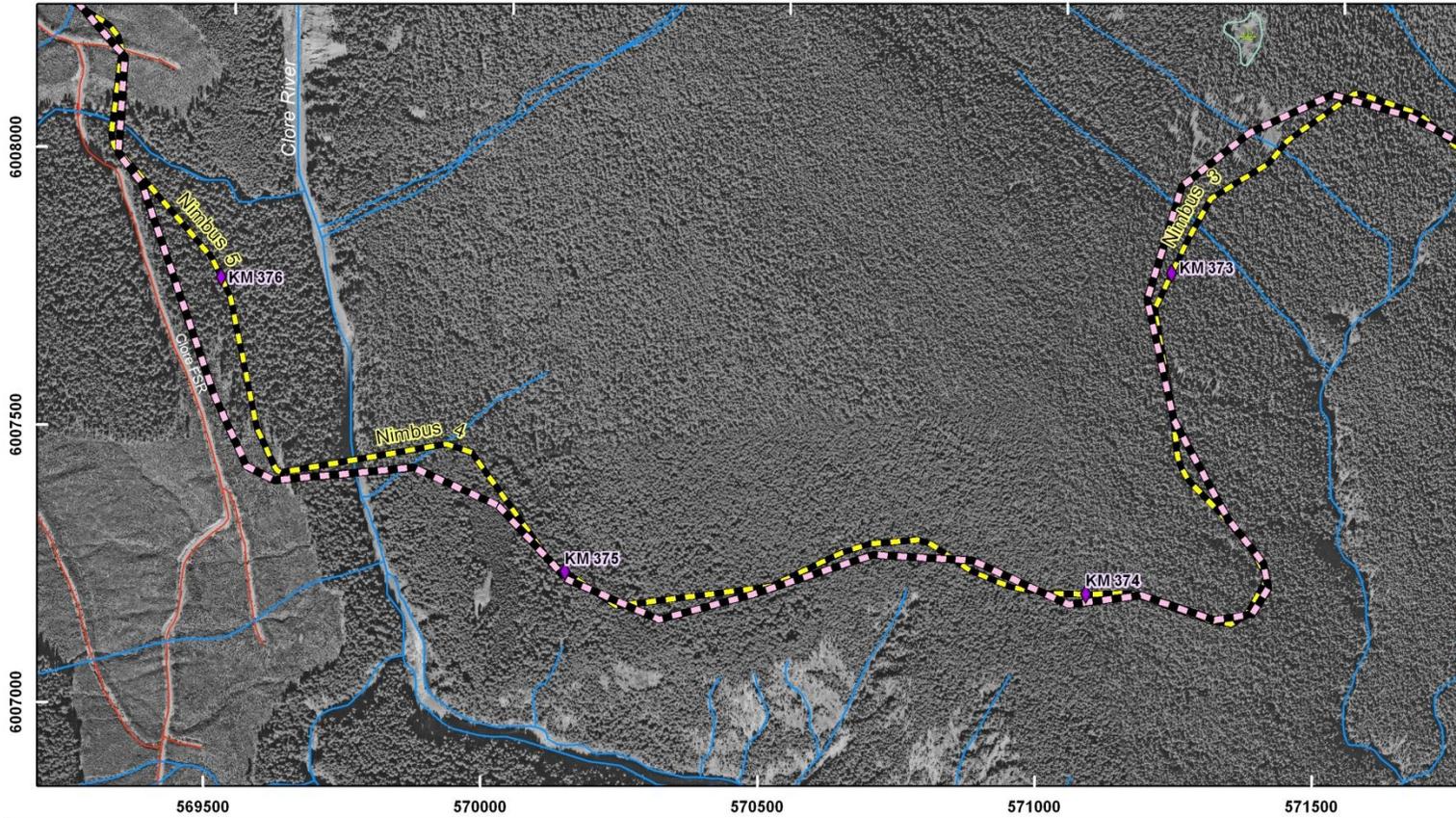


Figure 45. Nimbus 3 Minor Route Adjustment (KM 372.6 to KM 373.0)

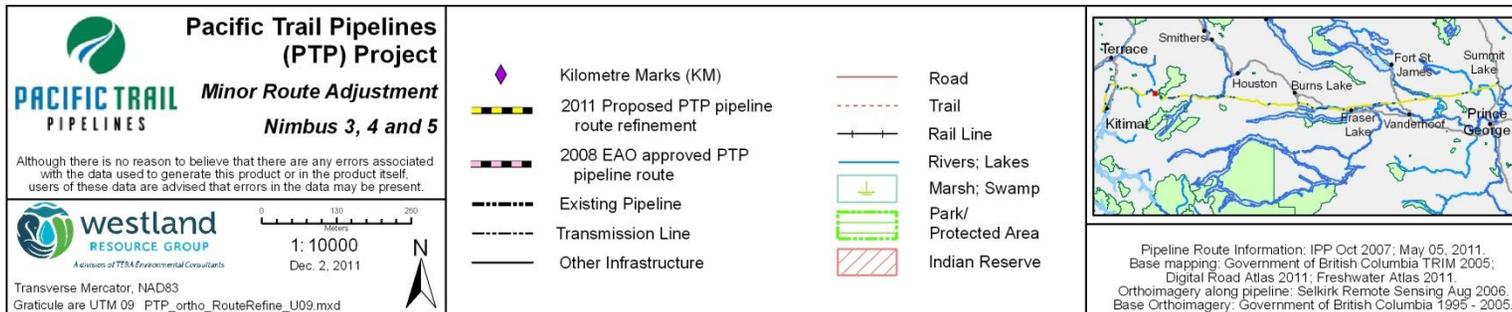
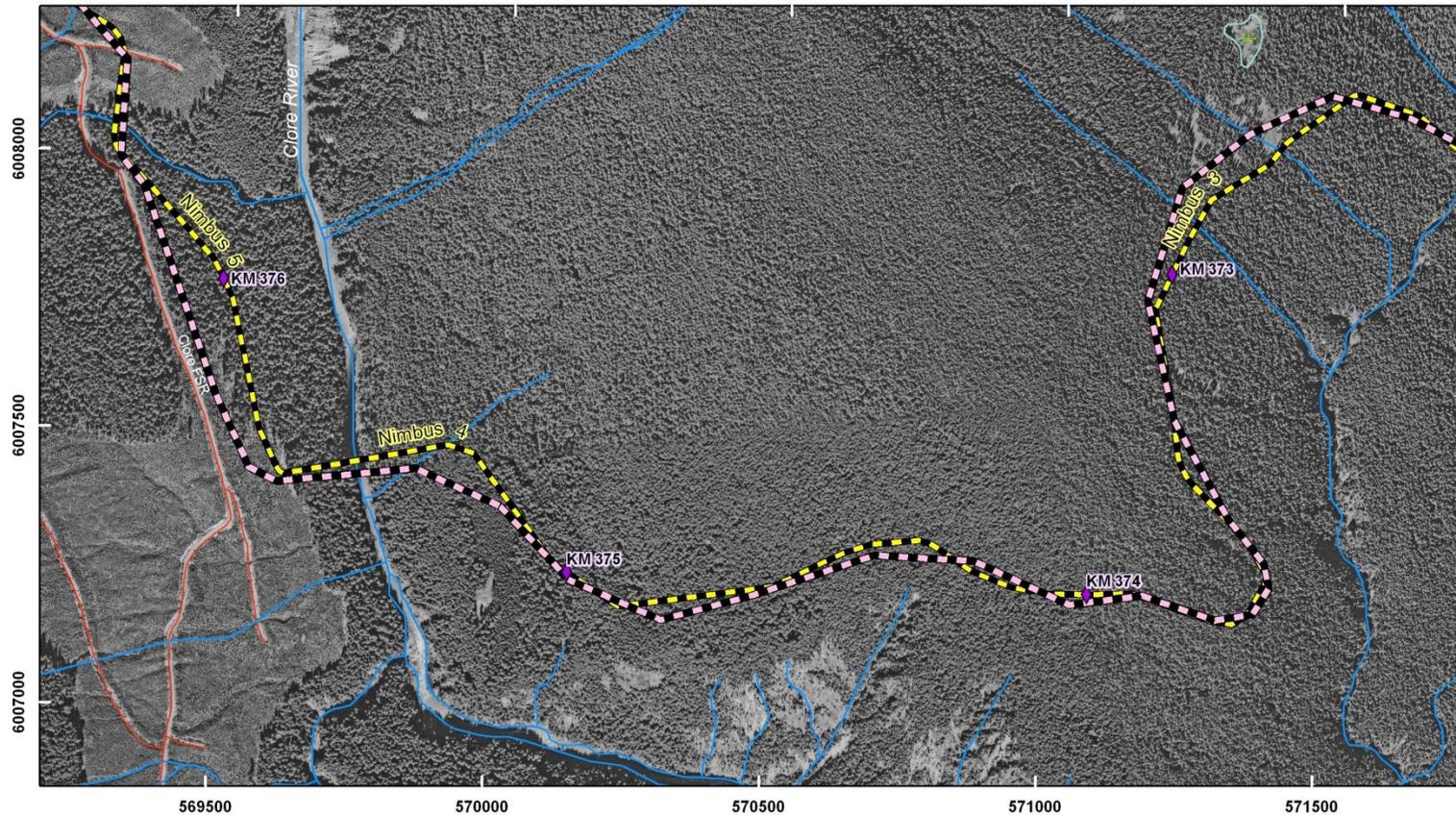


Figure 46. Nimbus 4 Minor Route Adjustment (KM 375.2 to KM 375.5)

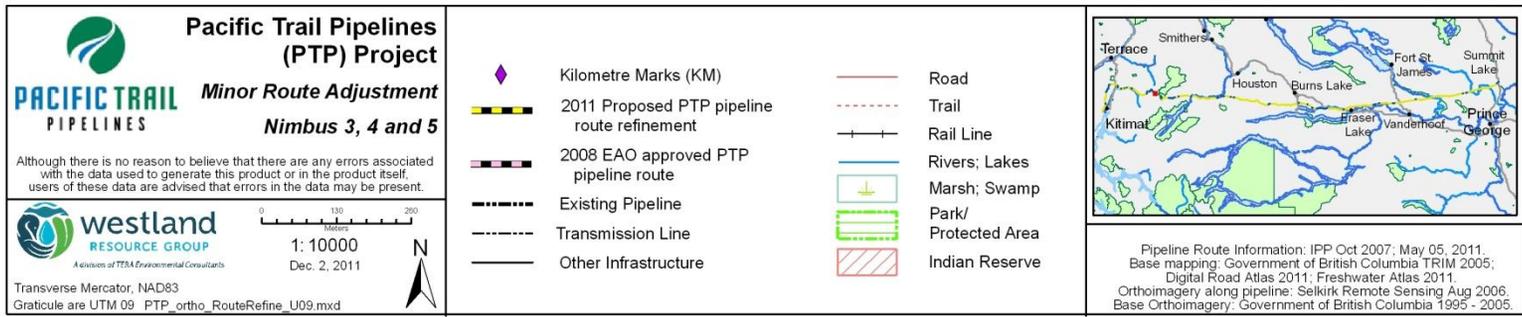
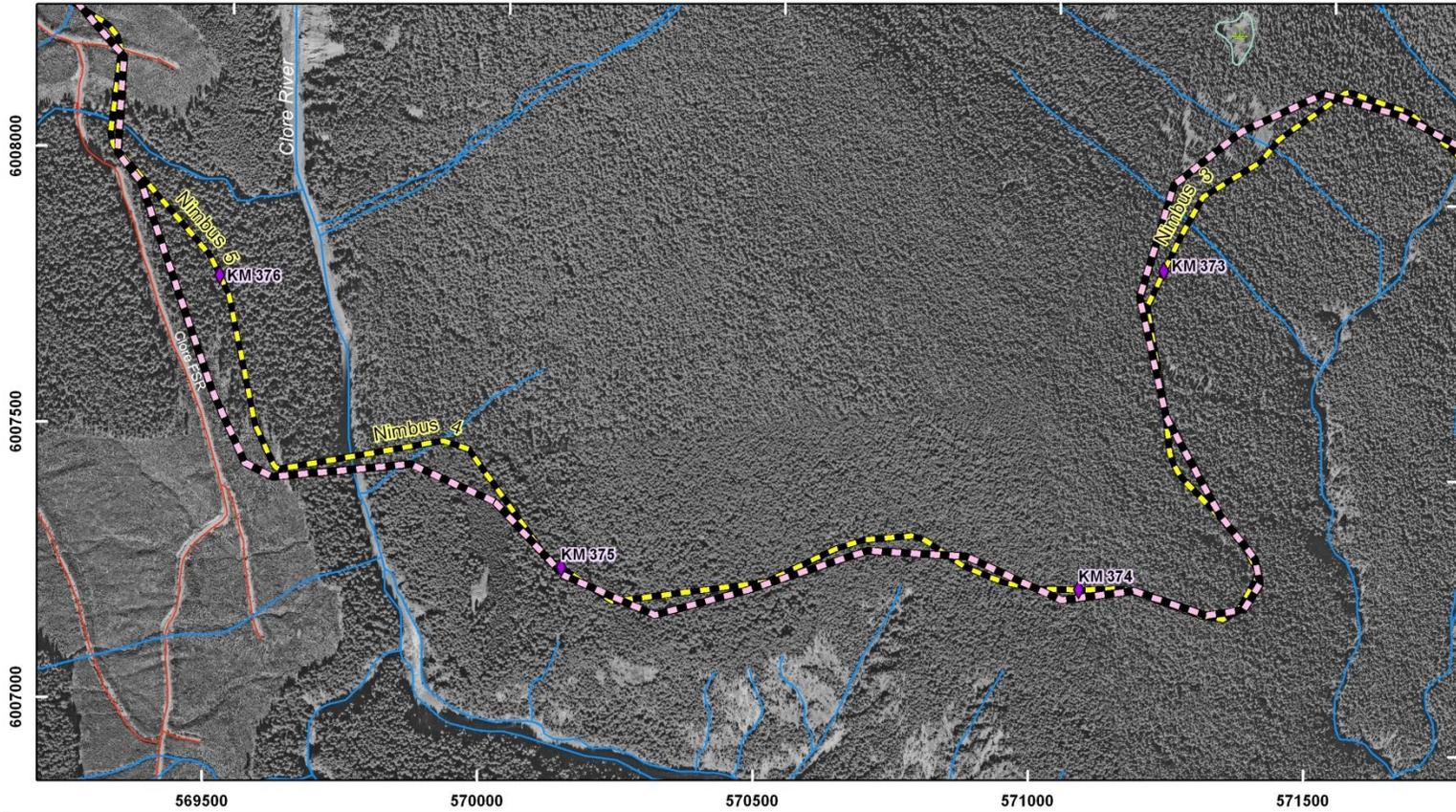


Figure 47. Nimbus 5 Minor Route Adjustment (KM 375.7 to KM 376.2)

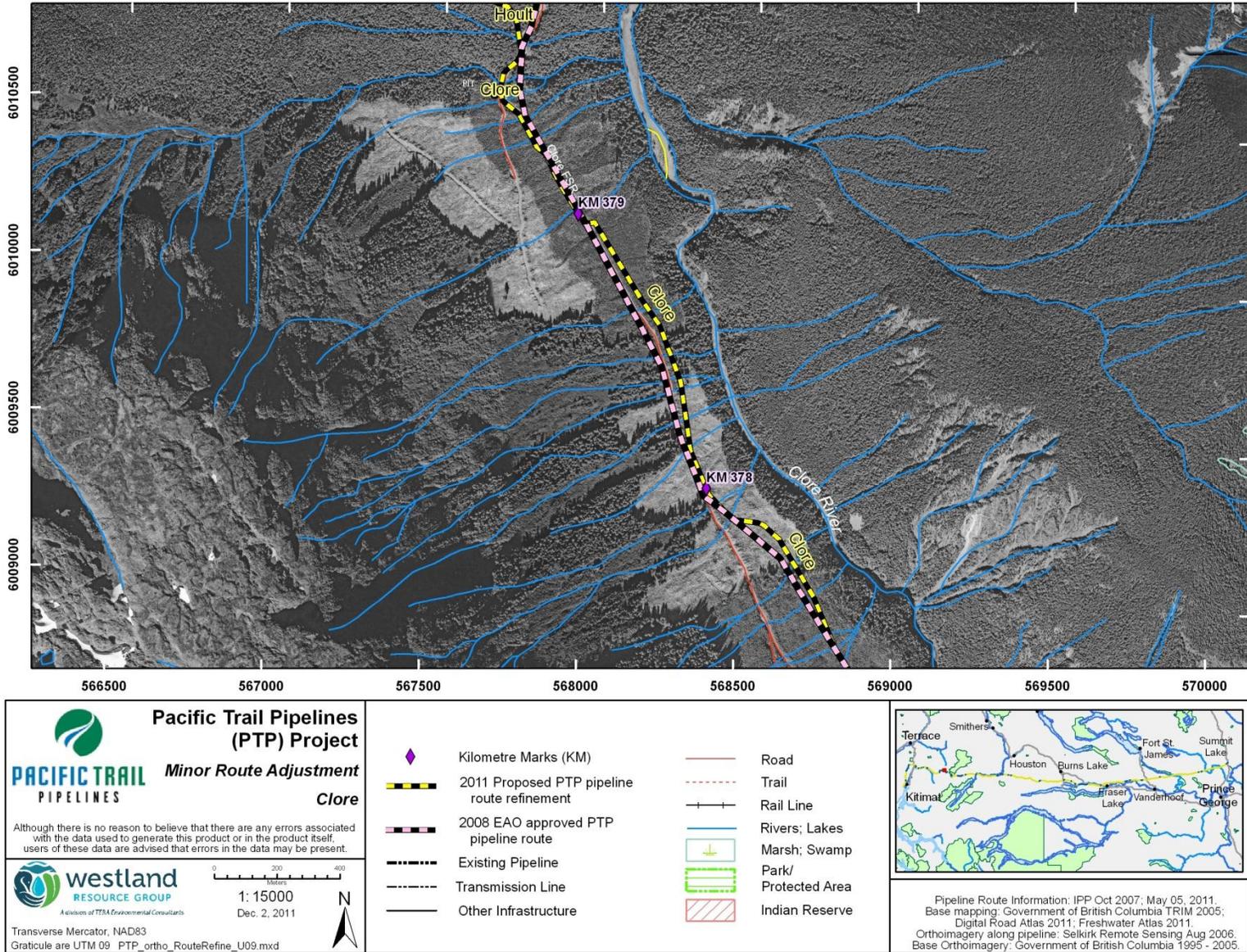


Figure 48. Clore Minor Route Adjustment (KM 377.5 to KM 379.5)

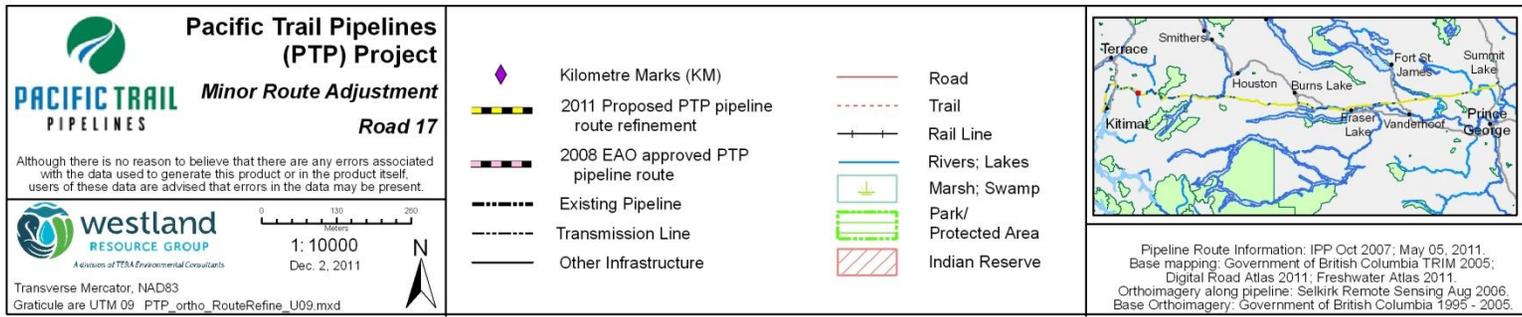
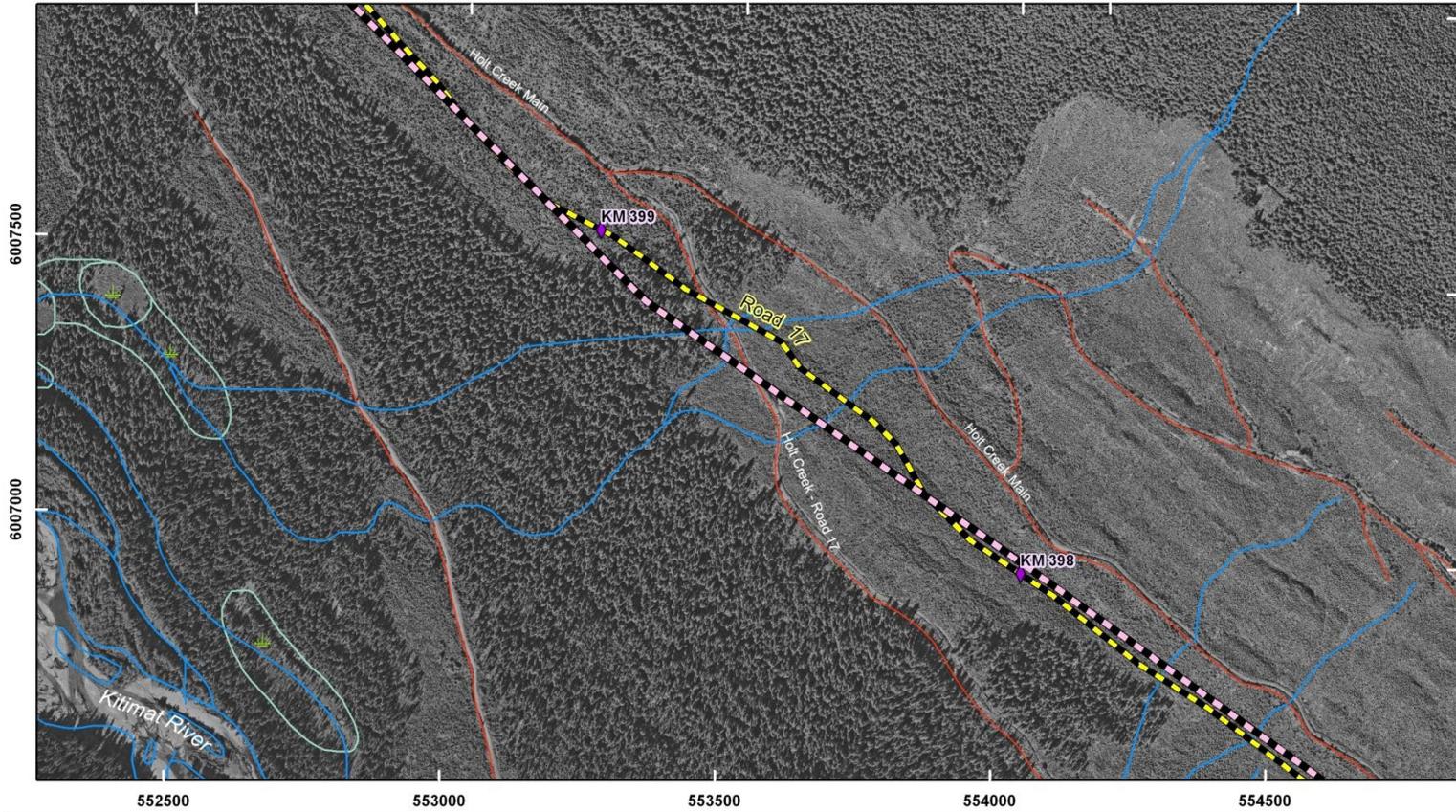


Figure 49. Road 17 Minor Route Adjustment (KM 398.3 to KM 399.0)

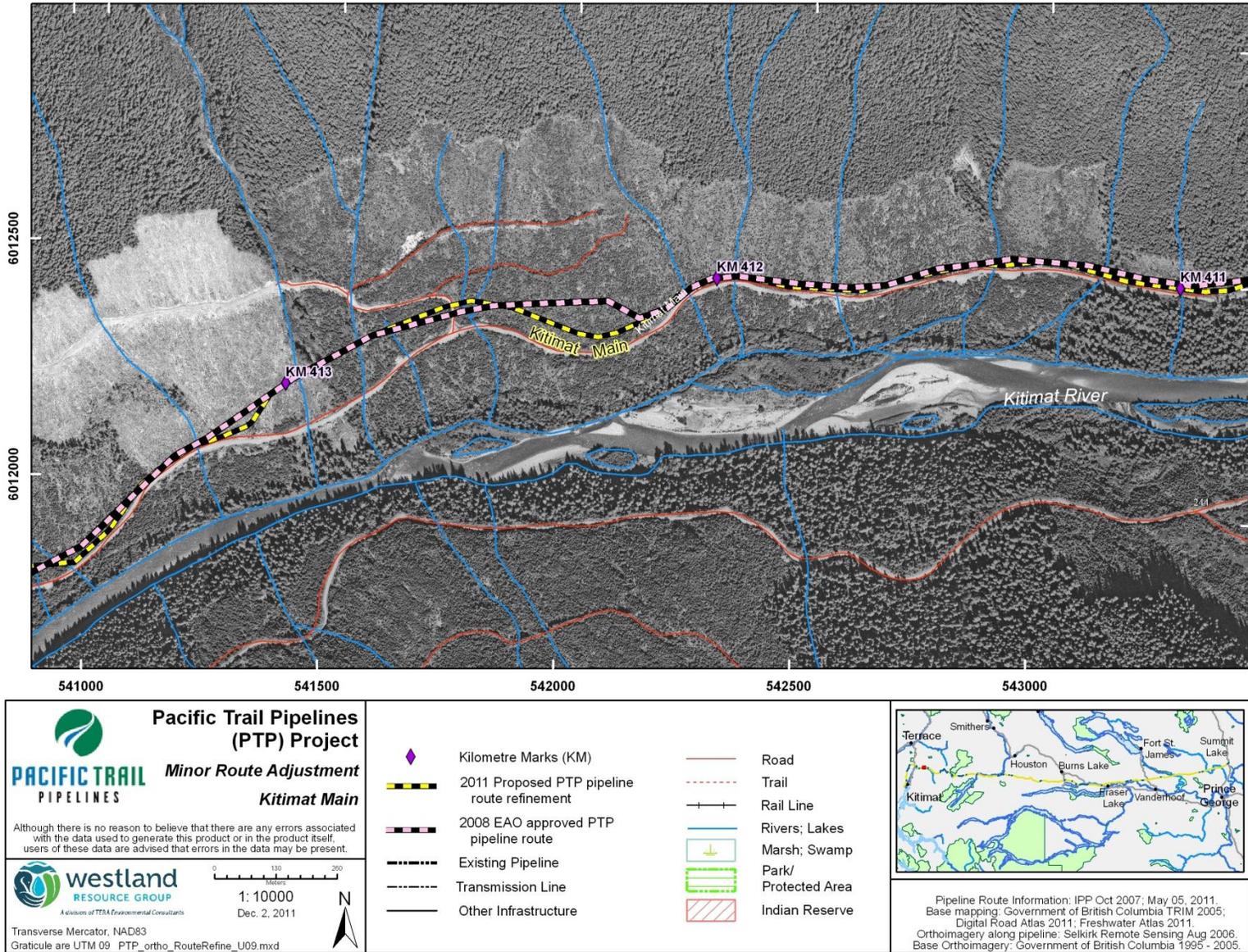


Figure 50. Kitimat main Minor Route Adjustment (KM 412.2 to KM 412.4)

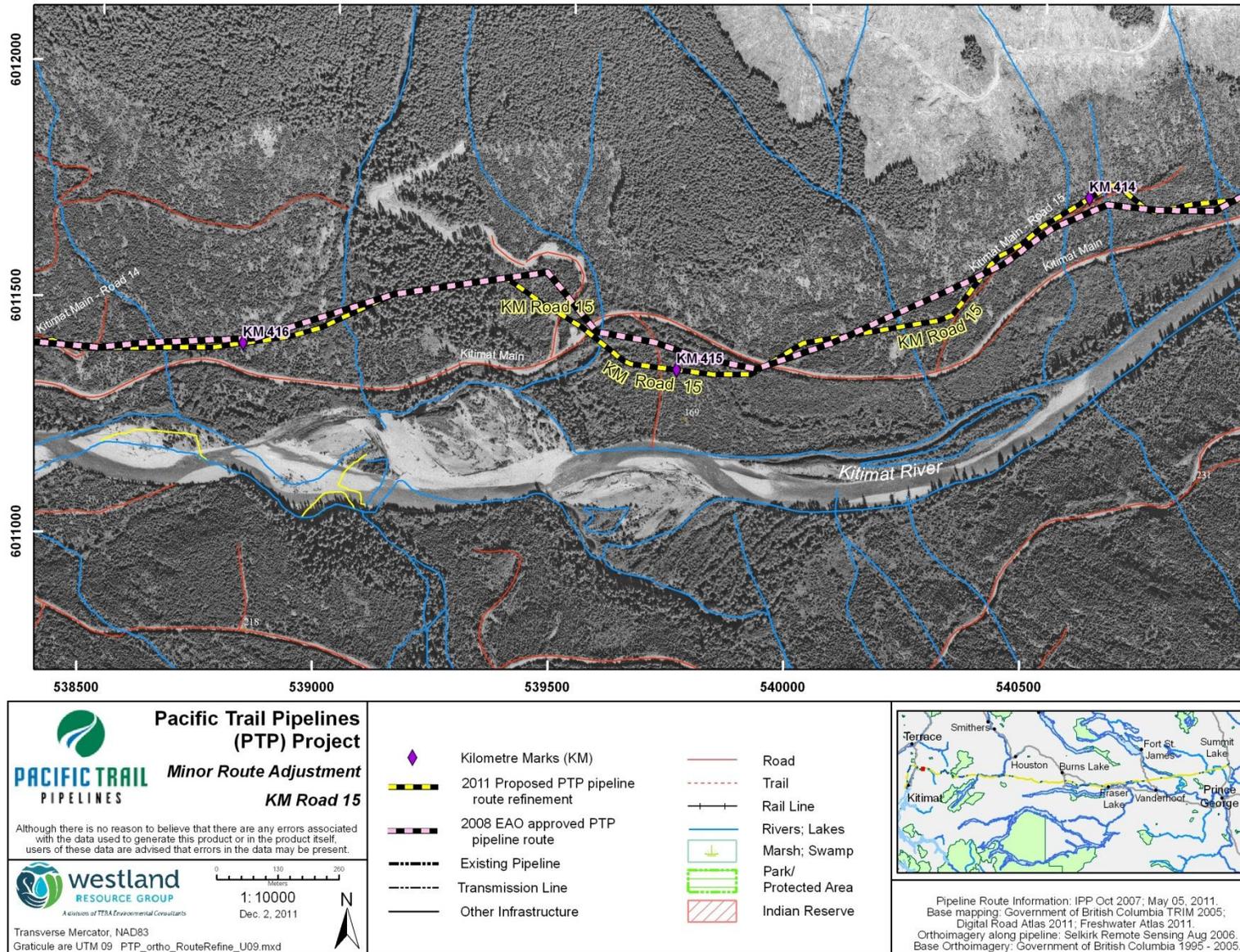
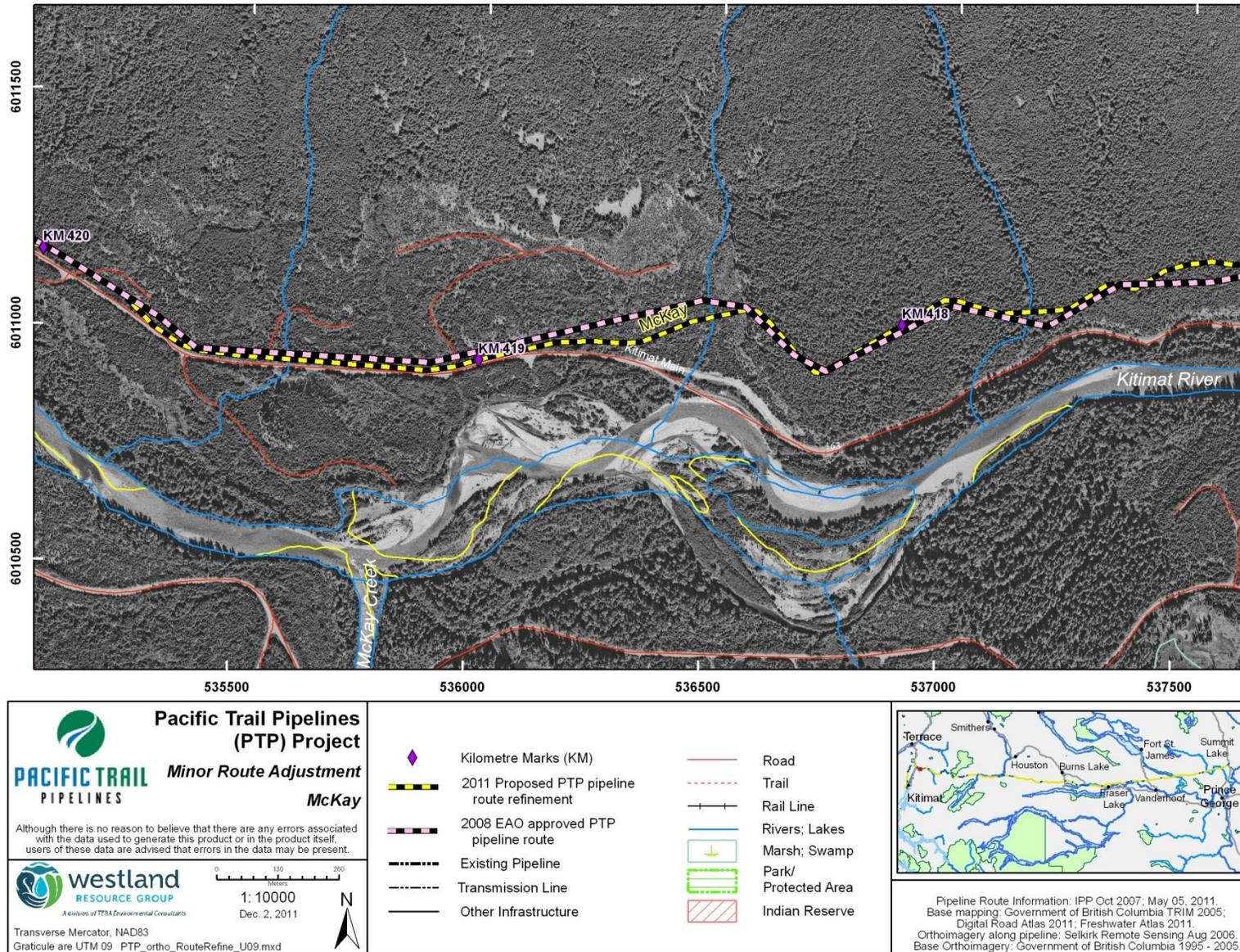


Figure 51. KM Road 15 Minor Route Adjustment (KM 415.3 to KM 415.4)



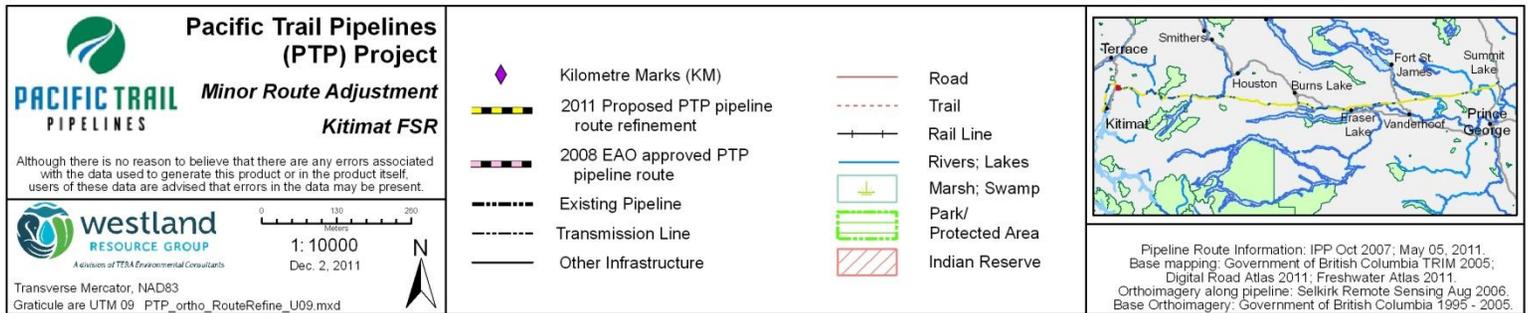
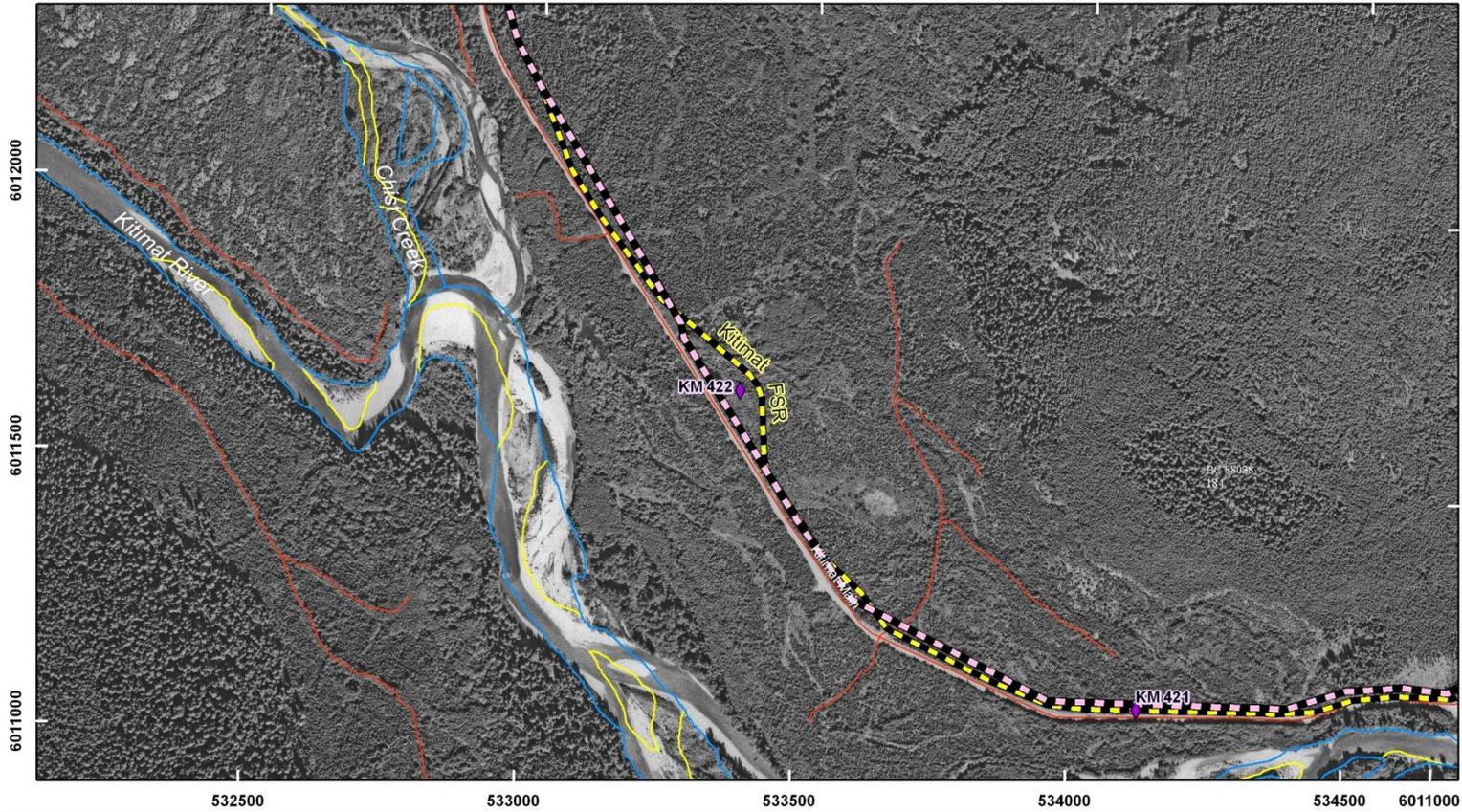


Figure 53. Kitimat FSR Minor Route Adjustment (KM 421.9 to KM 422.1)

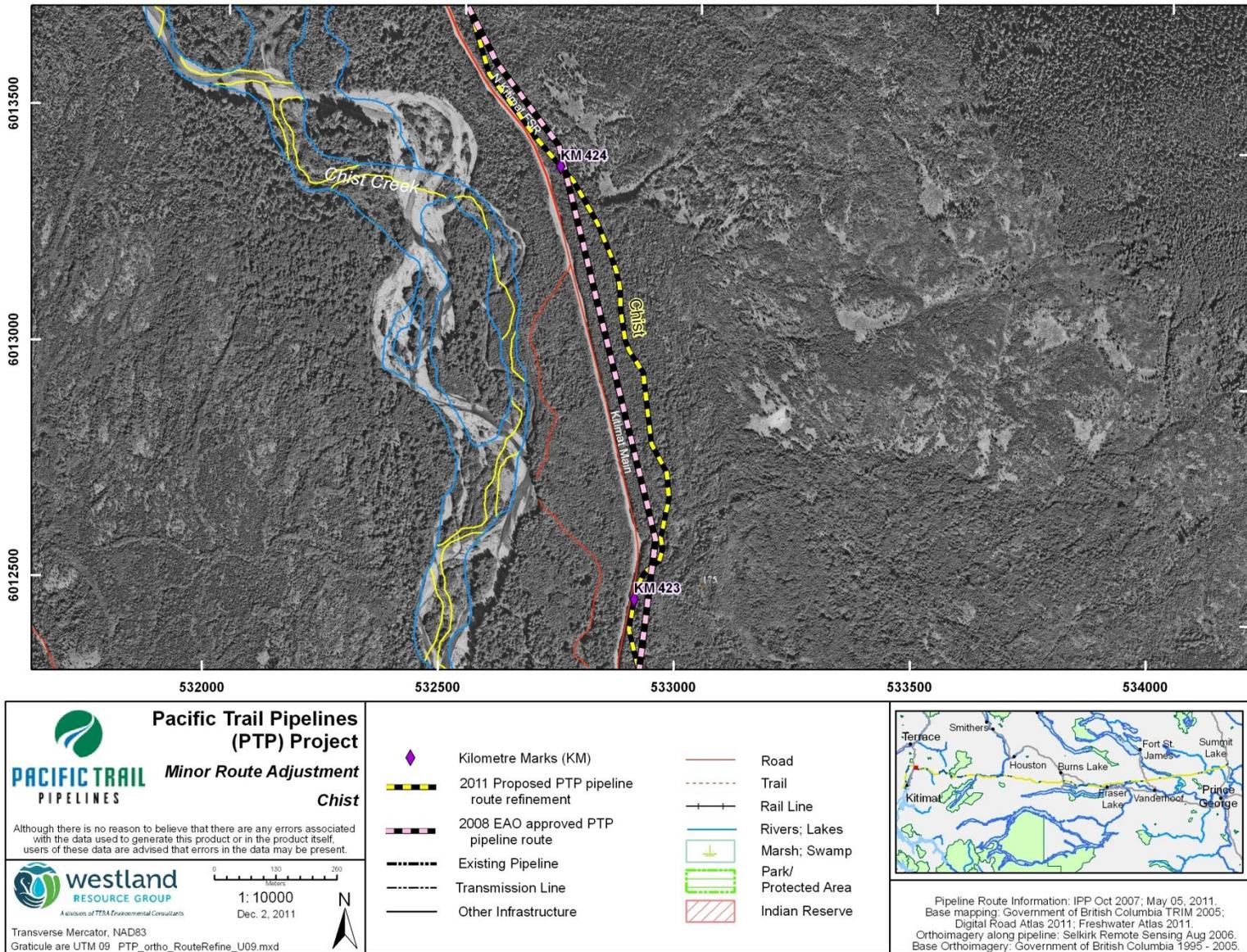


Figure 54. Chist Minor Route Adjustment (KM 423.2 to KM 424.3)

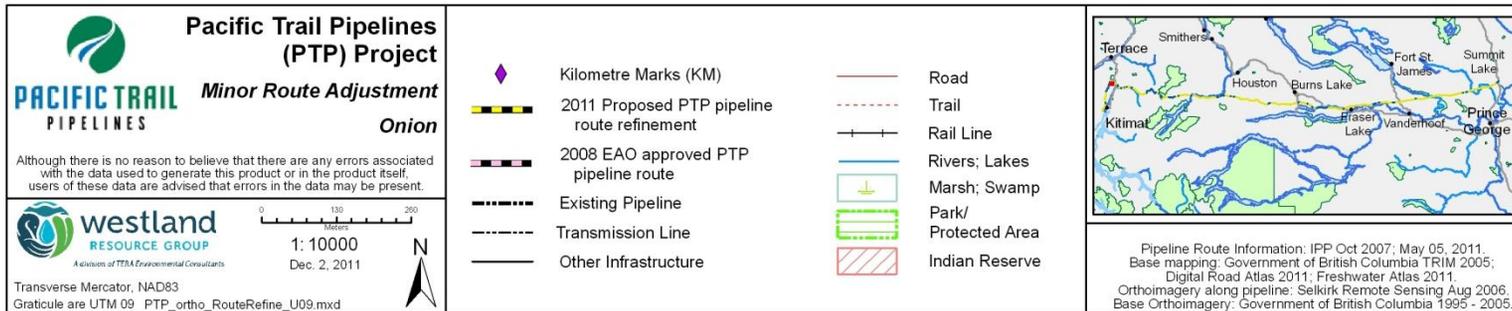
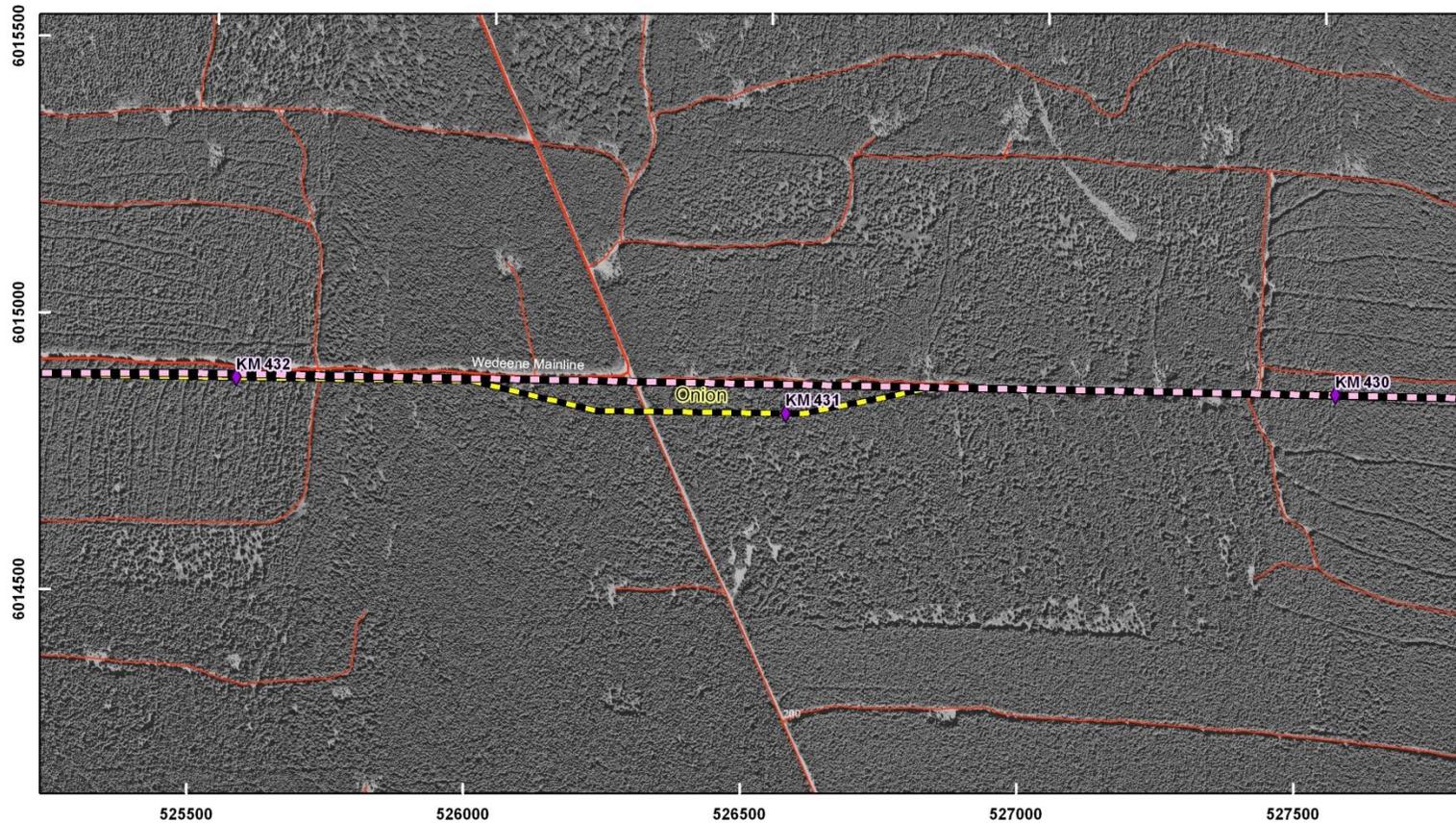


Figure 55. Onion Minor Route Adjustment (KM 430.8 to KM 431.5)

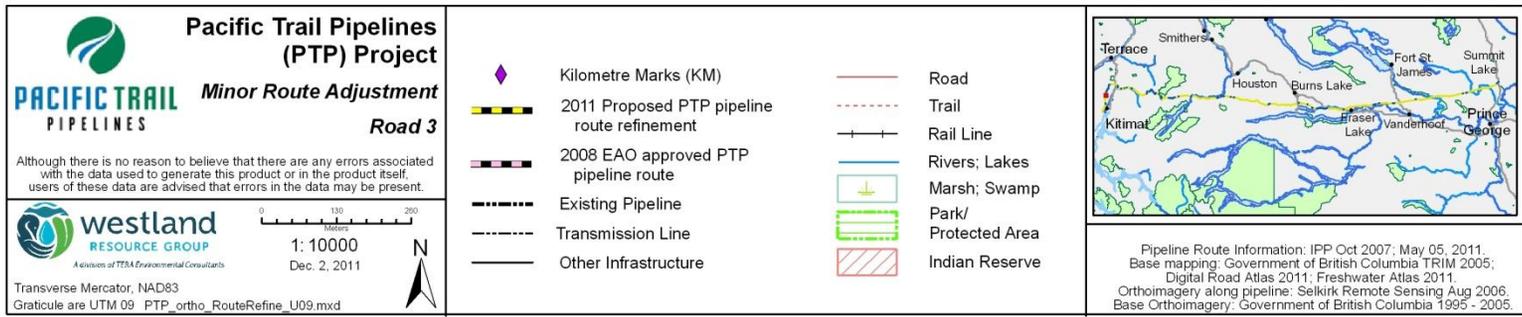
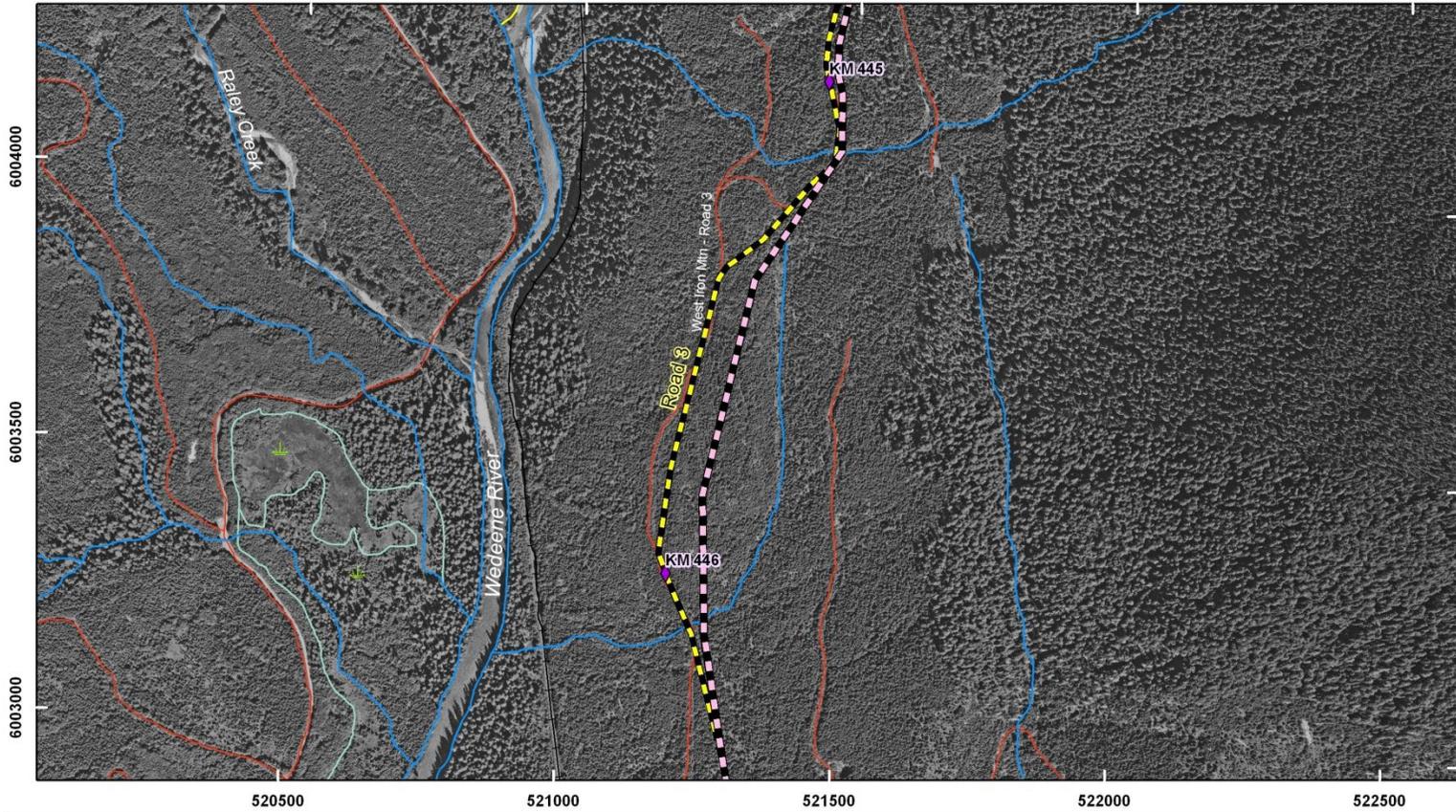


Figure 56. Road 3 Minor Route Adjustment (KM 445.3 to KM 446.1)

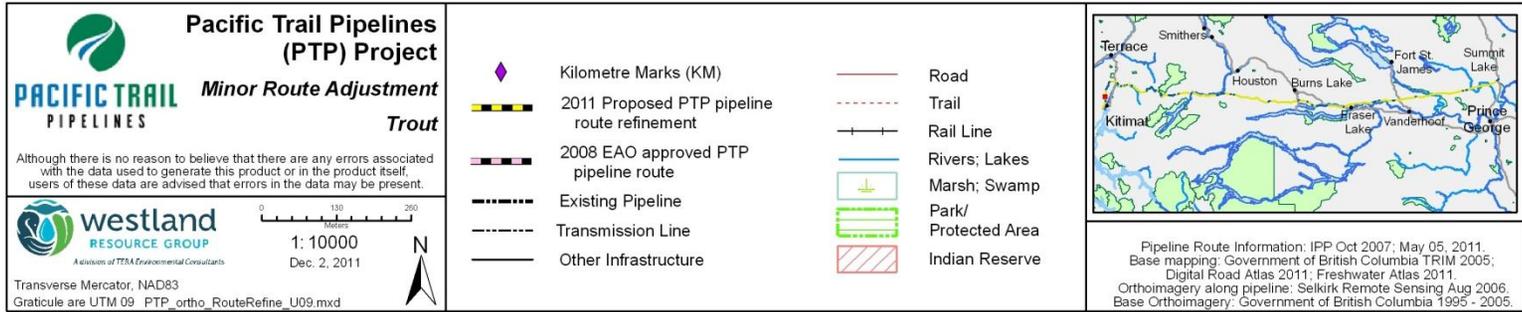
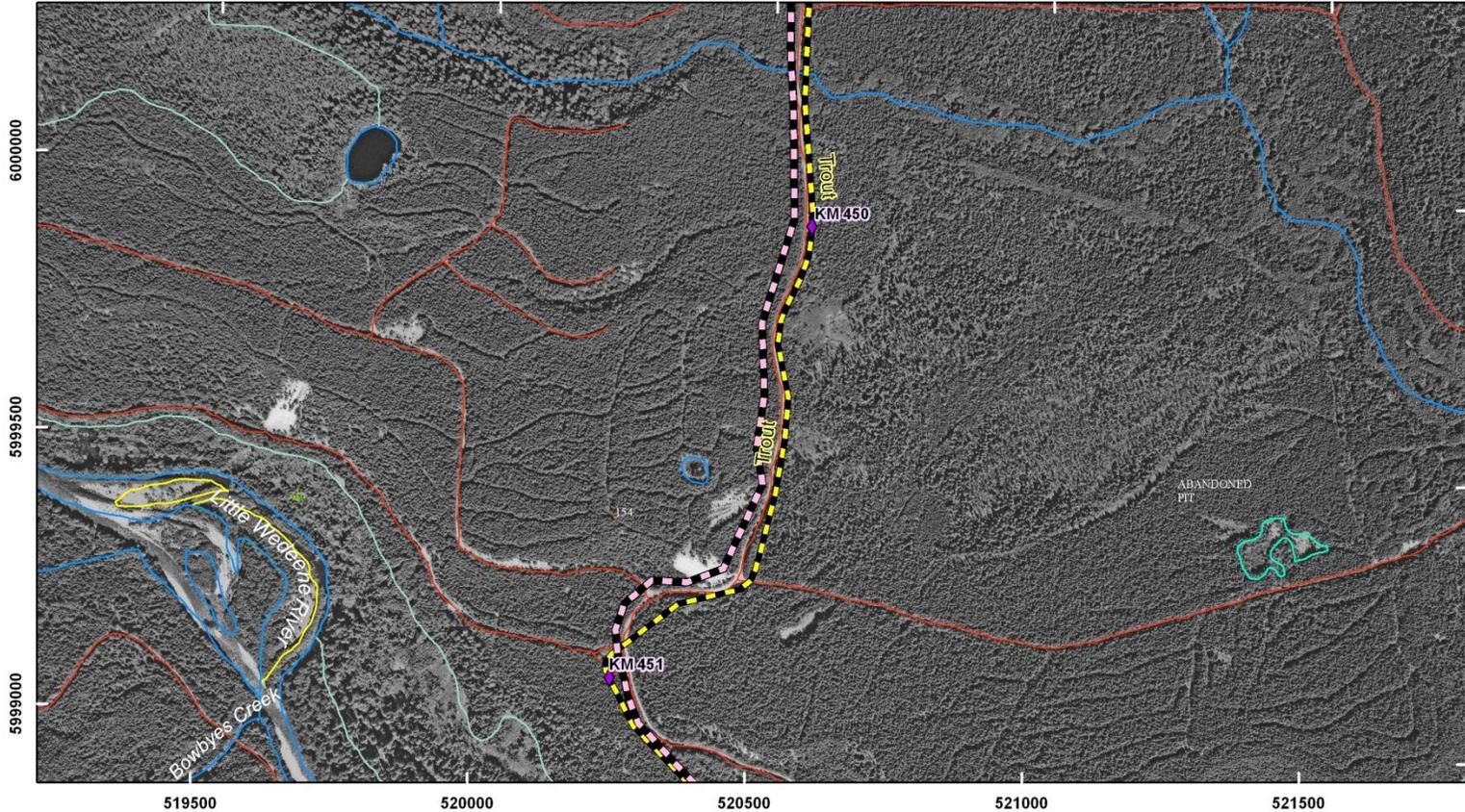


Figure 57. Trout Minor Route Adjustment (KM 449.8 to KM 450.9)

13.0 CUMULATIVE EFFECTS ASSESSMENT

A detailed cumulative effects assessment (CEA) was completed to evaluate changes to the environment that are caused by the Project in combination with other past, present and future human actions. The results of this CEA, presented in Section 8.0 of the 2007 EAC Application, will not be changed by the re-location of the Summit Lake compressor station, the addition of 2 temporary stockpile sites, the 20 route refinements, or the 27 minor route adjustments.

It is noteworthy that the 2007 CEA fulfilled the requirements of Section 16(1) (2) of the *Canadian Environmental Assessment Act (CEA Act)* and was used to provide the basis for the EAO and federal Responsible Authorities (RAs) to prepare the 2008 BC EA Report and the Canadian Environmental Assessment Agency (CEAA) screening report.

The 2007 CEA for the Project concluded that the most important adverse terrestrial, aquatic, and social cumulative effects in the regional study area are habitat alteration associated with mountain pine beetle infestation, salvage logging, and forest conversion for agricultural, residential, transportation, and industrial uses. Incremental increases due to the PTP Project, as originally proposed, and considering all the amendments applied for, will contribute to regional and sub-regional cumulative effects risk, however these PTP project-specific effects are comparatively small in extent.

The detailed air quality study conducted for the Summit Lake compressor station site in 2011, by RWDI Air Inc., provides information regarding the cumulative effects on ambient air quality from the Project and other sources in the local study area (Appendix F).

14.0 SUMMARY OF EFFECTS ASSESSMENT

All requested amendments have been field reviewed and assessed by the team of professionals who conducted the 2007 studies and prepared the PTP Environmental Assessment Certificate Application.

The 2011 requested amendments to the EAC No. E08-01 are:

- compressor station relocation from the Burns Lake area to Summit Lake.
- two (2) temporary stockpile sites (KM 298 and KM 426),
- twenty (20) route refinements, and
- twenty-seven (27) minor route adjustments.

The route refinements and minor route adjustments add approximately 1.1 km and 0.1 km, respectively, to the overall length of the pipeline route.

A “five pillars” approach to evaluating each requested amendment was used (Table 4) and impact assessment methods are consistent with those used for the 2007 EAC Application.

The requested amendments are all assessed to result in no material change to the assessment of a significant adverse effect and a total of 21 (45%) of the requested amendments are considered by the proponent to have a beneficial environmental or beneficial economic effect. No mitigable adverse effects were identified for the requested amendments. A summary of expected effects of the requested amendments, evaluated by effect assessment category, is presented in Table 9.

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Table 9. Summary of expected effects of the requested amendments evaluated by effect assessment category

Requested amendment	Location	Rationale for requested amendment	Assessment category*					Notes
			Environmental	Social	Economy	Heritage	Health	
Facility relocation								
Relocation of compressor station from Burns Lake area to Summit Lake	KM 0.1	Required to move natural gas from Summit Lake to Kitimat. (<i>i.e.</i> , change in flow direction).	Neutral	Neutral	Beneficial	Neutral	Neutral	Effects generally unchanged from original project assessment, however, increased construction and equipment costs are considered to be beneficial to the local, regional, and national economy.
Temporary stockpile sites								
Temporary stockpile site	KM 298	Required as a temporary pipe storage and equipment storage area during construction.	Neutral	Neutral	Neutral	Neutral	Neutral	Negligible effects expected following rehabilitation of site
Temporary stockpile site	KM 426	Required as a temporary pipe storage and equipment storage area during construction.	Neutral	Neutral	Neutral	Neutral	Neutral	Negligible effects expected following rehabilitation of site
Pipeline route refinement and minor route adjustment name								
Route refinements								
Thorps	KM 1.9 to KM 2.8	Route refinement to avoid new Summit Lake community sewage treatment facility.	Beneficial	Beneficial	Beneficial	Neutral	Beneficial	Route refinement is required to avoid conflict with newly constructed facility.
Crocker	KM 35.7 to KM 36.8	Route refinement to avoid wet area on north bank of Crocker Creek and minimize erosion risk.	Beneficial	Neutral	Neutral	Neutral	Neutral	Minimized erosion potential and no change in fish habitat potential at revised crossing location.

* NEUTRAL. No material change to the assessment of significant adverse effect.

BENEFICIAL. The requested amendment is expected to have a beneficial and advantageous effect compared to the approved project description. (Note: Increased construction and material costs are considered to be beneficial to the local, regional, and national economy.)

MITIGABLE ADVERSE EFFECT. The requested amendment may have an adverse effect compared to the original approved project description; however, this effect can be mitigated.

Requested amendment	Location	Rationale for requested amendment	Assessment category*					Notes
			Environmental	Social	Economy	Heritage	Health	
Road 51.5	KM 89.4 to KM 89.8	Route refinement to remain adjacent to PNG ROW.	Neutral	Neutral	Neutral	Neutral	Neutral	No change in fish habitat potential at revised crossing location.
Layton	KM 111.8 to KM 113.8	Route refinement to avoid a private residence on south side of PNG ROW.	Neutral	Beneficial	Beneficial	Neutral	Neutral	Residence avoided by requested amendment.
Nine Mile cabin	KM 127.3 to KM 128.6	Route refinement to comply with landowner request to avoid new cabin and remain adjacent to PNG ROW. New align also improves crossing of Nine Mile Creek.	Neutral	Beneficial	Beneficial	Neutral	Neutral	New cabin avoided by requested amendment and no change in fish habitat potential at revised crossing location.
Dog Creek FSR	KM 130.8 to KM 134.0	Route refinement to north side PNG ROW to avoid drainage and to parallel creek channel. Landowner request to increase offset from residence.	Beneficial	Beneficial	Beneficial	Neutral	Neutral	Offset from residence will be increased and requested amendment will improve drainage management. No change in fish habitat potential at revised crossing location.
Sub-Station	KM 165.5 to KM 166.3	Route refinement to move outside of BC Hydro sub-station property.	Neutral	Beneficial	Beneficial	Neutral	Neutral	BC Hydro substation property avoided.
Road 51.4	KM 198.3 to KM 198.9	Route refinement to avoid steep side slope.	Beneficial	Neutral	Neutral	Neutral	Neutral	No change in fish habitat potential at revised crossing location.
Seven Mile FSR	KM 214.3 to KM 215.2	Route refinement to avoid wetland complex.	Beneficial	Neutral	Neutral	Neutral	Neutral	Wetland avoided.
Buck	KM 277.3 to KM 278.1	Route refinement to avoid geotechnical hazard and follow existing logging road.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazard will be avoided.
Owen	KM 295.2 to KM 299.3	Route refinement to avoid relic slide (geohazard) and unstable slope near Owen Creek.	Beneficial	Neutral	Neutral	Neutral	Neutral	Reduced erosion potential. No change in fish habitat potential at revised crossing locations.
Fenton	KM 301.7 to KM 303.8	Route refinement to avoid geotechnical hazards.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazard will be avoided.

Requested amendment	Location	Rationale for requested amendment	Assessment category*					Notes
			Environmental	Social	Economy	Heritage	Health	
Gosnell	KM 348.5 to KM 354.6	Route refinement to improve location for Gosnell Creek crossing, improve feasibility for use of horizontal directional drilling techniques, and avoid crossing two side channels.	Beneficial	Neutral	Neutral	Neutral	Neutral	Improved crossing location from a fisheries perspective and side-channel fish habitat potential along Gosnell Creek avoided at revised crossing location.
Burnie	KM 364.2 to KM 365.5	Route refinement to avoid slope stability concerns west of the Burnie River.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazards minimized.
Hoult	KM 379.7 to KM 389.4	Route refinement to avoid slope stability concerns.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazards minimized.
Floodplain	KM 402.4 to KM 403.2	Route refinement requested by Kitselas First Nation to move pipeline route to upper side of Kitimat FSR, farther from Kitimat River side channel.	Beneficial	Neutral	Beneficial	Neutral	Neutral	Reduced riparian habitat impacts and avoids important grizzly bear habitat south of Kitimat Forest Service Road.
Ursus	KM 406.6 to KM 407.7	Route refinement request by Kitselas First Nation to avoid grizzly bear habitat in riparian area.	Beneficial	Neutral	Beneficial	Neutral	Neutral	Reduced riparian habitat impacts and avoids important grizzly bear habitat south of Kitimat Forest Service Road.
Cecil	KM 433.2 to KM 439.0	Route refinement to avoid marine clay and forestry sample plots.	Neutral	Beneficial	Neutral	Neutral	Neutral	Avoids forestry plot. No change in fish habitat potential at revised crossing location.
Iron Mountain	KM 440.5 to KM 442.3	Route refinement to avoid marine clay geohazards.	Beneficial	Neutral	Neutral	Neutral	Neutral	One fewer fish-bearing watercourse to be crossed along route refinement.
Clay	KM 454.5 to KM 455.7	Route refinement to avoid marine clay geohazards.	Neutral	Neutral	Neutral	Neutral	Neutral	No change in fish habitat potential at revised crossing location.
Minor route adjustments								
Miller	KM 0.3 to KM 0.5	Minor route adjustment to improve drainage management near PNG ROW and new Summit Lake compressor station.	Neutral	Neutral	Neutral	Neutral	Neutral	No change in fish habitat potential at revised crossing location.

Requested amendment	Location	Rationale for requested amendment	Assessment category*					Notes
			Environmental	Social	Economy	Heritage	Health	
Echo	KM 8.5 to KM 10.3	Minor route adjustment to avoid a creek and wetland adjacent to the south side of the PNG ROW. Route adjustment also improves constructability by minimizing grading on steep side slope.	Neutral	Neutral	Neutral	Neutral	Neutral	Improved drainage management.
Salmon	KM 21.7 to KM 21.8	Minor route adjustment to minimize drainage concerns.	Beneficial	Neutral	Neutral	Neutral	Neutral	Improved drainage management.
Chief Lake FSR	KM 39.6 to KM 40.1	Minor route adjustment to avoid road side drainages.	Beneficial	Neutral	Neutral	Neutral	Neutral	Improved drainage management
Davidson	KM 75.1 to KM 76.5	Minor route adjustment to increase separation from a small waterbody located on the north side of the PNG ROW.	Neutral	Neutral	Neutral	Neutral	Neutral	No impact to small water body anticipated on the approved route or the route refinement.
Baker	KM 204.8 to KM 205.2	Minor route adjustment to abut nearby road and reduce impacts on creek bank.	Beneficial	Neutral	Neutral	Neutral	Neutral	Reduced erosion potential and no change in fish habitat potential at revised crossing location.
Outcrop	KM 207.8 to KM 208.1	Minor route adjustment to avoid geotechnical hazards.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazard will be avoided.
Allin	KM 245.3 to KM 246.6	Minor route adjustment to avoid geotechnical hazards.	Neutral	Neutral	Neutral	Neutral	Neutral	No change in fish habitat potential at revised crossing location.
Sam	KM 263.6 to KM 263.9	Minor route adjustment to avoid geotechnical hazard and follow existing logging road.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazard will be avoided.
Parrott	KM 284.5 to KM 285.4	Minor route adjustment to avoid extreme side slope and drainage.	Neutral	Neutral	Neutral	Neutral	Neutral	No change in fish habitat potential at revised crossing location.
Morice	KM 330.2 to KM 330.6	Minor route adjustment to avoid geotechnical hazards.	Neutral	Neutral	Neutral	Neutral	Neutral	No change in fish habitat potential at revised crossing location.

Requested amendment	Location	Rationale for requested amendment	Assessment category*					Notes
			Environmental	Social	Economy	Heritage	Health	
Bench	KM 344.1 to KM 344.4	Minor route adjustment to avoid geotechnical hazards.	Neutral	Neutral	Neutral	Neutral	Neutral	No change in fish habitat potential at revised crossing location.
Nimbus 1	KM 366.4 to KM 376.2	Minor route adjustment to minimize grade and address slope stability concerns.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazard will be avoided.
Nimbus 2	KM 368.9 to KM 369.2	Minor route adjustment to minimize grade and address slope stability concerns.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazard will be avoided.
Nimbus 3	KM 372.6 to KM 373.0	Minor route adjustment to minimize grade and address slope stability concerns.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazard will be avoided.
Nimbus 4	KM 375.2 to KM 375.5	Minor route adjustment to minimize grade and address slope stability concerns.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazard will be avoided.
Nimbus 5	KM 375.7 to KM 376.2	Minor route adjustment to minimize grade and address slope stability concerns.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazard will be avoided.
Clore	KM 377.5 to KM 379.5	Minor route adjustment to avoid slope stability concerns.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazard will be avoided.
Road 17	KM 398.3 to KM 399.0	Minor route adjustment to minimize grade and improve construction safety.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazard will be avoided.
Kitimat main	KM 412.2 to KM 412.4	Minor route adjustment to avoid extreme side slope.	Neutral	Neutral	Neutral	Neutral	Neutral	Geohazard will be avoided.
KM Road 15	KM 415.3 to KM 415.4	Minor route adjustment to avoid geotechnical and drainage concerns.	Neutral	Neutral	Neutral	Neutral	Neutral	Improved drainage management and geohazard will be avoided.
McKay	KM 418.5 to KM 418.8	Minor route adjustment to avoid geotechnical hazards.	Neutral	Neutral	Neutral	Neutral	Neutral	No change in fish habitat potential at revised crossing location.
Kitimat FSR	KM 421.9 to KM 422.1	Minor route adjustment to avoid a wetland adjacent to the Kitimat FSR.	Beneficial	Neutral	Neutral	Neutral	Neutral	Fish bearing wetland area avoided by minor route adjustment.

Requested amendment	Location	Rationale for requested amendment	Assessment category*					Notes
			Environmental	Social	Economy	Heritage	Health	
Chist	KM 423.2 to KM 424.3	Minor route adjustment to move out of intermittent drainage and avoid marine clay concerns.	Beneficial	Neutral	Neutral	Neutral	Neutral	Improved drainage management and no change in fish habitat potential at revised crossing location.
Onion	KM 430.8 to KM 431.5	Minor route adjustment to avoid forestry sample plot.	Neutral	Beneficial	Neutral	Neutral	Neutral	Forest research plot avoided.
Road 3	KM 445.3 to KM 446.1	Minor route adjustments to avoid geotechnical hazards, improve construction safety, and use an existing logging route.	Neutral	Neutral	Neutral	Neutral	Neutral	Improved safety and geohazard will be avoided.
Trout	KM 449.8 to KM 450.9	Minor route adjustment to avoid geotechnical hazards and improve construction safety.	Neutral	Neutral	Neutral	Neutral	Neutral	Improved safety and geohazard will be avoided.

15.0 REFERENCES

- BGC. (2011). Geotechnical field reconnaissance of the Summit Lake compressor station site (KM 0.6 – proposed Pacific Trails Pipeline). Letter report to PTP and Integrated Pipeline Projects Canada Inc.
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- Pacific Trail Pipelines (PTP). (2011a). Environmental Management Plan, September 8, Rev. 3.0.
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- Pacific Trail Pipelines (PTP). (2011c). Environmental Management Plan, September, 2011.
- Pacific Trail Pipelines Looping Project (PTPLP). (2007). *Application for an Environmental Assessment Certificate for the KSL Pipeline Looping Project*
- RWDI. (2011). Pacific Trail Pipelines Air Quality Assessment KSL Natural Gas Pipeline RWDI Report #1100179. RWDI Consulting Engineers and Scientists.
- Westland Resource Group (WRG). (2007a). *Fish and fish habitat investigations for the proposed Kitimat - Summit Lake natural gas pipeline looping project*. Victoria: Unpublished report.
- Westland Resource Group (WRG). (2007b). *Vegetation technical report for the proposed Kitimat - Summit lake natural gas pipeline looping project*. Victoria: Unpublished report.
- Westland Resource Group (WRG). (2007c). *Wildlife and wildlife habitat technical report for the proposed Kitimat - Summit Lake natural gas pipeline looping project*. Victoria: Unpublished report.

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APPENDICES

Appendix A – Pacific Trail Pipelines open house

Appendix B – Proposed Summit Lake compressor station

Appendix C – Pacific Trail Pipelines 2011 community update

Appendix D – Pacific Trail Pipelines Summit Lake open house invitation

Appendix E – Noise impact assessment of the Summit Lake compressor station

Appendix F – RWDI Air quality cumulative effects assessment for the proposed Summit Lake compressor station

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APPENDIX A - PACIFIC TRAIL PIPELINES OPEN HOUSE

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WELCOME TO THE PACIFIC TRAIL PIPELINES OPEN HOUSE

Please fill out our information survey for a chance to win a prize.

www.pacifictrailpipelines.com



PROJECT OVERVIEW

PACIFIC TRAIL PIPELINES

- Apache Canada Ltd. (Apache), EOG Resources Canada Inc. (EOG) and Encana Corporation (Encana) are the limited partners of Pacific Trail Pipelines Limited Partnership (PTP LP)
- First Nations Limited Partnership has an option to acquire an ownership position in PTP LP in accordance with provisions of the Benefits Agreement
- PTP will provide an underground natural gas transmission pipeline system from Summit Lake to Kitimat
- The underground pipeline system will be about 463 km long with the capacity to match the Kitimat facility's requirements

KITIMAT LNG

- The Kitimat LNG facility (Kitimat LNG) will receive and liquefy natural gas from the Western Canadian Sedimentary Basin via the Pacific Trail Pipelines
- Kitimat LNG will be located at Bish Cove near the Port of Kitimat, thanks to a unique partnership with the Haisla Nation
- Kitimat LNG will include LNG storage and marine on-loading facilities at Bish Cove
- Kitimat LNG is jointly owned by affiliates of Apache, EOG and Encana (the Kitimat LNG owners)



SUMMIT LAKE COMPRESSOR STATION

- The proposed Summit Lake compressor station will help maintain the flow of natural gas on the Pacific Trail Pipelines between Summit Lake and the Kitimat LNG export facility
- The proposed site for the compressor station is located 1.8 km east of the Village of Summit Lake
- The station will be in a fenced compound and monitored to ensure security
- Construction of the compressor station is expected to occur in 2014 and will become operational in 2015
- The compressor station will incorporate noise mitigation measures such as acoustic enclosures for the turbines and silencers on air intakes and exhausts
- Construction of the station will generate local employment and regional opportunities to provide supplies and services
- The new compressor involves a \$90-million investment

PACIFIC TRAIL PIPELINES PROJECT MILESTONES

The Pacific Trail Pipelines Limited Partnership (PTP LP) is engaged in consultation and ongoing communication with First Nations, neighbouring communities and stakeholders throughout project planning, review and development.

PROJECT MILESTONES:

- June 2008 – PTP LP is granted an Environmental Assessment Certificate by the BC Environmental Assessment Office
- March 2009 – PTP LP is granted approval from the Canadian Environmental Assessment Agency
- 2010 – Apache and EOG acquire an interest in and become limited partners of PTP LP
- February 2011 – PTP LP enters into a Benefits Agreement with First Nations Limited Partnership (FNLNLP)
- March 2011 – Apache, Encana and EOG become the sole limited partners of PTP LP
- Summer 2011 – Front end engineering and design (FEED) for PTP is underway
- Fall 2011 – FEED for PTP is complete and the bidding process for the initial spreads begins
- November 2011 – First Nations business registry to be activated
- Winter 2011/12 – Kitimat LNG owners make a financial investment decision
- Summer 2012 – Clearing and logging begins
- 2013-2014 – Pipeline construction proceeds
- Winter 2015 – PTP is operational



WHAT IS LIQUEFIED NATURAL GAS?

- LNG is natural gas, mostly methane, cooled to -160°C , the point at which gas condenses to a liquid at atmospheric pressure
- The properties of LNG are very different from oil
- When natural gas is cooled to liquid form, its volume is reduced by a factor of 600, which means LNG uses 1/600th of the space required for the same volume of gas in its vapour state
- LNG is non-corrosive, non-toxic and will not pollute land or water resources
- Lighter than water, LNG disperses quickly when exposed to air
- These characteristics allow LNG to be shipped and stored safely for delivery to markets worldwide
- LNG is the cleanest-burning fossil fuel available

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APPENDIX B - SUMMIT LAKE PROPOSED COMPRESSOR STATION

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SUMMIT LAKE

PROPOSED COMPRESSOR STATION

About Pacific Trail Pipelines

The Pacific Trail Pipelines Limited Partnership (PTP LP) is planning to build a 463 kilometre (287-mile) underground pipeline from Summit Lake to the Kitimat LNG export facility in Bish Cove, near Kitimat, British Columbia. Pacific Trail Pipelines (PTP) will have a capacity of up to approximately 1,000 MMcf/day.

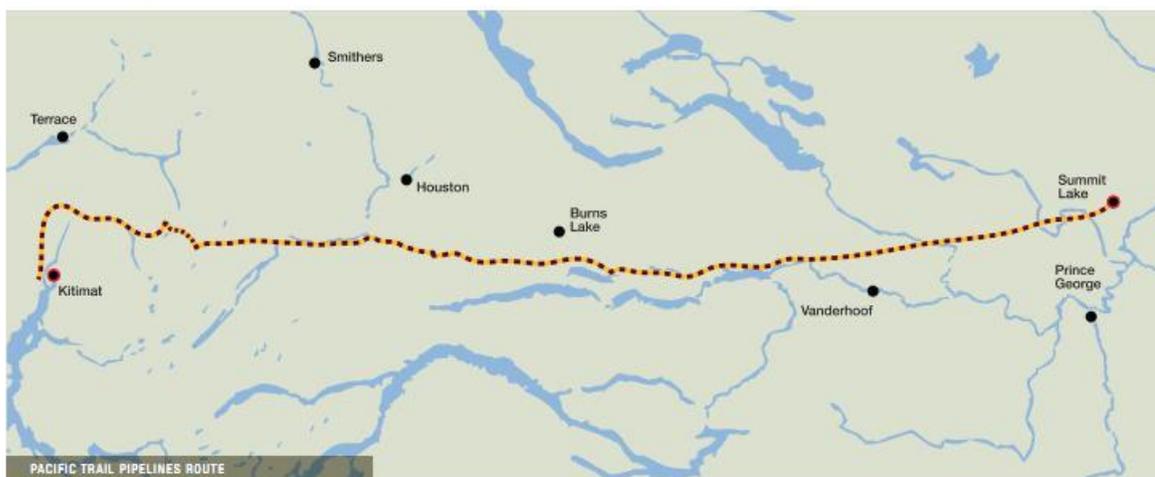
Following environmental assessment review processes, PTP LP successfully received permits from the Canadian Environmental Assessment Agency and the BC Environmental Assessment Office.

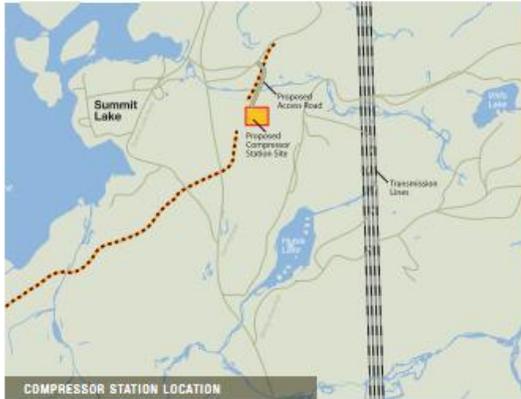
About the Proposed Summit Lake Compressor Station

A key component of the PTP project is a proposed compressor station in Summit Lake. The compressor station will help maintain the flow of natural gas on the pipeline between Summit Lake and the Kitimat LNG export facility. Construction of the station will generate local employment and regional opportunities to provide supplies and services.

Quick Facts

- Compressor station will maintain natural gas flow on the PTP
- Construction will begin in 2014
- Compressor station will be operational in 2015
- Station location is 350m east of Highway 97 (1.8km east of Summit Lake)
- Compound will occupy about 16 hectares of land





COMPRESSOR STATION LOCATION



TYPICAL COMPRESSOR STATION

Location: The proposed compressor station would be located in a fenced compound about 500 metres south of the existing Spectra Energy and Pacific Northern Gas compressor station facilities, some 350 metres east of Highway 97 (Hart Highway). The Village of Summit Lake is approximately 1.8 kilometres west of the proposed station.

Project Description: This fenced compound, which will be monitored for security, would occupy about 16 hectares of land. Built over a gravel surface, the facility includes offices, operations buildings, control equipment, shop facilities, the gas compressor, auxiliary equipment, a gas cooler unit and above-ground and below-ground piping.

Site Preparation: Initial site preparation will involve surveying, clearing, salvaging and storing topsoil, excavating and removing unsuitable fill, grading, drainage, preparing the gravel surface, foundation work and installation building support pads.

Construction Schedule: Primary construction will occur in 2014.

Project Standards: The station will be engineered and built according to rigorous industry and regulatory standards. The compressor will fully comply with the standards set out in the noise guidelines published by the BC Oil and Gas Commission and will incorporate noise mitigation measures including the use of acoustical enclosures for the turbines as well as the use of silencers on air intakes and exhausts.

Regional Economic Benefits: The Summit Lake compressor station and related facilities will bring local employment during the construction period and other economic benefits to the region.

PTP Summit Lake Open House

Drop in on Wednesday, September 28th to meet Pacific Trail Pipelines representatives, learn about our proposed compressor station and enjoy some snacks and refreshments.

WHAT: Community Open House

WHEN: Wednesday, September 28th
4:00 pm to 7:00 pm

WHERE: Summit Lake Community Hall
1140 Adams Road

Further Information

Please contact:
 Natalie Poole-Moffatt
 Manager of Public and Government Affairs
 Pacific Trail Pipelines
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**APPENDIX C - PACIFIC TRAIL PIPELINES 2011 COMMUNITY
UPDATE**

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MOVING FORWARD TOGETHER

The Pacific Trail Pipelines Project Continues to Make Progress

This 463-kilometre underground pipeline will carry natural gas from Summit Lake, 55 kilometres north of Prince George, to the proposed Kitimat LNG export facility on British Columbia's north coast. The project is being developed by the Pacific Trail Pipelines Limited Partnership (PTP LP), which acquired the project in February 2011 from Pacific Northern Gas. PTP LP is made up of the three partners in the Kitimat LNG project – Apache Canada Ltd., EOG Resources Canada Inc. and Encana Corporation. The pipeline, together with the proposed Kitimat LNG facility, will open up western Canada's abundant natural gas resources to new export markets in the Asia-Pacific region. This important energy infrastructure will create new jobs, training opportunities and economic benefits across this economic corridor.

Creating Economic Opportunities

PTP LP is pleased to be working closely with First Nations Limited Partnership (FNLP) businesses and First Nation businesses along the pipeline route. As engineering and design work moves forward, the project is steadily creating new jobs and training opportunities throughout the region.

Construction of the pipeline is expected to generate as many as 2,000 jobs over a two- to three-year period. Significant emphasis has been put on ensuring local workers and businesses are given the opportunity to supply services and labour in areas such as:

- **General construction**
- **Industrial rentals and repairs**
- **Supplies (concrete, gravel and building materials)**
- **Transportation (air, trucking and rail)**
- **Clearing, logging and salvage**
- **Site restoration**
- **Equipment and parts**
- **Fuel**
- **Environmental monitoring**
- **Construction camps and catering**

Kitimat LNG Export Facility Planning Continues

Planning continues for the construction of the Kitimat LNG export facility. Kitimat LNG is currently carrying out a front end engineering and design (FEED) study, which is expected to provide certainty around project design, construction timelines and costs, and labour force requirements. The study is expected to be completed late in 2011 or early 2012. Currently, site preparation is underway, with clearing and rough grading taking place.

Kitimat LNG expects to be in a position to make a final investment decision (FID) on the facility by the end of 2011 or early



2012. Once FID is granted, construction of the Kitimat LNG export facility is expected to begin in 2012, with commercial operations expected to start in late 2015.

The regulatory approval process for the Kitimat LNG export facility is proceeding. The National Energy Board (NEB) continues to review Kitimat LNG's application for a 20 year export licence, and a decision is expected soon. The licence would allow the export of up to 10 million tonnes annually from the proposed Kitimat LNG facility. The project already has permits from the Canadian Environmental Assessment Agency and BC Environmental Office.

In the meantime, Kitimat LNG has made another significant investment in Kitimat with the purchase of the former Eurocan industrial site from West Fraser. Pending project approvals, the site will be used for pre-fabrication work, storing materials and as a work camp.

Proposed Compressor Station Would Link Existing and New Pipelines

A key component of the Pacific Trail Pipelines project is the proposed Summit Lake compressor station. The compressor will help maintain the flow of natural gas on the pipeline between Summit Lake and the Kitimat LNG facility. The compressor station would be located a half-kilometre south of the existing Spectra Energy and Pacific Northern Gas compressor station facilities near Highway 97, east of the Village of Summit Lake.

The compressor station will incorporate noise mitigation measures such as acoustical enclosures for the turbines and silencers on air intakes and exhausts.

Construction of the station is expected to generate local employment and regional opportunities to provide supplies and



services.

Construction of the station is aiming to meet an in-service date for PTP of 2015. While some preliminary construction work may occur in 2013, the bulk of work will occur in 2014.

Open Houses Continue Commitment to Consultation

The PTP LP continues to reach out to communities across the project area to provide information and updates. In June 2008, the PTP project was granted an Environmental Assessment Certificate after a comprehensive review led by British Columbia's Environmental Assessment Office. Consistent with the obligations of this regulatory approval, consultation and communications activities continue with First Nations, landowners, local governments, environmental organizations, federal and provincial authorities and other interested parties.

Looking Forward

- Winter 2011/12 – FEED for PTP is complete and the bidding process for the initial spreads begins
- Winter 2011/12 – Kitimat LNG owners make a FID
- Summer 2012 – Clearing and logging begins along the pipeline route
- 2013-2014 – Pipeline construction proceeds
- Winter 2015 – PTP is operational

Carefully Managing Our Environmental Impact

The partners in these two important projects are committed to environmental protection and minimizing environmental impacts. Both the pipeline project and the Kitimat LNG export facility will be engineered to the necessary standards and adhere to government and industry regulations. Environmental protection, health and safety are important corporate and personal responsibilities, and many policies and procedures have been developed to protect the environment.

Further Information

For more information about PTP, log on to: www.pacifictrailpipelines.com, www.kitimatlngfacility.com or email PTP at pacifictrailpipelines@apachecorp.com.

APPENDIX D - PACIFIC TRAIL PIPELINES SUMMIT LAKE OPEN HOUSE INVITATION

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**Pacific Trail Pipelines
invites you to our
Summit Lake Open House.**

Drop in on **Wednesday, September 28th** to meet Pacific Trail Pipelines representatives, learn about our proposed compressor station, and enjoy some snacks and refreshments.

WHAT: Community Open House

WHEN: Wednesday, September 28th
4:00 pm to 7:00 pm

WHERE: Summit Lake Community Hall
1140 Adams Road

For more information about Pacific Trail Pipelines, please visit www.pacifictrailpipelines.com

www.pacifictrailpipelines.com

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APPENDIX E – NOISE IMPACT ASSESSMENT OF THE SUMMIT LAKE COMPRESSOR STATION

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**NOISE IMPACT ASSESSMENT
SUMMIT LAKE COMPRESSOR STATION**

**Prepared for:
PACIFIC TRAIL PIPELINES LP**

**Prepared by:
MATRIX PROJECTS LIMITED**

December 7, 2010

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1.0 INTRODUCTION

The Summit Lake Compressor Station Project consists of the construction and operation of a new compressor station on the proposed KSL Pipeline. The station would enable the east to west flow of natural gas on the Pacific Trail Pipelines (PTP) proposed 36 inch diameter pipeline between Summit Lake, BC and a new proposed LNG Facility located near Kitimat, BC (the KSL Pipeline Project). The noise study summarized in this report was a study of the potential noise impact which would result from the construction and operation of the station

The Summit Lake Compressor Station replaces the previously proposed mid-point compressor station located south of Burns Lake, east of Highway 35.

The proposed Summit Lake Compressor Station is planned to be located on an area of land approximately 500 meters south of the existing Spectra Energy and Pacific Northern Gas Compressor Station facilities and approximately 350 meters east of Highway 97 (Hart Highway).

The Village of Summit Lake is approximately 1.2 km to the west of the proposed new compressor station site.

Access to the station would be via an extension of the existing access road servicing the PNG and Spectra stations.

Figure 1 illustrates the general location of the new Compressor Station.

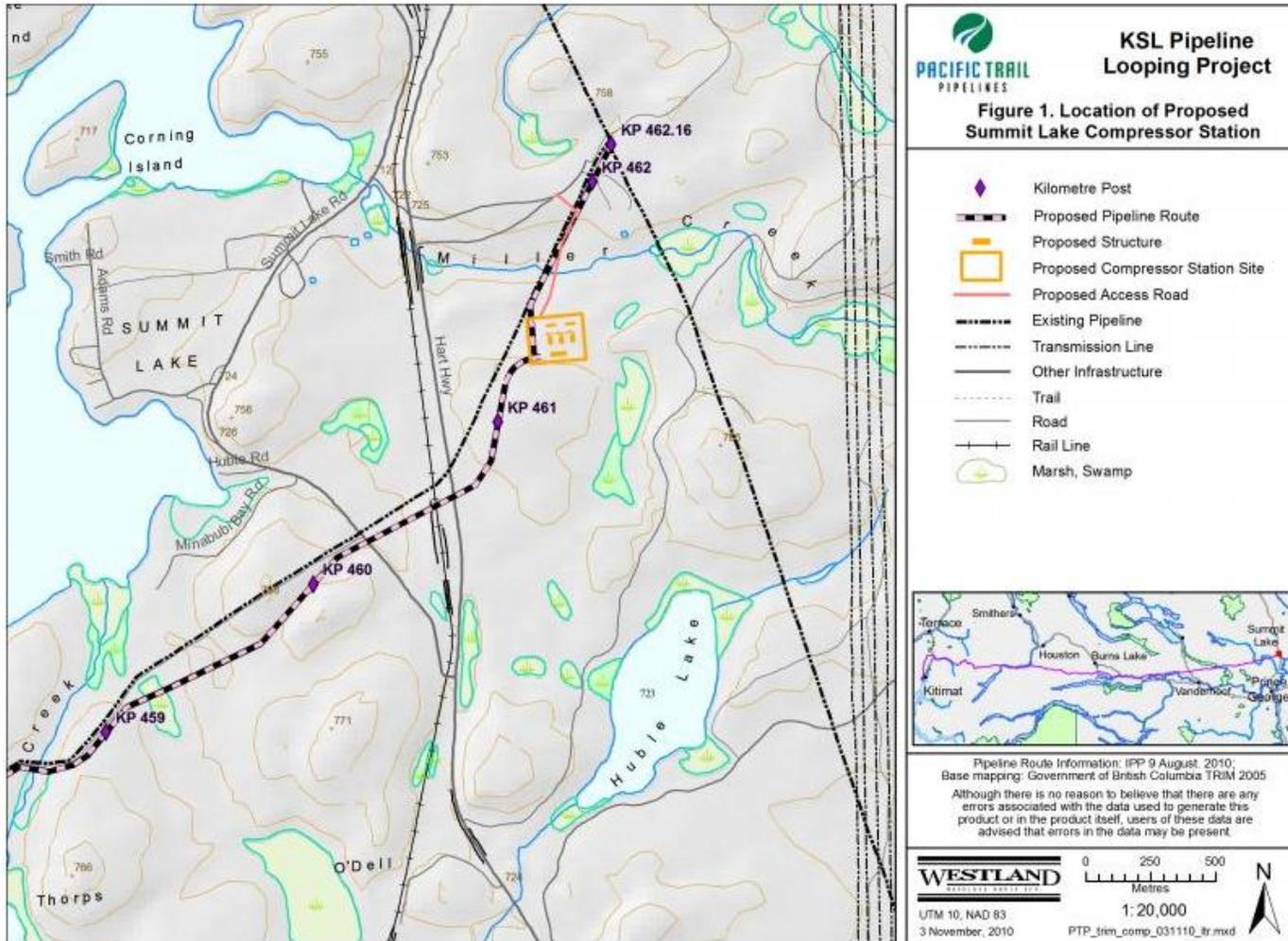


Figure 1. Location of proposed Summit Lake Compressor Station

The Compressor Station will consist of a fenced compound approximately 4 hectares in size (200 meters by 200 meters).

The compound will consist of a levelled gravel surfaced area with either two or three compressor buildings depending on the results of the detailed design for the KSL Project. For the purpose of this study, a worst case of three compressor buildings was assumed. Each building would house one large gas turbine driven gas compressor package. Normal operation of the pipeline would require that at least one of these gas compression units to be running at all times.

The surrounding forested area will be maintained intact to the greatest extent possible. The gas piping at the station will mostly be buried.

There will be approximately three smaller utility/control type buildings on the site.

All buildings and equipment will be designed to meet the stringent noise requirements that pertain to this type of facility (BC Oil and Gas Commission; BC Noise Control Best Practices Guideline; March 2009). The station will be designed to meet or exceed the permit requirement of emitted noise being equal to or less than 40 dBA at the nearest residence. While it is unlikely to occur, noise calculations have been determined on the basis of the cumulative noise level of all three compressor stations (existing PNG; existing Spectra; new PTP) operating at the same time in order to ensure that the permissible sound level (40 dBA) can be achieved.

The compressor packages at the station are proposed to be silenced gas turbine-driven centrifugal compressor units.

Figure 2 is a picture of a similar gas turbine driven compressor station with three compressor buildings of a similar size to what is being proposed. The station in this picture is still being constructed, so final site remediation has not yet been completed. The picture also shows the natural gas coolers which are similar to what would be installed at the Summit Lake site.



Figure 2. Example of a Compressor Station similar to the proposed Summit Lake Station. The station shown in the photo is still under construction.

2.0 BASELINE NOISE SURVEY

2.1 General

Noise is defined as unwanted sound and is measured in decibels (dB). The human perception of loudness varies with the intensity and frequency of the sound. Humans hear high frequency sound better than low frequency sound and to account for this the dBA measurement system has been developed. This involves using an A-weighted filter on the sound level meter to approximate the frequency response of the human ear. The dBA measurement system has gained wide acceptance and is now used for most noise studies.

In general, people cannot perceive a change in sound levels less than 3 dBA in magnitude. A change of 3 to 5 dBA is noticeable and a change of 10 dBA is perceived as a doubling of sound level.

Typical sound levels are as follows:

Whisper at 2 meters:	20 dBA
Rustle of leaves in breeze:	25 dBA
Quiet room:	40 dBA
Normal conversation at 1 meter:	60 dBA
Passenger car at 15 meters:	65 dBA
Damaging to hearing:	85 dBA
Chain saw:	120 dBA

Community noise levels are rarely steady but vary in intensity from second to second, hour to hour and day to day. The noise descriptor that is most widely utilized to measure this variation in noise is the Equivalent Sound Level, or Leq. The Leq is defined as the calculated -weighted sound level over a defined time period that has the same acoustic energy as the actual fluctuating sound level occurring during the same period.

The ambient noise is measured in terms of the hourly Leq's and from them the 24 hour Leq is determined.

To further define the ambient noise levels, the statistical distribution of the noise is also measured in terms of the exceedance levels, L10, L50, and L90. These are the noise levels that are exceeded 10%, 50%, and 90% of the time.

2.2 Description of the survey area

The proposed station would be located near Summit Lake B.C. This is a rural/recreational community about 44 km north of Prince George.

The area has two existing compressor stations operated by PNG and Spectra Energy. They share a common site located just NE of the proposed station site. The PNG station has two Solar T4500 gas turbine driven compressor packages. The Spectra station has two operational gas turbine driven compressor packages: a General Electric LM 2500G4; and a Rolls-Royce Spey. It is understood that the Spey unit is presently used for backup purposes and is seldom used.

A primary highway, Hwy 97, is located west of the proposed site.

The main Summit Lake community is located along the lakeshore of nearby Summit Lake and also on small islands in the lake. This mostly recreational community is about 1.2 km to 1.8 km from the proposed compressor station.

A small grouping of houses consisting of several year round residences is located in the northern part of the community of Summit Lake. These houses are on the west side of both the highway and the railway line and are considered to be the nearest noise sensitive receptors. The houses, the existing stations, and the proposed new compressor station are shown in Figure 2-1.

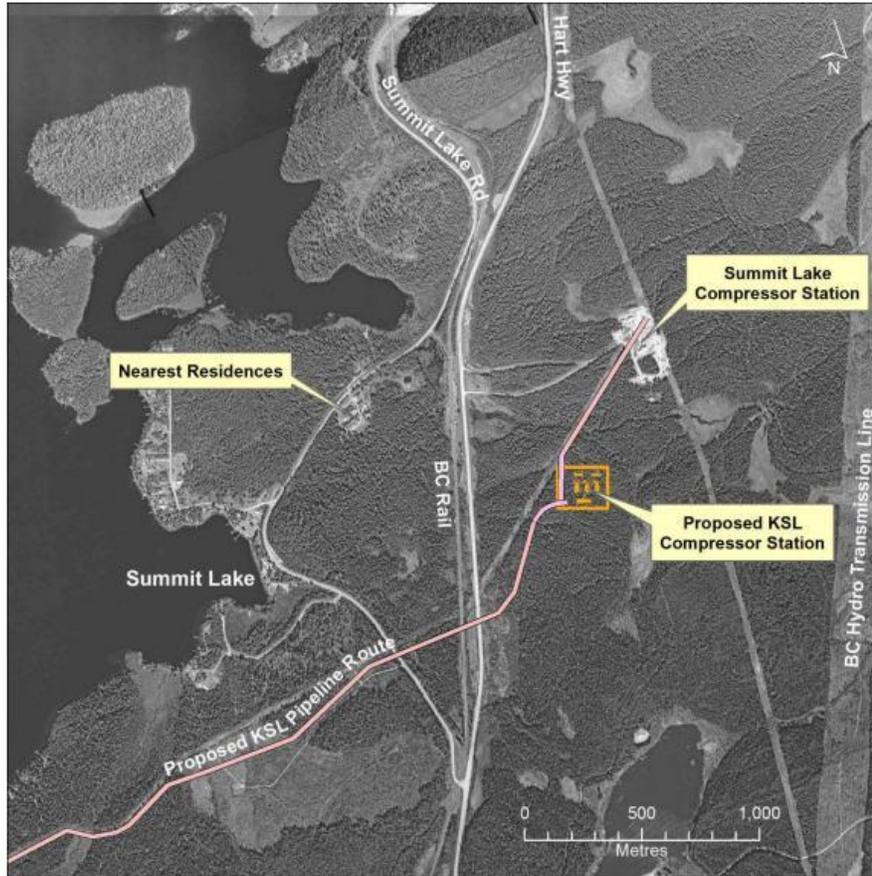


Figure 2-1. Existing Stations, Proposed Stations and Nearest Residences

2.3 Baseline measurements

A baseline noise survey was conducted on September 4 and 5, 2010 at the nearest impacted residences to the proposed compressor station. The measurement location is shown in Figure 2-2 and Photo 2-1. This location, close to an unoccupied residence, was selected at a short distance from other homes where localized noise (hammering and dogs) was on-going.

The nearest residence is about 1250 m from the PNG and Spectra stations and 950 m from the proposed new station



Figure 2-2. Measurement Location



Photo 2-1. Measurement Location

The sound level meter used in the study was a Larson-Davis LXT Integrating Sound Level Meter. The meter complies with the following codes and meets the BC Noise Guideline sound meter requirements:

- ANSI: S1.4-1985 (R 2001), S1.43-1997 (R 2002), S1.25-1991 (R 2007), S1.11-2004
- IEC: 61672-2002, 60651-2001, 60804-2000, 61260-2001, 61252-002
- CE: Directive 2004/108/EC, IEC 61326-1:2005

The weather conditions during the survey were calm, 10° C, with no precipitation.

2.4 Results of the survey

The survey results are summarized in Table 2-1 and Figure 2-3.

Table 2-1. Summary of the results

Measurement period	L _{eq} (dBA)	L ₉₀ (dBA)
Daytime (3-hr sample)	49.1	27.0
Night-time (2-hr sample)	42.7	32.0

Note: LAS is the SPL with A weighting and slow meter response per the BC Noise Guideline

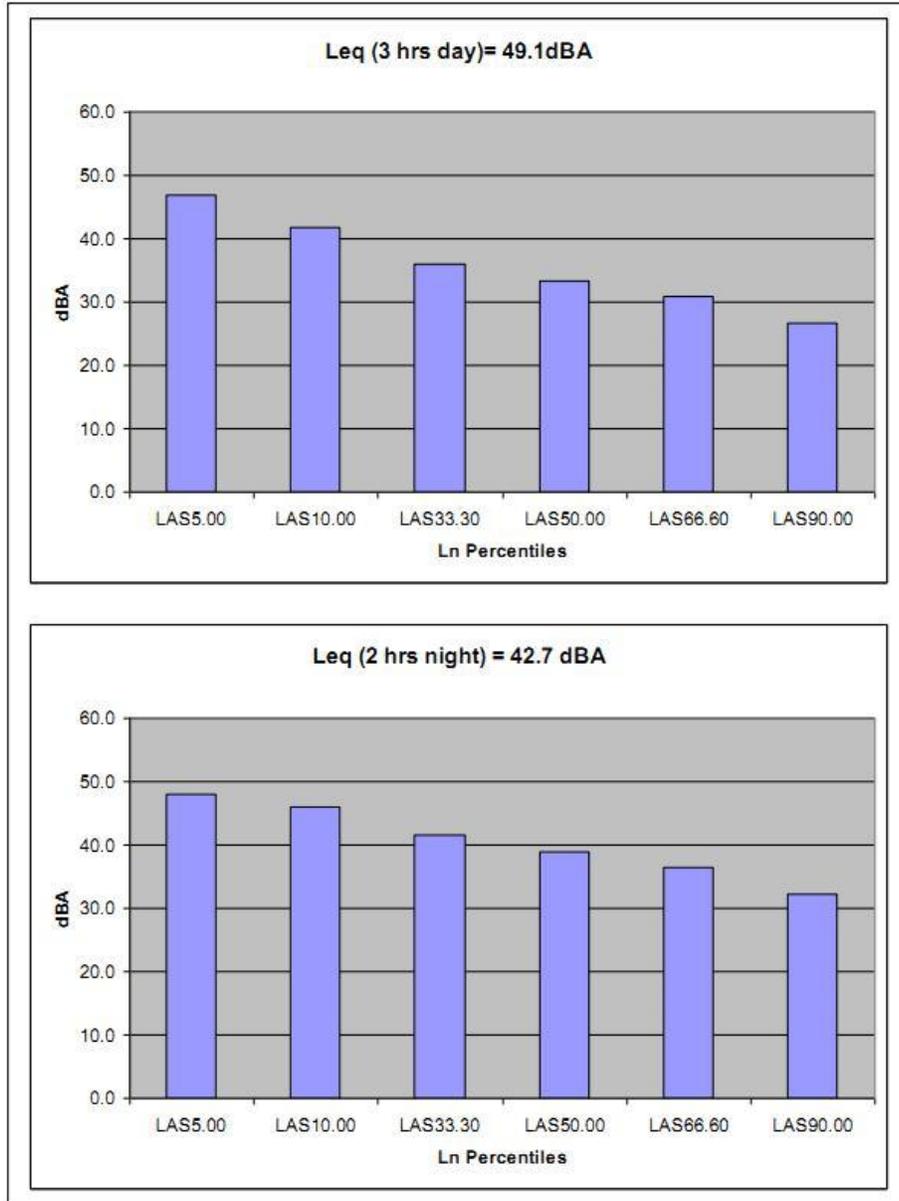


Figure 2-3. Day/Night L_{eq} and Percentile noise levels

3.0 ACOUSTICAL OBJECTIVES

The British Columbia Noise Control, Best Practices Guideline, (OGC, March 2009), outlines the requirements for noise control as they apply to operations, production facilities, and gas processing plants under the jurisdiction of the BC Oil and Gas Commission. This Guideline will be used in the noise assessment study of the Summit Lake compressor station.

3.1 Permissible Sound Level (PSL)

The PSL is calculated from the British Columbia Noise Control, Best Practices Guideline, taking into account the Basic Sound Level (BSL) and allowable A and B adjustments. Table 1, from the BC Noise Guideline, shows the BSL for various types of dwellings

Table 1. Basic sound levels for nighttime*

Proximity to transportation	Dwelling unit density per quarter section of land		
	1 - 8 dwellings; 22:00 - 07:00 (nighttime) (dBA Leq)	9 - 160 dwellings; 22:00 - 07:00 (nighttime) (dBA Leq)	>160 dwellings; 22:00 - 07:00 (nighttime) (dBA Leq)
Category 1	40	43	46
Category 2	45	48	51
Category 3	50	53	56

***Notes:**

- The average rural ambient noise level is 5 dBA less than the BSL.
- Category 1—dwelling units more than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
- Category 2—dwelling units more than 30 m but less than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
- Category 3—dwelling units less than 30 m from heavily travelled roads and/or rail lines and/or subject to frequent aircraft flyovers.
- Density per quarter section—refers to a quarter section with the affected dwelling at the centre (a 451 m radius). For quarter sections with various land uses or with mixed densities, the density chosen is then averaged for the area under consideration.
- See Appendix 1 for more definitions.

The noise sensitive receptors are part of a larger community made up of more than nine dwellings. However most of the recreational dwellings would be unoccupied for large periods so for the purpose of this study a worst case, conservative, Category 1, with a dwelling density of 1 to 8 dwellings per ¼ section of land, will be assumed.

The permissible BSL from Table 1 is 40 dBA during nighttime.

The A and B adjustments, which amend the BSL for unusual ambient noise levels and the duration of the noise respectively are not used in this instance and therefore are considered to be zero so that the PSL = BSL = 40 dBA.

4.0 ASSESSMENT OF NOISE IMPACTS

4.1 Proposed Compressor Station

The operational noise generated by the proposed station will be continuous and long term in duration. The operational noise will be attenuated to ensure compliance with BC Noise Guidelines. This noise assessment addresses the following issues:

- Identifies the major noise sources associated with the facility either from vendor's sound data or from field measurements of similar equipment.
- Identifies the predicted composite sound level at the nearest noise sensitive receptors.
- Identifies how the predicted sound level was calculated.

The dominant noise sources have been identified as follows:

- Gas Turbines
The gas turbines will be enclosed in acoustical enclosures and installed inside noise attenuating compressor buildings. Air intakes and exhaust will be fitted with silencers.
- Compressors
The compressors will be housed inside noise attenuating compressor buildings.
- Gas coolers
Low noise gas coolers will be selected.
- Piping
Noise radiating from the gas piping will be attenuated by burying the piping where possible. Above grade piping will be clad with noise attenuating insulation.
- Gas Blowdowns
All operational gas blowdown noise will be attenuated so that the noise limits are met. Emergency blowdowns and safety relief valves will not be silenced.

5.0 POTENTIAL PROJECT EFFECTS

The following potential noise issues were addressed to assess the impact of the proposed station on noise levels outside the site boundary:

- Construction noise,
- The continuous plant operational noise, and
- Low frequency noise.

The potential noise impacts of the proposed compressor station on areas outside the site boundary were assessed by modelling the incremental noise level contribution from the proposed station, adding this increment to the ambient noise level (defined as 35 dBA for rural areas in the BC Noise Guidelines – the ambient noise level is 5 dBA less than the Permissible Sound Level), then assessing if this change in noise level complies with the BC Noise Guidelines.

5.1 Construction noise

Construction noise guidelines are expected to be implemented during the construction phase of the project to mitigate the effects of noise from equipment and construction activities. Prior to the commencement of construction, consideration will be given to quieter alternative construction methods and techniques. Construction noise guidelines for the proposed station will consider the following:

The construction contractor will execute the work and operate the equipment and power driven tools in compliance with all national, provincial, and local regulations and by-laws. Onsite construction noise will be controlled in accordance with WCB regulations.

All diesel and gas powered equipment such as welding machines, air compressors, concrete mixers, and mobile equipment will be properly muffled to limit noise emissions during construction. Silencers will be provided where possible for specific noisy activities. Noisy equipment will be operated with noise attenuation enclosure panels closed and the equipment will be shut down when not in use for long periods.

Where the use of inherently noisy equipment such as jackhammers is unavoidable, their use will be limited.

The temporary construction period will span the summer vacation period when recreational properties are mostly occupied. PTP will attempt to minimize the construction noise disruption during prime vacation periods.

5.2 Operational noise of the stations

Since specific equipment has not been purchased prior to this study, design basis sound pressure levels for the major noise producing equipment were obtained from field measurements of similar equipment at other locations in British Columbia or from manufacturer's data. This information was then used to model the noise levels from the proposed compressor station and the existing PNG and Spectra Energy stations. The design basis used for the proposed new station was a LM2500 unit (this is the compressor unit currently operating at the Spectra compressor station). For the purposes of this study, it is assumed that vendors will supply equipment with a sound pressure level equal to, or less than the design basis.

Table 5-1. Source Noise Levels

Sound Source	Sound Pressure Level (dBA)	Reference
LM 2500	49 @ 200 m	Measured data
Solar Centaur T4500	76 @ 15 m	Manufacturer's data
Rolls Royce Spey	56 @ 120 m	Measured data

The sources were modelled based on the above Sound Pressure Levels. The attenuation resulting from distance, air absorption, excess anomalous attenuation, and vegetation was subtracted to arrive at the sound pressure level at the nearest sensitive receptor. The cumulative sound level at the residence was then determined by adding the noise of the proposed compressor station to the ambient noise level as determined from the BC Noise Guidelines for rural areas, namely, 35 dBA. Table 5-2, below, shows the acoustical calculations and the resultant cumulative noise level at the nearest impacted residence.

Table 5-2. Calculation of Cumulative Noise Level at the nearest receptor

Noise Source	Sound Pressure Level (dBA)
PNG: (two) Centaur T4500	13
Spectra Energy: (one) LM 2500	9
Spectra: (one) RR Spey	11
Proposed station: (three) LM 2500	17
Combined noise of sources	19.6
Ambient PSL (per BC Noise Guidelines)	35
Cumulative Noise Level	35.1

5.3 Parameters/Assumptions used in Calculations

In the calculations, distance, molecular absorption and anomalous excess attenuations are used resulting in significant noise reduction at distances from the stations.

Sound passing over tall grass, shrubbery, and trees is absorbed and shielded from the receptors. A 20 dBA insertion loss has been used in the calculations of Cumulative Noise Level in Table 5-2.

5.4 Low Frequency Noise

It should be noted that there is not any noise legislation in British Columbia regarding low frequency noise and the BC Noise Guidelines has not any recommended permitted levels. Noise legislation where it exists is based on the broadband noise levels measured in dBA. This does not mean that the dBA measurement system ignores low frequency noise rather it simply uses a weighting scale, which attempts to simulate the human ear. Human hearing does not hear low frequency sounds as easily as the middle to higher frequency sounds. However, if the low frequency noise is significant it will certainly be reflected in the dBA level as well.

The State of Oregon utilizes a guideline for low frequency noise that is considered conservative particularly in the 31.5 Hz. octave band. The guideline values are as follows:

- 31.5 Hz octave band: 65 dB
- 63.0 Hz octave band: 62 dB

The predicted low frequency sound from the proposed station at the nearest residence is shown in Table 5-3

Table 5-3. Calculation of low frequency noise at the nearest receptor

Sound Power Level of three LM 2500's	136 dB (31.5 Hz octave band)	130 dB (63.0 Hz octave band)
Attenuation due to distance, terrain, air absorption, and excess anomalous attenuation	77 dB	77 dB
Resultant SPL at the nearest residence	59 dB (31.5 octave band)	53 dB (63.0 octave band)
Oregon State Guideline	65 dB for 31.5 octave band	62 dB (63.0 octave band)

The low frequency sound from the Spectra Energy and PNG stations is estimated to add about 3 dB to the sound from the proposed new station. The combined low frequency sound from all of the stations is below the Oregon State Guidelines

6.0 CONCLUSIONS

The residual impacts of the proposed compressor station operational noise are concluded to be in compliance with the BC Noise Guidelines (OGC, March 2009). This conclusion is based on the determination of cumulative noise levels for the worst case scenario where all 7 compressor units (2 existing PNG units; 2 existing Spectra units; and 3 new PTP units) are running simultaneously (although this is very unlikely to occur).

The plant will incorporate significant noise mitigation by installing the turbines in acoustical enclosures within standard steel compressor buildings. The air intakes and exhausts will be fitted with silencers. The compressors will be installed inside the compressor buildings and the piping will be buried or acoustically insulated. The gas coolers will be low noise models. Unit and station operational blowdowns will be fitted with silencers. No further noise mitigation or monitoring is considered to be necessary.

**APPENDIX F – RWDI AIR QUALITY CUMULATIVE EFFECTS
ASSESSMENT FOR THE PROPOSED SUMMIT LAKE
COMPRESSOR STATION**

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5 CUMULATIVE EFFECTS ASSESSMENT

As discussed in Section 2.5, there are two existing industrial point sources of criteria air contaminants and CEPA Schedule 1 substances in the LSA: PNG's Summit Lake Compressor Station and Spectra's Summit Lake Compressor Station. There is the potential for cumulative effects on ambient air quality due to emissions from these existing compressor stations in combination with the Project (assuming all three possible compressors are running). In addition, there are other non-point sources of emissions in the LSA, listed in Table 2.4, that have the potential to act cumulatively with Project emissions.

5.1 Common Air Contaminants and CEPA Schedule 1 Substances

The potential cumulative effect of the existing compressor stations was assessed by modelling their emissions using the CALPUFF dispersion model. The potential cumulative effect of the non-point sources was assessed by adding the representative background concentrations listed in Table 2.13.

The continuous emission sources at the PNG compressor station include two turbines and one boiler. The emergency generator and blowdown stack were not assessed in this study as they do not represent normal operation but rather operate intermittently when required. At the Spectra compressor station the main sources of emissions are two turbines. The stack parameters of these emission sources are shown in Table 5.1. Emission rates of these sources are provided in Table 5.2.

Table 5.3 summarizes the building dimensions that were used to assess building downwash effects in the model. All data were provided by PNG and Spectra or estimated based on photos.

Table 5.1: PNG and Spectra Source Parameters Used for Dispersion Modelling

Source Description	Stack Height (m)	Elevation (m)	Stack Diameter (m)	Exit Velocity (m/s)	Exit Temperature (°C)
PNG solar turbine unit 2	10.7	743.1	1.1	33.6	452.8
PNG solar turbine unit 3	10.7	743.8	1.1	33.6	452.8
PNG boiler stack	7.0	741.5	0.5	0.4	452.8
Spectra Spey 1900	10.8	746.1	3.3	3.3	513.4
Spectra LM2500	13.6	749.6	3.6	6.5	513.4

Table 5.2: PNG and Spectra Emission Rates Used for Dispersion Modelling

Source Description	CO (g/s)	NO _x (g/s)	PM (g/s)	VOC (g/s)	Benzene (g/s)	Formaldehyde (g/s)	Acetaldehyde (g/s)	PAH (g/s)
PNG solar turbine unit 2	2.4	6.0	0.28	0.14	2.7E-05	1.6E-03	9.1E-05	5.0E-06
PNG solar turbine unit 3	2.4	6.0	0.28	0.14	2.7E-05	1.6E-03	9.1E-05	5.0E-06
PNG boiler stack	1.8E-03	8.9E-03	2.7E-04	4.7E-04	7.4E-08	2.7E-06	0	2.3E-08
Spectra Spey 1900	0.68	2.7	6.1	0.51	1.1E-2	0.66	0.04	2.0E-03
Spectra LM2500	1.4	3.6	6.1	92	1.1E-2	0.66	0.04	2.0E-03

Table 5.3: PNG and Spectra Building Parameters Used for Dispersion Modelling

Building Name		PNG 1	PNG 2	PNG 3	Spectra1	Spectra2	Spectra3	Spectra4	Spectra5
Base Elevation	(m)	741.97	741.42	742.03	744.00	745.57	746.99	749.02	749.67
Height	(m)	6.10	6.10	6.10	6.10	7.21	5.20	12.01	8.01
Vertices:									
Corner1	(mE)	524877	524894	524922	524947	524960	524938	524946	524941
	(mN)	6015685	6015691	6015701	6015684	6015647	6015648	6015571	6015562
Corner2	(mE)	524883	524914	524935	524957	524975	524949	524972	524948
	(mN)	6015689	6015699	6015706	6015689	6015653	6015652	6015578	6015564
Corner3	(mE)	524888	524917	524937	524963	524980	524961	524977	524952
	(mN)	6015677	6015686	6015692	6015671	6015637	6015615	6015565	6015555
Corner4	(mE)	524879	524899	524926	524953	524965	524952	524953	524945
	(mN)	6015671	6015680	6015689	6015667	6015631	6015612	6015556	6015552

Table 5.4 compares the representative background concentrations, maximum concentrations predicted for the Project effects case, and maximum concentrations predicted for the cumulative effects case for each pollutant. All maximum predicted concentrations for the cumulative effects case are less than the corresponding most stringent objective. In addition, the maximum annual PM_{2.5} concentration of 5.4 µg/m³ is less than the BC planning goal of 6 µg/m³. The representative background concentrations contribute approximately 80% of the cumulative concentrations for PM₁₀, PM_{2.5} and CO. Background NO₂ contributes 40% of the cumulative concentrations while the Project contributes 30% of the cumulative concentrations. Existing PNG and Spectra facilities have the largest contribution to the cumulative VOCs, benzene, acetaldehyde, formaldehyde and PAH. For all contaminants, emissions from the Project contribute least to the maximum concentrations predicted for the cumulative effects case. Cumulative effects are mainly due to existing sources in the LSA. The maximum predicted cumulative concentrations are all less than 50% of the most stringent corresponding objectives except PM_{2.5} where the maximum predicted cumulative concentrations are less than 82% of the most stringent objectives.

Table 5.4: Maximum Predicted Ambient Concentrations in the Air Quality Local Study Area – Cumulative Effects Case

Contaminant	Averaging Period	Background Concentration (µg/m ³)	Project Effects Case (µg/m ³)	Cumulative Effects Case (µg/m ³)	Percent Cumulative Concentration of Objective	Most Stringent Air Quality Objective (µg/m ³)
NO ₂	1-Hour	55	38	132	33%	400
	24-Hour	46	7.1	57	29%	200
	Annual	17	0.9	19	31%	60
PM ₁₀	24-Hour	19	0.8	22	44%	50
PM _{2.5}	24-Hour	18	0.8	20	81%	25
	Annual	5	0.1	5	67%	8
CO	1-Hour	1,059	47	1,106	8%	14,300
	8-Hour	988	12	1,000	18%	5,500
VOC	1-Hour	-	1	214	-	-
Benzene	1-Hour	-	0.005	0.1	0.2%	30
Acetaldehyde	1-Hour	-	0.02	0.2	0.2%	90
Formaldehyde	1-Hour	-	0.3	3.3	5%	65
PAH	1-Hour	-	0.001	0.01	-	-

The spatial extent of maximum predicted cumulative concentrations are presented in the form of isopleth maps in Figure 5.1 to Figure 5.9. Similar to the maximum predicted concentrations associated with the Project alone, the maximum predicted cumulative concentrations are less than the corresponding ambient objectives; therefore, only one plot is shown per contaminant for the shortest relevant averaging period.

As shown in Figure 5.1, the highest NO₂ concentrations were predicted to occur adjacent to the existing PNG and Spectra compressor stations, which are located approximately 0.5 km northeast of the proposed compressor station. Comparing the isopleth contours for Project effects case (Figure 3.3) to the cumulative effects case for NO₂, the highest concentrations have moved from immediately southwest of the proposed compressor station to immediately southeast of the existing PNG and Spectra facilities.

Maximum predicted 24-hour average PM₁₀ concentrations were predicted to occur about three kilometres northeast of the proposed compressor station (Figure 5.2). The isopleths of maximum predicted 24-hour average PM_{2.5} concentrations for the cumulative effects case are shown in Figure 5.3. The highest PM_{2.5} concentrations were predicted to occur adjacent to the existing PNG and Spectra compressor stations and 0.5 km to the northeast of the proposed compressor station. Comparing the isopleth contours for the cumulative effects case to the Project effects case, the higher concentration contours of PM₁₀ and PM_{2.5} moved farther away from the compressor station towards the northeast.

The highest one-hour CO, VOC, acetaldehyde, benzene, formaldehyde and PAH concentrations were predicted to occur immediately east of the existing PNG and Spectra facilities (see Figure 5.4 to Figure 5.9). Comparing the isopleth contours for the cumulative effects case to the Project effects case (Figure 3.5 to Figure 3.10), the higher concentration contours of these pollutants moved from immediately southwest of the proposed compressor station to immediately southeast of the existing PNG and Spectra facilities.

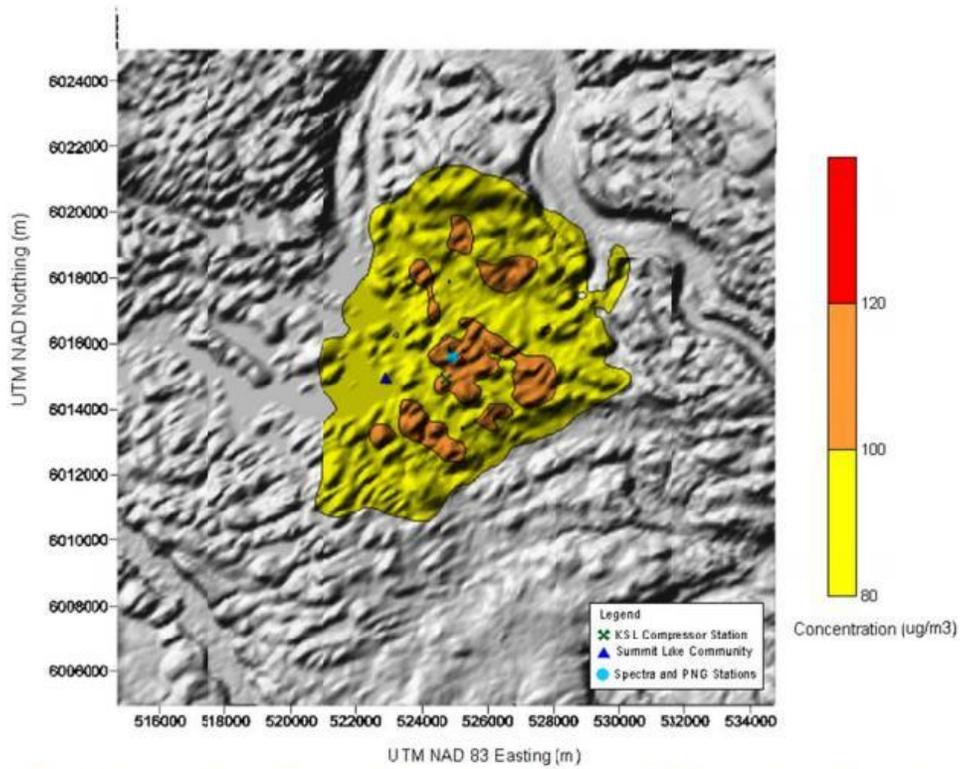


Figure 5.1: Isopleths of Maximum Predicted One-Hour Average NO₂ Concentrations – Cumulative Effects Case - The Most Stringent Air Quality Objective is 400 µg/m³

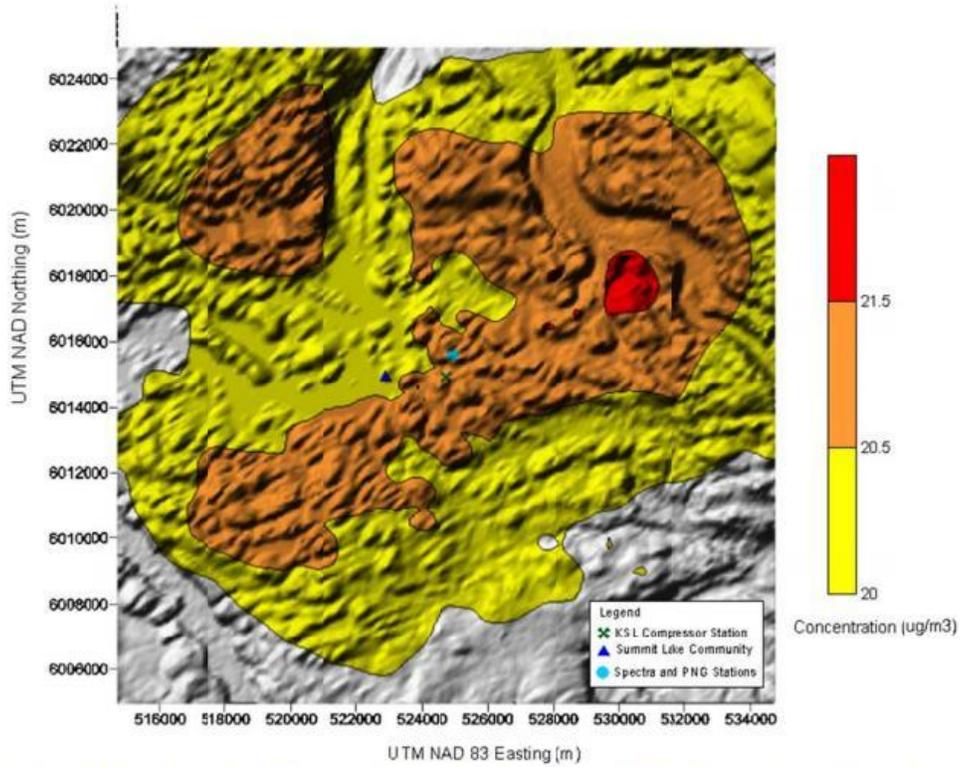


Figure 5.2: Isopleths of Maximum Predicted 24-Hour Average PM₁₀ Concentrations – Cumulative Effects Case – Most Stringent Air Quality Objective is 50 µg/m³

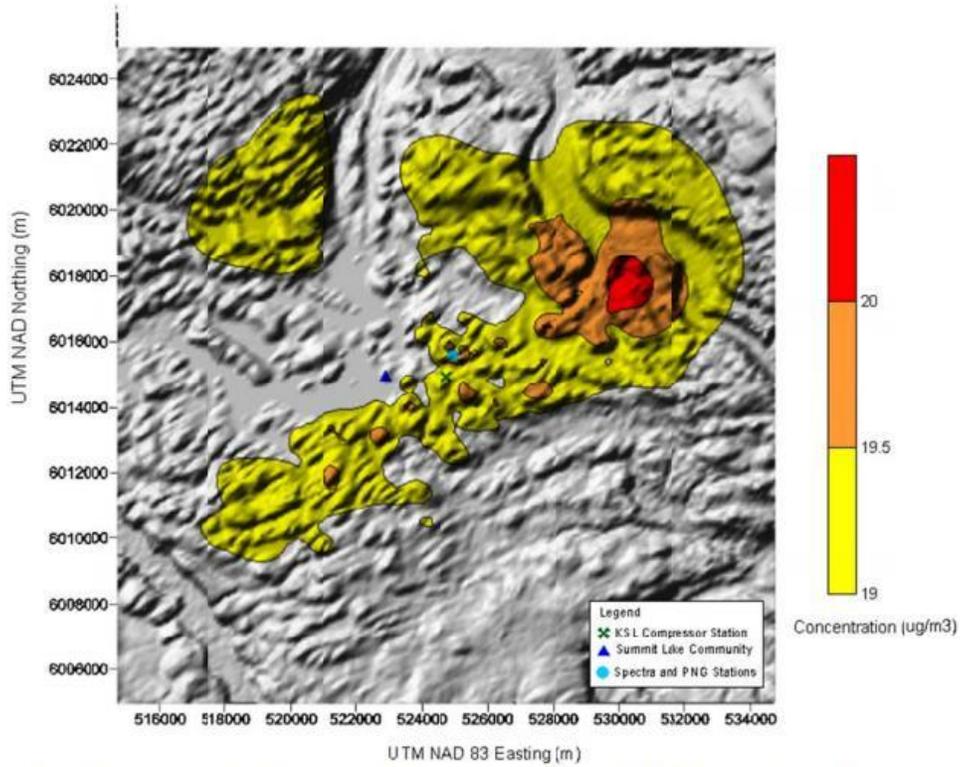


Figure 5.3: Isoleths of Maximum Predicted 24-Hour Average PM_{2.5} Concentrations – Cumulative Effects Case - Most Stringent Air Quality Objective is 25 µg/m³

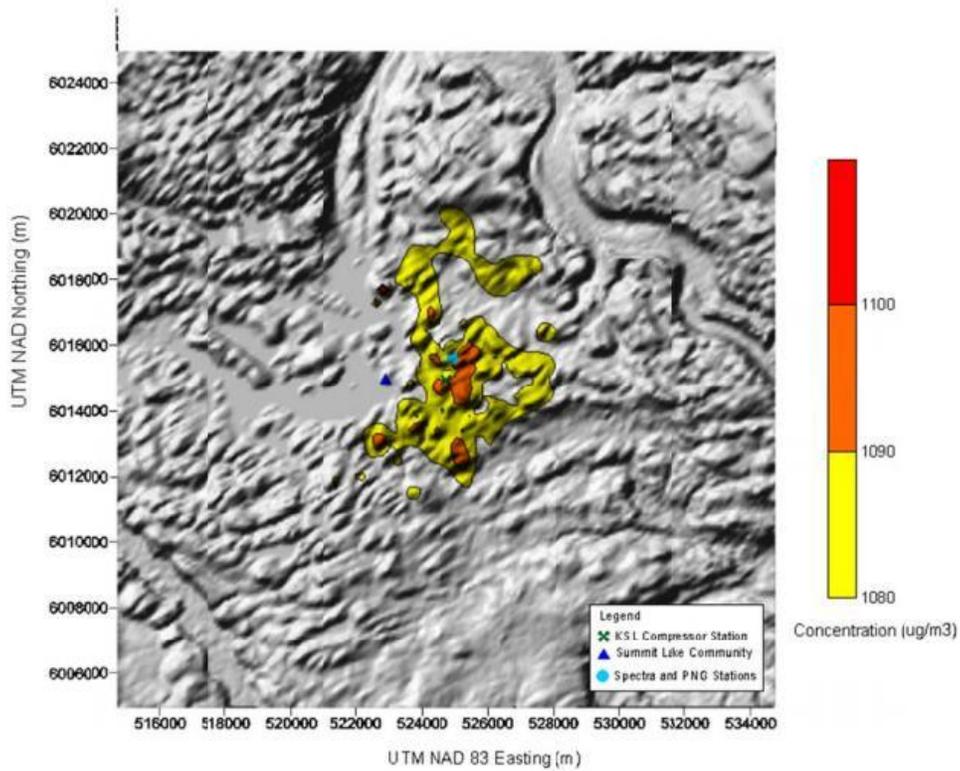


Figure 5.4: Isopleths of Maximum Predicted One-Hour Average CO Concentrations – Cumulative Effects Case - Most Stringent Air Quality Objective is $14,300 \mu\text{g}/\text{m}^3$

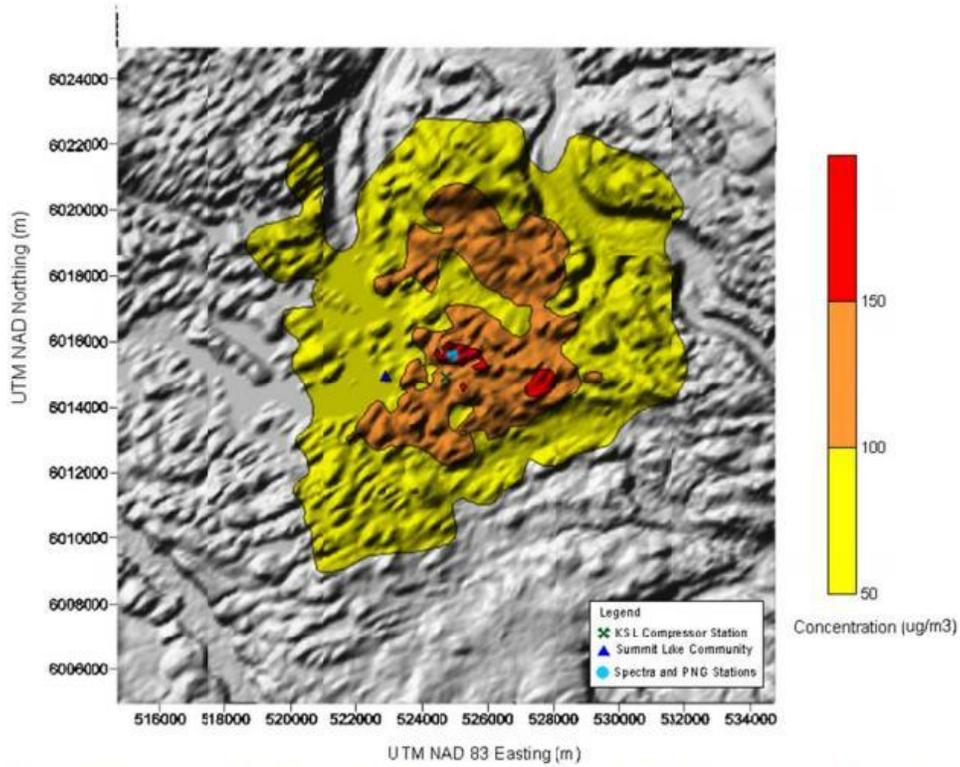


Figure 5.5: Isopleths of Maximum Predicted One-Hour Average VOC Concentrations – Cumulative Effects Case

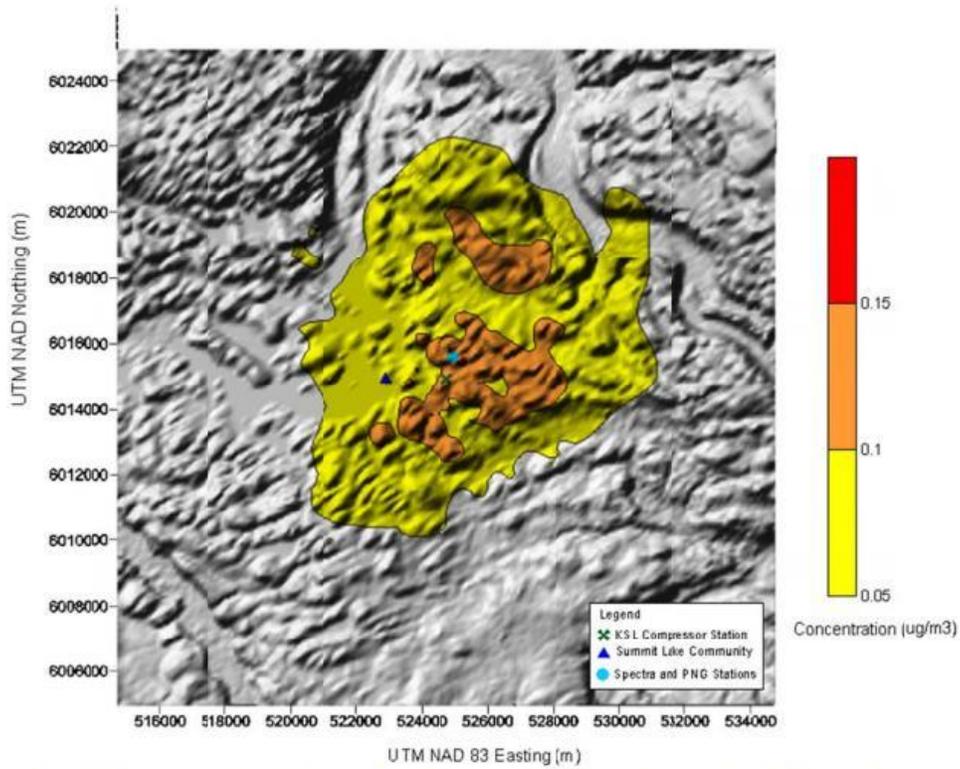


Figure 5.6: Isopleths of Maximum Predicted One-Hour Average Acetaldehyde Concentrations – Cumulative Effects Case - Most Stringent Air Quality Objective for Acetaldehyde is $90 \mu\text{g}/\text{m}^3$

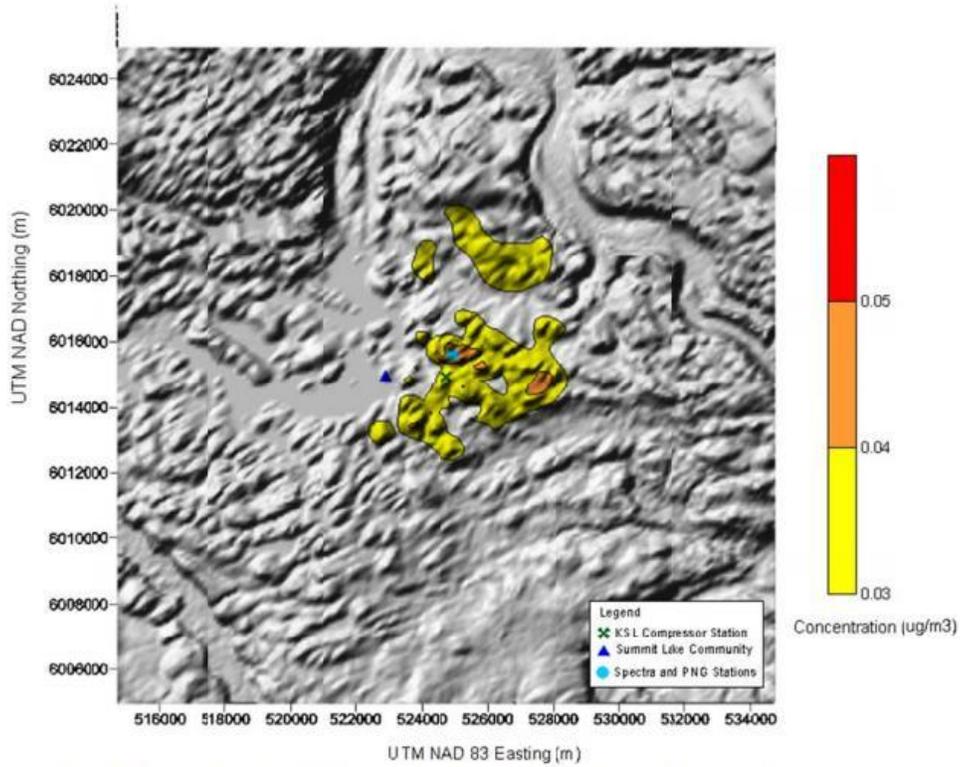


Figure 5.7: Isopleths of Maximum Predicted One-Hour Average Benzene Concentrations – Cumulative Effects Case - Most Stringent Air Quality Objective for Benzene is $30 \mu\text{g}/\text{m}^3$

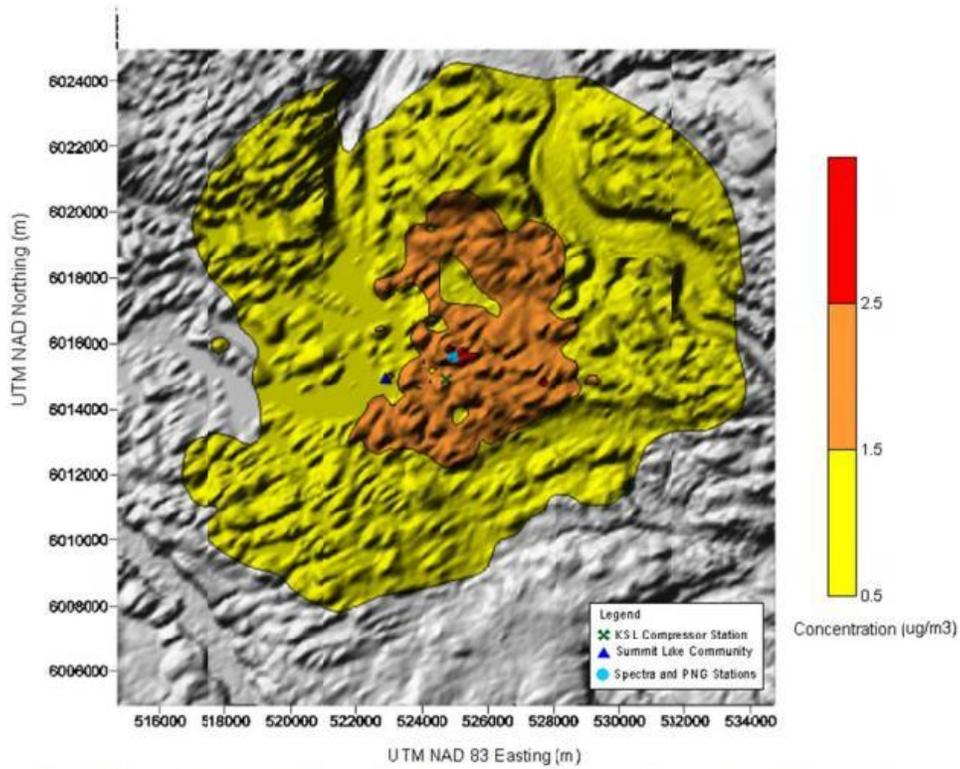


Figure 5.8: Isopleths of Maximum Predicted One-Hour Average Formaldehyde Concentrations – Cumulative Effects Case - Most Stringent Air Quality Objective for Benzene is $65 \mu\text{g}/\text{m}^3$

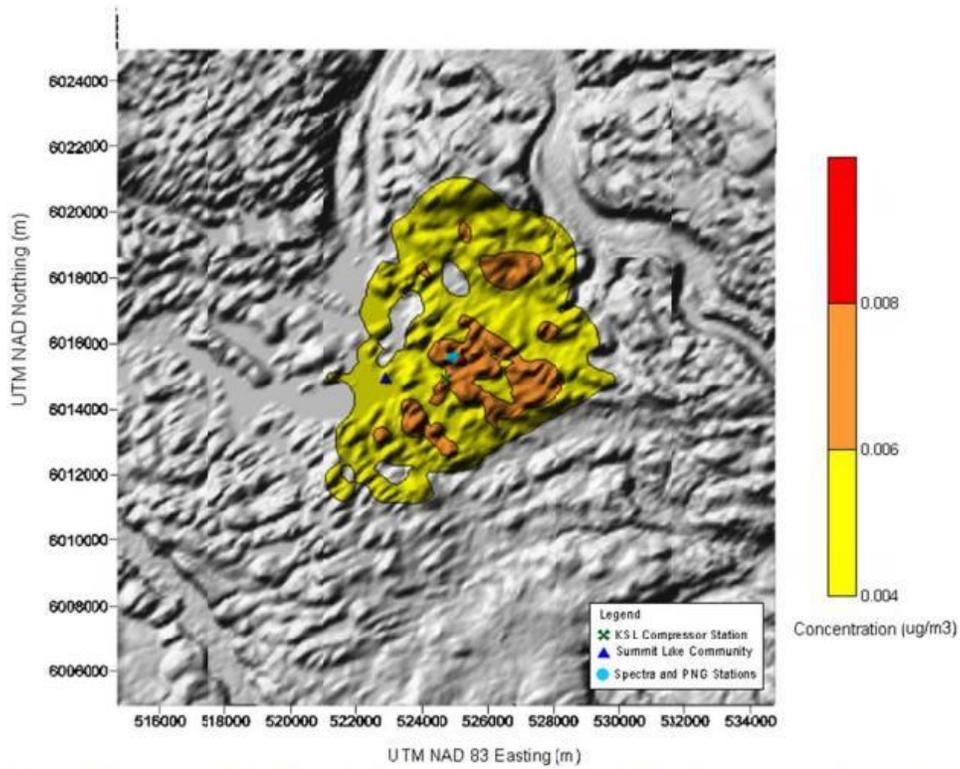


Figure 5.9: Isoleths of Maximum Predicted One-Hour Average PAH Concentrations – Cumulative Effects Case

5.2 Greenhouse Gases

The combined GHG emissions from the Project, PNG and Spectra facilities are estimated to be approximately 0.66 Mt of CO₂ equivalent. After the proposed Project is constructed, the cumulative greenhouse gas in the Project area could contribute to 1% of the total greenhouse gas emissions in British Columbia and 0.09% of greenhouse gas in Canada.

5.3 Cumulative Effects Assessment of Significance

Potential cumulative effects of air emissions from the Project and other sources in the LSA were assessed using the criteria provided in Table 2.3. The cumulative air quality effects ratings are summarized in Table 5.5.

5.3.1 Criteria Air Contaminants and CEPA Schedule 1 Substances

Maximum predicted 24-hr and annual PM_{2.5} concentrations are greater than half the corresponding objectives and therefore the magnitude is rated medium for PM_{2.5}. For all other pollutants, the maximum predicted concentrations are greater than detection limits but less than half the corresponding objectives and therefore the magnitude is rated low. All pollutants evaluated will have air quality effects for the duration of the operation of the compressor station. The duration and reversibility for these pollutants are therefore rated long term. The effects will occur primarily within the LSA and, thus, the spatial extent of the effects is deemed local. Emissions from the existing and proposed compressor stations as well as other emission sources in the LSA will occur continuously; therefore, the frequency of cumulative effects is rated continuous and the probability of occurrence is rated high.

The overall level of confidence is rated moderate for all pollutants since the cause-effect relationships are well understood but stack parameters for the Spectra facility were not available and were estimated from photographs and combustion calculations. Furthermore, emissions of the CEPA Schedule 1 substances were estimated using US EPA AP-42 emission factors and therefore may not be representative of actual emissions. Since the maximum cumulative concentrations were all below the most stringent corresponding objectives, the overall significance of the effects is considered less than significant for all pollutants.

5.3.2 Greenhouse Gases

Greenhouse gas emissions affect global climate change and therefore the spatial extent is global. Emissions will occur continuously for the life of the Project and therefore the cumulative effect is rated long term and continuous. Since the cumulative emissions in the study area are 1% of total emissions in BC and less than 0.1% of total emissions in Canada, the magnitude of emissions is rated medium. The probability of occurrence is high. The level of confidence is moderate since assumptions were made to estimate emissions. Due to the medium magnitude, the overall significance is rated less than significant.

Table 5.5: Summary of Cumulative Effects on Air Quality

Potential Project Effect	Spatial Extent	Temporal Extent			Magnitude	Probability of Occurrence	Level of Confidence	Significance
		Duration	Frequency	Reversibility				
Effect of NO ₂ emissions	Local	Long term	Continuous	Long term	Low	High	Moderate	Less than significant
Effect of SO ₂ emissions	Local	Long term	Continuous	Long term	Low	High	Moderate	Less than significant
Effect of PM ₁₀ emissions	Local	Long term	Continuous	Long term	Low	High	Moderate	Less than significant
Effect of PM _{2.5} emissions	Local	Long term	Continuous	Long term	Medium	High	Moderate	Less than significant
Effect of CO emissions	Local	Long term	Continuous	Long term	Low	High	Moderate	Less than significant
Effect of VOC emissions	Local	Long term	Continuous	Long term	Low	High	Moderate	Less than significant
Effect of benzene emissions	Local	Long term	Continuous	Long term	Low	High	Moderate	Less than significant
Effect of formaldehyde emissions	Local	Long term	Continuous	Long term	Low	High	Moderate	Less than significant
Effect of acetaldehyde emissions	Local	Long term	Continuous	Long term	Low	High	Moderate	Less than significant
Effect of PAH emissions	Local	Long term	Continuous	Long term	Low	High	Moderate	Less than significant
Effect of GHG emissions	Global	Long term	Continuous	Long term	Medium	High	Moderate	Less than significant