7.0 ASSESSMENT OF PROJECT IMPACTS, MITIGATION REQUIREMENTS, AND RESIDUAL EFFECTS

7.1 IMPACT ASSESSMENT METHODOLOGY

7.1.1 Overall Approach to the Impact Assessment

The following seven-step impact assessment process, as outlined in the Approved Terms of Reference (AToR) for the KSL Project has been used. This process ensures that the interactions between the Project components and the Project's settings are adequately described, that the potential effects are identified and properly assessed, and residual effects are identified.

1. Describe the Project facilities and activities (Section 4.0).
2. Identify and describe those components of the Project setting (environmental, socio-economic, heritage, First Nations, etc.) that will be or could be affected by Project development (Section 6.0).
3. Describe the nature and extent of the direct, indirect, and cumulative effects of any interaction between the Project and the existing Project setting and characteristics (environmental, socio-economic, etc.).
4. Describe measure(s) available to manage and mitigate the impacts identified above.
5. Identify the magnitude, duration and frequency, reversibility, and extent (geographic or otherwise) of any residual effects of the Project after mitigation measures are applied. (See Table 7.1-1)
6. Identify the probability of occurrence (likelihood) of any residual effect.
7. PTP will provide its assessment of the significance of any residual effects.

With respect to item seven, PTP will provide its own evaluation of the significance of residual effects, taking into account mitigation or compensation measures. PTP will use the definitions presented in Table 7.1-1 for the determination of significance.

The Proponent understands that some review agencies will also make their own assessment of significance, notably federal RAs for *CEA Act* review purposes.

Table 7.1-1
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.e.* permanent right-of-way, 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 centred on the pipeline right-of-way (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.e.* the zone of influence within 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 centred on the station.
Regional		The Regional Study Area (RSA) is broad enough to include those communities within the study region that may be affected economically (*e.g.* jobs, accommodation) or socially (*e.g.* 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.
	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 (*e.g.* construction period; less than or equal to <10% of the assessment period).
	Occasional	Event occurs intermittently and sporadically (*e.g.* 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 (*e.g.* mowing during routine maintenance activities; routine aerial patrols; estimated >15% but <80% of the assessment period).
	Continuous	Event occurs continually over the assessment period (*e.g.* 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.

Assessment Criteria	Definition
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 within 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.
High	Determination of significance based on good understanding of cause-effect relationships and data pertinent to the Project area.
SIGNIFICANCE [3] – of the residual effect	
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.

Notes: Significant Residual Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically mitigated.

In 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 federal RAs have the responsibility of determining significance under the CEA Act.

7.1.2 Methods – Valued Components

7.1.2.1 Geophysical Environment

A series of studies were undertaken to determine the interaction between activities associated with the KSL Project and the geophysical environment. These include:

- an analysis of terrain, slope stability and geomorphic process conditions (BGC 2006);
- a Soil Survey and Soil Assessment (Mentiga Pedology Consultants 2006); and
- an assessment of the potential for Acid Rock Drainage and Metal Leaching (Mesh Environmental Inc. 2006).

Based on the results of these studies, coupled with information provided by existing literature and background studies, the interactions between clearing, construction and restoration, and decommissioning and abandonment activities and the geophysical environment were qualitatively assessed and based on professional judgement. Concerns and issues raised by the EAO Working Group members and issues identified during discussions and meetings with government agencies, stakeholders and First Nations, were also considered in the assessment.

Identification of Residual Effects

Potential effects of the proposed KSL Project were defined as possible interactions between and among project-related activities and a geophysical VEC. Mitigation measures were developed for each of the potential effects in order to reduce or avoid the effect and reduce the likelihood of creating a residual effect. The reversibility and magnitude of all potential effects after mitigation were assessed using the criteria described in Section 7.1.1, and where appropriate, residual effects were identified.

7.1.2.2 Atmospheric Environment

The air quality effects assessment was prepared by RWDI Air Inc. A quantitative assessment was conducted for the Operations phase of the Project, since most of the emissions associated with the Project will be related to the operation of the Compressor Station, and Operations phase activity. The air quality impacts for other Project phases (Clearing, Construction and Restoration, and Decommissioning and Abandonment) were assessed qualitatively.

For the quantitative Operations phase effects assessment, the Air Quality Local Study Area (AQLSA) was defined as a 484 km^2 (22 km by 22 km) area centred on the Compressor Station at KP 265.5. The AQLSA included the communities of Burns Lake and Francois Lake. A standard assessment approach, developed in consultation with Health Canada and Environment Canada, was used to define air quality changes. Key components of this approach are presented below:

- Baseline conditions were assessed using existing air quality and wind climate information for the AQLSA. This included a review of meteorological data, ambient monitoring data, and emission inventories of existing sources in the AQLSA. The ambient air quality monitoring data accounted for the sources that were operating during the period when monitoring was conducted (*i.e.* existing sources).

- Potential interactions between Project activities and air quality were assessed by identifying and quantifying criteria air contaminant emissions from the Project and predicting the impact of those emissions on ambient air quality using a dispersion model. Greenhouse gas emissions were quantified and assessed using the CEA Agency document *Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners* general guidance for incorporating climate change consideration in environmental assessment.
- Mitigation measures incorporated into the Project design were discussed.
- Residual effects, after implementation of the design mitigation measures, were identified and assessed quantitatively for the operations phase by comparing predicted concentrations to air quality criteria.

Interactions between clearing, construction, and restoration, and decommissioning and abandonment activities and air quality were qualitatively identified by RWDI based on professional judgement.

For the air quality effects assessment, a residual effect is defined as the effect remaining after mitigation has been applied to a potential effect, if it is considered to be reversible in the medium- or long-term, and/or of medium or high magnitude. A potential effect was deemed to have no residual effect if, after mitigation, the effect is considered reversible in the immediate to short-term, and of negligible or low magnitude. The significance of residual effects identified was assessed using criteria outlined in Section 7.1.1. An additional spatial extent criteria called "global" was added to describe residual effects that extend beyond the RSA and are not limited by political boundaries.

Influence of Consultation on the Assessment

As a result of consultation with Health Canada, particulate matter, volatiles compounds, and benzene were scoped into the assessment. Environment Canada requested the inclusion of criteria air contaminants $PM_{2.5}$ and total particulate matter (TPM) as well as air pollutants listed on Schedule 1 (Toxic Substances List) of CEPA 1999. The Schedule 1 substances that could potentially be emitted by a natural gas fired Compressor Station, based on information contained in the US EPA AP-42, are benzene, formaldehyde, acetaldehyde, and polycyclic aromatic hydrocarbons (PAH).

Based on consultation with the BC MOE the following modifications were made to the initial modelling plan:

- the AQLSA was increased from 20 km by 20 km to 22 km by 22 km to include the communities of Burns Lake and Francois Lake;
- fine receptor grids (250 m spacing) were used in dispersion modelling for the communities of Burns Lake and Francois Lake;
- ambient concentrations were assessed at 2 m above ground level rather than ground-level since there are residences located within 2 km of the Compressor Station;
- SO2 and NO2 concentrations were predicted at tree canopy height; and
- seasonal variation in existing ambient air quality was analysed.

7.1.2.3 Aquatic Environment

This section addresses the methodology for assessing effects to Aquatic Environment VECs. A total of 16 fish species VECs for the KSL Project were determined by the EAO Working Group and are presented and discussed in Section 7.2.5.

Data were collected for Aquatic Environment VECs based on field observations, published sources, and discussions with regulatory agencies. Methods used to collect and compile relevant information are detailed in AAR (2007), and are summarized in Section 6.3. Potential interactions (*i.e.* impact pathways) between KSL Project activities and the Aquatic Environment VECs were identified by the Project Team based on biological information for the Project study area and knowledge of linear Project development. Concerns and issues identified by the EAO Working Group and topics identified during consultations with the BC MOE, DFO, stakeholders, and First Nations, were also considered in the assessment.

Environmental effects of the Project were considered at three scales:

- **Project Footprint (PF):** the area along the pipeline route that is expected to be disturbed by clearing, construction, and restoration activities. The Project Footprint includes the permanent pipeline right-of-way and associated permanent facilities, as well as temporary workspace and facilities supporting the construction of the Project.
- **Local Study Area (LSA):** a 2 km wide band of habitat along the entire length of the pipeline route. The LSA is approximately 1 km on each side, measured from the centre of the pipeline route, and includes the Project Footprint area.
- **Regional Study Area (RSA):** A large area extending from the pipeline route. The RSA scale is used to discuss regional scale effects of the Project, primarily related to population-level effects. The RSA includes both the Project Footprint area and the local study area.

Identification of Residual Effects

Potential effects of the KSL Project were defined as possible interactions of project-related activities on one or more Aquatic Environment VECs (see Section 7.2.5 for list of VECs). All VECs were considered in the assessment, however, specific information on a single element is only presented in the effects assessment if a potential interaction between the Project and that element is expected to occur. Some Aquatic Environment VECs are not discussed because they are not expected to interact with the Project.

Mitigation measures were developed for each of the potential effects in order to minimize project-related impacts and avoid the creation of residual effects. The reversibility and magnitude of all potential effects after mitigation was assessed using the criteria described in Section 7.1.1 and residual effects were identified.

A residual effect for Aquatic Environment VECs is defined as the effect remaining after mitigation has been applied to a potential effect, if it is considered to be reversible in the medium- or long-term, and of medium or high magnitude.

A potential effect was deemed to have no residual effect if, after mitigation, the effect is considered reversible in the immediate or short-term, and of negligible or low magnitude. The significance of residual effects identified was assessed using criteria outlined in Section 7.1.1, above.

7.1.2.4 Terrestrial Environment: Wildlife and Wildlife Habitat; Vegetation

Data collection for the Terrestrial Environment VECs involved assembling and analyzing existing published and unpublished information and Project specific field data collected in 2006 and 2007. The following Project specific information was obtained for environmental assessment purposes:

- Terrestrial Ecosystem Mapping (TEM; 1:20 000 scale);
- vegetation community plot work and description;
- wetland survey;
- spring breeding/migratory bird habitat assessment;
- wildlife habitat assessment;
- wetland wildlife and fall migratory bird survey;
- grizzly bear habitat and den surveys;
- northern goshawk habitat suitability assessment;
- coastal tailed frog stream suitability assessment;
- mountain goat habitat assessment; and
- winter wildlife track survey.

Interactions between planned KSL Project activities and Terrestrial Environment VECs were identified by the Project team biologists with input from First Nations, Regional BC MOE staff, local biologists, as well as the professional judgement of the Project team. The concerns and issues identified by the EAO Working Group members and topics identified during consultations with the BC MOE, ILMB, CWS, knowledgeable residents, stakeholders, and the general public were also considered in the Terrestrial Environment effects assessment.

The following publications aided in identifying project-related effects on wildlife and wildlife habitat and in developing mitigation for these effects:

- Interim Canadian Wildlife Service Guidelines for Addressing Migratory Birds and species at risk in Project Environmental Assessment;
- Migratory Birds Environmental Guidelines
- Best Management Practices for Raptor Conservation during Urban and Rural Land Development in British Columbia;
- Best Management Practices for Amphibians and Reptiles in Urban and Rural Environments in British Columbia; and
- Reduced Risk Timing Windows for Fish and Wildlife.

The effects of the Project on the Terrestrial Environment were considered at three different scales. These are:

- **Project Footprint (PF):** the land area along the pipeline route that is expected to be disturbed by clearing, construction, and restoration activities. The Project Footprint includes the permanent pipeline right-of-way and associated permanent facilities, as well as temporary workspace and facilities supporting the construction of the Project.
- **Local Study Area (LSA):** a 2 km wide band of habitat along the entire length of the pipeline route. The LSA is approximately 1 km of each side, measured from the centre of the pipeline route.
- **Regional Study Area (RSA):** a large area (approximately 14 000 km^2) in the BC MOE Skeena and Omineca Regions. The RSA covers a 30 km wide area centred on the pipeline route. The RSA is used for the qualitative analysis of effects of the Project on large ranging wildlife species such as grizzly bear or wolverine.

Identification of Potential and Residual Effects

Potential effects of the KSL Project were defined as possible interactions of project-related activities on the Terrestrial Environment VEC. The Terrestrial Environment VEC is the collective term for a total of 44 separate VEC elements defined for the Project in the Approved Terms of Reference. These VEC elements include specific wildlife species, wetlands, vegetation communities, and habitat types. Although all the VEC elements were considered in the assessment, specific information on a single element is only presented in the potential effects assessment if a potential interaction between the Project and that element is expected to occur.

For this reason, potential effects of the Project on some wildlife VEC species that are not expected to interact with the Project (*i.e.* Caspian tern, red fox).

Mitigation measures were developed for each of the potential effects in order to minimize project-related impacts and avoid the creation of residual effects. The reversibility and magnitude of all potential effects after mitigation is applied was assessed using the assessment criteria described in Section 7.1.1, and residual effects were identified.

A residual effect for Terrestrial Environment is defined as the effect remaining after mitigation has been applied to a potential effect, if it is considered to be reversible in the medium- or long-term, and of medium or high magnitude.

A potential effect was deemed to have no Residual Effect if, after mitigation, the effect is considered reversible in the immediate or short-term, and of negligible or low magnitude. The significance of residual effects identified was assessed using criteria outlined in Section 7.1.1, above.

7.1.2.5 Species and Ecosystems at Risk

The Species at Risk section considers potential and residual effects for Fish, Plants and Plant Communities, and Wildlife species at risk. Refer to the sections 7.1.2.3 and 7.1.2.4 for detail about methods used to identify potential effects and assess residual effects.

7.1.2.6 Archaeological and Heritage Resources

The Archaeological and Heritage Resources assessment was prepared for the purpose of providing background information about the nature and location of archaeological and heritage resources that may occur along the proposed pipeline alignment including the location of permanent and temporary facilities. The first phase of the study included a thorough literature review and a determination of the location of documented archaeological sites in the vicinity of the KSL Project. This information was included in an Archaeological Overview (AOA) study that also provided a rationale for determining areas of archaeological and heritage resources potential - essentially an "Archaeological Site Potential Model". The Archaeological Impact Assessment (AIA) outlined in Section 6.6 of this Application outlines the methodology used to examine a number of pre-determined site potential areas (based on the Site Potential Model) in the field, in the course of the AIA component of the study.

Although the focus of the Archaeological and Heritage Resources study was on archaeological resources - as defined in the B.C. Archaeology Branch's "British Columbia Guidelines for Archaeological Impact Assessment" (Government of B.C. 1998) - other "Heritage Resources" such as trails, historic cabin remains, post 1846 Culturally Modified Trees (CMTs) and other sites and features that may not come under the protection of the *B.C. Heritage Conservation Act*, but which may have some importance to the history of land use or human occupation within the Project Footprint were also included in the study. It should be noted that Traditional Use Studies (TUS) were undertaken as a separate examination for the purpose of the environmental assessment. While some cross-over between the TUS and the Archaeology and Heritage components did occur, most of the TUS generated data was found to have only minimal application to the overall AIA study results.

Identification of Residual Effects

Potential effects of the proposed KSL Project were defined as possible interactions between Project activities and, archaeological and heritage sites (existing and newly discovered). Mitigation measures, chiefly focused on impact avoidance, were developed to reduce the likelihood of creating a significant residual effect.

7.1.2.7 First Nations Community and Land Use

To fulfill the requirements described in the PTP Project Terms-of-Reference, information was collected in the following topic areas in relation to First Nations community and land use:

- Identification of First Nations traditional territories and overlap areas;
- Historic First Nation use of lands and resources in the study area;
- Current First Nation use of lands and resources in the study area;
- First Nations Land Use Plans and involvement in planning; and
- First Nations aboriginal rights, title and treaty rights.

Mapping information with respect to First Nations traditional territories was obtained from the British Columbia Treaty Commission Statements of Intent (SOI) for First Nations involved in the British

Columbia treaty negotiations process. Direct contact was made with First Nations not involved in this process, to obtain maps of traditional territories in relation to the Project route.

Two methods were employed to obtain information on historic and current First Nation use of land and resources:

(i) through literature review of historic and recent ethnographic documents related to the First Nations land use in the study area, and

(ii) through interviews conducted with First Nations informants as part of Traditional Use Studies (TUS).

Research methodology for the TUS work involved a series of interviews with First Nations Elders and members in the First Nations communities along the Project route. Community members were interviewed regarding local knowledge of traditional plant and animal use, seasonal activities, and land use near the Project route.

The interviews were both carefully structured and open-ended. The structured portions of these interviews involved a formal set of questions aimed at retrieving traditional use site-specific information. However, throughout the interviews, the methodology often became open-ended, as the interviewees were encouraged to take advantage of the opportunity to talk freely about issues that they considered important. These discussions often resulted in the identification of additional traditional use sites.

The interviews were conducted using a set of 1:50,000 NTS maps for reference and the plotting of traditional use locations. Mapping occurred during the interview process. A separate set of interview maps (mylar) was used for each interview. The data retrieved during the interview process was then remapped onto the 1:50,000 NTS preliminary maps.

Information collected through literature review and TUS interviews was analyzed to identify potential Project effects on First Nations land and resource use under study for the Environmental Assessment Application. Effects of the Project were considered at three different scales:

- **Project Footprint (PF):** The land area along the pipeline route that is expected to be disturbed by clearing, construction, and restoration activities. The Project Footprint includes the permanent pipeline right-of-way and associated permanent facilities, as well as temporary workspace and facilities supporting the construction of the Project.
- **Local Study Area (LSA):** A 2 km wide band of land along the length of the pipeline route. The LSA is approximately 1 km on each side, measured from the centre of the pipeline route.
- **Regional Study Area (RSA):** A large area extending 15 km from the pipeline route. The RSA scale is used to discuss regional scale effects of the Project, primarily related to communities.

Identification of Potential Residual Effects

Potential effects of the KSL Project are defined as possible interactions of project-related activities with the First Nations current use of lands and resources. Mitigation measures were developed for

each of the potential effects in order to minimize project-related impacts and avoid the creation of residual effects. The reversibility and magnitude of all potential effects after mitigation is applied were assessed using the assessment criteria described in Table 7.1-1, and residual effects were identified.

A residual effect for First Nations communities and land use is defined as an effect that remains after mitigation measures have been applied. The residual effects vary in duration and magnitude, but the common theme is that a residual effect is expected to occur despite mitigation plans and agreements. Residual effects may be adverse or beneficial.

7.1.2.8 Socioeconomic Elements

This section addresses the methodology for the Land and Resource Use, Community and Regional Infrastructure and Services, Employment and Economy, and Human Health and Safety Valued Social Components (VSCs).

Data for these Socio-Economic VSCs were collected from a combination of published sources, geographic information system (GIS) analysis, discussions with key stakeholders, and field observations. The following steps were used to compile relevant information:

- Obtain and review published reports and maps from government agencies involved in administering or regulating a specified area or resource.
- Review mapping and digital photography to identify potentially relevant features in the context of the Project.
- Conduct Internet searches or related online investigations.
- Contact resource planners, community representatives, engineers, regulators, interest group representatives, or individuals to identify potential issues associated with the Project. These included:
    - municipal and regional district administrators and staff,
    - British Columbia Government agency representatives,
    - federal government staff,
    - licence and tenure holders,
    - emergency service personnel,
    - representatives of Chambers of Commerce and other economic development groups, and
    - local interest groups.
- Prepare GIS maps of resources, facilities, utilities, or other topics under study to determine their spatial relationship to the Project.

- Analyze information collected to identify potential Project effects on the resource or topic under study for the Environmental Assessment Application.

The Socio-Economic effects of the Project were considered at three different scales. These are:

- **Project Footprint (PF):** The land area along the pipeline route that is expected to be disturbed by clearing, construction, and restoration activities. The Project Footprint includes the permanent pipeline right-of-way and associated permanent facilities, as well as temporary workspace and facilities supporting the construction of the Project.
- **Local Study Area (LSA):** A 2 km wide band of land along the entire length of the pipeline route. The LSA is approximately 1 km of each side, measured from the centre of the pipeline route.
- **Regional Study Area (RSA):** A large area extending from the pipeline route. The RSA scale is used to discuss regional scale effects of the Project, primarily related to communities.

Identification of Potential Residual Effects

Potential effects of the KSL Project were defined as possible interactions of project-related activities on the four identified Socio Economic VSCs. These Socio-Economic VSCs are defined for the Project in the Approved Terms of Reference. The VSC elements include specific land and resource uses, community and regional effects, economic elements, and human health topics.

Mitigation measures were developed for each of the potential effects in order to minimize project-related impacts and avoid the creation of residual effects. The reversibility and magnitude of all potential effects after mitigation is applied was assessed using the assessment criteria described in Table 7.1-1, and residual effects were identified.

A Residual Effect for Land and Resource Use, Community and Regional Infrastructure and Services, Employment and Economy, and Human Health and Safety is defined as an effect which remains after all of the mitigation measures have been applied. The residual effects range in duration and magnitude, but the common theme is that an effect is expected to occur despite mitigation plans and agreements. Residual effects may be positive or negative.

7.1.2.9 Navigable Waters

Transport Canada (TC), through this Navigable Waters section, is the regulatory authority in regard to the *Navigable Waters Protection Act (NWPA)*. Transport Canada is acting as a responsible authority under the *CEA Act* with respect to the KSL Project.

The determination of whether or not a river or stream is “navigable” can only be done by Transport Canada. PTP has provided Transport Canada with all of the data and information that has been collected on stream and river crossings for both the pipeline as well as for vehicle/equipment crossings. Transport Canada has determined those streams and rivers that will be considered “navigable” with respect to the *NWPA*. PTP will be required to submit Applications for approval of all works in, on, under, through or across navigable waters.

PTP will implement design measures to avoid impacts to navigable waters during clearing and construction and restoration. It is expected that mitigation measures will form the conditions associated with the approvals provided by TC. The appropriate engineering design will ensure there are no effects on navigability of navigable waters resulting from the operation of the pipeline.

7.1.2.10 Aesthetics and Viewsheds

This section addresses the methodology for Aesthetics and Viewsheds Valued Social Components (VSCs).

The information used to prepare this section was collected from a combination of digital sources, geographic information system (GIS) analysis, discussions with key stakeholders, and field observations. The following steps were undertaken to compile relevant information:

- Obtain and review published reports and digital mapping from the BC Ministry of Forests and Range, the Provincial government agency involved in managing the visual landscape.
- Review mapping and digital photography to identify potentially relevant features in the context of the Project.
- Conduct Internet searches or related online investigations.
- Contact resource planners and provincial government representatives to identify potential issues associated with the Project.
- Analyze information collected to identify potential Project effects on the visual resource for the Environmental Assessment Application.

The Aesthetic and Viewsheds effects of the Project were considered at three different scales. These are:

- **Project Footprint (PF):** The land area along the pipeline route that is expected to be disturbed by clearing, construction, and restoration activities. The Project Footprint includes the permanent pipeline right-of-way and associated permanent facilities, as well as temporary workspace and facilities supporting the construction of the Project.
- **Local Study Area (LSA):** A 2 km wide band of land along the entire length of the pipeline route. The LSA is approximately 1 km of each side, measured from the centre of the pipeline route.
- **Regional Study Area (RSA):** A large area extending from the pipeline route. The RSA scale is used to discuss regional scale effects of the Project, primarily related to communities.

Identification of Potential Residual Effects

Potential effects of the KSL Project were defined as possible interactions of project-related activities on the VSC.

The viewpoints selected for the determination of potential visual effects are:

- Enso Recreation Site,
- Upper Kitimat Recreation Site-Kitimat Lookout,
- Burnie River Valley,
- Morice River Valley,
- Maxan Trail,
- Tchesinkut Lake,
- Short sections along Highway 16,
- Ormond Creek Trail,
- Nyan Wheti Trail,
- Omineca Trail,
- Stuart River Valley, and
- Salmon River Valley.

The criteria used to identify these viewpoints include:

- degree of viewscape disturbance,
- primary viewing season,
- estimated number of potential viewers during primary viewing season,
- viewer distance from the pipeline route or facility,
- existing landforms and land us influencing viewscapes,
- likelihood of visibility,
- existing VQOs,
- length of time the Project might be visible to a viewer, and
- an overall assessment of the potential for an adverse effect.

Mitigation measures were developed for each of the potential effects in order to minimize project-related impacts and avoid the creation of residual effects. The reversibility and magnitude of all potential effects after mitigation is applied was assessed using the assessment criteria described in Table 7.1-1, and residual effects were identified.

A Residual Effect for Aesthetics and Viewsheds is defined as an effect, which remains after all of the mitigation measures have been applied. The residual effects range in duration and magnitude, but the common theme is that an effect is expected to occur despite mitigation plans and agreements. Residual effects may be positive or negative.

7.2 EFFECTS ASSESSMENT – PIPELINE AND PERMANENT FACILITIES [1]

7.2.1 Geophysical Environment

7.2.1.1 Clearing, Construction and Restoration

POTENTIAL EFFECTS AND MITIGATION MEASURES

The potential effects associated with the clearing, construction and restoration of the pipeline on the geological environment include:

- rock blasting of trench and grade rock,
- groundwater erosion,
- surface water erosion and loss of cover over the pipeline,
- earth flows,
- debris/earth slides,
- debris flows,
- rock slides,
- rock fall,
- Acid Rock Drainage/Metal Leaching,
- loss of topsoil and impact to soil capability, and
- effect on other linear developments.

The potential effects on the pedological (soil) environment include:

- lowering of soil capability caused by soil mixing,
- loss of topsoil through wind and water erosion,
- lowering of soil capability through compaction and rutting,
- increased stoniness in surface horizons, and
- trench subsidence.

The potential effects on the palaeontological environment include:

- disturbance of palaeontological resources.

[1] The reader is referred to the baseline studies contained in Volume II of this Application for background data and information on the VSCs and VECs discussed in this report section.

a. Potential Effect: Rock blasting of trench and grade rock

Where intact and unrippable bedrock is encountered within approximately 2 m of the ground surface for both trench excavation and for grading the construction right-of-way, it may be necessary to blast the bedrock in order for it to be excavated.

All blasting will be undertaken in a controlled and supervised manner to ensure that adjacent slopes and other landform features are not made unstable by the blasting activity. Warning sirens will be used for human safety and to scare off wildlife. Blast mats will be used as needed to protect infrastructure and dwellings. The potential effect of bedrock blasting is of isolated frequency and of low magnitude. ***The following residual effects have been identified: minor and localized instabilities that may occur in fill materials, the alteration of local topography resulting from right-of-way grading.***

b. Potential Effect: Linear features

There are numerous other linear features that are closely paralleled and crossed by the proposed KSL pipeline where there are concerns of causing instability in fill slopes as well as cut slopes used by a linear facility. These existing linear facilities include CN Rail, the existing PNG pipeline, highway crossings, and main forest service roads. With appropriate design and engineering in advance of construction, coupled with inspection during construction and periodic monitoring following construction (where warranted) the potential effect is reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

c. Potential Effect: Groundwater erosion

As a result of ditch excavation and backfill, particularly on sloping ground, the pipeline trench can act to redirect groundwater flows along the ditch line. This redirection and concentration of groundwater flow can result in subsurface erosion and ditch subsidence. By installing periodic ditch-breakers in the trench prior to backfill, subsurface water can be redirected to the surface where it can then be directed off the right-of-way and into the existing drainage courses. The potential effect is reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

d. Potential Effect: Surface water erosion

Grading the pipeline right-of-way and ditch excavation will result in the exposure of loose, unvegetated soils that, on sloping terrain, will be susceptible to surface water erosion. Erosion can include processes such as sheet-erosion, minor gullying, and localized sloughs and soil flows. The key to mitigating these effects is to incorporate appropriate engineering design into the project that will ensure that surface water flow is properly managed in the short- and long-terms. These designs will include the construction of cross-ditches, berms, and drains at strategic locations along the right-of-way as well as the judicious use of sediment transport barriers such as filter cloth and straw bales. Monitoring of the performance of these erosion control features on a regular basis (with particular emphasis following spring-thaw and intense precipitation events) and the undertaking of necessary repairs in a timely manner will greatly reduce the likelihood of substantial erosion along the right-of-way and access roads. Restoration and revegetation of the disturbed soils will greatly mitigate soil erosion over the long term. The potential effect is reversible in the short to medium-term and of low to medium magnitude. ***No residual effect has been identified.***

e. Potential Effect: Earth flows

The incursion of the ocean up the Kitimat River valley during deglaciation resulted in the deposition of marine clays on the floor and sidewalls of the valley up to elevations of approximately 200 m above present-day sea level. Due to their mineralogy, chemistry, and grain-size, these marine clays are very susceptible to failure in the form of earth flows, particularly on seepage slopes where there is high pore-water pressure. Several such earth-flow events are well documented in this area.

Pipeline routing in the Kitimat Valley has avoided all known marine clay occurrences (for example, selection of the Iron Mountain route on the west side of the valley) in order to reduce the likelihood of this being a concern to the KSL pipeline. Should marine clays be encountered during construction, geotechnical engineering expertise will be engaged to ensure sound practices are employed to reduce the risk of triggering an earth-flow, minimising its impact on the environment, while ensuring the integrity of the installed pipeline. The potential effect is reversible in the short - to medium-term and of low to medium magnitude. ***No residual effect has been identified.***

f. Potential Effect: Debris/earth slides and minor slope instabilities

Debris/earth slides are slope erosional processes that can occur on slopes greater than 20 degrees, usually in fine-grained glacial till and colluvium, and usually during periods of intense precipitation. Past debris/earth slides are documented in the Kitimat Valley. However, pipeline routing in the Kitimat Valley has sought to minimize exposure to these types of landslides. Should debris slide be encountered during construction, geotechnical engineering expertise will be engaged to ensure sound practices are employed to reduce the risk of triggering a debris-flow, minimising its impact on the environment, while ensuring the integrity of the installed pipeline. The potential effect is reversible in the medium-term and of medium magnitude. ***The following residual effect has been identified: areas of minor terrain instability.***

g. Potential Effect: Debris flows

Debris flows are slope erosional processes that generally initiate on open slopes as a debris slide or in existing steep gullies. The KSL pipeline crosses several gullies and mountain streams that are subject to natural debris flow activity. These locations are relatively easily identified, and the pipeline route has been chosen to minimise impact from debris flows. Through appropriate pipeline and access road location and engineering design, the impact of debris flow activity on the pipeline and the likelihood of construction activity resulting in a debris flow can be minimized. The potential effect is immediate, of isolated frequency, and of medium magnitude. ***No residual effect has been identified.***

h. Potential Effect: Rock slides

In steeply sloping, mountainous areas of the pipeline route where weathered bedrock occurs and perhaps where there is unfavourable orientation to the bedrock structure and oversteepened slopes, there is a possibility of rock slides to occur. Relic rock slides, which have occurred since deglaciation, are evident in several locations within the regional study area. The most effective means of mitigating the effect of rock slides is to entirely avoid terrain that is susceptible to this process. This technique has been adhered to in the routing for the KSL pipeline. The potential effect is of negligible magnitude and low probability of occurrence. ***No residual effect has been identified.***

i. Potential Effect: Rock fall

Rock fall is a slope erosional process that results from the detachment of bedrock masses either naturally due to existing oversteepened slopes, or through construction practices that result in the exposure of cuts in bedrock (usually greater than 10 m in height). The failure of rock faces is a concern to worker safety and possible environmental and visual impacts. These concerns will necessitate that a qualified registered engineering professional be involved in the design of the cut slopes and to monitor potentially unstable slopes for a period of time following construction. The potential effect is of negligible magnitude and low probability of occurrence. ***No residual effect has been identified.***

j. Potential Effect: Exposure of acid generating rock and rock subject to metal leaching

Those bedrock types that contain iron-bearing sulphur minerals can generate excessive acidity when exposed to the air (oxygen) and water. The leaching of metals such as zinc, copper, and molybdenum in discrete locations along the pipeline route can result in highly acidic conditions although some metal solubility can also occur at neutral pH conditions.

Issues related to acid rock drainage and metal leaching (ARD/ML) will be restricted only to areas where unweathered bedrock is exposed to the surface and where there is a high potential for acid drainage and metal leaching to occur. Where such conditions exist, avoidance will be considered, and otherwise proper containment of the excavated rock will be undertaken and the containment facilities will be subject to periodic monitoring and maintenance over a three year period. The potential effect is reversible in the medium-term and of low to medium magnitude. ***No residual effect has been identified.***

k. Potential Effect: Lowering of soil capability caused by soil mixing

Topsoil is generally prevalent in areas along the pipeline route that are used for agricultural purposes. Generally, these agricultural areas are contained in the Agricultural Land Reserve (ALR). Much thinner topsoil will also occur in other areas, and across significant portions of the right-of-way, no topsoil will exist. Where topsoil conservation is necessary to preserve the capability of the soil to produce an agricultural crop or to sustain favourable growing conditions for commercial tree species, shrubs, and groundcover, it is necessary to ensure that the topsoil resource is not mixed with subsoil materials. Topsoil often contains the necessary nutrient content, organic matter, pH, and water holding characteristics necessary to foster and sustain plant growth. Subsoil materials in the project area are often of high pH (calcareous), low in nutrients and organic matter and of excessive coarse fragment content (i.e. gravely and stony). Maintaining the separation of these two soil materials and subsequently replacing the topsoil on the surface of the disturbed landscape is the appropriate mitigation measure to ensure minimal reduction of the soils capability to sustain plant growth. The effect is considered reversible in the short to medium-term and of low to medium magnitude. ***The following residual effect has been identified: minor mixing of topsoil or root zone material with subsoil will likely occur.***

l. Potential Effect: Loss of topsoil or root zone material through wind and water erosion

Where topsoil and root zone material is stored along the pipeline right-of-way, there is a risk that, due to water and wind erosion, some of this exposed material will be lost. The result of this loss will be a reduction in the amount of this valuable material that will be available for restoration of the right-of-way as well as potential sedimentation into adjacent waterbodies. The soils assessment has identified that due to their sandy texture, Alix, Alluvium, Braeside, Crystal, and Mapes soils have a high wind erosion hazard. Berman and Nithi soils, due to their loam, silt loam, and sandy loam texture have a moderate to high wind erosion hazard. Where soils occur on slopes of greater than 15%, they are rated as having a high water erosion hazard. These include some Barrett, Berman, Crystal, and Mapes soils as well as the Rough Broken Land Unit that occurs adjacent to deeply incised creeks or rivers. The effect is considered reversible in the short-term and of low to medium magnitude. ***The following residual effect has been identified: loss of topsoil or root zone material can be expected until a vegetative cover is established.***

m. Potential Effect: Lowering of soil capability through compaction and rutting

Soils that have poor bearing capacity and are imperfectly, poorly, and very poorly drained are susceptible to compaction (increase in soil density) as well as rutting from wheeled construction equipment and vehicles. Soil compaction and rutting will not be a major concern if construction occurs in the winter when the soils are frozen. In non-frozen conditions, rutting that mixes subsoil into the topsoil layer will not be permitted. Fine-textured Pineview and shallow Pineview soils are highly susceptible to soil compaction and rutting and Kenzie soils are highly susceptible to soil compaction. The effect is considered reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

n. Potential Effect: Increased stoniness in surface soil horizons

Topsoil and subsoil handling procedures can result in an increase in the amount of coarse fragments (gravel, stones, boulders) that are brought to the soil surface as a result of pipeline clearing and construction. The loss of fines from the soil matrix can also result in an increase in the relative volume of coarse fragments. Coarse fragments in the topsoil can interfere with agricultural practices resulting in damage to equipment and the reduction of soil capability. The potential effect is considered reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

o. Potential Effect: Trench subsidence

Excavation of the trench for the pipeline generally results in a temporary loosening of the soil and a reduction in soil density. When the soil is replaced (backfilled) into the trench it will often have a lower density than the surrounding, undisturbed soil. Over time, the soil in the trench will often reconsolidate, resulting in a loss of volume, and subsequent subsidence of the trench relative to the adjacent ground surface. Such a condition can interfere with agricultural practices and result in the ponding of surface water. This condition is mitigated by light compaction of the subsoil and leaving a small crown over the trench to provide for some settlement. The potential effect is reversible in the short-term and of low magnitude***. The following residual effect has been identified: minor trench subsidence or a remnant crown may remain.***

p. Potential Effect: Disturbance of palaeontological resources

A literature and professional review of the KSL pipeline route has concluded that while the pipeline passes through local areas with good palaeontological potential, the pipeline route overall is of low potential. Palaeontological resources comprise fossils or other evidence of ancient life, including plants, animals, and single-celled organisms (this is distinct from archaeological resources). While the palaeontological potential is generally low along the pipeline route, in order to avoid or mitigate impacts to this resource, a number of mitigation measures are recommended. This includes informing the Environmental Inspectors of the need for due diligence in particular sections of the right-of-way during construction, as well as for the field checking of a number of gravel pits in the immediate vicinity of the pipeline route for the presence of vertebrate remains or rich, shelly deposits. Of particular note is the isolated find of a bison skull by previous researchers, in the vicinity of the Kitimat highway bridge. ***The following residual effect has been identified: potential to contribute to the understanding of the regional palaeontological resources as a result of the construction of the KSL Project.*** This is a positive residual effect and consequently, does not require an evaluation of significance.

Methanex Lateral

The proposed Methanex Lateral connection to the KSL Project follows an existing linear disturbance (Hydro right-of-way) for most of its length. The terrain is dominated by very poorly drained wetlands located in the Kitimat lowlands. While there are no concerns regarding mass wasting processes in this area, final engineering design will need to ensure that no impacts accrue to the existing powerline. In addition, the area is likely prone to high water tables and possibly flooding, and these factors will need to be addressed in final pipeline design (e.g. pipeline weighting). Potential effects are considered reversible in the short-term and of low magnitude. ***No residual effects have been identified.***

Compressor Station

The proposed compressor station is located in an area of low relief of the Nechako Plateau. The terrain consists of stable, thick deposits of glacial till that is generally well to moderately drained on slopes of 1% to 5%. There are no adverse geomorphic process affecting the site, at this time. Potential effects to the physical landscape are considered reversible in the short-term and of low magnitude. ***No residual effects have been identified.***

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual Effect: Alteration of local topography and minor, localized instabilities that may occur in fill material

Blasting of intact bedrock for purposes of grading the right-of-way and excavating the pipeline trench may temporarily destabilize adjacent fill materials. Excavation and grading will also alter the local topography along the construction right-of-way. PTP will employ appropriate controlled blasting techniques to reduce the risk of creating instability in adjacent soils and will monitor the effects of blasting to ensure that corrective measures are taken to restabilize any areas that are affected.

Alteration to local topography will generally be minor, and all cuts and fills required for pipeline and access road construction will be left in a stable state after construction. Restoration activities following construction will further reduce the extent of these effects. The residual effect is considered to be reversible in the short-term and medium in magnitude. ***The residual effect is less than significant.***

b. Residual Effect: Areas of minor terrain instability may occur

As a result of right-of-way grading and new access road developments minor areas of temporary terrain instability may occur that will require site-specific recommendations by a qualified engineer or geoscientist. Measures such as sloping back right-of-way cuts, re-establishing surface and subsurface drainage patterns and the installation of drainage and erosion control measures will be utilized to restabilize areas that may be prone to mass wasting processes such as earth flows, debris/earth slides, debris flows, and rock fall. The residual effect is considered to be reversible in the medium-term and of medium magnitude. ***The residual effect is less than significant.***

c. Residual Effect: Minor mixing of topsoil or root zone material with subsoil will likely occur

Where topsoil or root zone material is stripped off the construction right-of-way and stored for later use during the restoration phase of the project, it is not always possible to salvage all of this material and it is not always possible to prevent minor contamination of this material with excavated subsoil. In addition, topsoil can be lost into the excavated ditch due to occasional sloughing of the ditch sidewalls. By means of specifying the proper soil and root zone material salvage, stripping topsoil back from the planned trench sidewall, and implementing thorough inspection of this work by the contractor, the effect will be minimized. The residual effect is considered to be reversible in the short-term and of low magnitude. ***The residual effect is less than significant.***

d. Residual Effect: Loss of topsoil or root zone material through wind and water erosion

The soil assessment that was conducted for the KSL Project has identified those soil types that will be most prone to loss due to either water or wind erosion. While minor loss of topsoil and root zone material will likely occur where materials are windrowed or stockpiled for later use, the implementation of protection and stabilization techniques will prevent any substantial loss of this material (these techniques include the use of tackifiers, water, snow as well as the sowing of a cover crop). On the right-of-way, soil and root zone material erosion will be controlled by measures such as the use of diversion berms, the spreading of woody debris and slash on the right-of-way, and seeding. The salvage of topsoil and root zone material will be suspended under extremely windy and extreme rainfall conditions. Monitoring of the effectiveness of erosion control measures and the implementation of remedial measures where warranted will reduce this potential effect to being reversible in the short-term and of low magnitude. ***The residual effect is less than significant.***

e. Residual Effect: Minor trench subsidence or a crown may remain over the ditch line

Following proper backfill of the trench and site clean-up and reclamation, some areas along the right-of-way will experience a crown left over the trench and in some areas the backfill may settle to a

degree greater than expected heaving a concave depression along the trenchline. Where these situations occur, PTP will implement the appropriate restoration effort to reduce or eliminate the crown and to add soil material to depressional areas to bring them up to the elevation of the surrounding land. In some instances, this may require the salvaging of topsoil prior to the placement of subsoil material, and then replacing the topsoil. PTP will monitor the right-of-way to ascertain where these conditions exist that are affecting the use of the land, and will undertake the appropriate remedial measures. The residual effect is considered to be reversible in the medium-term and of low magnitude. ***The residual effect is less than significant.***

Table 7.2-1
Effects Assessment: Geophysical Environment
Clearing, Construction, and Restoration

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Physical Environment and Geological Processes			
Rock Blasting	In general, locations along the pipeline route where bedrock is within 2 m of ground surface.	• Bedrock encountered in the trench, on grade for facilities, or adjacent to road cuts may require blasting in rock that cannot be ripped with machinery. • Ensure that blasting is controlled and undertaken and supervised by licensed professional blasters and engineers in accordance with good industry practice.	• Minor rock and soil instabilities in the local area may be triggered from blasting. • Re-contouring of the ROW to the pre-construction profile may not be feasible at locations where blasting of grade rock has occurred. • Low frequency vibrations and sound may disturb local wildlife.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Linear Facilities	CN Rail Line Crossing, KP 17 Highway Crossings KP 37, KP 251, KP 305, KP 361, KP 461 Adjacent to Highway 16 KP 280 to KP 305 Existing FSRs: KP 0 to KP 32, KP 42 to KP 74; KP 84 to KP 88; KP 113 to KP 462. The Endako Mine is located 5 km south of KP 298.	• Any construction activities adjacent to an existing road, rail line, or powerline should be engineered/conducted in a manner that minimises the likelihood that construction fill, cut/fill slopes, and surface water could impact the road, rail line, or watercourse.	• No residual effects identified.
Groundwater Erosion	In general, locations along the pipeline route where drainage is poor and wetlands and lake are adjacent to the ROW. Slopes in fine grained soils are also susceptible to groundwater erosion	• As a pipeline trench infilled with coarse/disturbed backfill tends to attract natural groundwater flows, pipeline design along ROW slopes will include designs to re-direct surface water away from the ROW, re-direct groundwater in the trench to the surface and to the margins of the ROW and into existing drainage courses.	• No residual effects identified.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Surface Water Erosion	In general, locations along the pipeline route where slopes are greater than 15 degrees (30%) and soils are fine grained or loose. Kitimat River Valley from KP 0 to KP 2 and KP 13 to KP 42	• Surface water and groundwater control in the form of ditches, cross ditches, re-contouring, re-vegetation, drains, and berms on the access roads and along the ROW will be incorporated in the pipeline design as determined by a qualified and experienced geoscientist or engineer. • Minimise ground excavation and travel along or adjacent to soil slopes immediately after or during seasons of intense precipitation such as October and November prior to freeze up, in the spring during spring thaw and during August thunderstorm season. • Performance of the pipeline ROW and access roads will be monitored and repaired for a period after construction to ensure sedimentation and erosion is minimised. • Normal pipeline operations will include regular inspection of slope and areas susceptible to erosion to ensure that erosion and sedimentation is minimised.	• No residual effects identified.
Earth Flows	Kitimat River Valley from KP 7 to KP 13 KP 15 to KP 17 KP 20 to KP 24 KP 26 to KP 28	• Caution must be exercised during construction if glaciomarine clay is encountered at surface or beneath other soil units. Any cut banks within this clay will be very sensitive and susceptible to failure especially if the pore pressures within the soil are not dissipated. Machine vibration or high spoil piles adjacent to excavated or natural faces of glaciomarine clay can also reduce the stability of this soil. • Geotechnical engineering expertise was engaged during route selection to ensure that areas of potential terrain instability were identified and avoided to the extent feasible. • Minimise ground excavation and travel along or adjacent to soil slopes immediately after or during periods of intense precipitation during October and November prior to freeze up, in the spring during spring thaw and during August thunderstorm season.	• No residual effects identified.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Debris/Earth Slides and minor slope instabilities	Locations where road/ROW cut slopes or fill slopes, or ROW longitudinal slopes exceed 10 m in height, where susceptible slopes are located upslope of the road/ ROW or construction facilities, and where susceptible slopes are adjacent to watercourses. Specific areas include Kitimat River Valley from KP 13 to KP 42 Interior Plateau: KP 343 to KP 351 (east of Fraser Lake, on left (north) bank of the Nechako River); KP 405 to KP 408 (east of the Stuart River Crossing around Chinohchey Creek); KP 436 to KP 438 (around the Salmon 1 crossing); KP 455 to KP 457 (around the Salmon 3 crossing).	• Geotechnical engineering expertise was engaged during route selection to ensure that areas susceptible to debris/earth slides were identified and avoided to the extent feasible. • For cuts greater than 10 m in height, or where fine-grained soils are anticipated, soil cut slope design and support provisions should be designed and then refined by a qualified registered professional during construction in advance of the road/right-of-way heading. The primary purpose of this effort is to minimize the potential for cut slope failures that could impact worker safety and disrupt the construction schedules, and impact to the environment. • Minimise ground excavation and travel along or adjacent to soil slopes immediately after or during periods of intense precipitation during October and November prior to freeze up, in the spring during spring thaw and during August thunderstorm season. • Post slide mitigation will be designed to maximize slope stability, minimise further erosion and downstream impacts such as sedimentation of watercourses	• Areas of minor terrain instability may occur. • If a slide occurs then there may be some visual impact from the natural slide scar. • Slide scar may be susceptible to further erosion and may contribute to sedimentation of local watercourses.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Debris Flows	Within the Coast Mountain at existing mountain creek crossings KP 42 to KP 113. Large debris flow fans are located at KP 49, KP 61, KP 70 to KP 74, and KP 108 to KP 109.	• Geotechnical engineering expertise was engaged during route selection to ensure that areas susceptible to debris flows were identified and avoided to the extent feasible. • In general, during the design phase, the extents of these debris flow fans/cones (deposition zones) should be delineated by an experienced and qualified geological engineer or geoscientist and the new pipeline, at a minimum, should be buried at least an additional metre below the nominal design depth in order to protect it from scour from future debris flow events. If possible, the pipeline should be located as far as possible from the apex of the debris flow fan to avoid areas of the fan most susceptible to vertical scour. The pipe should also be located on the immediate upslope side of any access roads or natural benches to encourage debris flows and floods to deposit debris on top of the pipeline. In addition to deeper burial, the use of rock shield around the pipeline through the length of the fan should also be considered to protect against boulder impact.	• No residual effects identified. • If a flow occurs, there may be some visual impact from the natural slide scar. • Slide scar may be susceptible to further erosion and may contribute to sedimentation of local watercourses.
Rock Slides	Areas susceptible to rock slide include KP 74 to KP 77 and KP 89 to KP 95.	• Geotechnical engineering expertise was engaged during route selection to ensure that areas of potential rock slides were identified and avoided to the extent feasible. • Stabilisation of large rock slides is generally not practical mainly due to excessive cost and challenging access. Therefore avoiding the rock slides altogether and understanding their causes in order to avoid additional rock slide susceptible terrain are typically the best risk management techniques for pipeline routing.	• No residual effect identified.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Rock Fall	Locations where road/ROW cut slopes or fill slopes exceed 10 m in height or natural rockfall susceptible slopes are located upslope of the road/ ROW or construction facilities. Susceptible areas include KP 17 to KP 25 KP 74 to KP 84 KP 88 to KP 109 KP 307 to KP 309	• For cuts greater than 10 m in height, or where adverse geologic structure is suspected, rock cut slope design and support provisions should be designed and then refined by a qualified registered professional during construction in advance of the road/right-of-way heading. The primary purpose of this effort is to minimize the potential for cut slope failures that could impact worker safety and disrupt the construction schedules, and impact to the environment.	• No residual effects have been identified.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Acid Rock Drainage and Metal Leaching			
Exposure of acid-generating rock and rock subject to metal leaching	High Zones exist from KP 185 to KP 250, Moderate Zones from KP 0 to KP 20, KP 75 to KP 76, KP 150 to KP 185, and KP 280 to KP 310. The remainder of the pipeline corridor passes through Low Zones. In general, only for locations where bedrock is within 2 m of the ground surface.	• An assessment has been made to classify and determine the boundaries of the potential ARD/ML zones along the KSL pipeline route. Where warranted, a verification program will be undertaken to help develop specific construction stage monitoring and/or mitigation plans within each zone, where there is a high ARD/ML potential. • Areas of the pipeline that will cross colluvium or require rock excavations would include varying degrees of field inspections (assuming favourable access and logistics), mapping and sampling for laboratory testing of acid rock drainage and metal leaching properties. Sampling frequency and testing requirements will be more onerous for the high zones and less onerous for those areas considered to have moderate potential for ARD/ML. • General recommendations for each of the identified zone includes: – High – relatively closely spaced sampling to achieve representative material based on volume of each lithological unit to be excavated, detailed acid base accounting, solids chemistry and leach extraction analyses, potential testing of 'effective' buffering capacity and kinetic characteristics. – Moderate – adequate sampling to confirm classification and be considered representative of lithology to be encountered, detailed acid base accounting, solids chemistry and leach extraction analyses. – Low – limited to no sampling to confirm classification, analysis of indicator parameters such as sulphur and inorganic carbon. – Rock with high ARD /ML potential that has been excavated will require engineered containment to minimise its impacts on the environment. These containment facilities will require monitoring and maintenance.	• No residual effects identified. • Proper containment of excavated rock that has the potential for acid generation or metal leaching will be required.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Soil Capability			
Lowering of soil capability caused by soil mixing	Concentrated on agricultural land but also throughout project area where topsoil exists	• Salvage the total thickness of topsoil to a maximum depth as indicated on the Environmental Work Sheets. The EI will provide interpretation based on the Soils Assessment Report. • Salvage duff and upper root zone material to a maximum of 15 cm to 20 cm using the Environmental Work Sheets as a guide. • Salvage, store, and subsequently replace separately the topsoil or root zone material from subsoil wherever grading occurs. • Store spoil material over the existing PNG pipeline only under conditions where the spoil can be completely returned during final clean-up.	• Minor mixing of topsoil or root zone material with subsoil will likely occur
Loss of topsoil or root zone material through wind and water erosion	Where topsoil and root zone material are salvaged and stored	• Do not salvage topsoil or root zone material under extreme windy or rainy conditions. • Apply water, snow, or tackifier to the salvaged topsoil or root zone material as directed by the EA in order to prevent erosion. • Monitor the effectiveness of the erosion control measures and implement remedial work where warranted.	• Minor loss of topsoil and root zone material can be expected until a vegetated cover is established.
Lowering of soil capability through compaction and rutting	Pineview and Kenzie Soils	• Schedule clearing and construction of wet areas during the winter when the soils are frozen. • Minimize construction traffic in poorly drained soil areas. • Consider using swamp or rig mats over long distances of wet soils. • Decompact subsoil before placement of topsoil where warranted. • Decompact working side where warranted prior to restoration	• No residual effects identified.
Increased stoniness in surface soil horizons	Alix, Avis, and Crystal Soils	• Prior to topsoil or root zone material replacement, pick stones from the right-of-way that could result in the reduction of soil capability. • Dispose of stones at appropriate locations. • Monitor the right-of-way and following restoration for the presence of stones at the surface on agricultural lands and remediate where warranted.	• No residual effects identified.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Trench subsidence	Barrett, Berman and Pineview Soils	• Light compaction of subsoil in non-frozen conditions. Alternative methods of compaction may be used if approved by PTP's engineer. • Leave a slight crown (roach) over the trench to compensate for settlement. In frozen conditions, employ a larger crown. • Monitor the trench for subsidence following restoration and undertake remedial measures where warranted.	• Minor trench subsidence or a remnant crown may remain.
Palaeontological Resources			
Disturbance of palaeontological resources	Specific locations along the pipeline route. The Coast Mountain section is unlikely to contain palaeontological resources.	• Undertake the examination of specified gravel pits prior to construction to allow determination of palaeontological resource value and to develop appropriate mitigation strategies. • Monitor trenching activities where warranted. • Where discoveries are made, engage the resource specialist to assist in determining the appropriate sampling procedures, if warranted.	• No residual effects identified. • Monitoring and collection of samples (if they occur) will contribute to palaeontological knowledge of the area.

Table 7.2-2
Significance of Residual Effects: Geophysical Environment
Clearing, Construction, and Restoration

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
The alteration of local topography and minor, localized instabilities that may occur in fill material	Project Footprint	Short-term	Isolated	Short-term	Medium	High	High	Less than significant
Areas of minor terrain instability may occur	Project Footprint	Short-term	Isolated	Medium-term	Medium	High	Moderate	Less than significant
Minor mixing of topsoil or root zone material with subsoil will likely occur	Project Footprint	Short-term	Isolated	Short-term	Low	High	High	Less than significant
Loss of topsoil or root zone material through wind and water erosion	Project Footprint	Short-term	Isolated	Short-term	Low	High	High	Less than significant
Minor trench subsidence or a crown may remain over the ditch line	Project Footprint	Short-term	Isolated	Medium-term	Low	High	High	Less than significant

7.2.1.2 Operations and Maintenance

POTENTIAL EFFECTS AND MITIGATION MEASURES

The potential effects associated with the operation and maintenance of the KSL pipeline on the geological, soil and palaeontological environment include:

- surface water erosion along the right-of-way;
- minor terrain instabilities; and
- continuing soil compaction, trench subsidence, and soil fertility issues.

a. Potential Effect: Surface water erosion along the right-of-way

Following restoration of the right-of-way, localized areas may continue to experience the erosion of topsoil and subsoil material due to factors such as extreme rainstorm events, the poor growth of grasses and forbs used in the revegetation effort and the ineffectiveness of installed erosion control measures such as diversion berms and drains. PTP will monitor the pipeline right-of-way until the surface has stabilized and will implement appropriate remediation measures to control erosion where warranted. The potential effect is reversible in the medium-term and of medium magnitude. ***No residual effect has been identified.***

b. Potential Effect: Minor terrain instabilities may occur

PTP has and will continue to utilize the services of an engineer or geoscientist to provide recommendations for slope stabilization measures where unstable conditions are identified. Due to the nature of some mass wasting and terrain instability processes, it is possible that in some locations these processes will not be evident until the pipeline is put into operation. PTP will monitor the right-of-way on a regular basis in order to determine if areas of instability are developing and will implement the appropriate measures to restabilize the terrain. The potential effect is reversible in the medium-term and of medium magnitude. ***No residual effect has been identified.***

c. Potential Effect: Continuing soil compaction, trench subsidence and soil fertility issues

PTP has and will continue to utilize the services of a soil scientist and agrologist as needed to provide recommendations for the protection and management of the soil resource. Due to the nature of some soil processes and the longer-term effects of construction, it is possible that effects such as soil compaction, trench subsidence and fertility will not be fully identified until the pipeline is put into operation. PTP will monitor the right-of-way on a regular basis to identify if these types of conditions are persisting and will implement the appropriate measures to restore the land to as close to pre-construction conditions as practical. The potential effect is reversible in the medium-term and of medium magnitude. ***No residual effect has been identified.***

Methanex Lateral

The proposed Methanex Lateral may experience potential effects during the operations and maintenance phase that are similar to those put forward for the KSL pipeline (other than “minor

terrain instabilities" since the lateral is located on flat, stable terrain). PTP will mitigate these effects in the same manner as put forward for the pipeline. ***No residual effect has been identified.***

Compressor Station

Due to the nature of the land that will be used for the compressor station and the fact that the compressor compound will be engineered, drained, and resurfaced to meet its purpose, ***no potential effects have been identified*** during the operation and maintenance phase.

SIGNIFICANCE OF RESIDUAL EFFECTS

No residual effects have been identified.

Table 7.2-3
Effects Assessment: Geophysical Environment
Operations and Maintenance

Valued Component/ Potential Effect	Location	Mitigation Measures	Residual Effect
Surface water erosion along the right-of-way	Specific locations along the pipeline right-of-way and new access roads; generally where slopes are greater than 15 degrees (30%) and soils are fine-grained and loose.	• Monitor sections of the pipeline right-of-way and new access roads where surface erosion may be anticipated. • Implement appropriate remediation measures to control erosion where warranted.	• No residual effect identified.
Minor terrain instabilities may occur	Specific locations along the right-of-way and new access roads where mass wasting processes such as debris flows, debris slides and rock slides have occurred or where they may be anticipated; particular attention to be paid to susceptible slopes adjacent to water courses.	• Monitor sections of the pipeline right-of-way and new access roads where mass wasting processes may be anticipated. • Implement appropriate remediation measures to restabilize the slope. • Pay particular attention to potentially unstable slopes adjacent to watercourses.	• No residual effect identified.
Continuing soil compaction, trench subsidence and soil fertility issues	At specific locations along the right-of-way, usually where the land is used for agricultural purposes.	• Monitor conditions along the right-of-way if persistent conditions exist (often these are identified by the property owner). • Implement appropriate remediation measures such as land levelling, decompaction, stone picking, and fertilization.	• No residual effect identified.

7.2.1.3 Decommissioning and Abandonment

POTENTIAL EFFECTS AND MITIGATION MEASURES

The decommissioning and abandonment of the KSL Pipeline will comply with the acceptable regulatory standards that are in-place at that time. The procedures followed would likely be removal of all above ground facilities and surface appurtenances and the abandonment of the pipeline in-place, with the pipe severed and sealed at strategic locations, and with the right-of-way left in its established stable condition. If required for a special area of concern, or by regulation, the pipeline will be removed. Consequently, decommissioning and abandonment will likely result in potential effects that are of substantially less magnitude to those which have been described for the construction of the pipeline. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards of the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Lateral

The discussion provided under the "Pipeline" section is entirely applicable to the Methanex Lateral.

Compressor Station

A compressor station will likely only be abandoned if the pipeline is abandoned. Due to operational considerations, the compressor station could be idled for a considerable period if it is not required to assist with the flow of natural gas. In the case of abandonment, all of the underground piping, aboveground buildings, and facilities would be dismantled and removed from the compound. Fill and aggregate material would be removed from the site and the area would be restored to as close to pre-disturbance conditions as possible. Topsoil that had been salvaged during construction would be used to restore the land. Decommissioning and abandonment will likely result in potential effects that are similar but of less magnitude to those which have been described for the construction of the compressor station. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards for the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Meter Station

See information provided above for Compressor Stations.

7.2.2 Atmospheric Environment

7.2.2.1 Clearing, Construction and Restoration

POTENTIAL EFFECTS AND MITIGATION MEASURES

The potential effects associated with the clearing, construction, and restoration of the pipeline on the atmospheric environment include:

- greenhouse gas emissions,
- emissions from construction equipment,
- dust generated by construction traffic on the right-of-way and unpaved access, roads and from blasting, and
- smoke from slash burning.

a. Potential Effect: Greenhouse gas emissions

Sources of greenhouse gas emissions associated with the clearing, construction, and restoration of the pipeline include:

- combustion of fossil fuels associated with the transport of equipment and material to the pipeline construction site;
- combustion of fossil fuels associated with pipeline construction activities; and
- emissions associated with the temporary and longer-term clearing of site vegetation (in particular, forest cover) and changes to land-use and vegetative cover.

PTP will use multi-passenger vehicles to transport crew to site to the extent practical to limit the amount of traffic and accompanying emissions. Following existing linear disturbances where feasible will minimize the amount of greenhouse gas emissions associated with clearing of vegetation. The contribution of the Project to greenhouse gas emissions during clearing, construction, and restoration is reversible in the long-term and of negligible to low magnitude. ***No residual effect has been identified.***

b. Potential Effect: Emissions from construction equipment

The operation of heavy equipment (*e.g.* earth movers, excavation equipment, and grading equipment) will result in air emissions such as, carbon monoxide, sulphur dioxide, nitrogen oxides, and volatile organic compounds. There will also be air emissions associated with the exhaust of trucks transporting salvageable timber and with crew transport vehicles (*i.e.* pickup trucks and buses).

Fuel economy will be a consideration when purchasing, upgrading, and maintaining the vehicle fleet and equipment will be well maintained to minimize emissions. Equipment use will be maximized when running and unnecessary idling of equipment will be minimized. PTP will use multi-passenger

vehicles to transport crew to site to the extent practical to limit the amount of traffic and accompanying emissions. The best management practices in an Air Quality Management Plan will be adhered to at all times. The potential effect is reversible in the short-term and of low magnitude. ***The following residual effect has been identified: short-term increase in vehicle emissions.***

c. Potential Effect: Dust from construction traffic

Excavation and grading activities during clearing and construction and vehicle traffic on the right-of-way and driving to and from the site on unpaved access roads will result in fugitive dust emissions. PTP will apply water to exposed soil piles if wind erosion occurs, and to the Project Footprint at intersections and near residences and other sensitive areas during dry conditions. In the winter, snow will generally decrease dust emissions. Vehicle speeds will be controlled to reduce traffic-induced dust dispersion and resuspension from the operation of heavy vehicles and speed limit signs will be posted in sensitive areas. Trucks hauling sand, dirt, or other loose materials will be covered. The best management practices in an Air Quality Management Plan will be adhered to at all times. The potential effect is reversible in the short-term and of low magnitude. ***The following residual effect has been identified: short-term increase in dust arising from construction traffic.***

d. Potential Effect: Dust from blasting

Dust will be created during blasting operations which will naturally occur in rocky portions of the route. The best management practices in an Air Quality Management Plan will be adhered to at all times. The potential effect is reversible in the immediate to short-term and, as a result of the mitigation measures, of low magnitude. ***No residual effect has been identified.***

e. Potential Effect: Smoke from open burning

Land clearing will result in the removal of trees and other vegetation. Some of this material will likely be disposed of by open burning. PTP will comply with all permit restrictions to burning in the vicinity of highways, rivers and residences, and will be conducted in compliance with local government bylaws, the BC *Open Burning Smoke Control Regulation,* and the *Forest Fire Prevention and Suppression* regulation. Prior to burning options will be explored to reduce, reuse, or recycle as much material as practical. The best management practices in an Air Quality Management Plan will be adhered to at all times. The potential effect of open burning will be limited to areas in proximity to human receptors (*i.e.* permanent residences and public facilities); thus, the effect at any one location will be temporary and localized. The potential effect is reversible in the immediate to short-term and of low magnitude. ***No residual effect has been identified.***

Permanent Facilities

The potential effects, mitigation measures, and residual effects associated with clearing, construction, and restoration of the Methanex Lateral, Compressor Station, and other permanent facilities are the same as those described above.

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual Effect: Short-term increase in vehicle emissions

Although nuisance emissions arising from construction equipment will occur along the entire route, the residual effect of an increase in vehicle emissions will be limited to areas in proximity to human receptors (*i.e.* permanent residences and public facilities). Thus, the effect of construction-related emissions at any one location will be temporary and localized. The event will be short-term in duration and isolated in frequency, since the potential effect will only occur during the clearing, construction, and restoration phase. Air emissions during construction will be minimized using best management practices as described in the Air Quality and Dust Control Plan. This residual effect is reversible in the short-term and, as a result of the mitigation measures, is of low magnitude. The probability of occurrence is high and the level of confidence related to the significance evaluation is high. ***The residual effect is less than significant.***

b. Residual Effect: Short-term increase in dust arising from construction traffic

Fugitive dust emissions are transient in nature and are dependent on many factors, such as the moisture in the soil, the level of activity at a particular location, and meteorological conditions at the time of the construction activities. The potential effect will be of a local spatial extent. Any potential for dust generation would likely occur during periods of high winds or extremely dry periods and, as such, are expected to be of isolated frequency and short-term in duration. The residual effect is reversible in the short-term and, as a result of the mitigation measures to minimize dust during construction, is of low magnitude. The probability of occurrence is high and the level of confidence related to the significance evaluation is high. ***The residual effect is less than significant.***

Permanent Facilities

The potential effects, mitigation measures, and residual effects associated with clearing, construction, and restoration of the Methanex Lateral, Compressor Station, and other permanent facilities are the same as those described in above.

Table 7.2-4
Effects Assessment: Atmospheric Environment
Clearing, Construction, and Restoration

Valued Component/ Potential Effect	Location	Mitigation Measures	Residual Effects
Greenhouse gas emissions	Entire pipeline route Methanex Lateral Compressor Station	• Use multi-passenger vehicles to transport crew to site to the extent practical to limit the amount of traffic and accompanying emissions. • Minimize the amount of greenhouse gas emissions associated with clearing of vegetation by following existing linear disturbances where feasible.	• No residual effect identified.
Emissions from construction equipment	Entire pipeline route Methanex Lateral Compressor Station	• Consider fuel economy when purchasing, upgrading, and maintaining the vehicle fleet. • Use well-maintained equipment to minimize emissions. • Maximize equipment use when running and minimize unnecessary idling of equipment. • Use multi-passenger vehicles to transport crew to site to the extent practical to limit the amount of traffic and accompanying emissions. • Adhere to the Air Quality and Dust Control Plan.	• Short-term increase in vehicle emissions.
Dust from construction traffic	Entire pipeline route Methanex Lateral Compressor Station	• Apply water to exposed soil piles if wind erosion occurs. • Apply water to the Project Footprint during dry conditions at intersections and near residences and other sensitive areas. • Control vehicle speeds to reduce traffic-induced dust dispersion and resuspension from the operation of heavy vehicles. • Post speed limit signs in sensitive areas. • Ensure trucks hauling sand, dirt, or other loose materials are covered. • Adhere to the Air Quality and Dust Control Plan to be developed prior to construction.	• Short-term increase in dust arising from construction traffic.
Dust from blasting	Entire pipeline route Methanex Lateral Compressor Station	• Adhere to the Air Quality and Dust Control Plan to be developed prior to construction.	• No residual effect identified.

Valued Component/ Potential Effect	Location	Mitigation Measures	Residual Effects
Smoke from open burning	Entire pipeline route Methanex Lateral Compressor Station	• Conduct burning in compliance with local government bylaws, the BC *Open Burning Smoke Control Regulation,* and the *Forest Fire Prevention and Suppression* regulation. • Prior to burning, explore options to reduce, reuse, or recycle as much material as possible. • Adhere to the Air Quality and Dust Control Plan.	• No residual effect identified.

Table 7.2-5
Significance of Residual Effects: Atmospheric Environment
Clearing, Construction, and Restoration

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Short-term increase in vehicle emissions	Project Footprint to LSA	Short-term	Isolated	Short-term	Low	High	High	Less than significant
Short-term increase in dust arising from construction traffic	Project Footprint to LSA	Short-term	Isolated	Short-term	Low	High	High	Less than significant

7.2.2.2 Operations and Maintenance

POTENTIAL EFFECTS AND MITIGATION MEASURES

a. Potential Effect: Fugitive greenhouse gas emissions from pipeline operations

A source of greenhouse gas emissions during operations of the KSL pipeline, the Methanex Lateral, the Methanex Meter station and Compressor Station is fugitive emissions of natural gas including venting during blowdown, purging and emergency situations.

PTP will use modern low-bleed pneumatic controllers to minimize fugitive emissions from operations. These controllers significantly reduce greenhouse gas emissions created by older, continuous-bleed pneumatic controllers that constantly vent low volumes of natural gas. Low-bleed controllers vent only during operation and may vent into downstream gas piping.

Prior to commissioning, the pipeline will be pressure tested with air or water to ensure system integrity during normal operation, thereby minimizing, or eliminating greenhouse gas emissions as a result of pipeline leakage.

Fugitive greenhouse gas emissions at compressor stations are primarily related to venting of natural gas trapped in the station pipeline during maintenance and emergency shut downs, and leakage of natural gas from the compressor casing.

PTP will use dry gas seals to prevent high-pressure gas in the compressor from leaking past the casing along the shaft to the atmosphere. Dry gas seals extend the time period that a shutdown unit can remain pressurized, thereby reducing the frequency of depressurizing the compressor case and reducing the quantity of gas emitted. Dry gas seals also reduce friction on the compressor shaft, increasing the power available to compress gas. These seals have in the past been wet seals, which use oil systems. The use of dry gas seals instead of the traditional wet gas seals eliminates the need for seal oil pumps and seal oil cooler fans, resulting in increased available power and a reduction in fuel consumption. Dry gas seals are state of the art and will minimize fugitive greenhouse gas emissions.

Compressor station blowdown gas is released when the station isolates and vents the gas trapped in the station piping. Unit blowdown gas is released when the compressor unit isolates and vents the gas trapped in the unit piping. Station blowdowns are rare and may occur once a year, on average. Unit blowdowns happens when a unit emergency shutdown is triggered. It is anticipated that this may happen several times a year. The reason for venting and the extent of venting are determined by the specific triggering event. Typical triggers are: pushing the emergency shutdown buttons, fire detection, heat detection, or gas detection. For each of these triggers, the possible consequences are minimised by isolation and rapid venting of the pressurised piping. Opportunities to reduce blowdown gas must be balanced with safety concerns. Some of the station blowdowns are inadvertent. Advanced control systems will assist in providing integrity checks so that device failures will not trigger a blowdown. Unit blowdown volumes will be reduced in the station design by minimising the actual trapped volume.

The potential effect of fugitive emissions in operations is reversible in the long-term. The magnitude of the emissions is considered low. ***The following residual effect has been identified: fugitive greenhouse gas emissions from pipeline operations.***

b. Potential Effect: Greenhouse gas emissions from Compressor Station operations

Combustion of fuel gases at the compressor station is the largest source of greenhouse gas emissions. PTP's operating and maintenance procedures will ensure the new state of the art compressor, with a dry-low No_x fuel optimization system, will be maintained at peak efficiency to ensure fuel efficient combustion and to minimize exhaust emissions.

Although the potential effect of greenhouse gas emissions from operation of the compressor station is of low magnitude, it will occur continuously for the life of the project and therefore is reversible in the long-term. ***The following residual effect has been identified: greenhouse gas emissions from Compressor Station operations.***

c. Potential Effect: Emissions of common air contaminants and schedule 1 substances from Compressor Station operations

The sources of emissions of common air contaminants (*i.e.* NO_x, NO_2, TSP, PM_{10}, $PM_{2.5}$, CO, and VOC) and Schedule 1 substances (*i.e.* acetaldehyde, benzene, formaldehyde, and PAH) during normal operation of the Compressor Station are combustion emissions from the compressor engine and the four microturbines. Dispersion modelling in the AQLSA was conducted in accordance with the *Guidelines for Air Quality Dispersion Modelling in British Columbia* (BC MOE 2006). Please see the *Air Quality Technical Report* for information on model assumptions and inputs.

Dispersion Model Results

Table 7.2-6 summarizes the maximum ambient concentrations predicted by the ISC-PRIME and RTDM models. Output file print-outs have not been provided due the lengthy nature of the files, but are available upon request.

The maximum predicted one-hour, 24-hour, and annual NO_x concentrations are well below the most stringent federal objectives. The highest NO_x concentrations are predicted in the immediate vicinity of the Compressor Station, with some measurable concentrations predicted in the elevated terrain to the northeast and east-southeast of the Compressor Station.

The maximum predicted one-hour, 24-hour, and annual SO_2 concentrations are well below the provincial Level A objectives. The highest SO_2 concentrations are predicted in the immediate vicinity of the Compressor Station due to building downwash effects as noted by the considerably lower concentrations predicted by the RTDM model in areas of elevated terrain.

The maximum predicted 24-hour particulate emissions are well below the most stringent air quality objectives for TSP, $PM_{10,}$ and $PM_{2.5}$. The highest particulate concentrations are predicted in the

immediate vicinity of the Compressor Station, with some higher concentrations predicted in the elevated terrain to the northeast and east-southeast of the Compressor Station.

The maximum predicted one-hour and eight-hour CO concentrations are well below the provincial Level A objective.

The highest VOC concentrations are predicted in the immediate vicinity of the Compressor Station, especially in the elevated terrain to the northeast and east-southeast of the Compressor Station.

Table 7.2-6
Maximum Predicted Ambient Concentrations of Common Air Contaminants and Schedule 1 Substances in the Air Quality Local Study Area

Contaminant	Averaging Period	Maximum Predicted Concentration (µg/m³)	Most Stringent Air Quality Objective (µg/m³)
NO_x	1-Hour	38	-
	24-Hour	12	-
	Annual	0.8	-
NO_2	1-Hour	38	400
	24-Hour	12	200
	Annual	0.6	60
SO_2	1-Hour	2.8	450
	24-Hour	1.6	150
	Annual	0.2	25
TSP	24-Hour	0.9	120
	Annual	0.1	60
PM_{10}	24-Hour	0.9	50
$PM_{2.5}$	24-Hour	0.9	30[1]
CO	1-Hour	47	14,300
	8-Hour	21	5,500
VOC	1-Hour	0.8	-
Benzene	1-Hour	0.004	30
PAH	1-Hour	0.001	-
Acetaldehyde	1-Hour	0.01	90
Formaldehyde	1-Hour	0.3	65

Note: [1]Annual 98th percentile value, averaged over three consecutive years.

Table 7.2-7 summarizes the maximum predicted NO_2 and SO_2 concentrations at tree canopy height. The maximum predicted one-hour NO_2 and SO_2 concentrations are 110 and 120 µg/m³, respectively. The highest predicted concentrations are located in a small area in the immediate vicinity of the Compressor Station.

Table 7.2-7
Maximum Predicted Concentrations of NO_2 and SO_2 at Tree Canopy in the Air Quality Local Study Area

Contaminant	Averaging Period	Maximum Predicted Concentration (µg/m³)
NO_x	1-Hour	532
	24-Hour	58
	Annual	2.0
NO_2	1-Hour	110
	24-Hour	34
	Annual	1.4
SO_2	1-Hour	120
	24-Hour	8.7
	Annual	0.4

At the Compressor Station, the 7,690-kW compressor (10,310 nominal hp Solar T-70 or equivalent) will be equipped with a dry-low NO_x emission system, known as SoLoNOx, developed to provide the lowest possible emissions during normal operating conditions. To optimize fuel performance the combustion and fuel systems are designed to reduce NO_x, CO, and unburned hydrocarbons. Solar's standard temperature range warranty for SoLoNOx engines is greater than -20°C. The four 60-kW microturbines from Capstone have a low NO_x concentration of less than 9 ppm.

The maximum predicted concentrations for all common air contaminants and Schedule 1 substances are well below the most stringent objectives and below the ambient background concentrations, where applicable. No additional mitigation is required for the compressor engine or microturbines. The potential effect is considered to be of low magnitude, but will occur continuously for the life of the Project, and therefore is rated long-term duration and reversibility. ***The following residual effect has been identified: emissions of common air contaminants and Schedule 1 substances from Compressor Station operations.***

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual Effect: Fugitive greenhouse gas emissions from pipeline operations

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 are considered long-term in duration and reversibility, and continuous in frequency. Total greenhouse gases from the Project represent a 0.01% increase compared to total reported national emissions in 2005 and a 0.09% increase relative to total reported provincial emissions in the same year. Therefore, the magnitude of emissions is considered low. The probability of occurrence is high. The level of confidence is moderate since assumptions were made to estimate emissions. ***The residual effect is less than significant.***

b. Residual Effect: Greenhouse gas emissions from Compressor Station operations

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 are rated long-term in duration and reversibility and continuous in frequency. As discussed in Section 6.2.4.2, total greenhouse gases from the Project represent a 0.01% increase compared to total reported national emissions in 2005 and a 0.09% increase relative to total reported provincial emissions in the same year. Therefore, the magnitude of emissions is considered low. The probability of occurrence is high. The level of confidence is moderate since assumptions were made to estimate emissions. ***The residual effect is less than significant.***

c. Residual Effect: Emissions of common air contaminants and schedule 1 substances from compressor station operations

The maximum predicted concentrations for all common air contaminants and Schedule 1 substances are well below the most stringent objectives, and below the ambient background concentrations, where applicable. The spatial extent of the potential effect is local. All common air contaminants and Schedule 1 substances will have air quality effects for the duration of the operation of the Compressor Station, and will cease after decommissioning of the facility. The duration and reversibility for these pollutants are therefore rated long-term. Emissions from the Compressor Station will occur continuously, but elevated concentrations above detection limit will only occur intermittently. Thus, the frequency of effects is rated periodic for all pollutants except particulate matter, CO, and benzene for which the maximum predicted concentrations are below detection limit. The frequency of effects for PM, CO, and benzene is rated occasional. Similarly, the probability of occurrence is rated low for PM, CO, and benzene and high for all other pollutants.

The overall level of confidence is rated moderate since the cause-effect relationships are well understood but emission rates and source parameters based on engineering design specifications for the Project were not available and therefore dispersion modelling was conducted based on emission factors from AP-42 and various assumptions regarding combustion. The overall significance of the effects is considered less than significant for all common air contaminants and

Schedule 1 substances due to the low or negligible magnitude. ***The residual effect is less than significant.***

Table 7.2-8
Effects Assessment: Atmospheric Environment
Operations and Maintenance

Valued Component/ Potential Effect	Location	Mitigation Measures	Residual Effects
Fugitive greenhouse gas emissions from pipeline operations	Entire pipeline route Methanex Lateral Methanex Meter Station Compressor Station	• Use low-bleed pneumatic controllers to minimize fugitive emissions. • Pressure test the pipeline with air or water before commissioning to ensure system integrity during normal operation and minimise or eliminate greenhouse gas emissions as a result of pipeline leakage. • Use dry gas seals at the Compressor Station to prevent high-pressure gas in the compressor from leaking past the casing along the shaft to the atmosphere. • Use advanced control systems to assist in providing integrity checks so that device failures will not trigger a blowdown. • Reduce unit blowdown volumes in the station design by minimising the actual trapped volume.	• Fugitive greenhouse gas emissions from pipeline operations.
Greenhouse gas emissions from Compressor Station operations	Compressor Station	• Use dry-low NO_x emission systems designed to optimise fuel performance. • Maintain compressor at peak efficiency to ensure fuel efficient combustion and to minimize exhaust emissions.	• Greenhouse gas emissions from Compressor Station operations.
Emissions of common air contaminants and Schedule 1 substances from Compressor Station operations	Compressor Station	• Equip the compressor with a dry-low NO_x emission system, to provide the lowest possible emissions during normal operating conditions.	• Emissions of common air contaminants and Schedule 1 substances from Compressor Station operations

Table 7.2-9
Significance of Residual Effects: Atmospheric Environment
Operations and Maintenance

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Fugitive greenhouse gas emissions from pipeline operations	Global	Long-term	Continuous	Long-term	Low	High	Moderate	Less than significant
Greenhouse gas emissions from Compressor Station operations	Global	Long-term	Continuous	Long-term	Low	High	Moderate	Less than significant
Emissions of common air contaminants and Schedule 1 substances from Compressor Station operations	Local	Long-term	Occasional to periodic	Long-term	Negligible to low	Low to High	Moderate	Less than significant

7.2.2.3 Decommissioning and Abandonment

POTENTIAL EFFECTS AND MITIGATION MEASURES

The decommissioning and abandonment of the KSL Pipeline will comply with the acceptable regulatory standards that are in-place at that time. The procedures followed would likely be removal of all above ground facilities and surface appurtenances and the abandonment of the pipeline in-place, with pipe severed and sealed at strategic locations, and with the right-of-left in its established stable condition. If required for a special area of concern, or by regulation, the pipeline can be removed. Consequently, decommissioning and abandonment will likely result in potential effects that are of substantially less magnitude to those which have been described for the construction of the pipeline. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards of the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Lateral

The discussion provided under the "Pipeline" section is entirely applicable to the Methanex Lateral.

Compressor Station

A compressor station will likely only be abandoned if the pipeline is abandoned. Due to operational considerations, the compressor station could be idled for a considerable period if it is not required to assist with the flow of natural gas. In the case of abandonment, all of the underground piping, aboveground buildings, and facilities would be dismantled and removed from the compound. Fill and aggregate material would be removed from the site and the area would be restored for any subsequent land use. Topsoil that had been salvaged during construction would be used to restore the land. Decommissioning and abandonment will likely result in potential effects that are similar but of less magnitude to those which have been described for the construction of the compressor station. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards for the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Meter Station

See information provided above for Compressor Stations.

7.2.3 Aquatic Environment

This section describes potential effects and assesses residual effects of the KSL Project in relation to 16 species of fish and the habitats that support these species. Five classes of potential effect are discussed:

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

Impact pathways and potential effects of each phase of the KSL Project on the 16 aquatic environment VECs are presented and mitigation to minimize potential effects is discussed. Anticipated residual effects are identified and an assessment of significance is presented.

7.2.3.1 Clearing, Construction and Restoration

POTENTIAL EFFECTS AND MITIGATION MEASURES

a. Potential Effect: Direct and indirect mortality of fish

During the clearing, construction, and restoration phases of the KSL Project, direct and indirect mortality to fish may occur as a result of blasting, hydrocarbon spills, entrainment at water intakes, instream construction activities, and increased fishing pressure. These five impact pathways are discussed separately.

i. Impact Pathway: Fish mortalities from blasting

Explosive charges have the potential to harm or kill fish even when the charges are relatively small and the fish are a considerable distance from the explosion (Falk and Lawrence 1973, Wright and Hopky 1998). This concern is restricted to the LSA spatial scale.

The use of explosives is widely known as an effective method for killing fish and is forbidden under the *Fisheries Act*. Biotic impacts from an explosion are dependent on magnitude of the charge, distance from the charge, and the species and size of organism. Fish may be injured or killed by the effects of underwater explosions in several ways, ranging from minor injuries such as loss of scales and minor blood vessel rupture, to major damage such as tearing of muscle tissue, rupture of internal organs, and disruption of the nervous system. The swim bladder is the organ most sensitive to pressure changes from explosions (Wright and Hopky 1998). The effect of explosions on invertebrates is believed to be negligible. Explosives are somewhat size-selective, in that larger fish are generally more susceptible than smaller individuals.

Blasting procedures in and near fish-bearing waters within the Project area will be guided by *Fisheries and Oceans Canada guidelines as* outlined in the publication "Guidelines for the Use of Explosives in Canadian Fisheries Waters" (Wright and Hopkey 1998). These blasting specifications will be included in the EPP that will be developed prior to project construction.

Provided these recommendations for blasting in and near fish-bearing waters are implemented, ***no residual effect has been identified.***

ii. Impact Pathway: Fish mortalities from spills

The release of toxic substances during construction has the capacity to cause mortality or sublethal health effects to fish. This potential impact is related to leaks and spills of lubricants, fuels, and hydraulic fluids directly from construction and transportation equipment or from fuelling and maintenance of this equipment. The concern is assessed at the LSA spatial scale, as it is unlikely that spills could occur of sufficient magnitude to affect fish populations at a scale greater than the LSA. The release of suspended sediments is discussed separately as a habitat-related concern (See Potential Effect: loss or degradation of instream fish habitat).

Numerous procedures and plans have been devised to prevent release of hydrocarbons from construction machinery, to contain spills should they occur, and to remediate sites should spills occur. These plans are detailed in the EPP, which describes how environmental risks will be mitigated during construction through proper work management, and in the event of an incident, procedures that will limit impacts to the environment. The following measures are included in the EPP:

1. Machinery working within the wetted perimeter of a fish-bearing watercourse must convert their hydraulic and lubrication oils to a non-petroleum based mineral hydraulic oil, which is non-toxic and inherently biodegradable (Chevron Clarity product or equivalent).
2. Compressors, generators, and other fuel-containing equipment used onsite must have secondary containment capable of holding 110% of the contents of the fuel tank.
3. All containment basins shall be inspected daily for leaks and wear points, cleaned out, and water removed.
4. Fuelling and servicing of equipment, and refilling small field containers is to be carried out at least 30 metres from any stream, river, lake, swamp or other watercourse.
5. Any fuel transfer points and refuelling facilities shall be sited at locations approved by the Environmental Monitor and contained within an impermeable dyke.
6. Small trucks, equipment, or gas-powered tools must not be serviced or refuelled in riparian areas.
7. The filling system shall contain an accepted overflow preventer, which will cut off fuel delivery prior to the tank becoming completely full.
8. Absorbent pads shall be kept available, or stored in a conspicuous place, at all areas where fuelling occurs.

9. All work sites must have compact emergency spill kits (*e.g.* pads, absorbent booms, etc.) available on site. The kits shall be suitable for the quantities and types of material stored at the site.
10. Site personnel must be trained in the proper use of the kits in case of a spill.
11. A site-specific Hazardous Waste Management and Spill Plan shall be posted at key locations (*e.g.* in refuelling area) on site.

Provided these recommendations for hydrocarbon handling and storage are implemented, ***no residual effect has been identified.***

iii. Impact Pathway: Fish mortalities from entrainment at water intakes

During the clearing, construction, and restoration phases of the KSL Project, direct and indirect mortality to fish may occur as a result of entrainment at water intakes. Potential effects of entrainment are restricted to the LSA spatial scale or smaller. Pumping of water will be required primarily for two activities: for hydrostatic testing of the pipe and for moving flows around a stream crossing worksite. All intakes will be screened according to DFO guidelines (DFO 1995). For example, they will be screened with a maximum mesh size of 2.54 mm and ensure an approach velocity of 0.038 m sec^{-1} or less. Provided these screening guidelines are implemented, ***no residual effect has been identified.***

iv. Impact Pathway: Fish mortalities from instream construction activities

Direct and indirect mortality to fish may potentially occur as a result of instream construction activities on fish-bearing watercourses. Potential causes of mortality include: dewatering of habitat, exposure to intense suspended sediment levels, direct impingement by construction equipment, entrainment into water intakes, and smothering of incubating eggs and alevins. This concern is restricted to the Project Footprint.[2] Direct and indirect mortality to fish from instream activities will be mitigated by specialized instream construction techniques or offset by compensation.

Flow isolation crossing techniques will be employed at all fish-bearing watercourse crossings, with the exception of 10 streams that are intended to be crossed using HDD or aerial techniques. Flow isolation techniques, when well designed and implemented, result in low output of suspended sediments and restrict direct impacts to a small portion of the streambed. Typically, a short portion of the stream is isolated with two dams and flow is passed around or over the worksite using pumps, hoses, culverts, or flumes. Construction can then proceed in the isolated portion of the stream without causing impacts to upstream or downstream portions. The primary mitigation used to address potential impacts within the isolated construction area is fish salvage and release to appropriate habitat beyond the work area. When conducted by an experienced crew, fish salvage is an effective mitigation measure. However, some conditions inhibit the efficacy of this measure, most notably water temperature and turbidity. Fish are less active at cold temperatures, which can

[2] Effects of release of suspended sediment to downstream habitat is assessed as a habitat impact, see Potential Effect: Loss or Degradation of Instream Fish Habitat.

make them less responsive to electrofishing techniques and less likely to enter fish traps. In high turbidity conditions fish are difficult to observe and are therefore difficult to catch with dipnets or seine nets. In summary, fish salvage is effective and the best mitigation available, but may not be 100% effective at removing fish from the isolated construction area. Fish that cannot be salvaged may be subjected to dewatering of habitat, exposure to intense suspended sediment levels, direct impingement by construction equipment, and entrainment into water intakes.

Mortalities may also occur downstream of pipeline crossings if very high suspended sediment levels occur for prolonged periods. Two factors make this scenario unlikely at most crossings. First, pipeline crossings of fish-bearing streams will be completed using isolation techniques, HDD, or aerial crossings. The latter two involve no instream work. Short pulses of elevated concentrations of suspended sediment typically occur during installation and removal of temporary dams for isolated crossings, but these events are usually of short duration and lower magnitude than levels known to cause mortality of juvenile and adult fish (Newcombe and Jensen 1996, Lévesque and Dubé 2007). Second, the timing of instream construction has generally been selected to avoid spawning and incubation periods. By avoiding times of spawning and incubation there is expected to be no effect of construction on incubating eggs and alevins. Juveniles and adults may be subjected to short duration increases in suspended sediment concentrations, but these mobile life stages are able to move in response to these events and are not expected to be subjected to concentrations sufficient to cause mortality or long-term physiological effects. Where instream work occurs outside biologically-based work windows or using open cut methods there is some risk to incubating eggs and alevins. ***The following residual effect has been identified: pipeline construction on the route will result in increased fish mortalities from instream construction activities.***

v. Impact Pathway: Fish mortalities from increased fishing pressure

Increased recreational fishing pressure from construction crews could potentially increase harvest and mortality rates of fish populations along the KSL pipeline route. The concern is restricted to the LSA spatial scale or smaller. Recreational fishing activities beyond the LSA by the public and construction crews is assumed to be adequately regulated through provincial and federal fishing regulations. Increased mortality from fishing can be mitigated by restricting pipeline construction personnel from fishing on the worksite. Provided this recommendation is implemented, ***no residual effect has been identified.***

b. Potential Effect: Loss or degradation of instream fish habitat

During the clearing, construction and restoration phases of the KSL Project, disturbance of instream habitat will occur at the majority of pipeline crossings, since trenching of the watercourse will be required to complete most crossings. Ten crossings are intended to be completed using HDD or aerial techniques; these crossings will require no instream work and therefore have no effect on instream habitat. On crossings requiring a buried pipeline, mitigation and restoration will offset most impacts to instream fish habitat, by controlling suspended sediment releases, restoring or maintaining streambank stability, and restoring or creating instream cover at all fish-bearing

crossings. Instream habitat at all fish-bearing stream crossings will be restored with the intent of replicating or improving existing conditions.

Two impact pathways are discussed in this section: direct physical alterations caused by disturbance of instream habitats, and indirect alterations caused by release of suspended sediments. The two impact pathways are discussed and assessed separately.

i. Impact Pathway: Direct physical alteration of instream habitat at crossing sites

Instream habitat will be altered temporarily by trenching and backfilling during construction of buried pipeline crossings, and by installation of temporary vehicle crossings. Pipeline and vehicle crossings are discussed separately.

Pipeline Crossings — During the clearing, construction, and restoration phases of the KSL Project, physical alteration of instream habitat will occur at all buried pipeline crossings. Instream habitat will be altered temporarily by trenching and backfilling during construction of buried pipeline crossings. Instream construction at stream crossings will be of short duration and typically occur within specified work windows, which are times of reduced risk to the fish resource. Most crossings will occur over a period of days, with the largest of crossings being completed in less than two weeks. Instream habitat at all fish-bearing stream crossings will be restored with the intent of replicating or improving existing conditions. The streambed and banks will be restored, based on pre-construction habitat surveys and the natural drainage and channel configurations will be maintained or restored. Particular attention will be paid to maintaining adequate stream depth and stream gradients. Instream cover for fish species will be provided by boulder clusters and anchored large woody debris. On S3 and S4 streams, restoration activities will be guided by restoration "typicals" and onsite supervision by a restoration specialist. On S1 and S2 streams, restoration may require engineering input and will therefore be guided by engineering designs as well as onsite supervision by a restoration specialist.

Mitigation and restoration measures will effectively address changes to streambank stability and instream cover associated with loss or degradation of riparian habitats at pipeline crossings. Provided restoration and mitigation is implemented as planned, ***no residual effect has been identified***.

Temporary Vehicle Crossing — Loss or degradation of instream fish habitat will occur at vehicle crossings where installation of culverts or bridges is anticipated. Depending on the type of vehicle crossing used, the effects can be substantially less intrusive than those noted above for pipeline crossings. The effects of a temporary vehicle crossing on the right-of-way and on an access road are similar. Construction of temporary vehicle crossings on fish-bearing watercourses will follow provincial guidelines for installation of road crossings (BC Ministry of Forests 2002) or adhere to DFO Operational Statements (*e.g.* Clear Span Bridges, Ice and Snow Fill Bridges) where certain crossing types are used.

All vehicle crossings are expected to be temporary and will be removed at the end of the construction and restoration phase of the Project. Following removal of vehicle crossings, instream habitat on fish-bearing streams will be restored with the intent of replicating or improving pre-construction conditions. The streambed and banks will be restored, based on pre-construction habitat surveys, and the natural drainage and channel configurations will be maintained or restored. Particular attention will be paid to maintaining adequate stream depth and stream gradients. Instream cover for fish species will be provided by boulder clusters, and anchored large woody debris. On S3 and S4 streams, restoration activities will be guided by restoration "typicals" and onsite supervision by a restoration specialist. On S1 and S2 streams, restoration may require engineering input and will therefore be guided by engineering designs as well as onsite supervision by a restoration specialist.

Vehicle crossings will be designed to ensure adequate streambank stability, and since construction will follow existing guidelines for fish-stream crossings there is expected to be no significant loss of instream cover. Therefore, ***no residual effect has been identified*** for vehicle crossings.

ii. Impact Pathway: Physical alteration of instream habitat through sediment release

Instream habitat downstream of buried pipeline crossings and temporary vehicle crossings may potentially be affected by release of suspended sediments, where suspended sediment concentrations are high and habitat values are sensitive. Potential impacts of sediment input are greatest where spawning and incubation habitats occur, especially where there are incubating eggs and alevins in the gravel. Effects on habitat will be mitigated by specialized construction and mitigation techniques. Effects are therefore expected to be short-lived and additionally mitigated by flushing flows during spring freshet or storm events.

Effects of sediment release on instream fish habitat are discussed separately for pipeline and vehicle crossings.

Pipeline Crossings — During the clearing, construction, and restoration phases of the KSL Project, physical alteration of instream habitat may potentially occur downstream of buried pipeline crossings, due to release of suspended sediments during construction. Impacts to fish habitat are expected to be minimized through the use of two key mitigation strategies: use of flow isolation construction methods and adherence to work windows of least biological risk. Where feasible, flow isolation methods will be used on all fish-bearing crossings where flowing water exists; feasibility is primarily determined by the magnitude of expected flows at the time of construction. On non-fish-bearing stream crossings, release of suspended sediment to adjacent downstream fish-bearing watercourses will be mitigated using onsite sediment control measures and flow isolation techniques as necessary. These measures will be presented and discussed in the EPP.

Flow isolation crossing techniques will be employed at all fish-bearing watercourse crossings, with the exception of 10 stream crossings that are intended to be completed using HDD or aerial techniques. Flow isolation techniques, when well designed and implemented, result in low output of suspended sediments and restrict direct impacts to a small portion of the streambed. Typically, a short portion of the stream is isolated with two dams and flow is passed around or over the worksite

using pumps, hoses, culverts, or flumes. Construction can then proceed in the isolated portion of the stream without causing impacts to upstream or downstream portions. Spikes in suspended sediment concentrations often occur as the dams are installed at the beginning of construction, and when they are pulled when the crossing is complete, but these events tend to be of short duration (Lévesque and Dubé 2007). To further reduce impacts to fish and fish habitat, instream work windows have been devised based on the biology of the fish species and the configuration of habitats present in each stream. The rationale for project-specific work windows is discussed in Solander (2006) and Section 6.3.1.1; a key component of the windows is the avoidance of spawning and incubation times for important fish species. Mitigation in the form of isolated crossings and adherence to biologically-based work windows is expected to effectively prevent impacts to instream fish habitat at the majority of pipeline crossings. ***Where isolation crossing methods are used inside the specified work windows there is expected to be no residual effect to fish habitat.***

There are a number of short duration work windows and it will be difficult to meet the demands of the construction schedule and the instream windows. PTP has committed sufficient construction resources to complete the great majority of fish-bearing crossings within the instream work window. However, some crossings may have to be completed outside the work windows especially if certain contingencies (*e.g.* especially wet weather or unanticipated construction difficulties) slow the expected progress of construction. In this situation, priorities have been assigned to fish-bearing crossings within each construction spread, and crossings will be completed in order of priority. ***Where crossings occur outside the specified work windows there is expected to be a residual effect to fish habitat***. Habitat compensation may be required to offset impacts in these instances, and is discussed in greater detail in Appendix F (Conceptual Compensation Plan for Fish Habitat).

Pipeline crossings of the Little Wedeene, Wedeene, Chist, and Stuart rivers are proposed as HDD, with open cut as the contingency crossing method. Flow in these systems is too high year round to make use of isolation methods. Best efforts will be made to complete the crossings using HDD, but open cut remains a possibility if HDD is infeasible or fails. Geotechnical work is underway to evaluate the feasibility of HDD crossings. ***Where open cut crossing methods are used, due to the infeasibility or failure of HDD, there is expected to be a residual effect to fish habitat.*** Habitat compensation may be required to offset impacts in these instances, and is discussed in greater detail in Appendix F (Conceptual Compensation Plan for Fish Habitat).

Pipeline crossings of Gosnell Creek are proposed as HDD, with flow isolation as the contingency crossing method. HDD has been proposed as the primary method in order to minimize impacts to a riparian floodplain environment with high value as fish and wildlife habitat. ***If HDD is infeasible or fails for Gosnell Creek, flow isolation remains a viable contingency method and no residual instream impact is expected.*** Concerted restoration efforts would be implemented to restore riparian areas for fish and wildlife.

Temporary Vehicle Crossings — Impacts to instream fish habitat may occur at vehicle crossings, through release of suspended sediments during installation of culverts or bridges. Depending on the type of vehicle crossing used, the effects can be substantially less intrusive than those noted above for pipeline crossings. Construction of temporary vehicle crossings on fish-bearing watercourses will

follow provincial guidelines for installation of road crossings (BC Ministry of Forests 2002) or adhere to DFO Operational Statements (*e.g.* Clear Span Bridges, Ice and Snow Fill Bridges) where certain crossing types are used.

All vehicle crossings are expected to be temporary and will be removed at the end of the construction and restoration phase of the Project. There is expected to be no significant loss of instream fish habitat during installation and removal of vehicle crossings because existing guidelines for fish-stream crossings will be followed. Therefore, ***no residual effect has been identified*** for suspended sediment impacts to instream fish habitat associated with vehicle crossings.

c. Potential Effect: Loss or degradation of riparian habitat

Riparian zones form a physical transition zone between aquatic and terrestrial ecosystems, and there are often strong physical and biological interactions between the two. For fish, riparian zones offer three important functions: streambank stability (*e.g.* roots adhere streambank soils and prevent erosion), instream cover (*e.g.* large and small woody debris, overhanging vegetation), and food (*e.g.* contribution to invertebrate drift in streams). Streambank stability and instream cover are important primarily on fish-bearing watercourses; food inputs from riparian areas may be important on both fish-bearing and non-fish-bearing watercourses. Impacts to riparian areas occur at both pipeline and vehicle crossings and are discussed separately. The spatial scale of this effect is limited to the Project Footprint area.

Pipeline Crossings — During the clearing, construction and restoration phases of the KSL Project, loss or degradation of riparian habitat will occur at most pipeline crossings, since clearing of riparian trees and shrubs is essential to completing the crossing except for HDD. Mitigation and restoration will offset most of the impact that is relevant to fish production by restoring or maintaining streambank stability and providing instream cover at all fish-bearing crossings. Stream crossings will be restored with the intent of replicating or improving existing conditions. The streambed and banks will be restored, based on pre-construction habitat surveys, and the natural drainage and channel configurations will be maintained or restored. Additional cover will be provided, primarily through the use of boulder and large woody debris placement. Approach slopes will be seeded with a native seed mix and streambanks will be restored with shrubs; some larger tree species will be planted or allowed to recruit to disturbed areas.

On S3 and S4 streams, restoration activities will be guided by restoration "typicals" and onsite supervision by a restoration specialist. On S1 and S2 streams, restoration may require engineering input and will therefore be guided by engineering designs as well as onsite supervision by a restoration specialist.

Mitigation and restoration measures will effectively address changes to streambank stability and instream cover associated with loss or degradation of riparian habitats at pipeline crossings. Provided restoration and mitigation is implemented as planned, ***no residual effect has been identified*** for these riparian functions. Riparian contributions of invertebrates to watercourses will be lost or diminished within the Project Footprint area, but is expected to be uninterrupted from the KSL

Project outside this spatial area. ***The following residual effect has been identified: loss of food inputs from riparian areas at pipeline crossings.***

Vehicle Crossings — Loss or degradation of riparian habitat will occur at most vehicle crossings, since clearing of riparian trees and shrubs is essential to completing the crossing. The effects on riparian areas are similar to those noted above for pipeline crossings, with the exception that some vehicle crossings will be associated with permanent access roads. Construction of temporary vehicle crossings on fish-bearing watercourses will follow provincial guidelines for installation of road crossings (BC Ministry of Forests 2002) or adhere to DFO Operational Statements (*e.g.* Clear Span Bridges, Ice and Snow Fill Bridges) where certain crossing types are used.

Vehicle crossings will be designed to ensure adequate streambank stability, and since construction will follow existing guidelines for fish-stream crossings there is expected to be no significant loss of instream cover. Therefore, ***no residual effect has been identified*** for alteration of riparian functions associated with streambank stability or instream cover. Riparian contributions of invertebrates to watercourses will be lost or diminished within the Project Footprint area, but is expected to be uninterrupted from the KSL Project outside this spatial area. ***The following residual effect has been identified: loss of food inputs from riparian areas at vehicle crossings.***

d. Potential Effect: Loss or degradation of habitat connectivity

During the clearing, construction, and restoration phases of the KSL Project, loss or degradation of habitat connectivity may occur at pipeline or vehicle crossing sites, where these sites become barriers to fish movement. It is important to distinguish between effects of habitat connectivity and effects of habitat loss or alteration. Habitat connectivity refers to the ability of individuals to move among habitat units. Inability or restricted ability to move or migrate among habitats can potentially result in population-level effects if a barrier prevents access to important habitat types. For example, a barrier may prevent access to a key spawning or rearing area. A population-level effect may also result if a barrier divides and isolates portions of a population. For example, a barrier may subdivide a population and prevent genetic exchange among the two. Potential effects of barriers to fish movement occur on fish-bearing streams at the RSA spatial scale or smaller. In contrast, effects of habitat loss or alteration are related to the productivity of a specific location. If the loss or alteration occurs over a large area or to an important habitat, productivity may be altered and carrying capacity of a watercourse is affected. Habitat effects are discussed and assessed elsewhere in section 7.2.3.1.

Pipeline Crossings — Barriers to fish movement occur during the construction phase of pipeline installation while instream work is underway. More permanent restrictions to fish movement are possible if a crossing is completed without sufficient attention to the long-term needs for movement of fish upstream and downstream across the pipeline. Partial or complete barriers may occur as a result of restored stream channels being too shallow for fish migration (usually a result of being too wide), or by abrupt changes in stream gradient (*e.g.* small falls).

Work windows for stream crossings have been designed to minimize risks to fish populations and stream crossings will be completed efficiently to avoid excessive duration of instream construction. For example, work windows have been selected to avoid important migration timing. Since instream construction duration will be minimized, it is expected that fish movements will be affected for a few days or less at most crossings.

Stream crossings will be restored with the intent of replicating or improving existing conditions. The streambed and banks will be restored, based on pre-construction habitat surveys, and the natural drainage and channel configurations will be maintained or restored. Particular attention will be paid to maintaining adequate stream depth and stream gradients.

Provided these construction and restoration objectives are implemented, ***no residual effect has been identified.***

Vehicle Crossings — Temporary and permanent barriers to fish movement may also occur at vehicle crossings. Construction of temporary vehicle crossings on fish-bearing watercourses will follow provincial guidelines for installation of road crossings (BC Ministry of Forests 2002) or adhere to DFO Operational Statements (*e.g.* Clear Span Bridges, Ice and Snow Fill Bridges) where certain crossing types are used.

Provided these construction and restoration objectives are implemented, ***no residual effect has been identified.***

e. Potential Effect: Interbasin transfer of aquatic organisms

The KSL pipeline route crosses watercourses in four major watersheds: the Kitimat, Skeena, Fraser, and Peace. It is assumed that many organisms are locally-adapted to conditions in each watershed. Movement and migration likely occurs within each watershed and to some extent among watersheds.

Potentially, disease organisms or invasive species can be transferred among watersheds during hydrostatic testing of the pipe or by equipment that is used in stream crossings when it is moved from one stream location to another. No disease organisms or invasive species that occur within the RSA have been identified that appear in danger of expanding their range. It is nevertheless prudent to undertake some precautionary steps to avoid transferring organisms among watersheds. The following mitigation measures are recommended for the KSL Project:

- all water used for hydrostatic testing should be returned to its source watershed, and
- all construction equipment used in stream crossings or that comes in contact with topsoil (e.g. stripping and cleanup crews) should be cleaned prior to moving it among major watersheds.

"Watershed" in this context is taken to mean the four major watersheds — the Kitimat, Skeena, Fraser, and Peace — that are crossed by the KSL pipeline route. Provided the above mitigation measures are implemented, ***no residual effect has been identified.***

Methanex Lateral

The Methanex Lateral pipeline connection crosses one stream, a tributary to Anderson Creek in the Kitimat watershed. Habitat surveys were conducted, but at the time of assessment water temperatures were to low to assess fish presence. Spawning, rearing, and overwintering habitat were rated as moderate quality. The stream is assumed to be fish-bearing given habitat ratings and proximity to fish-bearing waters. When sampling conditions are appropriate, additional surveys will be conducted to confirm fish presence or absence, and appropriate instream work windows will be developed. It is expected that planning for this crossing will use the same logic as that developed for other crossings of this size, in this region. That is, the crossing will be constructed inside the work window, using isolation techniques, and mitigation and restoration techniques outlined in earlier discussions of stream crossings will be implemented. Provided these mitigation measures are implemented, ***no residual effect has been identified***.

Compressor Station

Construction of the Compressor Station does not interact with any watercourses. ***No residual effect has been identified.***

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual Effect: Fish mortalities from instream construction activities

Residual effects related to direct and indirect mortality of fish were identified from the following impact pathway: Fish Mortalities from Instream Construction Activities. Fish salvage will be employed at all fish-bearing stream crossings, however, some mortalities are expected to occur at several to many crossings due to incomplete efficiency of fish salvage within the isolated worksite. The impact is expected to occur within the Project Footprint area, but not beyond this spatial scale. Fish salvage will be conducted by experienced fish salvage crews, but incomplete efficiency is nevertheless expected, particularly when water temperatures are less than 4 ˚C. Nevertheless, fish mortalities are expected to be few and be restricted to relatively small areas of habitat. Fish salvage efficiency is expected to be sufficiently high at all sites that overall ***the residual effect is less than significant***.

Increased mortality of embryos and alevins is also possible at incubation habitat downstream of some pipeline crossings, but instream work windows have been developed to avoid this impact. This effect is discussed further as a habitat impact under the heading *Residual Effect: Physical Alteration of Instream Habitat at Crossings Sites and Through Sediment Release.*

b. Residual Effect: Loss or degradation of instream fish habitat

Residual effects related to loss or degradation of instream fish habitat were identified from the following impact pathway: Physical Alteration of Instream Habitat through Sediment Release.

It is possible that there will be loss or degradation of instream fish habitat downstream of some pipeline crossings. Where crossings of fish-bearing streams are completed using flow isolation techniques inside work windows there is expected to be no residual effect. The great majority of crossings of fish-bearing streams will be completed in this manner. Where crossings of fish-bearing streams are completed using flow isolation techniques outside work windows, or where open cut methods are used, there is expected to be some residual effect. Residual effects will be offset using habitat compensation.

Instream Construction Outside of Project Work Windows. — For crossings that use isolation methods outside the least risk window impacts to habitat are expected to be short-lived and negated or significantly diminished by flushing flows during spring freshet. Two scenarios are described here: crossings purposely planned to be constructed outside the instream work window (e.g. so that a lower flow season makes isolation technique feasible), and other crossings where unanticipated delays (*e.g.* especially wet weather or unanticipated construction difficulties) slow the expected progress of construction, such that all crossings cannot be completed within the instream work window. Habitat compensation may be required to offset impacts in both cases these instances; each scenario is addressed here.

Three crossings of the Salmon River are planned for winter construction, outside the preferred instream work window, for reasons of flow handling capability constraints and access. These crossings will be completed using flow isolation techniques, which will minimize release of suspended sediment to downstream habitat. Impacts to habitat may occur through settling of fines, but these effects are expected to be minimal, short-lived, and be mostly offset by flushing flows during spring freshet or storm runoff events. Compensation will be provided to offset these temporary impacts within the zone of influence. The form and amount of compensation is described in Appendix F. Conceptually, compensation is expected to take the form of constructed off-channel rearing habitat in the general proximity of the crossings. In the Salmon River floodplain there are numerous locations with suitable land and drainage features that are accessible for construction equipment. The rationale for constructing off-channel rearing habitat is that fish production is believed to be limited primarily by accessible overwintering habitats with sufficient depth and cover.

Only the Salmon River crossings are specifically planned for construction outside the work window. As noted earlier, PTP has committed sufficient construction resources to complete the great majority of the rest of the fish-bearing crossings within the instream work windows, but some crossings may have to be completed at other times if construction progress is slower than expected. This is most likely on construction spreads where the water crossing density is very high and terrain is especially rugged (*e.g.* upper Kitimat, Morice). Since priorities have been set that determine the approximate order of crossings (Table 6.3.3) it is expected that instream construction outside the windows, if it occurs, will be on relatively small streams with relatively lower fish resource values. Nevertheless, a residual effect to fish habitat and habitat is expected on those systems, and compensation may be

required to offset impacts in these instances. The form and amount of compensation will be determined in consultation with DFO, and conceptual plans are provided in Appendix F. Conceptually, compensation is expected to take the form of constructed off-channel rearing habitat in the general proximity of the crossings, but more than likely in the floodplain of the parent stream (*e.g.* Kitimat, Morice). There are numerous locations with suitable land and drainage features that are accessible for construction equipment. The rationale for constructing off-channel rearing habitat is that fish production is believed to be limited primarily by accessible overwintering habitats with sufficient depth and cover.

Open Cut Crossings. — Pipeline crossings of the Little Wedeene, Wedeene, Chist, and Stuart Rivers are proposed as HDD, with open cut as the contingency crossing method. Flow in these systems is too high year round to make use of isolation methods. All practical efforts will be made to complete the crossings using HDD, but open cut remains a possibility if HDD is infeasible or fails. Geotechnical work is underway to evaluate the feasibility of HDD crossings. Open cut contingency crossing methods are assessed here.

Mitigation of open cut on these systems would include careful selection of work windows and, to the extent feasible, use of specialized techniques to minimize suspended sediment loads. These techniques may include partial flow bypass (*e.g.* diverting some of the flow around the work site), use of a clamshell excavator bucket, and partial reliance on natural bedload movement to complete the backfill of the trench. Timing of any open cut crossings would be selected to minimize potential effects to fish and fish habitat. Instream work windows for all streams are indicated in Table 6.3.3. The high number of species observed in these systems, many of which have different life history timing, means that work windows cannot avoid all species' spawning and incubation times. A redd survey will be conducted prior to construction on those systems where spawning habitat occurs within the zone of influence and open cut contingency methods are proposed. The redd survey will be completed for areas within the zone of direct disturbance and downstream for 500 m. The distance of this survey is greater than that proposed for situations where isolation methods are used outside the work windows, with the rationale that sediment movement will be greater when open cut is the method used in comparison to isolation methods. Compensation will be provided to offset impacts within this zone. The form and amount of compensation will be determined in consultation with DFO. Conceptual plans for compensation are provided in Appendix F.

Conceptually, compensation for the Little Wedeene, Wedeene and Chist Rivers is expected to take the form of constructed off-channel rearing habitat in the general proximity of the crossings, with the rationale that fish production in these systems is believed to be limited primarily by accessible overwintering habitats with sufficient depth and cover. Examination of air photos confirms that there are numerous locations in close proximity to the proposed crossing locations, which have suitable land and drainage features and are accessible for construction equipment. Suitable locations on the Little Wedeene and Wedeene are in the floodplains of those systems. The most suitable compensation location near the Chist crossing is likely nearby on the mainstem Kitimat River.

If HDD proves infeasible for the Stuart River, compensation for an open cut crossing may take a somewhat different form than that proposed for the Little Wedeene, Wedeene, and Chist Rivers.

Based on habitat surveys and fish sampling, habitats near the proposed crossing are unlikely to be used as spawning and incubation habitat for VEC species. The habitats nevertheless have modest value as rearing habitats and higher value as a migration corridor (notably by Stuart run sockeye and white sturgeon). Timing of any open cut crossings would be selected to minimize potential effects to fish and fish habitat, especially sockeye and white sturgeon. The proposed instream work window is indicated in Table 6.3.3. Due to the especially high value of white sturgeon within the Stuart system, compensation will be directed at recovery efforts for this species or toward local population of Chinook, which spawn in Dog Creek, near the proposed crossing. The form and amount of compensation will be determined in consultation with DFO but it is expected that compensation efforts directed at white sturgeon or Chinook would be completed in partnership with Carrier Sekani Tribal Council. Conceptual plans for compensation are provided in Appendix F.

In summary, all pipeline crossings of fish-bearing streams that are completed outside the work windows, or by open cut techniques will be sufficiently compensated to offset residual effects.

The three crossings of the Salmon River are planned to occur in winter, outside the instream work window. Other crossings may also occur outside work windows if weather or other issues impede construction progress. Where crossings are completed using flow isolation techniques outside work windows there is expected to be some residual effect, but compensation will ensure that ***residual effects at these crossings are less than significant.***

Open cut crossing techniques are not planned as primary crossing methods for any fish-bearing stream crossing, but are contingency methods for Little Wedeene, Wedeene, Chist and Stuart rivers, if HDD is infeasible or fails. Crossings completed using open cut techniques are expected to result in some residual effect. Compensation will be required to offset these impacts and will ensure that ***residual effects at these crossings are less than significant.***

c. Residual Effect: Loss of food inputs from riparian areas at vehicle and pipeline crossings

A residual effect has been identified for the loss of food inputs from riparian areas at vehicle and pipeline crossings. Based on existing literature we know that inputs from terrestrial invertebrates and vegetation constitute an important energy input and food source for stream-dwelling fish (Wipfli 1997, Wipfli and Gregovich 2002). However, it is also true that this input of energy occurs over many kilometres of stream in most systems. The loss of input from riparian vegetation within the Project Footprint area is expected to result in negligible reductions in food availability for fish. Furthermore, at all pipeline and vehicle crossings this loss is expected to be temporary. Therefore, ***the residual effect is less than significant.***

Table 7.2-10
Effects Assessment: Aquatic Environment
Clearing, Construction, and Restoration

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effect
Direct and indirect mortality	Fish-bearing watercourses within LSA along entire pipeline route	• Use isolation techniques on pipeline watercourse crossings as indicated in the EAC. • Adhere to instream work windows and minimize instream work period. • Salvage fish from instream construction areas prior to dewatering, trenching, and other construction activities. • Use qualified environmental monitors during all instream construction activities, and follow emergency procedures for all incidents as will be presented in the forthcoming EPP. • Implement adequate erosion control on upslope areas and non-fish-bearing watercourses, to prevent release of harmful concentrations of suspended sediment to fish-bearing waters. • Follow DFO requirements when blasting in the vicinity of watercourses. • Pump intakes, in compliance with DFO requirements, should not disturb streambeds and should be screened with a maximum mesh size of 2.54 mm and approach velocity of 0.038 m/sec. • Water for hydrostatic testing should be removed from streams at no more than 10% of existing flows. • Pipeline construction personnel should not fish on the worksite.	Fish mortalities from instream construction activities.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effect
Loss or degradation of instream fish habitat.	Fish-bearing watercourses within LSA Along entire pipeline route	• Minimize the number of watercourse crossings by adopting environmental objectives during route selection. Where feasible avoid important instream habitats. • Select vehicle and pipeline crossing methods that reduce direct and indirect effects on productive fish habitat. • Adhere to instream work windows and minimize instream work period. • Implement adequate erosion control on upslope areas and non-fish-bearing watercourses, to prevent release of harmful concentrations of suspended sediment to fish-bearing waters. • Welding, coating, weighting, and where applicable, testing, of the pipe should be completed prior to commencement of instream trenching. • Crossings should commence only after ensuring that sufficient equipment and supplies are available to complete the crossing in an efficient and timely manner. • Isolate instream construction areas where surface flow is present (on both fish-bearing and non-fish-bearing watercourses) and implement measures to reduce downstream sediment input, as discussed in the EPP, including: – salvage streambed surface material for return to top layer of streambed during backfilling. – salvaged surface material should be placed above the high water mark in a manner that does not block drainage or runoff, – excavated instream materials should be contained using appropriate techniques (*e.g.* berms, silt fences or straw bale filters), to ensure that sediment-laden water and spoil do not re-enter the waterbody, – water from flumes, pump-arounds, diversions, or other methods should be released to downstream areas	Physical alteration of instream habitat.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effect
		using dissipation structures, to avoid causing erosion or sediment release. – sediment-laden trench water should be pumped onto stable surfaces in a manner that does not cause erosion of soils or release of suspended sediments to watercourses, – hard ditch plugs at least 3 m wide should be left in place until the crossing has been initiated. • Horizontal Directional Drilling is proposed to cross fish streams that cannot be isolated. • Use qualified environmental monitors during all stream crossing construction activities, and follow emergency procedures for all incidents as presented in the EPP. • Restore streambed and banks, based on pre-construction habitat surveys. Restore rearing potential with adequate stream depth and instream structures. Restore spawning areas with gravel placement. Maintain or restore natural drainage and channel configurations. • Where feasible, salvage and return aquatic vegetation and organic debris removed from the construction area following trench backfilling. • Contour and stabilize banks and approach slopes and install temporary berms, silt fences, or cross ditches in locations where run-off from the right-of-way may flow into a watercourse. • Seed exposed soils with native seed mix prior to spring freshet wherever possible.	

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effect
Loss or degradation of riparian habitat in non-fish-bearing watercourses.	Non-fish-bearing watercourses within LSA along entire pipeline route	• Minimize watercourse crossings by adopting environmental objectives during route selection. • Implement mitigation measures at all watercourse crossings, as presented in the EPP, including: – minimize clearing and ground disturbance within 10 m of the high water mark of all waterbodies, – maintain or restore natural drainage and channel configurations, – contour and stabilize banks and approach slopes and install temporary berms, silt fences, or cross ditches in any location where run-off from the right-of-way may flow into a watercourse, – implement erosion control measures throughout all phases of the Project, – commence clean-up and restoration immediately following backfill operations, and – monitor approach slopes and banks regularly, especially after heavy rainfalls and spring snowmelt for two years after construction. Monitoring should be continued at specific locations if chronic erosion occurs, or if riparian vegetation recovery is delayed.	Loss of food inputs from riparian areas at vehicle and pipeline crossings.
Loss or degradation of riparian habitat in fish-bearing watercourses.	Fish-bearing watercourses within LSA along entire pipeline route	• Implement mitigation measures at all watercourse crossings, as summarized above for non-fish-bearing watercourses. Additional mitigation measures for fish-bearing watercourses are presented in the EPP, and include: – postpone clearing of slopes and banks until immediately prior to construction and leave a temporary uncleared buffer zone of 10 m width as measured from the high water mark, – where earlier clearing is necessary, leave the vegetative ground mat and root structure intact,	Loss of food inputs from riparian areas at vehicle and pipeline crossings.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effect
		– maintain low vegetation or vegetative ground mat within the 10 m buffer of watercourses to the extent practical by walking, storing, and constructing over the undisturbed areas, – pump isolated trench water onto stable surfaces in a manner that does not cause erosion of soils and sedimentation of watercourses, – use appropriate restoration techniques (*e.g.* brush bundles, willow staking, seed with native seed mix, etc.) to enhance recovery of disturbed riparian areas and reduce erosion risk, – to the extent feasible, use horizontal directional drilling to minimize impact to high value riparian areas.	
Loss or degradation of habitat connectivity.	Fish-bearing watercourses within LSA along entire pipeline route	• Adhere to instream work windows and minimize instream work period. • Use qualified environmental monitors during all instream construction activities, and follow emergency procedures for all incidents as presented in the EPP. • Maintain adequate water flows downstream of instream construction sites. • Water for hydrostatic testing should be removed from streams at no more than 10% of existing flows. • Restore pipeline crossing sites to ensure adequate depth and velocities. • Maintain connectivity at all vehicle crossings of fish-bearing watercourses through appropriate construction and installation techniques.	No residual effect identified.
Interbasin transfer of aquatic organisms.	All watercourses within RSA along entire pipeline route	• For all hydrostatic testing, return test water for discharge to its source watershed to prevent inter-basin transfer of aquatic organisms.	No residual effect identified.

Table 7.2-11
Significance of Residual Effects: Aquatic Environment
Clearing, Construction, and Restoration

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Fish mortalities from instream construction activities.	**Project Footprint**	**Immediate**	**Isolated**	**Short-term**	**Low**	**High**	**High**	**Less than significant**
Physical alteration of instream habitat at crossing sites and through sediment release.	**LSA**	**Immediate to Medium-term**	**Isolated**	**Medium-term**	**Low to Medium**	**High**	**High**	**Less than significant (after compensation)**
Loss of food inputs from riparian areas at vehicle and pipeline crossings.	**Project Footprint**	**Short- to Medium-term for pipeline crossings and temporary vehicle crossings, long-term for permanent vehicle crossings**	**Isolated**	**Medium-term for pipeline crossings and temporary vehicle crossings, permanent for permanent vehicle crossings**	**Negligible**	**High**	**Moderate**	**Less than significant**

7.2.3.2 Operations and Maintenance

a. Potential Effect: Alteration or degradation of instream fish habitat

Instream activity is typically not required on pipelines as part of operations and maintenance except in emergency situations where the pipe may become exposed on streams with actively migrating channels. For long term integrity of the pipeline, crossings are designed with sufficient cover under bed and banks to protect against anticipated stream changes, thus minimizing the potential for upsets. In the event that emergency instream works are required, all instream activities would require assessment, approvals, mitigation and possibly compensation, which would be determined with input from regulators during the approvals process. We assume that the permitting and approval process would require no net loss of productivity, as per existing policy and legislation. Due to the requirement for a separate permitting and approvals process, ***no residual effect has been identified***.

b. Potential Effect: Loss of riparian vegetation

Operational activities along the pipeline route will involve the maintenance of a travel corridor on select sections of the right-of-way (as described in the Access Management Plan). The travel corridor is typically 3-5 m wide, and vegetation on these corridors must be maintained at an early seral stage (*i.e.* herbaceous and low woody vegetation only). Maintenance of the travel corridor will potentially result in loss of riparian vegetation, with concomitant effects on aquatic species. Section 7.2.3 discusses and assesses the effects of loss of riparian vegetation and concludes that there is no significant residual effect, provided stream crossings are restored with the objective of stabilizing streambanks and providing instream cover. No additional riparian impacts are associated with operations and maintenance activities. ***No residual effect has been identified***.

c. Potential Effect: Increased angling pressure

Maintenance of the travel corridor will also potentially result in increased access to fish-bearing streams. Increased access can result in greater levels of fishing pressure on fish species. Public access to the right-of-way will be managed, but it is possible that unauthorized access will occur by anglers seeking fishing opportunities along the right-of-way. This is considered unlikely. Public access is currently widespread throughout this region via forest service roads, transmission lines, and other existing infrastructure. Most stream crossings associated with the KSL Project are in close proximity to this existing infrastructure. Fishing pressure is therefore not expected to change as a result of this Project. ***No residual effect has been identified.***

Methanex Lateral

The above discussion regarding general pipeline operations and maintenance also applies to the Methanex Lateral. ***No residual effect has been identified.***

Compressor Station

Operation and maintenance of the Compressor Station does not interact with any watercourses. ***No residual effect has been identified.***

SIGNIFICANCE OF RESIDUAL EFFECTS

No residual effects have been identified.

Table 7.2-12
Effects Assessment: Aquatic Environment
Operations and Maintenance

Valued Component/Potential Effect	Location	Mitigative Measures	Residual Effect
Alteration or degradation of instream fish habitat	this would occur only on streams with actively migrating channels	• adhere to regulatory approvals process for any future emergency instream works	No residual effect identified.
Increased angling pressure	pipeline crossings of fish-bearing streams	• KSL Project stream crossings are in close proximity to existing infrastructure and increased angling pressure is expected to be less than significant	No residual effect identified.
Loss of riparian vegetation	pipeline crossings of fish-bearing bearing streams	• adhere to restoration recommendations for fish-bearing streams	No residual effect identified.

7.2.3.3 Decommissioning and Abandonment

POTENTIAL EFFECTS AND MITIGATION MEASURES

The decommissioning and abandonment of the KSL Pipeline will comply with the acceptable regulatory standards that are in-place at that time. The procedures followed would likely be removal of all above ground facilities and the abandonment of the pipeline in-place, with the pipe severed and sealed at strategic locations, and with the right-of-way left in its established stable condition. If required for a special area of concern, or by regulation, the pipeline could be removed. Consequently, decommissioning and abandonment will likely result in potential effects that are of substantially less magnitude to those which have been described for the construction of the pipeline. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards of the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Lateral

The discussion provided under the "Pipeline" section is entirely applicable to the Methanex Lateral.

Compressor Station

A compressor station will likely only be abandoned if the pipeline is abandoned. Due to operational considerations, the compressor station could be idled for a considerable period if it is not required to assist with the flow of natural gas. In the case of abandonment, all of the underground piping, aboveground buildings, and facilities would be dismantled and removed from the compound. Fill and aggregate material would be removed from the site and the area would be restored for any subsequent land use. Topsoil that had been salvaged during construction would be used to restore the land. Decommissioning and abandonment will likely result in potential effects that are similar but of less magnitude to those which have been described for the construction of the compressor station. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards for the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Meter Station

See information provided above for Compressor Stations.

7.2.4 Terrestrial Environment; Wildlife and Wildlife Habitat; Vegetation

The Terrestrial Environment description of potential effects and assessment of residual effects considers the following elements:

- Wetlands,
- Terrestrial Vegetation,
- Forest Health,
- Invasive Plant Species, and
- Wildlife and Wildlife Habitat.

The following sections will discuss the potential effects of each phase of the KSL Project on these elements, and recommended mitigation to minimize the potential effects. An assessment of significance of residual effects following mitigation is also presented.

7.2.4.1 Clearing, Construction and Restoration

POTENTIAL EFFECTS AND MITIGATION MEASURES

Wetlands

Project activities associated with clearing, construction, and restoration of the KSL Project area will interact with wetlands in the Project Footprint and LSA along the entire pipeline route. The most effective way to avoid potential impacts to wetlands is to direct project-related activities away from wetlands. The Greenfield portion of the KSL pipeline route was selected to minimize the number of wetland crossings. Where wetland crossings could not be avoided, PTP will implement mitigation measures to minimize effects on wetland function. Construction activities will be scheduled during frozen ground conditions, whenever feasible. If this is not feasible, and construction proceeds in unfrozen ground conditions, PTP will use low ground pressure equipment, or will install appropriate temporary work platforms for heavy vehicle/equipment crossings of wetlands. Temporary platforms will be removed immediately after construction activity at that location has been completed. At the base of approach slopes, and between the wetland and disturbed areas, berms, cross ditches, and silt fences will be installed. Any grading adjacent to wetlands will be conducted away from the wetland, whenever practical, to reduce the risk of sediment and other material entering the wetland. Material excavated from wetlands will be stored in a manner that does not interfere with natural drainage patterns. Pre-construction profiles of wetlands will be recontoured during final clean-up.

PTP will schedule post-construction pipeline maintenance activities during winter to the extent feasible, and will follow the previously listed mitigation measures for work in wetlands during the operational phase of the Project.

Effects to wetlands could occur through: effects on wetland hydrologic function, wetland water quality function, and habitat function. The potential effect on wetland hydrology and water quality is discussed below, while wetland habitat function is discussed in the vegetation section following.

a. Potential Effect: Alteration or degradation of wetland hydrology and water quality

The KSL Project Footprint crosses approximately 96 wetlands along the entire length of the route. The hydrologic function and water quality of these wetlands can be altered or degraded by pipeline clearing, construction, or restoration activities. Approximately 67, or 70%, of the wetlands may have experienced previous changes in hydrology or water quality due to the construction and maintenance of existing roads, railways, pipelines, and powerlines, or because they occur adjacent to or within a logging cutblock. The remaining 29 wetlands crossed by the pipeline route are undisturbed. The previous disturbance of wetlands is taken into account for the mitigation planning and effects assessment.

One of the most important measures to minimize project-related effects on wetland hydrology and water quality is assuring that pre-construction elevations and contours are achieved during restoration. During construction, PTP will also narrow down the area of disturbance and protect the wetland by using fencing or flagging to clearly mark wetland boundaries, and limiting traffic in the restricted area, where feasible. The width of grubbing through wet areas will be minimized to facilitate the re-establishment of shrub communities, whenever practical. To limit sediment from entering wetlands, an undisturbed organic mat will be left as a buffer zone, to the extent feasible. Trench breakers will be installed at the edge of wetlands, where warranted, as needed to prevent the pipe trench from acting as a drain. To minimize direct degradation of wetland water quality, spill prevention measures will be implemented. Measures to avoid sedimentation deposition in wetlands will be implemented. These and other water quality protection measures will by utilized to minimize hydrologic function and water quality impacts in wetlands. The Environmental Protection Plan, that will be developed prior to clearing and construction, will outline the measures to be followed. PTP will also monitor wetlands for hydrologic function during the Post-Construction Monitoring Program (*i.e.* first and second years following construction).

With the implementation of mitigation measures, the potential effect of alteration of hydrologic function and water quality of wetland areas disturbed by clearing, construction, and restoration phase activities is considered to be reversible in the short-term, and of low magnitude. ***No residual effect has been identified.***

Vegetation

Construction of the KSL Project will involve clearing of vegetation along the entire pipeline route. The pipeline route was selected to minimize clearing of mature vegetation whenever practical, and as such, much of the clearing will occur in areas that have previously been disturbed by forest harvesting, utility corridors, industrial facilities, agriculture, and rural-residential development.

Clearing will also occur in areas with less human disturbance. Undisturbed vegetation including mature and old coniferous forests, riparian areas, wetlands, deciduous (aspen) stands,

subalpine/alpine areas, and a small grassland occur at a number of locations along the pipeline route.

For the most part, these vegetation VECs can generally be restored and will naturally recover following pipeline construction, particularly on the restored working space. Rates of recovery will depend upon several factors including soil type, elevation, aspect, and slope. Human disturbance agents including invasive plants and grazing may also affect the rate of habitat restoration.

PTP will implement mitigation measures to minimize the disturbance to vegetation communities and facilitate fast and successful restoration of areas cleared for pipeline construction. Disturbed areas of the Project Footprint will be seeded using appropriate seed mixes. Native plant seed mixes will be developed to suit local site conditions. To minimize the potential for erosion and rapidly establish vegetative cover, moderate to steep slopes will be revegetated using an appropriate seed mix and approved cover crop. PTP will plant previously forested temporary workspace with tree species approved by BC MOFR, and the forest licensees. To monitor the efficacy of the Restoration Program and mitigation measures, PTP will undertake a Post-Construction Monitoring Program of the right-of-way.

Coniferous and deciduous trees taller than 3 m are generally not permitted over or immediately beside the pipe for pipeline integrity and inspection reasons. Therefore a loss of mature trees, tall shrubs and changes to plant community structure on new pipeline right-of-way will have residual effects on vegetation VECs.

These residual effects and effects of the Project on non-forested vegetation VECs are presented below. Mitigation measures for each vegetation VEC are also presented.

b. Potential Effect: Alteration or degradation of wetland vegetation

Wetland vegetation, with known importance as feeding, cover, and nesting habitat for a variety of wildlife species, will be disturbed during clearing and construction along the entire pipeline route. To minimize the effects of clearing in wetlands, PTP will implement wetland vegetation protection measures. The removal of vegetation and disturbance of soil adjacent to wetlands will be minimized. To preserve roots of woody wetland plants, shrubs and small deciduous trees will be cut, hydroaxed, or walked-down at ground level where practical. PTP will also minimize the width of grubbing through wet areas during construction to facilitate the restoration of shrub communities. To restore shrub cover on wetland edges, willow staking along the wetland edge will be used. PTP will recontour the disturbed area and re-establish drainage patterns to promote natural regeneration of wetland plant species.

As wetland vegetation is considered to be one of the most resilient of the numerous vegetation VECs crossed by the pipeline and the mitigation measures outlined have been effective in restoring wetland habitat values, in the past, project-induced effects to wetland vegetation are expected to be reversible in the medium-term and of low magnitude. ***The following residual effect has been***

identified: approximately 88 ha of wetland vegetation along the entire pipeline route will be altered or degraded by Project clearing and construction.

c. Potential Effect: Alteration or degradation of mature to old Douglas-fir forest

The interior Douglas-fir forests located along the pipeline route are near the northern-most limit of their provincial range. These stands, especially the mature to old age classes (*i.e.* between 81 and 250 years old) have been identified as vegetation VECs. Eleven mature and old Douglas-fir forests have been identified along the KSL pipeline route between KP 307 and KP 337. To minimize clearing of mature trees, and where practical, PTP will narrow down the cleared ROW to avoid previously undisturbed stands of mature and old Douglas-fir forest. PTP will plant Douglas-fir seedlings in temporary workspace at appropriate sites. The effectiveness of Douglas-fir forest restoration efforts will be monitored during the Post-Construction Monitoring Program.

With these mitigation measures applied, the potential effect of alteration or degradation of mid-seral to old Douglas-fir forests is reversible in the long-term. There are no regulations specifically protecting Douglas-fir stands in the Project area. Therefore the magnitude of the effect was assessed to be low. ***The following residual effect has been identified: pipeline construction on the route will result in the clearing of approximately 32 ha of mature to old Douglas-fir forest.***

d. Potential Effect: Alteration or degradation of mature to old aspen forest

Aspen dominated stands occur throughout the Project area. Typically these stands are young and even-aged. Undisturbed, older aspen stands (*i.e.* mid-seral to mature) are less common and were found at only four locations along the pipeline route between KP 149 and KP 298. To minimize the impact on these old aspen stands, PTP will narrow down the ROW clearing to the extent feasible, to reduce clearing mature aspen trees and protect the old aspen stands. Natural regeneration of aspen will be encouraged in temporary workspace following construction and aspen will be planted in appropriate areas during the restoration phase of the Project. The effectiveness of the restoration measures will be monitored during the Post-Construction Monitoring Program.

With these mitigation measures applied, the potential effect of alteration and degradation of mid-seral to old aspen forest is reversible in the long-term. The magnitude of this potential effect is considered to be low. ***The following residual effect has been identified: clearing of approximately 7 ha of mature to old aspen dominated forest***.

e. Potential Effect: Alteration or degradation of mature and old riparian and floodplain forest

The construction of the KSL Project will involve clearing mature and old riparian and floodplain forests near watercourses crossed at various locations of the pipeline route. The pipeline route crosses a total of 24 mature riparian areas and floodplain forests. PTP will implement mitigation measures to minimize effects associated with clearing this habitat type. Clearing of mature deciduous and coniferous trees will be minimized, and the width of temporary workspace will be

narrowed to the extent practicable. Where grading is not required, grubbing will be minimized to the extent practical, thus allowing coppicing and to keep root systems intact. To retain stream bank stability and minimize erosion potential, PTP will implement bio-engineering along stream banks using appropriate species. PTP will redistribute coarse woody debris on ground surface during the final clean-up and restoration phase to restore the structural complexity and wildlife habitat function of riparian and floodplain forest. Cleared riparian and floodplain forest will be seeded with appropriate seed mixes and riparian shrubs and trees will be planted. The effectiveness of these mitigation measures will be monitored during the Post-Construction Monitoring Program.

Riparian areas, in general, are considered to be ecologically resilient, and often re-establish relatively quickly following final clean-up and restoration. Potential effects of the Project on this VEC were considered to be reversible in the long-term and of medium magnitude. ***The following residual effect has been identified: approximately 46 ha of riparian and floodplain forest will be cleared.***

f. Potential Effect: Alteration or degradation of mature and old coniferous forests

Mature and old stands of western hemlock, mountain hemlock, subalpine fir, white-bark pine, lodgepole pine, black spruce, Englemann spruce, hybrid spruce and white spruce occur at various locations along the pipeline route. The most contiguous of these older coniferous forests are found in the Mountain Region between KP 74.9 and KP 112. A large portion of the older coniferous forests crossed by the pipeline route in the Interior Region have been attacked by mountain pine beetle, and forest harvesting is occurring or is planned for many of these Interior Region stands. To mitigate effects on mature and old coniferous forests, restoration will involve planting coniferous tree seedlings on working space and using native plant species on the right-of-way. The effectiveness of restoration efforts will be monitored during the Post-Construction Monitoring Program.

Clearing of mature and old coniferous forest vegetation will be unavoidable along the pipeline route. This projected action is reversible in the long-term and considered to be of medium magnitude. ***The following residual effect has been identified: approximately 600 ha of mature and old coniferous forest habitat will be cleared for the Project.***

g. Potential Effect: Alteration or degradation of non-forested subalpine and alpine areas

The KSL pipeline route crosses subalpine and alpine areas in the western portion of the Project area for approximately 7.3% of the total length of the route. These high elevation forests and heathlands occur between KP 74.9 and KP 116.2. To restore project-related disturbed areas, PTP will recontour slopes to stable contours. Suitable native plant species will be hydroseeded in disturbed areas. Where krummholz and small conifers have become established, conifer seedlings will be planted in clusters to create microsites to promote natural regeneration of subalpine and alpine species. PTP will monitor the effectiveness of the restoration during the Post-Construction Monitoring Program.

Vegetation in subalpine and alpine areas is the least resilient of any vegetation type in the KSL Project area. As such, project-induced impacts to subalpine and alpine vegetation types are

reversible in the long-term and are considered to be of medium magnitude. ***The following residual effect has been identified: approximately 17 ha of subalpine and alpine habitat will be disturbed by the Project.***

h. Potential Effect: Alteration or degradation of grassland area

The KSL pipeline route crosses a single grassland area between KP 242.5 and KP 243.5. Clearing and construction of the KSL Project will cause the alteration or degradation of this grassland area. Topsoil will be stripped and replaced during construction activities, and the native plant species or a natural recovery technique will be employed. The effectiveness of the restoration efforts will be monitored during the Post-Construction Monitoring Program. With the implementation of the mitigation measures, the potential alteration or degradation of the grassland area is considered reversible in the medium-term and of low magnitude. ***The following residual effect has been identified: Approximately 4 ha of grassland area will be disturbed by construction activities***.

Forest Health

i. Potential Effect: Acceleration or the spread of forest pathogens and pests

Construction of the KSL Project will involve clearing of trees for the pipeline alignment and associated temporary workspace. There are currently three types of forest health pathogens that affect the health of the forest surrounding the area to be cleared: the mountain pine beetle infestation affects pine-dominated forests east of the Coast Mountains, while the spruce beetle infestation and various types of root rot are present at much lower intensity along the entire pipeline route. The mountain pine beetle outbreak is widespread and of high intensity in the RSA. To prevent additional spread of forest pathogens and pests, PTP will adopt Standard Operating Procedures for storage, hauling, and milling of mountain pine beetle-infested wood as specified by BC Ministry of Forests and Range Forest Districts. Spruce trees infested with spruce beetle will be stockpiled and burned on-site or will be removed and processed before the spruce beetle flight period (May to July), to reduce the risk of infestation of adjacent spruce stands. With the implementation of these mitigation measures, and in consideration of current levels of forest pathogen outbreaks, the potential acceleration or the spread of forest pathogens and pests is considered reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

Invasive Plant Species

j. Potential Effect: Introduction, and acceleration of the spread of invasive plants

Activities associated with the clearing, construction and restoration of the Project area could cause the introduction, and acceleration of the spread of invasive plants. This potential exists along the entire pipeline route. PTP will implement the following mitigation measures to minimize the introduction or spread of invasive plants:

- An Invasive Plant Management Plan will be developed prior to clearing and construction to minimize the introduction and spread of noxious weeds during Project construction activities; which will include but not be limited to:

- employ standard weed control measures, such as cleaning of equipment of seeds and vegetative debris attached to the equipment prior to arrival on the right-of-way;
- pre-treat heavily infested weed areas along the Route by chemical, hand or mechanical means prior to construction where directed by the appropriate authority;
- minimize weed spread by cleaning all equipment in contact with topsoil, prior to moving from an area of high weed infestation;
- restore native vegetation as quickly as practical following ground disturbing activities; and
- monitor the right-of-way during the post-construction monitoring and operations for areas of new weed growth; undertake measures to control weeds at these locations.

With the implementation of these mitigation measures, and in consideration of past programs on similar pipeline projects, the introduction and acceleration of the spread of invasive plants is considered to be reversible over the medium-term and of low magnitude. ***The following residual effect has been identified: introduction of invasive species immediately after construction may occur.***

Wildlife and Wildlife Habitat

Project activities associated with the clearing, construction, and restoration of the Project area will interact directly or indirectly with wildlife and wildlife habitat. Clearing, construction, and restoration activities will result in the following potential effects:

- alteration or degradation of habitat,
- direct and indirect wildlife mortality, and
- sensory disturbances to wildlife.

The following sections contain information on the project-induced effects, impact pathways, mitigation measures to reduce or avoid potential effects, and a statement on whether a residual effect is anticipated. See Table 7.2-15 for a summary of potential effects on wildlife and wildlife habitat. Specific residual effects identified will be discussed and assessed below in Significance of Residual Effects, and summarized in Table 7.2-16.

k. Potential Effect: Alteration or degradation of habitat

Construction of the KSL Project will involve clearing of vegetation and ground disturbances resulting in the alteration or degradation of habitat. These activities will cause direct and indirect effects on wildlife VECs when they occur in important seasonal habitats (*e.g.* reproductive areas), specific habitat features (*e.g.* dens and mineral licks), and when protective or thermal cover is cleared in wildlife movement corridors.

The most effective mitigation to minimize project-related effects on important wildlife habitats involves designing the route to avoid these important habitats and features to the greatest extent practicable, and scheduling construction activities to avoid seasonal ranges while they receive the greatest use by wildlife. PTP will implement the following general mitigation measures to minimize effects of the alteration or degradation of habitat:

- the route is located adjacent to the existing PNG right-of-way, other linear disturbances such as roads, and power lines for approximately 60 % of its length, thereby minimizing the disturbance to wildlife habitat;
- the route crosses large areas of currently disturbed forest (cutblocks, beetle killed forest, and early seral regenerating forest);
- the pipeline route generally avoids wetland and riparian areas;
- where appropriate, salvage cut deciduous woody debris for redistribution on alignment post-construction as coarse woody debris;
- inform the pipeline construction workforce regarding wildlife and habitat protection measures prior to initiation of work by means of compulsory pre-job orientations; and
- conduct a pre-construction survey (route walk) in select locations to record any site-specific wildlife habitat features (*e.g.* wildlife trees, stick nests etc).

Three impact pathways were considered to identify residual habitat effects. These are:

i) alteration or degradation of important seasonal habitats;
ii) loss of site-specific habitat features; and
iii) alteration of wildlife movement corridors.

i. Impact Pathway: Alteration or degradation of important seasonal habitats

The KSL pipeline route crosses a number of important seasonal habitats used by wildlife VEC species, including migratory bird staging area, suitable breeding habitats for northern goshawk, wood duck, sandhill crane, and marbled murrelet, winter habitats for moose and mountain goats, grizzly bear feeding habitats, and suitable streams for coastal tailed frogs.

Migratory bird areas. The KSL pipeline route crosses four areas that are important to migrating birds between KP 190 and KP 415. To avoid disturbing habitats used by migrating birds, no clearing activities are to occur within the migratory bird nesting period (May 1 to July 31) except where nesting absence has been specifically verified at time of clearing and clearing outside of this period is acceptable to the appropriate regulatory authorities. Construction will continue during this period only through areas that have been pre-logged, pre-brushed, or pre-mowed. With the implementation of this mitigation measure, the potential alteration or degradation of these four migratory bird areas is considered reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

Coastal Northern Goshawk. The KSL pipeline route overlaps with four areas of high suitability breeding habitat for coastal northern goshawk (*laingi* subspecies) between KP 74 and KP 94. The coastal northern goshawk is provincially red-listed, listed as 'Threatened' by COSEWIC, and is included in Schedule 1 of *SARA*. There are no known nest records in these suitable breeding habitats, but to avoid possible disturbance, no clearing activities are to occur during the migratory bird nesting period (April 1 to July 31) at this location unless the area has been pre-logged. Clearing in mature and old forest habitats will be minimized. The alteration or degradation of highly suitable coastal northern goshawk habitat is considered reversible in the long-term and of low magnitude. ***The following residual effect has been identified:*** a***pproximately 40 ha of high suitability coastal northern goshawk habitat will be cleared.***

Interior Northern Goshawk. The KSL pipeline route crosses a nesting territory of the interior subspecies of northern goshawk near KP 217. This subspecies is not listed provincially or federally, but is considered as being of management interest in the Skeena Region, and its management is addressed in the *Morice LRMP*. To avoid impacts of the Project on this nesting territory, logging and clearing of the pipeline route at this location will be restricted to only that area required for the efficient and safe construction of the project. With the implementation of this mitigation measure, the potential alteration or degradation of the interior northern goshawk nesting territory is considered reversible in the short-term and of negligible magnitude. ***No residual effect has been identified.***

Wood Ducks. The KSL pipeline route crosses 23 wetlands that may provide suitable breeding habitat for wood ducks between KP 4.6 and KP 459.3. To minimize disturbance of nesting habitat, no clearing activities are to occur within the migratory bird nesting period (April 1 to July 31 at KP 0 to KP 130; May 1 to July 31 at KP 130 to KP 462.2) unless the area has been pre-logged, pre-brushed, or pre-mowed. At swamps with appropriate wood duck habitat, PTP will record any wildlife trees to be cleared, and, if feasible, install wildlife trees and put up nest boxes during the restoration phase. With the implementation of these mitigation measures, the potential alteration or degradation of suitable wood duck nesting swamps is considered reversible in the short-term, and of low magnitude. ***No residual effect has been identified.***

Sandhill Crane. The KSL pipeline route crosses areas with suitable nesting habitat for sandhill cranes between KP 325 and KP 365. Sandhill cranes are a blue-listed species in British Columbia. To minimize interactions of Project clearing, construction and restoration activities on sandhill cranes, no clearing activities are to occur within the migratory bird nesting period (May 1 to July 31) at this location unless the area has been pre-logged, pre-brushed, or pre-mowed. If a sandhill crane nest is discovered within 400 m of the Project Footprint during construction, PTP will implement a Wildlife Incident Contingency Plan. With the implementation of these mitigation measures, the potential alteration or degradation of sandhill crane nesting habitat is considered reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

Marbled Murrelet. The KSL pipeline route crosses one area with potentially suitable habitat for marbled murrelet nesting between KP 16.9 and KP 17.2. The marbled murrelet is provincially red-listed, listed as 'Threatened' by COSEWIC, and is included in Schedule 1 of *SARA*. To avoid possible

disturbance to marbled murrelet nesting, no clearing activities are to occur during the migratory bird nesting period (April 1 to July 31) at this location unless the area has been pre-logged. Clearing in mature and old forest habitats will be minimized. The alteration or degradation of suitable of marbled murrelet habitat is considered reversible in the long-term and of low magnitude. ***The following residual effect has been identified: approximately 1 ha of suitable marbled murrelet nesting habitat will be cleared.***

Moose Winter Habitat. The KSL pipeline route crosses three moose wintering areas between KP 239 and KP 280. These moose winter habitats are associated with wetland habitats. For mitigation to minimize the alteration or degradation of wetland habitat function, please refer to the Wetland section above. With the implementation of mitigation measures to reduce impacts to wetlands, the effect of alteration or degradation on moose habitat is considered reversible in the short-term, and of low magnitude. ***No residual effect has been identified***.

Mountain Goat Winter Habitat. The KSL pipeline route crosses two mountain goat winter habitat areas between KP 74 and KP 100. To minimize interactions of project-related activities and mountain goat winter habitats, no clearing or construction activities are to occur within 200 m of mountain goat winter habitat (KP 74 to KP 100) between October 15 and May 15. The alteration or degradation of mountain goat winter habitat is considered reversible in the medium-term and of medium magnitude. ***The following residual effect has been identified: approximately 18 ha of mountain goat winter habitat will be altered by the pipeline route.***

Grizzly Bear Habitat. The KSL pipeline route crosses 25 areas where key grizzly bear habitats have been identified between KP 25 and KP 460. Grizzly bear denning areas have been identified between KP 65 and KP 108. Grizzly bears are provincially blue-listed, listed as "Special Concern" by COSEWIC, and are included in Schedule 1 of *SARA*. To avoid altering or degrading important grizzly bear feeding habitats, the clearing of vegetation adjacent to roads will be minimized to the greatest extent feasible. Disturbed areas will be restored with natural shrub species to enhance bear security and feeding habitats. With the implementation of these mitigation measures, the potential alteration or degradation of grizzly bear habitat is considered to be reversible in the short- to medium-term, and of low magnitude. ***No residual effect has been identified.***

Coastal Tailed Frog Streams. The KSL pipeline route crosses 52 streams assessed to have moderate to high suitability for coastal tailed frogs between KP 1.3 and KP 74.25. Coastal tailed frogs are provincially blue-listed, listed as "Special Concern" by COSEWIC, and are included in Schedule 1 of *SARA*. To avoid altering or degrading coastal tailed frog streams, similar mitigation used to avoid potential environmental effects on fish habitat will be employed. The removal of shrubs within 30 m of all streams will be minimized, and grubbing of the work area within 10 m of stream banks will be minimized to protect, to the greatest extent practicable, the existing amphibian habitat. With the implementation of mitigation to avoid alteration or degradation of coastal tailed frog streams, the effect on coastal tailed frog habitat is considered reversible in the long-term and of medium magnitude. ***The following residual effect has been identified: the suitability of 52 streams used by coastal tailed frogs will be reduced***.

ii. Impact Pathway: Loss of site-specific habitat features

The KSL pipeline route may interact with and cause the loss of specific habitat features such as stick nests, wildlife trees, or dens. This effect may occur along the entire length of the pipeline route. To minimize effects associated with the loss of site-specific habitat features, these features will be avoided whenever practicable. If wildlife trees cannot be retained, they will be replaced whenever practical. To ensure the usability of any site-specific habitat feature installations, a Post-Construction Monitoring Program will be implemented. With the implementation of mitigation to avoid the loss of site-specific habitat features, the effect on wildlife VECs is considered reversible in the short-term, and of low magnitude. ***No residual effect has been identified.***

iii. Impact Pathway: Alteration of wildlife movement corridors

The KSL pipeline route interacts with 16 wildlife movement corridors that are associated with major river corridors along the entire pipeline route. There are also countless, less defined movement corridors throughout the Project area. Clearing, construction, and restoration activities associated with the Project may lead to disturbances and alterations of wildlife movement patterns. To minimize impacts on wildlife movement, the following mitigation measures will be implemented:

- work expeditiously to maintain a tight construction spread, from trench opening to backfill, to minimize potential barriers and hazards to wildlife;
- leave gaps in set-up and welded pipe, spoil piles, and trench to allow wildlife to cross the right-of-way. Locate gaps at obvious game trails. Coincide breaks in pipe with gaps in topsoil or root zone material, spoil, snow (if present) and rollback (if present) windrows;
- install or maintain trench plugs across open trench to allow the cross-ditch movement of wildlife to and from the seasonal ranges along designated wildlife movement corridors and to special habitat features;
- salvage and redistribute coarse woody debris in suitable habitat types for use by small mammals and other wildlife species, as appropriate and practicable; and
- use native plant species to maintain biodiversity, reduce weed cover, and help create wildlife movement corridors as outlined in the Restoration Plan.

With the implementation of these mitigation measures to avoid the alteration of wildlife movement patterns, the effect on wildlife VECs is considered reversible in the medium-term, and of low magnitude. ***The following residual effect has been identified: alteration of seasonal movement patterns of wide-ranging predators (e.g. grizzly bear, grey wolf, lynx, cougar, wolverine).***

I. Potential Effect: Direct and indirect wildlife mortality

The clearing, construction, and restoration of the KSL Project could directly or indirectly result in wildlife mortality. Wildlife mortality may result directly from construction activities (*e.g.* wildlife becomes trapped in the pipeline trench for extended periods, and wildlife vehicle collisions). The western mountainous section of the KSL pipeline route crosses undisturbed areas with limited

human access. By establishing new access to these areas, there will be new opportunities for increasing authorized and unauthorized hunting, an indirect wildlife mortality effect of the KSL Project. Also, the increased presence of people in the Project area during clearing, construction and restoration activities may lead to habituation by wildlife, and thus cause indirect mortality of wildlife due to human-wildlife conflicts.

Four impact pathways were considered to identify residual wildlife mortality effects. They are:

i) direct wildlife mortality related to construction activities;
ii) direct wildlife mortality related to vehicle collisions;
iii) indirect mortality related to increased access to remote areas (*e.g.* hunting and poaching); and
iv) wildlife mortality resulting from human-wildlife conflicts (*e.g.* problem bears, aggressive moose).

The direct and indirect wildlife mortality impact pathways and mitigation measures to minimize their effect are discussed below.

i. Impact Pathway: Direct wildlife mortality resulting from construction activities

The entire KSL pipeline route crosses habitats that may be used by wildlife. Trenching and pipeline installation activities produce temporary traps to wildlife, especially smaller species with small or restricted ranges, such as coastal tailed frogs, snowshoe hare, and small furbearers such as weasels. To lessen the risk of mortality of wildlife that may become trapped in the construction zone, the following mitigation measures will be applied:

- report any incidents or collisions with wildlife to the Environmental Inspector who will notify local wildlife authorities and the police as appropriate;
- remove trapped animals from the pipeline trench at the start of each day before conducting construction activities that may have the potential to harm an animal in the trench;
- capture and move adult, tadpole, and metamorph coastal tailed frogs prior to stream crossing activities; and
- implement a Wildlife Incident Contingency Plan in the event of a wildlife mortality.

With the implementation of these mitigation measures and in consideration of past data from similar pipeline construction projects, the effect of direct wildlife mortality related to construction activities is considered to be reversible in the short-term and of low magnitude for small mammal species. On coastal tailed frogs, the effect is considered to be reversible in the medium-term for coastal tailed frogs and of low magnitude. ***The following residual effect has been identified: incidental construction-related mortality of individual coastal tailed frogs. No residual effect has been identified for small mammals.***

ii. Impact Pathway: Direct wildlife mortality related to vehicle collisions

There is a risk of wildlife-vehicle collisions causing wildlife mortality throughout the entire KSL pipeline route and all associated accesses during the clearing, construction, and restoration of the Project. The following mitigation measures will be implemented to reduce the risk of wildlife-vehicle collisions:

- minimize construction vehicles traveling to and from the worksite (*e.g.* use multi-passenger vehicles to transport workers) to the extent practical;
- travel to and from the worksite during daylight hours, whenever practical; and
- adhere to posted speed limits.

With the implementation of these mitigation measures and in consideration of past programs, the potential increase in direct wildlife mortality related to vehicle collisions is considered to be reversible in the short-term and of medium magnitude. ***The following residual effect has been identified: the risk of wildlife vehicle collisions will increase during construction***.

iii. Impact Pathway: Indirect mortality related to increased access to remote areas

The KSL pipeline route crosses two currently pristine, unroaded, mountainous areas between KP 75 and KP 104. These areas currently receive little human use, and hunting and poaching pressure on wildlife in these areas is lower than in neighbouring roaded areas. Introduction of access during the clearing, construction and restoration phase of the Project will allow for greater human access, and the risk of mortality related to authorized and unauthorized hunting will increase. PTP is committed to reducing unauthorized motorized access to currently unroaded areas by implementing an Access Management Plan that will be developed prior to clearing and constsruction. PTP will monitor unauthorized motorized use in newly accessible areas to assess the efficacy of access control strategies and take corrective action where needed. The very rugged terrain in this area of the pipeline lends itself to practical implementation of effective controls at strategic locations.With the implementation of the mitigation measures, the potential for indirect mortality related to increased access to remote areas is considered to be reversible in the long-term and of medium magnitude. ***The following residual effect has been identified: increased authorized and unauthorized hunting during and post-construction***.

iv. Impact Pathway: Wildlife mortality resulting from human-wildlife conflicts

The KSL pipeline route crosses a large range of habitats, and encounters with wildlife may occur along the entire pipeline route. Some wildlife species VECs are susceptible to habituation to humans, such as black bears, grizzly bears, and red fox. If individuals of these species become habituated, their presence near the construction site may pose a safety risk to pipeline construction personnel, and the animals may need to be destroyed. PTP will implement a Bear Management Plan that outlines specific measures of preventing negative bear encounters, and the habituation of bears. Garbage will be collected daily in bear-proof containers, and disposed of in appropriate locations. PTP will also inform the pipeline construction workforce regarding wildlife and habitat

protection measures prior to initiation of work by means of compulsory pre-job orientations. In the event that a wildlife encounter occurs, PTP will implement a Wildlife Incident Contingency Plan. With the implementation of the mitigation measures and in consideration of similar programs on similar projects, the potential for wildlife mortality resulting from human-wildlife conflicts is considered to be reversible in the short-term and of low magnitude. ***No residual effect has been identified***.

m. Potential Effect: Sensory disturbances to wildlife

Clearing, construction, and restoration activities associated with the KSL Project have the potential to result in sensory disturbances to wildlife along the entire length of the pipeline route. Sensory disturbances often result in wildlife leaving and avoiding areas with construction activities.

Consequences of sensory disturbances are most severe during important life cycle events, or in important seasonal ranges, when the animals are already energetically stressed. The KSL pipeline route crosses the following wildlife habitats and ranges that support wildlife during sensitive life cycle events or stressful seasons:

- migratory bird areas (four areas between KP 190 and KP 413);
- bird nesting (along entire pipeline route);
- moose winter habitats (three areas between KP 239 and KP 280);
- mountain goat winter habitat (two areas between KP 74 and KP 100); and
- grizzly bear habitats (25 areas with identified key habitats between KP 25 and KP 460; denning areas between KP 65 and KP 108).

The potential sensory disturbances to wildlife are reduced by PTP's pipeline routing and scheduling of clearing and construction. PTP will inform the pipeline construction workforce regarding wildlife and habitat protection measures prior to initiation of work by means of compulsory pre-job orientations. PTP will conduct a pre-construction survey (route walk) to record any site-specific wildlife habitat features in the Project Footprint and will implement a Wildlife Incident Contingency Plan if important features are located. PTP will adhere to the following timing constraints to avoid sensory disturbances in identified important habitats:

- no clearing or construction activities are to occur within 200 m of an active grizzly or black bear den between November 1 and April 30;
- no clearing or construction activities are to occur within 200 m of mountain goat winter habitat between October 15 and May 15 between KP 74 and KP 100; and
- no clearing activities are to occur within the migratory bird nesting period (April 1 and July 31 between KP 0 and KP 130; May 1 and July 31 between KP 130.0 and KP 462.2) unless the area has been pre-logged, pre-brushed or pre-mowed, or at specific locations where nesting is confirmed to be absent at the time of clearing and clearing outside of this period is acceptable to the appropriate regulatory authorities.

With the implementation of these mitigation measures, the effect of sensory disturbances of wildlife during important life cycle events is considered to be reversible in the short-term and of low magnitude. ***No residual effect has been identified***.

Methanex Lateral

n. Potential Effect: Alteration or degradation of wetland hydrology and water quality

The Methanex Lateral connection with the KSL pipeline route crosses two wetlands. Both wetlands have been previously disturbed by an electrical transmission corridor, adjacent roads, and a railway. To minimize effects on wetland hydrology and water quality, the same mitigation measures as proposed for the construction of the pipeline route will be applied. Because of the previous disturbances to the affected wetlands, and the pipeline lateral's adjacency to an existing transmission corridor, potential effects on wetland hydrology and water quality are considered to be reversible in the short-term, and of low magnitude. ***No residual effect has been identified.***

o. Potential Effect: Alteration or degradation of wetlands

The Methanex Lateral pipeline crosses two wetlands. Construction of this lateral pipeline will require clearing of wetland vegetation for approximately 200 m of its length. To minimize effects on wetland habitat function as a result of clearing vegetation, the same mitigation measures used during construction of the KSL pipeline route will be employed. Because wetland vegetation has been previously disturbed, the effects of alteration or degradation of wetlands caused by the clearing, construction or restoration of the Methanex Lateral pipeline is considered to be reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

p. Potential Effect: Introduction, and acceleration of the spread of invasive plants

Activities associated with clearing, construction, and restoration of the Methanex Lateral pipeline could result in the introduction, and acceleration of the spread of invasive plants. To minimize the risks associated with introducing or spreading invasive plants, the same mitigation measures used during construction and restoration of the pipeline route will be applied. The introduction and acceleration of the spread of invasive plants is considered to be reversible over the medium-term and of low magnitude. ***The following residual effect has been identified: introduction of invasive plant species immediately after construction may occur.***

q. Potential Effect: Sensory disturbances to wildlife

The Methanex Lateral pipeline route is located in the Coastal Closed Forest and Coastal Wetland habitat types. The area is renowned for use by grizzly bear during spring and by several forest bird species. Clearing, construction, and restoration activities associated with the KSL Project have the potential to result in sensory disturbances to wildlife on the Methanex Lateral route. Sensory disturbances often result in wildlife leaving and avoiding areas with construction activities. Consequences of sensory disturbances are most severe during important life cycle events, or in

important seasonal ranges, when the animals are already energetically stressed. No important seasonal ranges that support critical periods of the life history of wildlife have been identified on the Methanex Lateral pipeline route. For this reason, the potential effect of sensory disturbances to wildlife during clearing, construction and restoration of the Methanex Lateral pipeline are considered to be reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

Compressor Station

r. Potential Effect: Introduction, and acceleration of the spread of invasive plants

The Compressor Station site will be fenced and the portions of the site not used for buildings and above-ground pipeline infrastructure will be gravelled. Vegetation within the compound will be controlled, and no invasive plants will become established at the Compressor Station site. ***No residual effect has been identified.***

s. Potential Effect: Sensory disturbances to wildlife

Clearing, construction, and restoration activities associated with the KSL Project have the potential to result in sensory disturbances to wildlife at the Compressor Station site. Sensory disturbances often result in wildlife leaving and avoiding areas with construction activities. Consequences of sensory disturbances are most severe during important life cycle events, or in important seasonal ranges, when the animals are already energetically stressed. No important seasonal ranges that support critical periods of the life history of wildlife have been identified on the Compressor Station site. For this reason, the potential effect of sensory disturbances to wildlife during clearing, construction and restoration of the Compressor Station are considered to be reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

SIGNIFICANCE OF RESIDUAL EFFECTS

The significance of residual effects pertaining to vegetation, wildlife, and wildlife habitat are evaluated in the following section. These residual effects are listed below, and their assessment is summarized in Table 7.2.-16:

a. approximately 88 ha of wetland habitat will be altered or degraded;

b. approximately 32 ha of mid-seral to old Douglas-fir dominated forest will be cleared;

c. approximately 7 ha of mid-seral to old aspen-dominated forest will be cleared;

d. approximately 46 ha of riparian and floodplain forest will be cleared;

e. approximately 600 ha of mature and old coniferous forest will be cleared;

f. approximately 16.8 ha of subalpine and alpine habitat will be disturbed;

g. approximately 4 ha of grassland area will be disturbed;

h. introduction of invasive species to previously undisturbed areas immediately after construction;

i. approximately 40 ha of high suitability coastal northern goshawk habitat will be cleared;

j. approximately 1 ha of suitable marbled murrelet nesting habitat will be cleared;

k. approximately 18 ha of mountain goat winter range will be crossed by the pipeline route;

l. suitability of 52 streams used by coastal tailed frogs will be altered;

m. seasonal movement patterns of wide ranging predators (*e.g.* grizzly bear, grey wolf, lynx, cougar, wolverine) will be altered;

n. incidental construction-related mortality of individual coastal tailed frogs will occur;

o. risk of wildlife-vehicle collisions will increase during construction; and

p. authorized and unauthorized hunting during and post-construction will increase.

a. Residual Effect: Alteration or degradation of wetland habitat

Approximately 88 ha of wetland habitat in the Project Footprint will be altered or degraded. The KSL pipeline route overlaps with numerous wetlands along the entire length of the route. Vegetation removal and soil disturbance will be minimized when working in wetlands. Shrubs and small deciduous trees will be cut, hydroaxed, or walked down to ground level, to avoid disturbing root structure of woody wetland vegetation where practical. The width of grubbing will be minimized through wet areas during construction to facilitate the restoration of shrub communities. Restoration will include recontouring of the disturbed areas to promote natural regeneration, and willow staking, when appropriate. The residual effect of alteration or degradation of wetland habitat is localized to the Project Footprint, and is considered to be reversible in the medium-term, and of low magnitude. ***The residual effect is less than significant.***

b. Residual Effect: Clearing of Douglas-fir forest

Construction of the pipeline route will result in the clearing of approximately 32 ha of mature to old Douglas-fir forest. The KSL pipeline route crosses 11 mature to old Douglas-fir forests between KP 307 and KP 337. To minimize clearing of mature trees, PTP will narrow down the project footprint through these areas to the extent practicable. PTP will plant Douglas-fir seedlings in temporary workspace at appropriate sites. The effectiveness of Douglas-fir forest restoration efforts will be monitored during a Post-Construction Monitoring Program. The residual effect of clearing mature and old Douglas-fir forest is localized to the Project Footprint, and is considered to be reversible in the long-term and of low magnitude. ***The residual effect is less than significant.***

c. Residual Effect: Clearing of aspen forest

Approximately 7 ha of mature to old aspen dominated forest will be cleared for construction of the KSL Project. Old aspen stands occur at four locations along the pipeline route between KP 149 and KP 298. Through these old aspen stands, PTP will narrow down the Project Footprint to reduce clearing mature aspen trees and protect the old aspen stands to the extent practical. Natural regeneration of aspen will be encouraged in temporary workspace following construction, and aspen

will be planted in appropriate areas during the restoration phase of the Project. The effectiveness of the restoration measures will be monitored during a Post-Construction Monitoring Program. The residual effect of clearing aspen forest is localized to the Project Footprint, and is considered reversible in the long-term and of low magnitude. ***The residual effect is less than significant.***

d. Residual Effect: Clearing of riparian and floodplain forest

Approximately 46 ha of riparian and floodplain forest will be cleared. The pipeline route crosses a total of 24 mature riparian areas and floodplain forests throughout its entire length. Clearing of mature deciduous and coniferous trees in these areas will be minimized, and the width of temporary workspace will be narrowed to the extent practicable. Grubbing of temporary workspace will be minimized to the extent practical to allow for coppicing and to keep root systems intact. To retain stream bank stability and minimize erosion potential, PTP will implement bioengineering along stream banks using appropriate species. PTP will redistribute coarse woody debris on ground surface during the final clean-up and restoration phase to restore the structural complexity and wildlife habitat function of riparian and floodplain forest. Cleared riparian and floodplain forest will be seeded with appropriate seed mixes, and riparian shrubs and trees will be planted. The effectiveness of these mitigation measures will be monitored during a Post-Construction Monitoring Program. The residual effect of clearing riparian and floodplain forest is localized on the Project Footprint, and is considered reversible in the long-term and of medium magnitude. ***The residual effect is less than significant.***

e. Residual Effect: Clearing of mature and old coniferous forest

Approximately 600 ha of mature and old coniferous forest habitat will be cleared for the Project. Mature and old forest stands occur at various locations along the pipeline route, but the most contiguous mature and old forest stands are found in the Mountain Region between KP 74.9 and KP 112. To minimize effects on mature and old coniferous forests, restoration will involve planting coniferous tree seedlings, and using native plant species on the right-of-way. If feasible, clearing of old forest stands will be minimized by narrowing down the project footprint. The effectiveness of restoration efforts will be monitored during a Post-Construction Monitoring Program. The residual effect of clearing mature and old coniferous forest is localized on the Project Footprint, and is considered reversible in the long-term and of medium magnitude. ***The residual effect is less than significant.***

f. Residual Effect: Disturbance of subalpine and alpine area

Approximately 17 ha of subalpine and alpine habitat will be cleared for construction activities. The KSL pipeline route crosses subalpine and alpine areas in the western portion of the Project area between KP 74.9 and KP 116.2. To restore project-related disturbed areas, PTP will recontour slopes to stable conditions. Suitable native plant species will be hydroseeded in disturbed areas, as outlined in the Restoration Plan. Where krummholz and small conifers have previously become established, conifer seedlings will be planted in clusters to create microsites to promote natural regeneration of subalpine and alpine species. PTP will monitor the effectiveness of the restoration during the Post-Construction Monitoring Program. The residual effect of disturbing subalpine and

alpine areas is localized on the Project Footprint, and is considered reversible in the long-term and of medium magnitude. ***The residual effect is less than significant.***

g. Residual Effect: Disturbance of grassland area

Approximately 4 ha of grassland area will be cleared for construction activities. The KSL pipeline route crosses a single grassland area between KP 242.5 and KP 243.5. Clearing and construction of the KSL Project will cause alteration and degradation of this grassland area. Topsoil will be stripped and replaced during construction activities, and the native plant species or a natural recovery technique will be employed. The effectiveness of the restoration efforts will be monitored during a Post-Construction Monitoring Program. The residual effect of disturbing a grassland area is localized on the Project Footprint, and is considered reversible in the medium-term and of low magnitude. ***The residual effect is less than significant.***

h. Residual Effect: Introduction of invasive species

Introduction of invasive species immediately after construction may occur. Activities associated with clearing, construction, and restoration of the KSL Project will cause the introduction, and acceleration of the spread of invasive plants. This effect occurs along the entire pipeline route and will be minimized by following an Invasive Plant Management Plan to minimize the introduction and spread of noxious weeds, and employing standard weed control measures to avoid introducing weeds to the Project area. Pre-existing weed infestations will be pre-treated, and the spread of weeds minimized by cleaning equipment prior to moving from an area with a weed infestation. Native vegetation will be restored as quickly as practical following ground disturbing activities. The right-of-way will be monitored during a Post-Construction Monitoring Program to locate any new areas with weed growth, and control weeds at these locations. The residual effect of introducing invasive species is localized on the Project Footprint to LSA, and is considered reversible in the medium-term and of low magnitude. ***The residual effect is less than significant.***

i. Residual Effect: Clearing of coastal northern goshawk habitat

Approximately 40 ha of high suitability habitat for breeding by the coastal subspecies of northern goshawk (*laingi* subspecies) will be cleared to allow for the construction of the pipeline. The KSL pipeline route overlaps with four areas of high suitability breeding habitat between KP 74 and KP 94. There are no known nest records in these suitable breeding habitats, but to avoid possible disturbances, no clearing activities are to occur during the migratory bird nest period (April 1 to July 31) unless the area has been pre-logged. Clearing in mature and old forest habitats will be minimized. The residual effect of clearing approximately 40 ha of high suitability coastal northern goshawk breeding habitat is considered to be of low magnitude, because breeding home ranges of coastal northern goshawks are generally between 700 ha and 19,000 ha in size. The residual effect is concentrated on the Project Footprint, and is considered to be reversible in the long-term. ***The residual effect is less than significant.***

j. Residual Effect: Clearing of marbled murrelet habitat

Approximately 1 ha of suitable marbled murrelet nesting habitat will be cleared. The KSL pipeline route crosses one area with potentially suitable habitat for marbled murrelet nesting between KP 16.9 and KP 17.2. To avoid possible disturbance of marbled murrelet nesting in this 1 ha of suitable habitat, no clearing activities are to occur during the migratory bird nesting period (April 1 to July 31) unless the area has been pre-logged. Clearing in mature and old forest habitats will be minimized. Because of the small amount of suitable habitat being cleared, and the adjacency of this habitat to mostly early-seral forests, the residual effect of clearing 1 ha of suitable marbled murrelet habitat is considered to be of low magnitude, and reversible over the long-term. ***The residual effect is less than significant.***

k. Residual Effect: Alteration of mountain goat winter range

Approximately 18 ha of mountain goat winter habitat will be altered by the KSL pipeline route. The pipeline route crosses two mountain goat winter habitat areas between KP 74 and KP 100. To minimize project-related effects, PTP will not conduct any clearing or construction activities within 200 m of mountain goat winter habitat from October 15 to May 15 between KP 74 and KP 100. The residual effect is localized on the Project Footprint, and is considered reversible over the medium-term, and of medium magnitude. ***The residual effect is less than significant.***

l. Residual Effect: Alteration of coastal tailed frog streams

The suitability of 52 streams used by coastal tailed frogs will be altered during the clearing, construction, and restoration phase of the KSL Project. The 52 streams that have been assessed to have moderate to high suitability for coastal tailed frogs are located between KP 1.3 and KP 74.25. To avoid altering or degrading coastal tailed frog streams, similar mitigation to avoiding potential environmental effects on fish habitat will be employed. The removal of shrubs within 20 m of all streams will be minimized, and grubbing of the work area will be minimized within 10 m of stream banks to protect, to the greatest extent practicable, the existing amphibian habitat. The residual effect is localized on the Project Footprint, and is considered reversible in the long-term and of medium magnitude. ***The residual effect is less than significant.***

m. Residual Effect: Alteration of seasonal movement patterns

The clearing, construction, and restoration of the KSL Project will cause alteration of seasonal movement patterns of large ranging predators, such as grizzly bear, grey wolf, lynx, cougar, and wolverine. The pipeline route crosses 16 major wildlife movement corridors, and countless less defined corridors throughout the Project area. The alteration of habitat and sensory disturbances involved with the clearing, construction, and restoration of the pipeline will cause large ranging wildlife to avoid the Project Footprint, and temporarily alter their movements. The following mitigation measures will be implemented to minimize the effect:

- work expeditiously to maintain a tight construction spread, from trench opening to backfill, to minimize potential barriers and hazards to wildlife;

- leave gaps in set-up and welded pipe, spoil piles and trench to allow wildlife to cross the right-of-way; locate gaps at obvious game trails; coincide breaks in pipe with gaps in topsoil or root zone material, spoil, snow (if present) and rollback (if present) windrows;
- install or maintain trench plugs across open trench to allow the cross-ditch movement of wildlife to and from the seasonal ranges along designated wildlife movement corridors and to special habitat features;
- salvage and redistribute coarse woody debris in suitable habitat types for use by small mammals and other wildlife species, as appropriate and practicable; and
- use native plant species to maintain biodiversity, reduce weed cover, and help create wildlife movement corridors as outlined in a Restoration Plan.

Changes in wildlife movements will occur at scales ranging from the Project Footprint to the Regional Study Area. The residual effect is considered to be reversible in the medium-term, and of low magnitude, due to the implementation of mitigation measures. ***The residual effect is less than significant.***

n. Residual Effect: Mortality of coastal tailed frogs

Incidental construction-related mortality of individual coastal tailed frogs will occur. The KSL pipeline route crosses 52 streams with moderate to high suitability for coastal tailed frogs. Tailed frogs are present in streams year round. PTP Wildlife Specialists will capture and move adult, tadpole, and metamorph coastal tailed frogs prior to stream crossing activities. Despite the implementation of this mitigation, mortality of individual tailed frogs in some life stages will occur. As the generation time of coastal tailed frogs is relatively long, this residual effect is considered to be reversible over the medium-term. The residual effect occurs on the Project Footprint, and is of low magnitude. ***The residual effect is less than significant***.

o. Residual Effect: Increased risk of wildlife-vehicle collisions

The risk of wildlife-vehicle collisions will increase during the clearing, construction, and restoration of the KSL Project. To lessen the risk of wildlife-vehicle collisions, PTP will minimize construction vehicles traveling to and from the worksite (*e.g.* Use multi-passenger vehicles to transport workers), travel to and from the worksite during daylight hours, whenever practical, and adhere to posted speed limits. The residual effect occurs at scales ranging from the Project Footprint to the Regional Study Area, and is considered to be reversible in the short-term and of medium magnitude. ***The residual effect is less than significant.***

p. Residual Effect: Increased authorized and unauthorized hunting

Increased authorized and unauthorized hunting will occur in during and post-construction in currently pristine, unroaded, mountainous areas between KP 75 and KP 104. The introduction of access during the clearing, construction, and restoration phase of the Project will allow for greater human access, and the risk of mortality related to authorized and unauthorized hunting will increase. PTP is

committed to implementing measures that will reduce unauthorized motorized access to the currently unroaded areas by implementing an Access Management Plan. PTP will monitor unauthorized motorized use in newly accessible areas associated with the Project to assess the efficacy of access control strategies and take corrective action where needed. Wildlife mortality related to increased authorized and unauthorized areas will increase during the clearing, construction, and restoration phase of the KSL Project, until the access control measures can be fully implemented. The residual effect is considered to be reversible in the long-term, of medium magnitude, and affects scales ranging from the Project Footprint to the RSA. ***The residual effect is less than significant.***

Methanex Lateral

q. Residual Effect: Introduction of invasive species

Activities associated with clearing, construction, and restoration of the Methanex Lateral pipeline will cause the introduction, and acceleration of the spread of invasive plants immediately after construction. This effect is minimized by following an Invasive Plant Management Plan to curtail the introduction and spread of noxious weeds and employing the same mitigation measures as during the construction of the KSL pipeline. The residual effect of introducing invasive species is localized on the Project Footprint to LSA, and is considered reversible in the medium-term and of low magnitude. ***The residual effect is less than significant.***

Compressor Station

r. Residual Effect: Introduction of invasive species

Activities associated with clearing, construction, and restoration of the Compressor Station site will cause the introduction, and acceleration of the spread of invasive plants immediately after construction. This effect is minimized by following an Invasive Plant Management Plan to curtail the introduction and spread of noxious weeds and employing the same mitigation measures as during the construction of the KSL pipeline. The residual effect of introducing invasive species is localized on the Project Footprint to LSA, and is considered reversible in the medium-term and of low magnitude. ***The residual effect is less than significant.***

Table 7.2-13
Effects Assessment: Terrestrial Environment
Clearing, Construction, and Restoration

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Wetlands			
General	Wetlands in Project Footprint and LSA along entire pipeline route Methanex Lateral	• Greenfield portion of the KSL pipeline route selected to minimize the number of wetland crossings. • Schedule construction during frozen ground conditions, to the extent practicable. • Use low ground pressure equipment or install temporary work pads for heavy vehicle/equipment crossing through wetland in unfrozen ground conditions. • Remove temporary work pads immediately after construction activity at that location has been completed. • Install berms, cross ditches and silt fences at the base of approach slopes to wetlands and between the wetland and the disturbed area. • Conduct grading adjacent to wetlands away from the wetland to the extent practical to reduce the risk of sediment and other material entering the wetland. • Store excavated material in a manner that does not interfere with natural drainage patterns. • Recontour pre-construction profile in wetlands during final clean-up. • Schedule post-construction pipeline maintenance activities during winter to the extent feasible. Consider above measures for work in wetlands during operations where feasible.	N/A

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Alteration or degradation of wetland hydrologic function and wetland water quality	Wetlands along various locations along entire route Methanex Lateral	• Narrow down the area of disturbance and protect the wetland by using fencing, clearly mark the wetland boundaries using flagging and limit traffic in the restricted area, where feasible. • Where feasible, minimize the width of grubbing through wet areas during construction to facilitate the re-establishment of shrub communities. • If practical, leave an undisturbed organic mat as a buffer zone to limit sediment entering wetlands. • Install trench breakers, where warranted, at the edge of wetlands to prevent the pipe trench from acting as a drain. • Adhere to spill prevention measures outlined in a KSL Environmental Protection Plan. • Monitor wetlands for hydrologic function during a Post-Construction Monitoring Program (i.e. first and second years following construction).	• No residual effect identified.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Vegetation			
General	Entire pipeline route	• Greenfield portion of the KSL pipeline route was selected to minimize clearing of mature vegetation. • Seed disturbed areas of the Project Footprint with the appropriate native seed mix. • Develop native seed mixtures to suit local site conditions. • Revegetate disturbances on moderate and steep slopes with an appropriate seed mix and approved cover crop to minimize erosion potential and rapidly establish a vegetative cover. • Plant previously forested temporary workspace with tree species approved by BC MOFR and forest licensees. • Monitor the effectiveness of revegetation efforts during the Post-Construction Monitoring Program of the right-of-way. Inspect moderate and steep slopes during regular aerial patrols. Undertake remedial work where warranted. • Revegetate any post-construction maintenance disturbances using appropriate native seed mixes.	N/A

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Alteration or degradation of wetland habitat	Wetlands along various locations along entire route Methanex Lateral	• Minimize the removal of vegetation and the disturbance of soil adjacent to wetlands. • Cut, hydroaxe, or walkdown shrubs and small (<1.5 m) deciduous trees at ground level to preserve roots of woody wetland plants. • Minimize the width of grubbing through wetland areas during construction to facilitate the re-establishment of shrub communities. • Where shrubs were present prior to construction, use willow staking along the wetland edge. • Recontour the disturbed area and re-establish drainage patterns to promote natural regeneration of wetland plant species. • Monitor wetlands for habitat quality and function during a Post-Construction Monitoring Program.	• Approximately 88 ha of wetland habitat will be altered or degraded in the Project Footprint.
Alteration or degradation of mature to old Douglas-fir forest	11 stands concentrated from: • KP 307.1 to KP 312.8, • KP 320.4 to KP 325.5, and • KP 336.2 to KP 336.5.	• Clearing of mature trees has been minimized in designing the Project Footprint to avoid mature and old stands of Douglas-fir whenever practical. • Narrow down footprint where feasible. • Plant Douglas-fir tree seedlings in temporary workspace at appropriate sites. • Monitor the effectiveness of restoration efforts during a Post-Construction Monitoring Program.	• Approximately 32 ha of mid-seral to old Douglas-fir dominated forest will be cleared.
Alteration or degradation of mature to old aspen forest	Four undisturbed, old stands from: • KP 149.9 to KP 150.0, • KP 263.1 to KP 264.1, • KP 264.4 to KP 264.7, and • KP 297.2 to KP 297.4.	• Narrow down Project Footprint to leave as many undisturbed aspen trees adjacent to workspace as practical. • Encourage natural regeneration of aspen on temporary workspace.	• Approximately 7 ha of mid-seral to old Aspen-dominated forest will be cleared.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Alteration or degradation of mature and old riparian and floodplain forest.	24 stands, covering approximately 11.3 km along entire pipeline route.	• Where grading is not necessary, cut trees at ground level and do not grub. Minimize grubbing of temporary workspace area to allow for coppicing and to keep root systems in tact to the extent practical. • Plant riparian shrubs and trees as outlined in a Restoration Plan. • Minimize clearing of mature trees and narrow width of workspace clearing to extent practical to maintain forest structure. • Redistribute coarse woody debris on ground surface during final clean-up and restoration phase. • Use native plant species for restoration. • Monitor the effectiveness of restoration during a Post-Construction Monitoring Program.	• Approximately 46 ha of riparian and floodplain forests will be cleared.
Alteration or degradation of mature and old coniferous forests dominated by western hemlock, mountain hemlock, subalpine fir, white-bark pine, lodgepole pine, black spruce, Engelmann spruce, hybrid spruce, and white spruce.	Along entire pipeline route.	• Plant native coniferous tree seedlings in temporary workspace. • Use native plant species for restoration. • Monitor the effectiveness of restoration efforts during a Post-Construction Monitoring Program. • Avoid clearing impacts by narrowing down project footprint to the extent practical.	• Approximately 600 ha of mature and old coniferous forest habitat will be cleared.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Alteration or degradation of non-forested subalpine and alpine areas	4.2 km of non-forested subalpine and alpine habitats from KP 74.9 to KP 116.2.	• Recontour slopes to stable conditions. • Hydroseed suitable native plant species. • Plant coniferous seedlings in clusters to create microsites to promote natural regeneration of subalpine and alpine species. • Monitor the effectiveness of restoration efforts during a Post-Construction Monitoring Program.	• Approximately 16.8 ha of subalpine and alpine habitat will be disturbed.
Alteration or degradation of grassland area	KP 242.5 to KP 243.5.	• Strip and replace topsoil. • Use native plant species or a natural recovery technique during restoration. • Monitor the effectiveness of restoration efforts during a Post-Construction Monitoring Program.	• Approximately 4 ha of grassland area will be disturbed.
Forest Health			
Acceleration or the spread for forest pathogens and pests	**mountain pine beetle (MPB) infestation** KP 100 to KP 462.2 **spruce beetle infestation** KP 0 to KP 462.2 **root rot** KP 0 to KP 462.2	• Adopt Standard Operating Procedures for storage, hauling and milling of MPB Infested Wood as specified by BC MOFR Forest Districts. • Remove and process spruce trees harvested from the pipeline route before spruce beetle flight period (May to July), to reduce risk of infestation of adjacent spruce stands. • Remove and burn stumps of susceptible harvested trees from Project Footprint.	• No residual effect identified.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Invasive Plant Species			
Introduction, and acceleration of the spread of invasive plants	Along entire pipeline route. Methanex Lateral Compressor Station	• Implement an Invasive Plant Management Plan to minimize the introduction and spread of noxious weeds during Project construction activities. • Employ standard weed control measures, such as cleaning of equipment of seeds and vegetative debris attached to the equipment prior to arrival on the right-of-way. • Pre-treat heavily infested weed areas along the route by chemical, hand or mechanical means prior to construction where directed by the appropriate authority. • Minimize weed spread by cleaning equipment in contact with topsoil prior to moving from an area of high weed infestation. • Restore native vegetation as quickly as practical following ground disturbing activities. • Monitor the right-of-way during post-construction monitoring and operations for areas of new weed growth. Undertake measures to control weeds at these locations.	• Introduction of invasive species to previously undisturbed area immediately after construction.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Wildlife and Wildlife Habitat			
Alteration and degradation of habitat			
General	Along entire pipeline route.	• Pipeline routing and scheduling of clearing and pipeline construction have reduced the potential impacts to wildlife and wildlife habitat as follows: ▪ The route is located adjacent to the existing PNG right-of-way, other linear disturbances such as roads, and power lines for approximately 60% of its length, thereby minimizing the disturbance to wildlife habitat. ▪ The route crosses large areas of currently disturbed forest (cutblocks, beetle killed forest, and early seral regenerating forest). ▪ The pipeline route generally avoids wetland and riparian areas. ▪ Pipeline construction is scheduled, in some areas, during frozen soil conditions when fewer wildlife species (*e.g.* migratory birds) are present in the LSA. • Where appropriate, salvage cut deciduous tree debris for redistribution on alignment post-construction as coarse woody debris. • Inform the pipeline construction workforce regarding wildlife and habitat protection measures prior to initiation of work by means of compulsory pre-job orientations. • Conduct a pre-construction survey (route walk) in select locations to record any site-specific wildlife habitat features (*e.g.* wildlife trees, stick nests etc).	N/A

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
• i) Impact Pathway: Alteration or degradation of important seasonal habitats (*e.g.* migratory bird areas, ungulate winter ranges, feeding areas)	**migratory bird areas** W036 (KP 192.7 to KP 192.85) W077 (KP 386.65 to KP 387.0) Stuart River (KP 388.8) W082 (KP 412.9)	• No clearing activities are to occur within the migratory bird nesting period (April 1 and July 31 from KP 0 to KP 130; May 1 and July 31 from KP 130 to KP 462.2) unless the area has been pre-logged, pre-brushed or pre-mowed.	• No residual effect identified.
	coastal northern goshawks – habitats with high suitability KP 74.0 to KP 75.8 KP 81.5 to KP 83.2 KP 83.5 to KP 84.5 KP 88.4 to KP 93.5 **interior northern goshawk – nesting territory** KP 217	• Minimize clearing in mature and old forest habitats. • Narrow down the clearing footprint to the extent practical in order to reduce impact to the interior northern goshawk nesting territory at KP 217.	• Approximately 40 ha of high suitability coastal northern goshawk habitat will be cleared. • No residual effects on interior northern goshawks identified.
	wood ducks – suitable wetlands 23 wetlands from KP 4.6 to KP 459.3	• At swamps with appropriate wood duck habitat, record any wildlife trees to be cleared, and install wildlife trees and put up nest boxes during the restoration phase, if feasible. • No clearing activities are to occur within the migratory bird nesting period (April 1 and July 31from KP 0 to KP 130; May 1 and July 31from KP 130 to KP 462.2) unless the area has been pre-logged, pre-brushed or pre-mowed.	• No residual effect identified.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
	sandhill crane – suitable habitat Wetlands, grasslands or agricultural areas from KP 325 to KP 365	• No clearing activities are to occur within the migratory bird nesting period (May 1 to July 31) unless the area has been pre-logged, pre-brushed, or pre-mowed. • Implement a Wildlife Incident Contingency Plan in the event that a sandhill crane nest is discovered within 400 m of the Project Footprint during construction.	• No residual effect identified.
	marbled murrelet – suitable habitat KP 16.9 to KP 17.2	• No clearing activities are to occur within the migratory bird nesting period (April 1 to July 31) unless the area has been pre-logged, pre-brushed, or pre-mowed. • Minimize clearing of mature and old coniferous forest habitat.	• Approximately 1 ha of suitable marbled murrelet nesting habitat will be cleared.
	moose wintering areas KP 239 to KP 245 KP 261.5 to KP 264 KP 275 to KP 280	• See wetland habitat section for mitigation in wetland habitats.	• No residual effect identified.
	mountain goat – ungulate winter habitat KP 76.5 to KP 80.6 KP 98.9 to KP 99.1	• No clearing or construction activities are to occur within 200 m of mountain goat winter habitat between October 15 and May 15 from KP 74 to KP 100.	• Approximately 18 ha of mountain goat winter range will be altered by the pipeline route.
	grizzly bear habitat 25 areas with identified key habitats from KP 25 to KP 460. Denning areas from KP 65 to KP 108.	• Minimize the clearing of vegetation adjacent to roads to the extent feasible. • Restore disturbed areas with natural shrub species to enhance bear security and feeding habitat.	• No residual effect identified.
	coastal tailed frogs – streams with moderate to high suitability 52 streams from KP 1.3 to KP 74.25	• Stream crossing mitigation measures (see Fish and Fish Habitat Section) will reduce impacts to coastal tailed frogs and their habitat.	• Alter suitability of 52 streams used by coastal

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
		• Minimize removal of shrubs within 30 m of coastal tailed frog streams. • Grubbing of the pipeline trench will be minimized within 10 m of stream banks to protect the existing amphibian habitat, to the greatest extent practicable.	tailed frogs.
• ii) Impact Pathway: Loss of site-specific habitat features (*e.g.* stick nest sites, dens, etc.)	Along entire pipeline route.	• Removal of wildlife trees on the Project Footprint will be avoided. If wildlife tree(s) cannot be retained, they will be replaced whenever practical. • Avoid site-specific habitat features, whenever practical. • Post-construction monitoring of any site-specific habitat feature installations.	• No residual effect identified.
• iii) Impact Pathway: Alteration of wildlife movement patterns	Wedeene River to Cecil Creek (KP 25) Lakelse to Hirsh creeks (KP 30 to KP 32) Chist to Upper Cecil creeks (KP 39) Upper Kitimat to Dala rivers (KP 70) Clore to Zymoetz rivers (KP 85) Burnie River to Atna Creek (KP 100) Gosnell Creek to Holland Lake (KP 112) Bulkley to Morice rivers (KP 130 to KP 165) Francois Lake to Morice River (KP 168) Parrot Lake to Buck Creek (KP 185) Goosly Lake to Buck Creek (KP 200) Tchesinkut to Fraser lakes (KP 265 to KP 305) Nautley Creek to Nechako River (KP 325 to KP 345) Stuart to Nechako rivers (KP 390)	• Work expeditiously to maintain a tight construction spread to minimize potential barriers and hazards to wildlife • Leave gaps in set-up and welded pipe, spoil piles, and trench to allow wildlife to cross the right-of-way. Locate gaps at obvious game trails. Coincide breaks in pipe with gaps in topsoil or root zone material, spoil, snow (if present) and rollback (if present) windrows. • Install or maintain trench plugs across open trench to allow the cross-ditch movement of wildlife to and from the seasonal ranges along designated wildlife movement corridors and to special habitat features. • Salvage and redistribute coarse woody debris in suitable habitat types for use by small mammals and other wildlife species, as appropriate and practicable. • Use native plant species to maintain biodiversity, reduce weed cover, and help create wildlife movement corridors.	• Alteration of seasonal movement patterns of wide ranging predators (*e.g.* grizzly bear, grey wolf, lynx, cougar, wolverine).

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
	Salmon to Fraser rivers (KP 430,KP 440,KP 450) Summit Lake to Crooked River (KP 460)		
Direct and Indirect Wildlife Mortality			
• i) Impact Pathway: Direct wildlife mortality related to construction activities.	Along entire pipeline route.	• Report any incidents or collisions with wildlife to the Environmental Inspector who will notify local wildlife authorities and the police as appropriate. • Remove trapped animals from the pipeline trench at the start of each day before conducting construction activities that may have the potential to harm an animal in the trench. • Capture and move coastal tailed frogs prior to stream crossing activities. • Implement a Wildlife Incident Contingency Plan in the event of a wildlife mortality.	• Incidental construction-related mortality of individual coastal tailed frogs and other wildlife with small, restricted ranges.
• ii) Impact Pathway: Direct wildlife mortality related to vehicle collisions	All access routes and pipeline alignment.	• Minimize construction vehicles traveling to and from the worksite (*e.g.* use multi-passenger vehicles to transport workers), to the extent practical. • Travel to and from the worksite during daylight hours, whenever practical. • Adhere to posted speed limits.	• The risk of wildlife-vehicle collisions will increase during construction.
• iii) Impact Pathway: Indirect mortality related to increased access to remote areas (*i.e.* hunting and poaching)	**Un-roaded mountainous area in the Skeena Region** KP 75 to KP 83 KP 88.5 to KP 104	• Implement an Access Management Plan. • Monitor the effectiveness of access management measures.	• Increased authorized and unauthorized hunting during and post-construction.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
• iv) Impact Pathway: Wildlife mortality resulting from human-wildlife conflicts (*e.g.* problem bears, aggressive moose)	Along entire pipeline route.	• Implement a Bear Management Plan. • Inform the pipeline construction workforce regarding wildlife and habitat protection measures prior to initiation of work by means of compulsory pre-job orientations. • Collect garbage daily in bear-proof containers and dispose in approved locations. • Implement a Wildlife Incident Contingency Plan in the event of a wildlife encounter.	• No residual effect identified.
Sensory disturbance during important life cycle events (*e.g.* at feeding areas, breeding areas, calving areas, migratory bird areas, winter ranges)	**migratory bird areas** W036 (KP 192.7 to KP 192.85) W077 (KP 386.65 to KP 387.0) Stuart River (KP 388.8) W082 (KP 412.9) **bird nesting** Entire Project Footprint **moose winter ranges** KP 239 to KP 245 KP 261.5 to KP 264 KP 275 to KP 280 **mountain goat – ungulate winter habitat** KP 76.5 to KP 80.6 KP 98.9 to KP 99.1 (Goat UWR from KP 88.5 to KP 89.5) **grizzly bear habitat** 25 areas with identified key habitats from KP 25 to KP 460. Denning areas from KP 65 to KP 108.	• Pipeline routing and scheduling of clearing and pipeline construction have reduced the potential sensory disturbances to wildlife during important life cycle stages. • Inform the pipeline construction workforce regarding wildlife and habitat protection measures prior to initiation of work by means of compulsory orientations. • Conduct a pre-construction survey (route walk) to record any site-specific wildlife habitat features (*e.g.* wildlife trees, stick nests). • Implement a Wildlife Incident Contingency Plan in the event of a wildlife encounter. • No clearing or construction activities are to occur within 200 m of an active grizzly or black bear den between November 1 and April 30. • No clearing or construction activities are to occur within 200 m of mountain goat winter habitat between October 15 and May 15 from KP 74 to KP 100. • No clearing activities are to occur within the migratory bird nesting period (April 1 to July 31 from KP 0 to KP 130; May 1 to July 31 from KP 130 to KP 462) unless the area has been pre-logged, pre-brushed or pre-mowed.	• No residual effect identified.

Table 7.2-14
Significance of Residual Effects: Terrestrial Environment
Clearing, Construction, and Restoration

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Approximately 88 ha of wetland habitat will be altered or degraded.	Project Footprint	Medium-term	Isolated	Medium-term	Low	High	High	Less than significant
Approximately 32 ha of mid-seral to old Douglas-fir forest will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	High	Less than significant
Approximately 7 ha of mid-seral to old Aspen forest will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	High	Less than significant
Approximately 46 ha of riparian and floodplain forests will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Medium	High	High	Less than significant
Approximately 600 ha of mature and old coniferous forest habitat will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Medium	High	High	Less than significant
Approximately 16.8 ha of subalpine and alpine habitat will be disturbed.	Project Footprint	Long-term	Isolated	Long-term	Medium	High	Moderate	Less than significant
Approximately 4 ha of grassland area will be disturbed.	Project Footprint	Medium-term	Isolated	Medium-term	Low	High	Moderate	Less than significant
Introduction of invasive species to previously undisturbed areas immediately after construction.	Project Footprint to LSA	Medium-term	Isolated	Medium-term	Low	High	Moderate	Less than significant

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Approximately 40 ha of high suitability coastal northern goshawk habitat will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	Moderate	Less than significant
Approximately 1 ha of suitable marbled murrelet nesting habitat will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	Moderate	Less than significant
Approximately 18 ha of mountain goat winter range will be crossed by the pipeline route.	Project Footprint	Medium-term	Isolated	Medium-term	Medium	High	Moderate	Less than significant
Suitability of 52 streams used by coastal tailed frogs will be altered.	Project Footprint	Long-term	Isolated	Long-term	Medium	High	Moderate	Less than significant
Seasonal movement patterns of wide ranging predators (*e.g.* grizzly bear, grey wolf, lynx, cougar, wolverine) will be altered.	Project Footprint to RSA	Medium-term	Isolated	Medium-term	Low	High	Moderate	Less than significant
Incidental construction-related mortality of individual coastal tailed frogs and other wildlife with small, restricted ranges will occur.	Project Footprint	Immediate	Occasional	Short- to medium-term	Low	High	Moderate	Less than significant
The risk of wildlife vehicle collisions will increase during construction.	Project Footprint to RSA	Medium-term	Occasional	Short-term	Medium	High	Moderate	Less than significant
Increased authorized and unauthorized hunting during and post-construction will occur.	Project Footprint to RSA	Medium-term	Occasional	Long-term	Medium	High	Moderate	Less than significant

7.2.4.2 Operations and Maintenance

POTENTIAL EFFECTS AND MITIGATION MEASURES

Wetlands

a. Potential Effect: Alteration or degradation of wetland hydrology and water quality

Routine pipeline maintenance and repair activities may be required for sections of the pipeline in or adjacent to wetlands during the operations phase of the Project. Conducting work in and around wetlands has the potential to alter water flow patterns through the wetland, or to introduce sedimentation into the system and thereby affect the water quality of the wetland. When working in wetland areas, the same environmental protection and mitigation measures used during Project construction will be utilized to the extent feasible. The potential effect of alteration or degradation of wetland hydrology and water quality is reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

Vegetation

b. Potential Effect: Alteration or degradation of vegetated areas

Operational activities along the pipeline route will involve the maintenance of a travel corridor on select sections of the right-of-way. The travel corridor is typically 3-5 m in width, or one pick-up truck wide. The trees and tall vegetation on these corridors must be removed and maintained at an early seral stage (*i.e.* herbaceous and low woody vegetation only). The periodic clearing of trees and woody debris from the travel corridor areas will delay the re-establishment of natural plant communities. The potential effect of altering and degrading vegetated areas to maintain travel corridors along the pipeline right-of-way is considered reversible in the long-term and of low magnitude. ***The following residual effect has been identified: maintenance of vegetation at an early seral stage along travel corridors on the pipeline right-of-way.***

Forest Health

No potential effects related to the operations and maintenance of the KSL Project on Forest Health have been identified.

Invasive Plant Species

c. Potential Effect: Introduction and acceleration of the spread of invasive plants

Operational activities of the KSL Project will involve use of a maintained travel corridor on select sections of the right-of-way. Use of this travel corridor by maintenance vehicles may lead to the introduction or spread of invasive plants. To minimize this potential effect, an Invasive Plant Management Plan will be implemented, and standard weed control measures to minimize the likelihood of introducing or spreading weed seeds will be used. The potential effect of introduction and acceleration of the spread of invasive plants is considered to be reversible in the medium-term

and of low magnitude. ***The following residual effect has been identified: introduction or spread of invasive species as a result of operations and maintenance activities.***

Wildlife and Wildlife Habitat

d. Potential Effect: Alteration or degradation of wildlife habitat

Pipeline operations and maintenance activities on the right-of-way will involve periodic tree clearing and vegetation management. Clearing of the travel corridor will alter wildlife habitat, especially for ground nesting birds. All scheduled right-of-way vegetation clearing will be completed outside the breeding bird season. Local clearing may be undertaken following verification of no nesting activity and in consultation with CWS. Routine pipeline maintenance work that involves clearing will adhere to the same mitigation measures as required during pipeline construction. The effect of alteration or degradation of wildlife habitat is considered to be reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

e. Potential Effect: Wildlife mortality related to wildlife-vehicle collisions

There is a potential for wildlife vehicle collisions to occur during maintenance and operations activities when personnel are travelling to and from the pipeline right-of-way, or travelling along the right-of-way. Personnel will travel during daylight hours whenever practical, and adhere to speed limits to avoid collisions with wildlife. The effect of wildlife vehicle collisions during the operations phase of the Project is considered reversible in the short-term and of low magnitude. ***No residual effect has been identified***.

f. Potential Effect: Sensory disturbance of wildlife during important life cycle events

Operational activities on the pipeline right-of-way have the potential to disturb wildlife on important seasonal ranges. To minimize this effect, all scheduled, routine maintenance of the pipeline in seasonally important wildlife habitats will be conducted using the same mitigation measures and timing windows as during pipeline construction. The effect of sensory disturbances on wildlife during the operation of the pipeline is considered reversible in the short-term, and of low magnitude. ***No residual effect has been identified.***

Methanex Lateral

g. Potential Effect: Alteration or degradation of wetland hydrology and water quality

Routine maintenance and repair activities may be required for sections of the Methanex Lateral pipeline in or adjacent to the wetland during the operations phase of the Project. Conducting work in and around wetlands has the potential to alter water flow patterns through the wetland, or to introduce sedimentation into the system and thereby affect the water quality of the wetland. When working in wetland areas, the same environmental protection and mitigation measures used during Project construction will be applied. The potential effect of alteration or degradation of wetland hydrology and water quality is reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

h. Potential Effect: Alteration or degradation of vegetated areas

Operational activities along the Methanex Lateral pipeline will involve the maintenance of an 18 m wide row. The trees and tall vegetation on these corridors must be removed and maintained at an early seral stage (*i.e.* herbaceous and low woody vegetation only). The periodic clearing of trees and woody debris from the ROW will eliminate the re-establishment of natural plant communities. The potential effect of altering and degrading vegetated areas along the pipeline right-of-way is considered reversible in the long-term and of low magnitude. ***The following residual effect has been identified: maintenance of vegetation at an early seral stage along travel corridors on the pipeline right-of-way.***

i. Potential Effect: Alteration or degradation of wildlife habitat

Operations and maintenance activities of the Methanex Lateral pipeline will involve periodic tree clearing and vegetation management. Clearing of the travel corridor will alter wildlife habitat, especially for ground nesting birds. All scheduled right-of-way vegetation clearing will be completed outside the breeding bird season, and will be completed by mechanical means. Routine pipeline maintenance work that involves clearing will adhere to the same mitigation measures as required during pipeline construction. The effect of alteration or degradation of wildlife habitat is considered to be reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

j. Potential Effect: Wildlife mortality related to wildlife-vehicle collisions

There is a potential for wildlife vehicle collisions to occur during maintenance and operations activities when personnel are travelling to and from the Methanex lateral facility site. Personnel will travel during daylight hours whenever practical, and adhere to speed limits to avoid collisions with wildlife. The effect of wildlife vehicle collisions during the operations phase of the Project is considered reversible in the short-term and of low magnitude. ***No residual effect has been identified***.

k. Potential Effect: Sensory disturbance of wildlife during important life cycle events

Operational activities on the pipeline right-of-way have the potential to disturb wildlife on important seasonal ranges. To minimize this effect, all scheduled, routine maintenance of the pipeline in seasonally important wildlife habitats will be conducted using the same mitigation measures and timing windows as during pipeline construction. The effect of sensory disturbances on wildlife during the operation of the pipeline is considered reversible in the short-term, and of low magnitude. ***No residual effect has been identified.***

SIGNIFICANCE OF RESIDUAL EFFECTS

The significance of residual effects pertaining to Terrestrial Environment are evaluated in the following section. Identified residual effects are listed below, and assessment of the significance of these effects is summarized in Table 7.2-16.

a. Residual Effect: Maintenance of vegetation at an early seral stage

Vegetation on the right-of-way will be maintained at an early seral stage. To mitigate effects of this maintenance activity, the width of the clearing will be minimized to the extent feasible. The residual effect is located in the Project Footprint, and is considered reversible in the long-term, and of low magnitude. ***The residual effect is less than significant.***

b. Residual Effect: Introduction or spread of invasive plant species

Operations and maintenance activities on the pipeline right-of-way may lead to the introduction or spread of invasive plant species. To minimize this risk, an Invasive Plant Management Plan will be implemented, and similar measures as during Project construction will apply. Standard weed control measures will be employed, such as cleaning equipment of seeds and vegetative debris prior to arrival on the right-of-way. The residual effect of introduction or spread of invasive plant species is located on the Project Footprint, and is considered to be reversible in the medium-term, and of low magnitude. ***The residual effect is less than significant.***

Methanex Lateral

c. Residual Effect: Maintenance of vegetation at an early seral stage

Vegetation on the right-of-way will be maintained at an early seral stage. To mitigate effects of this maintenance activity, the width of the clearing will be minimized to the extent feasible. The residual effect is located in the Project Footprint, and is considered reversible in the long-term, and of low magnitude. ***The residual effect is less than significant.***

Table 7.2-15
Effects Assessment: Terrestrial Environment
Operations and Maintenance

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Wetlands			
Alteration or degradation of wetland hydrology and water quality.	Wetlands in Project Footprint and LSA along entire pipeline route, Methanex Lateral	• Where feasible, minimize clearing of vegetation, and narrow area of disturbance, and protect the wetland by using flagging, and limiting traffic in the flagged areas. • If practical, leave an undisturbed organic mat as a buffer zone, if working at wetland edges, to limit the potential sediment to enter the wetland. • Adhere to spill prevention measures outlined in a KSL Environmental Protection Plan.	• No residual effect identified.
Vegetation			
Alteration or degradation of vegetated areas to maintain access along select sections of the pipeline right-of-way.	Select locations requiring access along the pipeline right-of-way, Methanex Lateral	• Minimize the width of clearing along the right-of-way. • All vegetation clearing will be done using methods that will reduce impacts to adjacent vegetation.	• Maintenance of vegetation at an early seral stage along travel corridors on the pipeline right-of-way.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Invasive Plant Species			
Introduction and acceleration of the spread of invasive plants.	Select locations requiring access along the pipeline right-of-way., Methanex Lateral	• Minimize the width of clearing along the right-of-way. • Follow an Invasive Plant Management Plan to minimize the introduction and spread of noxious weeds during Project operation and maintenance activities. • Employ standard weed control measures, such as cleaning of equipment of seeds and vegetative debris prior to arrival on the right-of-way. • Minimize weed spread by cleaning equipment prior to moving from an area of high weed infestation.	• Introduction or spread of invasive species as a result of operations and maintenance activities.
Wildlife and Wildlife Habitat			
Alteration or degradation of important wildlife habitats.	Locations along entire pipeline route, Methanex Lateral	• Minimize width of clearing along the right-of-way. • No clearing activities related to routine pipeline maintenance are to occur within the migratory bird nesting period (April 1 and July 31 from KP 0 to KP 130; May 1 and July 31 from KP 130 to KP 462.2) unless the area is pre-surveyed to determine there is no nesting activity and in consultation with CWS. • All vegetation clearing will be done using mechanical means. • Routine maintenance of the pipeline right-of-way will adhere to the same mitigation as required during pipeline construction.	• No residual effect identified.
Wildlife mortality related to wildlife-vehicle collisions.	All access routes and pipeline right-of-way, Methanex Lateral	• Travel to and from the worksite during daylight hours, whenever practical. • Adhere to posted speed limits.	• No residual effect identified.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Sensory disturbance of wildlife during important life cycle events.	Locations along entire pipeline route, Methanex Lateral	• All scheduled, routine maintenance activities in seasonally important wildlife habitats will be conducted using the same mitigation measures and timing windows as during pipeline construction.	• No residual effect identified.

Table 7.2-16
Significance of Residual Effects: Terrestrial Environment
Operations and Maintenance

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Maintenance of vegetation at an early seral stage along travel corridors on the pipeline right-of-way.	Project Footprint	Long-term	Periodic	Long-term	Low	High	High	Less than significant
Introduction or spread of invasive species as a result of operations and maintenance activities.	Project Footprint	Long-term	Accidental	Medium-term	Low	High	High	Less than significant

7.2.4.3 Decommissioning and Abandonment

POTENTIAL EFFECTS AND MITIGATION MEASURES

The decommissioning and abandonment of the KSL Pipeline will comply with the acceptable regulatory standards that are in-place at that time. The procedures followed would likely be removal of all above ground facilities and the abandonment of the pipeline in-place, with the pipe severed and sealed at strategic locations, and with the right-of-way left in its established stable condition. If required for a special area of concern, or by regulation, the pipeline could be removed. Consequently, decommissioning and abandonment will likely result in potential effects that are of substantially less magnitude to those which have been described for the construction of the pipeline. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards of the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Lateral

The discussion provided under the "Pipeline" section is entirely applicable to the Methanex Lateral.

Compressor Station

A compressor station will likely only be abandoned if the pipeline is abandoned. Due to operational considerations, the compressor station could be idled for a considerable period if it is not required to assist with the flow of natural gas. In the case of abandonment, all of the underground piping, aboveground buildings, and facilities would be dismantled and removed from the compound. Fill and aggregate material would be removed from the site and the area would be restored for any subsequent land use. Topsoil that had been salvaged during construction would be used to restore the land. Decommissioning and abandonment will likely result in potential effects that are similar but of less magnitude to those which have been described for the construction of the compressor station. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards for the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Meter Station

See information provided above for Compressor Stations.

7.2.5 Species and Ecosystems At Risk

7.2.5.1 Clearing, Construction and Restoration

POTENTIAL EFFECTS AND MITIGATION MEASURES

Aquatic

The KSL pipeline route crosses several streams used by aquatic species at risk. Species at risk are those listed federally by COSEWIC, on Schedule 1 of the *Species at Risk Act,* or listed provincially by the BC Conservation Data Centre.

The following aquatic species at risk are considered in the assessment of the KSL Project:

- white sturgeon,
- interior Fraser coho,
- eulachon,
- Dolly Varden,
- bull trout, and
- coastal cutthroat trout.

This section addresses the combined effects of the KSL Project on the aquatic species at risk listed above. For specific assessment of minimizing effects to important aquatic habitats, refer to Aquatic Environment in Section 7.2.3.

General mitigation that will be applied, where feasible, to reduce impacts on aquatic species at risk include:

- use of specialized crossing techniques, such as flow isolation methods or horizontal directional drilling;
- adherence to least risk windows for instream construction;
- procedures to prevent release of hydrocarbons from construction machinery;
- control of erosion and sediment inputs from instream and upslope construction activities;
- all intakes will be screened according to DFO guidelines and water releases will use appropriate dissipation devices to minimize scour and erosion;
- environmental monitoring of construction activities; and
- additional management practices and emergency procedures that will be detailed in the Environmental Protection Plan.

The following sections present project-induced effects on aquatic species at risk, mitigation measures identified to reduce or avoid potential impacts, and a summary statement indicating whether a residual effect remains after mitigation has been applied to the potential effect. See

Table 7.2-17 for a summary of potential effects on species at risk. Specific residual effects identified will be discussed and assessed in Significance of Residual Effects, and summarized in Table 7.2-18.

a. Potential Effect: Combined effects on white sturgeon

In the KSL Project area white sturgeon occur in the Nechako and Stuart rivers. The KSL pipeline route does not cross the Nechako River, but follows the Nechako Valley from the outlet of Fraser Lake between KP 325 and KP 343, where the route diverges northward from the Nechako mainstem. The route is closest to the Nechako River between KP 336 and KP 343, and at KP 343 comes within approximately 420 m of the Nechako left bank. This part of the Nechako River is approximately 29 river kilometres upstream of the Vanderhoof spawning site.

The primary Project-associated threat to Nechako white sturgeon, is the potential release of toxic substances during construction. The KSL project plans include numerous procedures to prevent release of hydrocarbons from construction machinery, and to control erosion and sediment inputs from instream and upslope construction activities. All fish bearing tributaries to the Nechako will be crossed using flow isolation techniques, where flowing water is encountered. Nechako water if used for pipe testing will meet provincial water quality guidelines for protection of aquatic resources prior to release back to watercourses (except where diverted water already exceeds these guidelines); all intakes will be screened according to DFO guidelines and water releases will use appropriate dissipation devices to minimize scour and erosion.

The KSL pipeline route crosses the Stuart River at KP 389. This crossing is proposed as a horizontal directional drill (HDD). No instream impacts from this crossing are expected. Environmental monitoring of HDD and other construction activities is planned. Best efforts will be made to complete the crossings using HDD, but open cut is the contingency crossing method and remains a possibility if HDD is judged infeasible or fails. Geotechnical work is underway to evaluate the feasibility of HDD crossings. The crossing location of the Stuart River is unlikely to be used as spawning and incubation habitat for VEC species, but is used for migration (notably by Stuart run sockeye and white sturgeon) and likely used as rearing habitat by some fish species. Timing of any open cut crossings would be selected to minimize potential effects to white sturgeon and their habitats. Instream work windows for all streams are indicated in Table 6.3-3. Compensation will be provided to offset impacts, with the form and amount of compensation to be determined in consultation with DFO. Conceptual plans for compensation are provided in Appendix F. If open cut is used as the crossing method, compensation will fully offset any impacts, so ***no residual effect has been identified.***

b. Potential Effect: Combined effects of interior Fraser coho

The KSL pipeline route crosses numerous fish-bearing watercourses within the presumed range of interior Fraser coho, but no coho were found within this range during inventories conducted for this assessment. Coho from this population are assumed to be absent from streams on the KSL pipeline route or present in very low numbers.

The primary Project-associated threat to interior Fraser coho is potential release of toxic substances during construction, or disruption of suitable habitat. The KSL project plans include numerous procedures to prevent release of hydrocarbons from construction machinery, and to control erosion and sediment inputs from instream and upslope construction activities. All fish-bearing streams within the range of interior Fraser coho will be crossed using flow isolation techniques, where flowing water is encountered.

Within the range of interior Fraser coho, any water used for pipe testing will meet provincial water quality guidelines for protection of aquatic resources prior to release back to watercourses (except where diverted water already exceeds these guidelines); all intakes will be screened according to DFO guidelines and water releases will use appropriate dissipation devices to minimize scour and erosion. ***No residual effect has been identified.***

c. Potential Effect: Combined effects on eulachon

Within the KSL Project area, this species is found only in the lower Kitimat River. The KSL pipeline route does not cross the Kitimat mainstem, although it does cross numerous tributaries. Watercourses crossed by the pipeline route are at all times at least 750 m outside the wetted area of the lower Kitimat River, and at most locations is considerably further away. Based on known spawning distributions within the Kitimat River, there is no apparent risk of direct disturbance of suitable eulachon habitat.

The primary Project-associated threat to eulachon is potential release of toxic substances during construction. The KSL project plans include numerous procedures to prevent release of hydrocarbons from construction machinery, and to control erosion and sediment inputs from instream and upslope construction activities. All fish-bearing streams within the distribution range of eulachon will be crossed using flow isolation techniques, where flowing water is encountered.

Any water extracted from the lower Kitimat River for pipe testing will meet provincial water quality guidelines for protection of aquatic resources prior to release back to watercourses (except where diverted water already exceeds these guidelines); all intakes will be screened according to DFO guidelines and water releases will use appropriate dissipation devices to minimize scour and erosion. Should water from the lower Kitimat River be considered for withdrawl for hydrostatic test purposes, it is proposed that no water will be withdrawn during the period of February 15th to May 30th to protect eulachon. ***No residual effect has been identified.***

d. Potential Effect: Combined effects on Dolly Varden, bull trout and coastal cutthroat trout

Dolly Varden were found in moderate abundance at a number of locations in the western portion of the KSL Project study area, but were not found east of the Morice River watershed. Since this species is not especially rare, the inventory conducted for the Project will be considered accurate for the purposes of project planning. Bull trout were not identified in any of the watersheds surveyed. Distinguishing between bull trout and Dolly Varden can be difficult in the field, but it is assumed that

mitigation measures directed at one of these species are suitable for the other. Coastal cutthroat trout were found in moderate abundance in streams in the Kitimat River watershed and in lesser abundance in the Morice River watershed.

The primary Project-associated threats to Dolly Varden, bull trout, and coastal cutthroat trout are potential release of toxic substances during construction, and disruption of suitable habitat. The KSL project plans include numerous procedures to prevent release of hydrocarbons from construction machinery, and to control erosion and sediment inputs from instream and upslope construction activities. All small to medium-size fish-bearing streams within the range of these species will be crossed using flow isolation techniques, where flowing water is encountered. Crossing of larger streams is planned to be accomplished using flow isolation techniques, depending on flows encountered at the time of construction, with plans for HDD or aerial crossings of the largest streams.

Adherence to instream work windows is an important impact avoidance and mitigation measure and fish life history timing was a priority when developing construction timing plans. As noted during discussions with regulatory agencies, selection of work windows on a project of this size is complicated and necessarily involves multiple considerations, including biological, physical, technical, and regulatory issues. PTP has committed sufficient construction resources to complete the great majority of fish-bearing crossings within the instream work window. However, some crossings may have to be completed outside the work windows if certain contingencies (*e.g.* especially wet weather or unanticipated construction difficulties) slow the expected progress of construction. In this situation, priorities have been assigned to fish-bearing crossings within each construction spread, and crossings will be completed in order of priority. Streams with Dolly Varden, bull trout or coastal cutthroat trout have been given higher priority than those without these species. Habitat compensation may be required to offset impacts if work occurs outside proposed instream work windows. For crossings that require instream work to be completed outside the least risk window, a redd survey will be conducted prior to construction. The redd survey will be completed for areas within the zone of direct disturbance (*i.e.* the area proposed for isolation) and downstream for 500 m. Compensation will be provided to offset any redds occurring within this zone. The form and amount of compensation will be determined in consultation with DFO. Conceptual plans for compensation are provided in Appendix F. Impacts to habitat are expected to be short-lived and negated or significantly diminished by flushing flows during spring freshet.

Within the range of Dolly Varden, bull trout and coastal cutthroat trout, any water used for pipe testing will meet provincial water quality guidelines for protection of aquatic resources prior to release back to watercourses (except where diverted water already exceeds these guidelines); all intakes will be screened according to DFO guidelines and water releases will use appropriate dissipation devices to minimize scour and erosion.

Loss of riparian habitat is likely at crossing locations of streams with Dolly Varden, bull trout, and coastal cutthroat trout. Riparian vegetation provides bank stability, cover, food, and shade for stream-dwelling fish. Bank stability will be ensured through appropriate design input to the building of each stream crossing. Given the spatial footprint of stream crossings, the loss of food (*e.g.*

through input of terrestrial organisms to drift) and shade is deemed to be negligible. Loss of instream cover will be compensated for through the deployment of instream restoration techniques (*e.g.* boulder clusters, root wads, whole tree revetments, spawning gravels). Detailed compensation plans will be provided during the permitting phase of the Project. ***No residual effect has been identified.***

Impact Summary for Listed Fish Species

Given what is known about the distribution and habitats of listed fish species in the Project area and the mitigation for Project activities, the likely spatial and temporal impacts to listed fish species and their habitats are deemed to be ***less than significant***.

Plants and Plant Communities

Plants at risk may be listed federally by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), included in Schedule 1 of the *Species at Risk Act*, or listed provincially by the BC Conservation Data Centre. Plant communities at risk are listed provincially by the BC Conservation Data Centre.

e. Potential Effect: Loss or alteration of rare plants and plant communities

Four rare plant communities will be crossed by the pipeline route within the Project Footprint:

- **Sitka Spruce-Salmonberry Community:** this is a red-listed plant community with one occurrence on the Project Footprint from KP 17.0 to KP 17.3;
- **Old Growth Whitebark Pine Forest:** the Project Footprint crosses this blue-listed plant community in three areas (KP 95.0 to KP 97.2, KP 99.1 to KP 99.2, and KP 100.5 to KP 102.2);
- **Saskatoon-Slender Wheatgrass Community:** this is a red-listed plant community with one occurrence on the Project Footprint from KP 242.5 to KP 243.4; and
- **Hybrid White Spruce/Ostrich-fern Community:** this is a red-listed plant community with one occurrence on the Project Footprint from KP 449.5 to KP 450.2.

Numerous rare plant species occur in the Project Footprint in the plant communities listed above and elsewhere along the pipeline route. To minimize the loss of plant species at risk, PTP will survey previously undisturbed portions of the pipeline route that have suitable rare plant habitat before the area is grubbed.

Selecting a pipeline route that follows existing linear disturbances to the extent feasible, thereby minimizing the amount of disturbance to plant communities at risk, is one of the most important impact avoidance measures. Where the pipeline route crosses rare plant communities, PTP will implement mitigation to minimize effects on these sensitive ecosystems. For example, PTP will narrow down the area of disturbance to the extent practical to retain mature and old components of plant communities. Plant communities that can be saved will be fenced off to restrict pipeline construction traffic. A Restoration Program that uses native plants will be implemented. The

effectiveness of mitigation measures will be monitored during the Post-Construction Monitoring Program.

With the implementation of mitigation measures, the potential loss or alteration of rare plants and rare plant communities is considered to be reversible in the long-term and of low to high magnitude.

The following residual effects have been identified:

- approximately 1 ha of Sitka Spruce-Salmonberry rare plant community will be cleared;
- approximately 9 ha of rare Old Growth Whitebark Pine forest will be cleared;
- approximately 4 ha of Saskatoon-Slender Wheatgrass rare plant community will be cleared; and
- approximately 3 ha of Hybrid White Spruce/Ostrich Fern rare plant community will be cleared.

Wildlife and Wildlife Habitat

The KSL pipeline route crosses several habitats used by species at risk. Species at risk may be listed federally by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), included in Schedule 1 of the *Species at Risk Act*, or be listed provincially by the BC Conservation Data Centre.

The following wildlife species at risk are considered in the assessment of the KSL Project:

a) Woodland caribou;
b) Wolverine;
c) Grizzly bear;
d) Fisher;
e) Northern goshawk (coastal subspecies, *laingi*)
f) Marbled murrelet;
g) Great blue heron;
h) Sandhill crane;
i) Caspian tern;
j) Coastal tailed frog.

This section will address the combined effects of the KSL Project on the wildlife species at risk listed above. For specific assessment of minimizing effects to important wildlife habitats, please refer to the Wildlife Section in Section 7.2.4 – Terrestrial Environment.

General mitigation that will be applied to reduce impacts on all wildlife species at risk include:

- implement a Wildlife Incident Contingency Plan in the event of a wildlife encounter; and
- work expeditiously to maintain a tight construction spread when working in important wildlife habitats (*i.e.* seasonal habitats such as winter ranges, rutting areas and lambing areas).

The following sections contain information on the project-induced effects on wildlife species at risk, mitigation measures identified to reduce or avoid potential impacts, and a summary statement indicating whether a residual effect remains after mitigation has been applied to the potential effect. See Table 7.2-17 for a summary of potential effects on species at risk. Specific residual effects identified will be discussed and assessed in Significance of Residual Effects, and summarized in Table 7.2-18.

f. Potential Effect: Combined effects on woodland caribou

Woodland caribou occur in the regional study area (RSA) of the Project. The northern ecotype of woodland caribou found in the RSA are listed federally by COSEWIC (threatened), are included in Schedule 1 of *SARA*, and are provincially blue-listed. The KSL pipeline route crosses a summer feeding area between KP 95 and KP 130, but avoids sensitive winter ranges and calving ranges. Where the Project may interact with caribou summer feeding areas, native plant species will be used for restoration, to maintain biodiversity and reduce weed cover, which will be outlined in a Restoration Plan. Combined effects on woodland caribou are considered to be reversible in the short-term and of negligible magnitude. ***No residual effect has been identified.***

g. Potential Effect: Combined effects on wolverine

Wolverines are widely distributed at low densities throughout the KSL Project area. Wolverines are listed as "Special Concern" by COSEWIC, and are blue-listed provincially. As wolverines are generally associated with high elevations and mature and old forest, PTP will save mature old trees on the edges of the work footprint to the extent practicable. Combined effects on wolverine are considered to be reversible in the short-term and of negligible magnitude. ***No residual effect has been identified.***

h. Potential Effect: Combined effects on grizzly bear

Grizzly bears are widely distributed throughout the KSL Project area, but 25 key feeding and movement habitat areas have been identified between KP 25 and KP 460, and denning areas between KP 65 and KP 108 have been delineated. The KSL pipeline route also crosses two unroaded, mountainous areas between KP 75 and KP 104. These areas currently receive little human use, and pressure from authorized and unauthorized hunting on grizzly bears in these areas is lower than in neighbouring roaded areas. Introduction of access during the clearing, construction and restoration phase of the Project will allow for greater human access, and the risk of mortality related to authorized and unauthorized hunting will increase.

Grizzly bears are listed as "Special Concern" by COSEWIC, are included in Schedule 1 of *SARA*, and are blue-listed provincially. To minimize the effects of clearing, construction, and restoration activities on grizzly bears, the following mitigation measures are proposed:

- no clearing or construction activities are to occur within 200 m of an active grizzly bear or black bear den between November 1 and April 30;
- minimize the clearing of vegetation adjacent to roads to the extent feasible;
- restore disturbed areas on the row with natural shrub species to enhance bear security and feeding habitat;
- use native plant species to maintain biodiversity, reduce weed cover, and help create movement corridors;
- minimize the potential for displacement of bears during construction by encouraging greater use of group transportation (e.g. buses) to carry workers to and from job sites to the extent feasible;

- work expeditiously to maintain a tight construction spread from trench opening to backfill, to minimize potential barriers and hazards to wildlife;
- implement bear awareness and safety training in the environmental orientation program for workers;
- develop a Bear Management Plan;
- use of bear detection and deterrent systems to minimize human-bear conflicts, wherever appropriate;
- implement a Wildlife Incident Contingency Plan in the event of a grizzly bear mortality;
- implement an Access Management Plan; and
- monitor the effectiveness of access management measures.

With the implementation of the mitigation measures, the potential combined effects on grizzly bears is considered to be reversible in the medium- to long-term, and is of low to medium magnitude. ***The following residual effects have been identified:***

- construction phase sensory disturbance to grizzly bears at feeding and reproduction sites;
- construction phase disturbance to grizzly bear movement patterns; and
- increased unauthorized hunting of grizzly bears during and post-construction in previously unroaded mountainous areas.

i. Potential Effect: Combined effects on fisher

Fishers are distributed throughout the length of the KSL pipeline route, and are generally only found in black cottonwood floodplain habitats. Fishers are a provincially blue-listed species. To manage disturbance to fisher habitat, PTP plans to contain the project footprint to the minimum area actually required to efficiently and safely install the pipeline. With the implementation of mitigation measures, the potential combined effects on fisher are considered reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

j. Potential Effect: Combined effects on coastal northern goshawk

The KSL pipeline route overlaps with four areas of high suitability breeding habitat for coastal northern goshawk (*laingi* subspecies) between KP 74 and KP 94. The coastal northern goshawk is provincially red-listed, listed as 'Threatened' by COSEWIC, and is included in Schedule 1 of *SARA*. There are no known nest records in these suitable breeding habitats, but to avoid possible disturbance, general logging and clearing activities on the ROW are to occur outside the migratory bird nesting period (April 1 to July 31 for KP 130; May 1 to July 31 for KP 130 to KP 462.5). If minor logging and clearing is required adjacent to a previously cleared area, this will be undertaken within the migratory bird nesting period only if the area has been pre-surveyed to confirm there are no active nests and in consultation with CWS. The combined effects on northern goshawks are considered reversible in the long-term and of low magnitude. ***The following residual effect has been identified: approximately 40 ha of high suitability coastal northern goshawk habitat will be cleared.***

k. Potential Effect: Combined effects on marbled murrelet

The KSL pipeline route crosses one area with potentially suitable habitat for marbled murrelet nesting between KP 16.9 and KP 17.2. The marbled murrelet is provincially red-listed, listed as 'Threatened' by COSEWIC, and is included in Schedule 1 of *SARA*. To avoid possible disturbance to marbled murrelet nesting, general logging and clearing activities on the ROW are to occur outside the migratory bird nesting period (April 1 to July 31 for KP 130; May 1 to July 31 for KP 130 to KP 462.5). If minor logging and clearing is required adjacent to a previously cleared area, this will be undertaken within the migratory bird nesting period only if the area has been pre-surveyed to confirm there are no active nests and in consultation with CWS. The combined effects on marbled murrelets are considered reversible in the long-term and of low magnitude. ***The following residual effect has been identified: approximately 1 ha of suitable marbled murrelet nesting habitat will be cleared.***

l. Potential Effect: Combined effects on great blue heron

Two subspecies of great blue heron occur in the KSL Project area. The coastal subspecies (*fannini*) is listed as "Special Concern" by COSEWIC, and included under *SARA*, and provincially blue-listed. The interior subspecies (*herodias*) is provincially blue-listed. Great blue herons may occur in riparian or wetland habitats adjacent to rivers or lakes throughout the Project area, but there are no known great blue heron rookeries in the Project Footprint. To avoid impacts on nesting great blue herons, general logging and clearing activities on the ROW are to occur outside the migratory bird nesting period (April 1 to July 31 for KP 130; May 1 to July 31 for KP 130 to KP 462.5). If minor logging and clearing is required adjacent to a previously cleared area, this will be undertaken within the migratory bird nesting period only if the area has been pre-surveyed to confirm there are no active nests and in consultation with CWS. . If a great blue heron rookery is discovered within 300 m of the Project Footprint during clearing, construction, or restoration, PTP will implement a Wildlife Incident Contingency Plan. The combined effects on great blue herons are considered reversible over the short-term, and of low magnitude. ***No residual effect has been identified.***

m. Potential Effect: Combined effects on sandhill crane

The KSL pipeline route crosses areas with suitable nesting habitat for sandhill cranes between KP 325 and KP 365. Sandhill cranes are a blue-listed species in British Columbia. To minimize interactions of project clearing, construction and restoration activities on sandhill cranes, general logging and clearing activities on the ROW are to occur outside the migratory bird nesting period (April 1 to July 31 for KP 130; May 1 to July 31 for KP 130 to KP 462.5). If minor logging and clearing is required adjacent to a previously cleared area, this will be undertaken within the migratory bird nesting period only if the area has been pre-surveyed to confirm there are no active nests and in consultation with CWS. . If a sandhill crane nest is discovered within 400 m of the Project Footprint during construction, PTP will implement a Wildlife Incident Contingency Plan. With the implementation of these mitigation measures, the combined effects on sandhill cranes are considered reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

n. Potential Effect: Combined effects on coastal tailed frog

The KSL pipeline route crosses 52 streams assessed to have moderate to high suitability for coastal tailed frogs between KP 1.3 and KP 74.25. Coastal tailed frogs are provincially blue-listed, listed as "Special Concern" by COSEWIC, and are included in Schedule 1 of *SARA*. To avoid altering or degrading coastal tailed frog streams, similar mitigation used to avoid potential environmental effects on fish habitat will be employed. The removal of shrubs within 30 m of all streams will be minimized, and grubbing of the work area within 10 m of stream banks will be minimized. There is a risk of mortality of coastal tailed frogs during clearing, construction, and restoration activities. To reduce the risk of mortality, PTP will capture and move adult, tadpole, and metamorph coastal tailed frogs prior to stream crossing activities, to the extent practical. With the implementation of these mitigation measures, the combined effects on coastal tailed frogs are considered reversible in the medium- to long-term, and of low to medium magnitude. ***Two residual effects have been identified: the suitability of 52 streams used by coastal tailed frogs will be altered; and incidental construction-related mortality of individual coastal tailed frogs.***

Methanex Lateral

o. Potential Effect: Combined effects on Grizzly Bear

The Methanex Lateral pipeline occurs in an area known to be used by grizzly bear during spring. Clearing, construction, and restoration activities associated with the KSL Project have the potential to result in sensory disturbances to grizzly bears on the Methanex Lateral route. Sensory disturbances may result in grizzly bears leaving and avoiding areas with construction activities. Consequences of sensory disturbances are most severe during important life cycle events, or in important seasonal ranges, when the animals are already energetically stressed. No important grizzly bear seasonal ranges that supports a critical life history period have been identified on the Methanex Lateral pipeline route. For this reason, the potential effect of sensory disturbance to grizzly bears during clearing, construction and restoration of the Methanex Lateral pipeline is considered to be reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

SIGNIFICANCE OF RESIDUAL EFFECTS

The significance of residual effects pertaining to species at risk are evaluated in the following section. These residual effects are:

- approximately 1 ha of Sitka-spruce salmonberry community will be cleared;
- approximately 9 ha of old growth whitebark pine forest will be cleared;
- approximately 4 ha of Saskatoon-slender wheatgrass community will be cleared;
- approximately 3 ha of hybrid white spruce/ ostrich fern community will be cleared;
- construction phase sensory disturbance to grizzly bears at feeding and reproduction sites;
- construction phase disturbance to movement patterns;

- increased unauthorized hunting of grizzly bears during and post-construction in previously unroaded mountainous areas;
- approximately 40 ha of high suitability coastal northern goshawk habitat will be cleared;
- approximately 1 ha of suitable marbled murrelet breeding habitat will be cleared;
- incidental mortality of individual coastal tailed frogs at all life stages; and
- diminish instream and adjacent habitat suitability of 52 streams used by coastal tailed frogs.

a. Residual Effect: Clearing of Sitka spruce salmonberry community

Approximately 1 ha of Sitka-Spruce Salmonberry rare plant community will be cleared. This is a red-listed plant community occurring in the western extent of the Project area. PTP plans to contain the project footprint to the minimum area actually required to efficiently and safely install the pipeline. The community will be fenced off to restrict pipeline construction traffic. A Restoration Program using native plants will be implemented. The effectiveness of mitigation measures will be monitored during a Post-Construction Monitoring Program. The residual effect of clearing the Sitka Spruce Salmonberry Community is concentrated on the Project Footprint, and is considered reversible in the long-term. Because the disturbance is concentrated to the edge of the community, the residual effect is considered to be of low magnitude. ***The residual effect is less than significant.***

b. Residual Effect: Clearing of old growth whitebark pine forest

Approximately 9 ha of rare, old growth Whitebark Pine Forest will be cleared. This is a blue-listed plant community occurring in the mountains of the Project area. PTP plans to contain the project footprint to the minimum area actually required to efficiently and safely install the pipeline. A Restoration Program using native plants will be implemented. The effectiveness of mitigation measures will be monitored during a Post-Construction Monitoring Program. The residual effect of clearing the Old Growth Whitebark Pine Forest is concentrated on the Project Footprint, and is considered reversible in the long-term and of high magnitude. ***The residual effect is less than significant.***

c. Residual Effect: Clearing of saskatoon-slender wheatgrass community

Approximately 4 ha of Saskatoon-Slender Wheatgrass Community will be cleared. This is a red-listed plant community occurring in the Interior Region of the Project area. PTP plans to contain the project footprint to the minimum area actually required to efficiently and safely install the pipeline. The community will be fenced off to restrict pipeline construction traffic, and a Restoration Program using native plants will be implemented. The effectiveness of mitigation measures will be monitored during the Post-Construction Monitoring Program. The residual effect of clearing in the Saskatoon-Slender Wheatgrass Community is considered reversible in the long-term. Clearing of this community is considered to be of low magnitude because the site has previously been disturbed by seeding with agronomic grasses, and grazing by livestock. ***The residual effect is less than significant.***

d. Residual Effect: Clearing of hybrid white spruce/ ostrich fern community

Approximately 3 ha of Hybrid White Spruce/Ostrich Fern rare plant community will be cleared. This is a red-listed plant community occurring at the eastern end of the Project area. PTP plans to contain the project footprint to the minimum area actually required to efficiently and safely install the pipeline. The community at risk will be fenced off to restrict pipeline construction traffic. A Restoration Program using native plants will be implemented. For other relevant restoration, see Section 7.2.4.1 for mitigation to reduce impacts of clearing riparian and floodplain forests. The effectiveness of mitigation measures will be monitored during the Post-Construction Monitoring Program. Clearing of the Hybrid White Spruce/Ostrich Fern community is localized to the Project Footprint, and is considered to be reversible in the long-term, and of high magnitude. ***The residual effect is less than significant.***

e. Residual Effect: Sensory disturbance to grizzly bears

Construction phase sensory disturbances to grizzly bears at feeding and reproduction sites may occur. Grizzly bears are widely distributed throughout the KSL Project area, but 25 key habitat areas have been identified between KP 25 and KP 460. To minimize sensory disturbances to grizzly bears, PTP will minimize the clearing of vegetation adjacent to roads to the extent practical, and restore disturbed areas with natural shrub species to enhance bear security and feeding habitat. No clearing or construction activities will occur within 200 m of an active grizzly bear den between November 1 and April 30. The disturbances to bears will be minimized by encouraging greater use of group transportation (e.g. buses) to carry workers to and from job sites to the extent feasible. The pipeline construction workforce will receive bear awareness and safety training as part of their pre-job environmental orientations. The residual effect of sensory disturbance to grizzly bears occurs at the Project Footprint to RSA, and is considered to be reversible in the short-term, and of medium magnitude. ***The residual effect is less than significant.***

f. Residual Effect: Disturbance to grizzly bear movement corridors

Construction phase disturbances to grizzly bear movement corridors will occur. The KSL pipeline route interacts with 16 wildlife movement corridors that are associated with major river corridors throughout the Project area. Clearing, construction, and restoration activities associated with the Project may lead to disturbances and alterations of bear movement corridors. To minimize effects to grizzly bear movements and corridors, PTP will minimize the clearing of vegetation adjacent to roads to the extent feasible, and restore disturbed areas with natural shrub species to enhance bear security and feeding habitat. Native plant species will be used to maintain biodiversity, reduce weed cover, and help create movement corridors. These procedures will be outlined in a Restoration Plan. During construction, PTP will limit the duration and amount of human movement to and from job sites to the extent feasible, and work expeditiously to maintain a tight construction spread to minimize potential barriers and hazards to wildlife. The residual effect of construction phase disturbances to grizzly bear movement corridors is localized at the Project Footprint to RSA, and is considered to be reversible in the medium-term and of medium magnitude. ***The residual effect is less than significant.***

g. Residual Effect: Unauthorized hunting of grizzly bears

Increased unauthorized hunting of grizzly bears may occur in during and post-construction in undisturbed, mountainous areas between KP 75 and KP 104. The introduction of access during the clearing, construction, and restoration phase of the Project will allow for greater human access, and the risk of grizzly bear mortality related to authorized and unauthorized hunting will increase. PTP is committed to implementing measures that will reduce unauthorized motorized access to the currently unroaded areas by implementing an Access Management Plan. PTP will monitor unauthorized motorized use in newly accessible areas associated with the Project to assess the efficacy of access control strategies and take corrective action where needed. Grizzly bear mortality related to increased authorized and unauthorized areas will increase during the clearing, construction, and restoration phase of the KSL Project, until the access control measures can be fully implemented. The residual effect is considered to be reversible in the long-term, of medium magnitude, and affects scales ranging from the Project Footprint to the RSA. ***The residual effect is less than significant.***

h. Residual Effect: Clearing of coastal northern goshawk habitat

Approximately 40 ha of high suitability habitat for breeding by the coastal subspecies of northern goshawk (*laingi* subspecies) will be cleared to allow for the construction of the pipeline. The KSL pipeline route overlaps with four areas of high suitability breeding habitat between KP 74 and KP 94. There are no known nest records in these suitable breeding habitats, but to avoid possible disturbances, general logging and clearing activities on the ROW are to occur outside the migratory bird nesting period (April 1 to July 31 for KP 130; May 1 to July 31 for KP 130 to KP 462.5). If minor logging and clearing is required adjacent to a previously cleared area, this will be undertaken within the migratory bird nesting period only if the area has been pre-surveyed to confirm there are no active nests and in consultation with CWS. The residual effect of clearing approximately 40 ha of high suitability coastal northern goshawk breeding habitat is considered to be of low magnitude, because breeding home ranges of coastal northern goshawks are generally between 700 ha and 19,000 ha in size. The residual effect is concentrated on the Project Footprint, and is considered to be reversible in the long-term. ***The residual effect is less than significant.***

i. Residual Effect: Clearing of marbled murrelet habitat

Approximately 1 ha of suitable marbled murrelet nesting habitat will be cleared. The KSL pipeline route crosses one area with potentially suitable habitat for marbled murrelet nesting between KP 16.9 and KP 17.2. To avoid possible disturbance of marbled murrelet nesting in this 1 ha of suitable habitat, general logging and clearing activities on the ROW are to occur outside the migratory bird nesting period (April 1 to July 31 for KP 130; May 1 to July 31 for KP 130 to KP 462.5). If minor logging and clearing is required adjacent to a previously cleared area, this will be undertaken within the migratory bird nesting period only if the area has been pre-surveyed to confirm there are no active nests and in consultation with CWS. Because of the small amount of suitable habitat being cleared, and the adjacency of this habitat to mostly early-seral forests, the residual effect of clearing 1 ha of suitable marbled murrelet habitat is considered to be of low magnitude, and reversible over the long-term. ***The residual effect is less than significant.***

j. Residual Effect: Mortality of coastal tailed frogs

Incidental construction-related mortality of individual coastal tailed frogs will occur. The KSL pipeline route crosses 52 streams with moderate to high suitability for coastal tailed frogs. Tailed frogs are present in streams year round. PTP Wildlife Specialists will capture and move adult, tadpole, and metamorph coastal tailed frogs prior to stream crossing activities to the extent practical. Despite the implementation of this mitigation, mortality of individual tailed frogs in some life stages will occur. As the generation time of coastal tailed frogs is relatively long, this residual effect is considered to be reversible over the medium-term. The residual effect occurs on the Project Footprint, and is of low magnitude. ***The residual effect of is less than significant***.

k. Residual Effect: Alteration of coastal tailed frog streams

The suitability of 52 streams used by coastal tailed frogs will be altered during the clearing, construction, and restoration phase of the KSL Project. The 52 streams that have been assessed to have moderate to high suitability for coastal tailed frogs are located between KP 1.3 and KP 74.25. To avoid altering or degrading coastal tailed frog streams, similar mitigation to avoiding potential environmental effects on fish habitat will be employed. The removal of shrubs within 20 m of all streams will be minimized, and grubbing of the work area within 10 m of stream banks will be minimized to protect, to the greatest extent practicable, the existing amphibian habitat. The residual effect on coastal tailed frog streams is considered reversible in the long-term and of medium magnitude, and is focussed on the Project Footprint. ***The residual effect is less than significant.***

Permanent Facilities

No residual effects related to the construction of the Methanex Lateral Pipeline and Compressor Station on species at risk have been identified.

Table 7.2-17
Effects Assessment: Species and Ecosystems at Risk
Clearing, Construction, and Restoration

Valued Component /Potential Effect	Location	Mitigative Measures	Residual Effects
Aquatic			
General	At stream crossing along the entire pipeline route.	• Use of specialized crossing techniques, such as flow isolation methods or horizontal directional drilling. • Adherence to least risk windows for instream construction. • Procedures to prevent release of hydrocarbons from construction machinery. • Control of erosion and sediment inputs from instream and upslope construction activities. • All intakes will be screened according to DFO guidelines and water releases will use appropriate dissipation devices to minimize scour and erosion. • Environmental monitoring of construction activities. • Implement management practices and emergency procedures outlined in an Environmental Protection Plan. For specific assessment of minimizing effects to important aquatic habitat, refer to Aquatic Environment in Section 7.2.3.	N/A

Valued Component /Potential Effect	Location	Mitigative Measures	Residual Effects
Combined effects on white sturgeon	Nechako River, Stuart River	• Adhere to an Environment Protection Plan to prevent release of hydrocarbons from construction machinery and to control erosion and sediment inputs from instream and upslope construction activities. • Cross fish bearing tributaries to the Nechako using flow isolation techniques, where flowing water is encountered. • Ensure that water used for pipe testing meets provincial water quality guidelines for protection of aquatic resources prior to release back to watercourses (except where diverted water already exceeds these guidelines). • Screen all intakes according to DFO guidelines. • Water releases will use appropriate dissipation devices to minimize scour and erosion. • Use HDD for Stuart River crossing, if feasible. • Implement environmental monitoring of HDD and other construction activities as outlined in an Environmental Protection Plan.	• No residual effect identified.

Valued Component /Potential Effect	Location	Mitigative Measures	Residual Effects
Combined effects of interior Fraser coho	Nechako River	• Adhere to an Environmental Protection Plan to prevent release of hydrocarbons from construction machinery, and to control erosion and sediment inputs from instream and upslope construction activities. • Cross fish-bearing streams within the range of interior Fraser coho using flow isolation techniques, where flowing water is encountered. • Within the range of interior Fraser coho, water used for pipe testing will meet provincial water quality guidelines for protection of aquatic resources prior to release back to watercourses (except where diverted water already exceeds these guidelines). • Screen all intakes according to DFO guidelines. • Use dissipation devices during water releases to minimize scour and erosion.	• No residual effect identified.

Valued Component /Potential Effect	Location	Mitigative Measures	Residual Effects
Combined effects on eulachon	Kitimat River	• Adhere to an Environmental Protection Plan to prevent release of hydrocarbons from construction machinery, and to control erosion and sediment inputs from instream and upslope construction activities. • Cross all small- to medium-size fish-bearing streams in the lower Kitimat Valley using flow isolation techniques, where flowing water is encountered. • HDD is proposed to cross all streams that cannot be isolated. • Water used for pipe testing will meet provincial water quality guidelines for protection of aquatic resources prior to release back to watercourses (except where diverted water already exceeds these guidelines). • Screen all intakes according to DFO guidelines. • Use dissipation devices during water releases to minimize scour and erosion.	• No residual effect identified.

Valued Component /Potential Effect	Location	Mitigative Measures	Residual Effects
Combined effects on Dolly Varden, bull trout and coastal cutthroat trout	Kitimat River, Skeena River, Morice River, Stuart River	• Adhere to an Environmental Protection Plan to prevent release of hydrocarbons from construction machinery, and to control erosion and sediment inputs from instream and upslope construction activities. • Cross all small- to medium-size fish-bearing streams within the range of Dolly Varden, bull trout, and coastal cutthroat trout using flow isolation techniques, where flowing water is encountered. • HDD is proposed to cross all streams that cannot be isolated. • Adhere to instream work windows and consider the species life history timing a priority when developing construction timing plans. • Within the range of the Dolly Varden, bull trout, and coastal cutthroat trout water used for pipe testing will meet provincial water quality guidelines for protection of aquatic resources prior to release back to watercourses (except where diverted water already exceeds these guidelines). • Screen all intakes according to DFO guidelines. • Use dissipation devices during water releases to minimize scour and erosion. • Ensure stabilization of banks at each stream crossing through appropriate engineering input. • Implement a Restoration Plan.	• No residual effect identified.

Valued Component /Potential Effect	Location	Mitigative Measures	Residual Effects
Plants and Plant Communities			
Loss or alteration of rare plants and rare plant communities	**Sitka Spruce-Salmonberry Community (red-listed)** • KP 17.0 to KP 17.3 **Old growth whitebark pine forest (blue-listed)** • KP 95.0 to KP 97.2 • KP 99.1 to KP 99.2 • KP 100.5 to KP 102.2 **Saskatoon-Slender wheatgrass community (red-listed)** • KP 242.5 to KP 243.5 **Hybrid white spruce/ Ostrich-fern community (red-listed)** • KP 449.5 to KP 450.2 **Rare plants** Occurrences along entire pipeline route.	• Pipeline routing criteria applied to the Project included following existing linear disturbances to the extent feasible, thereby minimizing the amount of disturbance to plant communities at risk. • Contain project footprint to the minimum area required to efficiently and safely build the pipeline. • Fence off the plant community at risk where it occurs next to the construction ROW to restrict pipeline construction traffic. • Retain mature and old components of plant communities whenever practical. • Survey previously undisturbed portions of the pipeline route that have suitable rare plant habitat for the presence of rare plants before grubbing. • Monitor the effectiveness of mitigation measures during the Post-Construction Monitoring Program.	• Approximately 1 ha of Sitka-spruce salmonberry rare plant community will be cleared. • Approximately 9 ha of rare old growth whitebark pine forest will be cleared. • Approximately 4 ha of Saskatoon-slender wheatgrass rare plant community will be cleared. • Approximately 3 ha of hybrid white spruce/ ostrich fern rare plant community will be cleared.
Wildlife			
General	Along entire pipeline route.	• Implement a Wildlife Incident Contingency Plan in the event of a wildlife encounter. • Work expeditiously to maintain a tight construction spread from trench opening to backfill in order to minimize potential barriers and hazards in important wildlife habitats.	N/A

Valued Component /Potential Effect	Location	Mitigative Measures	Residual Effects
Combined effects on woodland caribou	Summer feeding area from KP 95 to KP 130	• Pipeline routing avoids sensitive woodland caribou winter ranges and calving ranges. • Use native plant species to maintain biodiversity and reduce weed cover in woodland caribou summer feeding areas.	• No residual effect identified.
Combined effects on wolverine	In appropriate habitats along entire pipeline route.	• Contain clearing in mature and old forest habitats to the extent practical.	• No residual effect identified.
Combined effects on grizzly bear	25 identified key habitat areas from KP 25 to KP 460. Denning areas from KP 65 to KP 108 Methanex Lateral	• No clearing or construction activities are to occur within 200 m of an active grizzly bear or black bear den between November 1 and April 30. • Minimize the clearing of vegetation adjacent to roads to the extent practical. • Restore disturbed ROW areas with natural shrub species to enhance bear security and feeding habitat. • Use native plant species to maintain biodiversity, reduce weed cover, and help create movement corridors. • Minimize the potential for displacement of bears during construction by managing human movement to and from job sites to the extent feasible. • Implement bear awareness and safety training in the environmental orientation program for workers. • Develop a Bear Management Plan. • Use of bear detection and deterrent systems to minimize human-bear conflicts, wherever appropriate. • Implement a Wildlife Incident Contingency Plan in the event of a grizzly bear mortality.	• Construction phase sensory disturbance to grizzly bears at feeding and reproduction sites. • Construction phase disturbance to grizzly bear movement patterns. • Increased unauthorized hunting of grizzly bears during and post-construction in previously unroaded mountainous areas.

Valued Component /Potential Effect	Location	Mitigative Measures	Residual Effects
		• Implement an Access Management Plan. • Monitor the effectiveness of access management measures.	
Combined effects on fisher	Intermittent from KP 0 to KP 462.2	• Reduce clearing in mature and old riparian, mature and old floodplain, and mature and adjacent old coniferous forests, whenever practical.	• No residual effect identified.
Combined effects on coastal northern goshawk (*laingi* subspecies)	Habitats with high suitability: • KP 74.0 to KP 75.8 • KP 81.5 to KP 83.2 • KP 83.5 to KP 84.5 • KP 88.4 to KP 93.5	• No general logging and clearing activities to occur within the migratory bird nesting period other than minor areas adjacent to a previously cleared area that has been pre-surveyed and following consultation with CWS. • Minimize clearing in mature and old forest habitats.	• Approximately 40 ha of high suitability coastal northern goshawk habitat will be cleared.
Combined effects on marbled murrelet	Suitable habitat from KP 16.9 to KP 17.2	• No general logging and clearing activities to occur within the migratory bird nesting period other than minor areas adjacent to a previously cleared area that has been pre-surveyed and following consultation with CWS. • Minimize clearing of mature and old coniferous forest habitat.	• Approximately 1 ha of suitable marbled murrelet nesting habitat will be cleared.
Combined effects on great blue heron	In suitable nesting habitat along the entire pipeline route.	• No general logging and clearing activities to occur within the migratory bird nesting period other than minor areas adjacent to a previously cleared area that has been pre-surveyed and following consultation with CWS. • Project Footprint avoids known great blue heron rookeries. • Implement a Wildlife Incident Contingency Plan in the event that a great blue heron rookery is discovered within 300 m of the Project Footprint during construction.	• No residual effect identified.

Valued Component /Potential Effect	Location	Mitigative Measures	Residual Effects
Combined effects on sandhill crane	In suitable nesting habitat from KP 325 to KP 365.	• No general logging and clearing activities to occur within the migratory bird nesting period other than minor areas adjacent to a previously cleared area that has been pre-surveyed and following consultation with CWS. • Implement a Wildlife Incident Contingency Plan in the event that a sandhill crane nest is discovered within 400 m of the Project Footprint during construction.	• No residual effect identified.
Combined effects on coastal tailed frog	52 streams between KP 1.3 and KP 74.25	• Stream crossing mitigation measures (see Fish and Fish Habitat Section) will reduce impacts to coastal tailed frogs and their habitat. • Minimize removal of shrubs within 30 m of Coastal Tailed Frog streams. • Grubbing of the pipeline work area will be minimized within 10 m of stream banks to protect the existing amphibian habitat, to the greatest extent practicable. • Capture and move tadpoles, metamorphs, and adults prior to stream crossing activities, to extent practical.	• Incidental mortality of individual coastal tailed frogs at all life stages. • Alter suitability of 52 streams used by coastal tailed frogs.

Table 7.2-18
Significance of Residual Effects: Species at Risk
Clearing, Construction, and Restoration

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Approximately 1 ha of Sitka-spruce salmonberry rare plant community will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	High	Less than significant
Approximately 9 ha of rare old growth whitebark pine forest will be cleared.	Project Footprint	Long-term	Isolated	Long-term	High	High	High	Less than significant
Approximately 4 ha of Saskatoon-slender wheatgrass rare plant community will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	High	Less than significant
Approximately 3 ha of hybrid white spruce/ ostrich fern rare plant community will be cleared.	Project Footprint	Long-term	Isolated	Long-term	High	High	High	Less than significant
Construction phase sensory disturbance to grizzly bears at feeding and reproduction sites.	Project Footprint to RSA	Short-term	Isolated	Short-term	Medium	High	Moderate	Less than significant
Construction phase disturbance to grizzly bear movement patterns.	Project Footprint to RSA	Medium-term	Isolated	Medium-term	Medium	High	Moderate	Less than significant

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Increased unauthorized hunting of grizzly bears during and post-construction in previously unroaded mountainous areas.	Project Footprint to RSA	Medium-term	Occasional	Long-term	Medium	High	Moderate	Less than significant
Approximately 40 ha of high suitability coastal northern goshawk habitat will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	Moderate	Less than significant
Approximately 1 ha of suitable marbled murrelet nesting habitat will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	Moderate	Less than significant
Incidental mortality of individual coastal tailed frogs at all life stages.	Project Footprint	Immediate	Occasional	Medium	Low	High	Moderate	Less than significant
Diminish instream and adjacent habitat suitability of 52 streams used by coastal tailed frogs.	Project Footprint	Long-term	Isolated	Long-term	Medium	High	Moderate	Less than significant

7.2.5.2 Operations and Maintenance

POTENTIAL EFFECTS AND MITIGATION MEASURES

Aquatics

a. Potential Effect: Habitat impacts from instream work

Instream activity is typically not required on pipelines as part of operations and maintenance except in emergency situations where the pipe becomes exposed on streams with actively migrating channels. Engineering design anticipates such potential stream migration occurrences and designs the pipeline in a manner that avoids future disruptions. In the event that emergency instream works are required, all instream activities would require assessment, approvals, mitigation and possibly compensation, which would be determined with input from regulators during the approvals process. It is assumed that the permitting and approval process would require no net loss of productivity, as per existing policy and legislation. Due to the requirement for a separate permitting and approvals process, ***no residual effect has been identified***.

b. Potential Effect: Loss of riparian vegetation

Operational activities along the pipeline route will involve the maintenance of the ROW. The ROW is typically 18 m wide, and vegetation must be maintained at an early seral stage (*i.e.* herbaceous and low woody vegetation only). Maintenance of the ROW will potentially result in loss of riparian vegetation, with concomitant effects on aquatic species at risk. Section 7.2.3 discusses and assesses the effects of loss of riparian vegetation and concludes that there is no significant residual effect, provided stream crossings are restored with the objective of stabilizing streambanks and providing instream cover. No additional riparian impacts are associated with operations and maintenance activities. ***No residual effect has been identified***.

c. Potential Effect: Increased access to fish-bearing streams

Maintenance of the ROW will also potentially result in increased access to fish-bearing streams. Increased access can result in greater levels of fishing pressure, which can be a legitimate concern especially for aquatic species at risk. Public access to the right-of-way will be managed according to an Access Management Plan, but it is possible that unauthorized access will occur and fishing pressure will increase at some locations. This potential effect is discussed separately for each aquatic species at risk.

White Sturgeon — *SARA* prohibits anglers from targeting of Nechako white sturgeon and no additional access is expected within the range of this species. ***No residual effect has been identified.***

Interior Fraser Coho — Interior Fraser coho were not observed during any of the fisheries surveys conducted for this project and they are assumed to be absent or in very low numbers within the RSA.

No additional access is expected within the range of this species, so fishing pressures are not expected to change as a result of this project. ***No residual effect has been identified.***

Eulachon — Within the RSA, eulachon occur only in the lower Kitimat River. No additional permanent access is expected within this area, so fishing pressures are not expected to change as a result of this project. ***No residual effect has been identified.***

Dolly Varden, Bull Trout and Coastal Cutthroat Trout — Dolly Varden were found in moderate abundance at a number of locations in the western portion of the KSL study area, but were not found east of the Morice River watershed. Bull trout were not identified in any of the watersheds surveyed. Coastal cutthroat trout were found in moderate abundance in streams in the Kitimat River watershed and in lesser abundance in the Morice River watershed. Public access to the right-of-way will be managed according to an Access Management Plan. It is possible that unauthorized access will occur by anglers, though this is unlikely. Public access is currently widespread throughout this region via forest service roads, and most stream crossings are in close proximity to this existing infrastructure. Fishing pressure is therefore not expected to change as a result of this project. ***No residual effect has been identified.***

In summary, ***no significant residual effects are expected for aquatic species at risk in relation to operations and maintenance activities.***

Plants and Plant Communities

d. Potential Effect: Alteration or degradation of rare plant communities

Operational activities along the pipeline route will involve the maintenance of the ROW. The ROW is typically 18 m in width, and vegetation must be maintained at an early seral stage (*i.e.* herbaceous and low woody vegetation only). The periodic clearing of trees, damage to low growing plants, soil compaction, and increased sun exposure along the ROW will delay the re-establishment of rare plant communities. To minimize this effect, rare plant communities will be avoided whenever practical and will be fenced off when they occur off the construction ROW in order to avoid incidental damage. The width of vegetation maintenance on the right-of-way will be minimized, and all vegetation clearing during operations and maintenance will generally be done using mechanical means. The potential effect of altering and degrading rare plant communities to maintain the pipeline right-of-way is considered reversible in the long-term and of medium magnitude. ***The following residual effect has been identified: disturbance of rare plant communities along travel corridors on the pipeline right-of-way.***

Wildlife

The pipeline route crosses habitats used by species at risk. Species at risk may be listed federally by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), included in Schedule 1 of the *Species at Risk Act*, or be listed provincially by the BC Conservation Data Centre.

This section will address the combined effects of pipeline operation and maintenance activities on the wildlife species at risk. See Table 7.2-19 for a summary of potential effects of Project Operation and Maintenance on species at risk. Specific residual effects identified will be discussed and assessed in Section 7.2.5.2 – Significance of Residual Effects, and summarized in Table 7.2-20.

e. Potential Effect: Combined effects on woodland caribou

No potential effects related to the operations and maintenance of the KSL Project on Woodland Caribou have been identified.

f. Potential Effect: Combined effects on wolverine

No potential effects related to the operations and maintenance of the KSL Project on Wolverine have been identified.

g. Potential Effect: Combined effects on grizzly bear

Operational and maintenance activities on the pipeline right-of-way have the potential to disturb grizzly bear on important seasonal feeding or breeding ranges. To minimize this effect, all scheduled, routine maintenance of the pipeline in important grizzly bear habitats will be conducted at times outside the restricted activity periods specified for pipeline clearing, construction, and restoration. The effect of sensory disturbances on grizzly bears during the operation of the pipeline is considered reversible in the short-term, and of low magnitude. ***No residual effect has been identified.***

h. Potential Effect: Combined effects on fisher

No potential effects related to the operations and maintenance of the KSL Project on Fisher have been identified.

i. Potential Effect: Combined effects on coastal northern goshawk

No potential effects related to the operations and maintenance of the KSL Project on coastal northern goshawk have been identified.

j. Potential Effect: Combined effects on marbled murrelet

No potential effects related to the operations and maintenance of the KSL Project on marbled murrelets have been identified.

k. Potential Effect: Combined effects on great blue heron

No potential effects related to the operations and maintenance of the KSL Project on Great Blue Herons have been identified.

l. Potential Effect: Combined effects on sandhill crane

The KSL pipeline route crosses areas with suitable nesting habitat for sandhill cranes between KP 325 and KP 365. Sandhill cranes are a blue-listed species in British Columbia. Pipeline operations and maintenance activities on the right-of-way will involve periodic tree clearing and vegetation management. All scheduled right-of-way vegetation clearing will be completed outside the migratory bird nesting period (May 1 to July 31), and generally will be completed by mechanical

means. Routine pipeline maintenance work that involves clearing in suitable sandhill crane nesting habitat will adhere to the same mitigation measures as required during pipeline construction. The combined effects of operations and maintenance activities on sandhill cranes are considered to be reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

m. Potential Effect: Combined effects on coastal tailed frog

The KSL pipeline route crosses 52 streams assessed to have moderate to high suitability for coastal tailed frogs between KP 1.3 and KP 74.3. Coastal tailed frogs are provincially blue-listed, listed as "Special Concern" by COSEWIC, and are included in Schedule 1 of *SARA*. In the highly unlikely event that scheduled pipeline operations and maintenance activity occurs in streams used by coastal tailed frogs, there is potential for alteration or degradation of the stream habitat. To mitigate this potential effect, the same environmental protection and mitigation measures used during project construction will be applied. The combined effects on coastal tailed frogs during the operations phase of the Project are considered to have accidental frequency, and to be reversible in the long-term, and of low magnitude. ***The following residual effect has been identified: alteration of the suitability of coastal tailed frog stream during instream maintenance of the pipeline.***

Methanex Lateral

n. Potential Effect: Alteration or degradation of rare plant communities

Operational activities along the Methanex Lateral Pipeline will involve the maintenance of the ROW). The ROW is typically 8 m in width, and vegetation must be maintained at an early seral stage (*i.e.* herbaceous and low woody vegetation only). The periodic clearing of trees, damage to low growing plants, soil compaction, and increased sun exposure along the ROW will delay the re-establishment of rare plant communities. To minimize this effect, rare plant communities will be avoided whenever practical and will be fenced off when they occur off the construction ROW in order to avoid incidental damage. The width of vegetation maintenance on the right-of-way will be minimized, and all vegetation clearing during operations and maintenance will generally be done using mechanical. The potential effect of altering and degrading rare plant communities to maintain the pipeline right-of-way is considered reversible in the long-term and of medium magnitude. ***The following residual effect has been identified: disturbance of rare plant communities along travel corridors on the pipeline right-of-way.***

o. Potential Effect: Combined effects on grizzly bear

Operational and maintenance activities on the Methanex Lateral Pipeline have the potential to disturb grizzly bear on important seasonal feeding or breeding ranges. To minimize this effect, all scheduled, routine maintenance of the pipeline in important grizzly bear habitats will be conducted at times outside the restricted activity periods specified for pipeline clearing, construction, and restoration. The effect of sensory disturbances on grizzly bears during the operation of the pipeline is considered reversible in the short-term, and of low magnitude. ***No residual effect has been identified.***

No potential effects of operation and maintenance of the Methanex Lateral Pipeline on other species at risk have been identified.

Compressor Station

No potential effects of operation and maintenance of the Compressor Station on species at risk have been identified.

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual Effect: Disturbance of rare plant communities

Rare plant communities along travel corridors on the pipeline right-of-way will be repeatedly disturbed, and maintained at an early seral stage. To minimize this effect, the width of the area through rare plant communities that is cleared during operations and maintenance will be minimized to the extent practical. The residual effect of altering and degrading rare plant communities to maintain the pipeline right-of-way is considered reversible in the long-term and of medium magnitude. ***The residual effect is less than significant.***

b. Residual Effect: Alteration of coastal tailed frog streams

The suitability of a stream used by coastal tailed frogs will be altered in the unlikely event that instream repairs of the pipeline are required. To mitigate potential effects, the same environmental protection and mitigation measures used during Project construction will be applied. The residual effect on coastal tailed frog streams is considered reversible in the long-term and of low magnitude, has a low probability of occurrence, and is focussed on the Project Footprint. ***The residual effect is less that significant***.

c. Residual Effect: Maintenance of vegetation at an early seral stage

Vegetation on travel corridors along select sections of the right-of-way will be maintained at an early seral stage. To mitigate effects of this maintenance activity, the width of the ROW to be cleared will be minimized to the extent feasible. All vegetation clearing will generally be done using mechanical means, to minimize effects on adjacent vegetation. The residual effect is located in the Project Footprint, and is considered reversible in the long-term, and of low magnitude. ***The residual effect is less than significant.***

Table 7.2-19
Effects Assessment: Species at Risk
Operations and Maintenance

Valued Component/Potential Effect	Location	Mitigative Measures	Residual Effects
Aquatic			
Habitat impacts from instream work during operations and maintenance	At stream crossings along the entire pipeline route.	• All instream activities would require assessment, approvals, mitigation and possibly compensation, which would be determined with input from regulators during the approvals process.	No residual effect identified
Loss of riparian vegetation	At stream crossings along the entire pipeline route.	• Restore stream crossings to stabilize streambanks. • Provide instream cover. • Implement Restoration Plan.	No residual effect identified
Increased access to fish-bearing streams	At fish-bearing stream crossings along the entire pipeline route.	• Manage public access to the right-of-way..	No residual effect identified
Plants and Plant Communities			
Alteration or degradation of rare plant communities	Select locations requiring access along the pipeline right-of-way, and with rare plant community occurrence.	• Minimize width of clearing during operations and maintenance in areas with rare plant communities. • All vegetation clearing will generally be done using mechanical means.	Disturbance of rare plant communities along travel corridors on the pipeline right-of-way.
Wildlife			
Combined effects on grizzly bear	25 identified key habitat areas between KP 25 and KP 460.	• All scheduled, routine maintenance of the pipeline in important grizzly bear habitats will be conducted using the same mitigation measures and timing windows as during pipeline construction.	No residual effect identified.
Combined effects on sandhill crane	In suitable nesting habitat between KP 325 and KP 365.	• No clearing activities are to occur within the migratory bird nesting period (May 1 to July 31)	No residual effect identified.

Valued Component/Potential Effect	Location	Mitigative Measures	Residual Effects
Combined effects on coastal tailed frog	52 streams between KP 1.3 and KP 74.25	• The same environmental protection and mitigation measures used during Project construction will be applied in the unlikely event that in-stream maintenance of the pipeline will be required.	Alteration of the suitability of coastal tailed frog streams during instream maintenance of the pipeline.

Table 7.2-20
Significance of Residual Effects: Species at Risk
Operations and Maintenance

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Disturbance of rare plant communities along travel corridors on the pipeline right-of-way	Project Footprint	Long-term	Periodic	Long-term	Medium	High	Moderate	Less than significant
Alteration of the suitability of coastal tailed frog streams during instream maintenance of the pipeline	Project Footprint	Long-term	Accidental	Long-term	Low	Low	Moderate	Less than significant

7.2.5.3 Decommissioning and Abandonment

POTENTIAL EFFECTS AND MITIGATION MEASURES

The decommissioning and abandonment of the KSL Pipeline will comply with the acceptable regulatory standards that are in-place at that time. The procedures followed would likely be removal of all above ground facilities and the abandonment of the pipeline in-place, with the pipe severed and sealed at strategic locations and with the right-of-way left in its established stable condition. If required for a special area of concern, or by regulation, the pipeline could be removed. Consequently, decommissioning and abandonment will likely result in potential effects that are of substantially less magnitude to those which have been described for the construction of the pipeline. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards of the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Lateral

The discussion provided under the "Pipeline" section is entirely applicable to the Methanex Lateral.

Compressor Station

A compressor station will likely only be abandoned if the pipeline is abandoned. Due to operational considerations, the compressor station could be idled for a considerable period if it is not required to assist with the flow of natural gas. In the case of abandonment, all of the underground piping, aboveground buildings, and facilities would be dismantled and removed from the compound. Fill and aggregate material would be removed from the site and the area would be restored for any subsequent land use. Topsoil that had been salvaged during construction would be used to restore the land. Decommissioning and abandonment will likely result in potential effects that are similar but of less magnitude to those which have been described for the construction of the compressor station. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards for the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Meter Station

See information provided above for Compressor Stations.

7.2.6 Archaeological and Heritage Resources

7.2.6.1 Clearing, Construction and Restoration

POTENTIAL EFFECTS AND MITIGATION MEASURES

a. Potential Effect: Conflict with archaeological and heritage sites

The archaeological field study surveyed areas that were deemed to have potential for archaeological and heritage resources as determined by the archaeological overview assessment (AOA). These sections of the Project were subject to ground survey extending 50 meters either side of the Project centerline. Five pre-1846 archaeological sites (protected by the Heritage Conservation Act), nine culturally modified tree (CMT) sites, and two historic sites were documented within these areas. These sites will be in conflict with the Project if avoidance is not feasible.

Effects on archaeological sites are defined in the BC Archaeological Impact Assessment Guidelines as the "net change between the integrity of an archaeological site with and without the proposed development" (Government of B.C. 1998). Although management and mitigation recommendations will be provided for each individual archaeological and heritage site identified during this study, all sites are in essence a single resource that may be subject to the same effect. Therefore, the effects assessment methodology is succinct and based upon the assumption that all sites within the Project corridor as subject to archaeological field survey may be permanently lost or altered.

Any land altering activities undertaken within the established boundaries of an archaeological or heritage site will result in detrimental effects to the resource. Those activities that will initially result in the loss of, or disruption to, archaeological and heritage resources are likely to occur during, and be limited to, the construction phase of the Project.

It is unlikely that there will be future impacts on archaeological and heritage resources unless the activities associated with later phases of the Project result in ground disturbing activities that may threaten archaeological sites that were not affected by the construction phase.

The magnitude of project effects on archaeological and historic sites is dependant upon the assessment of site significance in a scientific and cultural context, as well as the local and regional context. This assessment is highly subjective and is therefore based on professional judgment along with the consideration of information collected in the field such as site locations within the pipeline route, site integrity, artifact density and distribution, inferred site use and occupation, including temporal and cultural affiliations. Mitigation recommendations are based entirely on the findings within a specific site and the in-field evaluation of the above mentioned information.

The cultural, scientific, public, and economic significance of each of the sites identified during this study has been determined according to the criteria for site evaluation in the British Columbia Archaeological Impact Assessment Guidelines (Apland and Kenny 1998). It is important to note that First Nations communities generally consider all archaeological and heritage sites within their asserted traditional territories to be high in cultural value. The public and economic significance for

all of the identified sites is considered to be low due to the remote location as well as low artifact density or lack of distinct features that are likely to be of interest to the general public.

A total of 16 archaeological and heritage sites may be lost or disrupted within the areas examined along the Project route. The loss or compromise of these sites would be permanent. However, based on the findings of the AOA, the density and types of sites identified are typical of the region. PTP will undertake appropriate site mitigation measures for each site to ensure that the loss or alteration of these sites will not constitute a loss to the regional archaeological record. Each site is unique in its components and scientific value and therefore site-specific mitigation recommendations will be designed for each archaeological site individually.

Mitigation must provide reasonable compensation for the removal, loss, disruption, modification or alteration of archaeological and heritage resources as a result of the Project. It is anticipated that information gained through implementation of a mitigation strategy, including but not limited to, systematic data recovery through controlled excavation and/or surface collection, and stem round sampling of CMT features, as appropriate, will be valuable to the archaeological record and to understanding the prehistory of the study area.

Mitigation is considered necessary for all sites that are assessed as having moderate to high scientific value. However given that project effects from the KSL Project will potentially result in the loss or alteration of all archaeological and heritage resources within the Project footprint, PTP will also mitigate sites that are assessed as having low scientific value, as appropriate. Low scientific value may be attributed to sites that have low to moderate artifact density, and are of a common site type and lack of diagnostic or otherwise significant artifacts.

Although appropriate mitigation will offset the effects of the Project on archaeological and heritage resources, the project may result in the permanent loss or alteration of archaeological or heritage sites within the Project footprint. ***The following residual effect has been identified: construction may result in the permanent loss or alteration of archaeological or heritage sites.***

Methanex Lateral

The archaeological overview assessment concluded that potential for archaeological resources in these areas are low. No further archaeological study is recommended.

Compressor Station

The archaeological overview assessment concluded that potential for archaeological resources at this location is low. No further archaeological study is recommended.

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual Effect: Construction may result in the permanent loss or alteration of archaeological or heritage sites

The potential residual effect of the project will be the loss or alteration of the 16 archaeological and heritage sites identified during this assessment. Effects to archaeological and heritage resources will be limited to areas within the established boundaries of each individual site. The frequency of effects on archaeological sites will be dependant on the frequency and type of land altering activities. With the implementation of appropriate site mitigation, the residual effects to archaeological and heritage resources while permanent, are considered to be low in magnitude. The implementation of an Archaeological Resources Monitoring Plan will ensure that the proposed mitigation measures are followed. As well as a planned Contingency Plan for the management of archaeological or heritage resources discovered during construction will assist in impact mitigation. ***The residual effect is less than significant.***

Table 7.2-21
Effects Assessment: Archaeological and Heritage Resources
Clearing, Construction, and Restoration

Valued Component/ Potential Effect	Location	Mitigation Measures	Residual Effects
Conflict with 16 identified archaeological and heritage resources	KP 46 KP 130 KP 165 (X2) KP304 KP 311 (X2) KP 315 (X3) KP 327 KP 330 KP413 KP458	• Avoid impact of archaeological and heritage sites, where feasible. • If avoidance is not practical, a mitigation strategy will be developed and implemented. This strategy will be designed to adequately mitigate the effects of the Project by reasonably compensating for the removal, loss, disruption, modification, or alteration of archaeological and heritage resources as a result of the Project. It is anticipated that information gained through implementation of a mitigation strategy, including but not limited to, systematic data recovery through controlled excavation and/or surface collection, and stem round sampling, as appropriate, will be valuable to the archaeological record and to understanding the prehistory of the study area. • Employ an Archaeological Resources Monitoring Plan for the purpose of implementing the mitigation measures. • Implement a contingency plan for the management of archaeological or heritage resources discovered during construction.	• Permanent loss or alteration of archaeological and heritage resources within the Project footprint.

Table 7.2-22
Significance of Residual Effects: Archaeological and Heritage Resources
Clearing, Construction, and Restoration

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Permanent loss or alteration of archaeological and heritage resources within the Project footprint	Project Footprint	Long-term	Isolated	Permanent	Low	High	High	Less than significant

7.2.6.2 Operations and Maintenance

The activities that will effect archaeological and heritage resources are likely to occur during, and be limited to, the construction phase of the Project. It is unlikely that there will be post-construction effects for archaeological and heritage resources unless the activities associated with later phases of the Project result in ground disturbing activities that threaten archaeological sites that were not affected by the construction phase.

7.2.6.3 Decommissioning and Abandonment

POTENTIAL EFFECTS AND MITIGATION MEASURES

The decommissioning and abandonment of the KSL Pipeline will comply with the acceptable regulatory standards that are in-place at that time. The procedures followed would likely be removal of all above ground facilities and surface appurtenances and the abandonment of the pipeline in-place, with the pipe severed and sealed at strategic locations, and with the right-of-way left in its established stable condition. If required for a special area of concern, or by regulation, the pipeline will be removed. Consequently, decommissioning and abandonment will likely result in potential effects that are of substantially less magnitude to those which have been described for the construction of the pipeline. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards of the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Lateral

The discussion provided under the "Pipeline" section is entirely applicable to the Methanex Lateral.

Compressor Station

A compressor station will likely only be abandoned if the pipeline is abandoned. Due to operational considerations, the compressor station could be idled for a considerable period if it is not required to assist with the flow of natural gas. In the case of abandonment, all of the underground piping, aboveground buildings, and facilities would be dismantled and removed from the compound. Fill and aggregate material would be removed from the site and the area would be restored to as close to pre-disturbance conditions as possible. Topsoil that had been salvaged during construction would be used to restore the land. Decommissioning and abandonment will likely result in potential effects that are similar but of less magnitude to those which have been described for the construction of the compressor station. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards for the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Meter Station

See information provided above for Compressor Stations.

7.2.7 First Nations Community and Land Use

7.2.7.1 Clearing, Construction and Restoration

POTENTIAL EFFECTS AND MITIGATION MEASURES

Land and Resource Use Plans

a. Potential Effect: Conflict with identified management intent in First Nation Land use plans

Several First Nations have developed Land Use Plans for their traditional territories, or Management Plans for particular resources in portions of their territories in the Regional Study Area. These First Nations include the Haisla Nation, Kitselas First Nation, Office of the Wet'suwet'en Hereditary Chiefs, and the Carrier Sekani Tribal Council. These Land Use Plans have not been provided to the proponent or the Province for use in consideration of potential conflicts with the project. Nothing in the information provided by the First Nations indicates that the Project conflicts with their Land Use Plans. ***No residual effect has been identified.***

b. Potential Effect: Conflict with First Nation forest licensee operational plans and commitments

The Project crosses First Nation forestry tenures that include portions of Tree Farm Licenses and non-replaceable timber licenses. Most of the First Nations in the study area have negotiated Interim Measure Forest Agreements (or Forest and Range Agreements) with the Province of British Columbia. One TFL is held by the Coast Tsimshian First Nations, between KP 79.0 and KP 95.6. Four First Nations hold Non-Replaceable Forest Licences that cross approximately 136 km of the Project route. Approval of the Project may result in First Nations forest licensees being required to undertake additional planning in order to adhere to provincial forest objectives and designations, meet other existing commitments, or revise forest harvesting plans. For instance, the Project may be located in areas planned for future forestry road construction, requiring licensees to review and amend these plans.

PTP will discuss planning issues with forest licensees, and will negotiate agreements where applicable. Discussions will be held to determine if one Master License to Cut for the Project can be obtained from the OGC in order to minimize planning costs for licencees.

PTP will provide First Nation forest licensees with information and protocols regarding timeframes for approval of pipeline crossings to access timber harvesting areas, weight restrictions, standard operating procedures, and blasting restrictions. Discussions between PTP and First Nation forest licensees will be held to discuss outstanding concerns. Negotiated agreements, where applicable, will minimize effects related to alterations of forest plans. The effect is expected to be reversible in the short-term, of low magnitude, and fully mitigable. ***No residual effect has been identified.***

Current Use of Land and Resources

a. Potential Effect: Construction phase disruption of First Nation trapping operations

Construction of the pipeline route may temporarily disrupt commercial trapping operations on the 44 registered traplines along the Project route, some of which are operated by First Nations trappers. An Access Management Plan will assist in minimizing impediments to trappers reaching their traplines. First Nation trappers will be contacted before Project clearing and construction to advise them about Project scheduling and route location, resolve outstanding concerns, and allow operators to remove traps and other equipment from the Project footprint. The Project workforce will not disturb cabins, trapline equipment, or facilities associated with trapping outside of the Project Footprint.

A Restoration Plan will assist in minimizing long-term Project effects on habitat that supports fur-bearing animals. PTP will discuss demonstrated economic loss associated with Project activities with First Nation trappers. The Project mitigation measures are designed to reduce effects on wildlife and commercial operations, yet disruption may still occur. The Project effects on trapping activities are considered medium-term and medium in magnitude. ***The following residual effect has been identified: construction phase disruption of commercial trapping operations.***

b. Potential Effect: Disruption of seasonal harvesting activities by First Nations

Hunting, fishing, berry picking and plant and material gathering are important seasonal activities for the First Nations people in the study area. The primary hunting season is the late summer and fall in most areas. The primary fishing season is the early spring to late fall along the Project route. Berry picking activity is concentrated in late summer and early fall. Plant and material gathering takes place in all seasons of the year. The Project may introduce noise and access restrictions along the route during the construction phase that could disrupt harvesting activities.

First Nations will be notified about construction schedules to avoid conflicts with traditional use activities. PTP will use signs to inform users about construction activity along the Project route. An Access Management Plan will assist in minimizing disruption of traditional use activities. After Project completion, disturbed sites and trails will be rehabilitated to as close to their pre-construction condition as practical.

The Project effects on traditional use activities are considered medium-term and medium in magnitude. ***The following residual effect has been identified: construction phase disruption of traditional use activities.***

c. Potential Effect: Alteration or degradation of First Nation plant and material gathering sites

First Nations Traditional Use Studies have identified plant and material-gathering areas along the length of the Project route. These plants and plant materials are used for a variety of medicinal, nutritional, and cultural purposes. The protection of these plant and material-gathering areas is of

paramount importance to First Nations during the construction phase. General locations of plant gathering sites and mitigation measures are included in Table 7.2-23. Site information in Table 7.2-23 is not attributed to individual First Nations. This information is being treated as confidential, and will only be available on request from specific First Nations.

Construction of the KSL Project will involve clearing of vegetation along the entire pipeline route. The pipeline route was selected to minimize clearing of mature vegetation whenever practical, and as such, much of the clearing will occur in areas that have previously been disturbed by forest harvesting, utility corridors, industrial facilities, agriculture, and rural-residential development.

Where the Project crosses undisturbed lands, clearing will affect mature and old coniferous forests, riparian areas, wetlands, deciduous stands, subalpine and alpine areas, and grasslands. Many of these areas of undisturbed vegetation may contain species of importance to First Nations. A list of plant species of cultural importance to First Nations is in Section 6.7.3, Table 6.7-4.

Selecting a pipeline route that follows existing linear disturbances to the extent feasible, thereby minimizing the amount of disturbance to plant communities of value to First Nations, is an important impact avoidance measure. Where the pipeline route crosses such plant communities, PTP will implement mitigation measures to minimize effects on these sensitive ecosystems. Traditional use plant and material-gathering sites of critical importance to First Nations outside of the Project Footprint will be flagged off to restrict pipeline construction traffic from affecting this area.
Many berry plants of importance to First Nations will grow well on the Project right-of-way following construction. A Restoration Plan will use native plants to replant these types of disturbed areas. Native plant seed mixes will be developed to suit local site conditions and the needs of First Nations. PTP will follow an Invasive Plant Management Plan to minimize the introduction and spread of noxious weeds during Project construction activity. To determine the efficacy of the Restoration Program and mitigation measures, PTP will undertake a Post-Construction monitoring program of the right-of-way.

Potential effects of the Project on First Nation plant and material-gathering areas are considered to be reversible in the medium to long-term, depending on habitat type, and of medium magnitude. ***The following residual effect has been identified: removal of plants considered to be of cultural importance to First Nations.***

d. Potential Effect: Loss or degradation of instream or downstream lake fish habitat at First Nation traditional fishing sites

First Nations Traditional Use Studies have identified traditional fishing sites along the length of the Project route that are used for harvesting of fish species in the study area. The protection of these fishing sites is of paramount importance to First Nations during the construction phase.

During the clearing, construction, and restoration phases of the KSL Project, disturbance of instream habitat will occur where isolation techniques (rather than HDD) are used for stream crossings. Nine crossings as currently proposed will be completed using HDD plus one using an aerial technique; if feasible these crossings will require no instream work and therefore have no effect on instream habitat. Where isolated crossings are used, mitigation and restoration will offset most impacts to

instream fish habitat, by controlling suspended sediment releases, restoring or maintaining streambank stability, and restoring or creating riparian cover at fish-bearing crossings. Instream habitat at fish-bearing stream crossings will be restored with the intent of replicating or improving existing conditions. No Project construction will take place immediately adjacent to lake habitat.

Two impact pathways are discussed in detail in Section 7.2.3.1 b): direct physical alterations caused by disturbance of instream habitats, and indirect alterations caused by release of suspended sediments. First Nations Traditional Use Studies have identified locations along the Project route where damage to traditional fishing sites and fish habitat is a concern. These sites are listed in Table 7.2-23. Proposed mitigation strategies for these fishing sites, stream and river crossings and downstream lake habitat are also shown in Table 7.2-23.

First Nations will still be able to use traditional fishing sites following construction of the pipeline, during the operational phase of the Project. Fish habitat compensation for Project impacts on habitat is discussed in Sec. 7.2.3.1 b). The details of fish habitat compensation projects will be developed in discussion with the BC MOE, DFO, and First Nations. With implementation of stream bank restoration measures and recommended habitat protection, restoration and compensation measures, ***the following residual effects have been identified: direct alteration of instream fish habitat at stream crossings, and physical alteration of instream habitat and downstream lake habitat through sediment release.***

e. Potential Effect: Loss or degradation of ritual areas and ability of First Nations people to conduct ritual activities

Several First Nations have identified areas where ritual activities of a cultural nature take place near the Project route. No details were provided on the nature of the activities due to concerns for confidentiality.

PTP personnel will consult with local First Nations to discuss proper protocol in areas close to ritual activity sites, or in areas indicated as being significant in local history, mythology, or spirituality. The scheduling of clearing and construction activities may have to be discussed with First Nations in order to avoid conflict with ritual activities. Proper respect for a different cultural worldview and for Traditional Ecological Knowledge will be shown during work in areas indicated by First Nations as having special cultural significance. With respectful communication with First Nations, and proper respect shown in these areas on the ground, ***no residual effect has been identified***.

f. Potential Effect: Alteration or degradation of trails traditionally used by First Nations

The Office of the Wet'suwet'en (OW), as part of their Use Study, have identified a number of trails that have been used traditionally, as well as currently, by the OW that cross the ROW for the KSL pipeline. Concerns centre around the ability to continue using the trails once pipeline construction is completed.

Where identified trails cross the pipeline route, PTP will consult with First Nations to ensure a member of the community advises on activities in these areas, particularly in regard to safety during construction. The scheduling of clearing and construction activities will be discussed with First Nations in order, where practical, to avoid potential impacts to First Nations members using these trails. Disturbance to trails will be restored during the restoration phase of the Project in order to ensure the trails are fully functional following restoration. With proper and timely communication with First Nations and appropriate restoration of potentially impacted trails during the restoration phase of the Project, ***no residual effect has been identified***.

Methanex Lateral

The Kitimat Pipeline Lateral connects the existing PNG pipeline at the Methanex plant to the Project route at KP 0.3. No potential effects have been identified in relation to First Nation Community and Land Use and the Methanex Lateral pipeline.

Compressor Station

g. Potential Effect: Temporary disruption of seasonal First Nation hunting activity near the Compressor Station

The clearing and construction activity at the Compressor Station may introduce temporary noise, and hunting restrictions for the purposes of worker safety would be applied immediately adjacent to the site at KP 246.5. The area affected is small in relation to the total area of the First Nation's traditional territories available for hunting. Through the implementation of the mitigation measures described in Section 7.2.7, including proper signage and notification to local First Nation communities, ***no residual effect has been identified***.

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual Effect: Construction phase disruption of First Nation commercial trapping operations

Commercial trapping operations require seasonal access to the land and rivers crossed by the Project. Seasonal disruption may occur to trapping operations due to alterations in access and to wildlife habitat. Construction of the Project will create noise that may alter animal movements near the Project footprint. Project effects on fur-bearer habitat are slight in comparison with other development activities in the RSA, particularly the harvest of Mountain Pine Beetle wood. Medium-term effects to fur bearing mammals in some locations will be related to alteration of habitat along the Project route. Detailed effects on wildlife are discussed in Section 7.2.4. The Project route will be revegetated using methods outlined in a Restoration Plan. The residual effect of construction phase disruption is considered to be reversible in the medium-term, and medium in magnitude. ***The residual effect is less than significant.***

b. Residual Effect: Construction phase disruption of traditional use activities

Traditional activities such as hunting, fishing, berry picking and plant and material-gathering require seasonal access to lands and waters crossed by the Project. Disruption will occur to these seasonal activities due to alterations in access along the Project route. First Nations will be provided with information about construction schedules, locations and access restrictions, to avoid conflicts with traditional use activities. While every effort will be made by the proponent to minimize the effects on First Nations members, it is possible that traditional use activities could be disrupted in local areas during the Project clearing and construction phases. The residual effect of clearing and construction disruption is considered to be reversible in the medium-term, and medium in magnitude. ***The residual effect is less than significant***.

c. Residual Effect: Alteration or degradation of First Nation plant and material gathering sites

Approximately 800 ha of previously uncleared land will be cleared for the Project. Some proportion of the 800 ha of undisturbed habitat contains plants and plant materials considered important by First Nations. The most contiguous undisturbed forest stands are found in the Mountain Region between KP 74.9 and KP 112. To minimize effects on previously undisturbed forests, restoration will involve planting coniferous tree seedlings on workspaces, and using native plant species on the working space and ROW.

For other habitat types of importance to First Nations for traditional use plants and plant materials, sites where plant and material-gathering takes place has been reported in Traditional Use Studies. Traditional use plant and material-gathering sites identified by First Nations outside the Project Footprint will be flagged off to reinforce the requirement for pipeline construction traffic to confine activities to the designated work area. Equipment will be directed away from any flagged plant gathering areas during construction.

Cleared plant and material-gathering areas will be seeded with appropriate native seed mixes, and shrubs and trees will be planted following the principles outlined in a Restoration Plan. Plant species identified as important by First Nations will be considered when restoration plans are prepared. Conditions on the right-of-way will be conducive to the establishment of some plants of importance to First Nations, such as berry plants. The effectiveness of these mitigation measures will be monitored during a Post-Construction Monitoring Program. The residual effect of clearing plant and material-gathering areas is localized on the Project Footprint, and is considered reversible in the long-term and of medium magnitude. ***The residual effect is less than significant.***

d. Residual Effect: Physical alteration of instream habitat at crossings sites or downstream lake habitat through sediment release

Residual effects related to loss or degradation of instream fish habitat or downstream lake habitat were identified from the following impact pathway: physical alteration of instream or downstream lake habitat through sediment release.

Loss or degradation of instream fish habitat or lake habitat is possible at locations downstream of some pipeline crossings. Where crossings of fish-bearing streams are completed using flow isolation techniques inside work windows there is expected to be no residual effect. The great majority of crossings of fish-bearing streams will be completed in this manner.

The three crossings of the Salmon River are planned to occur in winter, outside the fisheries work window. Other crossings may occur outside work windows if weather or other issues impede construction progress. Where crossings are completed using flow isolation techniques outside work windows there is expected to be some residual effect. Compensation will be required to offset these impacts and will ensure that ***residual effects at these crossings are less than significant.*** The form and amount of compensation will be determined in consultation with DFO. Redd surveys will be conducted downstream of these sites to help determine the amount of compensation required.

Open cut crossing techniques are not planned as primary crossing methods for any fish-bearing stream crossing, but are contingency methods for Little Wedeene, Wedeene, Chist and Stuart rivers, if HDD is infeasible or fails. Crossings completed using open cut techniques are expected to result in some residual effect. Compensation will be required to offset these impacts and will ensure that ***residual effects at these crossings are less than significant.*** The form and amount of compensation will be determined in consultation with DFO. Redd surveys will be conducted downstream of these sites to help determine the amount of habitat compensation required.

Permanent Facilities

No residual effects have been identified.

Table 7.2-23
Effects Assessment: First Nations Communities and Land Use
Clearing, Construction, and Restoration

Valued Component/ Potential Effect	Location	Mitigation Measures	Residual Effects
Conflict with Identified Management Intent in First Nation Land Use Plans	Regional Study Area	• Discussion between Proponent and First Nations regarding completed Land Use Plans in the RSA	No residual effect identified.
Conflict with First Nation Forest Licensee operational plans and commitments	Forested Crown land along entire Project route	• Undertake discussions with forest licensees to discuss planning issues. Negotiate agreements where applicable. • Discuss the option of obtaining one Master Licence to Cut for the pipeline route from the OGC to minimize planning costs for licensees. • Provide forest licensees with information and protocols regarding timeframes for approval of pipeline crossings, weight restrictions, standard operating procedures, and blasting restrictions.	No residual effect identified.
Construction phase disruption of First Nation trapping operations	44 registered traplines along Project route, and specifically: KP 12.7 to KP 13.3 KP 13.3 to KP 16.7 KP 16.7 to KP 17.4 KP 42.5 to KP 72.0KP 140.0KP 147.0 KP 173.5to KP 198.0 KP 194.0 KP 233.8 to KP 235.0 KP 445.0 to KP 455.0 KP 450.0 to KP 454.0	• Notify First Nation trappers prior to initiating clearing or construction activities to provide updates on project scheduling, to resolve outstanding concerns, and to allow operators to remove traps and other equipment from the pipeline route. • Ensure that the Project work force does not disturb cabins, trapline equipment, or facilities associated with trapping outside the Project Footprint. • Implement an Access Management Plan to manage access to the pipeline route during and following Project construction. • Ensure appropriate revegetation occurs through the implementation of a Restoration Plan. • Discuss demonstrated economic loss associated with Project activities with First Nations trappers.	No residual effect identified.
Disruption of seasonal	Entire Project route, and	• Use signage to inform users of the presence of construction	No residual effect

Valued Component/ Potential Effect	Location	Mitigation Measures	Residual Effects
harvesting activities by First Nations	specifically: KP 3.5 (campsite) KP 4.5 to KP 9.2 and KP 12.0 to KP 13.5 (hunting, camping) KP 12.3 to KP 74.0 (hunting) KP 12.7 to KP 13.3 (berries) KP 16.7 to KP 17.4 (berries, medicines) KP 30.0 to KP 36.0 KP 42.5 to KP 74.0 (berries) KP 82 to KP 90 (hunting) KP 165.0 to KP 166.0 (campsite) KP 225.0 to KP 228.0 (hunting) KP 237.0 to KP 239.5 (berries, medicines) KP 242.0 to KP 250.0 (hunting) KP 253.0 to KP 254.0 (berries, medicines) KP 419.0 to KP 429.0 (hunting) KP 434.0 to KP 435.0 (hunting) KP 446.0 to KP 462 (hunting, camps) KP 450.0 to KP 462.0 (berries)	activity in popular harvesting areas and on access roads to harvesting areas. • Restore disturbed sites and trails to as near to their pre-construction condition as practical. • Implement an Access Management Plan to minimize unintended motorized access.	identified.
Alteration or degradation of	Entire Project route, and	• Plant and material-gathering sites identified by First Nations off	No residual effect

Valued Component/ Potential Effect	Location	Mitigation Measures	Residual Effects
First Nation plant and material-gathering sites	specifically: KP 3.6 KP 416.0 (aboriginal forestry) KP 434.0 to KP 435.0 (aboriginal forestry, cabin, camp) KP 436.0 (aboriginal forestry) KP 438.0 (aboriginal forestry)	the Project Footprint will be flagged off prior to construction. • First Nations may identify plants for revegetation along the disturbed areas of the Project route as part of a Restoration Plan. • PTP will undertake a Post-Construction monitoring program of the right-of-way. • Follow an Invasive Plant Management Plan to minimize the introduction and spread of noxious weeds during Project construction activity.	identified.
Loss or degradation of instream fish or downstream lake habitat at First Nation traditional fishing sites	Entire Project route, and specifically the following stream crossings and lakes: - Stream (KP 7.0, KP 9.0 to KP 10.5) - Stream (KP 12.2 to KP 12.8) - Stream (KP 16.8) - Stream (KP 30.2) Hoult Cr./Kitimat River (KP 42.5 to KP 63.4) Hunter Cr. (KP 63.4) - Gosnell Cr. (KP 107.0 KP 108.0) - Gosnell Cr. (KP 109 to KP 110) - Stream (KP 124 to KP 125) - Morice R. (KP 128.5) - Morice R. (KP 130 to KP 131 and KP 144 to KP 149 and KP 164 to	• Select vehicle and pipeline crossing methods that reduce direct and indirect effects on productive fish habitat. • Adhere to instream work windows and minimize instream work period. • Implement adequate erosion control on upslope areas and non-fish-bearing watercourses, to prevent release of harmful concentrations of suspended sediment to fish-bearing waters. • Minimize clearing and ground disturbance within 10 m of the high water mark of all waterbodies, to the degree practical. • Welding, coating, weighting, and where applicable, testing, of the pipe should be completed prior to commencement of instream trenching. • Crossings should commence only after ensuring that sufficient equipment and supplies are available to complete the crossing in an efficient and timely manner. • Isolate instream construction areas where surface flow is present (on fish-bearing watercourses) and implement measures to reduce downstream sediment input, including: – salvage streambed surface material for return to top layer of streambed during backfilling.	Direct physical alteration of instream habitat at crossing sites. Physical alteration of instream habitat through sediment release.

Valued Component/ Potential Effect	Location	Mitigation Measures	Residual Effects
	KP 167) - Cedric Cr. (KP 141.5) - Lamprey Cr. (KP 148.5) - Fenton Cr. (KP 162.1) - Owen Cr. (KP 164.8) - Owen Cr. (KP 165.5) - Parrot Cr. (KP 177.9) - Buck Cr. (KP 189.5) - Allin Cr. (KP 216.0) - Maxan Cr. (KP 224 to KP 227) - Anders L. (KP 233.8 to KP 235.0) - Endako R. (KP 240.5, KP 287,2, KP 299.6, KP 303.0, KP 316.8) - Stern Cr. (KP 306.8) - Tatsutnai Cr. (KP 332.2) - Kluk Cr. (KP 340.0) - Trankle Cr. (KP 348.7) - Redmond Cr. (KP 351.2) - Clear Cr. (KP 358.4) - Breadalbane Cr. (KP 378.9) - Stuart R. (KP 390.2) - Gravel Cr. (KP 398.0) - Chinochey Cr. (KP 401.2) - Crocker Cr. (KP 426.3) - Salmon R. (KP 430.5, KP 442.7, KP 450.9, KP 459.0) - EM&K L. (KP 450.8 to	– salvaged surface material should be placed above the high water mark in a manner that does not block drainage or runoff, – excavated instream materials should be contained using appropriate techniques (e.g. berms, silt fences or straw bale filters), to ensure that sediment-laden water and spoil do not re-enter the waterbody, – water from flumes, pump-arounds, diversions, or other methods should be released to downstream areas using dissipation structures, to avoid causing erosion or sediment release. – sediment-laden trench water should be pumped onto stable surfaces in a manner that does not cause erosion of soils or release of suspended sediments to watercourses, – hard ditch plugs at least 3 m wide should be left in place until the crossing has been initiated. • HDD is proposed to cross streams that cannot be isolated. • Use qualified environmental monitors during stream crossing construction activities. • Restore streambed and banks to the extent practical, based on pre-construction habitat surveys. Restore rearing potential with adequate stream depth and instream structures. Restore spawning areas with gravel placement. Maintain or restore natural drainage and channel configurations. • Where feasible, salvage and return aquatic vegetation and organic debris removed from the construction area following trench backfilling. Contour and stabilize banks and approach slopes and install temporary berms, silt fences, or cross ditches in locations where run-off from the right-of-way may flow into a watercourse.	

Valued Component/ Potential Effect	Location	Mitigation Measures	Residual Effects
	KP 451.7) - Summit L. (KP 458.0 to KP 460.0) -Fiust L. (KP 459.5 to KP 460.4) - Stream (KP 462.0)		
Loss or degradation of ritual areas and ability of First Nations people to conduct ritual activities	KP 30 to KP 36 KP 459.5 to KP 460.4 KP 109.9 KP 130.3 to KP 130.8 KP 131.0 to KP 132.2 KP 139.3 KP 149.8 KP 151.6 KP 162.8 to KP 166.0 KP 170 KP 203.0 to KP 205.5 KP 214.8	• PTP will contact the First Nations concerned to ensure a member of the community advises on activities in these areas. • The scheduling of clearing and construction activities will be discussed with First Nations in order to avoid potential impacts to ritual activities. • PTP construction personnel will be particularly attentive to respectful treatment of the land in these areas, in consultation with affected First Nations.	No residual effect identified.
Alteration or degradation of trails traditionally used by First Nations	KP 88.5 KP 98.8 KP 99.8 KP 99.8 to KP 105.5 KP 109.7 to KP 110.3 KP 129.5 to KP 133.5 KP 135.0 to KP 138.5 KP 145 to KP 149 KP 149.8 KP 149.9 KP 151.3 to KP 152.7 KP 162.8 to KP 166.0 KP 170 to KP 174.5	• PTP will work with concerned First Nations to ensure a member of the community advises on activities in these areas. • The scheduling of clearing and construction activities where the pipeline crosses the identified trails will be discussed with First Nations in order to avoid potential impacts to the seasonal use of the trails. • Physical impacts to the trails will be restored so that the trails crossing the pipeline ROW will be fully functional following the restoration phase of the Project.	No residual effect identified.

Valued Component/ Potential Effect	Location	Mitigation Measures	Residual Effects
	KP 178.5 to KP 180.0 KP 189 KP 192.3 KP 193.2 KP 194 KP 198.4 KP 198.7 KP 200 to KP 201.5 KP 203 to KP 205.5 KP 207 to KP 215 KP 208.5 KP 210.3 KP 225.3 KP 239.5 KP 243.2 KP 244.3 KP 257.6		

** Note: Site information in Table 7.2-23 is not attributed to individual First Nations. This information is being treated as confidential, and will only be available on request from specific First Nations.

Table 7.2-24
Significance of Residual Effects: First Nations Communities and Land Use
Clearing, Construction, and Restoration

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Construction phase disruption of First Nation commercial trapping operations	LSA	Medium-term	Occasional	Medium-term	Medium	High	Moderate	Less than significant
Construction phase disruption of First Nation traditional use activities	LSA	Medium-term	Periodic	Medium-term	Medium	High	High	Less than significant
Alteration or degradation of First Nation plant and material gathering sites	Project Footprint to LSA	Medium-term	Periodic	Medium-term	Medium	High	High	Less than significant
Physical alteration of instream habitat at crossing sites or downstream lake habitat through sediment release	LSA	Immediate to Medium-term	Isolated	Medium-term	Low to Medium	High	High	Less than significant (after habitat compensation)

7.2.7.2 Operations and Maintenance

POTENTIAL EFFECTS AND MITIGATION MEASURES

a. Potential Effect: Alteration or degradation of vegetated areas

Operational activities along the pipeline route will involve the maintenance of the ROW for the purpose of its identification (vegetation clearing, marker posts, etc.). The trees and tall vegetation must be removed and maintained at an early seral stage (*i.e.* herbaceous and low woody vegetation only). The periodic clearing of trees and woody debris will limit the re-establishment of natural plant communities. The maintenance of vegetation in an early seral stage may benefit the production of plants of importance to First Nations, such as berries. The potential effect of altering vegetated areas along the pipeline right-of-way is considered generally reversible in the long-term and of low magnitude. ***The following residual effect has been identified: maintenance of vegetation at an early seral stage along travel corridors on the pipeline right-of-way.***

b. Potential Effect: Introduction and acceleration of the spread of invasive plants

Operational activities of the KSL Project will involve the maintenance of the ROW for the purpose of its identification (vegetation clearing, marker posts, etc.). Use of the ROW by maintenance vehicles may lead to the introduction or spread of invasive plants. The spread of invasive plants may inhibit the regeneration of plant species of importance to First Nations. To minimize this potential effect, an Invasive Plant Management Plan will be implemented, and standard weed control measures to minimize the likelihood of introducing or spreading weed seeds will be used. The potential effect of introduction and acceleration of the spread of invasive plants is considered to be reversible in the medium-term and of low magnitude. ***The following residual effect has been identified: introduction or spread of invasive species as a result of operations and maintenance activities.***

SIGNIFICANCE OF RESIDUAL EFFECTS

The significance of residual effects pertaining to First Nation Community and Land Use are evaluated in the following section. Identified residual effects are listed below, and assessment of the significance of these effects is summarized in Table 7.2-26.

a. Residual Effect: Maintenance of vegetation at an early seral stage

Vegetation along the right-of-way will generally be maintained at an early seral stage. To mitigate effects of this maintenance activity, the width of the area where vegetation monitoring and clearing will be undertaken will be minimized to the extent feasible. All vegetation clearing will be done using methods that will minimize effects on adjacent vegetation. The residual effect is located in the Project Footprint, and is considered reversible in the long-term, and of low magnitude. ***The residual effect is less than significant.***

b. Residual Effect: Introduction or spread of invasive plant species

Operations and maintenance activities on the pipeline right-of-way may lead to the introduction or spread of invasive plant species. To minimize this risk, an Invasive Plant Management Plan will be implemented, and similar measures as during Project construction will apply. Standard weed control

measures will be employed, such as cleaning equipment of seeds and vegetative debris prior to arrival on the right-of-way. The residual effect of introduction or spread of invasive plant species is located on the Project Footprint, and is considered to be reversible in the medium-term, and of low magnitude. ***The residual effect is less than significant.***

Table 7.2-25
Effects Assessment: First Nations Community and Land Use
Operations and Maintenance

Valued Component/ Potential Effect	Location	Mitigation Measures	Residual Effects
Alteration or degradation of vegetated areas	Project Footprint	• Minimize the width of the area affected by vegetation maintenance along the right-of-way. • All vegetation clearing will be done in a manner that reduces impacts to adjacent vegetation.	Maintenance of vegetation at an early seral stage along travel corridors on the pipeline right-of-way.
Introduction and acceleration of the spread of invasive plants	Project Footprint and LSA	• Minimize the width of vegetation maintenance along the right-of-way. • Follow an Invasive Plant Management Plan to minimize the introduction and spread of noxious weeds during Project operation and maintenance activities. • Employ standard weed control measures, such as cleaning of equipment of seeds and vegetative debris prior to arrival on the right-of-way. • Minimize weed spread by cleaning equipment prior to moving from an area of high weed infestation.	Introduction or spread of invasive species as a result of operations and maintenance activities.

Table 7.2-26
Significance of Residual Effects: First Nations Community and Land Use
Operations and Maintenance

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Maintenance of vegetation at an early seral stage on the pipeline right-of-way.	Project Footprint	Long-term	Periodic	Long-term	Low	High	High	Less than significant
Introduction or spread of invasive species as a result of operations and maintenance activities.	Project Footprint	Long-term	Accidental	Medium-term	Low	High	High	Less than significant

7.2.7.3 Decommissioning and Abandonment

POTENTIAL EFFECTS AND MITIGATION MEASURES

The decommissioning and abandonment of the KSL Pipeline will comply with the acceptable regulatory standards that are in-place at that time. The procedures followed would likely be removal of all above ground facilities and the abandonment of the pipeline in-place, with the pipe severed and sealed at strategic locations, and with the right-of-way left in its established stable condition. If required for a special concern, or by regulation, the pipeline could be removed. Consequently, decommissioning and abandonment will likely result in potential effects that are of substantially less magnitude to those which have been described for the construction of the pipeline. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards of the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Lateral

The discussion provided above is entirely applicable to the Methanex Lateral.

Compressor Station

A compressor station will likely only be abandoned if the pipeline is abandoned. Due to operational considerations, the compressor station could be idled for a considerable period if it is not required to assist with the flow of natural gas. In the case of abandonment, all of the underground piping, aboveground buildings, and facilities would be dismantled and removed from the compound. Fill and aggregate material would be removed from the site and the area would be restored for any subsequent land use. Topsoil that had been salvaged during construction would be used to restore the land. Decommissioning and abandonment will likely result in potential effects that are similar but of less magnitude to those which have been described for the construction of the compressor station. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards for the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified.***

Methanex Meter Station

See information provided above for Compressor Station.

7.2.8 Land and Resource Use

7.2.8.1 Clearing, Construction and Restoration

POTENTIAL EFFECTS AND MITIGATION MEASURES

Land and Resource Use Plans

a. Potential Effect: Conflict with identified management policies in land use plans

The Project crosses five *Land and Resource Management Plan* (*LRMP*) areas and two *Sustainable Resource Management Plan* (*SRMP*) areas. *LRMP*s and *SRMP*s are strategic land use planning tools used by the Province of British Columbia to guide use of land and resources.

The Project crosses 300 m of the Kitimat Linkage Grizzly Bear Management Area identified in the *Kalum LRMP*. The intent of this zone is to prevent population fragmentation and genetic isolation by prohibiting hunting, and by increased inventory and monitoring efforts. The pipeline route is located adjacent to the FSR road through this management area. The Kalum Linkage Grizzly Bear Management Area does not prohibit pipeline construction. See Section 7.2.4 for a discussion of wildlife and wildlife habitat, and Section 9.3 for the Restoration Plan. The Project is consistent with the management policies for this zone. Any potential disruption related to the Project is considered low magnitude and reversible in the short-term. ***No residual effect has been identified.***

The Project crosses the proposed Burnie-Shea protected area, and the Herd Dome Area Specific Management Zone (ASMZ). These areas have been so designated because of their natural characteristics. Construction of the Project will involve clearing of the pipeline route and working space and the construction of temporary infrastructure.

Ongoing discussions are occurring between PTP and ILMB to identify ways to minimize impacts on the proposed protected area. Land in the proposed Burnie-Shea protected area and Herd Dome ASMZ that is disturbed by the Project will be rehabilitated through the implementation of a Restoration Plan. All working space and temporary infrastructure will be decommissioned and restored. Visual management strategies, such as vegetation replanting, will be used to minimize long-term disruption of important viewscapes.(See Section 7.2.13 Aesthetics and Viewsheds).

An Access Management Plan will be implemented to minimize unauthorized motorized use of the proposed Burnie-Shea protected area and the Herd Dome ASMZ. At strategic access points, PTP will provide physical or vegetation barriers to prevent unauthorized motorized access. PTP will monitor unauthorized motorized use in the proposed Burnie Shea protected area and Herd Dome ASMZ and assess the efficacy of access control strategies during the post-construction monitoring phase.

PTP will implement an Access Management Plan, but a potential residual effect of the Project may be occasional unauthorized motorized use of the proposed Burnie-Shea protected area and Herd Dome ASMZ in the medium-term, until vegetation regrows and blocks access. Increased access, if it occurs, is not consistent with stated management intent or the *Morice LRMP* in the proposed Burnie-Shea protected area of the Herd Dome ASMZ with respect to summer-motorized use. ***The following***

residual effect has been identified: unauthorized motorized use of the proposed Burnie-Shea protected area and Herd Dome ASMZ.

The Project will cross the Thautil-Gosnell and Morice River ASMZs in the *Morice LRMP* area. PTP has conducted extensive fisheries investigations in these areas. PTP will implement a Restoration Plan to minimize effects on fish, wildlife, and vegetation. In the Morice River ASMZ, the Project has been located outside of the Morice River floodplain, where feasible, and new road construction will be minimized in the Morice 100-year floodplain. Visual management strategies, such as vegetation replanting, will be used to minimize long-term disruption of important viewscapes. (See Section 7.2.13 Aesthetics and Viewsheds). Re-activiated and new access routes will be restored once Project construction is complete. During clearing, construction, and restoration, access will be maintained to recreation features, where feasible. With the implementation of these mitigation measures, the Project complies with existing plans. ***No residual effect has been identified.***

The Project will cross the Nourse-Allin-Maxan Trail and Tchesinkut Lake Recreation Emphasis Zones identified in the *Lakes LRMP*. The Project will be constructed in ways that minimize impacts to public recreational values and outdoor recreational opportunities in these recreation zones. Visual management strategies, such as vegetation replanting, will be used to minimize long-term disruption of important viewscapes. (See Section 7.2.13 Aesthetics and Viewsheds). Temporary access routes will be deactivitated and sites required to construct the Project will be restored once Project construction is complete. During clearing, construction, and restoration, recreation opportunities and access roads to important recreation features will be maintained to the extent feasible. The Project mitigation measures will be used to minimize effects of recreation and ensure the Project is consistent with the *Lakes LRMP* management policies. ***No residual effect has been identified.***

b. Potential Effect: Conflict with future industrial land use adjacent to the project route in the Kitimat Valley

Blasting and construction will be restricted near the pipeline once the Project is complete. Planners in the District of Kitimat have indicated that the location of the Project in lands identified for potential future heavy industrial development may introduce limitations to the siting of industrial operations. PTP will undertake discussions with landowners and municipal planners responsible for the Terrace Rural OCP and District of Kitimat OCP during detailed Project design to identify ways to minimize potential disruption of future industrial development. The potential effects of the Project on future industrial development is considered to be reversible in the short-term, and of low magnitude. Pipelines throughout Canada are located near to industrial facilities, and Project effects are not expected to inhibit development. ***No residual effect has been identified.***

c. Potential Effect: Infringement on provincially designated Old Growth Management Areas

The Project will cross eight provincially designated Old Growth Management Areas (OGMAs) for a total distance of 2.3 km. PTP has avoided locating the pipeline route through OGMAs, where feasible. In cases where OGMAs will be crossed, PTP will work with the Integrated Land

Management Bureau (ILMB) to identify suitable mitigation and compensation measures. Discussions with provincial staff have indicated that the OGMAs affected by the Project could be replaced by designating replacement areas. Discussions between PTP and ILMB are expected to reach a satisfactory conclusion, so ***no residual effect has been identified.***

d. Potential Effect: Infringement on provincially designated Mountain Goat Ungulate Winter Range Areas

The Project crosses one provincially designated Ungulate Winter Range (UWR) Area twice, for a total length of 2.1 km in the area between KP 85.1 and KP 95.2.

PTP has undertaken studies to identify mountain goat winter habitat in areas crossed by the pipeline route outside of the identified UWR (See Section 7.2.4 Wildlife Habitat). Studies have indicated that areas of primary concern crossed by the pipeline route are located from KP 76.5 to KP 80.6 and KP 99.0 to KP 99.1 (See Section 7.2.4 Wildlife Habitat).

The general wildlife measures outlined in UWR orders are primarily related to forestry activities. The wildlife measures in the UWR order do not apply when activities have been authorized for development under the *Pipeline Act* (See Section 7.2.4 Wildlife Habitat for a discussion of mitigation strategies for potential alteration to wildlife habitat). ***No residual effect has been identified.***

e. Potential Effect: Conflict with forest licensee operational plans and commitments

The Project crosses forestry tenures that include Tree Farm Licenses, non-replaceable timber licenses, community forests, and woodlots. Most of the areas crossed by the Project are covered by forest development plans. Approval of the Project may result in forest licensees being required to undertake additional planning in order to adhere to provincial forest objectives and designations, meet other existing commitments, or revise forest harvesting plans. The Project may be located in areas planned for future forestry road construction, requiring licensees to review and amend these plans.

PTP will discuss planning issues with forest licensees, and will negotiate agreements where applicable. One Master License to Cut for the Project will be discussed with the OGC and the BC MOFR to minimize planning costs for licensees.

PTP will provide forest licensees with information and protocols regarding timeframes for approval of pipeline crossings, weight restrictions, standard operating procedures, and blasting restrictions. Discussions between PTP and forest licensees will be held to discuss outstanding concerns. Negotiated agreements, where applicable, are expected to minimize effects related to alterations of forest plans. The effect is expected to be reversible in the short-term, of low magnitude, and fully mitigatable. ***No residual effect has been identified.***

Current Use of Land and Resources

f. Potential Effect: Permanent loss of harvestable timber from the Project ROW

Trees will be permanently removed from the Project ROW, as operation of the Project requires trees to be cleared from land over the pipeline on a permanent basis. Approximately 620 ha (based on an 18 m wide ROW) of forested land could be permanently removed from the commercial forest land base for the Project ROW. These forest lands could include areas with previous silvicultural investments.

PTP will work with BC MOFR and tenure holders to ensure appropriate recovery, handling, and processing of salvageable and beetle killed wood from the Project ROW. PTP will also communicate with BC MOFR to discuss hauling restrictions for beetle-infested trees. PTP will discuss mitigation and possible compensation measures with forest tenure holders for demonstrated economic losses due to expedited timber harvest, increased operational costs, reduced cut, or loss of investments in silviculture treatment stands.

The permanent loss of timber producing capacity is an irreversible effect, as commercial forests will not be replanted on the Project ROW. The magnitude is considered low, given the relatively small area of forest land affected. With the implementation of negotiated agreements for economic losses associated with the Project, the effects are considered permanent, but low in magnitude. ***The following residual effect has been identified: permanent reduction in commercial timber producing capacity on the Project ROW.***

g. Potential Effect: Temporary removal of timber from project working space and temporary facilities

Temporary timber clearing will occur on approximately 760 ha of forested land to be used for construction working space, storage areas, construction camps, and other temporary facilities. These forest lands could include areas with previous silvicultural investments. Storage areas, construction camps, and temporary facilities will be located in disturbed areas or other areas acceptable to the BC MOFR to minimize forest impacts, particularly on non-pine timber supply.

PTP will work with BC MOFR and tenure holders to ensure appropriate recovery, handling, and processing of salvageable wood from the working space. PTP will discuss mitigation and possible compensation measures with forest tenure holders for demonstrated economic losses due to expedited timber harvest, increased operational costs, reduced cut, or loss of investments in silviculture treatment stands. In these areas, Project restoration will ensure that appropriate tree species are replanted to restore the productive forest, as directed by BC MOFR and the OGC. Through the implementation of agreements with forest licensees, the effects of the Project are considered reversible in the short-term and low in magnitude. ***No residual effect has been identified.***

h. Potential Effect: Disruption of forestry operations

Construction of the Project will require access on Forest Service Roads (FSRs). In some areas, the Project will be constructed adjacent to FSRs. Project clearing, construction, and restoration may require forestry operations to temporarily use alternative access routes due to road closures. The Project may also introduce temporary delays for forestry operations.

A Traffic Management Plan will be implemented to maintain safe and efficient traffic movement for forestry operations, especially in areas where roads are heavily used. The Traffic Management Plan will address safety measures designed to minimize risks to operators, other road users, the public, and residents located near the Project. The Access Management Plan will reduce areas of potential conflict between forestry operation and pipeline construction, and to minimize future pipeline crossing issues.

PTP will develop a Communication Plan to share schedules, maps, and other relevant Project information with BC MOFR District Offices, BC MOFR Regional Protection Office, and forest licensees. The sharing of information (described in the KSL Communication Plan) will ensure the notification of forest tenure holders prior to the commencement of land clearing and construction activities.

PTP will develop Road Use Agreements (RUAs) with permit holders for roads potentially affected by the Project. Discussions with licensees will address Project schedules, timeframes necessary for access, expected traffic volumes and timing, road maintenance, road upgrades planned by PTP and licensees, road safety issues and signage, radio frequencies and protocols, and load, weight, and blasting restrictions, where applicable. PTP will leave FSRs and other roads used for construction in a condition equal to, or better than, the pre-construction condition.

Signage will be used on highways and main FSRs to alert users about construction activities, the presence of heavy equipment, radio frequencies, and main access points to the Project. Most Project effects will be reversible in the short-term, and of low magnitude. However, some Project effects on road use may remain as a result of temporary road closures, traffic delays related to road upgrades, and Project construction activities. ***The following residual effect has been identified: construction phase traffic effects on FSRs and forestry operations.***

i. Potential Effect: Loss of, or damage to, existing forest research plots

The pipeline route crosses an established long-term tree species forestry trial for 300 m, between KP 26.0 and KP 26.3. PTP will reroute the Project to establish a 50 m minimum buffer between the pipeline route and the forest research plot. Due to the relocation of the pipeline route to avoid the research plot, the effect will be avoided. ***No residual effect has been identified.***

j. Potential Effect: Increased risk of forest fire due to project construction

The clearing, construction, and restoration phases of the Project may increase the risk of forest fire. PTP will implement a Forest Fire Prevention Plan that specifies how the requirements of the *Wildfire Act* will be met, including measures for slash handling and storage, burning procedures, and fire-

fighting crew access. Crews responsible for slash burning and construction will have appropriate fire-fighting equipment onsite to respond to fires that may be related to Project activities. PTP will ensure that appropriate Project construction personnel participate in fire training. The presence of heavy equipment onsite during construction contributes to the ability of Project workers to respond effectively to forest fire on or near the route. Advance clearing is planned, which will reduce combustion materials on site during construction.

PTP will communicate regularly with the BC MOFR Regional Protection Office in Prince George and the Regional Fire Centres to share information, discuss Project scheduling, and address concerns. Additional communication may be required during the primary fire season from April 15 to October 15. With the implementation of proposed mitigation measures, the effects of the Project are considered to be of low magnitude, and reversible in the short-term. ***No residual effect has been identified.***

k. Potential Effect: Inconvenience to landowners in the Project LSA

Portions of the pipeline route will be constructed on private land used for agriculture, forestry, rural residences, and light industrial activities. Project clearing, construction, and restoration may cause disruption to existing activities in the short-term. Local access may be temporarily disrupted for private landowners, including industrial operators.

PTP will consult with private landowners to determine and resolve concerns associated with clearing, construction, and restoration activities, and provide Project scheduling and other relevant information. Noise may be generated near residences during the construction phase. (See Section 7.2.11 Human Health and Safety). PTP will implement an Access Management Plan to minimize disruption to landowners during Project clearing, construction, and restoration periods.

PTP will negotiate agreements with landowners for land use effects and related economic losses related to inconveniences caused by construction and operation of the Project. Effective communication, implementation of an Access Management Plan, and negotiated agreements for economic losses with landowners will ensure Project effects are short-term and of low magnitude. ***No residual effect has been identified.***

l. Potential Effect: Disruption of aggregate pits.

The Project will avoid construction in active aggregate pits, where feasible. Nonetheless, the Project Footprint crosses 38 areas currently identified as pits or quarries (of which most are inactive). Forest companies and other users have stated that few good aggregate resources are available in the Project RSA. PTP will discuss mitigation measures with aggregate producers for economic losses, if any, related to construction of the Project in aggregate pits.

The pipeline route crosses an active aggregate removal operation at KP 2.5. The operator has expressed concern about the effect of the location of the Project on potential aggregate development plans. PTP will engage the aggregate operator to explore concerns with current Project

routing. Through negotiated agreements with aggregate producers, the effects of the Project are expected to be reversible in the short-term and low in magnitude. ***No residual effect has been identified.***

m. Potential Effect: Conflicts with mineral claims and operations

Mineral exploration, and mining activities such as digging, drilling, or blasting will be restricted near the pipeline route during construction and after Project completion. Mineral claim holders will be identified and contacted prior to clearing and construction to confirm the status and specific location of their tenures. Relevant information, such as routing and scheduling, will be provided. Representatives from Endako and Huckleberry Mines will be notified prior to construction, as the pipeline will be cross under the access roads to these mines.

During Project clearing, construction, and restoration, access to mineral claims along existing roads, trails, and informal pathways may be intermittently disrupted. PTP will discuss access needs for mineral claim holders and develop agreements where required. Once construction and restoration are complete, existing access routes will be returned to their former condition, or better. Through consultation with mineral claim holders, and the implementation of appropriate mitigation measures, the Project effects are reversible in the short-term, and low in magnitude. ***No residual effect has been identified.***

n. Potential Effect: Disruption of agricultural production

The Project crosses 40.7 km of land designated under the Agricultural Land Reserve (description in Section 6.8). The Project crosses other agricultural lands, primarily east of KP 240. Project impacts on agricultural operations will vary depending on construction timing, but potential issues could include disruption of crop production, and decreased agricultural productivity as a result of disruption to soil horizons, drainage, erosion, and soil compaction.

Soil productivity will be restored to pre-construction conditions in agricultural areas crossed by the pipeline route after the Project is completed. (See Section 7.2.1 Geophysical and Soil Environment). Agricultural crop producers near the pipeline route will be notified of Project schedules and routes prior to the commencement of clearing and construction. Incidental damage to agricultural irrigation or drainage infrastructure will be repaired. PTP will negotiate compensation with landowners or leaseholders for demonstrated economic losses related to construction of the Project. The Project effects are considered reversible in the short-term and of low magnitude once mitigation measures have been implemented. ***No residual effect has been identified.***

o. Potential Effect: Disruption of ranching activities

Ranchers may experience disruption of grazing activities and hindered livestock movement during Project clearing, construction, and restoration, especially if these activities occur during the late spring, summer, and early fall when most grazing occurs.

Advanced notification of Project routing and construction scheduling will be provided to affected landowners to enable alternative arrangements to be made for continued operations, and to ensure livestock safety during the clearing, construction, and restoration periods. Where disruption of cattle water sources occurs, PTP will provide alternative water sources. Access requirements for ranching operations will be identified. Soils disturbed by the Project on forage producing lands will be restored to pre-construction productivity levels (See Section 7.2.1 Geophysical and Soils Environment).

Removal of natural barriers and fencing during Project clearing, construction, and restoration could allow cattle drift (movement outside of preferred grazing areas). PTP will install, repair, or reinforce existing fencing and gating where necessary to protect livestock safety and limit livestock movement to new areas during the construction period. Construction workers will close all gates during Project construction. PTP will install new fences where natural barriers to livestock movement are removed. Weed control measures will be used to minimize the transfer of weeds to ranch land along the Project ROW. With the implementation of the mitigation measures, the Project effects are considered to be reversible in the short-term, and low magnitude. ***No residual effect has been identified.***

p. Potential Effect: Construction phase disruption of commercial fish, wildlife, and other nature-based operations

Construction of the pipeline route may temporarily disrupt fish, wildlife, and nature-based commercial operations on the 44 registered traplines, 11 guide-outfitting territories, 5 commercial recreation tenured sites, 2 popular guided fishing destinations, and tourism operations that rely on access to the Project LSA. An Access Management Plan will be implemented to minimize access disruptions to commercial operations. Visual management strategies, such as vegetation replanting, will be used to minimize long-term disruption of important viewscapes.

Commercial recreation operators, tourism operators, trappers, and guided hunting and fishing operators will be contacted before Project clearing and construction to advise them about Project scheduling and route location, and allow operators to remove traps and other equipment from the pipeline route. The Project workforce will not disturb cabins, trapline equipment, or facilities associated with trapping, guide outfitting, and tourism operations along the pipeline route. A Construction Waste Management Plan will be developed and implemented to minimize risk to wildlife and potential aesthetic effects from litter.

Implementation of a Restoration Plan will help to minimize long-term Project effects on fish, wildlife, and nature-based commercial operations. PTP will discuss mitigation options with commercial recreation and tourism operators, trappers, and guided hunting and fishing operators for demonstrated economic loss associated with Project activities. The Project mitigation measures are designed to reduce effects on fish, wildlife, and nature-based operations, yet disruption may still occur. The Project effects are considered medium-term and medium in magnitude. ***The following residual effect has been identified: construction phase disruption of commercial fish, wildlife, and nature-based operations.***

q. Potential Effect: Construction phase disruption of public recreation use

The pipeline route crosses or is located near recreational features including trails, recreation sites, snowmobiling routes, access routes, and rivers and lakes used for paddling and fishing. Clearing, construction, and restoration activities may introduce physical disturbance, auditory, visual, or access disruption of recreation features.

PTP will make construction schedules and other relevant information on anticipated trail closures available to hiking, snowmobile, cross-country ski, mountaineering, and other outdoor clubs, and to visitor centres to reach the general public and visitors. Signage will be used to inform recreationists of the presence of construction activity, and potential noise disturbance on access roads, near recreation features, and on waterbodies used by recreationists. Sites and trails disturbed by the Project will be restored, to the extent feasible, to their pre-construction condition. PTP will implement a Restoration Plan to revegetate the pipeline route and working space. Visual management strategies, such as vegetation replanting, will be used to minimize long-term disruption of important viewscapes. (Section 7.2.13 Aesthetics and Viewsheds).

PTP's river-crossing techniques will minimize effects on recreation users. PTP will adhere to the Navigable Waters Approval conditions on identified waterbodies.

The foregoing mitigation will reduce the overall Project impact on recreationists, yet a residual effect is expected. ***The following residual effect has been identified: construction phase disruption of public recreation use.***

r. Potential Effect: Disruption of recreational activity at unnamed lake located 525 m from the Compressor Station site.

An unnamed lake is located 525 m north of the compressor station site. No information is known about current recreational activities and use levels. PTP will use signage to inform potential users of construction activities. Through the use of signage, alerting users to construction activities near the lake, ***no residual effect has been identified.***

s. Potential Effect: Disruption of seasonal hunting activities

Hunting is an important seasonal activity for residents of the RSA. The primary hunting season is the late summer and fall in most areas. The Project may introduce noise, and restrict access in localized areas during the construction phase.

PTP will use signage and public service announcements to inform users of the presence of construction activity in popular hunting areas and along access roads to hunting areas. Hunting activities will still be permitted near the pipeline route, but will be directed outside of a 1 km buffer through signage. An Access Management Plan will be implemented to minimize unintended motorized access during and after construction along the pipeline route. A Construction Waste Management Plan will be employed to ensure appropriate waste management at the Project site. After Project completion, disturbed sites and trails will be rehabilitated to their pre-construction condition, to the extent feasible.

With the implementation of the foregoing mitigation measures, including signage and implementation of an Access Management Plan, ***no residual effect has been identified.***

Domestic Water Supply and Quality

t. Potential Effect: Alteration of domestic surface water supply and quality for downstream users

Alteration of surface water supply and quality during clearing, construction, and restoration activities may occur through:

- sediment input to streams during land-based clearing, construction, and restoration activities (*e.g.* excavation, grading, blasting),
- contamination of watercourses from accidental spills or leaks from construction equipment,
- sediment input to streams during construction of pipeline water crossings, and
- alteration of water supply and quality during hydrostatic testing.

PTP will implement the following mitigation measures to minimize effects of the alteration of surface water supply and quality:

- identify the location of registered and unregistered points of diversion within 200 m downslope and 100 m upslope of clearing, construction, and restoration activities;
- monitor pH, turbidity, total dissolved solids, total suspended solids, and true colour at these locations before, during, and after construction; if blasting will occur in the area, also monitor nitrates;
- implement and adhere to a Hazardous Waste Management and Spill Plan and Emergency Response Plan;
- implement and adhere to a Surface Water Quality and Sediment Control Plan;
- select appropriate waterbody crossing techniques to minimize the risk of sedimentation to the extent practicable;
- implement and adhere to a Hydrostatic Test Plan; and
- provide potable water to residents if water supply is degraded.

Following mitigation, the potential effect of land clearing, construction, and restoration activities on sediment input to watercourses is reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

Contamination of watercourses from accidental spills or leaks will be minimized or avoided through the implementation of a Hazardous Waste Management and Spill Plan and Emergency Response

Plan. If a spill or leak does occur, it will be immediately identified, contained, and cleaned up. The likelihood of a spill is very low. The effect is reversible in the short term and of low magnitude. ***No residual effect has been identified.***

Appropriate crossing techniques will be used to minimize the risk of sedimentation during construction of pipeline water crossings. Nonetheless, a residual effect is expected. ***The following residual effect has been identified: brief, low level increases in domestic water turbidity associated with the installation and removal of dams, flumes, and pumps near surface water points of diversion.***

A Hydrostatic Test Plan will contain protection measures designed to control soil erosion and to prevent contamination of waterbodies or watercourses. Adherence to this plan will ensure that the effect of hydrostatic testing is reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

u. Potential Effect: Alteration of water well flow and quality

Trenching, blasting, and soil replacement may, in unusual circumstances, interrupt groundwater flows to shallow wells or result in sediments or nitrates entering the wellwater. PTP will implement the following mitigation measures to minimize effects of the alteration of water well flow and quality:

- identify the location of registered and unregistered water wells within 200 m downslope and 100 m upslope of clearing, construction, and restoration activities. Ten registered wells are known to be located within 200 m of the pipeline route.
- monitor pH, turbidity, total dissolved solids, total suspended solids, and true colour before, during, and after construction;
- monitor nitrate levels in water wells within 200 m of blasting sites before and after the blasting occurs;
- install cross ditches, trench breakers, or subdrains where substantial subsurface seepage is encountered at depth on sloping terrain;
- implement and adhere to a Hazardous Waste Management and Spill Plan and Emergency Response Plan;
- implement and adhere to a Surface Water Quality and Sediment Control Plan; and
- provide potable water to residents if water supply is degraded.

Although mitigation will minimize the potential effect, a residual effect is expected. ***The following residual effect has been identified: water well flows and quality may be affected by construction.***

Contaminated Sites

- A Site Registry search identified two sites in the Project Footprint that had previously been investigated for contamination issues, including the Eurocan Mill Site between KP 0 and KP 2, and the electric sub-station complex at KP 296.

v. Potential effect: Disturbance of previously contaminated soil

Disturbance of previously contaminated soil during clearing, construction, and restoration activities could harm workers and release contaminants, such as Polychlorinated Biphenyls (PCBs) or Extractable Petroleum Hydrocarbons, into air or water.

PTP will implement the following mitigation measures to minimize effects from disturbance of previously contaminated soil:

Eurocan Mill Site, Kitimat, and electrical sub-station complex, Fraser Lake

- determine boundaries of contamination and avoid, where feasible;
- if contamination is encountered during Project construction, ensure a qualified environmental consultant conducts a Detailed Site Investigation (DSI) before construction continues; and
- dispose of contaminated material disturbed by Project activities in accordance with BC Contaminated Sites Regulation;

Unregistered Sites of Concern

- if contamination is encountered along the pipeline route, ensure a qualified environmental consultant conducts a Detailed Site Investigation before construction continues; and
- dispose of contaminated material disturbed by Project activities in accordance with BC Contaminated Sites Regulation.

Following mitigation, potential effects from exposure of contaminants during soil disturbing activities are expected to be reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

Methanex Lateral

w. Potential Effect: Conflict with land use zoning and proposed road alignment

The Methanex Lateral connects the existing PNG pipeline at the Methanex plant to the KSL pipeline route at KP 0.3. The *Kalum LRMP* identifies the area crossed by the lateral as private land. The *Kalum SRMP* provides no additional management direction. The District of Kitimat OCP designates the land crossed by the lateral as Industrial. Discussions with District of Kitimat planners identified the lands as suitable for manufacturing activities. The main concern expressed by District of Kitimat planners is that a Harbour Road is likely to be built across the lateral at some point in the future. The timing of Harbour Road construction is unknown, and a specific route is undetermined at this time. Planners request that the lateral be designed and built in a way that would allow the new road

to be constructed. PTP is prepared to develop an agreement with the District of Kitimat to ensure future road alignments can cross the lateral at a specific, mutually acceptable, location. ***No residual effect has been identified.***

Compressor Station

x. Potential Effect: Conflict with land use zoning

The Compressor Station site at KP 246.5 is located in the General zone of the *Lakes LRMP*, which would allow the construction of the Compressor Station. The site is also contained in Electoral Area E-Francois-Ootsa Rural OCP area in the Regional District of Bulkley-Nechako. Area E does not have a Rural OCP. The Compressor Station is consistent with the applicable zoning, so ***no residual effect has been identified.***

y. Potential Effect: Permanent loss of forested land

The Compressor Station will be constructed on forested land at KP 246.5. Trees on the site have been logged in the recent past. PTP will develop agreements with the forest tenure holder for the loss of future forest production on this site. ***No residual effect has been identified.***

z. Potential Effect: Temporary disruption of seasonal hunting activity in the immediate vicinity of the Compressor Station

The clearing and construction activity for the Compressor Station may introduce temporary noise. In addition, hunting restrictions may be applied adjacent to the site at KP 246.5 to protect human safety. Through the implementation of the mitigation measures in Section 7.2.8, including signage, ***no residual effect has been identified.***

aa. Potential Effect: Increased risk of forest fire due to Compressor Station construction

Clearing and construction of the Compressor Station may increase the risk of forest fire. The mitigation measures that will be put in place are discussed in "Increased risk of forest fire due to Project construction" however, the risk is considered to be low. ***No residual effect has been identified.***

bb. Potential Effect: Potential disruption of recreational activity at unnamed lake

The Compressor Station site is located 525 m south of an unnamed lake. No recreational activity is known to occur on this lake. PTP will use signage to inform potential users of the lake of construction activity. ***No residual effect has been identified.***

cc. Potential Effect: Alteration of surface water supply and quality for downstream users and alteration of water well flow and quality

See above: Domestic Water Supply and Quality

dd. Potential Effect: Potential disturbance of previously contaminated soil

See above: Contaminated Sites

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual Effect: Unauthorized motorized use of the proposed Burnie-Shea Protected Area and Herd Dome ASMZ

PTP will implement an Access Management Plan and conduct monitoring, but a potential residual effect of the Project may be unauthorized motorized use of the Proposed Burnie-Shea protected area and Herd Dome ASMZ in the medium-term as vegetation regrows. PTP will implement a Restoration Plan, and at strategic access points install physical and vegetation barriers to help prevent unauthorized motorized access. PTP will provide financial resources to monitor unauthorized motorized use in the proposed Burnie Shea protected area and Herd Dome ASMZ and assess the efficacy of access control strategies to minimize unauthorized access. The number of potential motorized users is considered low, due to isolation, difficulty in crossing the Burnie River, and steep, rugged topography. The residual effect is considered to be reversible in the long-term, and is of medium magnitude. ***The residual effect is less than significant.***

b. Residual Effect: Permanent reduction in commercial timber producing capacity on the Project ROW

The Project will permanently remove approximately 620 ha of land (based on an 18 m wide ROW) from the forest land base. The Project ROW will not be replanted with commercial tree species, and therefore, the loss of forested land on the ROW will be a permanent effect. Negotiated agreements will be developed with forest licensees to provide compensation for economic losses. The residual effect is considered to be permanent, and low in magnitude. ***The residual effect is less than significant.***

c. Residual Effect: Construction phase traffic effects on FSRs and forestry operations

The FSR network in the Project RSA is extensive. These roads are used for resource-based operations, and as resident access to properties, homes, and recreational facilities. Project vehicles will use some FSRs as access routes during Project construction, and portions of the Project will be constructed adjacent to FSRs. Project clearing, construction, and restoration may require forestry operations to temporarily use alternative access routes due to road closures. The Project may also introduce temporary delays for forestry operations. An Access Management Plan, Road Use Agreements, signage, and notification of resource operators and residents will resolve most of the access-related issues. However, isolated road use overlaps may still occur between forestry operations and Project construction. Delays or other traffic conflicts will be minimized, and signage and other information will be provided to road users. The residual effect of road delays for forestry operations is considered to be short-term, and medium in magnitude. ***The residual effect is less than significant.***

d. Residual Effect: Construction phase disruption of commercial fish, wildlife, and nature-based operations

The trapping, guided hunting and fishing, commercial recreation, and tourism operations in the Project LSA require seasonal access to land and rivers crossed by the Project. Seasonal access disruptions will occur as a result of the construction of the Project. Medium-term effects in some locations will be related to improved access. While some operators view additional access as a positive benefit, others are concerned about an increase in unregulated hunting activity.

Construction of the Project will elevate noise levels in the active construction zone, and along access roads used to reach the Project construction area. PTP will contact commercial fish, wildlife, and other nature-based operations prior to construction to advise them of project scheduling, and enable them to shift operations during the Project construction phase. The pipeline route will be revegetated according to the Restoration Plan to minimize disturbance to commercial operations. Effects on wildlife habitat are discussed in Section 7.2.4.

Commercial nature-based operations may be temporarily disrupted during the construction and restoration phases as a result of access disruptions or delays, and noise disturbance. PTP will discuss mitigation and possibly compensation with commercial recreation and tourism operators, trappers, and guided hunting and fishing operators for demonstrated economic loss associated with Project activities.

The residual effect of the construction phase disruption is considered to be reversible in the medium-term, and medium in magnitude. ***The residual effect is less than significant.***

e. Residual Effect: Construction phase disruption of public recreation use

In some cases, access to trails and recreation features may be temporarily altered. While every effort will be taken to minimize effects on recreationalists during the construction phase, it is possible that recreation could be disrupted in local areas during the Project. PTP will make construction schedules and other relevant information on anticipated trail closures available to hiking, snowmobile, cross-country ski, mountaineering, and other outdoor clubs, and provide similar information to visitor centres to reach the general public and visitors in order to minimize effects on recreationists. Signage and public service announcements will be used to inform recreational users of potential disruption of activity or noise disturbance and direct them away from active construction areas. Many alternative recreation opportunities are available to local residents and visitors during the Project construction period. The residual effect is considered to be reversible in the short-term, and medium in magnitude. ***The residual effect is less than significant.***

f. Residual Effect: Brief, low level increases in domestic water turbidity associated with the installation and removal of dams, flumes, and pumps near surface water points of diversion.

Brief, low level peaks in domestic water turbidity may occur during the construction period. The timing of instream work generally coincides with periods of low streamflow. Monitoring will be undertaken to identify and correct any sediment input resulting from construction activity. The residual effect is reversible in the immediate to short-term and of low to medium magnitude. ***The residual effect is less than significant.***

g. Residual effect: Disruption of water well flows and quality by construction

Disruption of groundwater flows and quality caused by trenching, blasting, and soil replacement can potentially result in a reduction of flow rates in a water well, which could be of importance of this affects a critical water supply. However, relatively few wells are known to exist near the pipeline route, and pipeline installation rarely affects aquifers or wells. Also, mitigation provides for rectification or compensation to the well owner and, if warranted, the provision of water of equal or better quality and quantity until repaired. The residual effect is reversible in the short-term, and of low magnitude. ***The residual effect is less than significant.***

Table 7.2-27
Effects Assessment: Land and Resource Use
Clearing, Construction and Restoration

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Land and Resource Use Plans			
Conflict with identified management policies in land use plans	KP 43.3 to KP 43.6 Kitimat Linkage Grizzly Bear Management Area (*Kalum LRMP*) KP 95.6 to KP 100.5 Proposed Burnie Shea protected area (*Morice LRMP*) KP 100.5 to KP 103.2 Herd Dome Area Specific Management Zone (ASMZ) (*Morice LRMP*) KP 103.2 to KP 128.9 Thautil-Gosnell ASMZ (*Morice LRMP*) KP 128.9 to KP 166.5 Morice River ASMZ (*Morice LRMP*) KP 225.5 to KP 226.9 Nourse-Allin-Maxan Trail Recreation Emphasis Zone (*Lakes LRMP*) KP 262.8 to KP 264.3 Tchesinkut Lake Recreation Emphasis Zone (*Lakes LRMP*)	• Minimize disruption of fish, wildlife, and vegetation (See Sections 7.2.3 Aquatic Environment and 7.2.4 Wildlife and Terrestrial Habitat) • Implement a Restoration Plan to restore disturbed areas. • Deactivate and restore temporary access routes and sites required to construct the Project once Project construction is complete. • Implement an Access Management Plan, including access control measures where needed (*e.g.* signage, road closures, snowmobile restrictions etc.) to minimize unauthorized motorized access. At strategic access points, install berms or equivalent, and plant vegetation to help prevent motorized access. • Maintain access to established recreation features, through the clearing, construction, and restoration period, where feasible. (See Section 7.3 Temporary Facilities). • Provide financial resources to monitor unauthorized motorized use in identified land management zones and to assess the efficacy of access control strategies post-construction. • Use visual management strategies to minimize long-term disruption of important viewscapes. (See Section 7.2.13 Aesthetics and Viewsheds). • Minimize new road construction in the Morice River 100-year floodplain.	Unauthorized motorized use of the proposed Burnie-Shea protected area and Herd Dome ASMZ.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Conflict with future industrial land use zoning in the Kitimat Valley	Kitimat Valley	• Undertake discussions with landowners and municipal planners responsible for the Terrace Rural OCP and District of Kitimat OCP during detailed Project design to identify ways to minimize potential disruption of future industrial development.	No residual effect identified.
Conflict with land use zoning	Methanex Lateral	• Further discuss development plans with the District of Kitimat, and ensure road development can be accommodated at some point in the future at an agreed upon location.	No residual effect identified.
Infringement on provincially designated Old Growth Management Areas (OGMAs)	KP 17.0 to KP 17.2 KP 55.7 to KP 55.9 KP 60.6 to KP 61.1 KP 63.29 to KP 63.32 KP 63.4 to KP 63.45 KP 82.8 to KP 83.2 KP 88.4 to KP 88.5 KP 226.2 to KP 227.0	• Work with ILMB to identify appropriate mitigation measures for altering OGMAs.	No residual effect identified.
Infringement on provincially designated Mountain Goat Ungulate Winter Range (UWR) areas	KP 88.4 to KP 89.5 KP 94.0 to KP 95.0	• Minimize disruption on vegetation and wildlife (See Section 7.2.4 Wildlife Habitat)	No residual effect identified.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Conflict with forest licensee operational plans and commitments	Forested Crown Land along entire pipeline route	• Undertake discussions with forest licensees to discuss planning issues. • Discuss the issuance of one Master Licence to Cut for the pipeline route with BC MOFR and the OGC to minimize planning costs for licensees. • Provide forest licensees with information and protocols regarding timeframes for approval of pipeline crossings, weight restrictions, standard operating procedures, and blasting restrictions. • Discuss mitigation measures with forest licensees for economic losses related to construction of the Project.	No residual effect identified.
Current Use of Land and Resources			
Permanent loss of harvestable timber from the Project ROW	Permanent loss of 620 ha of forested land in the Project Footprint	• Work with BC MOFR and tenure holders to ensure appropriate recovery and processing of salvageable wood from the Project ROW. • Discuss mitigation measures with forest tenure holders for demonstrated economic losses. PTP will communicate with BC MOFR to discuss hauling restrictions for beetle-killed wood.	Permanent reduction in commercial producing capacity on the Project ROW

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Temporary removal of timber from Project workspace and temporary facilities.	Temporary loss of 760 ha of forested land for working space, storage areas, construction camps, and other temporary facilities.	• Work with BC MOFR and tenure holders to ensure appropriate recovery and processing of salvageable wood from the workspace. • Locate storage areas, construction camps, and temporary facilities in disturbed areas or other areas acceptable to the BC MOFR to minimize forest impacts, particularly on non-pine timber supply. • Ensure temporary sites are replanted with appropriate tree species to restore the productive forest, as directed by BC MOFR. Communicate with BC MOFR to discuss hauling restrictions for beetle-killed wood. Discuss mitigation measures with forest tenure holders for demonstrated economic losses.	No residual effect identified
Disruption of forestry operations	2 TFLs in Project Footprint (see Section 6.8.2) 7 Woodlot Licences in Project Footprint (see Section 6.8.2) 2 Community Forests in Project Footprint (see Section 6.8.2) 14 volume-based tenures in Project LSA (see Section 6.8.2)	• Implement a Traffic Management Plan to maintain safe and efficient traffic movement for forestry operations, especially in areas where roads are heavily used. • Implement an Access Management Plan to reduce areas of potential conflict between forestry operation and pipeline construction, and to minimize future pipeline crossing issues. • Develop a Communication Plan with BC MOFR District offices, BC MOFR Regional Protection Office in Prince George, and Forest Licensees to share Project schedules, maps, and other Project information. Key elements of the plan should include notification of all forest tenure holders prior to commencement of land clearing and construction activities. • Negotiate Road Use Agreements (RUAs) with permit holders for roads potentially affected by the Project. Discuss Project schedules, timeframes necessary for access, expected traffic volumes and timing, road	Construction phase traffic effects on FSRs and forestry operations.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
		maintenance, road upgrades planned by PTP and licensees, road safety issues and signage, radio frequencies and protocols, and load, weight, and blasting restrictions, where applicable. • Leave FSRs and other roads used for construction in a condition equal to, or better than, the pre-construction atate, if desired by forest licensees and the BC MOFR. Place traffic signage on major highways and main FSRs to notify resource users of construction activities, the presence of heavy equipment, radio frequencies, and main access points to the Project.	
Loss of, or damage to, existing forest research plots	KP 26.0 to KP 26.3	• Reroute the Project to establish a 50 m minimum buffer between the pipeline route and existing forest research plot.	No residual effect identified.
Increased risk of forest fire due to Project construction	Along entire pipeline route Compressor Station	• Implement a Forest Fire Prevention Plan that specifies how the requirements of the *Wildfire Act* will be met, including measures for slash handling and burning procedures. Conduct a Fire Risk Assessment near settled areas. • Ensure slash burning and construction crews have fire-fighting equipment on site that is capable of controlling fire that may result from Project activities. Ensure that Project construction personnel participate in fire training. • Coordinate ongoing communication with the Regional Protection Office in Prince George, and the Regional Fire Centres, especially during the primary fire seasons from April 15 to October 15.	No residual effect identified.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Inconvenience to landowners in the Project LSA.	Kitimat area KP 241.0 to KP 245.0 KP 271.0 to KP 299.5 KP 307.2 to KP 351.0 KP 387.2 to KP 402.3 KP 417.8 KP 458.3 to KP 461.6	• Consult with the private landowners to determine and resolve any concerns associated with clearing, construction, and restoration activities. Provide landowners with Project scheduling and other relevant information prior to Project clearing, construction, and operation. • Minimize noise near residences (See Section 7.2.11 Human Health and Safety). • Implement an Access Management Plan to minimize disruption to landowners during the Project clearing, construction, and restoration periods). • Negotiate agreements with landowners for demonstrable economic losses caused by construction of the Project.	No residual effect identified.
Disruption of aggregate pits	38 aggregate pits cross by the pipeline route across the pipeline route	• Avoid construction of the Project in aggregate pits, where feasible. • Discuss mitigation with aggregate pit operators for economic losses related to construction of the Project. • Engage aggregate operator at KP 2.5 in further discussions to explore concerns with Project routing.	No residual effect identified.
Conflicts with mineral claims.	20 mineral claims in Project Footprint (see Table 6.8-10) 29 mineral claims in Project LSA (see Table 6.8-10)	• Notify mineral claim holders prior to commencement of land clearing and construction activities. Provide Project routing and scheduling information, as required. • Undertake discussions to identify access needs for mineral claim holders and develop agreements where required. • Return existing access routes used by the Project to their former condition or better once construction and restoration are complete. • Notify representatives from Huckleberry and Endako Mines prior to installing the pipeline under the access roads to the mines.	No residual effect identified.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Disruption of agricultural crop production.	Agricultural Land Reserve: KP 158.0 to KP 163 KP 272.9 to KP 278.9 KP 307.1 to KP 307.9 KP 326.3 to KP 327.1 KP 327.9 to KP 352.8 KP 441.0 to KP 444.2 Other agricultural lands: KP 240 to KP 244 (Highway 35) KP 270 to KP 299 (Savory Lake-Endako) KP 329 to KP 338 (Nechako River) KP 341 to KP 351 (Nechako River to Highway 27 KP 387 to KP 390 (Stuart River)	• **Notify agricultural crop producers near the pipeline route prior to commencement of land clearing and construction. Provide Project routing and scheduling information, as required, and identify specific access needs through the construction phase.** • **Restore soil productivity in agricultural areas crossed by the pipeline route. (See Section 7.2.1 Geophysical and Soil Environment).** • **Repair damage to agricultural irrigation and drainage infrastructure. Close gates and ensure animals do not stray into planted fields.** • **Implement the Soil Erosion Contingency Plan.** • **Follow a Soil Erosion and Invasive Plant Management Plan to minimize the introduction and spread of noxious weeds during Project construction activity (See Section 4.4).** • **Comply with the Agricultural Land Commission requirements regarding soil handling and reclamation during construction in the agricultural land reserve. (See Section 7.2.1 Geophysical and Soil Environment).** • **Negotiate agreements with landowners or leaseholders for demonstrable economic losses related to construction of the Project.**	**No residual effect identified.**

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Disruption of ranching activities	**KP 175 to KP 200 (South of Houston)** KP 240 to KP 245 (Bald Hill Road) KP 255 to KP 270 (Along 700 Road north of Tchesinkut Lake) **KP 270 to KP 296 (Highway 16 from Hicks Hill to Endako)** KP 296 to KP 299 (Endako River) KP 315 to KP 330 (North shore of Fraser Lake) **KP 330 to KP 351 (Nechako River floodplain)**	• Notify ranchers with property or tenures crossed by the pipeline route prior to commencement of land clearing and construction. Provide work schedules and other relevant information. • Restore soils on forage croplands crossed by the pipeline route (See Section 7.2.1 Geophysical and Soils Environment). • Where disruption of cattle water sources occurs, provide alternative water sources. • Install, repair, or reinforce existing fencing and gating where necessary to protect livestock safety and minimize livestock mobility during the construction period. Ensure construction workers close all gates during Project construction. Install new fences where natural barriers to livestock movement are removed. • Follow an Invasive Plant Management Plan to minimize the introduction and spread of noxious weeds during Project construction activity (See Section 4.4). • Implement an Access Management Plan to manage potential impacts on range tenure holders. • Discuss mitigation with ranchers for economic losses related to construction of the Project.	No residual effect identified.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Disruption of commercial fish, wildlife, and nature-based operations.	5 tenured Commercial Recreation operations (Table 6.8-14) Guided fishing on the Kitimat, Morice, and other guided rivers. Wildlife viewing operations at various locations across the LSA	• **Notify commercial recreation operators, tourism operators, trappers, and guided hunting and fishing operators prior to initiating clearing or construction activities to provide updates on project scheduling, and to allow operators to remove traps and other equipment from the pipeline route.** • **Ensure that the Project work force does not disturb cabins, trapline equipment, or facilities associated with trapping, guide outfitting, or tourism operations along the pipeline route.** • **Implement an Access Management Plan to minimize access disruptions to commercial operations. (See Access Management Plan).** • **Use visual management strategies, such as vegetation replanting, to minimize long-term disruption of important viewscapes. (See Section 7.2.13 Aesthetics and Viewsheds).** • **Implement an Construction Waste Management Plan to minimize risk to wildlife and potential aesthetic effects from litter.** • **Implement a Restoration Plan to help minimize long-term Project effects on fish, wildlife, and nature-based commercial operations. .** • **See Section 6.4 Terrestrial Environment for a discussion of Wildlife and Vegetation.** • **Discuss mitigation with commercial recreation operators, tourism operators, trappers, and guided hunting and fishing operators for demonstrated economic loss associated with Project activities.**	**Construction phase disruption of commercial fish, wildlife, and nature-based operations.**

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Disruption of public recreational use.	14 Trails crossed by the Project Footprint 9 Additional trails in Project LSA 10 Recreation Sites in Project LSA 3 Identified snowmobiling routes 1 Popular paddling lake in Project LSA 4 Popular fishing lakes in Project LSA 3 Access routes to popular paddling lakes crossed by pipeline route 5 Paddling routes crossed by pipeline route 2 Additional paddling routes in Project LSA 3 Popular fishing rivers crossed by Project Route 2 Additional popular Fishing rivers in Project LSA	• Provide construction schedules and other relevant information on anticipated trail closures to hiking, snowmobile, cross-country ski, mountaineering, and other outdoor clubs, and provide similar information to visitor centres to reach the general public and visitors. • Use signage to inform users of the presence of construction activity, and potential noise disturbance on access roads, near recreation features, and on waterbodies used by recreationists. • Restore disturbed sites and trails to their pre-construction condition. • Implement a Restoration Plan to revegetate the pipeline route and working space. • Use river-crossing techniques that minimize effects on recreational users. • Follow the Navigable Waters Approval conditions on identified waterbodies. • Use visual management strategies, such as vegetation replanting, to minimize long-term disruption of important viewscapes. (See Section 7.2.13 Aesthetics and Viewsheds).	Construction phase disruption of public recreation use.
Disruption of recreational activity at unnamed lake located 525 m from the Compressor Station site.	Compressor Station	• Use signage to inform users of the unnamed lake of construction activities.	No residual effect identified.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Disruption of seasonal hunting activities	Hunting areas and access routes to hunting areas Compressor Station	• Use signage and public announcement to inform users of the presence of construction activity in popular hunting areas and on access roads to hunting areas. • Enable seasonal hunting activities to occur outside of a designated 1 km no shooting zone along the pipeline route during Project clearing, construction, and restoration. Use signage to inform hunters of the 1 km no shooting zone. • Implement an Access Management Plan to minimize unintended motorized access. • Implement a Construction Waste Management Plan to ensure appropriate and efficient waste management. • Rehabilitate disturbed sites and trails to their pre-construction conditions.	No residual effect identified.
Domestic Water Supply and Quality			
Alteration of surface water supply and quality for downstream water users.	Points of diversion within 200 m downslope and 100 m upslope of clearing, construction, and restoration activities. Compressor Station	• Identify the location of registered and unregistered points of diversion within 200 m downslope and 100 m upslope of clearing, construction, and restoration activities. • Monitor pH, turbidity, total dissolved and suspended solids, and true colour before, during, and after construction. If blasting in the area, monitor nitrates. • Implement and adhere to a Hazardous Waste Management and Spill Plan and Emergency Response Plan. • Implement and adhere to a Surface Water Quality and Sediment Control Plan. • Select appropriate waterbody crossing techniques to minimize the risk of siltation. • Implement and adhere to Hydrostatic Test Plan. • Provide potable water to residents if water supply is degraded.	Brief, low level increases in domestic water turbidity associated with the installation and removal of dams, flumes, and pumps near surface water points of diversion.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Alteration of water well flow and quality	Water wells within 200 m downslope and 100 m upslope of clearing, construction, and restoration activities. Compressor Station	• Identify the location of registered and unregistered water wells within 200 m downslope and 100 m upslope of clearing, construction, and restoration activities. • Monitor pH, turbidity, total dissolved solids, total suspended solids, and true colour before, during, and after construction. • Monitor nitrate levels in water wells within 200 m of blasting sites before and after the blasting occurs. • Install cross ditches, trench breakers, and/or subdrains where substantial subsurface seepage is encountered at depth on sloping terrain. • Implement and adhere to a Hazardous Waste Management and Spill Plan and Emergency Response Plan. • Implement and adhere to a Surface Water Quality and Sediment Control Plan. • Provide potable water to residents if water supply is degraded.	Water well flows and quality may be affected by construction.

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Contaminated Sites			
Disturbance of previously contaminated soil during construction	Eurocan Mill Site KP 0 to KP 2 Electric sub-station complex (KP 303) (Registered Site)	<u>Eurocan Mill Site and electrical sub-station complex</u> • Determine boundaries of contaminated sites and avoid, where feasible. • If contamination is encountered during Project construction, ensure a qualified environmental consultant conducts a Detailed Site Investigation before construction continues. • Dispose of contaminated material disturbed by Project activities in accordance with BC Contaminated Sites Regulation. <u>Unregistered Sites of Concern</u> • If contamination is encountered, ensure a qualified environmental consultant conducts a Detailed Site Investigation before construction continues • Dispose of contaminated material disturbed by Project activities in accordance with BC Contaminated Sites Regulation	No residual effect identified.

Table 7.2-28
Significance of Residual Effects: Land and Resource Use
Clearing, Construction, and Restoration

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Unauthorized motorized use of the proposed Burnie-Shea protected area and Herd Dome ASMZ	Project Footprint	Medium-term	Isolated	Long-term	Medium	High	Moderate	Less than significant
Permanent reduction in commercial timber producing capacity on the Project ROW.	Project Footprint	Long-term	Continuous	Permanent	Low	High	Moderate	Less than significant
Construction phase traffic effects on FSRs and forestry operations	Project Footprint	Short-term	Isolated	Short-term	Medium	Medium	High	Less than significant
Construction phase disruption of commercial fish, wildlife, and nature-based operations	Project Footprint	Medium-term	Occasional	Medium-term	Medium	High	Moderate	Less than significant
Construction phase disruption of public recreation use	Project Footprint	Medium-term	Occasional	Short-term	Medium	High	Moderate	Less than significant
Brief, low level increases in domestic water turbidity associated with the installation and removal of dams, flumes, and pumps near surface water points of diversion.	Project Footprint to LSA	Immediate to Short-term	Isolated	Immediate to Short-term	Low to Medium	Low	Moderate	Less than significant
Disruption of water wells flows and quality by construction	Project Footprint to LSA	Short-term to medium	Isolated	Medium-term	Low	Low	Moderate	Less than significant

7.2.8.2 Operations and Maintenance

POTENTIAL EFFECTS AND MITIGATION MEASURES

a. Potential Effect: Increased public use of the pipeline route

Operational activities along the pipeline route will involve the maintenance of the right-of-way, outside of the mountainous Burnie-Shea and Herd Dome region. Trees and tall vegetation will be maintained at an early seral stage (*i.e.* herbaceous and low woody vegetation only). The periodic clearing of trees and woody debris from the travel corridor areas will limit the re-establishment of natural plant communities.

Public recreation use, including motorized and non-motorized activities can be expected along the pipeline route, similar to the existing PNG route. Approximately 319 km of the 462 km pipeline route is adjacent to existing linear infrastructure, including the PNG ROW, transmission lines, and resource roads. Much of the Project area is already well-served by access roads, limiting the effect of the Project route.

Through the Burnie-Shea and Herd Dome areas, restoration will include the implementation of an Access Management Plan to minimize unauthorized public motorized use. At strategic access points in this region, PTP will install berms or the equivalent and will plant trees to limit unauthorized motorized access. PTP will also monitor unauthorized motorized use in the proposed Burnie Shea protected area and Herd Dome ASMZ and assess the efficacy of access control strategies during the post-construction monitoring phase. ***The following residual effect has been identified: use of the pipeline ROW as a public travel corridor .***

b. Potential effect: Alteration of surface water supply and quality for downstream users

Domestic surface water supply and quality may be affected by right-of-way maintenance, particularly sediment input to streams from soil disturbance related to vegetation management.

PTP will adhere to a Surface Water Quality and Sediment Control Plan and provide potable water to residents if water supply is degraded. The potential effect of maintenance activities on sediment input to watercourses is reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual effect: Use of the pipeline ROW as a public travel corridor

The cleared area along the pipeline ROW may serve as an access route for recreational activities such as skiing, snowmobiling, ATV use, and hunting. Much of the pipeline route is extensively roaded as a result of forestry activities. With an extensive network of roads and trails throughout most of the Project RSA, creation of an additional travel corridor is not expected to change the pattern or

increase the volume of unauthorized public travel. Access along the ROW will be limited where deemed appropriate ***The residual effect is less than significant.***

Table 7.2-29
Effects Assessment: Land and Resource Use
Operations and Maintenance

Valued Components/ Potential Effect	Location	Mitigative Measures	Residual Effects
Increased public use of the pipeline route	Pipeline route, outside of the Burnie-Shea and Herd Dome areas	• Implement a Restoration Plan to restore disturbed areas. • Implement an Access Management Plan to minimize unauthorized access. • In the Burnie-Shea and Herd Dome areas, install physical and vegetation barriers on the pipeline route to limit unauthorized motorized access. • Monitor unauthorized motorized use in the proposed Burnie Shea protected area and Herd Dome ASMZ and assess the efficacy of access control strategies during the post-construction monitoring phase.	• No residual effect identified.
Alteration of surface water supply and quality for downstream users	Points of diversion within 200 m downslope and 100 m upslope of maintenance activities.	• Adhere to a Surface Water Quality and Sediment Control Plan. • Provide potable water to residents if water supply is degraded.	• Use of portions of the pipeline ROW as a public travel corridor.

Table 7.2-30
Significance of Residual Effects: Land and Resource Use
Operations and Maintenance

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Use of the pipeline ROW as a public travel corridor	Project Footprint	Long-term	Periodic	Long-term	Medium	High	High	Less than Significant

7.2.8.3 Decommissioning and Abandonment

The decommissioning and abandonment of the KSL Pipeline will comply with the acceptable regulatory standards that are in-place at that time. The procedures followed would likely be removal of all above ground facilities and the abandonment of the pipeline in-place, with the pipe severed and sealed at strategic locations, and with the right-of-way left in its established stable condition. If required for a special concern, or by regulation, the pipeline could be removed. Consequently, decommissioning and abandonment will likely result in potential effects that are of substantially less magnitude to those which have been described for the construction of the pipeline. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards of the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Lateral

The discussion provided above is entirely applicable to the Methanex Lateral.

Compressor Station

A compressor station will likely only be abandoned if the pipeline is abandoned. Due to operational considerations, the compressor station could be idled for a considerable period if it is not required to assist with the flow of natural gas. In the case of abandonment, all of the underground piping, aboveground buildings, and facilities would be dismantled and removed from the compound. Fill and aggregate material would be removed from the site and the area would be restored for any subsequent land use. Topsoil that had been salvaged during construction would be used to restore the land. Decommissioning and abandonment will likely result in potential effects that are similar but of less magnitude to those which have been described for the construction of the compressor station. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards for the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified.***

Methanex Meter Station

See information provided above for Compressor Station.

7.2.9 Community and Regional Infrastructure and Services

7.2.9.1 Clearing, Construction and Restoration

POTENTIAL EFFECTS AND MITIGATION MEASURES

Community Utilities and Services

a. Potential Effect: Increased demand on existing emergency services

The Project will employ a large labour force during construction. Medical emergencies are an important planning consideration for an industrial project such as the KSL Project. PTP personnel will adhere to Worksafe BC safety standards for worksites during clearing, construction, and restoration phases of the Project. The Project construction force will include medical response personnel who are able to respond to medical emergencies, including full-time ambulance and First Aid personnel at Project work sites.

PTP will implement an Emergency Response Plan (ERP) for Project-related emergencies. PTP will communicate with RCMP, fire departments, and local emergency personnel to examine issues such as staffing requirements and appropriate access routes for evacuation. PTP will provide key Project contact telephone numbers, construction schedules, and Project maps with access routes to local and regional Provincial Emergency Program (PEP) Authorities, RCMP detachments, fire departments, Regional Districts, and other emergency coordinators. PTP will identify and discuss Project needs, with local and regional helicopter and small aircraft companies that serve the LSA. These mitigation measures will be implemented to ensure demands on existing emergency services are minimized. ***No residual effect has been identified.***

b. Potential Effect: Worker and project requirements for goods and services in RSA communities

During Project clearing, construction, and restoration, materials and services will be required from RSA communities. Workers may purchase local goods and services during their stay in a community or on days off. PTP will provide Project information to hotel associations, community chambers of commerce, business owners, recreation facility operators, and other relevant groups by way of newspaper ads and similar methods. The effects of the Project are short-term and medium magnitude. Some of the effects are considered to be positive, in the form of economic benefits to communities and businesses in the RSA. ***The following residual effects have been identified: construction phase increase in economic activity and business for local suppliers. An additional residual effect was identified: construction phase increase in local community population and use levels at recreational facilities and other community facilities.***

c. Potential Effect: Waste generation during clearing, construction, and restoration

Waste will be generated through the clearing, construction, and generation of the Project, and at work camps. PTP will implement a Construction Waste Management Plan to ensure appropriate and efficient waste management and will ensure compliance with existing legislation, regulations, policies, permits, codes, and orders. Waste will be disposed of in approved landfills or other

regulated facilities. Transport waste in accordance with provincial and federal regulatory requirements and local guidelines.

PTP will implement a Bear Management Plan to guide waste management practices along the pipeline route, and at temporary facilities, including work camps. With the implementation of a Construction Waste Management Plan and Bear Management Plan, Project effects are reversible in the short-term and low in magnitude. ***No residual effect has been identified.***

Accommodation

d. Potential Effect: Worker use of accommodation facilities may displace visitors

The workforce in the pipeline "spreads" will average about 300 persons, and may reside in an area for one to three months as construction progresses. The workforce will peak at 500 to 700 people, in addition to PTP's inspection and technical team of up to 80 people. Some members of the Project workforce may be housed in hotels, motels, or other facilities and rental units in RSA communities. The use of accommodation facilities by the Project workforce will increase occupancy rates. This increase in occupancy rates during the low or shoulder season could allow accommodation to reach full capacity. During peak seasons, however, full motels and hotels could prevent visitors from securing accommodation.

The Project will include the development of construction camps at KP 84 and KP 233 to house workers during construction. The construction works camps and existing accommodation facilities will ensure that worker accommodation needs will be satisfactorily met. Project effects on the visitor accommodation sector are likely to be beneficial. ***No residual effect has been identified.***

e. Potential Effect: Work camp requirement for water, sewage, and garbage disposal

The Project work camps located at KP 84 and KP 233 will require potable water, sewage management,, and garbage disposal. PTP will truck in potable water needs to the work camp. Toilets will be contained and waste will be trucked off site to a location that is acceptable to authorities having jurisdiction on these matters (i.e. no on-site waste disposal). Other wastes, including kitchen waste and garbage will be transferred to appropriate facilities off-site. A Construction Waste Management Plan will be followed to minimize potential concerns. Power generation will be provided by mobile diesel generators that meet provincial standards. As water removal, sewage treatment, and waste disposal will be conducted in accordance with accepted standards and applicable regulations. Project effects are reversible in the short-term and low magnitude. ***No residual effect has been identified.***

Transportation and Transmission

f. Potential Effect: Disruption of existing transmission lines, pipelines, and other underground services

The Project crosses and is located adjacent to existing linear features along much of the route. These features include electrical transmission lines and pipelines (including the existing PNG

pipeline), and other utility services. To minimize potential for any disruption, PTP will review its construction plans with transmission line operators, pipeline operators, and utility service providers abutting the proposed alignment, prior to construction.

The Project is expected to cross water and sewer lines in the District of Kitimat. PTP will consult with District planners to identify existing infrastructure and any specific areas of concern. Other inhabited areas of the Project LSA are primarily rural residences. PTP will identify existing infrastructure through: discussions with regional district staff and local residents; easement searches; field observations; and by other means prior to construction. PTP will acquire any necessary crossing agreements with the infrastructure owners prior to installation of each crossing.

PTP will locate and expose all known locations of underground facilities in accordance with prescribed, safe methods. To protect worker safety, flagging and signage will be used at overhead line crossings to alert equipment operators of hazards. With effective communication, co-ordinated construction, and safe construction practices, the Project effect is reversible in the short-term and low magnitude. ***No residual effect has been identified.***

g. Potential Effect: Construction across the CN rail line

The pipeline route crosses the CN Rail line four times at KP 17.0, KP 298.0, KP 457.2, and KP 460.6. The Project crossing sites on the CN Rail line will be surveyed and marked in the field prior to construction. PTP will obtain site specific crossing agreements with CN Rail prior to implementing each crossing, including exchange of key contacts in the field. During construction, PTP will maintain communications with CN Rail representatives. Project construction will be designed to avoid disruption of rail service. Typically, the pipeline will be bored beneath rail lines, causing no disruption to tracks. Careful planning and open communications with CN Rail representatives during Project construction is expected to result in low magnitude Project effects, which are reversible in the short-term. ***No residual effect has been identified.***

h. Potential Effect: Increase in traffic volumes along and across highways 37, 35, 16, 27, and 97 and other paved roads during clearing, construction, and restoration

The Project will be constructed adjacent to, and will cross, highways and other paved roads at various locations along the pipeline route. Many of these roads serve as primary travel routes for residents and industrial traffic. PTP will implement a Traffic Management Plan for highways and other paved roads to manage vehicular movements during clearing, construction, and restoration phases of the Project. An Access Management Plan will address access requirements for industrial activity.

Prior to clearing and construction, PTP will place notices in the local media, announcing Project location and construction activities. Traffic signage will be used on highways to notify the public of long-load turn-off locations and construction zones such as highway crossing locations, all in accordance with BC MOT traffic safety requirements. In an effort to minimize traffic safety concerns,

PTP will work with local traffic and law enforcement authorities to resolve any outstanding concerns. PTP will also notify local BC MOT staff and road contractors of expected schedules for arrival of labour, materials, equipment, and pipe. To the extent feasible, PTP will use CN Rail to transport materials to the Project area to reduce the number of heavy vehicles on major access routes in the RSA.

Project workers will travel from their accommodations to the worksite. To minimize the amount of traffic on roads, workers will be transported in multi-passenger vehicles, where feasible. Project-related traffic on highways and other access roads will observe all applicable traffic and road use and safety regulations. Despite the use of the mitigation strategies identified above, a residual effect is expected. ***The following residual effect has been identified: construction phase increase in traffic on highways and other paved roads.***

Methanex Lateral

i. Potential Effect: Disruption of existing transmission lines, underground services, and traffic movement during clearing, construction, and restoration

The Methanex Lateral is located adjacent to an industrial road and a transmission line. To minimize disruption, PTP will review its construction plans with the transmission line operator, and industrial operators who may need to access the area. District of Kitimat planning staff have not identified any existing infrastructure concerns to date. Planners have indicated that they may seek to build a road across the pipeline route at some time in the future. The Methanex Lateral may cross water and sewer lines. PTP will consult with District planners and engineers to prior to construction to confirm utility locations and to identify specific concerns.

PTP will locate and expose known underground facilities in accordance with prescribed, safe methods. To protect worker safety, flagging and signage will be used at overhead line crossings to alert equipment operators of hazards. With effective communication, co-ordinated construction, and safe construction practices, the Project effect is low magnitude and reversible in the short-term. ***No residual effect has been identified***

Compressor Station

No infrastructure or services are affected by the clearing, construction, or restoration of the Compressor Station. No potential effects have been identified.

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual Effect: Construction phase increase in economic activity and business for local suppliers

The Project will purchase local goods and services as the Project is constructed. PTP will provide project information to local stakeholders such as hotel associations, community chambers of commerce, business owners, recreation facility operators, and other relevant groups by means of newspaper ads and other similar methods. The residual effect will primarily occur through the

construction phase, and is medium in magnitude. This impact is considered beneficial, though ***the residual effect is less than significant.***

b. Residual Effect: Construction phase increase in local community population and use levels at recreational facilities and other community facilities.

Some Project construction staff will be housed in communities in the RSA, therefore small increases in the local population could be expected while the Project is constructed. Project workers may also use recreational facilities, and other community amenities while working on the Project. Many of the Project workers are expected to be housed in construction camps through areas with limited available accommodation, so large scale population influxes in these areas are not likely to occur. The residual effects are short-term and low in magnitude. ***The residual effect is less than significant.***

c. Residual Effect: Construction phase increase in traffic on highways and other paved roads

The Project will cross highways and other paved roads. PTP will implement a Traffic Management Plan and Access Management Plan to manage traffic and road access during the clearing, construction, and restoration phases. The residual effects of increased traffic are considered short-term, and medium in magnitude. Most of the impacts can be mitigated. ***The residual effect is less than significant.***

Table 7.2-31
Effects Assessment: Community and Regional Infrastructure and Services
Clearing, Construction and Restoration

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Community Utilities and Services			
Increased demand on existing emergency services	Along the entire pipeline route	• Adhere to all Worksafe BC safety standards for worksites during the clearing, construction, and restoration phases of the Project. • Ensure PTP medical response staff are on duty during Project construction. This will include full-time ambulance and First Aid personnel at Project work sites. • Implement an Emergency Response Plan (ERP) for Project-related emergencies. • Communicate with RCMP and fire departments, and with local emergency personnel, to examine issues such as staffing requirements, and appropriate access routes for evacuation. • Provide key Project contact telephone numbers, construction schedules, and Project maps with access routes, to Local and Regional Provincial Emergency Program (PEP) Authorities, RCMP detachments, fire departments, and other emergency coordinators. • Identify local and regional helicopter and small aircraft companies in the LSA with the capacity to serve in a rapid response emergency situation.	• No residual effect identified.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Worker and project requirements for goods and services in RSA communities	Along the entire pipeline route	• Communicate with hotel associations, community chambers of commerce, business owners, recreation facility operators, and other relevant groups to communicate Project schedules and support requirements	• Construction phase increase in economic activity and business for local suppliers. • Construction phase increase in local community population and use levels at recreational facilities and other community facilities.
Waste generation during clearing, construction, and restoration	Along the entire pipeline route	• Implement a Construction Waste Management Plan to ensure appropriate and efficient waste management. • Transport waste in accordance with provincial and federal regulatory requirements and local guidelines. Comply with other existing legislation, regulations, policies, permits, codes, and orders in effect with respect to waste management. • Implement a Bear Management Plan to minimize potential effects on bears.	• No residual effect identified.
Accommodation			
Worker use of accommodation facilities may displace visitors	Communities in the RSA	• Provide construction work camps. • Communicate with hotel associations, chambers of commerce, and other community representatives when accommodation needs and schedules are clearly known.	• No residual effect identified.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Work camp requirements for potable water, sewage management, and garbage disposal	KP 84 and KP 233	• Truck in potable water needs to the work camp • Toilets will be contained and waste will be trucked off site to a location that is acceptable to authorities having jurisdiction on these matters (i.e. no on-site disposal). • Other wastes, including kitchen waste and garbage will be transferred to appropriate facilities off-site. • Waste Management Plan will be followed to minimize potential concerns. • Ensure power generation via diesel generators that meet applicable provincial standards.	• No residual effect identified.
Transportation and Transmission			
Disruption of existing transmission lines, pipelines, and other underground services.	Along the entire pipeline route	• Review plans with abutting transmission line and pipeline operators and utility service providers prior to construction. • Work with planners in Kitimat, and other communities, as needed, to identify underground infrastructure such as water and sewer lines. • Identify existing infrastructure through discussions with regional district staff and local residents and by other means prior to construction, where required. • Locate and expose all known locations of underground facilities in accordance with prescribed, safe methods. • Use flagging and signage at overhead line crossings to alert equipment operators of hazards.	• No residual effect identified.
Construction across the CN Rail line	KP 17.0 KP 298.0 KP 457.2 KP 460.6	• Obtain site-specific crossing agreements with CN Rail. • Provide CN Rail with key Project contacts. • Avoid disruption of rail service as a result of Project construction.	• No residual effect identified.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Increase in traffic volumes along and across Highways 37, 35, 16, 27, and 97 and other paved roads during clearing, construction, and restoration.	Along the entire pipeline route	• Implement a Traffic Management Plan for highways and paved roads to manage vehicular movements during clearing, construction, and restoration phases of the Project. • Implement an Access Management Plan to address access requirements for industrial activity. • Prior to clearing and construction, place notices in local media, announcing Project location and construction activities. • Place traffic signs on highways to notify the public of long load turn-off locations and construction zones. • Provide notification to local BC MOT staff and road contractors of expected schedule for arrival of labour, materials, equipment, and pipe delivery. • Communicate with local traffic and law enforcement authorities to address outstanding traffic safety concerns. • Transport Project supplies and materials during construction on CN Rail to the extent feasible, to reduce the number of heavy vehicles on major access routes in the LSA. • Transport workers in multi-passenger vehicles to reduce traffic volume, where feasible. • Project-related traffic on highways and other access roads will observe all applicable traffic and road use and safety regulations.	• Construction phase increase in traffic on highways and paved roads.

Valued Component/ Potential Effect	Location	Mitigative Measures	Residual Effects
Disruption of existing transmission lines, underground services, and traffic movement during clearing, construction, and restoration.	Methanex Lateral	• Review plans with the transmission line operators and industrial operators who may need to access the area. • Consult with District planners to prior to construction to confirm utility locations and to identify specific concerns. • Locate and expose all known locations of underground utilities in accordance with prescribed, safe methods. To protect worker safety, use flagging and signage at overhead line crossings to alert equipment operators of hazards.	• No residual effects identified.

Table 7.2-32
Significance of Residual Effects: Community and Regional Infrastructure and Services
Clearing, Construction, and Restoration

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Construction phase increase in economic activity and business for local suppliers	RSA	Short-term	Continuous	Short-term	Medium, beneficial	High	High	Less than significant
Construction phase increase in local community population and use levels at recreational facilities and other community facilities.	RSA	Short-term	Continuous	Short-term	Low	High	Moderate	Less than significant
Construction phase increase in traffic on highways and paved roads	LSA	Short-term	Periodic	Short-term	Medium	High	High	Less than significant

7.2.9.2 Operations and Maintenance

POTENTIAL EFFECTS AND MITIGATION MEASURES

No potential effects have been identified.

SIGNIFICANCE OF RESIDUAL EFFECTS

No residual effects have been identified.

7.2.9.3 Decommissioning and Abandonment

The decommissioning and abandonment of the KSL Pipeline will comply with the acceptable regulatory standards that are in-place at that time. The procedures followed would likely be removal of all above ground facilities and the abandonment of the pipeline in-place, with the pipe severed and sealed at strategic locations, and with the right-of-way left in its established stable condition. If required for a special concern, or by regulation, the pipeline could be removed. Consequently, decommissioning and abandonment will likely result in potential effects that are of substantially less magnitude to those which have been described for the construction of the pipeline. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards of the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Lateral

The discussion provided above is entirely applicable to the Methanex Lateral.

Compression Station

A compressor station will likely only be abandoned if the pipeline is abandoned. Due to operational considerations, the compressor station could be idled for a considerable period if it is not required to assist with the flow of natural gas. In the case of abandonment, all of the underground piping, aboveground buildings, and facilities would be dismantled and removed from the compound. Fill and aggregate material would be removed from the site and the area would be restored for any subsequent land use. Topsoil that had been salvaged during construction would be used to restore the land. Decommissioning and abandonment will likely result in potential effects that are similar but of less magnitude to those which have been described for the construction of the compressor station. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards for the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified.***

Methanex Meter Station

See information provided above for Compressor Station.

7.2.10 Employment and Economy

7.2.10.1 Clearing, Construction and Restoration

POTENTIAL EFFECTS AND MITIGATION MEASURES

Local and Regional Economy

a. Potential Effect: Increased project and employee spending in communities in the RSA

Construction of the Project will require access to supplies and services that could be available through local suppliers. PTP is committed to a procurement program that actively promotes local opportunities, including Aboriginal businesses. The Project effects will primarily occur during the construction phase. ***The following residual effect has been identified: construction phase increase in local and regional business activity.***

Jobs and Labour Force

b. Potential Effect: Project construction will increase employment in communities in the RSA

Construction of the Project will require a large workforce. Many members of this workforce require specialized skills with experience in constructing pipeline projects. Other components of the workforce will not require this degree of specialization. Opportunities exist for local labour and businesses to participate in Project clearing, construction, and restoration activities. PTP will communicate with local economic development offices, First Nations, and regional employment agencies groups to describe workforce needs and identify potential opportunities for local employment. PTP has already begun this communication, and will continue to encourage local economic benefits throughout the life of the Project. ***The following residual effect has been identified: construction phase increase in local employment.***

c. Potential Effect: Increase in local employment for the construction of the Methanex Lateral and Compressor Station

Construction of the permanent facilities for the Project may require local workers to augment the specialized workforce. PTP will communicate with local economic development offices, First Nations, and regional employment agencies to identify workforce needs and identify potential opportunities for local employment. PTP has already begun this communication, and will continue to encourage local economic benefits throughout the life of the Project. ***The following residual effect has been identified: increase in local employment during construction of permanent facilities.***

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual Effect: Construction phase increase in local and regional business activity

The Project will require access to local goods and services during the Project clearing, construction, and restoration phase. The residual effect is considered short-term, beneficial, and medium in magnitude. ***The residual effect is less than significant.***

b. Residual Effect: Construction phase increase in local employment

Opportunities for local employment exist primarily during Project clearing, construction, and restoration. The Project's impact of the economies of communities along the pipeline route is considered beneficial, and of medium magnitude, but because it is short-term, ***the residual effect is less than significant.***

c. Residual Effect: Increase in local employment during construction of permanent facilities

Opportunities for local employment will exist during Project clearing, construction, and restoration. The residual effect is considered beneficial, short-term, and low in magnitude. ***The residual effect is less than significant.***

Table 7.2-33
Effects Assessment: Employment and Economy
Clearing, Construction and Restoration

Valued Components /Potential Effect	Location	Mitigative Measures	Residual Effects
Local and Regional Economy			
Increased Project and employee spending in communities in the RSA	Communities in the RSA	• PTP is committed to a procurement program that actively promotes local opportunities, including Aboriginal businesses.	Construction phase increase in local and regional business activity
Jobs and Labour Force			
Project construction will increase employment in communities in the RSA	Communities in the RSA Methanex Lateral area Compressor Station area	• PTP will communicate with local economic development offices, First Nations, and regional employment agencies to identify workforce needs and potential opportunities for local employment. • Continue to encourage local economic benefits throughout the life of the Project	Construction phase increase in local employment

Table 7.2-34
Significance of Residual Effects: Employment and Economy
Clearing, Construction, and Restoration

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Construction phase increase in local and regional business activity	RSA	Short-term	Periodic	Short-term	Medium, beneficial	High	High	Less than significant
Construction phase increase in local employment	RSA	Short-term	Periodic	Short-term	Medium, beneficial	High	High	Less than significant
Increase in local employment during construction of permanent facilities	RSA	Short-term	Periodic	Short-term	Low, beneficial	Moderate	Moderate	Less than significant

7.2.10.2 Operations and Maintenance

POTENTIAL EFFECTS AND MITIGATION MEASURES

a. Potential Effect: Increased employment and requirement for goods and services

Most of the employment generated by the construction of the Project will occur during the clearing, construction, and restoration phases; the operation of the pipeline and permanent facilities are not expected to require additional employees over the life of the Project. Operational crews may be stationed at key locations along the pipeline route. PTP will communicate with local economic development offices, First Nations, and regional employment agencies to identify workforce needs and potential opportunities for local employment.

The Project will require the purchase of goods and services from local communities periodically during the operations and maintenance phases of the Project. ***The following residual effect has been identified: purchase of goods and services from local communities.***

b. Potential Effect: Increased tax revenues to municipal and provincial governments

The Project will cross provincial and local government jurisdictions along the 462 km route. PTP will pay taxes to various municipal and provincial government bodies. ***The following residual effect has been identified: long-term payments to municipal and provincial bodies.***

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual Effect Purchase of goods and services from local communities

The requirement for goods and services will vary over time. The residual effects are considered beneficial, long-term, and low in magnitude. ***The residual effect is less than significant.***

b. Residual Effect: Long-term payments to municipal and provincial bodies

PTP will pay levies and taxes through the operations phase of the Project. The Project is estimated to generate taxes of $59.8 million for the Province of British Columbia, and an increase in local government revenues of $14.2 million. The residual will be beneficial, long-term, and medium magnitude. ***The residual effect is less than significant.***

Table 7.2-35
Effects Assessment: Employment and Economy
Operations and Maintenance

Valued Components /Potential Effect	Location	Mitigative Measures	Residual Effects
Increased employment and requirement for goods and services.	RSA	• PTP will communicate with local economic development offices, First Nations, and regional employment agencies to identify workforce needs and potential opportunities for local employment.	• Purchase of goods and services from local communities.
Increased tax revenues to municipal and provincial governments.	RSA	• PTP will pay taxes to municipal and provincial government bodies.	• Long-term payments to municipal and provincial bodies.

Table 7.2-36
Significance of Residual Effects: Employment and Economy
Operations and Maintenance

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Purchase of goods and services from local communities.	RSA	Long-term	Periodic	Long-term	Low, beneficial	High	High	Less than significant
Long-term payments to municipal and provincial bodies, along portions of the pipeline route.	RSA	Long-term	Periodic	Long-term	Medium, beneficial	High	High	Less than significant

7.2.10.3 Decommissioning and Abandonment

The decommissioning and abandonment of the KSL Pipeline will comply with the acceptable regulatory standards that are in-place at that time. The procedures followed would likely be removal of all above ground facilities and the abandonment of the pipeline in-place, with the pipe severed and sealed at strategic locations, and with the right-of-way left in its established stable condition. If required for a special concern, or by regulation, the pipeline could be removed. Consequently, decommissioning and abandonment will likely result in potential effects that are of substantially less magnitude to those which have been described for the construction of the pipeline. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards of the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Lateral

The discussion provided above is entirely applicable to the Methanex Lateral.

Compressor Station

A compressor station will likely only be abandoned if the pipeline is abandoned. Due to operational considerations, the compressor station could be idled for a considerable period if it is not required to assist with the flow of natural gas. In the case of abandonment, all of the underground piping, aboveground buildings, and facilities would be dismantled and removed from the compound. Fill and aggregate material would be removed from the site and the area would be restored for any subsequent land use. Topsoil that had been salvaged during construction would be used to restore the land. Decommissioning and abandonment will likely result in potential effects that are similar but of less magnitude to those which have been described for the construction of the compressor station. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards for the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified.***

Methanex Meter Station

See information provided above for Compressor Station.

7.2.11 Human Health and Safety

7.2.11.1 Clearing, Construction and Restoration

POTENTIAL EFFECTS AND MITIGATION MEASURES

Air Quality

a. Potential Effect: Alteration of air quality contributing to adverse health effects

The operation of heavy equipment (including excavation equipment, and grading equipment) and other construction vehicles will result in dust and the release of air contaminants, including carbon monoxide, particulate matter, sulphur dioxide, nitrogen oxides, and volatile organic compounds. Earth moving, blasting, grading, and vehicle traffic will result in fugitive dust emissions. Land clearing will necessitate open burning, which will produce smoke. Emissions-producing equipment will be working simultaneously and temporarily at various locations along the pipeline route.

Smoke, dust, and air emissions may be found bothersome and, in some instances, of concern to individuals with existing health conditions or sensitivities to poor air quality. Local air quality will be affected by construction activities. All emissions will be required to fall below provincial and federal air quality criteria and will meet WorkSafe BC standards. The criteria and standards previously mentioned represent the minimum levels at which a pollutant may jeopardize human health. By meeting these levels, the emissions, dust, and smoke resulting from the temporary construction and restoration activities are not expected to pose a danger to human health. Levels of pollution that satisfy government standards may, nonetheless, have health effects for some sensitive individuals. Fortunately, few residents live near the pipeline route to be affected by emissions or dust from construction activities.

PTP will implement an Air Quality and Dust Control Plan to reduce the effects of air emissions. PTP will maintain equipment in good condition to minimize emissions, and construction crews will minimize idling time and use multi-passenger vehicles for travel, to the extent practical, in order to limit the amount of traffic and accompanying emissions. Water will be applied to exposed soil piles in windy conditions, near residences, and in sensitive areas, and where practical, vehicle speeds will be reduced to decrease traffic-induced dust dispersion and resuspension from the operation of heavy vehicles. Where practical, and where necessary, trucks hauling sand, dirt, or loose materials will use covers over the hauled material.

PTP will conduct burning in compliance with local government bylaws, the BC Open Burning Smoke Control Regulation, and the Forest Fire Prevention and Suppression regulation.

To address potential health concerns of sensitive individuals PTP will provide notification of construction activities in areas near residences, allowing time for local residents to leave the area who may have sensitivities to reduced air quality.

Air emissions produced during construction and restoration activities will be short-term in duration, and localized. ***Despite every effort to minimize air emissions the following residual effect has been***

identified: air emissions during the clearing, construction, and restoration phase may cause irritation for some residents.

Water Quality

b. Potential Effect: Alteration of domestic surface water supply and quality for downstream users

Alteration of surface water supply and quality during clearing, construction, and restoration activities may occur through:

- sediment input to streams during land clearing, construction, and restoration activities (e.g. excavation, grading, blasting),
- contamination of watercourses from accidental spills or leaks from construction equipment,
- sediment input to streams during construction of pipeline water crossings, and
- alteration of water supply and quality during hydrostatic testing.

PTP will implement the following mitigation measures to minimize effects of the alteration of surface water supply and quality:

- Identify the location of registered and unregistered points of diversion within 200 m downslope and 100 m upslope of clearing, construction, and restoration activities;
- monitor pH, turbidity, total dissolved solids, total suspended solids, and true colour of user's water before, during, and after construction. If blasting will occur in the area, also monitor nitrates;
- implement and adhere to a Hazardous Waste Management and Spill Plan and Emergency Response Plan;
- implement and adhere to a Surface Water Quality and Sediment Control Plan;
- select appropriate waterbody crossing techniques to minimize the risk of sedimentation;
- implement and adhere to a Hydrostatic Test Plan;
- provide potable water to residents if water supply is degraded; and
    - where required, compensate affected water users.

Following mitigation, the potential effect of land clearing, construction, and restoration activities on sediment input to watercourses is reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

Contamination of watercourses from any potential accidental spills or leaks will be minimized or avoided through implementation of a Hazardous Waste Management and Spill Plan and a Emergency Response Plan. If a spill or leak does occur, it will be immediately identified, contained,

and cleaned up. The likelihood of a spill is very low. The effect is reversible in the short term and of low magnitude. ***No residual effect has been identified.***

Appropriate crossing techniques will be used to minimize the risk of sedimentation during construction of pipeline water crossings. Nonetheless, a residual effect is expected. ***The following residual effect has been identified:*** *Brief, low level increases in domestic water turbidity associated with the installation and removal of dams, flumes, and pumps near surface water points of diversion.*
A Hydrostatic Test Plan contains protection measures designed to control soil erosion and to prevent contamination of waterbodies or watercourses. Adherence to this plan will ensure that the effect of hydrostatic testing is reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

c. Potential Effect: Alteration of water well flow and quality

Trenching, blasting, and soil replacement may, in unusual circumstances, interrupt groundwater flows to shallow wells or result in sediments or nitrates entering the wellwater. PTP will implement the following mitigation measures to minimize effects of the alteration of water well flow and quality:

- locate registered and unregistered water wells within 200 m downslope and 100 m upslope of clearing, construction, and restoration activities. Ten registered wells are known to be located within 200 m of the pipeline route.
- monitor pH, turbidity, total dissolved solids, total suspended solids, and true colour of well water before, during, and after construction;
- monitor nitrate levels in water wells within 200 m of blasting sites before and after the blasting occurs;
- install cross ditches, trench breakers, or subdrains where substantial subsurface seepage is encountered at depth on sloping terrain;
- implement and adhere to a Hazardous Waste Management and Spill Plan and Emergency Response Plan;
- implement and adhere to a Surface Water Quality and Sediment Control Plan;
- provide potable water to residents if water supply is degraded; and
- where required, compensate affected well owners.

Although mitigation will minimize the potential effect, a residual effect is expected. ***The following residual effect has been identified: water well flows and quality may be affected during construction.***

Noise

d. Potential Effect: Noise resulting from project clearing, construction, and restoration

The clearing, construction, and restoration phases of the Project will generate noise in the Project LSA. Blasting and construction may be required near to permanent or seasonal residences. These residences are located primarily from KP 241.0 to KP 245.0 (Bald Hill), KP 271.0 to KP 299.5 (Tchesinkut Creek-Savory Lake-Endako), KP 307.2 to KP 392.0 (north of Fraser Lake-Nechako River-existing PNG ROW), and KP 458.3 to KP 461.6 (Summit Lake). PTP will notify residents of Project scheduling prior to clearing, construction, or restoration.

Construction of the Project will require the use of heavy machinery, which generates noise during operation. Construction machinery will be well maintained, and will use standard noise reduction technologies such as mufflers. The Project will adhere to local noise by-laws, where they are in effect. In areas close to occupied seasonal and permanent residences, where noise bylaws do not exist, construction will be conducted between the hours of 7:00 am and 7:00 pm unless otherwise approved by the appropriate authority, and except for some specific continuing activities such as pressure testing, unless otherwise approved by the appropriate authority. ***The following residual effect has been identified: construction phase increase in noise levels near permanent or seasonal residences***

Human Safety

e. Potential Effect: Risk to public safety during construction

Construction of the Project will require the use of heavy machinery, trench digging, water crossings, and will increase traffic on FSRs. Risk to public safety may increase as a result of construction activities that result in: changes in traffic movement, increased traffic levels, exposed trenches, and the presence of heavy machinery.

PTP will implement an Access Management Plan to co-ordinate access and to ensure ongoing communication between PTP staff, contactors, forestry operations, government representatives, and other resource users during the clearing, construction, and restoration phases. A Traffic Management Plan will be implemented to ensure road users are aware of safety protocols and procedures. Project vehicles will adhere to posted speed limits.

PTP will make public communication a key element in maintaining public safety. PTP will provide construction notification to local media. Signage will be used near populated areas and on access routes near the pipeline route that will be affected by Project construction or increased traffic levels, to alert the public about ongoing construction activities. Public access will be controlled near the work area to protect public safety. Fencing will be installed around the perimeter of excavations in public areas if required to meet provincial and local safety standards. With the implementation of the aforementioned mitigation, the Project effects are considered to be of low magnitude and reversible in the short-term. ***No residual effect has been identified.***

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual effect: Air emissions during the clearing, construction, and restoration phase may cause irritation for some residents

The clearing, construction, and restoration phases of the Project will release air emissions as a result of machinery, road dust from transport and soil movement, and burning. Equipment maintenance will help to reduce emissions, burning windows will be observed, and other mitigative measures taken to reduce the overall effect, though some residences may be affected. Fortunately, the Project is located away population centres, and construction periods in localized areas are relatively short. The residual effect is expected to be reversible in the short-term, and medium in magnitude. ***The residual effect is less than significant.***

b. Residual Effect: Brief, low level increases in domestic water turbidity associated with the installation and removal of dams, flumes, and pumps near surface water points of diversion

Brief, low level peaks in domestic water turbidity may occur during the construction period. The timing of instream work generally coincides with periods of low streamflow. Monitoring will be undertaken to identify and correct any sediment input resulting from construction activity. The residual effect is reversible in the immediate to short-term and of low to medium magnitude. ***The residual effect is less than significant.***

c. Residual effect: Disruption of water well flows and quality during construction phase

Disruption of groundwater flows and quality caused by trenching, blasting, and trench backfilling can reduce flow rates in a water well, which could be a concern to the owner if this occurred to a critical water supply. However, the probability of disruption of flows to water wells during construction is low because there are relatively few wells near the pipeline route, and pipeline installation rarely affects aquifers or wells. Also, mitigation provides for compensation to the well owner and, if warranted, the replacement of water of equal or better quality and quantity until repaired. The residual effect is reversible in the medium-term, and of low magnitude. ***The residual effect is less than significant.***

d. Residual Effect: Construction phase increase in noise levels during clearing and construction

The clearing, construction, and restoration phases of the Project will generate noise in the Project LSA. Most of the Project route is located away from concentrated population centres. Notification will be provided to local area residents prior to Project construction. The residual effects are expected in the short-term at specific locations, and are medium in magnitude. ***The residual effect is less than significant.***

Table 7.2-37
Effects Assessment: Human Health and Safety
Clearing, Construction and Restoration

Valued Component /Potential Effect	Location	Mitigative Measures	Residual Effects
Air Quality			
Alteration of air quality contributing to adverse health effects	Along the entire pipeline route	• Adhere to an Air Quality and Dust Control Plan. • Maintain equipment frequently to minimize emissions. • Use multi-passenger vehicles to transport crew to site to the extent practical to limit the amount of traffic and accompanying emissions. • Apply water to exposed soil piles, near residences, and in sensitive areas to reduce dust. • Reduce vehicle speeds to decrease traffic-induced dust dispersion and resuspension from the operation of heavy vehicles. • Where practical, and where necessary, ensure trucks hauling sand, dirt, or other loose materials are covered. • Provide notification of construction activities in areas near residences. Allow time for local residents to leave the area who may have sensitivities to poor air quality. • Conduct burning in compliance with local government bylaws, the BC Open Burning Smoke Control Regulation, and the Forest Fire Prevention and Suppression regulation.	Air emissions during the clearing, construction, and restoration phase may cause irritation for some residents.

Valued Component /Potential Effect	Location	Mitigative Measures	Residual Effects
Water Quality			
Alteration of domestic surface water supply and quality for downstream water users.	Points of diversion within 200 m downslope and 100 m upslope of clearing, construction, and restoration activities. Compressor Station	• Identify the location of registered and unregistered points of diversion within 200 m downslope and 100 m upslope of clearing, construction, and restoration activities. • Monitor pH, turbidity, total dissolved solids, total suspended solids, and true colour of user's water before, during, and after construction. If blasting in the area, also monitor nitrates. • Implement and adhere to a Hazardous Waste Management and Spill Plan and Emergency Response Plan. • Implement and adhere to a Surface Water Quality and Sediment Control Plan. • Select appropriate waterbody crossing techniques to minimize the risk of sedimentation. • Implement and adhere to a Hydrostatic Test Plan. • Provide potable water to residents if water supply is degraded. • Where required, compensate affected water users.	• Brief, low level increases in turbidity associated with the installation and removal of dams, flumes, and pumps near surface water points of diversion.
Alteration of water well flow and quality	Water wells within 200 m downslope and 100 m upslope of clearing, construction, and restoration activities. Compressor Station	• Identify the location of registered and unregistered water wells within 200 m downslope and 100 m upslope of clearing, construction, and restoration activities. • Monitor pH, turbidity, total dissolved solids, total suspended solids, and true colour of user's water before, during, and after construction. • Monitor nitrate levels in water wells within 200 m of blasting sites before and after the blasting occurs. • Install cross ditches, trench breakers, and/or subdrains where substantial subsurface seepage is encountered at depth on sloping terrain. • Adhere to a Hazardous Waste Management and Spill Plan and Emergency Response Plan. • Adhere to a Surface Water Quality and Sediment Control Plan. • Provide potable water to residents if water supply is degraded. • Where required, compensate affected well owners.	• Water well flows and quality may be affected during construction.

Valued Component /Potential Effect	Location	Mitigative Measures	Residual Effects
Noise			
Noise resulting from Project clearing, construction, and restoration.	Along the entire pipeline route	• Notify residents of Project scheduling prior to clearing, construction, or restoration. • Generally, confine work to between 7am and 7pm near to occupied seasonal and permanent residences (*e.g.* KP 287 to KP 291.8), unless otherwise approved by the appropriate authority. • Adhere to local noise by-laws, where in existence. • Maintain equipment, and minimize unnecessary noise through the use of standard noise reduction technologies (*e.g.* mufflers)	Construction phase increase in noise levels near permanent or seasonal residences
Human Safety			
Risk to public safety during construction	Along the entire pipeline route	• Implement an Access Management Plan to coordinate access to the pipeline route. Ensure ongoing communication between PTP staff, contractors, forestry operations, government representatives, and other resource users during the clearing, construction, and restoration phases. • Implement a Traffic Management Plan to ensure road users are aware of safety protocols and procedures. • Provide construction notification to local media. • Use signage near populated areas and on access routes near the pipeline route, that will be affected by Project construction or increased traffic levels, to alert the public about ongoing construction activities. • Install fencing around the perimeter of excavations in public areas, if required to meet provincial and local safety standards.	No residual effect identified.

Table 7.2-38
Significance of Residual Effects: Human Health and Safety
Clearing, Construction, and Restoration

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Air emissions during the clearing, construction, and restoration phase may cause irritation for some residents	LSA	Short-term	Occasional	Short-term	Medium	Low	Moderate	Less than significant
Brief, low level increases in domestic water turbidity associated with the installation and removal of dams, flumes, and pumps near surface water points of diversion.	Project Footprint to LSA	Immediate to Short-term	Isolated	Immediate to Short-term	Low to Medium	Low	Moderate	Less than significant
Disruption of water well flows and quality during construction phase	Project Footprint to LSA	Immediate to Short-term	Isolated	Medium-term	Low	Low	High	Less than significant
Construction phase increase in noise levels during clearing and construction	LSA	Short-term	Occasional	Short-term	Medium	High	Moderate	Less than significant

7.2.11.2 Operations and Maintenance

POTENTIAL EFFECTS AND MITIGATION MEASURES

a. Potential effect: Alteration of surface water supply and quality for downstream users

Alteration of surface water supply and quality during maintenance may occur through sediment input to streams from soil disturbance during vegetation management activities.

PTP will adhere to a Surface Water Quality and Sediment Control Plan and provide potable water to residents if water supply is degraded. The potential effect of maintenance activities on sediment input to watercourses is reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

Compressor Station

b. Potential Effect: Noise from the operation of the Compressor Station

The Project will require the installation of a Compressor Station at KP 246.5. The Compressor Station is a permanent facility, which will generate noise during operation. The nearest receptor is located approximately 2 km from the site. The facilities at the Compressor Station will be designed to meet noise regulation standards, as measured at the station property line.

Noise is generated at the Compressor Station from five primary sources, including the compressor building, gas turbine, compressor, piping, and during occasional gas blowdowns. The compressor building, which will house the compressor, will be designed to minimize noise escapes through roof vents and other ventilation openings in the walls.

Gas turbine noise consists of noise from the exhaust, inlet, and casing. The turbine intake and exhaust will be fitted as necessary with special silencers to limit noise radiation. The compressor piping, a major source of noise, will be buried below grade or will be acoustically insulated as necessary. Station or unit gas blowdowns can be a source of substantial noise if unsilenced. PTP will meet noise regulation standards, and measures needed may include installation of custom silencers on blowdowns for flow volumes commensurate with safely evacuating the piping systems. PTP proposes to monitor noise emissions to ensure they meet stated objectives. The mitigation listed above will greatly reduce the impact on areas surrounding the Compressor Station, however, a residual effect is expected. ***The following residual effect has been identified: long-term increase in noise levels below defined limits.***

c. Potential Effect: Lighting at the Compressor Station

PTP will install lighting at the Compressor Station site to ensure safe working conditions. PTP will minimize light pollution by using shielded lights, focusing on target areas using motion sensors. The Compressor Station will be fully lit only when necessary. ***No residual effect has been identified.***

d. Potential Effect: Air emissions from the Compressor Station

See Section 7.2.2: Air Quality

e. Potential effect: Alteration of surface water supply and quality for downstream users

Surface water supply and quality may be affected during vegetation management if sediment enters streams from soil disturbance. during vegetation management activities.

PTP will adhere to a Surface Water Quality and Sediment Control Plan and provide potable water to residents if water supply is degraded. The potential effect of maintenance activities on sediment input to watercourses is reversible in the short-term and of low magnitude. ***No residual effect has been identified.***

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual Effect: Long-term increase in noise levels

Noise will be generated by the operation of the Compressor Station. Noise levels will be reduced through the use of noise abatement technology for each noise source. Noise emissions are expected to be permanent and below acceptable standards. The residual effect is considered long-term and medium in magnitude. ***The residual effect is less than significant.***

Table 7.2-39
Effects Assessment: Human Health and Safety
Operations and Maintenance

Valued Component/ Potential Effect	Location	Mitigation Measures	Residual Effects
Noise from the operation of the Compressor Station	KP 246.5	• Design the Compressor Station to minimize noise escapes through roof vents and other ventilation openings. • Fit the turbine intake and exhaust with special silencers as needed to reduce noise radiation below specified levels. • Bury compressor piping below grade or use acoustic insulation as needed to minimize noise emissions. • Meet noise regulation standards. • Monitor noise emissions to ensure they meet stated objectives.	• Long-term increase in noise levels
Light from the Compressor Station	KP 246.5	• PTP will minimize light pollution and use motion sensors and screening. • The Compressor Station will be fully lit only when necessary	• No residual effects identified.
Compressor Station air emissions.	KP 246.5	• (See Section 7.2.2 Atmospheric Environment).	• No residual effect identified.
Alteration of surface water supply and quality for downstream users	Points of diversion within 200 m downslope and 100 m upslope of maintenance activities.	• Adhere to a Surface Water Quality and Sediment Control Plan. • Provide potable water to residents if water supply is degraded.	• No residual effect identified.

Table 7.2-40
Significance of Residual Effects: Human Health and Safety
Operations and Maintenance

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Long-term increase in noise levels	LSA	Long-term	Continuous	Permanent	Low	High	High	Less than significant

7.2.11.3 Decommissioning and Abandonment

POTENTIAL EFFECTS AND MITIGATION MEASURES

The decommissioning and abandonment of the KSL Pipeline will comply with the acceptable regulatory standards that are in-place at that time. The procedures followed would likely be removal of all above ground facilities and the abandonment of the pipeline in-place, with the pipe severed and sealed at strategic locations, and with the right-of-way left in its established stable condition. If required for a special concern, or by regulation, the pipeline could be removed. Consequently, decommissioning and abandonment will likely result in potential effects that are of substantially less magnitude to those which have been described for the construction of the pipeline. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards of the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Lateral

The discussion provided above is entirely applicable to the Methanex Lateral.

Compressor Station

A compressor station will likely only be abandoned if the pipeline is abandoned. Due to operational considerations, the compressor station could be idled for a considerable period if it is not required to assist with the flow of natural gas. In the case of abandonment, all of the underground piping, aboveground buildings, and facilities would be dismantled and removed from the compound. Fill and aggregate material would be removed from the site and the area would be restored for any subsequent land use. Topsoil that had been salvaged during construction would be used to restore the land. Decommissioning and abandonment will likely result in potential effects that are similar but of less magnitude to those which have been described for the construction of the compressor station. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards for the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified.***

Methanex Meter Station

See information provided above for Compressor Station.

7.2.12 Navigable Waters

Section 6.12 of this Application identified those watercourses that will be crossed by the KSL pipeline that are presently deemed navigable by Transport Canada – Navigable Waters Protection Division. Information was also provided on the proposed Primary and Contingency methods to be used for the watercourses crossing (see also Section 6.3). For those crossings that will require temporary instream works (i.e. temporary bridges, flumes, trenching, berms, cofferdams) PTP will require approval under the *Navigable Waters Protection Act (NWPA)*.

Table 7.2-41 provides an assessment of potential impacts to navigable waters resulting from the KSL Project. Based on the application of mitigation measures put forward, ***no significant residual effects have been identified***.

Because all of the temporary bridges will be removed following the clearing, construction and restoration phase, there will be no adverse effects during operation of the pipeline. The only bridge that is proposed to remain will be the structure over the Clore River that will support the pipeline. This structure, due to its extreme height above the river, will in no manner interfere with the navigability of the Clore River.

Should it be decided that during Decommissioning and Abandonment of the pipeline that the pipe should be removed from the watercourse crossing, PTP will again seek approval for this work from Transport Canada under the *NWPA*.

Table 7.2-41
Effects Assessment: Navigable Waters

Primary Pipeline Crossing Technique and Temporary Vehicle/Equipment Crossing Structures	Navigable Stream (KP)	Potential Effect	Mitigation Measures	Residual Effects
Flow Isolation	Unnamed Channel (KP 6.9); Little Wedeene Wetland (KP 12.2); Hunter Creek (KP 63.4); Burnie River (KP 99.6); Crystal Creek (KP 124.5); Owen Creek (KP 165.3); Allin Creek (KP 215.2); Tchesinkut Creek (KP 278.9); Salmon River (KP 430.3, KP 441.2, KP 449.2)	• Disruption of commercial guided fishing and nature-based operations. • Disruption of public recreational use of streams crossed by the Project during clearing, construction, and restoration phase. • No affects identified during operations and maintenance phase or decommissioning and abandonment phase.	• Notify commercial guided fishing operations prior to initiating construction activities to provide updates on construction scheduling. • Provide construction schedules and other relevant information to outdoor clubs and similar organizations and to Visitor Centres in order to reach the general public and visitors. • Use signage to inform river users of the presence of construction activity. • Where deemed necessary, provide information on where portages can be used to get around temporary construction activity.	No residual effect identified.
Horizontal Directional Drilling (HDD)	Little Wedeene River (KP 12.9); Wedeene River (KP 17.0); Chist Creek (KP 38.8); Unnamed Channel (KP 109.3); Gosnell Creek Side Channel (KP 109.8); Gosnell Creek (KP 110.0); Morice River (KP 130.6); Endako River (KP 297.5);	• No effects identified during all Project phases since there is no in-stream activity.	• No mitigation measures necessary.	No residual effect identified.

Primary Pipeline Crossing Technique and Temporary Vehicle/Equipment Crossing Structures	Navigable Stream (KP)	Potential Effect	Mitigation Measures	Residual Effects
	Stuart River (KP 388.9)			
Aerial Crossing	Clore River (KP 88.5)	• No effects identified all project phases since there is no in-stream activity.	• No mitigation measures necessary.	No residual effect identified.
Temporary Clearspan Bridge	Clore River (KP 88.5)	• No effects identified during all project phases since there is no in-stream activity.	• No mitigation measures necessary.	No residual effect identified.
Temporary Bailey Bridge	Burnie River (KP 99.6); Crystal Creek (KP 124.5); Salmon River (KP 430.3, KP 441.2, KP 449.2)	• Temporary disruption of public recreational use of the identified navigable streams during bridge installation and removal. • No effects identified during operations and maintenance phase or decommissioning and abandonment phase.	• Notify commercial guided fishing operations prior to initiating construction activities to provide updates on construction scheduling. • Provide construction schedules and other relevant information to outdoor clubs and similar organizations and to Visitor Centres in order to reach the general public and visitors. • Use signage to inform river users of the presence of construction activity. • Where deemed necessary, provide information on where portages can be used to get around temporary construction activity.	No residual effect identified.

7.2.13 Aesthetics and Viewsheds

7.2.13.1 Clearing, Construction and Restoration

POTENTIAL EFFECTS AND MITIGATION MEASURES

Where the route crosses forested land, new clearing for pipeline construction will be visible. The pipeline route can be seen from several viewpoints. Reducing the clearing width, whenever practical, and special restoration measures at visually sensitive areas will mitigate many of these visual impacts. During construction, new or existing overgrown access roads, shoo-flys, storage yards, camps, and other temporary sites may also be visible. These temporary facilities will be completely restored following construction. The Restoration Plan will be implemented to ensure appropriate vegetation regrowth. The shoo-flys are discussed below.

The viewpoints selected for the assessment of potential visual effects are:

- Enso Recreation Site,
- Upper Kitimat Recreation Site-Kitimat Lookout,
- Burnie River Valley,
- Morice River Valley,
- Maxan Trail,
- Tchesinkut Lake
- Short sections along Highway 16,
- Ormond Creek Trail,
- Nyan Wheti Trail,
- Omineca Trail,
- Stuart River Valley, and
- Salmon River Valley.

The criteria used to identify potential changes in the visual aesthetic conditions observed from these viewpoints include:

- existing vegetation cover (*e.g.* forested, shrubs or cleared);
- number of potential viewers;
- season when views are likely to be affected;
- viewer distance from the pipeline route or facility;
- visibility of the Project from the viewpoints;

- likelihood of visibility;
- extent and type of present landscape disturbance;
- level of scenic value identified in land use plans; and
- length of time the Project might be visible to a viewer.

During construction activities, the amount of landscape disturbance will be minimized by clearing vegetation only from areas where necessary to allow the pipeline to be safely and efficiently installed. By constructing the Project adjacent to existing linear features, including roads, power lines, and pipeline, the incremental visual impact of the Project will be reduced.

To interrupt the sight lines created by the Project, where it crosses trails and roads, special restoration measures will be employed. Foreground views will be screened to the extent practical by the creation of partial visual barriers with tree plantings and vegetated berms at selected high value sites. Willow staking along shorelines will help to mitigate potential visual effects.

a. Potential Effect: Visual disturbance of Enso Recreation Site viewpoint

Enso Recreation Site is north of Kitimat and is accessed by the Wedeene FSR. The recreation site is located approximately 400 m west of KP 18.4, and is visited in all seasons by a variety of user groups. Forest cover dominates the landscape around the recreation site. Trees on the west side of the pipeline route will help screen the disturbed area from the Enso Recreation Site. The Project may be visible to recreation site users from vantage points near the Wedeene River where it climbs the slopes of the southwest of Iron Mountain. The portions of Iron Mountain where the Project will be constructed have been logged in recent decades and the forest cover varies in maturity. Where feasible, the Project follows logging roads and previously disturbed sites. PTP will implement a Restoration Plan. Initially, glimpses of the Project may be visible as a background feature, but it will be more difficult to detect after five years of plant growth. Although snow will make the pipeline route more visible in the winter, there are fewer users of the recreation site at this time of the year. Due to the existing nature of the landscape and the restoration that will follow construction, the visual effects will be of low magnitude. ***The following residual effect has been identified: viewscape from a recreation site will be altered.***

b. Potential Effect: Visual disturbance at the Upper Kitimat Recreation Site viewpoint

The Upper Kitimat Recreation Site, south of KP 43.5, is a year-round campsite used by outdoor groups including hunters, fishermen, and ATV riders. Logging activity has extensively altered the landscape. The riverbank is thinly forested along the north side of the Kitimat River and the Project will be located north of the Kitimat Forest Service Road. Construction activities will be visible to recreation site users in the short-term. ***The following residual effect has been identified: viewscape from recreation sites will be altered.***

c. Potential Effect: Visual disturbance in the Burnie River Valley

The Burnie River Valley, KP 98 to KP 101, is an area with continuous mature forests, a wetland complex, and mountain and valley views. The area is difficult to access and is visited infrequently by hikers and cross country skiers. Portions of the shoo-fly access will be visible initially, but the disturbed area through this interval will be fully restored following construction through the implementation of a Restoration Plan. When feasible, visual buffers and existing vegetation will be preserved. Portions of the pipeline route will be visible from the Burnie River in the long-term; however, the complex topography of the landscape will reduce the visibility of the Project from the Burnie River. Mitigation measures that will be applied include replanting existing shrubs and tree species in project work area. The cleared area will be more visible when covered with snow in winter months prior to full restoration. The number of potential viewers is expected to remain low. ***The following residual effect has been identified: viewscape in the Burnie River Valley will be altered.***

d. Potential Effect: Visual disturbance in the Morice River Valley

The provincial government has established restrictive visual alteration guidelines around the Morice River to help preserve the recreation experience for visitors and local residents. Portions of the Project will cross Preservation VQOs developed by the BC MOFR. Although the Morice River drainage has been extensively logged, clearing of timber from the pipeline route may exceed the amount of clearing recommended in the Preservation VQOs. Presently, tree cover on the riverbanks is intact and provides a mature forest screen between the river and the timber harvesting and other activities beyond. Project construction activities will be visible to recreational users of the Morice FSR. Portions of the Project will be constructed across contours and over small peaks, and these sections can be glimpsed from the river between KP 134 and KP 144. Following construction, a Restoration Plan will be implemented to reduce visual effects. The existing forest will screen the Project and minimize visibility from the river. Visual effects will diminish as the vegetation planted along the pipeline route grows. Figure 7.2-1 and Figure 7.2-2 illustrate the area north of KP 131 near the Morice River. ***The following residual effect has been identified: viewscape in the Morice River Valley will be altered.***

Figure 7.2-1. Existing view to the west from the Morice River, north of KP 131.

Figure 7.2-2. Artistic rendering of the area north of KP 131 following restoration.

e. Potential Effect: Visual disturbance at the Maxan Lake Trail crossing

The Project will cross the Nourse-Allin-Maxan Trail Recreation Emphasis Zone, an area with scenic values identified in the *Lakes LRMP*. The Project will cross the Maxan Lake Recreation Trail. Between KP 224 and KP 232, the Project will be constructed through a well-forested area and the associated clearing will be visible where the trail crosses the pipeline route. The Project is within 125 m of the trail for about 400 m and clearing the Project route will result in more light and openings visible to trail users. Mitigation of visual effects will include vegetation screens and vegetated berms to limit visibility of the Project from trails. With the implementation of a Restoration Plan and other mitigation measures, the clearing will become more difficult to detect

after five years of vegetation growth. ***The following residual effect has been identified: viewscape from a hiking trail will be altered.***

f. Potential Effect: Visual disturbance of the Tchesinkut Lake viewpoint

The Project will cross the Tchesinkut Lake Recreation Emphasis Zone identified in the *Lakes LRMP*. Timber harvesting has been active in the area and cutblocks and logging roads are evident. The route is adjacent to the 700 FSR, between KP 244.5 and KP 273.5. The route may be glimpsed from Tchesinkut Lake, located 1.5 km south of the route (at the nearest point). Through this area, the terrain is complex and there are many hills between the route and the lake. The viewshed from the lake includes cutblocks and logging roads, which will mitigate the visual disturbance created by the Project, as will the vegetation growth along the route. The restoration following construction, and distance from Tchesinkut Lake will further reduce potential visual effects of the Project. ***No residual effect has been identified.***

g. Potential Effect: Visual disturbance at the Highway 16 viewpoints

The Project will be constructed adjacent to Highway 16 between KP 273.5 and KP 276.0 and will cross the highway at KP 298. People traveling on Highway 16 will see construction activities in the foreground. The Project is located along a curve in the highway, which requires motorists to slow, potentially increasing the visibility of the pipeline route. Use of the cleared shoulder as working space will help reduce the amount of forest clearing required. Implementation of a Restoration Plan will reduce visual disturbance along Highway 16. The appearance of the pipeline route will be consistent with other landscape elements once restoration work is complete. The visual screening of openings along roadways is identified in the *Lakes LRMP* as a management strategy. The use of trees and shrub planting on the ROW for visual screening where the route crosses Highway 16, will be discussed with a BC MOT representative. The visual impact of the Project will be greatly reduced after five years. ***No residual effect has been identified.***

h. Potential Effect: Visual disturbance along portions of the Ormond Creek Trail

The Ormond Creek Trail, KP 315.0 to KP 315.3, is located in the Ormond-Oona Subzone of the *Vanderhoof LRMP*. This subzone is recognized in the *LRMP* as having high visual value. The entire north shore of Fraser Lake and the rolling hills north of the lake are considered to be a scenic area. The pipeline route will cross the Ormond Creek Trail and parallel it for about 250 m. Pipeline construction will include construction adjacent to a road, with some forest clearing near the trail. This clearing activity will result in more light and openings visible to trail users. Mitigation of visual effects on trail users will include implementing a Restoration Plan and planting trees or constructing vegetated berms at trail crossings. The route will become more difficult to detect after five years of vegetation growth. ***The following residual effect has been identified: viewscape from a hiking trail will be altered.***

i. Potential Effect: Visual disturbance at the Nyan Wheti Trail

The Nyan Wheti Trail, KP 326.4, is a physically challenging 45 km route from Fraser Lake to Stuart Lake. The trail has been identified as a scenic area and has a VQO of retention. The existing PNG ROW crosses the trail. The Project will be constructed adjacent to the existing, and thereby widening the existing opening. Mitigation of visual effects on trail users will include implementing a Restoration Plan and planting trees or constructing vegetated berms at the trail crossing. The route will become more difficult to detect after five years of vegetation growth. ***The following residual effect has been identified: viewscape from a hiking trail will be altered.***

j. Potential Effect: Visual disturbance at the Omineca Trail

Omineca Trail is a heritage trail located east of Highway 27 that travels through the Blue Mountain Demonstration Forest, and further north to the Stuart River. The pipeline route crosses the trail at KP 364.4. A VQO of retention exists for the trail corridor. The pipeline route will parallel the existing PNG ROW at the trail crossing, where a foreground and mid-ground visual disturbance already exist. Mitigation of visual effects on trail users will include implementing a Restoration Plan and planting trees or constructing vegetated berms at trail crossings. The route will become more difficult to detect after five years of vegetation growth. ***The following residual effect has been identified: viewscape from a hiking trail will be altered.***

k. Potential Effect: Visual disturbance on the Stuart River Paddling Route

The Stuart River, KP 388.8, is a popular boating route and is valued by commercial guide outfitters. Most of the Stuart River shoreline has been preserved due to park designation, except for parcels of private land at the terminus of Sturgeon Point Road that include woodlots. Farmland on the south shore and the existing PNG ROW river crossing are located near the site where the pipeline route will cross the river. The Project will be visible in the foreground and mid-ground. It may also be visible in the background as it crosses a slope above the river. The present land use activities, combined with adherence to a Restoration Plan and, where feasible, the planting of screen vegetation will reduce the visual effects. Existing trees will be preserved, where feasible, and a forested screen will be planted along the northern banks of the river to reduce the visibility of the Project. The Project will become more difficult to detect after five years of vegetation growth. ***No residual effect has been identified.***

l. Potential Effect: Visual disturbance on the Salmon River Valley Paddling Route

Salmon River is navigable and an established paddling route. The nearby landscape has been altered by logging operations and other human activities. Cutblocks and logging roads are evident. Where cutblocks meet the river, some vegetation remains to help screen views from the river. The Project will cross the Salmon River three times and will be visible by river users in the foreground and mid-ground. The third crossing of the Salmon River by the pipeline route, at KP 449.2, will cross the identified Salmon River paddling route. At the KP 449.2 crossing, the Project will be located slightly downstream of the existing ROW and will therefore create a new clearing along the riverbanks. Where feasible, mitigation in the form of screening vegetation will be incorporated into restoration

plans to reduce the visibility of the crossing from the river. Figure 7.2-3 and Figure 7.2-4 illustrate the Salmon River crossing at KP 441. ***No residual effect has been identified.***

Figure 7.2-3. Existing PNG ROW and Salmon River (right bank) at KP 441.

Figure 7.2-4. Artistic rendering of existing PNG ROW and Project at Salmon River crossing (right bank) KP 441 following restoration.

Temporary Facilities

m. Potential Effect: Visual disturbance related to NARs.

Reliable and safe access is crticial to the success of project construction. Construction of the project will use existing major access roads (EMARs), existing secondary access roads (ESARs), deactivated and overgrown access roads (DOARs), and new access roads (NARs) (See Section 4.4.7). Shoo-flys are new access roads and the term is used to define a narrow road connection between an existing road and the ROW where elevation differences between the two prohibit safe access for vehicles and equipment. The remaining access roads are existing.

The Project route, outside of the mountainous regions in the western portions of the route, is heavily roaded due to past resource development. These existing roads will be used for construction to the greatest extent possible. Little to no alteration is required for EMARs and ESARs. For DOARs, road preparation activities may involve repairing bridges, realigning or rebuilding failed slopes and washouts, removing access control barriers, installation of culverts, vegetation removal and possibly resurfacing the road.

Most of the NARs are concentrated in the western section of the pipeline route. Shoo-flys will be required for access in the Upper Hoult, Clore, Burnie, and Morice areas. NARs, including shoo-flys will alter the visual lanscape in their footprint. Vegetation will be removed, and disturbance will be include the appearance of a road, visible from select locations.

All new access roads and shoo-flys will be completely deactivated following pipeline construction. Invasive vegetation will be controlled along new access routes. Seed mixtures and planting to be used to restore new access routes will be developed in consultation with resource management agency staff (MOE, and MOFR). No permanent new access will be developed for the project. ***A residual effects has been identified: disturbance of viewscapes in areas where new, temporary access roads are constructed.***

Methanex Lateral

n. Potential Effect: Visual disturbance at the Kitimat viewpoints

The Methanex Lateral will be constructed adjacent to a transmission line and an existing PNG lateral in an area of industrial development. It will also be adjacent to a road for approximately 600 m. People traveling on roads that cross the Lateral will see construction activities in the foreground. Use of the cleared shoulder for working space will help reduce the amount of forest clearing required. Implementation of a Restoration Plan will reduce the visual disturbance evident from roads crossing the Lateral. The appearance of the Lateral will be consistent with other existing landscape elements once restoration work is complete. The visual impact of the Methanex Lateral will be greatly reduced after five years of vegetation regrowth. ***No residual effect has been identified.***

Compressor Station

o. Potential Effect: Construction activities visible from nearby residences

The Compressor Station site is 2 km from the nearest residence and construction activities will not be visible from these homes. The Compressor Station will be built in a recently logged cutblock, and the surrounding forest provides a visual buffer. Equipment and materials will be transported along Highway 35 and the 700 Road. The construction activities will be short-term in duration. Lighting at the Compressor Station will be operated to minimize night-time visibility of the facility. ***No residual effect has been identified.***

SIGNIFICANCE OF RESIDUAL EFFECTS

a. Residual Effect: Viewscape from recreational sites will be altered

During the clearing and construction phase, Project-related activities will be visible from nearby campsites and public recreation locations. Following restoration of the pipeline route, according to the Restoration Plan, the visibility of the ROW will decline but may remain visible to users of campsites and recreation sites. After several years, trees surrounding the recreation and campsites, and the regeneration of vegetation along the pipeline route will create visual buffers that will screen views of the Project. The location of potentially affected sites include the Enso campsite, the Upper Kitimat, and sites located alongside the Morice River. Much of the visual effect will be reversed after five years of vegetation growth, but some effects will be longer term. Topography and ongoing alteration of the landscape by logging and other human activities will mitigate adverse effects. The residual effect is considered to be reversible in the medium-term, and low in magnitude. ***The residual effect is less than significant.***

b. Residual Effect: Views from hiking trails will be altered

During the clearing and construction phase, Project-related activities will be visible from hiking trails. The locations of potentially affected trails are the Maxan Lake, Ormond Creek, Nyan Wheti, and Omineca trails. Following restoration of the pipeline, visual effects will be reduced, but the ROW will remain visible from identified hiking trails. After several years, trees surrounding these sites and the creation of visual barriers will screen foreground views of the pipeline route and reduce the amount of light and openings in the vegetation, making the pipeline route less visible to users. The residual effect is considered to be reversible in the long-term, and low in magnitude. ***The residual effect is less than significant.***

c. Residual Effect: Viewscapes in the Burnie River and Morice River valleys will be altered

During the clearing and construction phase, Project-related activities will be visible. Following restoration of the pipeline route, shoo-flys and associated clearing will be restored and revegetated. The ROW will remain visible as vegetation regrows, although the complexity of the terrain and growth of trees bordering the ROW will limit views. After several years, restoration of the vegetation at lower

elevations will mitigate views of the pipeline route. At higher elevations, vegetation will take longer to grow and these portions of the pipeline route will remain visible after the initial clearing and construction phase is completed The residual effect is considered to be reversible in the medium- to long-term, and medium in magnitude. ***The residual effect is less than significant.***

d. Residual effect: Disturbance of viewscapes in areas where NARs are constructed.

New access roads (NARs) will be required in some areas where existing access is not available. Any new access for the Project will be temporary. Once Project construction is complete, these roads will be completely deactivated to ensure no permanent new access will remain for the project.

Shoo-flys, by definition, are constructed in steep areas. In most of the areas of the Project route where NARs, including shoo-flys, will be constructed, the terrain is challenging to access, complex topography exists, and viewership is limited. Alteration of existing viewscapes from new, temporary access roads is expected not to cause serious adverse effects for viewers. The residual effect is considered to be reversible in the long-term, as vegetation regrows, and is low in magnitude. ***The residual effect is less than significant.***

Table 7.2-42
Effects Assessment: Aesthetics and Viewsheds
Clearing, Construction and Restoration

Valued Components /Potential Effect	Location	Mitigative Measures	Residual Effects
Visual disturbance of Enso Recreation Site viewpoint	KP 18.4	• The visual impact of the Project will be mitigated by implementing a Restoration Plan. • The surrounding landscape has been extensively altered by logging roads, cutblocks, and railway. Topography and vegetation of varying ages and heights increase viewshed complexity. • The pipeline route is screened by trees along the banks of the Wedeene River and in the campsite.	Viewscape from a recreation site will be altered.
Visual disturbance at the Upper Kitimat Recreation Site viewpoint	K 43.5	• The visual impact of the Project will be mitigated by implementing a Restoration Plan. • The surrounding landscape has been extensively altered by logging roads, cutblocks, and a bridge. Topography and vegetation of varying ages and heights increase viewshed complexity. • The pipeline route is screened by trees along the banks of the Kitimat River and in the campsite.	Viewscape from a recreation site will be altered.
Visual disturbance in the Burnie River Valley	Between KP 9 and KP 101	• The visual impact of the Project will be mitigated by implementing a Restoration Plan. • Shoo-flys will be remediated.	Viewscape in the Burnie River Valley will be altered.

Valued Components /Potential Effect	Location	Mitigative Measures	Residual Effects
Visual disturbance in the Morice River Valley	KP 130 and KPO 131 KP 146 to KP 149 KP 164.5 and KP 165.5	• The visual impact of the Project will be mitigated by implementing of a Restoration Plan. • Glimpses of Project likely from the river. • The surrounding landscape has been extensively altered by logging roads, cutblocks, and bridges. Topography and vegetation of varying ages and heights increase viewshed complexity and screen the Project. • The existing forest will screen the Project and minimize visibility from the river.	Viewscape in the Morice River Valley will be altered.
Visual disturbance at the Maxan Lake Trail	Between KP 224 and KP 232	• The visual impact of the Project will be mitigated by implementation of a Restoration Plan. • The visual impact of the Project will be mitigated by planting screens of trees and shrubs at trail crossings and between Project Footprint and trail.	Viewscape from a hiking trail will be altered.
Visual disturbance from Tchesinkut Lake viewpoint	2.5 km south of KP 246.5	• Implement a Restoration Plan • The visual impact of the Project will be mitigated by distance from Project, visual disturbance created by existing land clearing activities, and complex landscapes.	No residual effect identified.
Visual disturbance at the Highway 16 viewpoints	Between KP 273.5 and KP 276 Crossing at KP 298	• The visual impact of the Project will be mitigated by implementation of a Restoration Plan. • Traffic travelling at high speed will perceive Project clearing as a widened road margin. • The viewscape is previously affected by logging, agricultural clearing, roads, and powerlines.	No residual effect identified.

Valued Components /Potential Effect	Location	Mitigative Measures	Residual Effects
Visual disturbance of the Ormond Creek Trail viewpoint	KP 315.1	• The visual impact of the Project will be mitigated by implementation of a Restoration Plan. • The visual impact of the Project will be mitigated by planting screens of trees and shrubs or vegetated berms at trail crossings and between footprint and trail.	Viewscape from a hiking trails will be altered.
Visual disturbance at the Nyan Wheti Trail viewpoint	KP 325	• The visual impact of the Project will be mitigated by implementation of a Restoration Plan. • The visual impact of the Project will be mitigated by planting screens of trees and shrubs, vegetated berms at trail crossings and between footprint and trail. • The viewscape is previously affected by the existing PNG ROW.	Viewscape from hiking trails will be altered.
Visual disturbance at the Omineca Trail viewpoint	Between KP 364.3 and KP 364.5	• The visual impact of the Project will be mitigated by implementation of a Restoration Plan. • The visual impact of the Project will be mitigated by planting screens of trees and shrubs at trail crossings and between footprint and trail. • The viewscape is previously affected by the existing PNG ROW.	Viewscape from hiking trails will be altered.
Visual disturbance at the Stuart River paddling route viewpoint	KP 388.8	• Implement a Restoration Plan • The visual impact of the Project will be mitigated by visual disturbance created by land clearing for farming activities on south bank of river. • Preserve existing trees, and plant a forested screen along the northern banks of the river, where feasible, to reduce the visibility of the Project.	No residual effect identified.
Visual disturbance in the Salmon River Valley	KP 449.2	• Implement a Restoration Plan • The visual impact of the Project will be mitigated by visual disturbance created by the existing PNG ROW and other human activities. • Incorporate screening vegetation into restoration plans to reduce the visibility of the crossing from the river.	No residual effect identified.

Valued Components /Potential Effect	Location	Mitigative Measures	Residual Effects
Visual disturbance related to NARs.	All new access roads and shoo-flys	• All new access roads and shoo-flys will be completely deactivated following pipeline construction. • Invasive vegetation will be controlled along new access routes. • Seed mixtures and planting to be used to restore new access routes will be developed in consultation with resource management agency staff (MOE, and MOFR).	Visual disruption in areas where NARs are constructed.
Visual disturbance at the Kitimat viewpoints	Methanex Lateral	• The visual impact of the Project will be mitigated by implementation of a Restoration Plan. • The visual impact will be reduced by construction adjacent to existing linear facilities. • The viewscape is previously affected by a road and transmission lines.	No residual effect identified.
Visual effect of compressor stations	KP 246.5	• Compressor station will not be visible from residences. • Lighting will be operated to minimize night-time visibility of the facility.	No residual effect identified.

Table 7.2-43
Significance of Residual Effects: Aesthetics and Viewsheds
Clearing, Construction, and Restoration

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Viewscape from recreational sites will be altered.	LSA	Medium-term	Continuous	Permanent	Low	High	Moderate	Less than significant
Viewscape from hiking trails will be altered.	Footprint	Long-term	Continuous	Permanent	Low	High	Moderate	Less than significant
Viewscapes in the Burnie River Valley and Morice River Valley will be altered.	LSA	Medium- to long-term	Continuous	Permanent	Medium	High	Moderate	Less than significant
Visual disturbance in areas where NARs are constructed.	LSA	Long-term	Continuous	Long-term	Low	High	High	Less than significant

7.2.13.2 Operations and Maintenance

POTENTIAL EFFECTS AND MITIGATION MEASURES

a. Potential Effect: Project travel corridor will remain permanently visible

Operational activities along the pipeline route will involve the maintenance of the 18m wide right-of-way. The trees and tall vegetation on the ROW must be removed and maintained at an early seral stage (*i.e.* herbaceous and low woody vegetation only). The periodic clearing of trees and woody debris from the ROW will limit the re-establishment of natural plant communities. The temporary workspace will be restored. A vegetation management policy consistent with pipeline security will be implemented on the ROW. The ROW will be most visible in forested areas. The temporary working space will become unnoticeable once the planted trees grow. The travel corridor will appear as a narrow linear feature, vegetated with grasses, shrubs, or other vegetation recommended in the Restoration Plan. ***No residual effect has been identified.***

b. Potential Effect: Compressor Station will be visible from the 700 Road

The Compressor Station will be visible from the 700 Road. The facilities will be constructed on a property that has been recently logged. The surrounding forest will mitigate the visibility of the Compressor Station. Visual impacts of the Compressor Station may result from facility lighting. Minimal lighting and fully shielded lights will be used to reduce the nighttime light pollution. Lights will be focused toward target areas. Motion sensors will be used to avoid unnecessary light pollution. ***No residual effect has been identified.***

SIGNIFICANCE OF RESIDUAL EFFECTS

No residual effects have been identified.

Table 7.2-44
Effects Assessment: Aesthetics and Viewsheds
Operations and Maintenance

Valued Components /Potential Effect	Location	Mitigative Measures	Residual Effects
ROW will remain permanently visible	Various sections	• Restore the right of way in order to establish a complete vegetative cover of grasses and shrubs.	• No residual effect identified.
Compressor station will be visible from the 700 Road.	KP 246.5	• Surrounding forest will mitigate the visibility of the building. • Use minimal lighting and fully shielded lights to reduce night-time light effects. Focus lights toward target areas. Motion sensors will be used to avoid unnecessary light pollution.	• No residual effect identified.

7.2.13.3 Decommissioning and Abandonment

The decommissioning and abandonment of the KSL Pipeline will comply with the acceptable regulatory standards that are in-place at that time. The procedures followed would likely be removal of all above ground facilities and the abandonment of the pipeline in-place, with the pipe severed and sealed at strategic locations, and with the right-of-way left in its established stable condition. If required for a special concern, or by regulation, the pipeline could be removed. Consequently, decommissioning and abandonment will likely result in potential effects that are of substantially less magnitude to those which have been described for the construction of the pipeline. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards of the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified***.

Methanex Lateral

The discussion provided above is entirely applicable to the Methanex Lateral.

Compressor Station

A compressor station will likely only be abandoned if the pipeline is abandoned. Due to operational considerations, the compressor station could be idled for a considerable period if it is not required to assist with the flow of natural gas. In the case of abandonment, all of the underground piping, aboveground buildings, and facilities would be dismantled and removed from the compound. Fill and aggregate material would be removed from the site and the area would be restored for any subsequent land use. Topsoil that had been salvaged during construction would be used to restore the land. Decommissioning and abandonment will likely result in potential effects that are similar but of less magnitude to those which have been described for the construction of the compressor station. PTP's decommissioning and abandonment plan will comply with the current and acceptable standards for the day and mitigation measures will be developed to appropriately manage identified impacts. Based on this, ***no significant residual effects have been identified.***

Methanex Meter Station

See information provided above for Compressor Station.

7.3 EFFECTS ASSESSMENT – TEMPORARY FACILITIES

Temporary facilities required for the clearing, construction and operation of the KSL Project include:

- Two construction camps located at KP 84 and KP 233.
- Six stockpile sites (for construction equipment, pipe and materials) located at KP 84, KP 126, KP 223, KP 233, KP 249, KP 295) (note that the stockpile sites at KP 84 and KP 233 are the same sites as the proposed construction camps).
- The reactivation of presently deactivated (or decommissioned and overgrown) forest access roads.
- The construction of a limited number of new access roads commonly referred to as “shoo flys”.

The potential residual effects associated with the construction and operation of the temporary facilities are described in Table 7.3-1. Note that only those Valued Components that are considered to potentially interact with the Temporary Facilities are listed in Table 7.3-1.

The significance of the potential residual effects are described in Table 7.3-2. In all cases, the significance of the residual effects is less than significant.

Table 7.3-1
Effects Assessment – Temporary Facilities

Valued Component/ Potential Effect	Temporary Facility Type	Location	Mitigation Measures	Residual Effect
Geophysical Environment				
• increase in soil erosion and slope instability	All temporary sites and new access roads	Project Footprint	• implement measures outlined in Table 7.2-1	• Minor loss of topsoil and root zone material can be expected until a vegetated cover is established.
• mixing of topsoil or root zone material with subsoil	All temporary sites and new access roads	Project Footprint	• implement measures outlined in Table 7.2-1	• Minor mixing of topsoil or root zone material with subsoil will likely occur.
• exposure of acid generating bedrock or bedrock capable of metal leaching	All temporary sites and new access roads	Project Footprint	• implement measures outlined in Table 7.2-1	• No residual effects have been identified.
Aquatic Environment				
• direct and indirect mortality of fish	Reactivated and new access roads	Project Footprint/Local Study Area	• implement measures outlined in Table 7.2.-10	• Fish mortalities from instream construction activities (e.g. culvert placement) may result.
• degradation of instream fish habitat	Reactivated and new access roads	Project Footprint/Local Study Area	• implement measures outlined in Table 7.2-10	• There will likely be direct physical alteration of instream habitat caused by culvert placement and bridge abutments.
• influence on surface hydrology	Reactivated and new access roads	Project Footprint/Local Study Area	• implement measures outlined in Table 7.2-10	• No residual effects have been identified.
• degradation of water quality	Reactivated and new access roads	Project Footprint/Local Study Area	• implement measures outlined in Table 7.2-10	• No residual effects have been identified.

Valued Component/ Potential Effect	Temporary Facility Type	Location	Mitigation Measures	Residual Effect
Terrestrial Environment; Wildlife And Wildlife Habitat; Vegetation				
• introduction and acceleration of the spread of invasive plants (noxious weeds)	New access roads and all temporary sites	Local Study Area	• implement measures outlined in Table 7.2-13	• The introduction of invasive species to previously undisturbed areas along new access roads.
• alteration or degradation of mature forest and riparian vegetation	New access roads and all temporary sites	Project Footprint	• implement measures outlined in Table 7.2-13	• The clearing of mature forest and floodplain forests for new access roads.
• alteration or degradation of wildlife habitat	New access roads and all temporary sites	Project Footprint	• implement measures outlined in Table 7.2-13	• Alteration of seasonal movement patterns of wide ranging predators and the alteration of riparian habitat used by coastal tailed frogs.
• direct and indirect wildlife mortality	New access roads and all temporary sites	Project Footprint	• implement measures outlined in Table 7.2-13	• Increased risk of wildlife-vehicle collisions on new access roads.
• sensory disturbances during important wildlife life cycle events.	New access roads and all temporary sites	Project Footprint	• Implement measures outlined in Table 7.2-13	• No residual effects have been identified.
Species And Ecosystems At Risk				
• effects on aquatic species at risk	New access roads	Project Footprint	• implement measures outlined in Table 7.2-17	• No residual effects have been identified.
• effects on plants and plant communities at risk	New access roads and all temporary sites	Project Footprint	• implement measures outlined in Table 7.2-17	• Clearing of rare whitebark pine plant community for new access roads.
• effects on wildlife species at risk	New access roads and all temporary sites	Project Footprint	• implement measures outlined in Table 7.2-17	• Alteration of seasonal movement patterns, alteration of important habitats, and sensory disturbances to grizzly bears and coastal tailed frogs.

Valued Component/ Potential Effect	Temporary Facility Type	Location	Mitigation Measures	Residual Effect
Archaeological And Heritage Resources				
• effect on identified archaeological site	New access roads and all temporary sites	Project Footprint	• implement measures outlined in Table 7.2-21	• No archaeological sites have been identified at those locations; consequently there is no residual effect.
First Nations Communities And Land Use				
• effect on historic and current use and occupation of lands and resources	New access roads and all temporary sites	Project Footprint	• implement measures outlined in Table 7.2-23	• No residual effects have been identified.
• effects on areas or sites of significance	New access roads and all temporary sites	Project Footprint	• implement measures outlined in Table 7.2-23	• No residual effects have been identified.
• effects on future use of lands	New access roads and all temporary sites	Project Footprint	• implement measures outlined in Table 7.2-23	• No residual effects have been identified.
Land And Resource Use				
• effect on existing Land and Resource Plans	New access roads, reactivated roads and all temporary sites	Local Study Area	• implement measures outlined in Table 7.2-27	• A residual effect potentially existed due to the proposed designation of the Burnie-Shea Protected Area; however, the KSL Project will be accommodated within the Protected Area and hence there is no residual effect.
• effect on current use of land and resources	New access roads, reactivated roads and all temporary sites	Local Study Area	• implement measures outlined in Table 7.2-27	• No residual effects have been identified.
• effect on water supply and quality	New access roads, reactivated roads and all temporary sites	Local Study Area	• implement measures outlined in Table 7.2-27	• No residual effects have been identified.

Valued Component/ Potential Effect	Temporary Facility Type	Location	Mitigation Measures	Residual Effect
• presence of contaminated sites	New access roads and all temporary sites	Project Footprint	• implement measures outlined in Table 7.2-27	• No residual effects have been identified.
Community And Regional Infrastructure And Services				
• waste management during construction	Construction camps	Regional Study Area	• implement measures outlined in Table 7.2-31	• No residual effects have been identified.
• disruption of public use of some roads	New access roads and reactivated roads	Regional Study Area	• implement measures outlined in Table 7.2-31	• No residual effects have been identified.
• power generation for work camps	Construction Camps	Regional Study Area	• implement measures outlined in Table 7.2-31	• No residual effects have been identified.
Human Health And Safety				
• effect on air quality resulting from increased emissions from equipment and burning	New access roads and all temporary sites	Regional Study Area	• implement measures outlined in Table 7.2-37	• No residual effects have been identified.
• effect on surface water quality for downstream users	New access roads and reactivated roads	Local Study Area	• implement measures outlined in Table 7.2-37	• No residual effects have been identified.
• increased noise during construction and restoration	New access roads, reactivated roads and all temporary sites	Local Study Area	• implement measures outlined in Table 7.2-37	• No residual effects have been identified.
• risk to public safety during construction	New access roads, reactivated roads and all temporary sites	Project Footprint	• implement measures outlined in Table 7.2-37	• No residual effects have been identified.
Navigable Waters				
• effect on use of navigable waterway	New access roads and reactivated roads	Project Footprint	• apply for approval under the NWPA where required	• No residual effects have been identified.

Valued Component/ Potential Effect	Temporary Facility Type	Location	Mitigation Measures	Residual Effect
Aesthetics And Viewsheds				
• **effect on identified viewpoints**	New access roads and all temporary sites	Project Footprint	• **implement measures outlined in Table 7.2-421~~1~~**	• **No residual effects have been identified.**

Table 7.3-2
Significance of Residual Effects – Temporary Facilities

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
Fish mortalities from instream construction activities	Project Footprint	Immediate	Occasional	Short-term	Low	High	**High**	Less than significant
Direct physical alteration of instream habitat	Local Study Areas	Immediate to medium-term	Occasional	Medium-term	Medium	High	**High**	Less than significant (after compensation)
Introduction of invasive plant species (noxious weeds)	Local Study Area	Medium-term	Isolated	Medium-term	Low	High	**Moderate**	Less than significant
Clearing of mature forests and floodplain (riparian) forests	Project Footprint	Long-term	Isolated	Long-term	Medium	High	**High**	Less than significant
Alteration of seasonal movement patterns of predators and the alteration of riparian habitat used by coastal tailed frogs	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
Clearing of rare whitebark pine plant community for new access roads.	**Project Footprint**	**Long-term**	**Isolated**	**Long-term**	**High**	**High**	**High**	**Less than significant**

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Alteration of seasonal movement patterns, alteration of important habitats, and sensory disturbances to grizzly bears and coastal tailed frogs.	Project Footprint to RSA	Medium-term	Occasional	Long-term	Medium	High	Moderate	Less than significant

7.4 EFFECTS ASSESSMENT – ACCIDENTS AND MALFUNCTIONS

Accidents and malfunctions that occur during the construction of the KSL Project as well as those that may occur during the operation of the pipeline and facilities may result in adverse environmental effects. However, as amply demonstrated by PNG's successful operating history, PTP will employ the best available technology and safety measures and follow all applicable codes, in order to minimize the probability of accidents and malfunctions occurring. In itself, natural gas, being lighter than air, non-toxic, and not soluble in water, will quickly dissipate into the atmosphere should a break in the pipeline occur.

Potential residual effects that could occur as a result of accidental events during construction are as follows:

- spot spills of fuel or hydrocarbons from construction equipment, once remediated, will have little residual adverse effect;
- due to the properties of natural gas (methane, lighter than air, non-toxic, not soluble in water) a pipeline break or rupture will have little residual effect;
- forest fires could potentially be caused by clearing and construction activities; however constant vigilance and training and the fact that there will be ample heavy and light equipment available to control a forest fire, should it occur, will result in minor residual effects;
- Fly rock from blasting could potentially cause injury to wildlife or people, depending upon the proximity to the detonation area;
- a transportation accident (vehicles and equipment used during clearing and construction) could cause injury to people or wildlife;
- the release of drilling mud on land, once cleaned up and reclaimed, will have little residual effect; and
- the release of drilling mud into a watercourse could affect aquatic ecosystems, depending upon the location, and volume of the release.

While adverse effects could occur as a result of an accident during construction and operation of the pipeline, PTP will employ sound safety measures and the best available technology in order to minimize the probability of accidents occurring. Minor accidents or spills have a higher probability of occurrence during construction, but will have a low magnitude effect and are readily mitigated. Table 7.4-1 provides a summary of the significance evaluation.

Spills of Hazardous Materials During Construction

Terrestrial spills of fuel or hydrocarbons (gasoline, diesel, hydraulic oils) that may occur will generally be very small and localized within the Project Footprint. The duration of the potential adverse effect is short-term and reversible.

A spill on snow, frozen ground or an ice-covered waterbody would generally be localized and readily remediated through the scraping of the contaminated ice or snow surface and disposing of the contaminated material in an approved manner.

In the event of a large spill such as the rollover of a fuel truck, the adverse residual effects could be of high magnitude with longer lasting impacts to the terrestrial and aquatic ecosystem. Spill contingency and clean-up measures will reduce the magnitude and reversibility of the residual effects. Events such as this are considered rare within the Project Footprint, and the probability of a significant adverse residual effect is low.

Pipeline Failure During Operation

Due to the nature of natural gas (non-toxic, not soluble in water, and lighter than air), small leaks or sudden ruptures of the pipeline will have only short-term, reversible effects. Regular monitoring during operations enables immediate response and, where necessary, emergency shutdown.

Forest Fires During Clearing and Construction

The significant of a fire during clearing and construction depends on the size of the fire that might occur and its location. The likelihood of large fires developing is extremely low since the crews will have the necessary training and equipment to quickly contain a fire outbreak. In addition, the Project personnel will be in continual contact with the provincial Fire Centres for the purpose of monitoring fire hazard conditions and for fire reporting. Once the ROW is cleared of vegetation, the likelihood of a fire is very remote due to the absence of combustible material.

Use of Explosives During Construction

PTP will employ appropriate safety measures including controlled blasting procedures in order to ensure that fly rock from the detonation of explosives will generally not result in significant adverse residual effects. Through the use of warning calls prior to detonation and general noise associated with construction activity, wildlife will likely be displaced from the fly rock zone. The general public will be excluded from the construction area. The probability of a significant adverse residual effect is low.

Transportation Accidents

A transportation accident resulting from the additional vehicles associated with the clearing and construction of the Project would be considered a significant adverse residual effect if there was a loss of human life or a wildlife species of concern, or damage to property. PTP will implement strict traffic safety measure, including but not limited to,: direct contact with other forestry road user; two-way radios for controls where necessary; traffic-control personnel where necessary; and the adoption of speed limits in order to reduce the likelihood of transportation accidents. Such measures will reduce the probability of a vehicle or wildlife accident to low. During the operation phase of the Project, there will only be a minimal increase in the number of vehicles using the access road network.

Release of Drilling Mud

Drilling mud used during horizontal directional drilling (HDD) of a watercourse is usually bentonite, which is an inert, natural clay material. Design of the HDD profile will ensure the pipeline is sufficiently below the watercourse to minimize any potential for mud loss entering a watercourse. Due to the HDD technology, it is readily detectible, due to diligent monitoring, where mud is being released such that the release volume is kept very small. Design, skilled operation, and clean-up and remediation measures, result in the adverse residual effect being reversible and of short- to medium-term.

Table 7.4-1
Significance of Residual Effects: Accidents and Malfunctions

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Spills of fuel or hydraulic oils, once remediated, will have little residual effect	Project Footprint to LSA	Short-term	Accidental	Short-term	Low to High	Low	Moderate	Less than significant
Pipe rupture or leaks resulting in the release of natural gas	LSA	Short-term	Accidental	Short-term	Low to High	Low	High	Less than significant
Forest fires will affect adjacent vegetation	LSA to RSA	Immediate to Short-term	Accidental	Short- to Long-term	Low to High	Low	Moderate	Less than significant
Fly rock from blasting may cause injury to people or wildlife	Project Footprint to LSA	Immediate	Accidental	Immediate to Long-term	Low to High	Low	Moderate	Less than significant
A transportation accident involving clearing and construction vehicles and equipment may cause death or injury to people or wildlife	LSA	Short-term to Long-term	Accidental	Immediate to Permanent	Low to High	Low	Moderate	Less than significant
The release of drilling mud to land or into a watercourse may affect the ecosystems	Project Footprint to LSA	Short-term	Accidental	Short-term to Medium-term	Low to Medium	High	High	Less than significant

7.5 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

PNG has been safely and efficiently operating its natural gas transmission system in the Project area for over 40 years. As a result, they are fully aware of the range of environmental conditions along the proposed route and at the Project facilities. This knowledge is reflected in the engineering design, and mitigation measures that have been proposed to address these environmental conditions. In addition, the routing and construction schedule took into consideration existing and anticipated environmental and socio-economic conditions. For example: the routing has avoided the geotechnical and slope-instability issues associated with the Telkwa Pass; the logging and clearing schedule avoids the peak nesting and breeding period for migratory birds as well as critical times for other wildlife species; winter construction has been selected for some construction spreads in order to reduce impacts to certain land and resource use; and instream fisheries work windows have been carefully considered in scheduling stream crossing work.

It is recognized that several naturally occurring environmental events also have the potential to adversely affect the Project, either during construction and/or operation. These include:

- earthquake activity,
- mass wasting,
- flooding,
- forest fires, and
- changing climate conditions.

Earthquake Activity

The Project area is within Seismic Zones 2, 3, and 4 of the National Building Code (1990). Horizontal velocities associated with these zones range from 0.10 to 0.20 mm/year. Forces and movements of this type are fully considered in the design of the pipeline and facilities in order to meet the requirements of the Canadian Standards Association and the National Building Code. As a result, no adverse effects on the Project are anticipated.

Mass Wasting

The geotechnical evaluation for the Project that was undertaken during both the route selection phase and for the Environmental Assessment, revealed that the Project area is influenced by earth flows, debris/earth slides, debris flows, rock slides and rock fall at certain locations. Those mass wasting processes are generally confined to the Kitimat Valley area and the portion of the pipeline crossing the Coast Mountains. Areas where these processes are occurring have generally been avoided by the proposed pipeline route.

Engineering and design of the pipeline will take into consideration the potential for mass wasting along the route. Areas of potential terrain instability will be monitored during operations and remedial action will be promptly undertaken where warranted. Above-ground facilities such as the Compressor Station and Meter Station have been located in areas with low to nil potential for mass

wasting events. It is concluded that the probability of a significant adverse environmental effect on the Project resulting from mass wasting events is low.

Flooding

The potential effects of flooding and associated mitigation measures will vary depending upon the magnitude and timing of the event.

Temporary vehicle crossings will be designed for short term use, generally removed for spring freshettes, and will meet regulatory requirements. Flooding prior to the installation of the temporary vehicle crossing or prior to instream construction could delay the activity temporarily.

Unanticipated flood events during instream construction could result in exceeding the capacity of the dams, pumps, or flumes used to isolate the construction area. This may result in temporarily increased sedimentation into the watercourse. In order to mitigate this effect, PTP will continually monitor weather conditions and forecasts for the watersheds crossed by the pipeline route prior to commencing the instream work and will suspend activities when it is warranted by the increased risk of exceptional flooding.

Engineering design will anticipate potential stream migration over the life of the project. This will include, burial depth within a floodplain and the adequate set-back of sag-bends, which will minimize the potential effects of flooding as well as associated erosion, scouring and channel avulsion. ROW patrols during operation will pay particular attention to the bed and banks of watercourses following flood-events to ensure the integrity of the pipeline and to minimize impacts on the aquatic environment.

It is concluded that the probability of a flood-event resulting in a significant adverse environmental effect is low.

Forest Fires

A forest fire which might occur in the immediate vicinity of the Project during the clearing and construction phase could delay construction activities. In that event, construction activities and construction traffic at the affected location would be suspended if conditions were considered to be unsafe or if PTP is directed to take this action by provincial regulation (e.g. BC MOF). The probability that a forest fire of a magnitude sufficient to delay construction activities would occur that would result in major Project delays is considered low. It is noted that significant lengths of the Project will be constructed during the winter when there is no risk of wildfire activity.

Forest fires are very unlikely to adversely affect the buried pipeline during the operational phase. PTP has emergency measures in place to shut down the Compressor Station in the event of a forest fire risk.

The probability of a forest fire resulting in an adverse environmental effect is considered low.

Changing Climatic Conditions

Changes in climatic conditions within the area of the Project during operation of the pipeline and facilities could manifest themselves in many ways. For example:

- increased snowpack in the winter,
- warmer temperatures during the spring may extent and intensify runoff and alter hydrologic regimes including timing and duration of peak flows,
- the lack of cold winter temperatures may result in exacerbating the outbreak of mountain pine beetle, and
- changes in summer temperatures and altered rainfall patterns could lead to an increase in wildfires.

PTP, through its continued ROW surveillance efforts and scheduled inspection and maintenance activities, will utilize an adaptive management approach in order to accommodate local environmental conditions that may change due to changing climatic conditions. By implementing appropriate protection measures based on adaptive management principles, no adverse effects on the Project are anticipated.

7.6 EFFECTS ON THE CAPACITY OF RENEWABLE RESOURCES

The analysis that has supported this EAC Application has assessed the potential for the KSL Project to have an adverse environmental effect on a number of environmental components, including renewable resources. Renewable resources considered include: agriculture/ranching; trapping; forestry; guide outfitting/hunting; outdoor recreation; and potable water.

It is concluded that since the Project is not likely to cause significant adverse environmental effects on any of these components, the capacity of renewable resources to meet the needs of the present and those of the future are not likely to be changed by the Project.

7.7 SUMMARY OF ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS ASSESSMENT

The following section presents a summary of the residual effects identified and analyzed in Section 7.2 of this Application.

Table 7.7-1
Summary of Significance of Residual Effects

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Geophysical Environment								
The alteration of local topography and minor, localized instabilities that may occur in fill material	Project Footprint	Short-term	Isolated	Short-term	Medium	High	High	Less than significant
Areas of minor terrain instability may occur	Project Footprint	Short-term	Isolated	Medium-term	Medium	High	Moderate	Less than significant
Minor mixing of topsoil or root zone material with subsoil will likely occur	Project Footprint	Short-term	Isolated	Short-term	Low	High	High	Less than significant
Loss of topsoil or root zone material through wind and water erosion	Project Footprint	Short-term	Isolated	Short-term	Low	High	High	Less than significant
Minor trench subsidence or a crown may remain over the ditch line	Project Footprint	Short-term	Isolated	Medium-term	Low	High	High	Less than significant
Atmospheric Environment								
Short-term increase in vehicle emissions	Project Footprint to LSA	Short-term	Isolated	Short-term	Low	High	High	Less than significant
Short-term increase in dust arising from construction traffic	Project Footprint to LSA	Short-term	Isolated	Short-term	Low	High	High	Less than significant
Fugitive greenhouse gas emissions from pipeline operations	Global	Long-term	Continuous	Long-term	Low	High	Moderate	Less than significant
Greenhouse gas emissions from Compressor Station operations	Global	Long-term	Continuous	Long-term	Low	High	Moderate	Less than significant
Emissions of common air	Local	Long-term	Occasional	Long-term	Negligible	Low to	Moderate	Less than

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
contaminants and Schedule 1 substances from Compressor Station operations			to periodic		to low	High		significant
Aquatic Environment								
Fish mortalities from instream construction activities.	Project Footprint	Immediate	Isolated	Short-term	Low	High	High	Less than significant
Physical alteration of instream habitat at crossing sites and through sediment release.	LSA	Immediate to Medium-term	Isolated	Medium-term	Low to Medium	High	High	Less than significant (after compensation)
Loss of food inputs from riparian areas at vehicle and pipeline crossings.	Project Footprint	Short- to Medium-term for pipeline crossings and temporary vehicle crossings, long-term for permanent vehicle crossings	Isolated	Medium-term for pipeline crossings and temporary vehicle crossings, permanent for permanent vehicle crossings	Negligible	High	Moderate	Less than significant
Terrestrial Environment: Wildlife and Wildlife Habitat; Vegetation								
Approximately 88 ha of wetland habitat will be altered or degraded.	Project Footprint	Medium-term	Isolated	Medium-term	Low	High	High	Less than significant
Approximately 32 ha of mid-seral to old Douglas-fir forest will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	High	Less than significant
Approximately 7 ha of mid-seral to old	Project	Long-term	Isolated	Long-term	Low	High	High	Less than

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
Aspen forest will be cleared.	Footprint							significant
Approximately 46 ha of riparian and floodplain forests will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Medium	High	High	Less than significant
Approximately 600 ha of mature and old coniferous forest habitat will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Medium	High	High	Less than significant
Approximately 16.8 ha of subalpine and alpine habitat will be disturbed.	Project Footprint	Long-term	Isolated	Long-term	Medium	High	Moderate	Less than significant
Approximately 4 ha of grassland area will be disturbed.	Project Footprint	Medium-term	Isolated	Medium-term	Low	High	Moderate	Less than significant
Introduction of invasive species to previously undisturbed areas immediately after construction.	Project Footprint to LSA	Medium-term	Isolated	Medium-term	Low	High	Moderate	Less than significant
Approximately 40 ha of high suitability coastal northern goshawk habitat will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	Moderate	Less than significant
Approximately 1 ha of suitable marbled murrelet nesting habitat will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	Moderate	Less than significant
Approximately 18 ha of mountain goat winter range will be crossed by the pipeline route.	Project Footprint	Medium-term	Isolated	Medium-term	Medium	High	Moderate	Less than significant
Suitability of 52 streams used by coastal tailed frogs will be altered.	Project Footprint	Long-term	Isolated	Long-term	Medium	High	Moderate	Less than significant
Seasonal movement patterns of wide	Project	Medium-term	Isolated	Medium-term	Low	High	Moderate	Less than

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
ranging predators (*e.g.* grizzly bear, grey wolf, lynx, cougar, wolverine) will be altered.	Footprint to RSA							significant
Incidental construction-related mortality of individual coastal tailed frogs and other wildlife with small, restricted ranges will occur.	Project Footprint	Immediate	Occasional	Short- to medium-term	Low	High	Moderate	Less than significant
The risk of wildlife vehicle collisions will increase during construction.	Project Footprint to RSA	Medium-term	Occasional	Short-term	Medium	High	Moderate	Less than significant
Increased authorized and unauthorized hunting during and post-construction will occur.	Project Footprint to RSA	Medium-term	Occasional	Long-term	Medium	High	Moderate	Less than significant
Maintenance of vegetation at an early seral stage along travel corridors on the pipeline right-of-way.	Project Footprint	Long-term	Periodic	Long-term	Low	High	High	Less than significant
Introduction or spread of invasive species as a result of operations and maintenance activities.	Project Footprint	Long-term	Accidental	Medium-term	Low	High	High	Less than significant
Species and Ecosystems at Risk								
Approximately 1 ha of Sitka-spruce salmonberry rare plant community will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	High	Less than significant
Approximately 9 ha of rare old growth whitebark pine forest will be cleared.	Project Footprint	Long-term	Isolated	Long-term	High	High	High	Less than significant
Approximately 4 ha of Saskatoon-	Project	Long-term	Isolated	Long-term	Low	High	High	Less than

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
slender wheatgrass rare plant community will be cleared.	Footprint							significant
Approximately 3 ha of hybrid white spruce/ ostrich fern rare plant community will be cleared.	Project Footprint	Long-term	Isolated	Long-term	High	High	High	Less than significant
Construction phase sensory disturbance to grizzly bears at feeding and reproduction sites.	Project Footprint to RSA	Short-term	Isolated	Short-term	Medium	High	Moderate	Less than significant
Construction phase disturbance to grizzly bear movement patterns.	Project Footprint to RSA	Medium-term	Isolated	Medium-term	Medium	High	Moderate	Less than significant
Increased unauthorized hunting of grizzly bears during and post-construction in previously unroaded mountainous areas.	Project Footprint to RSA	Medium-term	Occasional	Long-term	Medium	High	Moderate	Less than significant
Approximately 40 ha of high suitability coastal northern goshawk habitat will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	Moderate	Less than significant
Approximately 1 ha of suitable marbled murrelet nesting habitat will be cleared.	Project Footprint	Long-term	Isolated	Long-term	Low	High	Moderate	Less than significant
Incidental mortality of individual coastal tailed frogs at all life stages.	Project Footprint	Immediate	Occasional	Medium	Low	High	Moderate	Less than significant
Diminish instream and adjacent habitat suitability of 52 streams used by coastal tailed frogs.	Project Footprint	Long-term	Isolated	Long-term	Medium	High	Moderate	Less than significant
Disturbance of rare plant communities	Project	Long-term	Periodic	Long-term	Medium	High	Moderate	Less than

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
along travel corridors on the pipeline right-of-way	Footprint							significant
Alteration of the suitability of coastal tailed frog streams during instream maintenance of the pipeline	Project Footprint	Long-term	Accidental	Long-term	Low	Low	Moderate	Less than significant
Archaeological and Heritage Resources								
Permanent loss or alteration of archaeological and heritage resources within the Project footprint	Project Footprint	Long-term	Isolated	Permanent	Low	High	High	Less than significant
First Nations Communities and Land Use								
Construction phase disruption of First Nation commercial trapping operations	LSA	Medium-term	Occasional	Medium-term	Medium	High	Moderate	Less than significant
Construction phase disruption of First Nation traditional use activities	LSA	Medium-term	Periodic	Medium-term	Medium	High	High	Less than significant
Alteration or degradation of First Nation plant and material gathering sites	Project Footprint to LSA	Medium-term	Periodic	Medium-term	Medium	High	High	Less than significant
Physical alteration of instream habitat at crossing sites or downstream lake habitat through sediment release	LSA	Immediate to Medium-term	Isolated	Medium-term	Low to Medium	High	High	Less than significant (after habitat compensation)
Maintenance of vegetation at an early seral stage on the pipeline right-of-way.	Project Footprint	Long-term	Periodic	Long-term	Low	High	High	Less than significant
Introduction or spread of invasive species as a result of operations and	Project Footprint	Long-term	Accidental	Medium-term	Low	High	High	Less than significant

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
maintenance activities.	Footprint							significant
Land and Resource Use								
Unauthorized motorized use of the proposed Burnie-Shea protected area and Herd Dome ASMZ	Project Footprint	Medium-term	Isolated	Long-term	Medium	High	Moderate	Less than significant
Permanent reduction in commercial timber producing capacity on the Project ROW.	Project Footprint	Long-term	Continuous	Permanent	Low	High	Moderate	Less than significant
Construction phase traffic effects on FSRs and forestry operations	Project Footprint	Short-term	Isolated	Short-term	Medium	Medium	High	Less than significant
Construction phase disruption of commercial fish, wildlife, and nature-based operations	Project Footprint	Medium-term	Occasional	Medium-term	Medium	High	Moderate	Less than significant
Construction phase disruption of public recreation use	Project Footprint	Medium-term	Occasional	Short-term	Medium	High	Moderate	Less than significant
Brief, low level increases in domestic water turbidity associated with the installation and removal of dams, flumes, and pumps near surface water points of diversion.	Project Footprint to LSA	Immediate to Short-term	Isolated	Immediate to Short-term	Low to Medium	Low	Moderate	Less than significant
Disruption of water wells flows and quality by construction	Project Footprint to LSA	Short-term to medium	Isolated	Medium-term	Low	Low	Moderate	Less than significant
Use of the pipeline ROW as a public travel corridor	Project Footprint	Long-term	Periodic	Long-term	Medium	High	High	Less than Significant
Community and Regional Infrastructure and Services								
Construction phase increase in	RSA	Short-term	Continuous	Short-term	Medium,	High	High	Less than

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
economic activity and business for local suppliers					beneficial			significant
Construction phase increase in local community population and use levels at recreational facilities and other community facilities.	RSA	Short-term	Continuous	Short-term	Low	High	Moderate	Less than significant
Construction phase increase in traffic on highways and paved roads	LSA	Short-term	Periodic	Short-term	Medium	High	High	Less than significant
Employment and Economy								
Construction phase increase in local and regional business activity	RSA	Short-term	Periodic	Short-term	Medium, beneficial	High	High	Less than significant
Construction phase increase in local employment	RSA	Short-term	Periodic	Short-term	Medium, beneficial	High	High	Less than significant
Increase in local employment during construction of permanent facilities	RSA	Short-term	Periodic	Short-term	Low, beneficial	Moder ate	Moderate	Less than significant
Purchase of goods and services from local communities.	RSA	Long-term	Periodic	Long-term	Low, beneficial	High	High	Less than significant
Long-term payments to municipal and provincial bodies, along portions of the pipeline route.	RSA	Long-term	Periodic	Long-term	Medium, beneficial	High	High	Less than significant
Human Health and Safety								
Air emissions during the clearing, construction, and restoration phase may cause irritation for some residents	LSA	Short-term	Occasional	Short-term	Medium	Low	Moderate	Less than significant
Brief, low level increases in domestic water turbidity associated with the	Project Footprint	Immediate to Short-term	Isolated	Immediate to Short-term	Low to Medium	Low	Moderate	Less than significant

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
installation and removal of dams, flumes, and pumps near surface water points of diversion.	to LSA							
Disruption of water well flows and quality during construction phase	Project Footprint to LSA	Immediate to Short-term	Isolated	Medium-term	Low	Low	High	Less than significant
Construction phase increase in noise levels during clearing and construction	LSA	Short-term	Occasional	Short-term	Medium	High	Moderate	Less than significant
Long-term increase in noise levels	LSA	Long-term	Continuous	Permanent	Low	High	High	Less than significant
Navigable Waters								
none								
Aesthetics and Viewsheds								
Viewscape from recreational sites will be altered.	LSA	Medium-term	Continuous	Permanent	Low	High	Moderate	Less than significant
Viewscape from hiking trails will be altered.	Footprint	Long-term	Continuous	Permanent	Low	High	Moderate	Less than significant
Viewscapes in the Burnie River Valley and Morice River Valley will be altered.	LSA	Medium- to long-term	Continuous	Permanent	Medium	High	Moderate	Less than significant
Visual distrubance in areas where NARs are constructed.	LSA	Long-term	Continuous	Long-term	Low	High	High	Less than significant
Temporary Facilities								
Minor loss of topsoil or rootzone	Project	Short-term	Isolated	Medium-term	Low	High	High	Less than

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
material	Footprint							significant
Minor mixing of topsoil or rootzone material with subsoil	Project Footprint	Short-term	Isolated	Short-term	Low	High	**High**	Less than significant
Fish mortalities from instream construction activities	Project Footprint	Immediate	Occasional	Short-term	Low	High	**High**	Less than significant
Direct physical alteration of instream habitat	Local Study Areas	Immediate to medium-term	Occasional	Medium-term	Medium	High	**High**	Less than significant (after compensation)
Introduction of invasive plant species (noxious weeds)	Local Study Area	Medium-term	Isolated	Medium-term	Low	High	**Moderate**	Less than significant
Clearing of mature forests and floodplain (riparian) forests	Project Footprint	Long-term	Isolated	Long-term	Medium	High	**High**	Less than significant
Alteration of seasonal movement patterns of predators and the alteration of riparian habitat used by coastal tailed frogs	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
Clearing of rare whitebark pine plant community for new access roads.	**Project Footprint**	**Long-term**	**Isolated**	**Long-term**	**High**	**High**	**High**	**Less than significant**
Alteration of seasonal movement patterns, alteration of important	**Project Footprint**	**Medium-term**	**Occasional**	**Long-term**	**Medium**	**High**	**Moderate**	**Less than significant**

Residual Effects	Location	Duration	Frequency	Reversibility	Magnitude	Probability	Confidence	Significance
habitats, and sensory disturbances to grizzly bears and coastal tailed frogs.	to RSA							
Accidents and Malfunctions								
Spills of fuel or hydraulic oils, once remediated, will have little residual effect	Project Footprint to LSA	Short-term	Accidental	Short-term	Low to High	Low	Moderate	Less than significant
Pipe rupture or leaks resulting in the release of natural gas	LSA	Short-term	Accidental	Short-term	Low to High	Low	High	Less than significant
Forest fires will affect adjacent vegetation	LSA to RSA	Immediate to Short-term	Accidental	Short- to Long-term	Low to High	Low	Moderate	Less than significant
Fly rock from blasting may cause injury to people or wildlife	Project Footprint to LSA	Immediate	Accidental	Immediate to Long-term	Low to High	Low	Moderate	Less than significant
A transportation accident involving clearing and construction vehicles and equipment may cause death or injury to people or wildlife	LSA	Short-term to Long-term	Accidental	Immediate to Permanent	Low to High	Low	Moderate	Less than significant
The release of drilling mud to land or into a watercourse may affect the ecosystems	Project Footprint to LSA	Short-term	Accidental	Short-term to Medium-term	Low to Medium	High	High	Less than significant