

16 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

As defined by s.2(1) of the *Canadian Environmental Assessment Act (CEA Act)*, assessing project effects requires considering changes to the Project as a result of the environment. Potential effects of the environment on the Project are typically considered during engineering design and are used to identify required mitigation measures.

Potential effects of the environment were identified for all phases of the Project, including design and planning, construction and operation. Effects of the environment on a buried pipeline are generally restricted to effects that can disturb the pipeline during installation or operation. Several design and planning factors are considered to minimize the risk of these effects, including:

- detailed route selection (avoiding areas of concern);
- construction scheduling (avoiding historical periods of severe weather where possible);
- site-specific design; and
- construction measures (e.g., watercrossing depth and erosion control measures).

16.1 Potential Effects Addressed During Project Planning

The Project team has benefited from NGTL's experience designing, constructing and operating its large network of pipelines. The Project team has applied this experience together with industry best practices when designing and planning the Project. The potential for identified effects of the environment and the nature of such effects are discussed in the subsections following. Where warranted, mitigation measures are provided.

16.2 Severe Weather

Severe weather is an important consideration in pipeline design, construction and operation. Severe weather generally comprises heavy precipitation (potentially resulting in flooding), snow storms and blizzards, high winds and lightning.

Severe weather is normally short term, the effects of which can generally be mitigated through scheduling changes and advance identification of potential problems areas (i.e., potential erosion sites). Where severe weather conditions have the potential to affect the Project, NGTL will take action to prevent or mitigate the potential effects. Such actions may include additional burial depth and erosion control measures, and may cause suspension of specific activities until weather conditions abate or effective mitigation procedures have been implemented.

16.2.1 Heavy Precipitation

Incoming low-pressure disturbances can produce extreme precipitation and wind events; however, most of these storms are short lived. During fall and winter, these mid-latitude disturbances track across the region approximately every two days.

Extreme precipitation could suspend construction and operation activities. Depending on timing, location and magnitude of the precipitation, rain or snowmelt, runoff can cause erosion (e.g., loss of cover over the pipelines at localized sites), particularly on disturbed soils.

Mitigation for the potential effects of precipitation and runoff includes installing adequate drainage measures (see EPP, Appendix 20A) for temporary and permanent erosion control measures). Any delays in construction caused by weather events are expected to be of short duration.

During pipeline operation, precipitation may affect access to aboveground facilities, but are not anticipated to negatively affect the buried pipeline. Depending on the severity of the weather, regular maintenance schedules may be affected; however, delays are expected to be of short duration.

16.2.2 Extreme Snow Events

Pacific weather systems interacting with cold Arctic air over the region can cause extreme snowfall events. These events are characterized by intense cold, strong winds and reduced visibility. These extreme winter events are most likely to occur during February, based on historical trends (Environment Canada 1990). Construction could be halted during a snow storm, or if worker safety becomes a concern. During operation, extreme snow events could affect the response time for emergency vehicles to reach a site of an accidental release, and could slow or delay maintenance activities. However, emergency response planning activities typically take such weather events into account. Extreme snow events may also affect access to facilities during pipeline operation, but should not adversely affect underground pipelines. Regular maintenance schedules may need to be adjusted during a snow storm; however, any delays are expected to be of short duration.

16.2.3 Lightning

Lightning is unlikely to cause any damage to the buried pipeline. However, lightning storms could cause short delays during construction or operation because of safety concerns. The risk of damage to aboveground equipment (e.g., block valves and cathodic protection equipment) is considered low. To minimize the risk of damage from lightning strikes, aboveground facilities will be grounded according to provincial and national building codes. No adverse effects of the environment on the Project are anticipated to result from lightning.

16.2.4 High Winds

High winds are unlikely to cause damage to the buried pipeline and are often associated with severe weather events. High winds could result in the suspension of some construction or operation activities, though delays are likely to be of short duration.

16.3 Wildfires

The construction of the Project is scheduled to start with clearing activities during winter 2012–2013 to continue with pipeline construction during late fall and winter 2013–2014. The risk of wildfires during winter is low. In the event of a wildfire, construction activities along the affected portions of the pipelines could be temporarily suspended. Should a severe wildfire affect large portions of the pipelines, all activities may be rescheduled until a later season. Because of the low risk of wildfires affecting the winter construction, there is no further consideration made to wildfires in the assessment.

During the operation phase, forest fires are unlikely to adversely affect the buried pipeline; however, they could affect aboveground facilities. NGTL has emergency response procedures in place for its entire operations and in the event of a wildfire, NGTL would implement its emergency response plan and fire contingency plan.

16.4 Residual Effects Assessment

Any effects on the Project caused by heavy precipitation, extreme snow events, lightning, high winds or wildfires are expected to be negative, short term, low magnitude, site specific, sporadic in frequency, reversible and, therefore, not significant. Prediction confidence is high.

16.5 References

Environment Canada. 1990. *The Climates of Canada*. Minister of Supply and Services Canada. Canadian Government Publishing Centre, Ottawa, Ontario, Canada.

17 ACCIDENTS AND MALFUNCTIONS

In addition to assessing project-specific effects, s.16.1(a) of the *Canadian Environmental Assessment Act* (CEA Act) requires that every screening consider the environmental effects of accidents and malfunctions that may occur in connection with a project. The following are project-related accidents and malfunctions that may occur during construction and operation:

- equipment failure and accidental spill of hazardous materials (e.g., fuel) during construction and operation;
- fires (for wildfire, see Section 17.3);
- release of drilling mud during horizontal directional drilling (HDD);
- transportation accidents; and
- pipeline failure during operation, resulting in an accidental release of natural gas.

The operation and maintenance of equipment during construction will result in the presence of hazardous materials onsite. Materials that are likely to be found on construction sites include:

- fuels (gasoline, diesel and propane);
- lubricants (engine oil, transmission or drive train oil, hydraulic oil, gear oil and lubricating grease);
- coolants (ethylene glycol and propylene glycol);
- methanol;
- paints; and
- solvents.

Hazardous liquids pose the greatest threat to the environment because of their ability to flow in an uncontrolled manner and seep into porous material if not properly contained. Some liquids (e.g., lubricating oil, methanol and antifreeze) contain components that are toxic to plants and wildlife. In addition, many of these materials are readily flammable or explosive. Antifreeze (ethylene glycol) is toxic and has a sweet smell that may attract wildlife. Inadvertent spills or a fire could result in contamination or alteration of soil, plants and ecological communities, surface or underground water quality, riparian habitat, wetland function, wildlife and wildlife habitat, and human health. Further damage to soils, vegetation and habitat could occur during spill clean-up and reclamation efforts following a spill.

To minimize the risk of an accidental release, accident or malfunction, the following mitigation measures are recommended:

- equipment should be in good working order and regularly maintained;
- crews should be properly trained to handle hazardous materials and wastes;

- all Project personnel should receive training and be required to comply with regulations for the containment, handling and disposal of potentially hazardous materials;
- all Project personnel should be aware of their responsibilities in the case of a spill;
- should hazardous liquids enter the environment, localized contamination may be required, with either the contaminated soil being removed or treated on-site;
- the spill contingency plan (see Appendix 20A) should be implemented in the event of an accidental release of hydrocarbons;
- Alberta One-Call should be used to identify foreign line crossings;
- foreign line crossings should be located and clearly marked before any ground disturbance during construction and operation; and
- in the event of a rupture, NGTL's emergency response plan should be followed.

Measures to address the potential for accidental spills during construction are outlined in the environmental protection plan (EPP, see Appendix 20A). These measures will apply to contractors and ensure mitigation of any potential effects.

Fires are a serious concern when working with highly flammable gases. A fire during construction or operation may adversely affect adjacent vegetation, and in rare situations wildlife or adjacent property.

To minimize the risk of fire caused by construction or operation, the following fire prevention measures and responses are recommended:

- crews should participate in a safety and environmental training session that includes instruction on how to properly use fire suppression equipment;
- all Project personnel should be aware of proper disposal and storage of flammable materials and sources of flame or spark;
- crews should ensure equipment with exhaust and engine systems are in good working order and regularly maintained;
- crews should use Alberta One-Call;
- the fire prevention and suppression contingency plan (see Appendix 20A) should be implemented in the event of a fire; and
- in the event of a rupture, follow NGTL's emergency response plan.

Depending on the volume and location of the release of HDD mud (frac-out) on land or into a watercourse, wetland or drainage, the release may adversely affect aquatic ecosystems or affect soil productivity.

To mitigate potential damaging effects resulting from release of HDD mud, the following measures are recommended:

- use nontoxic, bentonite clay-based material as drilling mud; and
- in the event of a release, follow the directional drilling procedures and instream drilling mud release contingency plan (see Appendix 20A) should be followed, which contains protocols to monitor, contain, and clean-up a potential frac-out and an alternative method for carrying out the crossing.

Transportation accidents can result in serious injury or death to humans and wildlife, as well as damage to property or critical habitat (if fire or chemical spillage occurs in conjunction with the accident). To prevent vehicle-related accidents, crews will participate in a safety and environmental training session and will be required to follow all traffic, road-use and safety laws.

The pipeline will be controlled from the NGTL OCC (operations control centre) located in Calgary, Alberta. The OCC is staffed 24 hours per day, and uses a comprehensive supervisory control and data acquisition (SCADA) system to continuously monitor and control pipeline operations.

17.1 Residual Effects Assessment

Any effects caused by accidents and malfunctions during construction and operation are expected to be negative, short term, low magnitude, site-specific, sporadic in frequency, reversible and, therefore, not significant. Prediction confidence is high.

18 CUMULATIVE EFFECTS ASSESSMENT

18.1 Introduction

In addition to assessing project-specific effects, s.16.1(a) of the *Canadian Environmental Assessment Act* (CEA Act) requires that every screening consider cumulative environmental effects that might result from the Project in combination with other projects or activities that have been or will be carried out.

18.2 Methods

18.2.1 Assessment Methods

Cumulative effects assessments were completed for all disciplines that completed residual project effects assessments:

- Vegetation and Wetlands (Section 7);
- Wildlife and Wildlife Habitat (Section 8);
- Fish and Fish Habitat (Section 10);
- Socio-economic Assessment (Section 13); and
- Traditional Land and Resource Use (Section 14).

The screening-level cumulative effects assessment was completed for identified project residual effects. If a project residual effect might act cumulatively with those of other projects and activities and the resulting cumulative effects might exceed acceptable levels without implementation of project-specific or regional mitigation, a more detailed cumulative effects assessment was also completed. Significance of potential cumulative effects was determined based on the detailed assessment.

18.2.2 Identification of Existing and Planned Development

18.2.2.1 Project Inclusion List

The cumulative effects assessment involved determining whether any existing or reasonably foreseeable projects and activities near the Project are anticipated to have identifiable residual effects. It further determines whether any of those effects, combined with the residual effects of the Project, would change the overall level of an effect on a specific valued ecosystem component (VEC) or valued socio-economic component (VSC). Cumulative effects were assessed based on the following three scenarios:

- Base Case: includes all existing development;

- Application Case: includes development in the Base Case plus the Project footprint; and
- Planned Development Case: includes development in the Base Case, the Project footprint and reasonably foreseeable future development.

If the residual effects of the Project are not expected to overlap with effects from other identified projects and activities, then it was concluded the Project would not contribute to cumulative effects, and no further analysis of cumulative effects was done. If residual effects of the Project are expected to overlap with residual effects from other identified projects and activities, then a cumulative effects assessment was completed for that VEC or VSC.

Existing, approved and planned developments were identified within a 15 km radius (30 km corridor) around the two proposed pipelines (see Table 18-1 and Figures 18-1 to 18-2). The list of existing, approved and planned developments was used in cumulative effects assessment for all disciplines except air quality.

Spatial extent of existing development was identified from the following sources:

- British Columbia Oil and Gas Commission Land and Resource Data Warehouse (OGC 2011a);
- Alberta Sustainable Resource Development Digital Integrated Dispositions (SRD 2011); and
- 2.5 m colour SPOT satellite imagery.

Although not identified explicitly in the cumulative effects assessment, existing forestry cut blocks and wildfire footprints were considered in the project residual effects assessment as existing disturbances. Existing cut block data for British Columbia was available through the British Columbia Oil and Gas Commission Land and Resource Data Warehouse (OGC 2011a). Existing cut block data for Alberta was not available in the SRD Digital Integrated Dispositions spatial database. However, existing disturbances (including cut blocks and wildfires) were classified as “disturbed” classes in both the vegetation mapping compiled and created for the local study area (LSA) and in the available land cover classification (GeoBase 2011) for the regional study area (RSA) for British Columbia and Alberta.

Approved and planned projects were identified from the following sources:

- NEB Major Applications and Projects (NEB 2011);
- Canadian Environmental Assessment Registry (CEA Agency 2011);
- ERCB Integrated Application Registry (ERCB 2011);
- Inventory of Major Alberta Projects (Government of Alberta 2011);
- Alberta Environment Environmental Assessment Activity Reports (AENV 2011);
- British Columbia Oil and Gas Commission Industry Activity Levels (OGC 2011b);
- British Columbia Major Projects Inventory (BCMF 2010);
- British Columbia Environmental Assessment Office Project Information Centre (EAO 2011);
- British Columbia iMap Natural Information Service (BC iMap 2011);

- Quicksilver Resources Inc. (Quicksilver Resources Inc. 2011); and
- Midwest Surveys Inc. (Midwest Surveys Inc. 2011, pers. comm.).

Table 18-1 Cumulative Effects Project Inclusion List

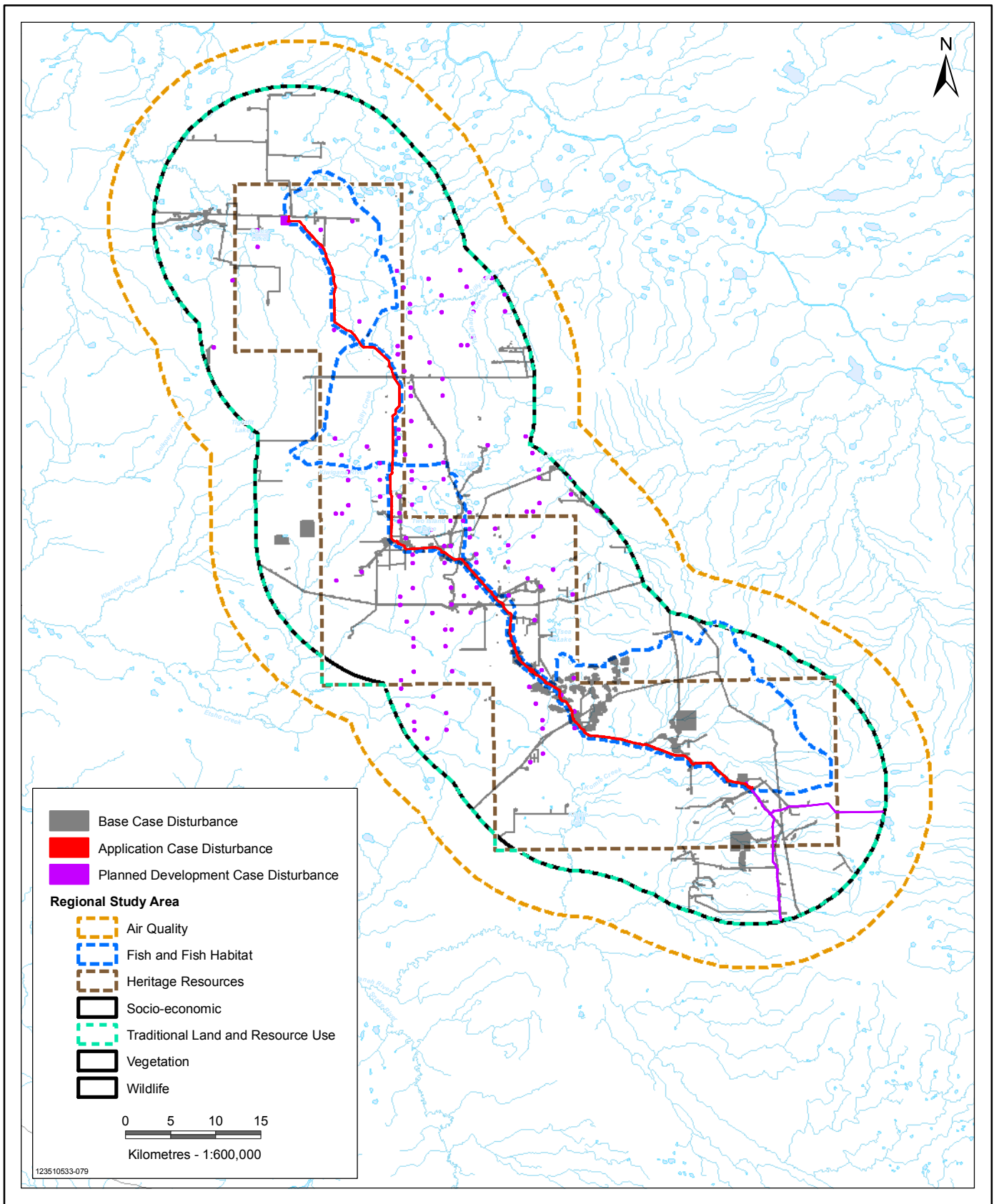
Project	Location	Base Case	Application Case	Planned Development Case
Komie North Section				
Existing development ^a	See note ^a	X	X	X
NGTL Horn River Mainline Cabin Section – Pipeline (approved)	c-74-J/94-P-4 to b-25-K/94-I-11			X
Apache Canada Ltd. – Well Development (licensed)	c-034-L/094-O-08			X
Apache Canada Ltd. – Well Development (licensed)	c-028-C/094-O-09			X
Apache Canada Ltd. – Well Development (licensed)	c-034-L/094-O-08			X
Apache Canada Ltd. – Well Development (licensed)	c-034-L/094-O-08			X
Apache Canada Ltd. – Well Development (licensed)	c-034-L/094-O-08			X
Apache Canada Ltd. – Well Development (licensed)	c-034-L/094-O-08			X
Apache Canada Ltd. – Well Development (licensed)	c-034-L/094-O-08			X
Apache Canada Ltd. – Well Development (licensed)	c-028-C/094-O-09			X
Avenex Energy Corp. – Well Development (licensed)	d-024-I/094-P-04			X
Crew Energy Inc. – Well Development (licensed)	a-056-H/094-O-09			X
Devon Nec Corporation – Well Development (licensed)	d-087-G/094-O-08			X
Devon Nec Corporation – Well Development (licensed)	a-020-J/094-O-08			X
Devon Nec Corporation – Well Development (licensed)	b-100-G/094-O-08			X
Devon Nec Corporation – Well Development (licensed)	d-087-G/094-O-08			X
Devon Nec Corporation – Well Development (licensed)	a-020-J/094-O-08			X
Devon Nec Corporation – Well Development (licensed)	d-070-F/094-O-16			X
Devon Nec Corporation – Well Development (licensed)	d-087-G/094-O-08			X
Devon Nec Corporation – Well Development (licensed)	d-087-G/094-O-08			X
Devon Nec Corporation – Well Development (licensed)	a-020-J/094-O-08			X
Devon Nec Corporation – Well Development (licensed)	a-020-J/094-O-08			X
Devon Nec Corporation – Well Development (licensed)	a-020-J/094-O-08			X
Devon Nec Corporation – Well Development (licensed)	a-020-J/094-O-08			X
EnCana Corporation – Well Development (licensed)	a-083-D/094-O-09			X

Table 18-1 Cumulative Effects Project Inclusion List (cont'd)

Project	Location	Base Case	Application Case	Planned Development Case
Komie North Section (cont'd)				
EnCana Corporation – Well Development (licensed)	b-061-K/094-O-08			X
EnCana Corporation – Well Development (licensed)	a-016-K/094-O-08			X
EnCana Corporation – Well Development (licensed)	b-098-F/094-O-08			X
EnCana Corporation – Well Development (licensed)	a-041-A/094-O-10			X
EnCana Corporation – Well Development (licensed)	c-056-J/094-O-08			X
EnCana Corporation – Well Development (licensed)	d-046-K/094-O-08			X
EnCana Corporation – Well Development (licensed)	a-008-C/094-O-09			X
EnCana Corporation – Well Development (licensed)	d-077-J/094-O-08			X
EnCana Corporation – Well Development (licensed)	b-061-K/094-O-08			X
EOG Resources Canada Inc. – Well Development (licensed)	c-007-J/094-O-10			X
EOG Resources Canada Inc. – Well Development (licensed)	b-084-B/094-O-09			X
Nexen Canada Inc. – Well Development (licensed)	a-016-I/094-O-08			X
Nexen Canada Inc. – Well Development (licensed)	b-077-H/094-O-08			X
Nexen Canada Inc. – Well Development (licensed)	b-077-H/094-O-08			X
Nexen Canada Inc. – Well Development (licensed)	d-001-J/094-O-08			X
Nexen Canada Inc. – Well Development (licensed)	b-077-H/094-O-08			X
Nexen Canada Inc. – Well Development (licensed)	b-077-H/094-O-08			X
Nexen Canada Inc. – Well Development (licensed)	b-077-H/094-O-08			X
Nexen Canada Inc. – Well Development (licensed)	b-077-H/094-O-08			X
Nexen Canada Inc. – Well Development (licensed)	b-077-H/094-O-08			X
Nexen Canada Inc. – Well Development (licensed)	b-077-H/094-O-08			X
Nexen Canada Inc. – Well Development (licensed)	b-077-H/094-O-08			X
Nexen Canada Inc. – Well Development (licensed)	c-016-I/094-O-08			X
Nexen Canada Inc. – Well Development (licensed)	b-077-H/094-O-08			X
Quicksilver Resources Canada Inc. – Well Development (licensed)	d-030-D/094-O-16			X
Quicksilver Resources Canada Inc. – Well Development (licensed)	d-050-A/094-O-15			X
Quicksilver Resources Canada Inc. – Well Development (licensed)	d-030-D/094-O-16			X
SMR Oil and Gas Ltd. – Well Development (licensed)	c-007-D/094-P-12			X
SMR Oil and Gas Ltd. – Well Development (licensed)	c-021-A/094-O-09			X

Table 18-1 Cumulative Effects Project Inclusion List (cont'd)

Project	Location	Base Case	Application Case	Planned Development Case
Komie North Section (cont'd)				
Storm Gas Resource Corp. – Well Development (licensed)	c-007-D/094-P-12			X
Storm Gas Resource Corp. – Well Development (licensed)	c-021-A/094-O-09			X
NGTL Horn River Mainline Komie East Extension – Pipeline (proposed)	48-J/94-P-4 to 31-J/94-P-4			X
Quicksilver – Fortune Gas Plant (announced)	55-A/94-O-15			X
Chinchaga Section				
Existing development ^a	See note ^a	X	X	X
Canadian Natural Resources – Pipeline (approved)	14-06-097-03 W6M to 06-12-097-04 W6			X
Arc Resources – Well Development (approved)	16-06-095-05 W6M			X
NGTL Tanghe Creek Lateral Loop No. 2 Cranberry Section – Pipeline (in review)	SW 31-096-07 W6M to NE13-096-05 W6M			X
NOTE: ^a Disturbance footprint of existing development was determined based on available information from government sources (OGC 2011a; SRD 2011). In addition, any additional ground disturbance visible in recent satellite imagery was digitized within 1 km on both sides of the proposed pipeline sections.				



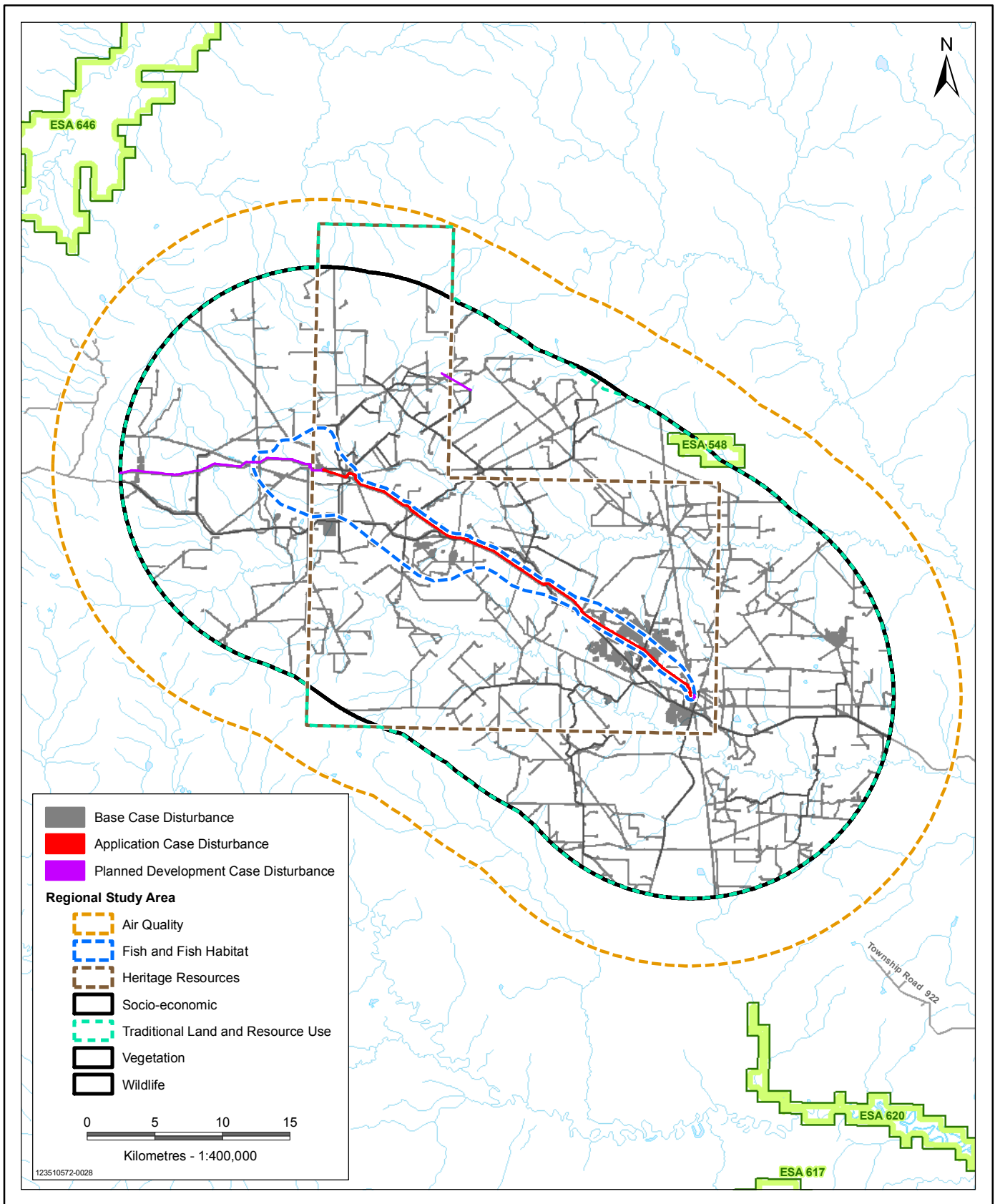
NOVA Gas Transmission Ltd. (NGTL) - Northwest Mainline Komie North Extension

Komie North Section Land Disturbance for Base Case, Application Case and Planned Development Case

Acknowledgements: Midwest Surveys Inc., and TCPL; Base data provided by the Government of British Columbia.

PREPARED BY	
PREPARED FOR	NGTL
FIGURE NO.	18-1

Last Modified: August 15, 2011 By: wsocha



NOVA Gas Transmission Ltd. (NGTL) - Northwest Mainline Komie North Extension

Chinchaga Section Land Disturbance for Base Case, Application Case and Planned Development Case

Acknowledgements: Midwest Surveys Inc., and TCPL. Base data provided by the Government of Alberta, and the Government of Canada, Planned Development data provided by ERCB.

PREPARED BY
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FIGURE NO.

18-2

Last Modified: September 7, 2011 By: borry

18.2.2.2 Timing of Identified Planned Development

Available information on the timing of planned development construction and operations is as follows:

- Komie North Section RSA:
 - NGTL Horn River Mainline Cabin Section: construction start Q4 2011, operations start Q2 2012;
 - NGTL Horn River Mainline Komie East Extension: construction start Q4 2011, operations start Q2 2012;
 - Quicksilver Fortune Gas Plant: construction start date unknown, operational by mid-2014; and
 - The timing of other planned development is unknown.
- Chinchaga Section RSA:
 - NGTL Tanghe Creek Lateral Loop No. 2 Cranberry Section: construction start Q3 2012, operations start Q2 2013; and
 - The timing of other planned development is unknown.

18.3 Vegetation and Wetlands

18.3.1 Screening for Cumulative Environmental Effects

With respect to vegetation resources, the screening of the Project's potential contribution to the cumulative effects of base case, application case, and future development case considers the following criteria to determine if assessment of cumulative effects might exceed acceptable thresholds. Additional assessment is warranted if:

- the Project results in a demonstrable residual effect;
- residual effects are likely to act in a cumulative fashion with those of other projects; and
- there is a reasonable expectation that the Project's contribution to cumulative effects will affect the viability or sustainability of vegetation resources.

A cumulative environmental effects assessment is warranted if residual project effects to vegetation or wetlands act cumulatively with those of other projects and activities in the RSA, and the resulting cumulative effects might exceed acceptable levels without implementation of project-specific or regional mitigation. The effects of the Project are not predicted to have a significant effect on vegetation or wetlands; however, even non-significant changes to vegetation and wetland resources and function can act cumulatively with other activities and need to be considered. See Tables 18-2 and 18-3 for a screening of potential cumulative effects.

Table 18-2 Potential Cumulative Environmental Effects to Vegetation from Future Projects

Other Projects and Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects			
	Species Diversity	Old Forests	Vegetation Community Diversity	Vegetation Landscape Diversity
Komie North Section				
NGTL – Horn River Mainline Cabin Section	1	0	1	1
NGTL – Horn River Mainline Komie East Extension	1	0	1	1
Apache Canada Ltd. – Well Development (9 sites)	1	0	1	0
Crew Energy Inc. – Well Development (1 site)	1	0	1	0
Devon Nec Corporation – Well Development (12 sites)	1	0	1	0
EnCana Corporation – Well Development (10 sites)	1	0	1	0
EOG Resources Canada Inc. – Well Development (2 sites)	1	0	1	0
Nexen Canada Inc. – Well Development (13 sites)	1	0	1	0
Quicksilver Resources Canada Inc. – Well Development (3 sites)	1	0	1	0
SMR Oil and Gas Ltd. – Well Development (2 sites)	1	0	1	0
Storm Gas Resource Corp. – Well Development (2 sites)	1	0	1	0
Quicksilver – Fortune Gas Plant (announced)	1	0	1	1
Chinchaga Section				
NGTL Tanghe Creek Lateral Loop No. 2 Cranberry Section – Pipeline (in review)	1	0	1	1
Canadian Natural Resources – Natural Gas Pipeline (approved)	1	0	1	1
Arc Resources – Well Development (approved) (1 site)	1	0	1	0
NOTES: 0 = Project environmental effects do not act cumulatively with those of other projects and activities. 1 = Project environmental effects act cumulatively with those of other projects and activities, but the resulting cumulative effects are unlikely to exceed acceptable levels with the application of best management or codified practices. 2 = Project environmental effects act cumulatively with those of other projects and activities and the resulting cumulative effects might exceed acceptable levels without implementation of project-specific or regional mitigation. Further assessment is warranted. Justification for each of these rankings is provided in section below.				

Table 18-3 Potential Cumulative Environmental Effects to Wetlands from Future Projects

Other Projects and Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects	
	Wetland Community Diversity	Wetland Function
Komie North Section		
NGTL – Horn River Mainline Cabin Section	1	1
NGTL – Horn River Mainline Komie East Extension	1	1
Apache Canada Ltd. – Well Development (9 sites)	0	0
Crew Energy Inc. – Well Development (1 site)	0	0
Devon Nec Corporation – Well Development (12 sites)	0	0
EnCana Corporation – Well Development (10 sites)	0	0
EOG Resources Canada Inc. – Well Development (2 sites)	0	0
Nexen Canada Inc. – Well Development (13 sites)	0	0
Quicksilver Resources Canada Inc. – Well Development (3 sites)	0	0
SMR Oil and Gas Ltd. – Well Development (2 sites)	0	0
Storm Gas Resource Corp. – Well Development (2 sites)	0	0
Quicksilver – Fortune Gas Plant (announced)	1	1
Chinchaga Section		
NGTL Tanghe Creek Lateral Loop No. 2 Cranberry Section – Pipeline (in review)	1	1
Canadian Natural Resources – Natural Gas Pipeline (approved)	1	1
Arc Resources – Well Development (approved) (1 site)	0	0
NOTES: 0 = Project environmental effects do not act cumulatively with those of other projects and activities. 1 = Project environmental effects act cumulatively with those of other projects and activities, but the resulting cumulative effects are unlikely to exceed acceptable levels with the application of best management or codified practices. 2 = Project environmental effects act cumulatively with those of other projects and activities and the resulting cumulative effects might exceed acceptable levels without implementation of project-specific or regional mitigation. Further assessment is warranted. Justification for each of these rankings is provided in section below.		

The proposed Project is largely within areas that have been disturbed previously by forestry, mining, and oil and gas development. Specifically, for the base case, 18% and 29% of the planned Project footprints for the Komie North and Chinchaga sections are already disturbed, respectively. The Project proposes to clear an additional 298 ha in the Komie North Section and 74 ha along the Chinchaga Section. The Project will parallel existing linear development for more than 60% of the planned length.

Although the vegetation in these areas will be altered to some degree during construction, the overall footprint is small, and care will be taken (with appropriate mitigation), to avoid adverse effects to vegetation resources. Further, any project disturbance will be minimized and quickly re-vegetated (e.g., invasive plant management), with the focus to maintain the function and viability of vegetation and wetland communities.

The residual effects to rare plants, rare ecosystems, wetland community diversity and landscape vegetation diversity are expected to be relatively small and, for the most part, reversible. From a landscape perspective the effects to vegetation resources associated with the Project are minor, or negligible in the case of old forests.

In summary, the overall cumulative effects to vegetation resources and are not expected to affect the viability or sustainability of vegetation resources given that:

- the existing level of Base Case disturbance within the Project footprint and RSA;
- the small footprint and looping nature of the Project in the Application Case;
- the Project is not expected to create any residual effects to vegetation resources; and
- the existing planned future development within the RSA is expected to be only 1.4% and 3.2 % for the Komie and Chinchaga section respectively.

Therefore, given the above information further assessment of cumulative effects to vegetation resources is not warranted.

18.4 Wildlife and Wildlife Habitat

18.4.1 Screening for Cumulative Environmental Effects

A cumulative environmental effects assessment is warranted if residual project wildlife and wildlife habitat effects act cumulatively with those of other projects and activities in the RSA, and the resulting cumulative effects might exceed acceptable levels without implementation of project-specific or regional mitigation. The effects of the Project are not predicted to have a significant effect on wildlife; however, even non-significant alterations to habitat, movement or mortality can act cumulatively with other activities and need to be considered. See Table 18-4 for a screening of potential cumulative effects.

Table 18-4 Potential Cumulative Environmental Effects to Wildlife from Future Projects

Other Projects and Activities with Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects		
	Habitat	Movement	Mortality
Komie North Section			
NGTL – Horn River Mainline Cabin Section	1	0	1
NGTL – Horn River Mainline Komie East Extension	1	0	1
Apache Canada Ltd. – Well Development (9 sites)	1	0	0
Crew Energy Inc. – Well Development (1 site)	1	0	0
Devon Nec Corporation – Well Development (12 sites)	1	0	0
EnCana Corporation – Well Development (10 sites)	1	0	0
EOG Resources Canada Inc. – Well Development (2 sites)	1	0	0
Nexen Canada Inc. – Well Development (13 sites)	1	0	0
Quicksilver Resources Canada Inc. – Well Development (3 sites)	1	0	0
SMR Oil and Gas Ltd. – Well Development (2 sites)	1	0	0
Storm Gas Resource Corp. – Well Development (2 sites)	1	0	0
Quicksilver – Fortune Gas Plant (announced)	1	0	1
Chinchaga Section			
NGTL Tanghe Creek Lateral Loop No. 2 Cranberry Section – Pipeline (in review)	1	0	0
Canadian Natural Resources – Natural Gas Pipeline (approved)	1	0	0
Arc Resources – Well Development (approved) (1 site)	1	0	0
<p>NOTES:</p> <p>0 = Project environmental effects do not act cumulatively with those of other projects and activities.</p> <p>1 = Project environmental effects act cumulatively with those of other projects and activities, but the resulting cumulative effects are unlikely to exceed acceptable levels with the application of best management or codified practices.</p> <p>2 = Project environmental effects act cumulatively with those of other projects and activities and the resulting cumulative effects might exceed acceptable levels without implementation of project-specific or regional mitigation. Further assessment is warranted.</p> <p>Justification for each of these rankings is provided in section below.</p>			

18.4.1.1 Habitat

The Project will result in residual effects on habitat in both project sections, although these effects are not considered significant (less than 20% temporary habitat change in LSA, see Section 8.3). Residual project effects on habitat availability are expected to be positive for common nighthawk and neutral for moose, but will be adverse for the other species. Even though the identified effects are very small, they will act in a cumulative fashion with the effects of other past, current or future projects and activities. Hydrocarbon development, and transportation, all involve removing vegetation from the area being developed, which results in at least short-term alteration of some wildlife habitat. Indirect loss of habitat adjacent to development might also result from sensory disturbance and avoidance of humans and predators.

Habitat loss can also occur through mechanisms other than development. An important source of habitat change in the boreal forest is mountain pine beetle. While beetle-killed stands can be used by olive-sided flycatcher and woodpeckers, these stands are typically harvested, creating artificially disturbed forest that frequently have relatively high predation rates (Altman and Sallabanks 2000; Robertson and Hutto 2007) and are therefore low quality habitat. Unharvested beetle-killed pine stands are at high risk of burning, which also results in alteration of wildlife habitat.

BASE CASE

A number of developments occur within the RSA of both sections under Base Case, including pipelines, wells, gas plants, transmission lines, cutblocks, seismic lines and roads. All of these features contribute to current loss of wildlife habitat prior to the introduction of the Project onto the landscape. Disturbances account for a relatively small proportion of the land cover under Base Case, with well over 80% of the LSA in each section available to wildlife. This suggests that under Base Case, current levels of habitat alteration are unlikely to have resulted in significant changes to wildlife populations. Some species, such as for moose, likely use pipeline and transmission line right-of-way (RoW) for foraging, and could actually gain habitat for some life requisites.

APPLICATION CASE

The Project will add incrementally to habitat loss caused by existing disturbances. The Project represents a relatively small disturbance footprint in both sections, with no significant changes in habitat availability for any of the species assessed. Because less than 20% of wildlife habitat in the LSA was affected by the Project, the Project will not contribute significantly to effects at the RSA scale for any species.

PLANNED DEVELOPMENT CASE

Although predicted habitat losses of the Application Case are well under the 20% threshold identified for the species assessed, habitat alteration associated with future projects might result in exceedances of this threshold and subsequent effects on wildlife abundance and viability. Future projects and activities have the potential to interact with the Project and other existing disturbances (Base Case). These projects

are primarily pipeline projects. In general, few projects have been identified, and many of them are looping projects. The areal extent of the future projects is relatively small, ranging between 51.9 ha (Chinchaga Section) and 161.1 ha (Komie North Section). Planned Development Case disturbance, including baseline, project and future developments, will account for 1.4% (Komie North section) to 3.2% (Chinchaga section) of the RSA (see Table 18-5). Therefore, residual cumulative effects on habitat are not expected to exceed acceptable thresholds (20% habitat change) within the RSA for Komie North or Chinchaga sections, and therefore, further assessment was not necessary.

Table 18-5 Proportion of Regional Study Areas Disturbed in the Planned Development Case

Section	Planned Development Case Disturbance (ha) ¹	RSA Area (ha)	RSA Disturbed in Planned Development Case (%)
Komie North	4,995	345,728	1.4
Chinchaga	5,349	168,110	3.2
NOTE: ¹ Includes disturbances in Base Case, Application Case and Planned Development Case.			

18.4.1.2 Mortality Risk

Mortality risk was scoped out as a potential effect on wildlife in both sections of the Project where the project disturbance was contiguous with another linear development. Therefore, cumulative effects will only be addressed for the new cut area of the Komie North Section. In addition, residual project effects on mortality are assessed only for boreal caribou and grizzly bear. The Maxhamish caribou herd, with which the Komie North Section intersects, has a population estimated of 306 animals (Environment Canada 2008) with very low calf survival due to predation (Rowe 2007). The Project also occurs in the Taiga Grizzly Bear Population Unit (GBPU), which was estimated to have a population of 92 bears in 2008 (Hamilton 2008). Hamilton et al. (2004) suggested that GBPU's with fewer than 100 bears be closed to hunting because the conservation risk of hunting such a small population was too high. However, the Taiga GBPU is still considered to be viable (Hamilton 2008).

BASE CASE

Linear features on the landscape are known to adversely affect boreal caribou and grizzly bear. Linear features identified in the Base Case include pipeline and powerline RoW, roads and seismic lines, among which seismic lines were most prevalent (see Section 8, Table 8-17). Under Base Case conditions the density of linear features in the new cut area of the Komie North Section LSA and UWR-Type A-BCAR020 (Caribou RSA) was considered low at 0.42 km/km², and therefore does not exceed any identified threshold for boreal caribou in this region (see Section 8.1.7.1 for a rationale on the threshold). The density of open road features (excluding seismic) under Base Case conditions was 0.02 km/km², well below the recommended threshold of 0.6 km/km² for grizzly bear (Guyg et al. 2004; SRD and ACA 2010).

APPLICATION CASE

The Project will add incrementally to existing linear features at Base Case, resulting in a density of 0.50 km/km² of linear features for boreal caribou (see Section 8, Table 8-17). For grizzly bear it was assumed that the project RoW could serve as a tertiary access route for hunters and poachers, and therefore when combined with existing open roads, the density increases to 0.04 km/km². Although these density values are still well below recognized thresholds, NGTL acknowledges the importance of mitigating any potential effects on boreal caribou and grizzly bear, and has committed to a suite of mitigation measures listed in the *Environmental Protection Plan*, including rollback to prevent access to the RoW (see Section 20).

PLANNED DEVELOPMENT CASE

Any future linear features, including roads, pipeline or powerline RoWs, or seismic lines, would add incrementally to the Application Case and contribute to cumulative effects on mortality risk of wildlife. Other pipeline projects are planned within the RSA but are looping (e.g., Tanghe Creek Lateral Loop No. 2 Cranberry Section) and will therefore not contribute to linear density. New pipeline RoW has the potential to serve as access corridors for humans and predators, but with the application of appropriate mitigation, such as use of rollback and access control, effects on mortality will likely be minimal. Based on reasonably foreseeable projects, cumulative mortality risk is unlikely to threaten the sustainability of boreal caribou or grizzly bear in the region, and is therefore considered not significant. No further assessment was necessary.

18.4.1.3 Wildlife Movement

Effects of the Project on wildlife movement were assessed only for smaller species including birds, small mammals and amphibians, because larger species were assumed to be able to traverse the RoW without difficulty. Moose and grizzly bear will likely be attracted to the RoWs for forage and ease of movement. The cumulative effects assessment therefore focused on smaller species, although potential effects on large mammals will be addressed as appropriate.

BASE CASE

At Base Case, disturbances including pipelines, wells, gas plants, transmission lines, cutblocks, seismic lines, and roads have the potential to disrupt movement of birds, small mammals and amphibians. As reviewed in the wildlife project effects assessment (see Section 8.3.3), however, most species do not encounter barrier effects when attempting to cross features less than 100 m wide. The width of Base Case disturbances was not determined, but it was assumed that the majority of linear features was less than 100 m wide, and therefore did not act as barriers to movement. Non-linear features such as cutblocks are a greater concern for habitat availability than movement; for example, Schmiegelow and Hannon (1999) found that some songbirds were absent from forest patches smaller than 10 ha.

APPLICATION CASE

The addition of the project RoW in the contiguous sections will increase the width of existing RoW by 32 m (see Table 18-6). The widest RoW will be associated with the Chinchaga section (72 m wide), followed by Komie North (contiguous) at 65 m, and Komie North (new cut) at 32 m. In all areas, the width of the RoW is unlikely to act as an impermeable barrier to movement for any species.

Table 18-6 Cumulative width of RoW, including the Project and Existing Adjacent Development

Section	RoW Width (m) ¹
Komie North (new cut)	32
Komie North (contiguous)	65
Chinchaga	72
NOTE	
¹ Average width of project, including temporary work space, and adjacent RoW.	

PLANNED DEVELOPMENT CASE

Any future linear features would add incrementally to the Application Case and contribute to cumulative effects on wildlife movement. For example, Tanghe Creek Lateral Loop No. 2 Cranberry section will parallel an existing pipeline, but not the Project. In addition, the combined total RoW width would be much less than 100 m. As residual cumulative effects on wildlife are not expected to exceed identified thresholds, particularly with effective use of mitigation measures, further assessment of cumulative effects on wildlife movement was not considered necessary.

18.4.2 Summary

- A number of new pipelines and wells, a gas plant and a compressor station were identified as projects planned for the RSA within the foreseeable future.
- Cumulative changes in habitat availability are not expected to exceed the 20% threshold within the RSA.
- Cumulative linear feature density is unlikely to exceed the thresholds identified for boreal caribou and grizzly bear in the RSA, because the majority of proposed pipeline construction will be looped and will therefore not contribute to linear feature density. Therefore, cumulative mortality risk is unlikely to threaten the sustainability of boreal caribou or grizzly bear in the region, and therefore, further assessment was not necessary.
- Cumulative changes to wildlife movement are unlikely to be significant because even for looping projects, ROW widths are not expected to exceed the 100 m threshold.

18.5 Fish and Fish Habitat

18.5.1 Screening for Cumulative Environmental Effects

18.5.1.1 Cumulative Effects on Fish Habitat

Although no significant residual effects on productive capacity of fish habitat are predicted to occur because of pipeline construction and roads, localized alterations of fish habitat will occur at moderate risk crossings. To satisfy DFO's Policy for the Management of Fish Habitat objective of net gain of productivity of fish habitat and the corresponding conservation guiding principle of no-net-loss of productivity of fish habitat, effective reclamation or habitat compensation for these losses will be required. It is anticipated that with effective construction and reclamation works, no-net-loss of habitat productive capacity is predicted.

Provided DFO agrees that no-net-loss can be achieved with the implementation of the reclamation plan, any adverse residual environmental effects on the productive capacity of fish habitat will be avoided and there will be no residual effect on fish habitat. Consequently, pipeline watercourse crossings for the Project will not contribute to cumulative effects in the assessment area.

18.5.1.2 Cumulative Effects on Fish Mortality

Potential changes in fish health and mortality from project activities are anticipated to be low because of detailed crossing design, effective mitigation measures, and the short-term duration of effects. Therefore, no residual risk to fish populations is anticipated from construction and operation of the Project. As a result, no cumulative effects are predicted for this aspect of the Project.

18.5.1.3 Cumulative Effects on Water Quality

Potential changes in water quality from project activities are anticipated to be low due to the implementation of proven, effective, mitigation measures and the short-term duration of effects. Therefore, no residual risk to water quality is anticipated from construction and operation of the Project. As a result, no cumulative effects are predicted for this aspect of the Project.

18.6 Socio-Economic Assessment

18.6.1 Screening for Cumulative Effects

This section evaluates the residual socio-economic effects directly associated with the Project in combination with the residual effects arising from other projects and activities that have been or will be carried out in the Project's socio-economic LSA and RSA. Existing and proposed developments have the potential for both a temporal overlap during construction and operation and a physical overlap with the socio-economic LSA and RSA. Table 18-7 identifies potential project interactions between existing and proposed projects and the Project's VSCs with residual socio-economic effects.

Table 18-7 Potential Cumulative Socio-Economic Effects

Other Projects and Activities with Potential for Cumulative Socio-Economic Effects	Potential Cumulative Socio-Economic Effects										
	Social and Cultural Well Being	Human Occupancy and Resource Use					Infrastructure and Services		Employment and Economy		
		Environmentally Significant and Protected Areas	Visual and Sensory Environment	Forestry	Other Energy Resource Activities	Hunting, Fishing, Trapping	Road Transportation	Emergency Services	Contract Procurement	Employment	Government Revenue
Komie North Section											
Existing Development	2	0	2	2	1	2	2	1	2	2	2
NGTL – Horn River Mainline Cabin Section	0	0	2	2	1	2	0	1	2	2	2
NGTL – Horn River Mainline Komie East Extension	0	0	2	2	1	2	0	1	2	2	2
Quicksilver – Fortune Creek Gas Plant	2	0	2	2	1	2	2	1	2	2	2
Chinchaga Section											
Existing Development	2	0	2	2	1	2	2	1	2	2	2
Canadian Natural Resources Ltd. – Natural Gas Pipeline	0	0	2	2	1	2	0	1	2	2	2
Arc Resources – Well Development	0	0	2	2	1	2	0	1	2	2	2

18.6.1.1 Cumulative Effects to Environmentally Significant and Protected Areas

The Project intersects areas that have been identified as important for wildlife values, e.g., core caribou habitat. Cumulative effects assessment on wildlife and wildlife habitat are addressed in Section 18.5. No recreational-related protected areas are in the project LSAs and RSAs. The Project's cumulative effects related to disturbance of land users' visual and sensory environment is addressed in Section 18.8.3.

18.6.1.2 Cumulative Effects to Emergency Services

Potential residual effects associated with Emergency Services identified in Section 13 include an unplanned event occurring during construction or operation that would lead to the need for local and regional emergency services. As a result of the extensive mitigation and precautionary measures in place related to safety, this potential residual effect of the Project is considered to be not likely to occur and a cumulative effects assessment for Emergency Services was not conducted.

18.6.1.3 Cumulative Effects to Employment and Economy

Potential cumulative effects associated with the construction and operation of the Project on employment and economy are: increased contract procurement opportunities; increased local employment opportunities; and the generation of revenue for municipal, provincial and federal governments. In accordance with Guide A.2.7 of the NEB *Filing Manual*, further analysis of these residual effects is not provided since these effects have been determined to have a positive residual effect (see Section 13).

18.6.1.4 Cumulative Effects to Other Energy and Resource Industries

The potential cumulative effect associated with the construction and operation of the Project on other energy and resources industries is the reduced availability of land for these other uses. Project contributions to this cumulative effect have been reduced by using existing pipeline rights-of-way for access as much as possible and by using previously disturbed areas for stockpile sites and temporary construction sites. Although project environmental effects act cumulatively with those of other projects and activities, the resulting cumulative effects are unlikely to exceed acceptable levels with the application of mitigation measures. A cumulative effects assessment was not conducted.

18.6.2 Assessment of Cumulative Effects to Social and Cultural Well-being

The Project is located in areas where substantial industrial development is occurring and near permanent population centers. There are existing sources of disruption of community residents from temporary workforces visiting communities, using local services and travelling on local roads. Existing activities, the Project and known future developments could act cumulatively to disrupt community residents.

A qualitative assessment of the cumulative effects to social and cultural well-being was deemed to be the most appropriate approach for evaluating the significance of potential cumulative environmental effects given the short duration of the project construction and the lack of quantifiable data. Consequently, the

evaluation of significance of the potential cumulative residual effect relied on the professional judgment of the assessment team.

18.6.2.1 Base Case

The Project is located in areas where there are numerous industrial developments. There are two permanent industrial camps found in the Komie North Section RSA. An estimation of the number of people residing in these camps is not available. There are no permanent industrial camps found in the RSA of the Chinchaga Section. It is assumed there are several temporary industrial camps at any given time in the project socio-economic RSA. The numbers of workers and locations associated with the temporary industrial camps are not available.

It is assumed that workers associated with existing permanent facilities such as the operation of gas plants reside in nearby communities and do not contribute to a temporary work force.

18.6.2.2 Application Case

Temporary construction camps will be located near each pipeline and each will house between 50 and 500 workers each month during the construction timeframe (November 2013 to April 2014). Workers in these camps could visit the nearby communities interacting with them and using the local facilities and services. The construction workers associated with the Project could interact with workers from existing projects in the RSA and act cumulatively on community social and cultural well-being.

18.6.2.3 Planned Development Case

It is anticipated that known future developments will house construction workers in camps and could disrupt community social and cultural well-being in the socio-economic RSA. Of the future projects identified in Table 18-8, one project (Fortune Creek Gas Plant) has the potential to be constructed concurrently with the Komie North Section and will interact cumulatively with the Project.

18.6.2.4 Mitigation of Cumulative Effect to Social and Cultural Well-being

Mitigation measures found in Section 13.1.5.1 are expected to address cumulative effects to Social and Cultural Well-being. No additional social and cultural well-being cumulative effect mitigation measures beyond the project-specific mitigation measures are warranted.

18.6.2.5 Residual Cumulative Effect to Social and Cultural Well-being

The Project will act cumulatively with existing developments and one known future development in the socio-economic RSA resulting in a disruption of local or community residents. The sources of disruption include the temporary workforces visiting communities using local services and travelling on local roads. Without knowing the number of people residing in the existing and temporary industrial work camps at any given time in the RSA, it is difficult to predict the Project's contribution to the disruption of social and

cultural well-being. Of the future projects identified in Table 18-8, one project (Fortune Creek Gas Plant) has the potential to be constructed concurrently with the Komie North Section and will interact cumulatively with the Project during construction. Project contributions to cumulative effects to social and cultural well-being have been reduced by stressing the need for the safe and respectful use of community facilities and the need for respectful behaviour while travelling outside of camp will be discussed with the workforce during the orientation sessions. In addition, zero tolerance will be enforced for unruly behaviour and illegal drug use. It is assumed that existing and known future developments occurring in the socio-economic RSA do employ or will employ similar measures.

The direction of the residual cumulative effect to disruption of community residents from temporary workforces is considered to be adverse. The magnitude of this adverse residual cumulative effect is expected to be medium given the small number of known camps in the area, the short duration of the construction schedule and the small number of known future projects that will overlap with the Project's construction timeframe. The geographic extent is expected to be the regional, as the residual cumulative effect will extend into the RSA. The duration will be short-term, as it is expected that the cumulative increase to disruption of community residents from temporary workforces is confined to the Project's construction phase, and the frequency will be once, as it will occur only during the construction phase. The residual cumulative effect to disruption of community residents from temporary workforces is expected to be reversible upon completion of construction. The residual cumulative effect is expected to be not significant. The probability of occurrence of the residual cumulative effect is high because construction of the Project in combination with existing activities and known future development will result in disruption of community residents from temporary workforces. The level of confidence in the determination of significance is low based on the difficulty in predicting how people perceive a temporary increase in a construction workforce and the assumptions made.

18.6.3 Assessment of Cumulative Effects to Visual and Sensory Environment

The Project is located in areas with active industrial development and development related activities. The presence of existing projects in the socio-economic RSA such as oil and gas, forestry and transportation activities have resulted in a change in viewscape in the project RSAs. The Project could interact with the existing and known future development.

There are existing sources of sensory disturbance in the socio-economic RSA such as oil and gas, forestry and transportation activities resulting in sources of noise and air emissions, vehicle and equipment traffic, overflights, on-going pipeline maintenance activities and operation of existing facilities resulting in sensory disturbance to land users. All project-related activities involving the use of equipment could interact with these existing and known future activities and cumulatively effect the sensory environment.

A quantitative approach was selected to determine the cumulative effect of the Project on alteration of viewscales since the change in this parameter in comparison to existing conditions can be quantified. However, it is difficult to predict how people perceive cumulative change and the confidence in the

accuracy of the results is low. Nonetheless, the quantitative assessment does facilitate the comparison of project-related contributions to those effects associated with existing and known future developments.

A qualitative assessment of increased sensory disturbance was deemed to be the most appropriate method to evaluate the significance of the potential residual cumulative environmental effects given the short duration of project construction and lack of quantifiable data. There are no established thresholds, standards or guidelines relating to the reduction in land base for forestry; therefore, the evaluation of significance relied on the professional judgment of the assessment team.

18.6.3.1 Base Case

The RSA is located where land use plans have designated or allowed for industrial use, at locations not readily accessible to nearby communities and at a substantial distance from tourist corridors. However, the RSAs are used by resident and Aboriginal hunters, fishers and trappers. Existing activities such as oil and gas developments, transmission lines and roads contribute to an existing alteration of the viewscape. For the purpose of the cumulative effect assessment, it has been assumed that any activity that clears trees can alter the viewscape. Table 18-8 identifies the alteration of viewscape within the socio-economic RSA for each pipeline.

In the RSAs, there is a limited amount of ambient noise due to the remoteness of the areas. Existing activities contributing to sensory disturbance include local and industrial vehicle traffic, industrial maintenance activities and operation of existing facilities. No active forestry dispositions were located in the Komie North Section RSA but forestry does occur in the Chinchaga Section RSA.

Table 18-8 Cumulative Alteration to Viewscapes in the Regional Study Area

	Komie North Section	Chinchaga Section	Total
Existing Alteration to Viewscape			
Regional Study Area Size	345,728	168,110	492,838
Area of Viewscape Alteration in RSA Attributed to Existing Activities (Existing) ¹	5,078	5,426	10,504
Estimated Future Alteration of Viewscapes			
Area of Future Viewscape Alteration Attributed to the Project (Project)	296	87	383
Area of Future Alteration Attributed to Known Future Projects (Future Projects)	1,077	52	1,129
Predicted Cumulative Alteration of Viewscape			
Total Cumulative Alteration of Viewscape (Existing + Project + Future Projects)	6,451	5,565	12,016
Percent Contribution of Project to Cumulative Alteration of Viewscape	4.6%	1.6%	3.2%
NOTES: Calculations are in hectares unless indicated otherwise. Calculations are approximate.			

18.6.3.2 Application Case

Project footprint preparation and RoW clearing will alter the viewscape in the immediate vicinity of each pipeline. Table 18-8 identifies the estimated area of potential alteration of viewscape for each pipeline attributed to the Project.

Project activities such as over flights, maintenance and other operational activities that may contribute to sensory disturbance are of a very short-term nature. Increased sensory disturbance is anticipated to be greater during the construction phase when compared to the operational phase. The construction phase will involve more pieces and types of heavy construction equipment and will last longer than the maintenance activities. Consequently, the potential for a cumulative increase in sensory disturbance for land users is greatest during the construction phase of the Project. The construction period is the focus of the cumulative effects assessment for this sensory disturbance.

18.6.3.3 Planned Development Case

It is anticipated that known future developments will alter viewscales in the socio-economic RSA. Table 18-8 identifies the estimated affected area that is attributed to the known future projects.

It is anticipated that known future developments within the socio-economic RSA will also increase sensory disturbance during construction. Of the future projects identified in Table 18-7, one project (Fortune Creek Gas Plant) might be constructed concurrently with the Komie North Section.

18.6.3.4 Mitigation of Cumulative Effect to Visual and Sensory Environment

Mitigation measures found in Section 13.3.2.2 are expected to address cumulative effects to the Visual and Sensory Environment. No additional visual and sensory environment cumulative effect mitigation measures beyond the project-specific mitigation measures were warranted.

18.6.3.5 Residual Cumulative Effect to Visual and Sensory Environment

The results of the quantitative analysis of the alteration of viewscales are summarized in Table 18-8. In the Komie North Section RSA, approximately 5,078 ha (1.5%) of the viewscape has been altered due to existing activities. When combined with the Komie North Section footprint and known future developments, the total cumulative alteration of viewscales is predicted to be approximately 6,451 ha, which increases the percentage of the Komie North Section socio-economic RSA with an altered viewscape to 1.9%. The Komie North Section contributes 4.6% to the total cumulative alteration of viewscape.

In the Chinchaga Section RSA, approximately 5,246 ha (3.2%) of the viewscape has been altered due to existing activities. When combined with the Chinchaga Section footprint and known future developments, the total cumulative alteration of viewscales is predicted to be approximately 5,565 ha, which increases the percentage of the Chinchaga Section socio-economic RSA with an altered viewscape to 3.3%. The Chinchaga Section contributes 1.6% to the total cumulative alteration of viewscape.

Overall, approximately 10,504 ha (2.4%) of the viewscape in the project RSAs has been altered by clearing activities associated with existing activities. When combined with the Project and known future developments, the total cumulative alteration of viewscape in the project RSAs is predicted to be approximately 12,016 ha, which increases the percentage of the RSA with an altered viewscape to 2.4%. The Project contributes 3.2% to the total cumulative alteration of viewscape.

The direction of the residual cumulative effect of increased alteration of viewscape is considered to be adverse. The magnitude of this residual cumulative effect is medium due to the low percentage that the Project contributes to the cumulative alteration of viewscape in the Socio-economic RSAs. The geographic extent is regional, because the residual cumulative effect will occur in the RSA. The duration will be long-term because the residual cumulative effect will last throughout the operation of the Project. The predicted residual cumulative effect will be continuous as it will occur throughout the life of the Project and is expected to be reversible upon decommissioning. Based on the definition found in Section 3.1.10, the residual cumulative effect is expected to be not significant. The probability of occurrence of the residual cumulative effect is high because construction and operation of the project, in combination with existing activities and known future development, will result in alteration of the natural landscape. The level of confidence in the determination of significance is low based on the difficulty in predicting how people perceive cumulative change.

Without knowing the timing of existing development's operation activities and road transportation movements or volumes and the length of the construction period for the known future development that overlaps with the Project during construction, it is difficult to predict the Project's contribution to sensory disturbance. It is anticipated that known developments in the Socio-economic RSA will contribute sensory disturbance to the area and will act cumulatively with the Project during construction. Of the future projects listed in Table 18-7, only one overlaps in construction timeframe with the Project contributing cumulatively to sensory disturbance.

The direction of the residual cumulative effect of increased sensory disturbance on land users is considered to be adverse. The magnitude of this adverse residual cumulative effect is expected to be medium given the remoteness of the project areas, the relatively low use in the area during construction and the small number of known future projects which will overlap the Project's construction timeframe. The geographic extent is expected to be the regional, as the residual cumulative effect will extend into the RSA. The duration will be short-term, as it is expected that the cumulative increases in sensory disturbance to land users is confined to the construction phase, and the frequency will be once, as it will occur only during the construction phase. The residual cumulative effect of increased sensory disturbance on land users is expected to be reversible upon completion of construction. The residual cumulative effect is expected to be not significant. The probability of occurrence of the residual cumulative effect is high since land users are likely to be affected by cumulative increases in sensory disturbance from the Project acting in combination with existing developments and known future developments within the socio-economic RSA during construction. The confidence is low based on the difficulty in predicting change and the assumptions made.

18.6.4 Assessment of Cumulative Effects to Land Base for Forestry

The Komie North Section is located in an area without active forest dispositions. The Chinchaga Section is located in an area of active forestry dispositions. Since clearing activities have been or will be associated with existing activities, the proposed Project and known future developments, these activities will act cumulatively to reduce the land base for forestry in the project cumulative effects RSA.

A quantitative approach was selected to determine the residual cumulative effect of the Project on the land base for forestry since the change in the parameter can be quantified. No established thresholds, standards or guidelines relating to the reduction in land base for forestry exist; therefore, the evaluation of significance relied on the professional judgment of the assessment team.

18.6.4.1 Base Case

Detailed mapping of merchantable timber for harvest is unavailable for the project RSAs; however, an estimate of the area available for forestry was quantified conservatively. It was assumed that all of the lands within the cumulative effects RSA can be harvested for timber.

Table 18-9 presents the area available for timber harvest in the cumulative effects RSA. This area was conservatively estimated to include all lands within the RSA that have not been previously disturbed.

Table 18-9 Cumulative Reduction of Land Base for Timber Harvest in the Regional Study Area

	Komie North Section	Chinchaga Section	Total
Existing Land Base Available for Timber Harvest			
Area Available for Timber Harvest in the RSA ¹	222,128	100,715	322,843
Area Removed from Land Base for Timber Harvest in RSA Attributed to Existing Developments (Existing) ¹	5,078	5,426	10,504
Estimated Future Reduction in Land Base for Timber Harvest			
Area Removed from Land Base for Timber Harvest in RSA Attributed to the Project (Project)	296	87	383
Area Removed from Land Base for Timber Harvest in RSA Attributed to Known Future Projects (Future Projects)	1,077	52	1,129
Predicted Cumulative Reduction in Land Base for Timber Harvest			
Total Cumulative Reduction of Land Base for Timber Harvest (Existing + Project + Future Projects)	6,451	5,565	12,016
Percent Contribution of Project to Cumulative Reduction of Land Base for Timber Harvest	4.6%	1.6%	3.2%
NOTES: Calculations are in hectares, except where indicated. Calculations are approximate. ¹ Area available for timber harvest in the RSA was calculated by combining the following land cover classes under the Base Case: Coniferous Dense, Coniferous Open, Coniferous Sparse, Broadleaf Dense, Broadleaf Open, Broadleaf Sparse, Mixedwood Dense, Mixedwood Open and Shrub Tail. Land cover classes that represent open water, barren land and wetlands, including treed wetlands, were not included.			

18.6.4.2 Application Case

Project construction will require the removal of forestry resources from the RoW and contribute cumulatively with existing projects to reduce the land available for forestry. It was conservatively estimated that the entire Project footprint supported merchantable timber. Table 18-9 presents the area removed from timber harvest in the cumulative effects RSA as a result of project construction.

18.6.4.3 Planned Development Case

It is expected that known future developments will reduce the availability of a land base for timber harvest and will act cumulatively with existing developments and the Project. Table 18-9 presents the estimated area of known future developments. It is conservatively assumed that the entire footprint of the known future developments will reduce the land available for timber harvest.

18.6.4.4 Mitigation of Cumulative Effect to Land Base for Forestry

Mitigation measures found in Section 13.3.2.2 are expected to address cumulative effects to the cumulative effect to land base for timber harvesting. No additional forestry cumulative effect mitigation measures beyond the project-specific mitigation measures were deemed warranted.

18.6.4.5 Residual Cumulative Effect to Land Base for Forestry

The result of the quantitative analysis of the decrease in land base for timber harvest is summarized in Table 18-9.

In the Komie North Section RSA, approximately 5,078 ha (2.3%) of the available land base for timber harvest has been removed due to existing activities. When combined with the Komie North Section footprint and known future developments, the total cumulative reduction of the land base for timber harvest is predicted to be approximately 6,451 ha, which increases the land base not available for timber harvest in Komie North Section cumulative effects RSA to 2.9%. The Komie North Section contributes 4.6% to the total cumulative reduction of land base for timber harvest.

In the Chinchaga Section RSA, approximately 5,426 ha (5.4%) of the available land base for timber harvest has been removed due to existing activities. When combined with the Chinchaga Section footprint and known future developments, the total cumulative reduction of the land base for timber harvest is predicted to be approximately 5,565 ha, which increases the land base not available for timber harvest in Chinchaga Section cumulative effects RSA to 5.5%. The Chinchaga Section contributes 1.6% to the total cumulative reduction of land base for timber harvest.

Overall, approximately 10,504 ha (3.2%) of the available land base for timber harvest activities in the Project area has been removed due to existing activities. When combined with the proposed Project and known future developments, the total cumulative reduction of land base for other energy resource activities in the project area is predicted to be approximately 12,016 ha, which increases the land base

not available for timber harvest to 3.7%. The Project contributes 3.2% to the total cumulative reduction of the land base for timber harvest.

Project contributions to cumulative effects a decrease in land base for timber harvest been reduced by using existing pipeline rights-of-way for access as much as possible, and using previously disturbed area for stockpile sites and temporary construction camps. It is expected that known future developments occurring in the cumulative effects RSA will also use measures to reduce their footprints.

The direction of the residual cumulative effect of a reduction in land base for timber harvest is considered to be adverse. The magnitude of this residual cumulative effect is medium due to the low percentage that the Project contributes to the reduction in land base for timber harvest in the cumulative effects RSAs. The geographic extent is regional, because the residual cumulative effect will occur in the RSA. The duration will be long-term because the residual cumulative effect will last throughout the operation of the Project. The predicted residual cumulative effect will be continuous as it will occur throughout the life of the Project; it is expected to be reversible upon decommissioning. The residual cumulative effect is expected to be not significant. The probability of occurrence of the residual cumulative effect is high because existing activities, the proposed Project and known future developments will combine to reduce the land base available for timber harvest. The level of confidence in the determination of significance is low due to the lack of detailed merchantable timber data for the project RSAs.

18.6.5 Assessment of Cumulative Effects to Hunting, Fishing, Trapping

Hunting, fishing and trapping by Aboriginal and non-Aboriginal land users occurs throughout the Project RSAs. Since activities potentially disrupting hunting, fishing and trapping land users will be associated with existing projects, the Project and known future developments, these activities will act cumulatively to potentially disrupt hunting, fishing and trapping land users during construction.

A qualitative assessment of the disruption to trapping, hunting and fishing land users was deemed to be the most appropriate approach to evaluate the significance of the potential cumulative environmental effects given the short duration of the project construction and the lack of quantifiable data. Consequently, the evaluation of significance of the potential cumulative residual effect relied on the professional judgment of the assessment team.

18.6.5.1 Base Case

Within the RSAs, existing activities that contribute to disturbance to hunting, fishing and trapping land users include local and industrial vehicle traffic, industrial maintenance activities and operation of existing facilities. There are no current forestry dispositions in the Komie North Section, but forestry does occur in the Chinchaga Section RSA.

18.6.5.2 Application Case

Project footprint preparation, RoW clearing and construction activities have the potential to disrupt hunting, fishing and trapping in the immediate vicinity of each pipeline section. Project operational activities such as over flights, maintenance and other operational activities also contribute to a disruption of hunting, fishing and trapping, but are of a very short-term nature. The construction phase will involve more pieces and types of heavy construction equipment and will last longer than the maintenance activities that occur during operation. Consequently, the potential for a cumulative disturbance to hunting, fishing and trapping is greatest during the construction phase of the Project and as a result the construction period is the focus of the cumulative effects assessment for disturbance to these socio-economic activities.

18.6.5.3 Planned Development Case

It is anticipated that known future developments could disrupt hunting, fishing and trapping land users in the cumulative effects RSA. Of the future projects identified in Table 18-7, one project (Fortune Creek Gas Plant) has the potential to be constructed concurrently with the Komie North Section and will interact cumulatively with the Project.

18.6.5.4 Mitigation of Cumulative Effect to Hunting, Fishing and Trapping

Mitigation measures found in Section 13.3.2.2 are expected to address cumulative effects to the Hunting, Fishing and Trapping. No additional Hunting, Fishing and Trapping cumulative effect mitigation measures beyond the project-specific mitigation measures were deemed warranted.

18.6.5.5 Residual Cumulative Effect to Hunting, Fishing and Trapping

The Project will act cumulatively with existing development and known future developments in the cumulative effects RSA to disrupt hunting, fishing and trapping land users during construction. Without knowing the timing of existing development operational activities and movements in the RSA and the length of the construction period for the known future development that overlaps temporally with the Project, it is difficult to predict the Project's contribution to the disruption of hunting, fishing and trapping land use activities. One known future project, the Fortune Creek Gas Plant, has the potential to be constructed concurrently with the Komie North Section. All other known future developments identified in Table 18-7 will not be constructed at the same time as the Project. Mitigation measures such as appropriate notification and, if appropriate, applicable compensation to trappers, will reduce the disruption of hunting, fishing and trapping activities.

The direction of the residual cumulative effect of disruption to hunting, fishing and trapping is considered to be adverse. The magnitude of this residual cumulative effect is medium because although there is expected to be a residual cumulative effect, it is unlikely to result in a serious disruption of hunting, fishing and trapping throughout the cumulative effects RSAs. The geographic extent is regional, because the residual cumulative effect will occur in the RSA. The duration will be short-term because the residual

cumulative effect will last throughout the construction phase of the Project. The predicted residual cumulative effect resulting from the construction of the Project acting in combination with existing developments and known future developments in the cumulative effects RSA is limited to the construction phase and will be reversible at the completion of project construction. The residual cumulative effect is expected to be not significant. The probability of occurrence of the residual cumulative effect is high because construction and operation of the project, in combination with existing activities and known future development, will result in disruption of hunting, fishing and trapping. The level of confidence in the determination of significance is low based on the difficulty in predicting cumulative change and the assumptions made.

18.6.6 Assessment of Cumulative Effects to Road Transportation

Traffic use on roads within the Project's cumulative effects RSAs are primary industry-related, although some private vehicle use also occurs. In addition, the project RSA is accessed using provincial primary and secondary roads in British Columbia and Alberta. Activities associated with existing and known future developments have a temporal overlap with project activities during construction as well as a physical overlap with the Project's cumulative effects RSAs.

A combination of quantitative and qualitative assessment of the cumulative effects of increase to traffic was deemed to be the most appropriate approach to evaluate the significance of the potential cumulative effects. This is because similar levels of quantitative data for base case traffic volumes in the cumulative effects RSA is not available for all project RSAs. Consequently, the evaluation of significance of the potential cumulative residual effect relied on the professional judgement of the assessment team.

18.6.6.1 Base Case

Historical traffic volume data is available for some provincial primary and secondary roads that will be used to access the project RSAs. The data is presented in Section 4.3.3 in Appendix 13A. A summary of the data is as follows:

KOMIE NORTH SECTION

Highway 97 near Fort Nelson and Highway 77 will be used to access the Komie North Section.

- On Highway 97 at a location 29 km south of Fort Nelson, traffic volumes are greater during the winter construction season (December to April) than during the summer months. Between 2009 and 2010, although the AADT volumes decreased by approximately 6.5 %, the average daily traffic for the proposed winter construction timeframe for the same years increased by approximately 4%.
- AADT volumes are available for only the year 2005 at a location 600 m north of Highway 97 on Highway 77. The AADT for 2005 at this location was 190 vehicles. No further historical data is available.

CHINCHAGA SECTION

Highway 35 will be used to access the Chinchaga Section.

- On Highway 35 at a location 3.7 km south of the junction with Highway 691, traffic volumes are greater during the winter construction season (December to April) than during the summer months.
- Between 2009 and 2010, the AADT volumes decreased by approximately 2.6% and the average daily traffic for the proposed winter construction timeframe stayed approximately the same.

It is assumed that within the RSAs, existing activities contribute to traffic volumes on local and regional roads and that this traffic volume is included in the historical traffic volume presented; however it is not known what portion of the historical traffic volumes are made up by traffic related to existing projects.

18.6.6.2 Application Case

Project construction will occur during the winter months and will increase traffic volumes on provincial primary and secondary highways which are used to access the RSA, as well as on the local industrial roads in the RSA. The greatest traffic volumes attributed with the Project are associated with transportation of equipment and pipe which will occur during the winter (November through March).

18.6.6.3 Planned Development Case

It is assumed that known future developments would be constructed during winter and, consequently, has the potential to act cumulatively with existing traffic levels and those arising from the Project. Of the future projects identified in Table 18-7, one project (Fortune Creek Gas Plant) has the potential to be constructed concurrently with the Komie North Section. The construction schedule and traffic volumes for this future development are not known.

18.6.6.4 Mitigation of Cumulative Effect Road Transportation

Mitigation measures found in Section 13.3.3.2 are expected to address cumulative effects increased traffic on local and regional roads. No additional Road Transportation cumulative effect mitigation measures beyond the project-specific mitigation measures were deemed warranted.

18.6.6.5 Residual Cumulative Effect Road Transportation

Based on the historical data of traffic volumes on the primary and secondary highways used to access the project RSAs, traffic volumes are heaviest during the summer tourist season (June, July, and August). Project related traffic on the primary and secondary highways will occur primarily during the winter construction months (November to March). It is assumed that traffic associated with existing and known future developments will also primarily occur during the winter months.

The local roads in the project cumulative effects RSA are primarily industrial roads. Traffic volumes on these local industrial roads will increase during the construction phase of the Project and will act cumulatively with existing projects that use these roads. Known future developments are not expected to be constructed concurrently with the Chinchaga Section. One development, the Fortune Creek Gas Plant, is expected to be constructed concurrently with the Komie North Section. Without knowing the anticipated traffic volumes for the existing projects and known future development during the Project's construction phase, it is difficult to predict the Project's contribution to the increase in traffic on local roads. However, it is assumed that the volume of traffic on the local industrial roads is also during the winter construction period and that the Project will act cumulatively with existing activities and known future developments in the project cumulative effects RSA and increase traffic on local roads during construction.

The direction of the residual cumulative effect of the increase of traffic volumes on local and regional roads is considered to be adverse. The magnitude of this residual cumulative effect is medium because, although measurable, due to the short construction timeframe and the project-specific mitigation measures, there is not expected to be a substantial disruption of local traffic given that the roads used in the cumulative effects RSA are predominately for industrial use and in consideration of the mitigative measures to reduce the Project's contribution to cumulative increases in traffic on primary and secondary provincial roads. The geographic extent is regional, since increased traffic on local roads resulting from the Project acting in combination with existing activities and known future developments in the cumulative effects RSA will extend along transportation routes used for project-related traffic during construction. The duration will be short-term because the residual cumulative effect will last throughout the construction phase of the Project. The predicted residual cumulative effect resulting from the construction of the Project acting in combination with existing developments and known future developments in the cumulative effects RSA is limited to the construction phase and will be reversible at the completion of project construction. The residual cumulative effect is expected to be not significant. The probability of occurrence of the residual cumulative effect is high since existing activities and known future developments within the cumulative effects RSA have the potential to act cumulatively with the Project and increase increased traffic volumes on local roads during construction. The level of confidence in the determination of significance is low based on the assumptions.

18.6.7 Significance Evaluation of Cumulative Effects on Socio-Economic Components

Table 18-10 provides effects characterization and significance evaluation for the assessed cumulative effects on VSCs.

18.7 Traditional Land Use

NGTL has engaged Aboriginal communities with an interest in the Project. Effects on TLRU have been assessed through Traditional Knowledge studies including discussions, map reviews, interviews, helicopter overflights, environmental field program engagement and ground reconnaissance with Aboriginal community representatives. Traditional Knowledge studies are on-going and follow-up reporting is pending summer ground reconnaissance and mitigation meetings. These additional steps are expected to confirm the ESA predictions about project effects on TLRU and will be filed with the NEB in supplemental reports.

18.7.1 Screening for Cumulative Effects

Table 18-11 identifies the potential and likely residual effects on TLU associated with project construction and operation, and the potential cumulative effect with known future developments acting in combination with the Project.

Subsistence hunting, trapping, fishing and harvesting activities by Aboriginal communities occur throughout the RSA. These TLU activities might be disrupted during construction of the Project. During construction, it is also possible that future developments could disrupt hunting, trapping, fishing and harvesting activities by Aboriginal communities. A qualitative assessment of the disruption of these activities was deemed the most appropriate approach for evaluating potential cumulative environmental effects, given the short duration of project construction and the lack of quantifiable data. Consequently, significance of the potential cumulative residual effect was determined based on the professional judgement of the assessment team, which includes members with 15 years of pipeline construction and ESA experience.

It is anticipated that some of the known future developments (see Table 18-1) within the TLU RSA for each pipeline section will disrupt hunting, trapping, fishing and harvesting activities by Aboriginal communities during construction of the Project.

Table 18-10 Summary of Identified Residual Socio-Economic Cumulative Effects

Activity	Residual Effect	Additional Mitigation Measures	Direction	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Prediction Confidence	Significance
Social and Cultural Well-being										
Construction and Operation	Disruption of community residents from temporary workforce visiting communities, using local services and project-related traffic	<ul style="list-style-type: none">None. Refer to Mitigation Measures in Section 13.1.5.1	Adverse	Medium	Regional	Once	Short-term	Reversible	Low	Not Significant
Human Occupancy and Resource Use										
Construction and Operation	Visual and Sensory Disturbance <ul style="list-style-type: none">incremental alteration of viewscales	<ul style="list-style-type: none">None. Refer to Mitigation Measures found in Section 13.3.2.2	Adverse	Medium	Regional	Continuous	Long-term	Reversible	Low	Not Significant
	Visual and Sensory Disturbance <ul style="list-style-type: none">incremental increased sensory disturbance to land users	<ul style="list-style-type: none">None. Refer to Mitigation Measures found in Section 13.3.2.2	Adverse	Medium	Regional	Once	Short-term	Reversible	Low	Not Significant
	Disruption of Forestry <ul style="list-style-type: none">reduction of land base available for forestry	<ul style="list-style-type: none">None. Refer to Mitigation Measures found in Section 13.3.2.2	Adverse	Medium	Regional	Continuous	Long-term	Reversible	Low	Not Significant
	Hunting, Fishing, Trapping <ul style="list-style-type: none">disruption of hunting, fishing and trapping land users due to construction activities	<ul style="list-style-type: none">None. Refer to Mitigation Measures found in Section 13.3.2.2	Adverse	Medium	Regional	Once	Short-term	Reversible	Low	Not Significant
Infrastructure and Services										
Construction and Operation	Road Infrastructure <ul style="list-style-type: none">increased traffic volumes due to movement of personnel, equipment and supplies	<ul style="list-style-type: none">None. Refer to Mitigation Measures found in Section 13.3.3.2	Adverse	Medium	Regional	Once	Short-term	Reversible	Low	Not Significant

Table 18-11 Potential Residual Effects of the Project on Traditional Land and Resource Use Considered for the Cumulative Effects Assessment

Potential Residual Effect	Pipeline Loop	Spatial Boundary	Temporal Boundary	Potential Cumulative Effect	Existing Activities/Known Future Developments with Residual Effects Acting in Combination with the Project
Disruption of subsistence hunting, trapping, fishing and harvesting may occur during construction.	Komie North Chinchaga	RSA	Construction	Potential disruption of hunting, trapping, fishing and harvesting during construction.	<ul style="list-style-type: none"> Known future developments within the RSA listed in Table 18-1. Project-related activities that could interact with the above activities include clearing, grading, strippings salvage, trenching, watercourse crossing, backfilling and reclamation.

18.7.2 Assessment of Cumulative Effects on Traditional Land and Resource Use

Within the Komie North Section RSA, of the 57 future developments that have been identified (see Table 18-1), two (NGTL Horn River Mainline Cabin Section and NGTL Horn River Mainline Komie East Extension) are scheduled to be constructed outside of the construction period for the Project. Consequently, they will not act cumulatively with the Project to disrupt land use activities by land users. Although the construction schedule of the remaining 55 developments is unavailable, it was assumed that these developments would be constructed concurrently with the Project for the purposes of this cumulative effects assessment.

Within the Chinchaga Section RSA, of the three future developments identified, only one (NGTL Tanghe Creek Lateral Loop No. 2 Cranberry Section) is scheduled to be constructed outside of the construction period for the Project and, consequently, will not act cumulatively with the Project to disrupt hunting, trapping, fishing and harvesting activities by Aboriginal communities. Although the development schedule of the remaining two developments is unavailable, for the purposes of the cumulative effects assessment for disruption of hunting, trapping, fishing and harvesting activities by Aboriginal communities, it was assumed that these developments would be constructed during the same period as the Project.

The Project will act cumulatively with known future developments in the Komie North Section and Chinchaga Section RSA to disrupt hunting, trapping, fishing and harvesting activities by Aboriginal communities during construction. Without knowing how long each construction period is for each known future development, it is difficult to predict the Project's contribution to the disruption of these activities. Given that pipelines are linear features and that facilities generally do not affect watercourses, it is assumed that pipeline construction would have a greater potential to disrupt hunting, trapping, fishing and harvesting activities by Aboriginal communities than facility or well site construction. Within the Komie North Section RSA, there are no known future pipelines to be constructed concurrently with the Project. Within the RSA for the Chinchaga Section RSAs there is one (respectively) known future pipeline to be

constructed concurrently with the Project. Consequently, it is assumed that these pipelines will contribute more to the disruption of hunting, trapping, fishing and harvesting activities by Aboriginal community users in the RSA for Chinchaga Section than the Project. Overall, while the project contribution to disruption of hunting, trapping, fishing and harvesting activities by Aboriginal communities for the Project is considered to be low when compared to known future developments, magnitude of the cumulative disruption of hunting, trapping, fishing and harvesting activities by Aboriginal communities is considered to be medium.

18.7.2.1 Mitigation of Cumulative Effects on Traditional Land and Resource Use

Mitigation measures proposed in Section 14.3 of this ESA will reduce the cumulative effects of hunting, trapping, fishing and harvesting activities by Aboriginal communities. It is expected that other operators will implement similar mitigation. No project-specific mitigation is warranted other than that proposed in Section 14.3 of the ESA.

18.7.3 Significance Evaluation of Cumulative Effects on Traditional Land and Resource Use

The cumulative effect of the Project with regards to disruption of hunting, trapping, fishing and harvesting activities by Aboriginal communities during construction of the Project is considered to have an adverse direction and is expected to be reversible in the short-term and of medium magnitude (see Table 18-12).

Table 18-12 Significance Evaluation of Cumulative Effects on Traditional Land and Resource Use

Predicted Cumulative Residual Effects	Direction	Geographic Extent	Temporal Context			Magnitude	Probability	Significance ¹	Prediction Confidence
			Duration	Frequency	Reversibility				
Potential disruption of hunting, trapping, fishing and harvesting during construction.	Adverse	Regional	Short-term	Isolated	Reversible	Medium	High	Not significant	Moderate
NOTE: ¹ <u>Significant Residual Socio-Economic Effect</u> : A residual socio-economic effect is considered significant if the effect is predicted to be: <ul style="list-style-type: none"> • high magnitude, high probability, reversible and regional, provincial or national in extent that cannot be technically or economically mitigated; or • high magnitude, high probability, irreversible and any spatial boundary that cannot be technically or economically mitigated. 									

The following provides a summary of the rationale for the significance criteria:

- Geographic extent – regional since it is considered by the assessment team to be the appropriate spatial scale where potential cumulative effects are considered to be non-trivial.
- Duration – short-term since events which would act cumulatively to disrupt hunting, trapping, fishing and harvesting activities are limited to the construction phase and completed within two years.
- Frequency – isolated since the events acting cumulatively to disrupt hunting, trapping, fishing and harvesting activities are confined to a specific period (construction of the pipelines, construction of known future developments).
- Reversibility – the disruption of hunting, trapping, fishing and harvesting activities resulting from the construction of the Project acting in combination with known future developments in the TLU RSA are reversible with reclamation and/or natural succession and/or decommissioning.
- Magnitude – medium since the cumulative effects of may be approaching the general standards of tolerance for people engaging in these activities although the cumulative effect are anticipated to be reversible in the short-term and the Project and known future developments are located in areas where the predominate land use is oil and gas-related.
- Probability – high since construction activities for the Project will overlap with hunting and fishing seasons and trapping activities and it is likely that known future developments will be constructed during the fall/winter to take advantage of frozen soil conditions.
- Confidence – moderate, based on the experience of the assessment team.

As shown in Table 14-4 of this ESA, there are no situations with regard to traditional land and resource use that meet the criteria of a significant cumulative residual socio-economic effect. Consequently, it is concluded that the cumulative residual effects of pipeline construction and operation on traditional land and resource use will be not significant.

18.8 References

18.8.1 Literature and Internet Sites

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18.8.2 Personal Communications

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19 SUPPLEMENTAL REPORTING

19.1 Traditional Land Use

Traditional Land Use (TLU) studies were initiated in January 2011 for the Komie North and Chinchaga sections and are on-going. See Appendices 14A and 14B of this Environmental and Socio-economic Assessment for further details regarding completed TLU studies.

Supplemental field work is scheduled to occur with participating Aboriginal communities for both pipeline sections in snow-free ground conditions in fall 2011.

19.2 Socio-Economic

A socio-economic study was initiated in 2010 and consultation is on-going. If, through this on-going consultation, additional issues are identified related to human occupancy and resource use, social and cultural well-being, infrastructure and services or employment and the economy that have not yet been addressed, they will be documented and mitigative or enhancement measures will be developed.

In addition, a supplemental quantitative economic analysis of the Project will be prepared and submitted to the National Energy Board in 2012.

