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July 15, 2015

National Energy Board  
517 Tenth Avenue SW  
Calgary, AB T2R 0A8

Filed Electronically

**Attention: Ms. Sheri Young, Secretary of the Board**

Dear Ms. Young:

**Re: NOVA Gas Transmission Ltd. (NGTL)  
North Montney Mainline Project (Project)  
Certificate GC-125  
Certificate Condition 15 – Preliminary Caribou Habitat Restoration Plan (CHRP)  
Board File OF-Fac-Gas-N081-2013-10 02**

In accordance with Certificate Condition 15, part (a), NGTL encloses for Board approval the Preliminary Caribou Habitat Restoration Plan (CHRP) for the Project. The Preliminary CHRP contains the required information applicable to each of the Aitken Creek and Kahta Sections of the Project.

If the Board requires additional information with respect to this filing, please contact me at (403) 920-7816, or by email at [crystal\\_rothenburger@transcanada.com](mailto:crystal_rothenburger@transcanada.com).

Yours truly,  
**NOVA Gas Transmission Ltd.**

*Original signed by*

Crystal Rothenburger  
Regulatory Project Manager  
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Enclosures

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Kerry Harvey, Ecosystems Biologist, Ministry of Forests, Lands and Natural Resource (MFLNRO)  
Conservation Officer – Peace Region Representative, BC Ministry of Environment – Peace Region  
Mohammad Farah, Authorizations Manager, BC Oil and Gas Commission (BC OGC)



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## 1.0 INTRODUCTION AND ORGANIZATION

This section provides an introduction to the preliminary Caribou Habitat Restoration Plan (CHRP) for the North Montney Mainline (Project) and outlines how this document is organized.

### 1.1 INTRODUCTION

NOVA Gas Transmission Ltd. (NGTL), a wholly owned subsidiary of TransCanada PipeLines Limited (TransCanada), filed an application with the National Energy Board (NEB or Board) on November 8, 2013 for a Certificate of Public Convenience and Necessity pursuant to section 52 of the *National Energy Board Act* (NEB Act) to construct and operate the Project and other approvals pursuant to section 58 and Part IV of the Act. For the Project regional location, see Figure 1-1. On June 11, 2015, the Governor in Council directed the Board to issue Certificate of Public Convenience and Necessity GC-125 to NGTL for the Project, subject to the terms and conditions in the GH-001-2014 Report (NEB Report) issued by the Board on April 15, 2015.

The Project is split into two sections: Aitken Creek Section and Kahta Section. The Aitken Creek Section is approximately 182 km, of which 8.1 km occurs in the Graham caribou range (see Figure 1-2), while the Kahta Section is approximately 119 km, of which 19 km occurs in the Pink Mountain caribou range (see Figure 1-3). No compressor or meter stations are proposed in the Graham caribou range and there are two proposed meter station sites in the Pink Mountain caribou range. Project scheduling was designed to avoid the critical timing period for caribou from January 15 to July 15.

This Preliminary Caribou Habitat Restoration Plan (CHRP) was prepared for the Project pursuant to Certificate Condition 15 and outlines NGTL's plan to avoid impacts for each of the Aitken Creek and Kahta Sections, minimize Project effects on caribou and restore affected caribou habitat. This document also incorporates:

- feedback from applicable regulators, technical experts and Aboriginal communities
- lessons learned from field experience
- industry experience
- updated results from ongoing literature review

The goal of both the Preliminary and Final CHRP will be to minimize residual effects of the Project on caribou habitat. Residual effects are environmental effects predicted to remain after mitigation is applied.

Tailored to site-specific conditions, restoration measures related to the disturbance of caribou habitat will be implemented in the Project footprint throughout the pre-construction, construction and post-construction phases of the Project.

The Final CHRP will detail the location and type of restoration that will be implemented along the Project right-of-way (ROW). The residual effects requiring caribou habitat offsetting measures presented in the Final CHRP will consider the length of time required for restoration measures to reach maturity (lag time) and factor in uncertainty associated with offsets, and will be further detailed in the Offset Measures Plan for Residual Impacts on Caribou Habitat (OMP). The Final CHRP will be filed on or before November 1 after the first complete growing season following the Project being placed into service.

The approach to validate residual effects predictions (direct and indirect) and restoration success is described in this CHRP, and the detailed adaptive management plan will be described in the Caribou Habitat Restoration and Offset Measures Monitoring Program (CHROMMP) for the Project. Pursuant to Condition 37, NGTL will file the CHROMMP with the Board on or before February 1 after the first complete growing season following the Project being placed into service. The CHROMMP will explain the Program for monitoring and verifying the effectiveness of the caribou habitat restoration and offset measures implemented as part of the CHRP and OMP. The monitoring period for the CHROMMP will be a minimum of 10 years.

NGTL will also develop an OMP to address Project residual effects on critical caribou habitat for the Aitken Creek Section pursuant to Condition 36. The Preliminary OMP will detail a plan to offset all residual effects of the Aitken Creek Section (the only section that includes critical caribou habitat) resulting from directly and indirectly disturbed critical habitat for caribou, after taking into account implementation of the Environmental Protection Plan (EPP) and CHRP measures, and will further detail the method used to quantify the offsets. The Preliminary OMP will be filed with the Board at least 90 days before requesting Leave to Open the Aitken Creek Section of the Project.

NGTL filed the Access Management Plan (AMP) pursuant to Condition 16 on June 3, 2015 (NEB Filing ID: A70510). The AMP detailed a plan for managing access along the ROW for non-parallel disturbances for each of the Aitken Creek and Kahta Sections.



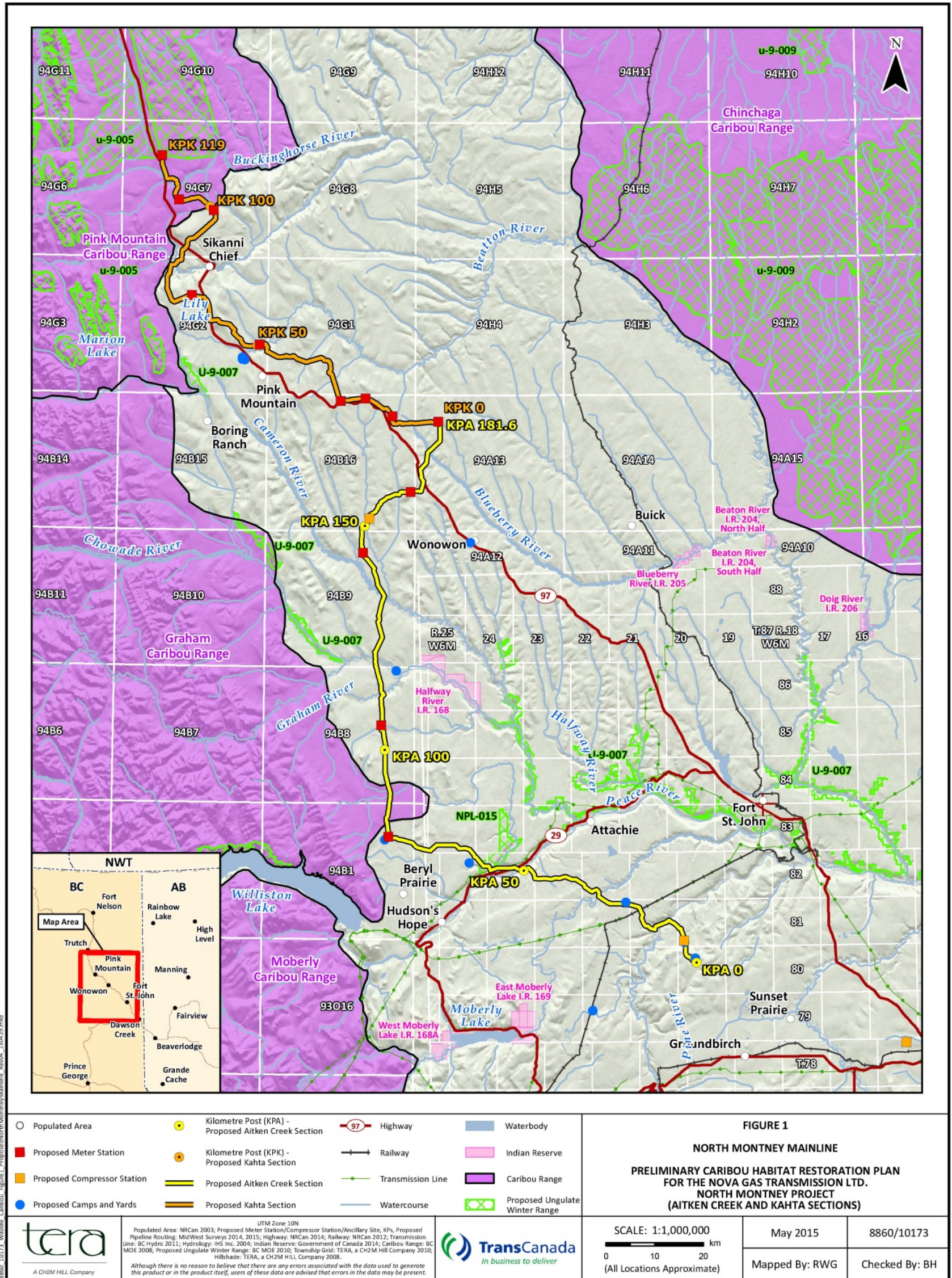


Figure 1-1: Regional Location







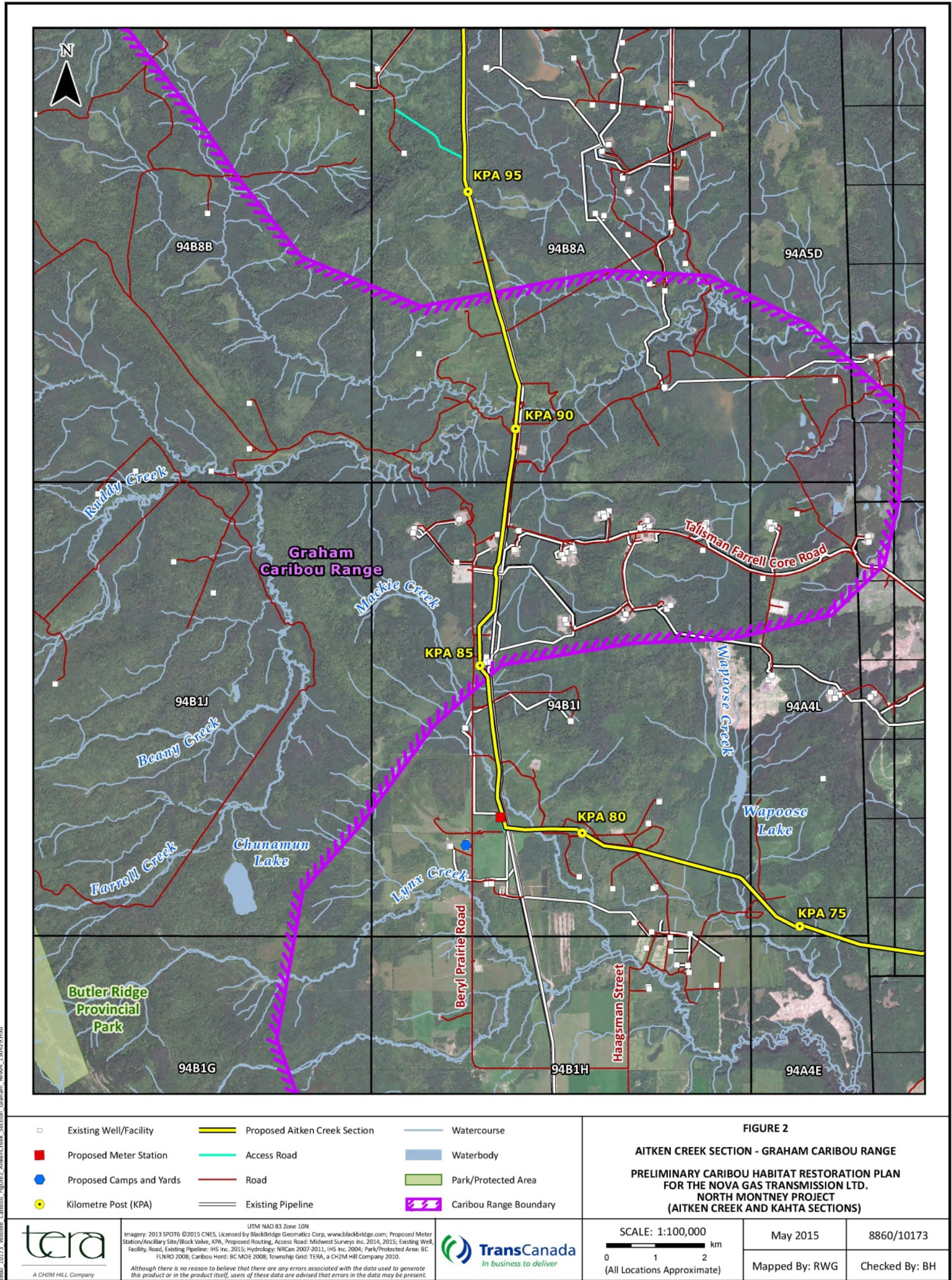


Figure 1-2: Aitken Creek Section – Graham Caribou Range







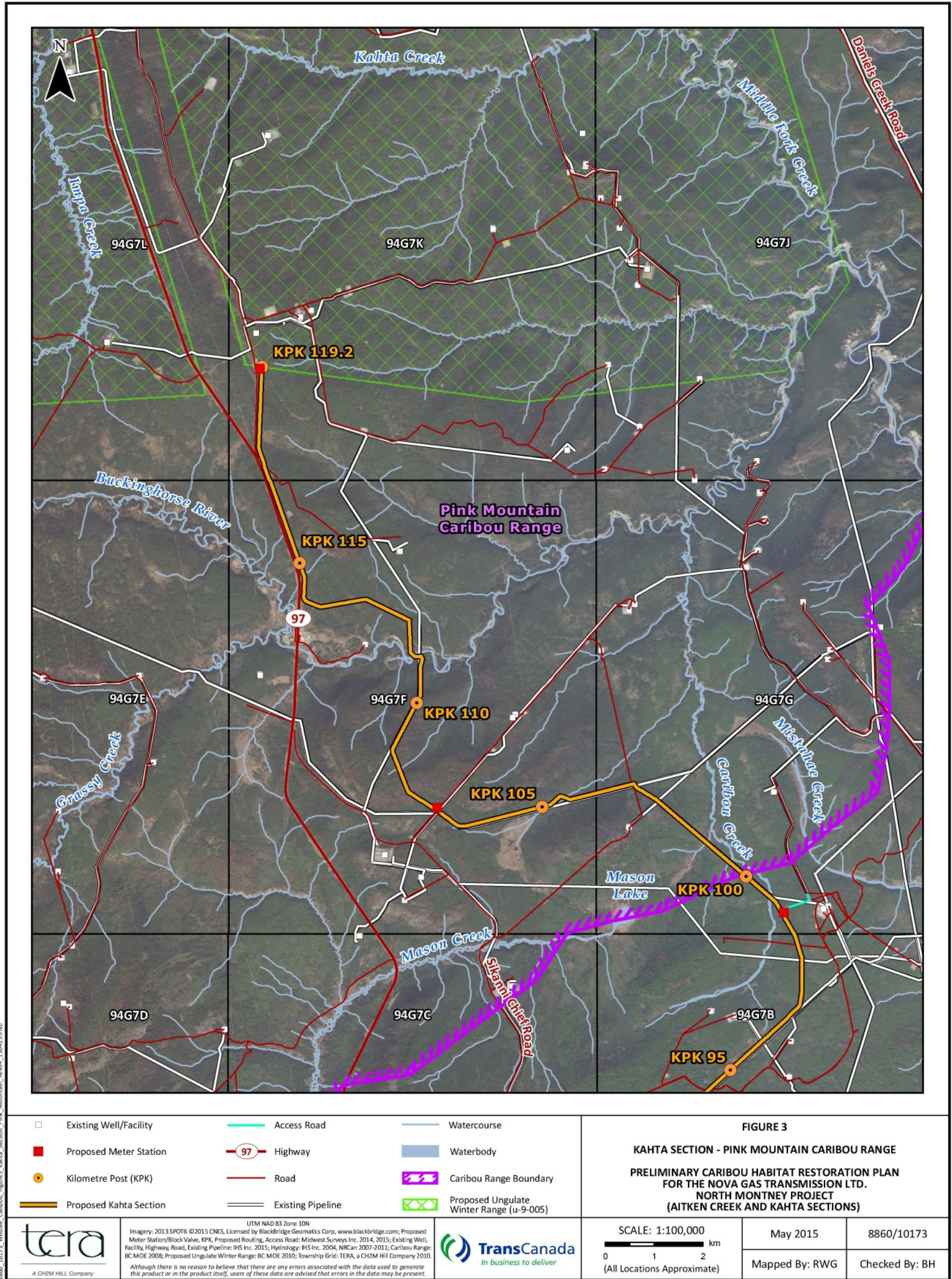


Figure 1-3: Kahta Section – Pink Mountain Caribou Range





## 1.2 ORGANIZATION OF THE PRELIMINARY CHRP

This Preliminary CHRP is organized in nine sections, as follows:

**Section 2:** introduces the goal, objectives and quantifiable targets.

**Section 3:** introduces the habitat restoration decision framework used to decide on potential caribou habitat restoration sites and to determine restoration measures in different site types, considering typical site factors that could constrain implementation.

**Section 4:** outlines quantifiable targets and performance measures that will be used to evaluate the extent of predicted residual effects, extent to which goals and objectives have been met and the need for consequent compensation offsets.

**Section 5:** includes a description of how the spatial disturbance will be calculated (as the calculation will not be completed until the Final CHRP is prepared), habitat restoration, monitoring, adaptive management and the proposed implementation schedule for each of the Aitken Creek and Kahta Sections.

**Section 6:** describes how field innovations and previous experience have been incorporated into the CHRP for the Project.

**Section 7:** provides a summary of caribou-specific consultation with Aboriginal communities and applicable regulators to-date, as well as a summary of how feedback was incorporated in the Preliminary CHRP.

**Section 8:** is a literature review, on which the decision framework for this document is based, that includes:

- identification of temporal and spatial caribou habitat restoration methods applicable to both boreal and mountain caribou
- assessment of the relative effectiveness of the identified methods
- description of the literature review approach

**Section 9:** cites references used throughout the document.

This Preliminary CHRP is organized to address each requirement of GC-125 Condition 15. For the locations in this document that outline how each condition has been met, see Table 1-1.

**Table 1-1: GC-125 Condition 15: Caribou Habitat Restoration Plan**

Condition	Details and Location in Report
<p>15. Caribou Habitat Restoration Plan (CHRP) NGTL shall file with the Board for approval, in accordance with the timelines below, preliminary and final versions of a CHRP for each of the Aitken Creek and Kahta Sections of the section 52 Facilities. At the time of filing with the Board, NGTL shall provide a copy of the filings to Environment Canada and the appropriate provincial authorities.</p>	<p>This document addresses the restoration plan for each of the Aitken Creek and Kahta Sections of the Project in Section 5. All other sections of this document are applicable to both the Aitken Creek and Kahta Sections of the Project.</p>
<p>a) Preliminary CHRP to be filed at least 90 days prior to commencing construction. This version of the CHRP shall include, but not be limited to:</p> <ul style="list-style-type: none"> <li>i) the goals and measureable objectives of the CHRP;</li> <li>ii) decision frameworks that will be used to prioritize potential caribou habitat restoration sites and to prioritize mitigative actions to be used at different types of sites, including consideration of typical site factors that may constrain implementation;</li> <li>iii) a review of literature upon which the decision frameworks are based including: <ul style="list-style-type: none"> <li>i. an identification of temporal and spatial caribou habitat restoration methodologies applicable to mountain caribou;</li> <li>ii. an assessment of the relative effectiveness of the identified methodologies;</li> <li>iii. detailed methodology of how the literature review was conducted.</li> </ul> </li> </ul>	<p>Section 2 of the Preliminary CHRP introduces the goal, objectives and quantifiable targets.</p> <p>Section 3 provides a decision framework.</p> <p>Section 8 of the Preliminary CHRP summarizes relevant literature and describes the method for the literature review.</p>
<ul style="list-style-type: none"> <li>iv) the quantifiable targets and performance measures that will be used to evaluate the extent of predicted residual effects, the extent to which the goals and objectives have been met, and the need for consequent compensation offsets;</li> <li>v) a schedule indicating when measures will be initiated and completed;</li> <li>vi) a table summarizing any differences or updates from the last previous NGTL CHRP filed with the Board for other projects; and</li> <li>vii) evidence and a summary of how consultation feedback from Environment Canada and appropriate provincial authorities is integrated into the CHRP.</li> </ul>	<p>Section 2 and Section 4 of the Preliminary CHRP describe quantitative criteria to evaluate effectiveness, and include a brief description of monitoring and adaptive management measures. Further information on monitoring and offsets will be provided in the OMP and CHROMMP under separate cover in accordance with GC-125 Conditions 36 and 37.</p> <p>Section 5.6 of the Preliminary CHRP provides the schedule for construction and habitat restoration activities for each of the Aitken Creek and Kahta Sections.</p> <p>Section 6.4 provides a table summarizing differences and updates since the last NGTL CHRP filed with the Board.</p> <p>Section 7 summarizes consultation and feedback from EC, BC MFLNRO, and effected Aboriginal communities.</p>



**Table 1-1: GC-125 Condition 15: Caribou Habitat Restoration Plan (cont'd)**

Condition	Details and Location in Report
<p>b) Final CHRP to be filed on or before 1 November after the first complete growing season following the commencement of operation for the Section 52 Facilities. This updated version of the CHRP shall include, but not be limited to:</p> <ul style="list-style-type: none"> <li>i) the preliminary CHRP, with any updates identified in a revision log that includes the rationale for any changes to decision making criteria;</li> <li>ii) a complete table describing caribou habitat restoration sites, including but not limited to location, spatial area, description of habitat quality, site-specific restoration activities and challenges;</li> <li>iii) specification drawings for the implementation of each restoration method;</li> <li>iv) maps or Environmental Alignment Sheets showing the locations of the sites;</li> <li>v) evidence of how further consultation feedback from Environment Canada and appropriate provincial authorities is integrated into the plan; and</li> <li>vi) a quantitative and qualitative assessment of the total area of direct disturbance to caribou habitat that will be restored, the duration of spatial disturbance, and the aerial extent of the resulting residual effects to be offset, which also includes indirect disturbance.</li> </ul>	<p>The Final CHRP will be filed on or before November 1 after the first complete growing season following the Project being placed into service. For schedule information, see Section 5.6.</p>



## 2.0 GOAL, OBJECTIVES AND QUANTIFIABLE TARGETS

This section describes the goal, objectives and quantifiable targets of the CHRP.

### 2.1 GOAL

The overarching goal of NGTL's caribou habitat restoration plan is to minimize the predicted residual effects of the Project and the Project's contribution to cumulative effects on caribou and caribou habitat in a manner that aligns with provincial and federal policies.

### 2.2 OBJECTIVES

The objectives of the CHRP were designed to achieve the goal in a way that incorporates the best information available, and can be implemented and measured to quantify residual effects on caribou and impacted caribou habitat. The three objectives of the CHRP are:

- 1. Habitat restoration:** revegetation of the Project footprint that achieves establishment, survival and growth of target species in the short term, so natural ecosystems, consistent with adjacent ecosystems, are expected to regenerate over the long term. For example, caribou habitat will be restored in the Project footprint through revegetation, mounding, bioengineering and berms to provide both immediate and sustainable functional habitat that supports caribou recovery over the long term.
- 2. Access control:** effectively discourages access in the Project footprint as an interim measure until results of the monitoring program indicate long term habitat restoration has been successful. For example, access and use of the ROW is controlled through placement of coarse woody debris, tree felling, sign placement and rollback to limit access.
- 3. Line-of-sight blocking:** reduce lines-of-sight along the Project footprint using barriers such as screens and vegetation. For example, tree planting, tree felling, vegetative and fabricated site screening are intended to reduce visibility along the ROW.

The CHRP goal to minimize Project residual effects on impacted caribou habitat will be attained by implementing the three objectives identified above. The Final CHRP will assess the objectives from a qualitative and quantitative perspective.

### **2.3 QUANTIFIABLE TARGETS**

Quantifiable targets are the criteria that will be used to determine whether the CHRP objectives identified in Section 2.2 have been achieved:

- extent of predicted residual effects
- whether the CHRP objectives have been achieved
- need for compensation offsets

For more information on quantifiable targets and performance measures, see Section 4.

### 3.0 DECISION FRAMEWORK

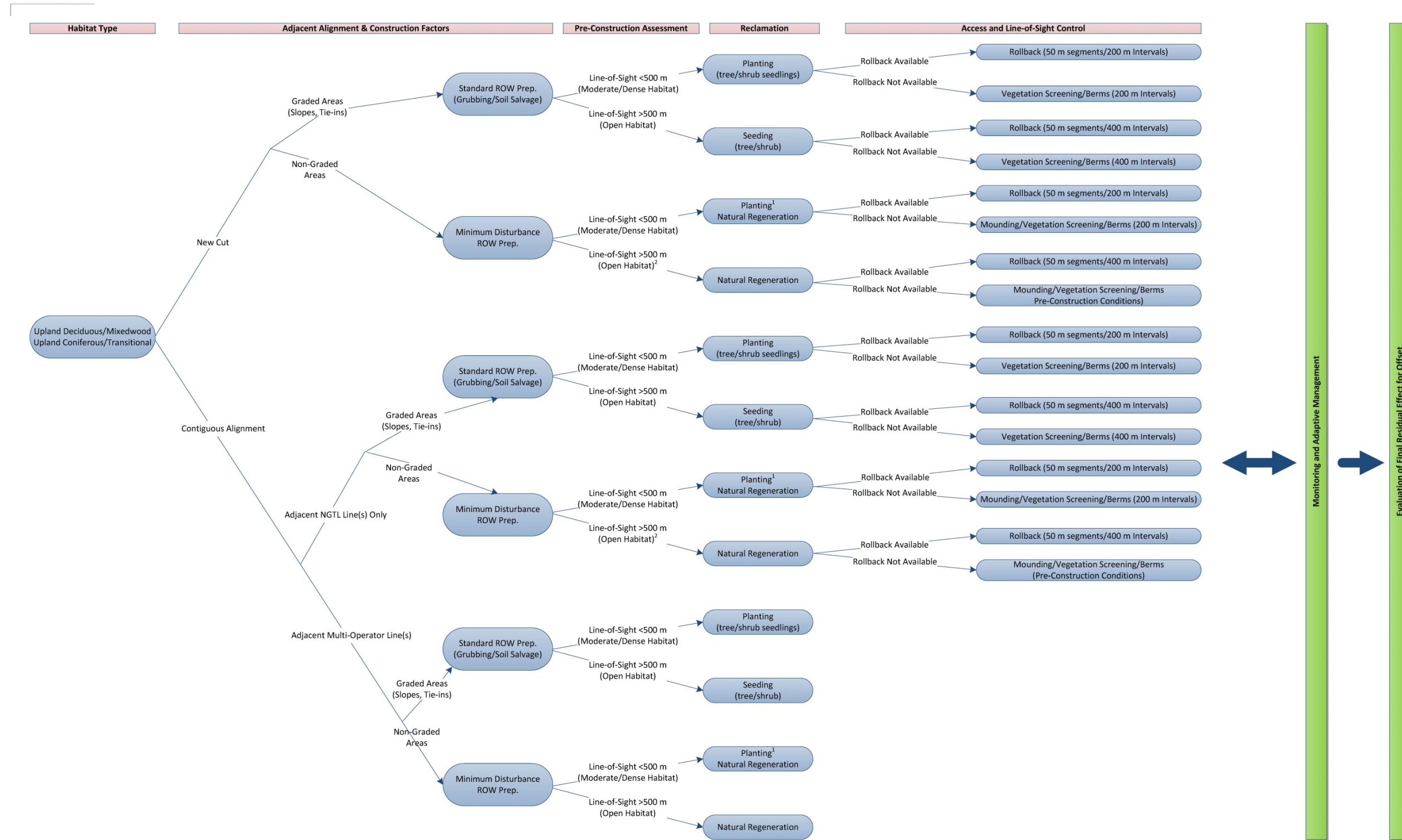
The decision framework (see Figures 3-1, 3-2 and 3-3) will be used to guide the Project in meeting the goal of the CHRP. The decision framework NGTL has developed is a principle based logic model specific to each of the three objectives and forms the basis for quantifiable targets. It was developed from information obtained in the literature review, as well as industry best management practices and industry consultation.

Figures 3-1, 3-2 and 3-3 also show restoration measures or tools that can be applied to the Project footprint in order to meet the CHRP goal. However, only tools applicable to the Project, as restoration measures, will be applied. These are outlined in Section 5, Table 5-3.

Key factors in the choice of these restoration measures or tools include:

- natural site characteristics
- existing disturbance and activities
- regulatory requirements
- site-specific construction methods



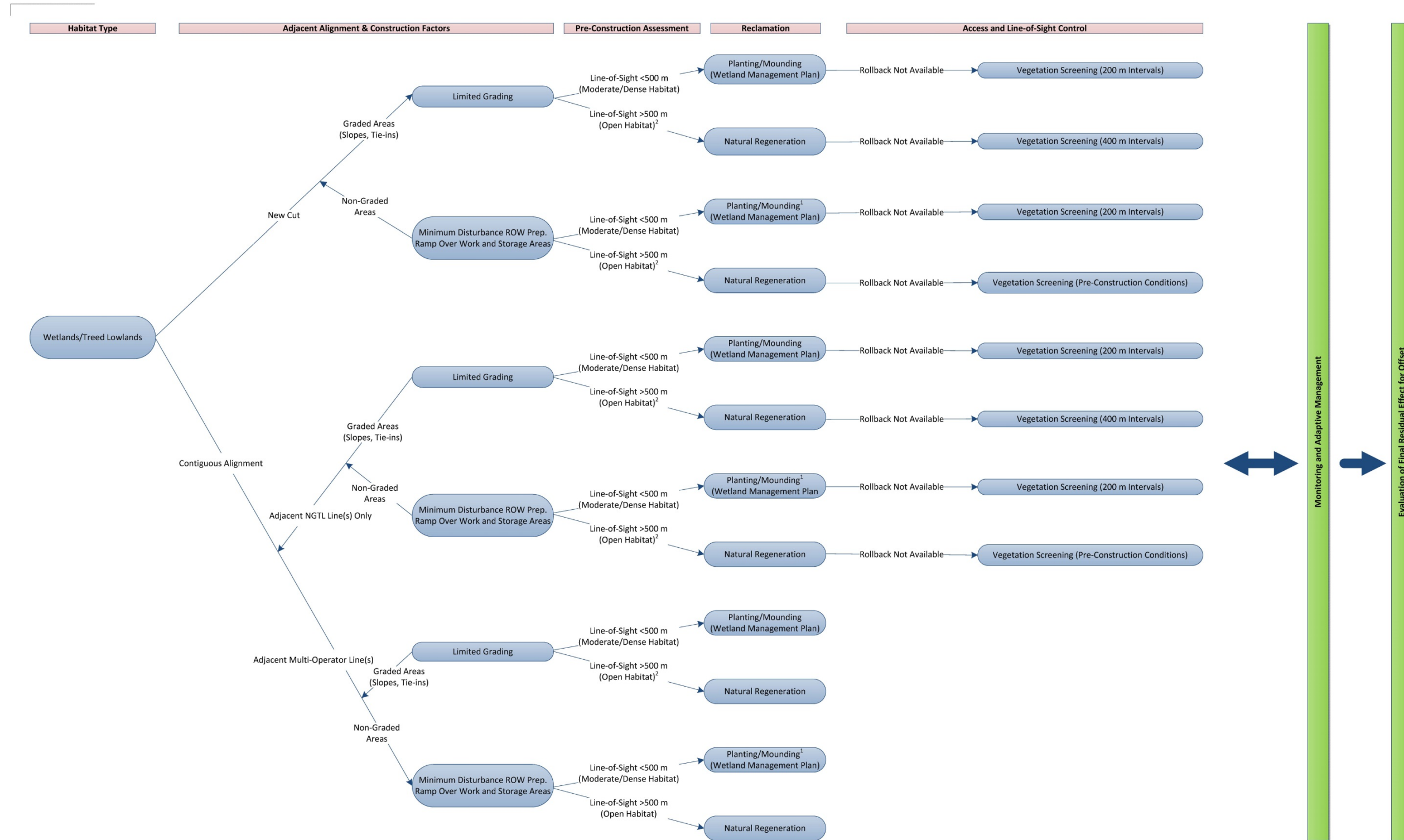


Note: (1) Habitat-specific planting to accelerate natural regeneration in areas of minimal disturbance ROW preparation with line-of-sight <500 m will be considered from detailed habitat information.  
 (2) In areas of new cut or contiguous alignment with NGTL lines only, where minimum disturbance ROW preparation and pre-construction conditions.

Figure 3-1: Decision Framework (for Upland Mixedwood/Upland Coniferous/Transitional Habitat)





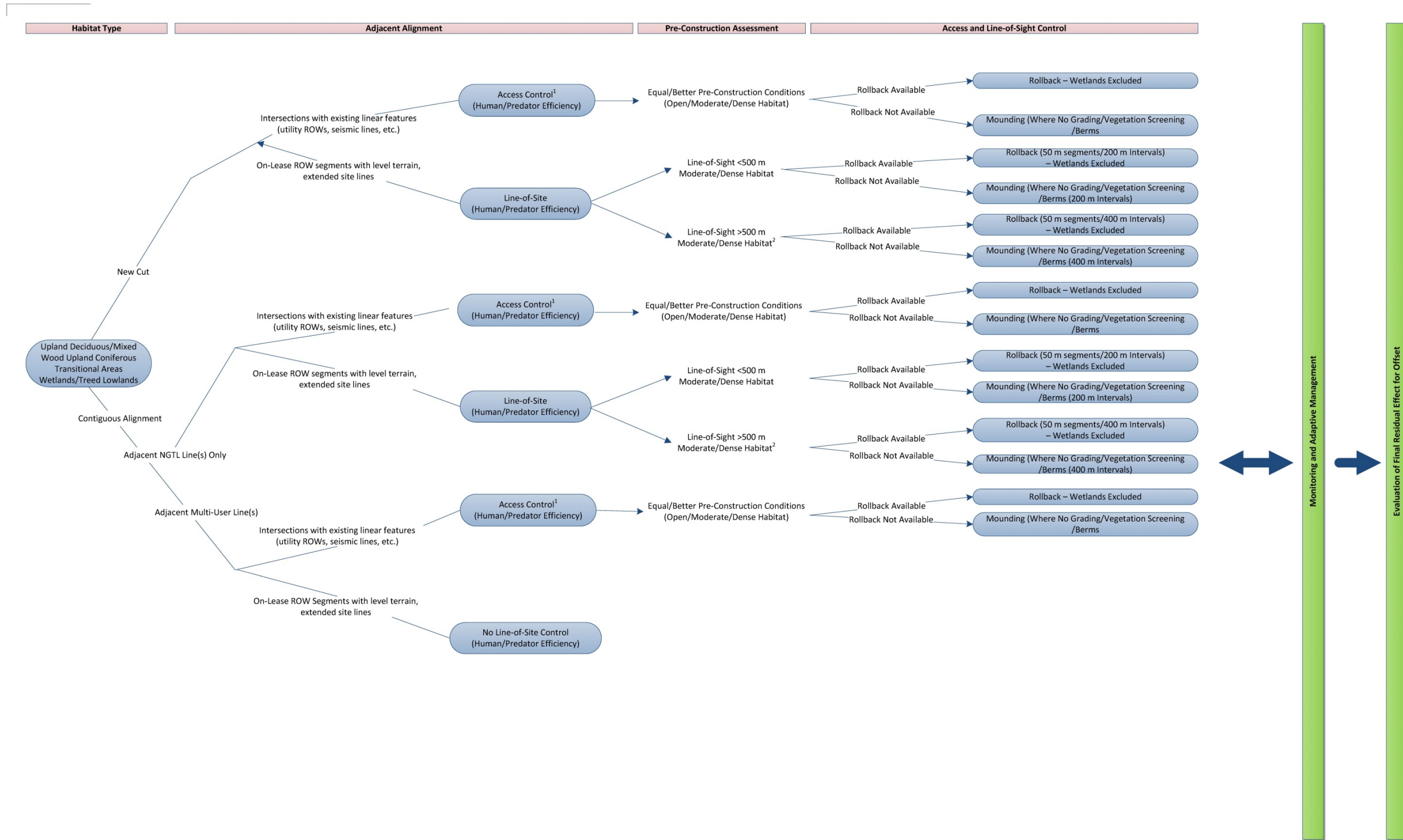


Note: (1) Habitat-specific planting to accelerate natural regeneration in areas of minimal disturbance ROW preparation with line-of-sight <500 m will be considered from detailed habitat information.

(2) In areas of new cut or contiguous alignment with NGTL lines only, where minimum disturbance ROW preparation and pre-construction line-of-site extends >500 m on-easement (i.e., open habitat), line-of-site blocking will be placed at intervals that achieve pre-construction conditions.

Figure 3-2: Decision Framework (for Treed Lowlands and Wetlands)





Note: (1) Access control at intersecting existing linear features (i.e., utility ROW, seismic lines, etc.) will not be implemented or inhibit traditional use.

Figure 3-3: Decision Framework (for Line-of-Sight and Access Control)



#### 4.0 QUANTIFIABLE TARGETS AND PERFORMANCE MEASURES

This section describes:

- quantifiable targets and performance measures used to evaluate the extent of predicted residual effects
- the extent to which CHRP goal and objectives have been met
- the need for compensation offsets for any residual effects remaining after implementation of the CHRP

For a summary of the quantifiable targets and performance measures available to the Project, see Table 4-1. The quantifiable targets and performance measures selected for the Project work in conjunction with the decision framework described in Section 3.

**Table 4-1: Quantifiable Targets and Performance Measures**

Objective <sup>1</sup>	Rationale/Limitations/Assumptions	Quantifiable Targets	Evaluation Criteria
<p><b>Habitat Restoration</b></p>	<ul style="list-style-type: none"> <li>• Successful native vegetation re-establishment using the proposed habitat restoration measures will achieve trajectories toward natural ecosystem types, which will eventually re-establish native wildlife habitat.</li> <li>• The Project footprint in a caribou range is the proposed clearing of new area (i.e., excludes overlapping/shared areas with existing disturbances).</li> <li>• NGTL's operation and maintenance practice includes vegetation control over the pipe centreline (approximately 6–10 m wide area centred over the pipeline) as a corporate mechanism to meet compliance with CSA-Z662-15. This Standard requires that vegetation is controlled along rights-of-way to maintain clear visibility from the air and provide ready access for maintenance crews (CSA 2015). However, there is flexibility within NGTL's vegetation control practice to allow for wildlife habitat objectives while still ensuring compliance with CSA Z662-15. NGTL acknowledges limitations for sustained revegetation success along the pipe centreline while the pipeline is in operation. NGTL also understands its obligations for achieving equivalent land capability at end of pipeline life.</li> </ul>	<p>Upland Deciduous/Mixed Wood/Transitional/ Upland Coniferous</p> <ul style="list-style-type: none"> <li>• Achieve <math>\geq 80\%</math> survival rate for seedlings within 10 years following planting.</li> <li>• Demonstrate sustained growth trends across <math>\geq 50\%</math> of restoration locations within 10 years following implementation of CHRP measures.</li> </ul>	<ul style="list-style-type: none"> <li>• Quantitative measures of success will include comparisons of regeneration parameters (e.g., vigour, height, percent cover, species composition) between Years 1, 3, 5 and 10 following start of operation, with the objective of ensuring establishment of each habitat type and a trend toward achieving equivalent land capacity. If regeneration parameters are not met, adaptive management measures will be implemented to meet vegetation reestablishment trajectory. It is intended that plantings will be monitored for 10 years pursuant to Condition 37.</li> <li>• GPS location, number and type of restoration treatments and the frequency of monitoring will be defined and mapped in the Final CHRP.</li> </ul>

**Table 4-1: Quantifiable Targets and Performance Measures (cont'd)**

Objective <sup>1</sup>	Rationale/Limitations/Assumptions	Quantifiable Targets	Evaluation Criteria
<b>Habitat Restoration (cont'd)</b>	<ul style="list-style-type: none"> <li>• Areas in the Project footprint that parallel existing footprints with grass cover could have limited successful survival of planted species, due to competition from species ingress from adjacent disturbance.</li> <li>• Overlapping dispositions such as a gravel roads or facilities could limit long-term restoration success.</li> </ul>	<p>Treed Wetlands/Treed Lowlands</p> <ul style="list-style-type: none"> <li>• Where tree seedlings are planted (i.e., mounded sites):                             <ul style="list-style-type: none"> <li>• achieve <math>\geq 50\%</math> survival rate for seedlings/transplants within 10 years following planting</li> <li>• demonstrate sustained growth trends across <math>\geq 50\%</math> of restoration locations within 10 years following implementation of CHRP measures</li> </ul> </li> </ul> <p>Shrub/Graminoid Wetland</p> <ul style="list-style-type: none"> <li>• Within 10 years following installation of CHRP measures:                             <ul style="list-style-type: none"> <li>• <math>\geq 50\%</math> cover of native vegetation species in the footprint</li> <li>• no restricted weeds</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Where revegetation success does not meet quantifiable targets, NGTL will determine appropriate adaptive management. For example, if seedling mortality is unexpectedly high, NGTL will do additional planting, improve site conditions for seedling success or improve restoration efforts at other sites.</li> </ul>

**Table 4-1: Quantifiable Targets and Performance Measures (cont'd)**

Objective <sup>1</sup>	Rationale/Limitations/Assumptions	Quantifiable Targets	Evaluation Criteria
<p><b>Access Control</b></p>	<ul style="list-style-type: none"> <li>Access control measures are most effective when implemented at intersections of the Project ROW with existing perpendicular linear features (e.g., roads, utility corridors, seismic lines).</li> <li>Access by NGTL staff and contractors, including operations personnel as well as reclamation and monitoring crews, will be recorded and monitored. Access by Project personnel in the footprint in caribou range will be limited to the extent practical. Traditional access will be maintained.</li> <li>The access control evaluation might be guided by the Access Management Plan (AMP), which will be prepared pursuant to Condition 16.</li> </ul>	<p>Access Control: The following quantifiable targets will be used to measure the access control objective:</p> <ul style="list-style-type: none"> <li>a lower measure (e.g., rate, proportion, count) of access along the segments of the Project ROW where access is controlled relative to uncontrolled segments</li> <li>&lt;20% increase in access (e.g., rate, proportion, count) from the baseline assessment as measured by remote cameras</li> </ul> <p>The quantifiable targets for access in the Project ROW are expected to be achieved within 5 years following CHRP implementation, though monitoring will continue over 10 years.</p>	<ul style="list-style-type: none"> <li>Evidence and level of access along Project ROW using criteria ratings such as: <ul style="list-style-type: none"> <li>access evident: Yes/No</li> <li>access type: all-terrain vehicle (ATV)/ truck/ snowmobile/ non-motorized/ predator/other</li> </ul> </li> <li>Access level: <ul style="list-style-type: none"> <li>No access evident</li> <li>Low: tracks/trail evident but difficult to discern or appears to be infrequently used</li> <li>High: tracks/trails appear to be well-used; vegetation is trampled down, bare ground from frequent use might be visible)</li> </ul> </li> <li>Access level definitions will be refined in the Final CHRP.</li> <li>An evaluation of whether the objective for access control is achieved will consider collected qualitative and quantitative data.</li> </ul>



**Table 4-1: Quantifiable Targets and Performance Measures (cont'd)**

Objective <sup>1</sup>	Rationale/Limitations/Assumptions	Quantifiable Targets	Evaluation Criteria
<p><b>Line-of-Sight Blocking</b></p>	<ul style="list-style-type: none"> <li>Operating practices for energy development in sensitive caribou range in British Columbia (BC Ministry of Environment 2011) suggest implementing line-of-sight management every 500 m on linear features that do not share a ROW boundary with a road. Line-of-sight blocking as part of this Project will follow this guideline where it is not collocated with roads or other linear developments.</li> <li>Bends in the pipeline (doglegs) can reduce line-of-sight, but opportunities to do this for the Project might be limited where the ROW parallels other linear developments.</li> <li>Wetlands and some treed lowlands encountered by the Project footprint naturally have low and/or open vegetation structure. The line-of-sight distance in these areas is naturally long and, therefore, sightline management techniques are not practical for these locations.</li> <li>Concern from provincial regulators regarding fire hazard and forest health (pathogen spread), availability of line of sight blocking material, suitability of substrate to support structures (i.e., peat does not support fencing), introduction of weeds from imported material and potential for alteration in surface hydrology (particularly from earth berms) can limit the use of line of sight blocking measures.</li> <li>Appropriate locations for line-of-sight blocks will be identified post-construction when final clearing is complete and included and as-built drawings.</li> </ul>	<p>Line-of-Sight Blocking:</p> <ul style="list-style-type: none"> <li>Along the Project ROW, in areas of new cut or contiguous Project ROW with NGTL lines only, achieve sightline distance of &lt; 500 m within 10 years following implementation of CHRP measures.</li> <li>Along the Project ROW, in areas of new cut or contiguous Project ROW with NGTL lines only, where planting for future vegetation screens in combination with or without rollback have been installed, achieve 80% or higher survival rate for planted seedlings that are intended as line-of-sight blocks within 10 years following implementation of CHRP measures.</li> </ul>	<ul style="list-style-type: none"> <li>Establish line-of-sight blocks in forested areas of the footprint in caribou range that will achieve a sightline distance of 500 m or less in areas of new cut or in sections contiguous with, and adjacent to, NGTL lines only.</li> </ul>

**Table 4-1: Quantifiable Targets and Performance Measures (cont'd)**

Objective <sup>1</sup>	Rationale/Limitations/Assumptions	Quantifiable Targets	Evaluation Criteria
<b>Line-of-Sight Blocking (cont'd)</b>	<ul style="list-style-type: none"> <li>• A combination of measures, including vegetation screening, rollback and mounding will be applied. Feasibility of installing berms or fencing will be investigated post-construction.</li> <li>• Few limitations are associated with using vegetation screening to reduce line-of-sight.</li> <li>• Paralleling an existing linear corridor presents challenges for line-of-sight blocking where the adjacent line is owned by a company other than TransCanada.</li> <li>• Application of sightline management techniques should extend across the width of the Project footprint and adjacent disturbance to be effective.</li> </ul>		
<p>Note: 1 Restoration objectives will continue to be evaluated for the Final CHRP to consider any updated consultation with stakeholders or if any other relevant information becomes available.</p>			

## **5.0 THE RESTORATION IMPLEMENTATION PLAN**

This section provides a high-level summary of Project impacts to affected mountain caribou habitat. This section also describes NGTL's plan to implement a decision framework (see Section 3) which will be used by the Project to achieve the overarching goal of the CHRP. The content of this section presents NGTL's plan to reduce residual and cumulative effects of the Project on caribou and impacted caribou habitat.

### **5.1 PROJECT IMPACTS TO CARIBOU HABITAT**

The Environmental and Socio-Economic Assessment (ESA) for the Project identified potential direct and indirect effects of the Project on caribou and caribou habitat through changes in habitat conditions, herd movement and caribou mortality risk. The cumulative effects analysis completed as part of the ESA determined that the Project will have small, incremental contributions to the overall cumulative effects to the Graham and Pink Mountain caribou ranges (see Figure 1-1). The Project linear disturbance presented in Table 5-1 reflects the most recent Project design at the time this Preliminary CHRP was prepared. Final determination of linear disturbance in caribou range will be presented in the Final CHRP.

The NEB Report stated that the Project will still result in loss of habitat (and could result in disturbance to caribou) beginning with construction and continuing through the lifecycle of the Project, notwithstanding the proposed mitigation within NGTL's EPP and CMP. The Board stated that disturbances within caribou ranges should be minimized, and measures taken before and during construction to help accelerate the restoration of caribou habitat. The Board is of the view that Project proponents have a responsibility to not only reduce effects on caribou habitat, but to also restore affected habitat as soon as possible and as much as possible. The Board, therefore, imposed Condition 15 requiring NGTL to prepare a Preliminary and Final CHRP for the Project. The Board acknowledged NGTL's preparation and submission of the preliminary CMP and noted that the CHRP will supersede and replace the CMP.

#### **5.1.1 Impacted Caribou Habitat**

The Project will impact the Graham and Pink Mountain caribou ranges (see Section 8.3). The Aitken Creek Section of the Project will result in a linear disturbance of approximately 8 km within the Graham caribou range. The linear disturbance on the Kahta Section extends approximately 19 km within the Pink Mountain caribou range (see Table 5-1).

Table 5-1 also describes both the Graham and Pink Mountain herds listing status. Both herds are provincially designated northern ecotype caribou (BC Ministry of Environment [MOE] 2010), but are classified differently at the population level.

The Graham herd belongs to the Southern Mountain population, Northern Group, and is designated as Threatened on Schedule 1 of the *Species at Risk Act* (SARA) and by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and is blue-listed in BC (BC Conservation Data Centre [CDC] 2015; COSEWIC 2015; Environment Canada (EC) 2015).

The Pink Mountain herd is part of the Northern Mountain population, and is designated as Special Concern on Schedule 1 of SARA and by COSEWIC, and is blue-listed in BC (BC CDC 2015; COSEWIC 2015; EC 2015). COSEWIC has further divided each population into Designatable Units (DU), and both the Graham and Pink Mountain herds are included in Northern Mountain DU7 (COSEWIC 2011).

Species designated as Special Concern (SC) on Schedule 1 of SARA, such as the Pink Mountain herd, require management plans developed by the federal government for the species and its habitat, whereas species designated as Threatened or Endangered, such as the Graham herd, require a recovery strategy. Because the Pink Mountain caribou population is designated SC, a management plan was developed for this population, where it is referred to in the collective as Northern Mountain caribou.

**Table 5-1: Caribou Nomenclature and Ranges that Interact with the Project**

Project Component	Caribou Range	BC Provincial Status Designation and Nomenclature	Federal Status Designation and Nomenclature	Current Population Trend	Project Linear Disturbance in Caribou Range		
					Total Length in Caribou Range	Total Parallel to Existing Linear Disturbance	New Linear Disturbance
Aitken Creek Section (pipeline)	Graham	Blue <sup>1</sup> Northern ecotype <sup>2</sup> Northern caribou <sup>3</sup>	Threatened <sup>4,5</sup> Northern Group subpopulation of the Southern Mountain population <sup>6</sup> DU7 <sup>7</sup>	Stable <sup>8</sup>	8.1 km	7 km (86.4%)	1.1 km (13.6%)
Kahta Section (pipeline and two meter station sites)	Pink Mountain	Blue <sup>1</sup> Northern ecotype <sup>2</sup>	Special Concern <sup>4,5</sup> Northern Mountain population <sup>6</sup> DU7 <sup>7</sup>	Unknown <sup>9</sup>	19 km	13.3 km (70%)	5.7 km (30%)

**Table 5-1: Caribou Nomenclature and Ranges that Interact with the Project (cont'd)**

Note:
1 BC provincial status designation (BC CDC 2015).
2 Ecotypes assigned by BC MOE (2010).
3 Northern caribou as described in the Implementation Plan for the Ongoing Management of South Peace Northern Caribou (BC MOE 2013)
4 Status designation under Schedule 1 of SARA (EC 2015).
5 Status designation under COSEWIC (2015).
6 Caribou populations described by COSEWIC (2002) and the SARA Public Registry (EC 2015), and subpopulation described by EC (2014).
7 Northern Mountain DU7 assigned by COSEWIC (2011).
8 Population trend reported by EC (2014).
9 Population trend reported by EC (2012a).

## 5.2 QUANTIFICATION OF HABITAT DISTURBANCE

Restoration of disturbed habitat assumes that caribou will return to spatial separation from primary prey (moose and deer) and predators and, as a result, return to pre-disturbance levels of mortality risk (Athabasca Landscape Team 2009).

Restoration of anthropogenic disturbances is also expected to reduce the degradation of functional habitat for caribou, since caribou will no longer exhibit reduced use on or near (i.e., in a zone of influence) the reclaimed disturbance (Oberg 2001). As such, restoration of caribou habitat is expected to alleviate the residual direct habitat disturbance over the long term.

By addressing residual direct habitat disturbance, indirect residual effects will also be addressed. Included in the direct disturbance footprint are the ROW, meter stations, temporary workspace, new temporary construction access and new permanent access. The Final CHRP will provide schematics that illustrate the quantification of direct and indirect residual effects of the Project on caribou habitat using as-built information. Indirect disturbance (i.e., reduced habitat effectiveness) is defined as the area within the 500 m buffer of anthropogenic disturbance features.

The spatial residual effect will be quantified using a method consistent with *Recovery Strategy for the Woodland Caribou Southern Mountain population* (Rangifer tarandus caribou) in Canada (EC 2014). The Recovery Strategy defines undisturbed caribou habitat in the Environmental Site Assessment Repository (ESAR) caribou range as habitat that has not burned in the last 40 years and is not in or within 500 m of anthropogenic disturbance. Although the Project footprint is in an area that has been burned by forest fires within the last 40 years, NGTL will still consider this non-permanent disturbance in its quantification of spatial residual effect.

Restoration of impacted mountain caribou habitat through implementation of the CHRP measures will not completely eliminate adverse Project effects on caribou habitat. During operations, NGTL will periodically manage vegetation within 5 to

10 m of the centreline of the operational pipeline, in accordance with TransCanada operational procedures for integrity monitoring under Canadian Standards Association (CSA) Z662-15 (CSA 2015). This area will be allowed to regenerate naturally, but will be periodically mowed or mulched. This theoretical access area will not achieve the quantifiable targets for the CHRP and is quantified as a residual direct disturbance of caribou habitat.

The area of direct disturbance in the Pink Mountain and Graham caribou ranges estimated during the application phase of the Project was approximately 162 ha and 29 ha. After application of the CHRP measures outlined in this document, the final disturbance footprint will be determined. Direct and indirect Project disturbance on caribou habitat will be quantified and presented in the Final CHRP, as outlined in Table 5-2.

**Table 5-2: Quantification of Direct and Indirect Project Disturbance of Caribou Habitat**

Area (ha)				
Length of Pipeline Segment	Direct Project Disturbance	Restored Project Footprint	Residual Direct Project Disturbance	Incremental Indirect Disturbance
TBD	TBD	TBD	TBD	TBD

To calculate the final offset requirement for the Project, the first step involves calculating the remaining project effect after CHRP measures are applied to the Project footprint. The restored Project footprint will be categorized as either new alignment or parallel alignment. New alignment is assumed to have full effect on caribou use of this part of the range, whereas segments parallel to adjacent disturbances have less effect on caribou use (this will be further outlined in the OMP).

The second step involves categorizing the portion of total area for new alignment and parallel alignment in their respective habitat classes to apply the appropriate delay factors (i.e., time lags) associated with each mitigation measure.

The third step categorizes the proportion of total area for each mitigation measure in each habitat type. The proportion of total area for each mitigation measure in each habitat type will be used to estimate the remaining Project effect using the following equation:

$$\text{Remaining Project Effect (ha)} = \text{Inherent Project Effect (ha)} \times \{1 - (\text{Measure Effectiveness} \times \text{Delay Penalty})\}$$

The remaining project effect calculation will be used to populate Table 5-2 in the Final CHRP.

For previous NGTL projects that impacted caribou habitat, NGTL allowed intermittent alternating plantings of woody vegetation over the pipeline centreline. For the Project, trees will be planted across the centreline with open areas left at

alternating sides of the ROW. This will allow for a meandering access line over the centreline, and will in time, establish line-of-sight breaks (i.e., vegetation screens). Using this alternating planting method the quantifiable targets for habitat restoration (revegetation) are expected to be achievable.

The entire width of the Project footprint that is planted will not be considered restored in the short term. The residual effect can be effectively addressed once the habitat regenerates in the long term. In the long term, the area of operational access is not expected to be a spatial residual effect where the ROW segment is planted with trees.

Some restoration measures are designed to be effective immediately or in the short term. For example, retention of vegetated visual screens, mounding and tree felling (particularly if in conjunction with mounding) are expected to reduce Project residual effects on caribou habitat immediately.

The lag time required to achieve habitat value equivalent to pre-construction conditions is important and will be considered in the quantification of residual effects in the Final CHRP. Residual effects presented in the Final CHRP will consider lag time and also factor in uncertainty associated with offsets. Over the long term, the vegetation community composition and structure is expected to mature to a seral stage that will provide functional caribou habitat and restore pre-disturbance predator-prey dynamics.

NGTL will develop an OMP to address Project residual effects on critical caribou habitat for the Aitken Creek Section pursuant to Condition 36. The Preliminary OMP will further detail the method used to quantify the offsets. The Project OMP will use a method of offset quantification that aligns with NGTL's previous OMPs for projects constructed in boreal woodland caribou range.

The residual effects to be quantified in the Final CHRP using the method described above will be modified in the calculation of residual effects in the OMP to factor in:

- uncertainty associated with effectiveness of the CHRP measures
- context of the footprint related to existing disturbance (e.g., contiguous or non-contiguous)
- time lag or duration of residual effects

### 5.3 HABITAT RESTORATION

The decision framework (see Section 3) and regulatory guidelines summarized in Section 8 provide the basis for the Preliminary CHRP and will further guide the Final CHRP. The decision framework provides direction on restoration factors such as variability in natural site characteristics, planting prescriptions, target vegetation, soil and site stability, and access management. This in-turn informs the quantifiable

targets and performance measures that will be used to evaluate the extent of predicted residual effects and the extent to which goals and objectives have been met.

For a suite of caribou habitat restoration measures, see Table 5-3. After applying the decision framework, suitable restoration measures will be selected. Several restoration methods described in the literature review and included in Table 5-3 are considered not suitable given the limitations to implementation or effectiveness. These measures could be reconsidered if additional information becomes available to support their use. For photos of potential restoration measures, including site conditions showing constraints and opportunities, see Appendix A.



**Table 5-3: Habitat Restoration Measures**

Restoration Measure	Objectives	Rationale	Comments
Berms	Access control Line-of-sight blocking	<p>Berms can be constructed of coarse woody debris and timbers, or a combination of coarse woody debris and earth. Supported berms are constructed using timber cleared from the ROW. To effectively block line-of-sight, berms should be constructed to an approximate minimum height of 1.5-2 m. Promote rapid shrub/tree regeneration at ends of berms (e.g., shrub staking/transplants, seedling planting) to increase effectiveness as access control. Earth berms were 76% effective at excluding vehicles over 50 inch wide and 22% effective at excluding all vehicles including off-road vehicles (Esri User Conference 1996). Berms create a barrier that can be effective immediately following implementation. Coarse woody debris/timber berms are dependent on approval from provincial authorities to retain coarse woody debris on-site, as well as sufficient space to store the material during construction. Woody debris berms may present an increased fire hazard, depending on composition and location. NGTL has found on its existing ROWs where this measure was used, that woody debris berms deteriorate relatively quickly after installation (within several years), particularly if berms are moved to allow access to the ROW.</p> <p>Quantity of source material is usually not sufficient for earth berm construction in areas where minimum disturbance construction techniques are employed. Importing material is not preferred given the risk of introducing invasive plants. Earth berms should not be located in peatlands due to potential for settling and alteration of surface hydrology.</p>	<p>Limitations of this measure reduce its value. Woody material available for inclusion in berms is often limited, which can make this option less useful. Woody debris berms might be used as CHRP measures if sufficient wood exists at the Project site.</p> <p>Earth berms will not be considered a viable option for the Project as NGTL has found that there is generally insufficient source material to create earth berms.</p>

**Table 5-3: Habitat Restoration Measures (cont'd)**

Restoration Measure	Objectives	Rationale	Comments
<p>Bioengineering</p> <ul style="list-style-type: none"> <li>• shrub staking/planting</li> <li>• tree seedling planting</li> </ul>	<p>Habitat Restoration Access control Line of sight blocking</p>	<p>Bioengineering in combination with stabilization measures (e.g., soil wraps) might be suitable at watercourses crossed with an open cut method.</p> <p>Bioengineering is the use of existing live vegetation to stabilize and revegetate a site (e.g., transplants; installing cuttings) and is a technique often used on slopes or riparian banks (Polster 2002).</p> <p>Species and planting densities used for bioengineering are site-dependent (Golder 2012a). Vegetation used is typically collected either from the disturbance site (i.e., before or during clearing), or from the adjacent area, in the form of cuttings (Golder 2012a). Vegetation might be planted during the growing season or during winter. Willows and poplar can be used as cuttings. Both species are fast growing, which establishes line-of-sight breaks quickly and works well for riparian restoration (Golder 2012a).</p> <p>Nursery-grown shrub seedlings might be planted where staking is not practical due to lack of available material, limitations associated with collecting material off-site, or where a restoration prescription calls for shrub planting of species that do not readily regenerate through cuttings/staking (e.g., alder). Alder has low browse value for ungulates such as moose and deer. Compacted sites that are difficult to treat using mechanical site preparation methods can benefit from inter-planting alder with conifers. When alder is interspersed with conifer plantings, line-of-sight and human access on linear features can be reduced relatively quickly (compared to conifers alone). The nitrogen-fixing characteristics of alder can provide soil enhancement (Sanborn et al. 2001; Sweeney 2005), potentially promoting improved conifer growth over the long-term (Courtin and Brown 2001; Simard and Heineman 1996). The fast growth of alder can reduce growth rates of conifer plantings due to competition when alder densities are high (CRRP 2007b; Simard and Heineman 1996).</p> <p>Species are determined based on the adjacent forest stand and restoration objectives (e.g., low palatability for ungulates). Combined plantings of shrub and tree seedlings can be appropriate, depending on site conditions and anticipated natural revegetation of both species. Procurement of shrub seedlings (container or bare-root) can be challenging given limited seed availability. Planted shrubs can be slow to establish.</p>	<p>Shrub planting is a suitable CHRP measure for select site-specific locations if a need for combined conifer/shrub plantings is identified. Many shrub species can attract prey species such as moose and deer, which can attract wolves, thus its application will be limited as these species can have a negative effect on caribou (see Section 8).</p>

**Table 5-3: Habitat Restoration Measures (cont'd)**

Restoration Measure	Objectives	Rationale	Comments
Conifer seedling planting	Habitat restoration Access control Line of sight blocking	<p>Restoration species are determined based on the biophysical characteristics of the site, adjacent forest stand composition, and restoration objectives (e.g., low palatability for ungulates). Tree seedling planting is considered a long-term restoration treatment (full effectiveness is expected to take longer than 10 years).</p> <p>Planting densities for reclamation of forested areas in Canada have been based on forestry standards, ranging from 1,500–2,500 stems/ha (MacDonald et al. 2012).</p> <p>In the Prince George Forest Region of BC, target stocking densities for coniferous trees range from 400-1,200 stems/ha and the minimum stocking standards range from 200-700 stems/ha (BC MOF 2000). Target stocking density for deciduous trees is 2,500 stems/ha and the minimum stocking densities range from 1,700-2,000 stems/ha (BC MOF 2000). Given the relatively harsh growing conditions inherent to boreal ecosystems, mortality of planted seedlings is anticipated to range from approximately 5% to 20% in most site types (Golder 2012a,b). A planting density of 2,000-2,500 stems/ha is recommended for restoration of linear disturbances in boreal caribou ranges in northeast BC (Golder 2015).</p> <p>Although the above information was used to determine seeding densities there is no direct information or literature available on appropriate planting densities in the mountain caribou range where this Project occurs. The Project terrain includes more upland habitat than would typically be commercially harvested and researched. For example, Kahta has mineral soils within the top 50 cm or less in peat so mounding might be necessary to create suitable growing conditions. Given this information and the literature specified above, the following planting prescription has been formulated for this CHRP:</p> <ul style="list-style-type: none"> <li>• minimum seedling density of 1,200-1,600 stems/ha on sites that are not mounded</li> <li>• minimum seedling density of 900-1,100 stems/ha (combined planted seedlings and/or natural regeneration) on mounded sites (dependent on mound density)</li> </ul>	Conifer seedling planting is a suitable CHRP measure for the Project.

**Table 5-3: Habitat Restoration Measures (cont'd)**

Restoration Measure	Objectives	Rationale	Comments
Mounding	Restore vegetation (create microsites) Access control	<p>For the purposes of enhancing microsites for planted seedlings, mounding is a well-researched and popular site-preparation technique in the silviculture industry. It is commonly used in wet, low-lying areas to create better-drained microsites to enhance seedling survival.</p> <p>Mounding treed wetlands (e.g., bogs, fens) can enhance a site to promote natural revegetation over time, as higher, drier spots are created that seed can eventually settle into and germinate (Golder 2012a; Macadam and Bedford 1998). Soil properties (e.g., substrate, drainage) affect the ability of mounds to retain their structure.</p> <p>Mounding has been used as an access control measure on old roads and seismic lines to discourage off-road vehicle activity. It can be effective immediately following implementation. For access control purposes, mounds should be created using an excavator to 0.75 m deep, where site conditions allow (Golder 2012a). The excavated material is dumped beside the hole (Macadam and Bedford 1998).</p> <p>Transitional areas, or places with shallow peat (&lt; 50 cm) are preferred for mounding.</p> <p>Suggested densities of mounding for access management or microsite creation purposes vary from 1,400-2,000 mounds/ha (Golder 2012a). Implementation of this mound density might be suitable for restoring disturbances such as seismic lines where specialized equipment is used and where frost is not driven into the soils to allow heavy equipment access. The mound density that can realistically be achieved on pipeline ROWs is lower (approximately 700-1,400 mounds/ha on previous NGTL projects). The limitations of mounding on pipeline ROWs include scheduling mounding for restoration during final cleanup, which typically depends on freezing-in of soils, availability of specialized equipment and minimum spatial separation of 5 m between mounds and the centreline of the operating pipeline.</p>	Mounding is a suitable CHRP measure that will be used in conjunction with conifer seedling planting for the Project.

**Table 5-3: Habitat Restoration Measures (cont'd)**

Restoration Measure	Objectives	Rationale	Comments
Minimum disturbance construction	Habitat Restoration Line of sight blocking	<p>Construction during winter conditions allows for minimum disturbance construction techniques, which reduce the need for soil salvage and grading, and limit the width of grubbing to the trench area where grading is required. Reduced disturbance to vegetation and root systems is achieved by cutting, mowing or walking down and mulching shrubs and small-diameter trees at ground level. Intact root systems and seed beds with little soil disturbance facilitate rapid regeneration of vegetation. Use of snow padding or matting can limit the need for cutting or mowing shrubs and small trees, thereby speeding regeneration of native vegetation. The extent of minimum disturbance construction might be limited by scheduling to avoid the restricted timing window for caribou (January 15 to July 15).</p> <p>Soil conditions limit the applicability of minimum disturbance construction methods. Construction in well to moderately drained sites during non-frozen conditions requires grubbing and grading to salvage surface soils so they can be stored separately from subsoils and replaced following construction. This prevents admixing and loss of the productive surface soils that facilitate regeneration of vegetation.</p>	Minimum disturbance construction is a suitable CHRP measure for the Project, and will be implemented where scheduling and soil conditions (e.g., frozen) allow.
Transplanting	Habitat Restoration Access control Line of sight blocking	Transplanting has the advantage of immediately establishing relatively large trees/shrubs (e.g., saplings). There are limitations to transplanting, including inconsistent availability of vegetation suitable for transplant, potential for degradation of neighbouring vegetation communities if transplants are sourced from adjacent stands. Transplanting programs often result in the storage of plant materials under less-than-ideal conditions due to uncontrollable factors (i.e., weather). Other treatments, such as seeding and seedling planting, have been shown to be more successful in comparison (Golder 2012a). See Section 8.6.2 for more details.	Transplanting native vegetation is not a suitable CHRP measure for the Project as it has been shown to be a difficult technique to implement on a large scale, with multiple limitations. This technique could prove more suitable for future projects if advances in the method improve survival success rates.

**Table 5-3: Habitat Restoration Measures (cont'd)**

Restoration Measure	Objectives	Rationale	Comments
Tree felling or bending	Access control Habitat Restoration Line of sight blocking	<p>Mechanically bending or felling live trees onto a linear disturbance has been tested as a measure to restore habitat and manage access on seismic lines in caribou range (COSIA 2012). Trees are typically bent or felled from both sides of the linear disturbance.</p> <p>Tree felling involves deliberately felling trees over the linear disturbance. It does not require specialized machinery. Tree bending requires specialized machinery to mechanically bend live stems over the linear disturbance. Mechanical tree bending can be expensive and time consuming. These measures are often used in conjunction with other restoration techniques such as mounding and conifer seedling planting. Tree felling/bending is only initially being evaluated and its utility remains unverified (Neufeld 2006). It is recommended that if tree felling is to be used as a line of sight blocking measure, it should be investigated more thoroughly, and not solely be relied on as a mitigation tool (Neufeld 2006). Preferably, line of sight blocking with tree felling (or tree bending) should be used in combination with other management actions such as habitat restoration (Neufeld 2006), and continue to be evaluated for effectiveness using an adaptive management approach.</p> <p>Tree felling/bending can promote natural revegetation by increasing cone deposition onto the ROW, creating microsites through shading and dropped dead woody debris, and protecting planted seedlings from extreme weather, wildlife trampling and damage from access.</p> <p>Application in pipeline ROWs might be limited due to the width (i.e., much wider than typical seismic lines where tree bending/felling has previously been implemented). Furthermore, NGTL has narrowed the construction ROW for the Project to minimize the footprint as much as site conditions and construction requirements allow, leaving inadequate space for tree retention along the edges of the footprint for tree felling. Provided regulatory permitting (e.g., temporary field authorization to fell trees adjacent to the approved construction ROW) could be obtained, this measure could be a valid option for non-contiguous portions of the Project footprint.</p>	<p>Tree felling might be an option for the CHRP; however, due to the uncertainty of its effectiveness and limitations to application to pipeline ROWs, its use will be on a limited and/or trial basis for the Project. Another consideration for tree felling is the amount of available trees that can be used for the technique and that will be determined after final construction. Tree bending is not a suitable CHRP measure for the Project, given constraints associated with specialized machinery and time necessary to implement. As well, this technique is still being studied and as new research on the technique emerges, it could be considered for future projects.</p>

**Table 5-3: Habitat Restoration Measures (cont'd)**

Restoration Measure	Objectives	Rationale	Comments
Tree/shrub seeding	Habitat Restoration Access control Line of sight blocking	Species and application rates required are site dependent. Seeding is considered a long-term restoration treatment. Given the relatively narrow disturbance associated with linear developments such as pipeline ROWs in forested landscapes, native seed dispersal readily covers the disturbed area. Conifer cone crops can vary dramatically from year to year, and in some areas good cone crops are relatively predictable (given documented cycles and climatic conditions). Seeding might be a suitable measure if poor cone crops are expected for several years following reclamation, or if target species differs from the adjacent stand. Accessibility (i.e., distance to airport) can be a technical limitation if seeding is to be conducted aerially. Predation of conifer seed might be a problem when this technique is used for reforestation (BC MOF 1997).	Seeding is not a suitable CHRP measure, given logistical constraints (i.e., availability of native seed, accessibility of seeding equipment), likelihood of native seed ingress from vegetation in the adjacent undisturbed areas and predation of seed.
Woody debris	Access control Habitat restoration	Coarse woody debris rollback might be used for access management and to enhance restoration of natural habitat characteristics (e.g., conserve soil moisture, moderate soil temperatures, provide nutrients as debris decomposes, prevent soil erosion, provide microsites for seed germination and protection for introduced tree seedlings [Pyper and Vinge 2012; Vinge and Pyper 2012]). Mulch depths less than 3 cm are preferred to avoid limiting natural ingress and vegetation growth (Pyper and Vinge 2012; Vinge and Pyper 2012).	Woody debris rollback is a suitable CHRP measure for the Project.

**Table 5-3: Habitat Restoration Measures (cont'd)**

Restoration Measure	Objectives	Rationale	Comments
Woody debris (cont'd)	Access control Habitat restoration (cont'd)	<p>Coarse woody debris should be spread evenly across the entire footprint width at a coverage/density that will not restrict ability to plant seedlings or limit planted or natural seedling growth. Woody debris should be applied at a density/volume that does not exceed 400 t/ha to deter access (Osisko and Glasgow 2010). Where sufficient material is available, woody debris coverage can range from 60-100 m<sup>3</sup>/ha on upland sites and 25-50 m<sup>3</sup>/ha on lowland sites, to mimic natural processes (Pyper and Vinge 2012; Vinge and Pyper 2012). Where sufficient material is available, woody debris coverage of 150-250 m<sup>3</sup>/ha along ROWs might be appropriate to manage access (Vinge and Pyper 2012). Research presented at the North American Caribou Workshop (2014) suggested that application of high densities (200 m<sup>3</sup>/ha) of salvage logs (i.e., rollback) at linear feature intersections reduces human use of the intersection by 100%, wolf use by 90%, and deer use by 50%. NGTL has found on previous caribou habitat restoration projects that coverage ranging from 200-300 m<sup>3</sup>/ha can deter access while allowing sufficient spaces between the debris to allow seedling planting.</p> <p>Rollback can be effective immediately following implementation, provided adequate material is available and properly applied (Vinge and Pyper 2012). The implementation and length of a rollback segment is dependent on sufficient quantities of coarse woody debris during clearing of new disturbance and the tradeoff between its use and the ability/space to store it during construction (CRRP 2007b). Long rollback segments are more effective at managing human access because ATV riders will be less inclined to try to ride through the debris or traverse around it in adjacent forest stands. Sections of rollback ≤100 m long might not be effective at deterring motorized access (Vinge and Pyper 2012). An expert opinion survey cited 400 m long rollback segments as sufficient length (Golder 2007). NGTL has found on previous caribou habitat restoration projects that material availability often limits the segment length that can be achieved to 50–100 m (approximately 75 m on average).</p> <p>Fire risk is a consideration when using or storing materials for rollback. Fire risk can be minimized through proper storage and placement of materials (Pyper and Vinge 2012; Vinge and Pyper 2012). A 25 m rollback-free fuel break placed at 250 m intervals along rollback segments is suggested (Pyper and Vinge 2012).</p>	



**Table 5-3: Habitat Restoration Measures (cont'd)**

Restoration Measure	Objectives	Rationale	Comments
Woody debris (cont'd)	Access control Habitat restoration (cont'd)	<p>Guidelines for application of rollback where materials are available recommend placement of rollback across the entire pipeline/easement width for a distance of at least 200 m from all points of intersection with wellsites, plant sites, roads and permanent watercourses (AER 2013). NGTL has found on previous caribou habitat restoration projects that material availability often limits the segment length that can be achieved to 50–100 m (75 m on average).</p> <p>Fire risk is a consideration when using or storing materials for rollback. Fire risk can be minimized through proper storage and placement of materials (Pyper and Vinge 2012). A 25 m rollback-free fuel break placed at 250 m intervals along rollback segments is recommended by the <i>Integrated Standards and Guidelines for the Enhanced Approval Process</i> (AER 2013).</p>	Woody debris rollback is a suitable CHRP measure for the Project.

Site-specific caribou habitat restoration measures implemented for the Project will be described in the Final CHRP, which will include maps or Environmental Alignment Sheets showing the locations of selected sites.

For an illustrative table showing site-specific restoration methods and location details that may be included in the Final CHRP, see Appendix B. The Final CHRP table will also include the rationale for restoration measure selection, additional site-specific details to inform implementation and implementation status. Accomplishments and lessons learned from implementing and monitoring NGTL’s other caribou habitat restoration initiatives will be included in the Final CHRP, and will inform the rationale for selection of restoration methods and locations. The Final CHRP will also include specification drawings of the restoration measures, in accordance with Condition 16 b (iii).

### 5.3.1 Natural Regeneration

Minimum disturbance construction is a promising approach for promoting native vegetation re-establishment. NGTL will, therefore, implement minimal disturbance construction techniques to facilitate natural regeneration to restore habitat along the ROW.

### 5.3.2 Tree Planting

Established reclamation and forestry reforestation practices will be applied to promote revegetation where natural regeneration might not achieve the quantifiable targets. Restoration measures that incorporate tree planting techniques, such as site preparation (e.g., mounding) and planting trees/shrubs, will be considered where site conditions allow (including construction methods and level of disturbance).

For a summary of habitat types that will be disturbed in caribou habitat as a result of the Project footprint, see Table 5-4 (Aitken Creek Section) and Table 5-5 (Kahta Section).

**Table 5-4: Aitken Creek Section – Habitat Types in Graham Caribou Range**

Habitat Types	TEM Unit/Ecosystem Description <sup>1</sup>	BEC Subzone-Site Series <sup>2</sup>	Leading Tree Species	Area (ha)	Percent of Total (%)
<b>Aitken Creek Section – Graham Caribou Range</b>					
Upland/Transitional – Conifer	Black spruce–lingonberry – coltsfoot	BWBSmw-04	PI(Sb)	4.5	12.5
	White spruce – trembling aspen – step moss	BWBSmw-01	Sw, At, PI, Ep, Acb	7.6	20.9
Upland/Transitional – Deciduous	Trembling aspen – creamy peavine	BWBSmw-01\$	At	9.9	27.1

**Table 5-4: Aitken Creek Section – Habitat Types in Graham Caribou Range (cont'd)**

Habitat Types	TEM Unit/Ecosystem Description <sup>1</sup>	BEC Subzone-Site Series <sup>2</sup>	Leading Tree Species	Area (ha)	Percent of Total (%)
Riparian	Mountain alder – common horsetail	BWBSmw-FI01	-	1.0	2.6
	Cottonwood – spruce – red-osier dogwood	BWBSmw-Fm02	Sb/Sw, Acb	<0.1	<0.1
Treed Wetland	Black spruce – lingonberry – peat moss	BWBSmw/BWBSwk-Wb03	Lt, Sb	0.4	1.0
	Tamarack – water sedge – fen moss	BWBSmw-Wb06	Lt	<0.1	0.1
Non-Vegetated	Exposed soil	-	-	0.4	1.2
	Gravel bar	-	-	0.1	0.3
	River	-	-	<0.1	0.2
	Rock outcrop	-	-	0.2	0.6
Anthropogenic	Cultivated field	-	-	3.6	9.9
	Corridor and/or industry-related disturbance	-	-	5.1	13.9
	Rural	-	-	0.9	2.4
	Road surface	-	-	1.2	3.2

Note:

- TEM was completed as part of the Project Application (Stantec 2013). The area and percentage calculations are based on the entire TEM polygon (i.e., the deciled TEM polygon data are assumed to be reflective of the area and percent of ecosystem units affected by the Project footprint).
- Site series are derived from TEM data (Stantec 2013) based on *A Field Guide to Site Identification and Interpretation for the North Central Portion of the Northern Interior Forest Region*, *A Field Guide for Identification and Interpretation of Ecosystems of the Northeast Portion of the Prince George Forest Region* and *A Field Guide to Ecosystem Identification for the Boreal White and Black Spruce Zone of British Columbia Land Management Handbooks* (DeLong 2004, DeLong et al. 1990, DeLong et al. 2011). The “\$” denotes seral stage, indicating early seral communities, usually deciduous-dominated.
- Cutblocks are incorporated in the TEM unit classifications (site series).
- Tree codes: Acb – balsam poplar; At – trembling aspen; Ep – common paper birch; Lt – tamarack; PI – lodgepole pine; Sb – black spruce; Sw – white spruce.
- Wetland codes: FI – flood association; Wb – bog; Wf – fen; Ws – swamp.

**Table 5-5: Kahta Section – Habitat Types in Pink Mountain Caribou Range**

Habitat Types	TEM Unit/Ecosystem Description <sup>1</sup>	BEC Subzone-Site Series <sup>2</sup>	Leading Tree Species	Area (ha)	Percent of Total (%)
<b>Kahta Section - Pink Mountain Caribou Range</b>					
Upland/Transitional – Conifer	White spruce– trembling aspen – step moss	BWBSmw-01	Sw, At, PI, Ep, Acb	0.6	0.7
	Black spruce – lingonberry – coltsfoot	BWBSmw-04	PI(Sb)	35.7	44.7
	White spruce – currant – horsetail	BWBSmw-07	Sw	1.3	1.6
	White spruce – huckleberry – step moss	BWBSwk2-01	Sw, PI	9.7	12.1
	Lodgepole pine – lingonberry – velvet-leaved blueberry	BWBSmk-02	PI, At, Sb, Sw	<0.1	<0.1

**Table 5-5: Kahta Section – Habitat Types in Pink Mountain Caribou Range (cont'd)**

Habitat Types	TEM Unit/Ecosystem Description <sup>1</sup>	BEC Subzone-Site Series <sup>2</sup>	Leading Tree Species	Area (ha)	Percent of Total (%)
<b>Kahta Section - Pink Mountain Caribou Range (cont'd)</b>					
Upland/Transitional – Deciduous	Trembling aspen – creamy peavine	BWBSmw-01\$	At	0.1	0.2
	Trembling aspen – highbush cranberry	BWBSwk2-01\$	At	2.3	2.8
	Trembling aspen – Labrador tea	BWBSmw-04\$	At	1.0	1.2
	Trembling aspen – Labrador tea – lingonberry	BWBSwk2-03\$	At	0.3	0.4
Riparian	Mountain alder – common horsetail	BWBSmw-FI01	–	0.7	0.9
	Bebb's willow – mountain alder – bluejoint swamp	BWBSmk-Ws03	–	0.3	0.4
	Scrub birch – willow – water sedge fen	BWBSmk/BWBSmw/BWBSwk2-Wf02	–	<0.1	<0.1
Treed Wetland	Black spruce– lingonberry – peat moss	BWBSmk/BWBSmw/BWBSwk2-Wb03	Lt, Sb	17.9	22.4
	Tamarack – water sedge – fen moss	BWBSmk/BWBSwk2-Wb06	Lt	< 0.1	< 0.1
Graminoid/ Shrub Wetland	Water sedge – beaked sedge fen	BWBSmk/BWBSmw/BWBSwk2-Wf01	–	0.5	0.6
Non-Vegetated	Cutbank	–	–	0.1	0.1
	Exposed soil	–	–	0.3	0.4
	River	–	–	<0.1	<0.1
Anthropogenic	Corridor and/or industry-related disturbance	–	–	7.1	8.9
	Reservoir	–	–	0.3	0.4
	Road surface	–	–	<0.1	<0.1

Note:

- TEM was completed as part of the Project Application (Stantec 2013). The area and percentage calculations are based on the entire TEM polygon (i.e., the deciled TEM polygon data are assumed to be reflective of the area and percent of ecosystem units affected by the Project footprint).
- Site series are derived from TEM data (Stantec 2013) based on *A Field Guide to Site Identification and Interpretation for the North Central Portion of the Northern Interior Forest Region*, *A Field Guide for Identification and Interpretation of Ecosystems of the Northeast Portion of the Prince George Forest Region* and *A Field Guide to Ecosystem Identification for the Boreal White and Black Spruce Zone of British Columbia Land Management Handbooks* (DeLong 2004, DeLong et al. 1990, DeLong et al. 2011). The "\$" denotes seral stage, indicating early seral communities, usually deciduous-dominated.
- Cutblocks are incorporated in the TEM unit classifications (site series).
- Tree codes: Acb – balsam poplar; At – trembling aspen; Ep – common paper birch; Lt – tamarack; PI – lodgepole pine; Sb – black spruce; Sw – white spruce.
- Wetland codes: FI – flood association; Wb – bog; Wf – fen; Ws – swamp.

Implementation targets and specifications for habitat restoration (e.g., seedling planting densities, mounding densities) will be designed to meet the quantifiable targets for the CHRP. These will be informed by available guidelines and standards (see Section 8), NGTL's experience implementing caribou habitat restoration measures and complementary research.

For the planting prescription for each habitat type, see the Quantifiable Targets column in Table 4-1. The quantifiable targets and performance measures in Table 4-1 should be considered preliminary and subject to change. The restoration methods and targets will be affected by variables such as extent of grading, construction method and availability of shared workspace and access.

The proposed habitat restoration quantifiable targets are designed to demonstrate restoration success in terms of survival and sustained growth trends of conifer and deciduous trees within 10 years following completion of restoration. These targets are to be met over the portion of the Project footprint available for restoration (i.e., excluding overlap with third-party developments or operational access outside planted areas).

#### **5.4 ACCESS CONTROL**

Access control principles outlined in this CHRP were guided by the Project's AMP. The goals of access control for the Project in caribou habitat are to:

- manage access along the pipeline ROW in a manner that discourages all forms of access
- maintain accessibility necessary for safe pipeline operations compliant with applicable regulations and guidelines
- maintain existing access at identified locations (e.g., third-party industry access, traditional access identified by Aboriginal communities through engagement activities)

Access control measures are most effective when implemented on non-contiguous segments of the Project ROW, and at intersections of the pipeline portion of the Project ROW with existing perpendicular linear features (e.g., roads, utility corridors, seismic lines). Quantifiable targets and criteria used to evaluate the effectiveness of access control measures will align with those in the CHROMMP.

Access control measures considered for the Project include:

- vegetation screens
- rollback
- fencing and signs
- vegetation planting
- mounding
- installation of berms
- tree felling over the ROW

Rollback, mounding and planting vegetation will be the key access control measures implemented for the Project. Some of these measures might not be selected for final restoration because of site-specific conditions. For example, lack of materials necessary for the installation of berms could limit the applicability of berm installation for this Project.

NGTL has engaged the British Columbia Oil and Gas Commission (BC OGC) and BC MFLNRO regarding use of merchantable timber for access management purposes in caribou ranges. BC MFLNRO has indicated that merchantable timber may be used for rollback for the Project with the following provisions (to which NGTL has agreed):

- Provide BC OGC and BC MFLNRO with the locations of proposed access management areas.
- Identify if any mitigation measures will be required for fire hazard abatement.
- Identify if any mitigation measures will be required for forest health issues.
- Identify how merchantable timber will be accounted for post clearing.

Locations for access control measures on the pipeline ROW will focus on intersections with other linear features, such as roads, utility ROWs, seismic lines or watercourses and non-contiguous sections of the ROW. NGTL might install signs at select locations to discourage access.

## **5.5 LINE OF SIGHT BLOCKING**

Line-of-sight blocks include planting vegetation (e.g., tree planting or willow staking), fabricated site screens and minimal disturbance construction to preserve vegetation. Line-of-sight blocks will be implemented in locations with sightlines >500 m, particularly where they intersect with existing road access. Trees will be planted in an alternating pattern across the pipeline centreline along portions of the ROW. Specifically, trees will be planted across the centreline with open vegetation left at alternating sides of the ROW along some sections. This alternating vegetation pattern will create a line-of-sight break. Details on exact configuration of

seedling planting to achieve line-of-sight breaks depend on as-built location of the pipe centreline and adjacent linear disturbances.

Measures to reduce sightlines might discourage access and might also decrease predator efficiency. In nature, sightlines are often longer in more open habitats of lowland muskeg communities compared with upland forest communities. As a result, line-of-sight distances can vary, depending on the location and structure of the adjacent vegetation community. In forested areas of the Project footprint where sightlines are 500 m long or more line-of-sight blocks will be established.

Operating practices for energy development in sensitive caribou range in British Columbia (BC Ministry of Environment 2011) suggest implementing line-of-sight management every 500 m on linear features that do not share a ROW boundary with a road. Line-of-sight blocking as part of this Project will follow this guideline where it is not co-located with roads or other linear developments.

NGTL has implemented 500 m line-of-sight breaks to be consistent across provincial boundaries regardless of the location of the pipeline segment and has incorporated this approach in other Project CHRPs.

As science is still emerging in this area, the long term monitoring of this and other NGTL CHRP measures will be modified based on monitoring results to determine the appropriate line-of-sight breaks.

Topography bends in the ROW, minimum disturbance construction to preserve vegetation and willow staking create immediate line-of-sight blocks (i.e., create visual barriers after restoration activities are implemented). Line-of-sight measures such as tree plantings will be implemented in areas where sightlines are not blocked by terrain or bends. Planting at staggered intervals across the pipeline centreline will establish these 500 m line-of-sight breaks in the long term.

The exact locations for implementing line-of-sight breaks will be determined after construction and presented in the Final CHRP.

## **5.6 MONITORING AND ADAPTIVE MANAGEMENT**

NGTL will create a CHROMMP for the Project to monitor effectiveness of planned habitat restoration measures that will be fully described in the Final CHRP. Adaptive management, i.e., the systematic process of monitoring and assessing outcomes and modifying restoration measures if necessary, will be implemented by adjusting and/or supplementing restoration measures, where warranted, to achieve the objectives of the CHRP.

Given that science is still emerging on caribou habitat restoration methods and effectiveness, adaptive management principles will be an important means of addressing uncertainty.

Adaptive management might be necessary to address uncertainty relating to planting trees in mountain caribou range. There might be soil limitations (e.g., poor nutrients and drainage, soil temperatures) that do not support tree seedling establishment without silvicultural site preparation (e.g., mounding). If seedling survival rates and/or sustained growth trends are not meeting the quantifiable targets (i.e., poorly understood planting conditions in higher-elevation habitat) this measure might need to be re-evaluated considering site-specific conditions.

Monitoring will be conducted on each pipeline segment for up to 10 years, starting one year after CHRP measures have been implemented. At each monitoring interval, performance measures will be evaluated and compared with quantifiable restoration targets. If measures indicate that restoration has achieved or is on a trajectory to achieving targets, no further restoration measures will be undertaken. If, however, at any point in the monitoring program evaluations indicate that targets are unlikely to be achieved after 10 years, restoration measures must be adjusted and additional monitoring (longer than 10 years) added.

This could include implementation of existing restoration measures or new measures, discovered through research or industry practice, that are proving to be successful. For example, NGTL is engaged in linear feature restoration research with the Regional Industry Caribou Collaboration in northeastern Alberta and lessons learned from this research can be applied to the Project.

Monitoring results, as well as any necessary adaptive management actions, will be reported to the NEB, EC and BC MFLNRO following the end of each monitoring interval.

Habitat restoration measures that require adaptive management at the conclusion of the 10 year monitoring program will require additional ground-based monitoring until they are successful. If adaptive management actions fail, a revised monitoring program and timeframe will be developed to address unsuccessful measures.

This Preliminary CHRP include brief descriptions of the restoration targets and how they will be measured. The Final CHRP will detail the actual habitat restoration methods implemented and their locations in the Project footprint for each pipeline segment. The residual disturbance to critical caribou habitat resulting from the Project will be calculated and finalized in an OMP for Aitken Creek. Specific details on the monitoring program methods, frequency, timing and locations will be included in the CHROMMP. The CHROMMP will describe a comprehensive monitoring program for Project CHRP measures and potential offset areas, as finalized in the OMP, to compensate for residual effects in caribou habitat.



## 5.7 SCHEDULE

Scheduling and logistical coordination before restoration implementation for each pipeline segment will consider seasonal access constraints, critical timing periods for caribou (see Section 5.7.1) and other valued components, production of nursery seedlings and appropriate timing for restoration efforts (e.g., season of planting).

Final cleanup will occur the summer/winter season following construction. As-built construction information will be compiled following construction and used to determine appropriate site-specific restoration measures and access management locations. Final site selection for caribou habitat restoration treatments will be completed during the first growing season following construction.

For the proposed schedule for construction and habitat restoration activities, see Table 5-6 and Table 5-7.

### 5.7.1 Caribou Timing Windows

There are multiple regulatory guidance documents for BC that identify timing windows that apply to caribou herds that overlap with the Project. The *Peace Region Least-Risk Timing Windows, April 2011 Update* (BC MFLNRO 2011) defines timing windows for northern ecotype caribou:

- **Low Risk:** July 16 to September 14 – Restrictions would not normally apply. Where ground conditions permit, plan development activities within these timeframes.
- **Cautionary:** September 15 to January 14 – Operators should avoid development activities during these timeframes.
- **Critical:** January 15 to July 15 – Development activities are not appropriate during this timeframe. Aerial activities should adhere to guidelines. In the event that working within a critical timing window is unavoidable, proponent should contact an appropriate qualified professional (e.g., Registered Professional Biologist with BC accreditation) to discuss alternatives, and potential mitigation and monitoring plans.

The recently released *A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia (Interim Guidance)* (BC MFLNRO 2014) presents the same timing windows as the BC MFLNRO 2011 document, but includes an additional critical timing window for northern ecotype caribou that relates to the migration period (April 1 to May 20 and December 1 to January 1; BC MFLNRO 2014). There are no identified migration corridors for caribou in proximity to the Project in either the Graham or Pink Mountain caribou ranges.

NGTL's intent is to apply the January 15 to July 15 critical timing window described by BC MFLNRO (2011, 2014). The NEB Report for the Project requires that NGTL proactively plan construction activities in caribou ranges in compliance with provincial and federal timing restrictions. NGTL will file construction progress reports with the NEB pursuant to Condition 27. These progress reports will include information on any mitigation implemented to complete construction activity outside the critical timing window.

To minimize the potential need for work to occur within the critical timing window in the Graham and Pink Mountain caribou ranges, NGTL will potentially increase construction manpower or use alternate equipment (e.g., wheel ditcher in place of a hoe) to increase productivity, where feasible to do so. NGTL's ability to implement these measures might be affected by factors beyond NGTL's control, such as adverse weather conditions.

Depending on logistical constraints and site conditions, habitat restoration efforts are expected to be completed during the first or second growing season following final cleanup. These activities are part of the post construction phase, and will be scheduled outside the critical timing window for caribou in the Graham and Pink Mountain caribou ranges.



**Table 5-7: North Montney Kahta Section – Pink Mountain Caribou Range – Proposed Construction and Habitat Restoration Preliminary Schedule**

	2015												2016												2017												2018											
	Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>Caribou Critical Timing Window</b>																																																
January 15 to July 15	█												█												█												█											
<b>Clearing, Construction and Clean-Up</b>																																																
Clearing and site preparation																																																
Pipeline construction <sup>1</sup>																									█																							
Final clean-up <sup>2</sup>																									█																							
<b>Caribou Habitat Restoration</b>																																																
Planning preliminaryCHRP and access management	█																																															
Final CHRP planning and preparation													█												█																							
Seedling procurement																									█																							
Nursery seedlings grown																									█												█											
Site preparation and access management implementation (e.g., mounding, spread coarse woody debris)													█												█																							
Tree seedling planting, shrub staking, bio-engineering																									█												█											

- Notes:**
1. Project construction is scheduled between September 2016 and April 2017; construction work will be prioritized within the Pink Mountain Caribou range between September and December 2016.
  2. Project final clean-up is scheduled between May and September 2017; clean-up will be prioritized within the Graham Caribou range between July 15 and September 2017.

## 6.0 CONTINUOUS IMPROVEMENT

In regards to caribou habitat restoration, NGTL is committed to continuous improvement. Continuous improvement will come from NGTL's analysis in the short, near, and long term of applied practice, the monitoring program and pure research.

This section describes caribou habitat restoration initiatives, industry collaboration and lessons learned by NGTL on other projects that impacted caribou habitat. Because of NGTL's commitment to continuous improvement, NGTL will continue to monitor all of the aforementioned components and incorporate learnings into its caribou habitat restoration efforts.

This Preliminary CHRP has incorporated updated results from:

- ongoing literature assessment
- research completed by industry associations
- lessons learned from previous NGTL projects
- consultation with applicable regulators and resource managers
- adaptive management practices in the field

Most of the updated results from these sources reference boreal caribou. Since there is little research applicable to mountain caribou in the area affected by the Project and boreal and mountain caribou are the same species, boreal caribou data will be used to inform mountain caribou restoration and monitoring plans for the Project. The monitoring program developed for the Project will add to the emerging database on mountain caribou habitat restoration.

For a list of historic and current habitat restoration initiatives, see Appendix C.

## 6.1 CARIBOU HABITAT INITIATIVES

This section summarizes caribou habitat restoration initiatives planned or implemented in woodland caribou ranges. Given the limited available information specific to northern and mountain caribou range restoration, this section includes identification of temporal and spatial caribou habitat restoration methods compiled from boreal caribou ranges. Boreal woodland caribou habitat restoration provides context and lessons learned from caribou habitat restoration initiatives that have been implemented in the recent past, and where available, monitoring results and effectiveness of measures. As the monitoring program progresses for this Project in northern caribou range, lessons learned and emerging data will be incorporated in NGTL's plans as adaptive management.

Although restoration ecology specific to caribou habitat is a relatively new science, some key initiatives have identified important lessons learned related to oil and gas development in caribou range. Common among many of these initiatives are lessons

learned on which plant species to use, when and where to replant, effective techniques to promote natural revegetation and a better understanding of effective methods to manage access.

Lessons learned from these initiatives were incorporated in large-scale habitat restoration projects near Grande Prairie, Cold Lake and Fort McMurray, Alberta, as well as NGTL's projects in caribou habitat. Though initiatives focused on revegetation and access management have been conducted in boreal caribou ranges (Caribou Range Restoration Project [CRRP] 2007a,b; Golder Associates Ltd. [Golder] 2010; Osko and Glasgow 2010); however, the research provides valuable information for the Project restoration program, as well as providing relevant information regarding limiting growth and establishment of plant species favourable to primary prey.

Oil sands-funded projects also included tree planting initiatives, coarse woody debris management best practices, habitat enhancement programs and habitat restoration trials in caribou range (CRRP 2007a,b; Enbridge Pipelines [Athabasca] Inc. [Enbridge] 2010; Golder 2010, 2011; COSIA 2012).

Another example of caribou habitat improvement initiatives is First Coal Corporation's proposed reclamation plan for a disturbed mine site, with the objective of restoring foraging habitat for caribou in the Burnt-Pine caribou range, while minimizing the creation or improvement of foraging habitat for early seral ungulate (primary prey) species (Turner et al. 2009). The Burnt-Pine caribou herd is part of the Central Group of the Southern Mountain Caribou Population located south of the Moberly (Klinse-Za) and Graham ranges. First Coal Corporation's reclamation plan adopted an ecosystem-specific approach, whereby reclamation strategies were developed considering biophysical site characteristics.

First Coal Corporation's proposed reclamation plan focused on introduction of terrestrial lichen as a mechanism for regenerating plants that might act as attractants to caribou, and manual brushing of "less desirable" vegetation was suggested to encourage establishment of plants attractive to caribou and to minimize forage for early seral ungulates (moose and deer). Transplanting conifers was suggested as a potential measure that would be considered for reclamation of engelmann spruce-subalpine fir (ESSF) forested sites. Research and monitoring of restoration trials was a key component of First Coal Corporation's proposed reclamation plan. The proponent withdrew the project in 2012, however, and the reclamation plan was not implemented.

Blocking line-of-sight will be implemented as a restoration tool for this Project because it is a tool believed to mitigate increased risk of predation in the short term, while longer-term goals of revegetation of sightlines are achieved. The Project monitoring program will feed into emerging science on this restoration tool.

## 6.2 INDUSTRY COLLABORATION

Canada's Oil Sands Innovation Alliance (COSIA) was launched in 2012 to enable responsible and sustainable growth of Canada's oil sands while delivering accelerated improvement in environmental performance through collaborative action and innovation (COSIA 2012).

The organization's four key focus areas are tailings, water, land and greenhouse gases. Part of the land focus area is a caribou habitat restoration initiative with the goal of improving woodland caribou habitat quality and herd survival through restoration of historic linear disturbances.

COSIA has developed the following habitat restoration initiatives:

- Determining effectiveness of different restoration techniques such as winter tree planting, mounding, seeding and placement of coarse woody debris. The winter tree planting trial was set up to determine the effectiveness of planting black spruce seedlings in wetland areas during winter. Results of the tree planting trial indicated 90% survival of the 900 seedlings planted.
- Development of the Landscape Ecological Assessment Planning (LEAP) tool to provide baseline levels of varying land use. LEAP can be used to determine the long-term effects of restoration in a given area, which can help guide planting initiatives.
- The Algar Historic Restoration Project takes an integrated regional approach, with six companies working together to repair fragmented habitat across an area of land outside their actual licence areas. This is a five-year program to replant trees and shrubs along the linear footprint in the Algar Region, covering an area approximately 570 km<sup>2</sup>.
- The LiDea Project aims to restore linear disturbances using mounding and tree felling. Rigorous monitoring and measurement programs have been designed for the life of the project, and currently include 37,000 ha of active treatment area. During spring and summer, conifer seedlings are planted along older, mounded seismic lines. LiDea is also experimenting with forest stand modification, which involves bending tree stems from the adjacent forest across the seismic line to create physical barriers and reduce sightlines along the linear corridor.

The Regional Industry Caribou Collaboration (RICC) is part of COSIA, and is a multi-industry partnership focused on restoring caribou habitat through regional, collaborative, range-based efforts. The objectives of RICC are to coordinate habitat restoration in the short term and long term, coordinate future activity, support and lead scientific research, conduct applied trials and align caribou habitat restoration programs with provincially led Range Plans and Action Plans.

NGTL has recently joined RICC. A major RICC research effort is to verify the effectiveness of restoration measures using a multi-scale predator/prey collaring program to address current knowledge gaps in habitat use and function. As new information on habitat restoration becomes available, NGTL will incorporate it in the planning and implementation process for its projects in caribou habitat.

### **6.3 LESSONS LEARNED FROM NGTL HABITAT RESTORATION**

Preliminary and Final CHRPs were completed for NGTL's Northwest Mainline Expansion Project, Leismer to Kettle River Crossover Project and Chinchaga Lateral Loop No. 3 Project (Chinchaga Section). A Preliminary ChRP was filed on June 30, 2015 for Liege Lateral Loop 2 and Leismer East Compressor Station.

Based on NGTL's experience with these projects, the following lessons learned were incorporated in this Preliminary ChRP:

- Rollback was used as firewood by land users when stacked as ladders. A more random arrangement of wood piles to discourage wood removal might be used in the future.
- Line-of-sight breaks on co-located ROWs are not effective because of unrestricted access on parallel ROWs. NGTL has learned that such methods are better used in non-contiguous ROWs and that such line-of-sight breaks are redundant on contiguous ROWs. There have been structural stability issues with constructed line-of-sight blocks (versus vegetation screens). NGTL has, therefore, been experimenting with constructing alternative line-of-sight structures (e.g., snow fencing constructed with 2x4s was tested during winter 2014/15).
- Tree planting on a linear corridor appears to not be as effective as on cutblocks (typical silvicultural practices) because of shading. This could result in changes to the planting densities and configurations as the monitoring program progresses.
- Access control cannot be absolute because of safety, operating and maintenance activities that must occur. On previous NGTL projects, lack of access resulted in ChRP measures being destroyed or removed by TransCanada staff to access the ROW. In the future, access-control locations will be strategically placed to allow for maintenance and traditional use access.
- Where ChRP measures have failed or been removed, they have been replaced as part of adaptive management.



#### 6.4 CHRP CONCORDANCE TABLE

For a summary of differences and updates from the most recent NGTL CHRP filed with the Board, the Liege Lateral Loop 2 (Thornbury Section) Preliminary CHRP filed on June 30, 2015 (NEB Filing ID: A71014), see Table 6-1 (compiled pursuant to Condition 15 a) vi). For a blackline comparison of this CHRP and the Liege Preliminary CHRP, see Appendix F.

**Table 6-1: Concordance Table**

<b>Component of CHRP</b>	<b>Location in Liege Preliminary CHRP</b>	<b>Location in Preliminary North Montney CHRP</b>	<b>Differences or Updates</b>
Introduction and Organization	Section 1	Section 1	There are no significant differences in this section between the two CHRPs, other than tailoring to project-specific details.
Goal, Objectives and Targets	Section 2	Section 2	No differences or updates in this section in between the two CHRPs.
Decision Framework	Section 3	Section 3	The decision framework used for this Project is consistent with the framework used in past NGTL CHRPs and is intended to be used going forward.
Targets and Measures	Section 4	Section 4	There are no significant differences in this section between the two CHRPs other than tailoring to project-specific details.
The Plan	Section 5	Section 5	This section of the North Montney CHRP was tailored to both the Aitken Creek and Kahta Sections, and accommodates the differences between boreal and mountain caribou.
Continuous Improvement	Section 6	Section 6	Information from a reclamation plan for a disturbed mine site was included in Section 6.1. The concordance table in Section 6.4 has been added to the North Montney CHRP and was not included in the Liege CHRP.
Consultation	Section 7	Section 7	This section of the North Montney CHRP includes a summary of consultation with Aboriginal communities, which was not included in the Liege CHRP.
Literature Review	Section 8	Section 8	The North Montney CHRP includes BC-specific regulatory policies and guidelines for mountain caribou, mountain caribou ecology and caribou habitat restoration initiatives for previous industrial developments.
References	Section 9	Section 9	There are no significant differences in this section between the two CHRPs other than tailoring in each CHRP relevant to boreal and mountain caribou.



## 7.0 CONSULTATION

This section provides a summary of consultation with Aboriginal communities and applicable regulators related to Project impacts on caribou and caribou habitat, as well as a summary of how feedback was incorporated in the Preliminary CHRP.

NGTL began consultation and working collaboratively with provincial regulators, Aboriginal communities, stakeholders and industry partners in 2011 regarding the Project. NGTL will continue to maintain open communication with federal and provincial regulatory agencies to align the CHRP measures with provincial and federal policy, as well as potentially affected Aboriginal communities, through the various Project phases. The Final CHRP will include updated consultation records.

## 7.1 ABORIGINAL ENGAGEMENT

Aboriginal communities had opportunities to inform the development of caribou mitigation through meetings, Information Requests (IRs), community-led Traditional Land Use (TLU) studies, Traditional Ecological Knowledge (TEK), independent technical review and through the hearing process for the Project (i.e., oral evidence, TLU studies).

Blueberry River First Nations, Prophet River First Nations, Saulteau First Nations and West Moberly First Nations all presented oral evidence at the North Montney Hearing in Fort St. John, BC. Each potentially affected and interested Aboriginal community received copies of the preliminary Caribou Management Plan (CMP) and updates, with requests by NGTL to review these documents and to provide input. Meetings have also been requested with each interested community to review the plan, respond to questions and receive further feedback from Aboriginal communities on the plan. For a summary of engagement activities related to caribou, see Table 7-1. The CMP preceded, and has been replaced by, this Preliminary CHRP.

In addition to comments and written evidence, NGTL has reviewed and considered the following reference documents submitted by Aboriginal communities for the Project:

- Saulteau First Nations and West Moberly First Nations provided, as an aid to cross-examination at the Project hearing, *Recovery Strategy for the Woodland Caribou, Southern Mountain population (Rangifer tarandus caribou) in Canada* (NEB Filing ID: A4E9U2).
- West Moberly First Nations submitted as part of their additional written evidence (AWE) Population and Distribution Objectives and Identification of Critical Habitat for Seven Herds of Woodland Caribou in the South Peace of British Columbia (Filing ID: A3Z0H2) and Action Plan for the Klinse-Za Herd of Woodland Caribou (Rangifer tarandus caribou) in Canada (Filing ID: A3X4D3).

Given differences in mapping approaches described in Section 8.2 (traditional knowledge about historic distribution and range of caribou versus caribou local population units and critical habitat in the federal Recovery Strategy), it was determined that the Preliminary CHRP would be developed to align with the delineated caribou habitat provided by the federal and provincial regulatory authorities.

NGTL has adopted the definition of critical habitat as defined in the Recovery Strategy (EC 2014). For the reasons described in NGTL's response to West Moberly First Nations IR No. 2 (Filing ID: A3Z6Y1), Final Argument (Filing ID: A64632) and Reply Argument to West Moberly First Nations (Filing ID: A4F7T5) (summarized in Section 8.2), NGTL will apply CHRP measures within the boundaries of the Recovery Strategy-delineated caribou herd ranges (equivalent to local population units). The caribou herd ranges are mapped by provincial and federal regulatory authorities responsible for management and recovery of the Graham and Pink Mountain caribou herds. However, mitigation measures described in the Environmental Protection Plan (EPP) and AMP will be applied for the entire Project.

The Independent Technical Review Group (Doig River First Nation, McLeod Lake Indian Band, Saulteau First Nations and West Moberly First Nations) commissioned a third-party consultant, LGL Ltd., to review the draft Preliminary CHRP and provide comments. The review provided by LGL Ltd. to NGTL supported the restoration measures and monitoring program detailed in the Preliminary CHRP. Comments focused mainly on differences in mapping of caribou critical habitat between the federal Recovery Strategy and Seven Herds report. LGL Ltd. also suggested the implementation of a lichen collection and transplantation program (see Table 7-1).

**Table 7-1: Summary of Aboriginal Engagement**

Aboriginal Community/ Date and Method	Engagement Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<b>Blueberry River First Nations</b>			
July 21, 2014	NGTL emailed Blueberry River First Nations information on the two preliminary plans related to the overall project planning and ESA. The ESA states that a CMP and a Caribou Mitigation Monitoring Plan (CMMP) would be prepared. A PDF document of the Preliminary CMP was included for Blueberry River First Nations' review. NGTL noted that access management mitigation measures have been included in the project's EPP. NGTL requested to meet with Blueberry River First Nations to discuss the Preliminary CMP (NEB Filing ID: A4C5V4) and proposed access management measures and locations, and seek input into the proposed plans.	N/A (no comments received)	–
September 8, 2014	NGTL emailed Blueberry River First Nations to request a meeting. Possible meeting dates were provided, with the request that Blueberry River First Nations provide alternative dates if the provided dates do not fit in with Blueberry River First Nations' schedule. The purpose of the meeting would be to discuss the CMP (NEB Filing ID: A4C5V4) and the access management measures and locations.	N/A (no comments received)	–
<b>Doig River First Nation</b>			
July 21, 2014	NGTL emailed Doig River First Nation information on the two preliminary plans related to the overall project planning and ESA. The ESA states that a CMP and a CMMP would be prepared. A PDF document of the Preliminary CMP was included for Doig River First Nation's review. NGTL noted that access management mitigation measures have been included in the Project's EPP. NGTL requested to meet with Doig River First Nation to discuss the Preliminary CMP (NEB Filing ID: A4C5V4) and proposed access management measures and locations, and seek input.	N/A (no comments received)	–

**Table 7-1: Summary of Aboriginal Engagement (cont'd)**

Aboriginal Community/ Date and Method	Engagement Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<b>Halfway River First Nations</b>			
July 21, 2014	NGTL emailed Halfway River First Nations information on the two preliminary plans related to the overall project planning and ESA. The ESA states that a CMP and a CMMP would be prepared. A PDF document of the Preliminary CMP was included for Halfway River First Nations' review. NGTL noted that access management mitigation measures have been included in the Project's EPP. NGTL requested to meet with Halfway River First Nations to share the Preliminary CMP (NEB Filing ID: A4C5V4) and proposed access management measures and locations, and seek input.	N/A	–
August 21, 2014	NGTL conducted a meeting to present Halfway River First Nations with the Preliminary CMP (NEB Filing ID: A4C5V4) and access management measures and locations. NGTL requested feedback on the access planning during the meeting. Halfway River First Nations commented that scoop-outs prevent trucks, but attract quads and motor bikes. It was also stated that signs are an informative way to deter access as well. Halfway River First Nations inquired about monitoring access points.	All Sections	The Preliminary CMP was incorporated in this Preliminary CHRP. Access management is included throughout this Preliminary CHRP as it is one of the three main objectives identified to achieve the CHRP goal. The AMP will provide further detail (to be filed under separate cover in accordance with Certificate Condition 16).
<b>McLeod Lake Indian Band</b>			
July 21, 2014	NGTL emailed McLeod Lake Indian Band information on the two preliminary plans related to the overall project planning and ESA. The ESA states that a CMP and a CMMP would be prepared. A PDF document of the Preliminary CMP was included for McLeod Lake Indian Band's review. NGTL noted that access management mitigation measures have been included in the Project's EPP. NGTL requested to meet with McLeod Lake Indian Band to share the Preliminary CMP (NEB Filing ID: A4C5V4) and proposed access management measures and locations, and seek input.	N/A	–

**Table 7-1: Summary of Aboriginal Engagement (cont'd)**

Aboriginal Community/ Date and Method	Engagement Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<b>McLeod Lake Indian Band (cont'd)</b>			
September 8, 2014	NGTL emailed McLeod Lake Indian Band to request a meeting. Possible meeting dates were provided, with the request that McLeod Lake Indian Band provide alternative dates if the provided dates do not fit in with McLeod Lake Indian Band's schedule. The purpose of the meeting would be to discuss Serious Harm to Fisheries, the CMP (NEB Filing ID: A4C5V4) and the AMP.	N/A	–
<b>Prophet River First Nation</b>			
July 21, 2014	NGTL emailed Prophet River First Nation information on the two preliminary plans related to the overall Project planning and ESA. The ESA states that a CMP and a CMMP would be prepared. A PDF document of the Preliminary CMP was included for Prophet River First Nation's review. NGTL noted that access management mitigation measures have been included in the Project's EPP. NGTL requested to meet with Prophet River First Nation to share the Preliminary CMP (NEB Filing ID: A4C5V4) and proposed access management measures and locations, and seek input.	N/A	–
September 24, 2014	NGTL conducted a meeting to present Prophet River First Nation with the Preliminary CMP (NEB Filing ID: A4C5V4) and access management measures and locations. No concerns specific to caribou or access management were recorded.	N/A	–
<b>Saulteau First Nations</b>			
February 28, 2012	NGTL attended the 2012 Caribou Workshop held by Saulteau First Nations. The purpose of the workshop was to bring together all proponents in the region whose activities might have an impact on caribou. Saulteau First Nations' goal was to develop a plan to protect boreal, northern and southern caribou herds.	N/A	Specific recommendations or comments related to planning or implementing caribou habitat restoration for the Project were not discussed.

**Table 7-1: Summary of Aboriginal Engagement (cont'd)**

Aboriginal Community/ Date and Method	Engagement Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<b>Saulteau First Nations (cont'd)</b>			
January 29, 2013	NGTL attended the Caribou Planning Session for the Peace Northern Caribou Committee on January 29-30, 2013. Approximately 35 people attended from industry, local First Nations communities and government. The workshop was a planning session to identify an appropriate governance structure for the committee and a discussion on how to immediately protect the Moberly caribou herd.	N/A	Specific recommendations or comments related to planning or implementing caribou habitat restoration for the Project were not discussed. The Project does not encounter the provincially/federally delineated range of the Moberly caribou herd.
April 25, 2013	NGTL met with Saulteau First Nations. Saulteau First Nations is concerned about caribou and how declining Moberly caribou population counts will be addressed.	8.2	The Project does not encounter the provincially/federally delineated range of the Moberly caribou herd. Regulatory objectives, including stopping decline of caribou populations, are reviewed and provide context for the development of the Preliminary CHRP. The CHRP is specific to the provincially/federally delineated range boundaries of the Graham and Pink Mountain caribou herds. However, NGTL will implement the mitigation measures outlined in the EPP and the AMP, which are applicable to the entire Project.
		8.3, 8.4	Ecology of the caribou herds encountered by the Project is discussed, including population trend, threats and limiting factors. This information provides ecological context considered in the development of the Preliminary CHRP, in particular, development of CHRP objectives.



**Table 7-1: Summary of Aboriginal Engagement (cont'd)**

Aboriginal Community/ Date and Method	Engagement Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<b>Saulteau First Nations (cont'd)</b>			
April 25, 2013 (cont'd)	See above	2,3,4,5	The goal of the CHRP is to reduce the residual effects of the Project on caribou and caribou habitat in a manner that aligns with provincial and federal policies, and will not affect the capacity for stated caribou recovery and habitat management objectives to be achieved. As noted above, regulatory policy identifies stopping caribou population decline as an objective. The toolbox of measures that NGTL can implement is detailed for all phases of the Project, from pre-construction through operations. Many of the relevant measures have already been implemented as part of the pre-construction (Project planning and design) phase. These, and the measures identified in Section 5 for the construction phase, will facilitate habitat restoration of the Project footprint in caribou range following completion of construction (post-construction phase).

**Table 7-1: Summary of Aboriginal Engagement (cont'd)**

Aboriginal Community/ Date and Method	Engagement Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<b>Saulteau First Nations (cont'd)</b>			
September 6, 2013	NGTL emailed Saulteau First Nations requesting a list of priority areas to visit for the helicopter overflight with Saulteau First Nations representatives scheduled for September 11, 2013. Saulteau First Nations replied the same day with an attachment outlining the focal areas of interest for the overflight. Focal areas included: <ul style="list-style-type: none"> <li>• Saturn Meter Station</li> <li>• Pine River crossing</li> <li>• Moberly River crossing</li> <li>• Entry into Peace Moberly Tract</li> <li>• Peace Moberly Tract Section</li> <li>• Peace River crossings East and Preferred Route</li> <li>• Caribou habitat crossing (north of Farrell Creek)</li> <li>• Prince Rupert Gas Transmission Project tie-in location (NEB Filing ID: A3Q6U2)</li> </ul>	7.1	TEK presented during field studies is summarized in this section.
September 11, 2013	A helicopter overflight was conducted with Saulteau First Nations that included a flyover of the Graham caribou range. Saulteau First Nations was shown where NGTL proposed to parallel the existing pipeline corridor (NEB Filing ID: A3Q6U2).	7.1	The routing criteria described in Section 4.1 of the ESA (Filing ID: A3Q6F8) comprise a key component of avoiding or minimizing adverse Project effects on caribou and caribou habitat at the pre-construction phase.
		7.1	TEK presented during field studies is summarized in Section 7.1.

**Table 7-1: Summary of Aboriginal Engagement (cont'd)**

Aboriginal Community/ Date and Method	Engagement Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<b>Saulteau First Nations (cont'd)</b>			
September 25, 2013	Saulteau First Nations emailed NGTL a routing memo that: <ul style="list-style-type: none"> <li>• outlined routing review work completed to date</li> <li>• listed Saulteau First Nations' concern with disturbance in Area of Critical Community Interest and Peace Moberly Tract</li> <li>• noted Saulteau First Nations' preferred route is the Chetwynd Route</li> <li>• stated that Tetra Tech agrees that the East Route is not feasible</li> <li>• requested implications for caribou habitat during construction (in vicinity of Farrell Creek)</li> <li>• requested NGTL comments on noted items (including suggestion for following the Chetwynd Route) (NEB Filing ID: A3Q6U2)</li> </ul>	7.1	The routing criteria described in Section 4.1 of the ESA (Filing ID: A3Q6F8) comprise a key component of avoiding or minimizing adverse Project effects on caribou and caribou habitat at the pre-construction phase.
July 21, 2014	NGTL emailed Saulteau First Nations information on the two preliminary plans related to the overall Project planning and ESA. The ESA states that a CMP and a CMMP would be prepared. A PDF document of the Preliminary CMP was included for Saulteau First Nations' review. NGTL noted that access management mitigation measures have been included in the Project's EPP. NGTL requested to meet with Saulteau First Nations to share the Preliminary CMP (NEB Filing ID: A4C5V4) and proposed access management measures and locations, and seek input.	N/A	–
October 5, 2014	NGTL provided the links to the Preliminary CMP filed with the NEB (NEB Filing ID: A4C5V4).	N/A	–

**Table 7-1: Summary of Aboriginal Engagement (cont'd)**

Aboriginal Community/ Date and Method	Engagement Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<b>Saulteau First Nations (cont'd)</b>			
October 6, 2014	NGTL presented Saulteau First Nations with the Preliminary CMP (NEB Filing ID: A4C5V4) and proposed access management measures and locations.	All Sections	The Preliminary CMP was incorporated in this Preliminary CHRP. Access management is included throughout this Preliminary CHRP as it is one of the 3 main objectives identified to achieve the CHRP goal. The AMP will provide further detail (to be filed under separate cover in accordance with Certificate Condition 16).
<b>West Moberly First Nations</b>			
February 14, 2013	NGTL met with West Moberly First Nations to discuss the Project and Community Agreements. West Moberly First Nations does not want pipelines through the Moberly caribou range west of Moberly Lake. West Moberly First Nations would like to have the government defer tenure in the northeast area of the Peace Moberly Tract, including the adjacent area to the east and would like NGTL to influence government to defer tenure in that area.	7.1	The routing criteria described in Section 4.1 of the ESA (Filing ID: A3Q6F8) comprise a key component of avoiding or minimizing adverse Project effects on caribou and caribou habitat at the pre-construction phase.
April 15, 2013	NGTL met with West Moberly First Nations to discuss the Project. West Moberly First Nations is concerned that the Project will open the door to further development through the Peace Moberly Tract and does not want pipeline development through critical caribou habitat. West Moberly First Nations is exploring the idea of a pipeline corridor to manage all the proposed pipelines in the area. West Moberly First Nations members would need a chance to provide feedback on the Project before a decision of support can be made (NEB Filing ID: A3Q6U2).	7.1	The routing criteria described in Section 4.1 of the ESA. The Peace Moberly Tract is outside provincially/federally delineated caribou range. The CHRP is specific to the provincially/federally delineated range boundaries of the Graham and Pink Mountain caribou herds. However, NGTL will implement the mitigation measures outlined in the EPP and the AMP, which are applicable to the entire Project.

**Table 7-1: Summary of Aboriginal Engagement (cont'd)**

Aboriginal Community/ Date and Method	Engagement Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<b>West Moberly First Nations (cont'd)</b>			
July 18, 2013	NGTL met with West Moberly First Nations to discuss the Project. West Moberly First Nations is concerned that the ROW will become an access point for hunters and predators; the community wants to monitor and limit the access to hunting areas. West Moberly First Nations is also concerned about a decline in wildlife (including caribou) (NEB Filing ID: A3Q6U2).	2,5,3,8,5	Access management is one of the objectives of the CHRP. Section 8.5 presents a summary of literature relevant to human access and interaction with habitat restoration. Section 5.3 presents information relevant to planning access control. The AMP for the Project will include additional information, and will be submitted under separate cover in accordance with Certificate Condition 16. The CHRP is specific to the provincially/federally delineated range boundaries of the Graham and Pink Mountain caribou herds. However, NGTL will implement the mitigation measures outlined in the EPP and the AMP, which are applicable to the entire Project.
July 21, 2014	NGTL emailed West Moberly First Nations information on the two preliminary plans related to the overall Project planning and ESA. The ESA states that a CMP and a CMMP would be prepared. A PDF document of the Preliminary CMP was included for West Moberly First Nations' review. NGTL noted that access management mitigation measures were included in the Project's EPP. NGTL requested to meet with West Moberly First Nations to share the Preliminary CMP (NEB Filing ID: A4C5V4) and proposed access management measures and locations, and seek input.	N/A	-

**Table 7-1: Summary of Aboriginal Engagement (cont'd)**

Aboriginal Community/ Date and Method	Engagement Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<b>West Moberly First Nations (cont'd)</b>			
October 15, 2014	NGTL conducted a meeting to present West Moberly First Nations with the Preliminary CMP (NEB Filing ID: A4C5V4) and proposed access management mitigation measures and locations. West Moberly First Nations suggested <i>Population and Distribution Objectives and Identification of Critical Habitat for Seven Herds of Woodland Caribou in the South Peace Area of British Columbia</i> (West Moberly First Nations 2014) and <i>Action Plan for the Klinse-Za Herd of Woodland Caribou (Rangifer tarandus caribou) in Canada [Draft]</i> (McNay et al. 2013) be applied to the CMP.	7.1	The routing criteria described in Section 4.1 of the ESA. The CHRP is specific to the provincially/federally delineated range boundaries of the Graham and Pink Mountain caribou herds. However, NGTL will implement the mitigation measures outlined in the EPP and the AMP, which are applicable to the entire Project.
<b>Independent Technical Review Group – Doig River First Nation, McLeod Lake Indian Band, Saulteau First Nations and West Moberly First Nations</b>			
January 30, 2015	NGTL met with the Independent Technical Review Group to discuss NGTL caribou habitat restoration and access management plans. Questions were raised regarding the development of camps and yards and the potential impact on caribou. It was indicated that the Treaty 8 communities want to take an active role in the development of the CHRP and the AMP.	7.1	The routing criteria described in Section 4.1 of the ESA. Construction of the section 58 components of the Project (e.g., camps, pipe yards) is proposed to start during summer 2015; however, none of these ancillaries are proposed in the Graham or Pink Mountain caribou ranges.
March 3, 2015	NGTL met with the Independent Technical Review Group to discuss the independent technical review of the CMP and the access management mitigation measures and locations. Questions were raised regarding the method and utility of the proposed restoration and access management mitigation measures, and monitoring of the restoration and access management mitigation. Interest in collaboration on the caribou habitat restoration planning was expressed.	7.1	The Preliminary CMP was incorporated in this Preliminary CHRP. Access management is included throughout this Preliminary CHRP as it is one of the 3 main objectives identified to achieve the CHRP goal. The AMP will provide further detail (to be filed under separate cover in accordance with Certificate Condition 16). The AMP is relevant to the entire Project.

**Table 7-1: Summary of Aboriginal Engagement (cont'd)**

Aboriginal Community/ Date and Method	Engagement Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<b>Independent Technical Review Group – Doig River First Nation, McLeod Lake Indian Band, Sauteau First Nations and West Moberly First Nations (cont'd)</b>			
March 4, 2015	Email correspondence between LGL Ltd., representing the Treaty 8 collaborative Nations, and NGTL. LGL Ltd. requested a draft Preliminary CHRP to review before the meeting with NGTL tentatively scheduled on April 7, 2015 to discuss mitigation measures proposed for the Project.	N/A	–
March 23, 2015	NGTL provided a draft copy of the Preliminary CHRP to the Independent Technical Review Group and requested review and comment.	N/A	–
April 6, 2015 April 7, 2015 April 9, 2015 April 14, 2015	Email correspondence between LGL Ltd. (on behalf of the Independent Technical Review Group and NGTL related to the technical review of the draft Preliminary CHRP.	N/A	The tentative meeting for April 7, 2015 was cancelled. LGL Ltd. advised on April 9, 2015 that written comments on the draft Preliminary CHRP would be provided.

**Table 7-1: Summary of Aboriginal Engagement (cont'd)**

Aboriginal Community/ Date and Method	Engagement Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<b>Independent Technical Review Group – Doig River First Nation, McLeod Lake Indian Band, Saulneau First Nations and West Moberly First Nations (cont'd)</b>			
April 28, 2015	<p>LGL Ltd. provided the results of a technical review of the draft Preliminary CHRP to NGTL on behalf of the Independent Technical Review Group.</p> <p>It was again suggested that the caribou habitat mapping by West Moberly First Nations in <i>Population and Distribution Objectives and Identification of Critical Habitat for Seven Herds of Woodland Caribou in the South Peace Area of British Columbia (West Moberly First Nations 2014)</i> and <i>Action Plan for the Klinse-Za Herd of Woodland Caribou (Rangifer tarandus caribou) in Canada [Draft]</i> (McNay et al. 2013) be applied to the CHRP. LGL Ltd. also suggested implementation of a lichen collection and transplantation program.</p> <p>LGL Ltd. acknowledged that this Preliminary CHRP describes planning considerations and provides mitigation measures and habitat restoration options that can be implemented during the pre-construction, construction and post-construction phases of the Project. It was further recognized that mitigation measures and habitat restoration options (specifically Tables 6 and 7) detailed in this Preliminary CHRP will likely be effective if they are implemented in appropriate locations and follow-up monitoring and adaptive management actions are applied.</p>	8	<p>Comments provided by LGL Ltd. were reviewed and considered by NGTL. Critical habitat as delineated by federal and provincial regulatory authorities will continue to be used to inform the Preliminary CHRP. Any changes to these boundaries will be considered in the development of the Final CHRP.</p> <p>NGTL has considered the use of lichen transplanting as a possible mitigation measure for the Project. Lichens are described throughout Section 8.</p> <p>NGTL is committed to continued engagement with the Treaty 8 collaborative Nations. The Final CHRP will incorporate updated records of consultation and engagement, including how additional information received from Aboriginal communities is incorporated in the Final CHRP.</p>



## 7.2 REGULATORY CONSULTATION

For a summary of caribou-related consultation for the Project with federal and provincial agencies, see Table 7-2. NGTL initiated consultation early (2011; 2013-specific to caribou) in the Project planning phase to enable regulatory agencies to provide relevant information and input in a timely manner. The two key recommendations received from BC MFLNRO were to:

- reduce the Project footprint by paralleling existing linear features
- avoid critical timing periods for caribou

A draft Preliminary CMP was provided to EC and BC MFLNRO regulators for review on April 21, 2014 and comments were received. The CMP was later replaced by this Preliminary CHRP following receipt of draft Conditions from the NEB, and also was provided to EC and BC MFLNRO regulators for review on March 20, 2015. NGTL has not received comments to the CHRP from EC or BC MFLNRO regarding caribou mitigation or habitat restoration planning at the time of finalizing this Preliminary CHRP. NGTL will continue to maintain open communication with EC and BC MFLNRO as the Project progresses.

Comments and recommendations received from both EC and BC MFLNRO from their review of the Preliminary CMP were considered and incorporated in the Preliminary CHRP. Key comments and recommendations provided during consultation with regulators include:

- The Project is not anticipated to affect high-elevation winter or summer critical habitat, or low-elevation summer critical habitat for the Graham Local Population Unit. The Project is likely to destroy a small area of matrix critical habitat.
- Aboriginal groups should be appropriately engaged regarding potential Project impacts on caribou.
- The construction schedule should adhere to the critical timing window for caribou.
- Avoid activities likely to destroy critical habitat for mountain caribou by means of alternative pipeline construction and operation activities. Consider extending trenchless crossings to reduce habitat disturbance if it is found that trenchless crossings reduce impacts on caribou.
- Maximize paralleling existing linear infrastructure and minimize the Project footprint.
- Discourage early seral vegetation and avoid the use of palatable species for erosion control.
- Mitigate the potential effects of integrity inspections/maintenance associated with operations.

NGTL will continue to work with provincial and federal regulators to align the CHRP measures with provincial and federal policy. Any future comments provided to NGTL will be considered for incorporation into the Final CHRP.

**Table 7-2: Summary of Consultation Activities with Federal and Provincial Authorities**

Name and Title	Date and Method	Consultation Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<b>Environment Canada</b>				
Joanne Kwok, Environmental Assessment Officer	August 28, 2013 November 25, 2013 Email(s)	<p>NGTL indicated being aware that EC was developing a federal recovery plan. EC understood the recovery plan was for the Southern Mountain National Ecological Area (SMNEA). NGTL requested EC to comment whether Graham, Pink Mountain, or both, are included in EC's current planning work and to comment on when EC planned to have a draft of the current planning work available for public review</p> <p>EC provided comment on their current planning work in regard to the Graham and Pink Mountain herds. The Graham herd is included in recovery planning for the Southern Mountain population of Woodland Caribou, as it falls in the SMNEA, which is the current area that the recovery strategy will apply to. Under COSEWIC's DUs, this herd falls in DU7.</p> <p>EC explained the Pink Mountain herd is not included in the current recovery planning processes as it does not fall in the SMNEA, but is in the NMNEA and DU7. The Pink Mountain herd is included in the Management plan for the Northern Mountain population of Woodland Caribou.</p> <p>EC indicated plans to post a draft recovery strategy for the Southern Mountain population of Woodland Caribou on the SARA registry for public comment by spring 2014.</p>	8.3,8.5	Conservation status and recovery/management planning for the Graham and Pink Mountain caribou ranges is provided in Sections 8.3 and 8.5
Joanne Kwok, Environmental Assessment Officer	December 4 and 6, 2013 Email(s)	<p>NGTL suggested a meeting in January to introduce the project to EC, to discuss any issues/concerns/questions EC might have, and to speak further regarding project effects and mitigation for caribou.</p> <p>EC indicated they would like to take the opportunity to meet with NGTL and discuss various components of this project including some wildlife issues, wetlands, caribou. EC proposed to have a meeting in mid-February (February 14, 2014).</p>	–	N/A
Cindy Hubbard, Environmental Assessment Officer Holly Middleton, Canadian Wildlife Service Jennifer Wilson, Special Projects Officer Joanne Kwok, Environmental Assessment Officer Darcy Peel, Canadian Wildlife Service Greg Ferguson, Canadian Wildlife Service Hugo Gherbavaz, Environmental Assessment Advisor	February 13, 2014 Meeting in Vancouver, BC February 14, 2014 Email	<p>NGTL provided a Project overview and a summary of consultation with BC MFLNRO related to caribou (i.e., BC MFLNRO advised that the <i>Implementation Plan for Ongoing Management of South Peace Northern Caribou in BC</i> should be considered for both the Graham and Pink Mountain caribou ranges and the Project does not intersect high elevation range in the Graham range and therefore does not trigger the requirement for offset measures). NGTL indicated they will prepare a CMP to address Project effects on caribou and caribou habitat in caribou ranges crossed by the proposed Project. NGTL agreed to provide a draft of the preliminary CMP to EC for review before the NEB Hearing (scheduled in August 2014). A final CMP would be prepared following construction. EC requested comments on the draft <i>Recovery Strategy for the Woodland Caribou, Southern Mountain Population (Rangifer tarandus caribou) in Canada</i> and offered to meet with NGTL to discuss how the draft recovery strategy could affect the Project.</p> <p>NGTL followed up with an email (February 14, 2014) and provided a map that shows routing revisions (the re-route at the Sikanni Chief River and a reduction in length in the Pink Mountain caribou range). These revisions were made after the NEB application was filed and were addressed in the AWE filed with the NEB in April 2014. NGTL provided web-links to the most recently filed CHRPs prepared by NGTL as a helpful reference to EC and noted that this work has evolved with each NGTL Project.</p>	8.2	<i>Implementation Plan for Ongoing Management of South Peace Northern Caribou in BC</i> exempts activities that occur outside identified high-elevation winter range (HEWR) for South Peace Northern Caribou from preparation of a CMMP. The Preliminary CMP and CHRP align with the first three levels of the mitigation hierarchy (i.e., avoid, minimize, restore onsite), and the associated principles and considerations described in the Implementation Plan have been considered. The Preliminary CMP is replaced by this Preliminary CHRP.
Cindy Hubbard, Environmental Assessment Officer	March 5, 10 and 11, 2014 Email(s)	<p>An effort was made to meet with EC to discuss the draft Recovery Strategy but EC was busy with the preparation of the draft Recovery Strategy and offered to meet at a later date. NGTL indicated their interest in meeting to discuss and determine how the draft Recovery Strategy will affect the Project. NGTL advised of their intent to circulate the preliminary CMP in mid-April 2014 and request to incorporate EC's comments before filing the report with the NEB in June 2014. For the purposes of Project planning and mitigation, NGTL requested EC's early input, specifically in regard to clarity on critical habitat. Further, NGTL reminded EC of NGTL's approach (as discussed at the February 13, 2014 meeting) and sought to understand if this was reasonable. NGTL noted that the process of "march charting" (construction scheduling) is ongoing and will include important timing windows for caribou to the extent possible.</p>	–	N/A
Cindy Hubbard, Environmental Assessment Officer	April 3 and 4, 2014 Email(s)	<p>Before the meeting with EC on April 11, 2014, NGTL provided the following based on a request from EC: portions of the ESA that address Project residual and cumulative effects on wildlife and wildlife habitat; and maps that show the Project in caribou range. NGTL noted that the preliminary CMP will provide information on mitigation measures to reduce the predicted residual effects of the Project's construction and operation on caribou and caribou habitat. Since the Project does not intersect defined HEWR in the Graham caribou herd range, the Project does not trigger the requirement for a CMMP under the <i>Implementation Plan for Ongoing Management of South Peace Northern Caribou in BC</i>, which would include a requirement for offset (compensation) measures. The Preliminary CMP will include information on: regulatory context; literature review; mitigation measures to be implemented before, during and following construction; and a summary of consultation with federal and provincial regulators. The Final CMP will document the onsite restoration measures implemented, identify their locations, and present them on Environmental Alignment Sheets. The Final CMP will be filed with the NEB following completion of final construction, cleanup and reclamation activities.</p>	Figure 1-1 7,8	The relevant components are incorporated in the Preliminary CHRP. Detailed information will be filed with the Final CHRP following completion of reclamation activities.

**Table 7-2: Summary of Consultation Activities with Federal and Provincial Authorities (cont'd)**

Name and Title	Date and Method	Consultation Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
<p>Stephen Hureau, Head, Species at Risk Recovery Unit, Canadian Wildlife Service Jennifer Wilson, Special Projects Officer Joanne Kwok, Environmental Assessment Officer Greg Ferguson, Canadian Wildlife Service</p>	<p>April 11, 2014 Meeting in Vancouver, BC</p>	<p>NGTL began the discussion with an introduction to their approach to mitigating Project effects on caribou: As routed, the Project does not intersect any defined HEWR in the Graham range and, thus the Project is not subject to the <i>Implementation Plan for the Ongoing Management of South Peace Northern Caribou</i>, and does not trigger the requirement for a CMMP, which would include a requirement for offsets. NGTL, in its ESA, committed to develop a CMP to address project effects on caribou and caribou habitat. This plan will consider and incorporate the threats and mitigation presented in applicable regulatory guidelines. NGTL also noted that a follow-up plan with adaptive management, to monitor the effectiveness of habitat restoration measures will be implemented. NGTL noted that the pipeline length had been reduced in the Pink Mountain range and the portion of the route in the UWR had been removed. EC noted this was a reasonable or appropriate approach.</p> <p>EC indicated the comment period on the proposed Recovery Strategy ended mid-March 2014. The final Recovery Strategy will include more detail on disturbance type and matrix habitat. It was noted that the 65% threshold is the best available information at this time and that mapping disturbance is one of the top priorities.</p>	<p>8.2</p>	<p>The Project does not cross identified HEWR. NGTL has reduced the length of the northern segment of the Kahta Section, which now avoids disturbance in the proposed UWR (u-9-005), and reduces the length of the proposed pipeline route in the Pink Mountain caribou range by 13 km. NGTL is continuing to engage EC regarding spatial delineation of critical habitat, including matrix habitat.</p>
<p>Cindy Hubbard, Environmental Assessment Officer</p>	<p>April 21, 2014</p>	<p>NGTL provided a draft Preliminary CMP for review.</p>	<p>–</p>	<p>N/A</p>
<p>Alisha Drinkwater, Senior Environmental Assessment Coordinator</p>	<p>June 20, 2014 Letter response</p>	<p>EC provided comments on draft Preliminary CMP. EC advised the Project is not anticipated to affect high elevation winter or summer critical habitat, or low elevation summer critical habitat for the Graham Local Population Unit. However, EC advised the Project is likely to destroy a small area of matrix critical habitat. EC recommends that the Proponent work with the province to address Project effects in the range of the Graham local population unit that have the potential to result in the destruction of critical habitat. EC is prepared to share its critical habitat data with the Proponent.</p> <p>EC recommends avoidance of activities likely to destroy critical habitat for southern mountain caribou (i.e., Graham local population unit) by means of alternative pipeline construction and operation activities.</p> <p>EC recommends that the Proponent ensures that all activities that are in the Pink Mountain local population unit are consistent with the Northern Mountain Caribou Management Plan.</p> <p>Specific comments on the draft Preliminary CMP were provided in an attachment, and are addressed individually in the following rows.</p>	<p>8</p>	<p>NGTL has requested further clarification of the Project's interaction with critical habitat, and has been advised that critical habitat mapping for the area of the Graham Local Population Unit overlapping the Project is currently in development. NGTL will continue to consult with EC to obtain spatial data files for critical habitat for the Graham Local Population Unit. Information will be considered in Project design and mitigation planning.</p> <p>NGTL is aware of the Management Plan for the Northern Mountain Population of Woodland Caribou (<i>Rangifer tarandus caribou</i>) in Canada, and has incorporated key elements of the plan into the Preliminary CHRP. Application of the identified management objectives and recovery goals to a specific project or proponent is limited, given the purpose of the Management Plan is to provide directives for the authorities responsible for management of the caribou populations discussed in the Plan.</p> <p>Please refer to entries beginning in the second section of this table for consultation to date with BC MFLNRO. NGTL will continue to consult with BC MFLNRO to address Project effects.</p>

**Table 7-2: Summary of Consultation Activities with Federal and Provincial Authorities (cont'd)**

Name and Title	Date and Method	Consultation Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
Alisha Drinkwater, Senior Environmental Assessment Coordinator (cont'd)	See above	A) Generally, EC recommends that the Proponent integrate the following criteria in the Preliminary Caribou Mitigation Plan: <ul style="list-style-type: none"> <li>• goals and objectives regarding mitigation measures that would be implemented to minimize impacts on southern mountain caribou</li> <li>• criteria for measuring the plan's success in achieving these goals and objectives</li> <li>• a summary of related baseline information that would be collected and, if no additional information will be collected, justification</li> <li>• a list of sites where mitigation measures would be implemented, the mitigation measure(s) proposed at those sites, and the rationale for selecting those sites and measures</li> <li>• the methods for monitoring the effectiveness of mitigation measures implemented</li> <li>• a description of adaptive management measures available and of the criteria the Proponent would use to determine if and when adaptive management measures are warranted</li> <li>• a detailed description of the locations where mitigation measures are put in place specifically for construction, as well as those that would remain in place into operations and would be monitored for the life of the Project</li> <li>• a commitment to report on the results of the mitigation measures implemented, monitoring undertaken, and the success of mitigation measures in meeting the goals and objectives of the Preliminary Caribou Mitigation Plan, as part of NGTL's post-construction environmental monitoring reports</li> </ul>	1.2	a) The goal of measures to be implemented under the CHRP is to reduce potential Project effects on caribou habitat. The certificate conditions for Caribou Habitat Restoration as well as organization of the Preliminary CHRP are described in Section 1.2. The planning and mitigation measures identified in the Preliminary CHRP comprise the toolbox of measures available to NGTL to avoid or minimize Project effects on caribou and caribou habitat. b, e, f, g) The criteria for measuring success, methods for monitoring effectiveness, description of adaptive management approach, and proposed timeline for monitoring will be included in the CHROMMP in accordance with Certificate Condition 37 and will be submitted under separate cover. c) Additional baseline information collected will include 360° aerial imagery. Detailed engineering design and construction planning information, and as-built documentation will also inform the CHRP. d, g) The Final CHRP will provide the list of sites where mitigation measures were implemented, including measures implemented during and following construction, in addition to the rationale for selecting those sites and measures. Detailed engineering and construction information is needed to determine the most appropriate mitigation tools on a site-specific basis. h) NGTL confirms their commitment to report results of mitigation and monitoring activities.

**Table 7-2: Summary of Consultation Activities with Federal and Provincial Authorities (cont'd)**

Name and Title	Date and Method	Consultation Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
Alisha Drinkwater, Senior Environmental Assessment Coordinator (cont'd)	See above	B) EC recognizes that this is a preliminary mitigation plan and requests confirmation on when a final version would be filed with the NEB. In the case that the final version is filed after the environmental assessment process is complete, it will limit EC's ability to review the plan and provide recommendations.	1,7.2	The Final CHRP will be filed on or before November 1 after the first complete growing season following start of operation of the Section 52 facilities.  NGTL will continue to engage EC through the development, implementation and monitoring phases of the CHRP, to the extent requested by EC.
		C) Section 3.1 discusses measures that could be used to minimize adverse effects, including extending trenchless crossings to reduce habitat disturbance. To evaluate the potential impacts of trenchless crossing methods on southern mountain caribou, EC recommends information on the likely effects on caribou for this pipeline construction method is provided for segment(s) that might overlap with the Graham local population unit. If it is found that trenchless crossings reduce impacts on caribou, then EC might recommend that the Proponent consider applying this installation method throughout caribou range.	5.3	Section 5.3 notes that NGTL is investigating opportunities for trenchless pipeline installation (e.g., extending trenchless crossings). There are no trenchless watercourse crossings planned in the Graham range. NGTL is considering opportunity to extend bored/drilled crossings of third-party dispositions, however, NGTL's options might be limited by the terms and conditions specified by the third party under their crossing agreement. Feasibility of trenchless crossings might also be constrained by technical considerations (e.g., access, additional workspace requirements, geological characteristics), as well as scheduling construction activities to avoid work during the critical timing window for caribou. Where extended trenchless crossings are not feasible, NGTL will consider other measures, as outlined in Section 5.3.

**Table 7-2: Summary of Consultation Activities with Federal and Provincial Authorities (cont'd)**

Name and Title	Date and Method	Consultation Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
Alisha Drinkwater, Senior Environmental Assessment Coordinator (cont'd)	See above	D) Section 3.1 lists opportunities to minimize Project effects and facilitate habitat restoration, including considering opportunities to narrow the Project ROW. EC requests that the Proponent clearly state how much (in metre) the ROW would be narrowed.	5.1,5.2,5.3	NGTL balances environmental and stakeholder concerns, engineering design, and constructability when determining ROW width requirements. The ROW width requirements have been established to achieve this balance, and account for a safe and efficient progression of project activities. A minimum 32 m ROW is required for construction of the Project, based initially on pipe size. Additional workspace requirements will be necessary. NGTL will fully evaluate opportunities to reduce disturbance in caribou ranges. The extent and location of narrowing the construction footprint will be determined as the Project progresses through detailed engineering and construction planning phases.
		E) Section 3.2.3 considers identification of candidate sites for short-term and long-term measures for line-of-sight blocks to reduce predator access. EC requests clarification on when these candidate locations would be identified and finalized. EC also recommends the criteria used to determine a 500 m line-of-sight threshold be provided (i.e., peer-reviewed literature).	5.4	Candidate locations for line-of-sight blocks are best identified as part of detailed construction planning and refined following completion of construction. The reason for this is to allow for incorporation of topographic variation and final footprint configuration, which are key components in determining effective line-of-sight blocking locations. Line-of-sight locations will be identified in the Final CHRP. Standard distances for line-of-sight breaks and supporting literature are not available. There is considerable variation in recommended distances for line-of-sight breaks across provincial regulatory jurisdictions responsible for managing woodland caribou habitat in western Canada. In consultation with BC MFLNRO for the Project, NGTL was advised that BC MFLNRO does not specify distance frequency for line-of-sight breaks, but noted that the BC OGC recommends sight breaks at least every 200 m for seismic operations and although a different ecotype, <i>Interim Operating Practices for Oil and Gas Activities in Identified Boreal Caribou Habitat in British Columbia</i> suggest 500 m between visual breaks for linear features.

**Table 7-2: Summary of Consultation Activities with Federal and Provincial Authorities (cont'd)**

Name and Title	Date and Method	Consultation Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
Alisha Drinkwater, Senior Environmental Assessment Coordinator (cont'd)	See above	F) Section 3.3 discusses implementation opportunities and constraints, and states that selection for habitat restoration measures would require as-built construction information. EC recommends that as-built information be provided for review in the environmental assessment process.	8.3	As-built information is collected following completion of construction and consists of a legal survey (showing areas disturbed by construction, including clearing and grading), as well as construction documentation, which would include change management documentation to address site-specific conditions. As such, this information cannot be provided before construction.
		G) Section 3.3.1 contains a hyperlink to a Decision Framework that does not link to anything. EC requests resubmission of the complete version of the Decision Framework for review in the environmental assessment process.	Figure 3-1,3-2,3-3	The decision framework was provided in the pdf version of the draft Preliminary CMP submitted to EC for review. The framework is provided as Figure 4 in this Preliminary CHRP.
		H) Section 3.4 discusses the scheduling of construction activities that would be initiated in caribou range. EC notes that pipeline installation activities would be initiated for the both sections of the pipeline (Atiken and Kahta) in Q3 2015. EC understands that the Q3 period is between July–September, which was proposed to avoid working in the critical timing window for caribou, which is January 15–July 15. EC advises that the proposed construction schedule would overlap with the end of the critical timing window for caribou. Accordingly, EC advises that the proposed construction schedule does not appear to adhere to the critical timing window for caribou as stipulated by BC MOE.	5.6	Construction will not start until after July 15 to align with the critical timing window for caribou.
		I) Section 3.4.1, Table 3 lists mitigation measures for work during the critical timing period for caribou. EC requests clarification on how “increase manpower resources to increase productivity” can be used as a mitigation measure, as this could result in additional noise disturbance or other effects for caribou.	Table 5-4	Increased manpower and resources increases the productivity of construction activities to speed construction and minimize work within the critical timing window. Noise associated with construction is unavoidable, regardless of the manpower. Expediting construction activities to complete construction within a single season (i.e., rather than delaying construction to a second season to avoid working within the critical timing window) is beneficial for reducing the duration of habitat disturbance (i.e., time lag between clearing and restoration activities).
		J) Table 3 lists mitigation measures for cleanup and reclamation activities, stating that activities would take place the following season outside the critical timing period. EC notes that delay of cleanup and reclamation activities to outside the caribou critical timing period could increase impacts on caribou depending on the lag time. Accordingly, EC requests more information on the biological rationale used to determine that to delay the complete cleanup and reclamation outside the critical timing window would result in fewer impacts on caribou. Additionally, further information on the specific season that the mitigation measure would be carried out in, and on the proposed cleanup and reclamation activities for which there is a lag time, is recommended.	Table 5-4	Table 5 has been clarified.
		K) In relation to Section 3.4.1 and the statement “in the event that caribou are observed in close proximity to the Project...,” EC requests that the Proponent quantify this distance in the finalized Caribou Mitigation Plan.	Table 5-4	The statement is in reference to incidental sightings of caribou by construction staff, which could occur in caribou range on access to or in the construction footprint.



**Table 7-2: Summary of Consultation Activities with Federal and Provincial Authorities (cont'd)**

Name and Title	Date and Method	Consultation Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
Alisha Drinkwater, Senior Environmental Assessment Coordinator (cont'd)	See above	L) Section 4, Table 4 lists mitigation measures for caribou during construction. EC seeks clarification on which measures provided would be likely to be implemented. EC's ability to comment on the efficacy of these measures to reduce impacts on caribou is limited given that there is considerable uncertainty on the locations and extent to which they would be implemented.  M) Section 5.1, Table 5 of the plan discusses and lists post-construction habitat restoration measures. EC seeks clarification from the Proponent on which measures would be likely implemented. EC's ability to comment on the efficacy of these measures to reduce impacts on caribou is limited given that there is considerable uncertainty on the locations and extent to which they would be implemented.	3 Table 5-3	The planning and mitigation measures identified in the Preliminary CHRP comprise the toolbox of measures available to NGTL to avoid or minimize Project effects on caribou and caribou habitat. Selection of the habitat restoration measures will require as-built construction information to allow for validation of site-specific conditions, and input from the NGTL construction and operation/maintenance staff, Project biologists and reclamation specialists, as well as appropriate regulatory agencies. Site-specific details will be provided in the Final CHRP. NGTL will implement the CHROMMP, including adaptive measures where warranted, to ensure the efficacy of mitigation measures implemented.
		N) EC notes that First Nations were not listed on the consultation record for this Plan. Aboriginal groups along the proposed pipeline corridor might have established or asserted Aboriginal or treaty rights to access caribou. Accordingly, it is important to ensure that Aboriginal groups are appropriately engaged regarding potential Project impacts on caribou.	7.1	NGTL has engaged with Aboriginal communities to collect Traditional Knowledge, which has been incorporated in the Preliminary CHRP. Communities engaged for the Project were advised of NGTL's commitment to complete a CHRP and NGTL will advise communities when the Preliminary CHRP and CHROMMP are filed. NGTL is committed to continuing engagement with Aboriginal communities in regard to concerns related to caribou.
		O) The Preliminary Caribou Mitigation Plan does not distinguish between the two northern ecotypes. EC requests that the Proponent clarify the local populations to which this plan applies.	8.3	The Preliminary CHRP discusses the differentiation between the Pink Mountain and Graham caribou in Sections 8.3. The mitigation and procedure for identifying appropriate site-specific methods discussed in the remainder of the Preliminary CHRP applies to both the Graham and Pink Mountain caribou herds.

**Table 7-2: Summary of Consultation Activities with Federal and Provincial Authorities (cont'd)**

Name and Title	Date and Method	Consultation Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
Alisha Drinkwater, Senior Environmental Assessment Coordinator (cont'd)	See above	<p>P) In addition to a Caribou Mitigation Plan, EC supports the development of an AMP for caribou outlining access control measures proposed for construction, operation and decommissioning. Implementing access control measures might limit predator access to caribou habitat and might reduce regulated and unregulated hunting access to caribou habitat, while allowing caribou to access to their critical habitat to carry out life processes. The AMP could include:</p> <ul style="list-style-type: none"> <li>• goals and objectives regarding access management for the control of both human and predator access</li> <li>• criteria for measuring the plan's success in achieving these goals and objectives</li> <li>• summary of related baseline information to be collected and, if no additional information would be collected, justification for why not</li> <li>• list of sites where access control measures would be implemented, control measure(s) proposed at those sites and rationale for selecting those sites and measures</li> <li>• summary of the Proponent's consultation with appropriate federal and provincial authorities, other appropriate stakeholders and potentially affected</li> <li>• Aboriginal groups regarding the AMP – summary should include any issues or concerns about the plan raised by those consulted and how the Proponent has addressed or responded to those issues or concerns</li> <li>• methods for monitoring the effectiveness of access control measures implemented</li> <li>• description of adaptive management measures available and of the criteria the Proponent would use to determine if and when adaptive management measures are warranted</li> <li>• detailed description of the locations where access control measures would be put in place specifically for construction, as well as those that would remain in place into operations and be monitored for the life of the Project</li> <li>• commitment to report on the results of the control measures implemented, monitoring undertaken and success of control measures in meeting the goals and objectives of the AMP, as part of the Proponent's post-construction environmental monitoring reports</li> </ul>	5.3	<p>Access control is one of the three primary objectives of restoring habitat, along with vegetation restoration and line-of-sight blocking (Section 4.3 of the Preliminary CHRP). The Final CHRP will specify access control measures in caribou ranges. NGTL is also committed to implementing access control outside caribou ranges. The details of these measures (e.g., location, type of access control) will be documented in the EPP and Environmental Alignment Sheets prepared for the Project before construction.</p> <p>NGTL is also required to prepare an Access Management Plan with a separate cover for non-parallel disturbances along the ROW for each section of the Section 52 facilities, in accordance with Condition 16.</p>
		<p>Q) EC recommends that the Proponent provide a description of how available and applicable Aboriginal Traditional Knowledge and TLU studies were considered in the Preliminary Caribou Mitigation Plan.</p>	7.1	<p>Available and applicable TEK and TLU studies were considered in the Preliminary CHRP. Wildlife features (e.g., trails, mineral licks) located in caribou range will be considered during routing, mitigation and access management planning.</p>
		<p>R) EC recommends an adaptive management approach for mitigation. The purpose of such an approach would be to ensure that effectiveness of mitigation measures, such as reductions to lines of sight, habitat restoration, decommissioning of access, is monitored and measures would be adjusted as needed during Project operations to ensure objectives for habitat disturbance and access would be achieved.</p>	5.5	<p>Adaptive management will be detailed in the CHROMMP filed under separate cover.</p>
Alisha Drinkwater, Senior Environmental Assessment Coordinator (cont'd)	July 2, 2014 Email	<p>NGTL provided an update on Attachment 1 (comments on the Southern Mountain and Northern populations of woodland caribou for the North Montney Project) and Attachment 2 (comments on the Preliminary Caribou Mitigation Plan). NGTL explained to EC that they notified the NEB that they would be delaying filing of the CMP (and the Preliminary CMMP) so that NGTL could address EC's comments on Attachment 2.</p>	5.1	<p>The Project does not cross identified HEWR. NGTL has reduced the length of the northern segment of the Kahta Section, which now avoids disturbance in the proposed UWR (u-9-005), and reduces the length of the proposed pipeline route in the Pink Mountain caribou range by 13 km.</p> <p>NGTL is continuing to engage EC regarding spatial delineation of critical habitat, including matrix habitat.</p>
	July 4 and 11, 2014 Email(s) Telephone	<p>NGTL understands that in regard to EC's comment letter addressing the North Montney Preliminary Caribou Mitigation Plan, dated June 20, 2014, EC indicates that the Project overlaps with 0.43 ha of critical habitat. Subsequently, EC indicated that it would advise the NEB that this would constitute a significant effect.</p> <p>NGTL requested an opportunity to review the spatial data showing this overlap, preferably before EC's letter to the NEB, planned for July 10, 2014. NGTL did receive all critical habitat data currently in the public domain, and those data do not overlap with the Project.</p> <p>EC explained that Canadian Wildlife Service has indicated they were able to use additional data from what was used for the June 20, 2014 letter NGTL received. Therefore, using the updated data, Canadian Wildlife Service revised conclusions made from that correspondence. EC's Letter of Comment to the NEB reflects those revised conclusions. EC indicated NGTL will be in receipt of the Letter of Comment shortly as it has been couriered to them and will also be posted to the NEB site.</p>		

**Table 7-2: Summary of Consultation Activities with Federal and Provincial Authorities (cont'd)**

Name and Title	Date and Method	Consultation Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
Alisha Drinkwater, Senior Environmental Assessment Coordinator (cont'd)	August 8 and 12, 2014 Email(s)	<p>NGTL followed up with EC, noting that they have not received a response from EC or Canadian Wildlife Service regarding the 0.43 ha of critical habitat described in EC's Letter of Comment to the NEB dated July 8, 2014. In Attachment 2, page 4 it states "there is likely destruction of 0.43 ha of matrix critical habitat arising from the Project's 55 m project development area corridor (i.e., Project ROW)".</p> <p>NGTL indicated strong interest in receiving spatial data on the location of this critical habitat so that options for reducing adverse effects on critical habitat can be reviewed. NGTL did previously receive some critical habitat mapping from EC, but this critical habitat did not overlap the Project ROWs. NGTL indicated they would appreciate if this request could be completed by August 31, 2014 to provide sufficient time for review before start of the hearing.</p> <p>EC responded that they had forwarded the NGTL request to Canadian Wildlife Service colleagues and have followed up with them now. EC/Canadian Wildlife Service provided publicly available links for the southern mountain caribou spatial data. EC stated, it is important to note that the analysis is ongoing, and that the classification of critical habitat type (i.e., high elevation, low elevation and matrix) might also change in the future. Information will be provided to the public as it becomes available.</p>	-	
	October 21, 2014 Email	<p>NGTL emailed EC the draft Klinse-Za Action Plan and indicated it was provided to NGTL by the West Moberly First Nation. NGTL noted the document is in draft form; dated 2013. NGTL indicated they do not see it listed on the SARA website and that it is very briefly mentioned in EC's Recovery Strategy – in a list of examples of Action Plans that have been developed. NGTL asked Canadian Wildlife Service to comment as to their position on this Action Plan.</p>	8.2	<p>NGTL understands the critical habitat identified in WMFN 2014 and the draft Action Plan for the Klinse-Za herd (McNay et al. 2013) was developed using an approach that was informed by traditional knowledge about historic distribution and range of caribou, which differs the delineation of caribou local population units and critical habitat in the federal Recovery Strategy (EC 2014). The Preliminary CHRP has been developed to align with the delineated caribou habitat provided by the federal and provincial regulatory authorities.</p>
<b>BC Ministry of Forests, Lands and Natural Resource Operations</b>				
Matt Austin, Director: Resource Management Megan Watters, Ecosystem Biologist Chris Ritchie, Fish and Wildlife Recovery Manager Gerald Kuzyk, Ungulate Specialist	July 23 and 25, 2013 Email(s)	<p>NGTL sought direction for the Project in regard to caribou (e.g., status of regulatory guidelines; available information on the Graham and Pink Mountain herds; and guidance related to mitigation). BC MFLNRO indicated that NGTL's questions should be directed to the Regional Wildlife Biologist in Fort St. John.</p>	-	N/A
Kerry Harvey, Ecosystem Biologist	August 15, 2013 Meeting in Fort St. John	<p>NGTL provided a summary of the Project in caribou range for discussion.</p> <p>BC MFLNRO indicated that with respect to routing, particularly in caribou range, there should be an effort to maximize paralleling existing linear infrastructure and an overall attempt to reduce project footprint. It was suggested that C. Ritchie (BC MFLNRO Fish and Wildlife Recovery Manager) be engaged to provide a broader perspective and information on standardized industry practices and management practices for restoration. A Mitigation Plan was recommended, to be prepared in advance of applying to the BC OGC.</p>	5.1	<p>Routing criteria provided in Section 4.1 of the ESA outline the key components used to avoid or minimize adverse Project effects on caribou and caribou habitat, including paralleling existing linear disturbances and reducing the Project footprint.</p>
Chris Ritchie, Fish and Wildlife Recovery Manager	August 16 and 20, 2013 Email(s)	<p>NGTL provided a Project overview and asked for direction related to caribou (e.g., application of implementation plan; requirement to prepare a CMMP; application of offsets; standard reclamation practices; and applicability of existing plans to the Pink Mountain caribou herd).</p> <p>BC MFLNRO noted that the Project in the Graham caribou herd did not require a formal CMMP or offsets since the route is not located in high elevation range. However, BC MFLNRO advised NGTL to address concerns such as minimizing the footprint, controlling human and predator access, discouraging early seral vegetation and avoiding the use of palatable species for erosion control. Regarding the Pink Mountain caribou herd, BC MFLNRO confirmed that there is no herd-specific management plan.</p>	5	<p>NGTL incorporated suggestions into the Preliminary CHRP.</p>

**Table 7-2: Summary of Consultation Activities with Federal and Provincial Authorities (cont'd)**

Name and Title	Date and Method	Consultation Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
Kerry Harvey, Ecosystem Biologist	August 26 and September 16, 2013 Email(s)	BC MFLRNO provides a summary letter that provides web-links to relevant provincial information for the Project and requested additional information related to route selection and consideration of route alternatives (i.e., the northern most portion of the Kahta Section).	5.1	NGTL's response noted that the route selection process considers minimizing the length, meeting applicable regulatory requirements and reducing the footprint, while carefully reviewing costs and constructability. The northernmost km's to Kahta (13 km in Pink Mountain range) were officially dropped in NGTL's March 10, 2014 project update to the NEB (Filing ID: A59202).  The Project does not cross identified HEWR. NGTL has reduced the length of the northern segment of the Kahta Section, which now avoids disturbance in the proposed UWR (u-9-005), and reduces the length of the proposed pipeline route in the Pink Mountain caribou range by 13 km.
Kerry Harvey, Ecosystem Biologist	October 15, 2013 Email	BC MFLRNO provided further information on the proposed UWR in the Pink Mountain caribou range.	-	NGTL committed to review routing in this UWR.
Kerry Harvey, Ecosystem Biologist Jocelyn Campbell, Ecosystem Biologist	December 4, 2013 Email	NGTL proposed to schedule a meeting in January 2014. In regard to caribou, items to review include: routing through the Pink Mountain range, the effects assessment for caribou (i.e., assessment approach); and mitigation, specifically if any changes are expected given the proposed release of a draft Recovery Strategy.	-	N/A
Chris Ritchie, Fish and Wildlife Recovery Manager Jocelyn Campbell, Ecosystem Biologist Kerry Harvey, Ecosystem Biologist	January 14, 15 and 22, 2014 Email(s)	NGTL asked, in light of EC's forthcoming release of the draft Recovery Strategy, whether there were any changes to provincial plans or delineation of critical habitat (HEWR, low-elevation winter range and matrix), specifically in the Graham range. This information would be useful in Project planning and development of mitigation.	-	No additional or revised provincial planning documents were provided.
Kerry Harvey, Ecosystem Biologist	January 27, 2014 Meeting	NGTL provided a Project overview and noted that the pipeline route is no longer located in an UWR in the Pink Mountain caribou range. Mitigation measures related to caribou and caribou habitat and the CMP were discussed. NGTL agreed to provide a draft plan to BC MFLNRO for review and feedback and noted that a final plan identifying specific measures and locations would be prepared following construction.	5	Recommendations regarding mitigation have been considered and incorporated in the Preliminary CMP. Draft Preliminary CMP was provided to BC MFLNRO for review on April 21, 2014.
Kerry Harvey, Ecosystem Biologist	January 28, 2014 February 5, 2014 Email	NGTL provided detailed maps of Project routing in the Graham range (Aitken Section), and noted detailed mapping in the Pink Mountain range (Kahta Section) will be completed soon (e.g., front end engineering and design [FEED] maps).	-	FEED maps for the Kahta Section were provided to BC MFLNRO on February 5, 2014.
Kerry Harvey, Ecosystem Biologist	March 2 and 14, 2014 Email	NGTL requested guidance from the province related to possible changes associated with the proposed Recovery Strategy (e.g., delineation of critical habitat and standard mitigation measures). NGTL also asked if BC MFLNRO has any concerns, based on review of FEED plans, related to routing in caribou range and noted that a preliminary CMP is being prepared for the Project.	-	No additional concerns were identified.
Elizabeth Hunt, Resource Management Officer	March 24, 2014 Telephone	NGTL discussed with BC MFLNRO the use of merchantable timber for rollback for access control in caribou range. BC MFLNRO did not have any issues and requested that they be consulted once locations have been selected. The transportation of mountain pine beetle-infected timber is not an issue and there are no transportation or harvesting restrictions on mountain pine beetle-infected pine trees.	5.3	Rollback for access control is considered one of the tools that NGTL will incorporate into the implementation of caribou mitigation and Final CHRP, where appropriate.  Potential rollback locations for access management will be selected and described in the AMP.

**Table 7-2: Summary of Consultation Activities with Federal and Provincial Authorities (cont'd)**

Name and Title	Date and Method	Consultation Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
Kerry Harvey, Ecosystem Biologist Chris Ritchie, Fish and Wildlife Recovery Manager	March 31, 2014 Telephone	NGTL noted that a preliminary CMP is being developed for the Project and would address routing, scheduling and mitigation planning before, during and after construction. NGTL again asks if the <i>Implementation Plan for Ongoing Management of South Peace Northern Caribou in BC</i> will be updated. BC MFLNRO will review the draft Preliminary CMP before submission to the NEB.	–	Updated provincial planning documents are not available.
Kerry Harvey, Ecosystem Biologist	April 1, 3 and 4, 2014 Email	BC MFLNRO noted that standardized industry management practices are in their infancy and that stakeholders and First Nations will be engaged in this process and there will be an opportunity to review and provide comment in the future. In reference to FEED plans, BC MFLNRO indicated it appears as though NGTL has paralleled existing footprint to a great extent, which is good. BC MFLNRO indicated it would like to reiterate that NGTL make every attempt to minimize new footprint and avoid activities during critical timing windows. BC MFLNRO did not express any additional concerns.	5.6	In response to timing, NGTL provided BC MFLNRO with the response to NEB Information Request 2.32 on this topic. Scheduling information is provided in Section 5.6 of the Preliminary CHRP, including discussion of critical timing windows for caribou.
Kerry Harvey, Ecosystem Biologist	April 14, 2014 Email	NGTL provided follow-up in regard to FEED plans and routing in caribou range. NGTL's construction, environment and engineering team members reviewed the FEED plans to address BC MFLNRO's request.	–	Routing and siting information is described in Section 4.1 of the ESA. No additional opportunities were identified to reduce the footprint in the Pink Mountain range. In the Graham range, NGTL's Lands Department approached an adjacent third-party line to determine whether a portion of their ROW could be used, as this would reduce NGTL's footprint. The third party responded that they could not accommodate that request.
Kerry Harvey, Ecosystem Biologist	April 21, 2014 Email	NGTL provided a draft Preliminary CMP for review.	–	N/A
Kerry Harvey, Ecosystem Biologist	May 1, 2014 Email	BC MFLNRO reviewed the draft Preliminary CMP and provided comments pertaining to: <ul style="list-style-type: none"> <li>• inclusion of indirect project effects (e.g., noise, aircraft if applicable, annual integrity inspections or monitoring) and, in particular, mitigating potential effects of integrity inspections/maintenance associated with operations</li> <li>• reference to the BC MOE (2014) Science Update for the South Peace Northern Caribou (<i>Rangifer tarandus caribou</i> pop. 15) in BC</li> <li>• modification of cautionary period timing window</li> <li>• provision of the document number for the EPP</li> <li>• inclusion of mitigation measures regarding incident/sighting reporting protocols related to traffic management, exclusion of wildlife from open excavations or other potential hazards (e.g., sumps), proper storage of construction materials, site-specific habitat features (e.g., mineral licks) and minimum disturbance construction techniques</li> </ul>	Throughout	Comments have been incorporated in the Preliminary CHRP.
Kerry Harvey, Ecosystem Biologist	June 23, 2014 Email	BC MFLNRO provided comments on draft Preliminary CMP pertaining to discrepancy in timing windows. Acknowledged that the BC OGC only has a critical timing window for caribou extending from May 15 through July 15. The BC MFLNRO critical timing window (January 15 through July 15) encapsulates a late-winter period and BC MFLNRO ask that activities also be planned considering that critical period. Perhaps this is an entirely moot point given vegetation restoration success (in all likelihood) needs to be assessed under snow-free conditions (and as such would avoid the said timing window). BC MFLNRO requested a short call in early July to follow up on a few issues.	5.6	The BC MFLNRO critical timing window is incorporated in Section 5.6.

**Table 7-2: Summary of Consultation Activities with Federal and Provincial Authorities (cont'd)**

Name and Title	Date and Method	Consultation Related to Caribou	Section in the Preliminary CHRP	Comments and Rationale
Kerry Harvey, Ecosystem Biologist	October 22, 2014 Email	<p>BC MFLNRO indicated the Province is aware of and interested in the information in the Klinse-Za Action Plan (as while it used different method to determine a management regime for caribou than the Peace Northern Caribou Plan it is not without merit) and is currently undertaking a comparative assessment of the relevant caribou plans. However, the Province has not endorsed this plan at this time and is comfortable with the management regime as set out in the South Peace Northern Implementation Plan, but remains open to amending/augmenting the current regime if new, compelling information becomes available.</p> <p>With regard to the federal Recovery Plan and their critical habitat maps, as BC MFLRNO understand it the boundaries were determined largely using the provincial data. However, BC MFLRNO cannot confirm this was the only source of data they used, so would be very cautious about using provincial data to better understand EC's mapping. BC MFLNRO understands that EC will be making the shapefiles for their critical habitat publicly available as soon as possible.</p>	8.2	<p>In the absence of an amended South Peace Northern Implementation Plan, NGTL is developing the CHRP to the most recent version of the South Peace Northern Implementation Plan. NGTL understands the critical habitat identified in WMFN 2014 and the draft Action Plan for the Klinse-Za herd (McNay et al. 2013) was developed using an approach that was informed by traditional knowledge about historic distribution and range of caribou, which differs from the delineation of caribou local population units and critical habitat in the federal Recovery Strategy (EC 2014). The Preliminary CHRP has been developed to align with the delineated caribou habitat provided by the federal and provincial regulatory authorities.</p>

## 8.0 LITERATURE REVIEW

This section describes the literature review that was conducted to provide regulatory and ecological context relevant to mountain caribou and specifically to the Graham and Pink Mountain caribou range, including threats to and management considerations for recovery of mountain caribou. This context provides an understanding of the current knowledge of the value and purpose of habitat restoration in caribou range.

In addition, available information on mitigation measures and habitat restoration methods was compiled and summarized in Section 5 and Appendix C. This summary was used to provide the foundation for the suite of measures available to NGTL to effectively restore potential Project effects on caribou and caribou habitat. Knowledge gaps that contribute to uncertainty in caribou habitat restoration are identified in Section 8.9. Based on the results of the literature review, the habitat restoration measures best suited for caribou range have been identified.

## 8.1 LITERATURE REVIEW METHODS

The literature review incorporates regulatory and ecological context relevant to the ESAR caribou range to inform the selection of appropriate mitigation and habitat restoration measures. The key results from current boreal caribou literature as well as previous and ongoing habitat restoration initiatives, techniques implemented and their reported successes and failures were reviewed to inform the CHRP.

The literature review was completed using a systematic approach and standard research techniques, which enabled NGTL to consider the most recent published information about caribou habitat restoration in the Preliminary CHRP. Sources reviewed include federal and provincial recovery strategies and management plans, previously submitted NGTL CHRPs, publically available government reports, in-house reference material and peer-reviewed journal articles.

The literature review for the Preliminary CHRP included a systematic search of the following industry and scholarly databases for queried keywords and phrases:

- Google
- Google Scholar
- BioOne
- Web of Science
- BC Ministry of Forests (BC MOF) Forest Practices Codes Guidebooks
- Cumulative Environmental Management Association (CEMA) database, including Oil Sands Leadership Initiative (OSLI) historic filings

The following search terms were used in the literature review:

- caribou habitat restoration
- northern caribou
- mountain caribou
- subalpine/conifer/mature/old forest restoration
- forested wetlands restoration
- linear corridor restoration/reclamation
- linear feature restoration in subalpine/conifer/mature/old forest and forested wetlands
- BC caribou recovery/range plan/policy/action plan

The COSIA website was searched to gather knowledge on current restoration measures, including the LiDea Project, the Algar Historic Restoration Project and OSLI environmental performance projects. Similarly, documents available on the BC Science and Community Environmental Knowledge (SCEK) Fund website, in particular those associated with the SCEK Fund's research and effectiveness monitoring and caribou programs, were reviewed. The Boreal Caribou Habitat Restoration Operational Toolkit for British Columbia (Golder 2015) provided a summary of habitat restoration techniques appropriate for boreal caribou range in BC, and is based largely on lessons learned from restoration activities in northern Alberta.

TERA, a CH2M Hill Company, attended the 15th North American Caribou Workshop (North American Caribou Workshop 2014), where several technical sessions related to habitat restoration for caribou were presented. Relevant information for CHRP planning related to use of rollback and monitoring wildlife use of restored linear features that was presented at the workshop is summarized in the relevant sections of the literature review.

Caribou habitat restoration is receiving increasing research attention and it is anticipated that methods to restore habitat will continue to be tested and modified in the near future. NGTL has incorporated this information in the AMP for the Project and will continue to incorporate new information in the Final CHRP and post-construction monitoring reports.

## **8.2 REGULATORY POLICY AND GUIDELINES FOR MOUNTAIN CARIBOU**

The Preliminary CHRP was developed considering the current regulatory policies specific to mountain caribou. NGTL began consultation and working collaboratively with provincial regulators, Aboriginal communities, stakeholders and industry partners several years ago at the outset of the Project. NGTL will continue to work with provincial and federal regulators to align the CHRP measures with provincial and federal policy.



The identified regulatory policy and management documents considered to develop the Preliminary CHRP include:

- *Management Plan for the Northern Mountain Population of Woodland Caribou (Rangifer tarandus caribou) in Canada* (EC 2012a), as it applies to the Pink Mountain herd
- *Implementation Plan for the Ongoing Management of South Peace Northern Caribou* (BC MOE 2013), as it applies to the Graham herd
- *Recovery Strategy for the Woodland Caribou, Southern Mountain Population (Rangifer tarandus caribou) in Canada* (EC 2014), as it applies to the Graham herd
- *Population and Distribution Objectives and Identification of Critical Habitat for Seven Herds of Woodland Caribou in the South Peace Area of British Columbia* (West Moberly First Nations 2014 [Filing ID: A3Z0H2])
- *Action Plan for the Klinse-Za Herd of Woodland Caribou (Rangifer tarandus caribou) in Canada [Draft]* (McNay et al. 2013 [Filing ID: A3X4D3])
- *A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia (Interim Guidance)* (BC MFLNRO 2014)
- *Compendium of Northern Woodland Caribou Forestry Guidelines in British Columbia* (Cichowski 2005)

Further information on each of the documents listed above is summarized in the following paragraphs.

The *Management Plan for the Northern Mountain Population of Woodland Caribou (Rangifer tarandus caribou) in Canada* (EC 2012a) applies to the Pink Mountain herd. Objectives of the plan for northern mountain caribou include determining herd status and trends, managing harvest and identifying and managing important habitats. The main threat identified for the Pink Mountain herd is reduction in range due to industrial development. An increase in predation by both wolves and wolverines was noted, and is attributed to the increase in moose populations following prescribed burns.

The *Implementation Plan for the Ongoing Management of South Peace Northern Caribou* (BC MOE 2013) applies to the Graham herd. Objectives include:

- protecting 90% of HEWR
- implementing management objectives and standardized management practices in HEWR and low-elevation winter range (there is currently no low-elevation winter range identified for the Graham herd)
- addressing non-habitat related threats
- monitoring compliance and effectiveness of management actions

Management objectives for industrial footprints are to restore, reduce or prohibit surface disturbance in high-elevation winter habitat, thereby reducing the potential for disturbance and displacement of caribou to lower elevation winter habitats that have a relatively higher predation risk. Implementation of standardized industry management practices to reduce or avoid habitat disturbance is one of the key implementation objectives of the Plan. The Plan suggests that these standardized management practices would be regulated under the *Oil and Gas Activities Act*, the *Forest and Range Practices Act* or the *Mines Act*. Currently, the standardized management practices suggested in the Plan have not been developed or implemented. The Project does not intersect defined HEWR in caribou range and, therefore, does not trigger the provincial requirement for a Caribou Mitigation and Monitoring Plan, which could include a requirement for offset (compensation) measures.

EC released the *Recovery Strategy for Woodland Caribou, Southern Mountain population* (*Rangifer tarandus caribou*) in Canada in June 2014, with the goal to achieve self-sustaining populations in all local population units within their current distribution (EC 2014). The Recovery Strategy applies to the Graham herd, or local population unit, but not the Pink Mountain herd. The Graham herd is part of the Northern Group subpopulation, and the Recovery Strategy has set a population target of 4,600 caribou for this group, which is 24% higher than the current population estimate of 3,707 caribou.

Population and distribution objectives identified in the Recovery Strategy include:

- stop the decline in both size and distribution of all local population units
- maintain the current distribution within each local population unit
- increase the size of all local population units to self-sustaining levels and, where appropriate and attainable, to levels that can sustain a harvest with dedicated or priority access to Aboriginal peoples (EC 2014)

The federal Recovery Strategy delineates critical habitat in the Northern Group into five categories:

- high-elevation summer or winter range
- low-elevation summer range
- low-elevation winter range
- Type 1 matrix range within annual ranges
- Type 2 matrix range surrounding annual ranges

Only high-elevation summer or winter range is currently spatially defined in the Recovery Strategy for the Graham range. The definition of critical habitat is subject to change in updates to the Recovery Strategy or through the development of federal action plans.

Maintenance of low and sustainable predation risk and access to food resources is the key habitat function of each of these identified range categories (EC 2014). In low-elevation winter range and Type 1 matrix range, a minimum 65% undisturbed habitat should be achieved or maintained (for Northern and Central groups), and, in Type 2 matrix range, ecological conditions to support low predation risk should be maintained. The Recovery Strategy considers minimal disturbance of high-elevation summer and winter ranges as necessary for the recovery of southern mountain caribou local population units.

Critical habitat for southern mountain caribou is partially mapped in the EC Recovery Strategy. The Project is not located in critical habitat as currently mapped for the Graham local population unit. NGTL acknowledges the incomplete identification of critical habitat for the Graham herd, and will continue to engage the appropriate regulatory agencies to incorporate updated information as results from the schedule of studies identified in the Recovery Strategy become available.

During the NEB application review process for the Project, West Moberly First Nations submitted written evidence, entitled *Population and Distribution Objectives and Identification of Critical Habitat for Seven Herds of Woodland Caribou in the South Peace Area of British Columbia* (West Moberly First Nations 2014), hereafter referred to as the Seven Herds report. In the Seven Herds report, additional critical habitat is proposed for woodland caribou, including the Graham and Klinse-Za (Moberly) herds, and current and historical population and distribution information is provided. The stated intent of the document is to provide information for inclusion in the development of the federal Recovery Strategy and Action Plans under SARA.

The *Action Plan for the Klinse-Za Herd of Woodland Caribou* (Rangifer tarandus caribou) in Canada [Draft] (McNay et al. 2013) identifies population and distribution objectives, disturbance thresholds for the critical habitat proposed in the draft Action Plan for the Klinse-Za herd and recommended measures to stabilize the Klinse-Za caribou herd population. The recovery actions listed in the draft Action Plan for the Klinse-Za herd, in order of priority, include:

- wolf reductions and calf penning
- protection of terrestrial lichen
- avoidance of calving areas during calving period
- restoration of early seral habitats
- deactivation of linear features
- implementing a range plan and cumulative effects assessment plan

NGTL understands the critical habitat proposed in the Seven Herds report and the draft Action Plan for the Klinse-Za herd was developed using an approach informed by traditional knowledge about historic distribution and range of caribou.

This approach differs from the delineation of caribou local population units and critical habitat in the federal Recovery Strategy, which is based on current and recently historic (since the 1980s) occupancy (EC 2014). NGTL recognizes that proposed critical habitat in the Sevens Herd report and the draft Action Plan for the Klinse-Za herd overlaps with a portion of the Aitken Creek Section of the Project. However, neither critical habitat nor the local population unit boundary for the Moberly (Klinse-Za) herd delineated in the EC Recovery Strategy overlaps with the Aitken Creek Section. Similarly, although the Graham local population unit boundary does overlap with the Aitken Creek Section, no critical habitat as delineated in the federal Recovery Strategy overlaps with the Project.

Given these differences in mapping, it was determined that the Preliminary CHRP would be developed to align with the delineated caribou habitat provided by the federal and provincial regulatory authorities. NGTL has adopted the definition of critical habitat as defined in the Recovery Strategy. NGTL is developing a consistent approach for all its projects, which aligns with the federal and provincial regulatory authorities. Furthermore, the mitigation measures that NGTL has proposed within this Preliminary CHRP are consistent with and have been developed in consideration of the objectives described in provincial and federal management and recovery plans. NGTL recognizes that critical habitat for caribou is only partially delineated by EC, and that the process is ongoing. Any changes made to the boundaries delineated in the Recovery Strategy will be considered in the development of the Final CHRP. The mitigation measures described in the EPP will be applied to the entire Project. In addition, access management measures will be implemented throughout the entire Project. The NEB Report concurs that NGTL has identified current caribou distribution in a manner consistent with the NEB Filing Manual, and that the mitigation applied to protect the Graham herd will ultimately protect the Moberly herd. The NEB noted that the Project does not overlap with the current distribution of the Moberly (Klinse-Za) caribou herd.

In addition to the regulatory policies and recovery objectives summarized above, the Preliminary CHRP considered regulatory guidelines relevant to industrial development in caribou ranges. Regulatory guidelines provide recommendations for industrial development to protect caribou habitat, avoid sensory disturbance during sensitive periods and manage human and predator access.

The recently released *A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia (Interim Guidance)* (BC MFLNRO 2014) provides recommendations for mitigating potential impacts on wildlife and wildlife habitat during the planning, development and operation of industrial projects, including pipelines.

The compendium focuses on northern BC, including the Northeast, Omineca and Skeena regions. With respect to caribou, the compendium indicates that threats to caribou are similar across ecotypes and are primarily changes to predator–prey dynamics and sensory disturbance during critical periods (late winter when cows are in their poorest physical condition and spring during calving and rearing). To address these threats, the identified management objectives of the compendium include maintaining the functional integrity of important habitats, avoiding or minimizing disturbance to caribou, and avoiding or minimizing an increase in predation risk. To meet these objectives, the compendium identifies 11 points of guidance:

1. Identify caribou habitat and historic and current caribou use of those habitats within the proposed project footprint and its area of influence.
2. Identify caribou indicators (e.g., habitat use and characteristics, population structure and dynamics, etc.) within the project area by caribou ecotype.
3. Identify the impacts of proposed activities on caribou and caribou habitat.
4. Avoid or minimize new disturbance to caribou habitat and the loss of important habitats.
5. Avoid increasing the density of linear disturbances within or in proximity to caribou habitat.
6. Avoid displacing caribou and minimize direct and indirect mortality on caribou populations.
7. Avoid increasing the predation risk for caribou populations.
8. Avoid contaminating caribou habitat.
9. Restore habitats to a condition that provides a similar level of functional caribou habitat as before any industrial activity took place.
10. Develop a monitoring and adaptive management plan to monitor effectiveness of measures to avoid, minimize and restore.
11. Risk timing windows for caribou.

The previously released *Compendium of Northern Woodland Caribou Forestry Guidelines in British Columbia* (Cichowski 2005) contains information on northern caribou, as well as a review of existing management strategies. Over 100 documents were reviewed, including provincial strategies and relevant Land and Resource Management Plans.

Management strategies were grouped into several categories, including:

- landscape level (direction on how an entire caribou range will be managed with respect to spatial and temporal disturbance and associated activities; landscape level strategies are consistent across caribou herds)
- stand level (direction on how industrial activities will be conducted in caribou range, with a focus on managing forage lichens; stand level strategies vary by caribou herd)
- access strategies (direction on how to avoid and minimize impacts from increased access and development of linear corridors, with an emphasis on road planning)
- oil and gas and mining strategies (focus on low impact methods for exploration, restoration of disturbed habitat and minimizing the creation of movement barriers)
- caribou population/monitoring strategies (complement caribou habitat strategies, and suggest further research)

The *Compendium of Northern Woodland Caribou Forestry Guidelines in British Columbia* (Cichowski 2005) refers to the *1996/97 Operating Guidelines for Industrial Activity in Caribou Ranges in West Central Alberta* (Alberta West Central Standing Committee 1996). The Operating Guidelines are for the West Central Alberta caribou ranges, including both mountain and boreal ecotype caribou. The main concerns addressed by the Operating Guidelines are public access routes, predation rates on caribou, caribou habitat availability and quality, and displacing or causing sensory disturbance to caribou. The strategy to address these concerns includes managing short- and long-term impacts of access, applying an “early in/early out” construction schedule, and identifying and providing an adequate supply of quality habitat.

The BC Oil and Gas Commission ([BC OGC] 2013) *Environmental Protection and Management Guide* provides information on the requirements of the Environmental Protection and Management Regulation. The guide provides timing windows for northern and boreal caribou, including:

- low risk (activities should be scheduled during these times, where ground conditions permit)
- cautionary (operations may proceed, subject to BC OGC review; recommend avoidance of intensive activities and additional mitigation measures might be required)
- critical (most activities are restricted during this time; if working within the timing window is unavoidable, operations must be accompanied by a rationale and mitigation and/or monitoring plans, subject to BC OGC approval)

### 8.3 MOUNTAIN CARIBOU ECOLOGY

As previously mentioned, both the Graham and Pink Mountain herds are provincially designated northern ecotype caribou (BC MOE 2010) – the Graham herd is part of the Southern Mountain Population and the Pink Mountain herd is part of the Northern Mountain Population (EC 2015). Mountain caribou are found in west-central and northern BC, where they span two National Ecological Areas: the Southern Mountain National Ecological Area (SMNEA) and the Northern Mountain National Ecological Area (NMNEA) (BC MFLNRO 2014). The Pink Mountain herd belongs to the NMNEA and the Pink Mountain herd is in the SMNEA. Northern ecotype caribou use terrestrial lichens as a primary food source in winter and overwinter either in low-elevation pine–lichen stands or at high elevation on windswept alpine ridges (BC MFLNRO 2014). Mountain caribou typically calve at high elevations, often migrating over large distances to open subalpine ridges where they maintain a spatial separation from predators, primarily wolves (BC MFLNRO 2014).

#### 8.3.1 Graham Caribou

In 2009 the population estimate for the Graham caribou herd was 708 individuals (EC 2014). There is low confidence in this estimate, and BC MFLNRO has scheduled a census for winter 2015 (Seip pers. comm.). EC (2014) currently considers the population to be stable and BC MOE (2014) considers it to be decreasing in the short term by. However, the long-term population trend is unknown (EC 2014). The seasonal habitat use and movement patterns of the Graham caribou herd are variable and largely dependent on snow conditions (e.g., depth and density) (Backmeyer 2000; Culling et al. 2005). Graham caribou use upland coniferous forests from 1,200 m to 1,600 m in elevation. Preferred habitats include subalpine parkland, alpine tundra, mature and old pine forests and wetland conifer forests, while early seral, deciduous forests are often avoided (Culling et al. 2005). The Engelmann Spruce-Subalpine Fir (ESSF) and Boreal White and Black Spruce (BWBS) biogeoclimatic zones are preferred by the Graham caribou, and use of each zone varies by season (Backmeyer 2000).

The following description of Graham caribou seasonal habitat use is based on a radio-collar study (Culling et al. 2005). During the spring (early April to mid-May), Graham caribou use habitats below 1,300 m, although alpine tundra areas can be used during spring in years with higher than average snowfall. Pregnant females move to higher elevations (1,500 m) to calve in mid-May through the end of June, where they typically remain below the treeline. In summer (July through August) caribou are found in high-elevation alpine tundra and subalpine parkland, and males tend to use higher elevations (1,650 m) than females (1,550 m).

Both males and females begin to move to lower elevations (> 1,500 m) during fall (September through October), where males show a preference for spruce-fir forests and alpine tundra, and females show a preference for subalpine parkland and alpine tundra. Alpine and subalpine habitats are used during the rut. Habitat use during the early winter (November through January) is quite variable, with both alpine tundra and wetland conifer habitats being selected. This variability in habitat selection might be the result of variability in snow conditions and access to forage.

A substantial proportion of the Graham herd detected in the study selected old and mature pine forests and subalpine parkland in late winter (February through March) (Culling et al. 2005). The core winter habitat used by the Graham caribou herd is located along the eastern foothills and is lower in elevation (1,300 m) than habitats used in the summer. More variable use of habitats by the Graham herd in late winter was reported in another study, with a split between individuals using low- and high-elevation habitats (Backmeyer 2000). The federal recovery strategy for southern mountain caribou indicates that low-elevation winter range for the Northern Group (Graham herd) is characterized by low-elevation pine forests 80-250+ years in age with ground cover of terrestrial lichens (EC 2014).

In the Graham caribou herd, there are both migratory (i.e., distinct summer and winter ranges) and resident (i.e., overlapping summer and winter ranges) individuals (Backmeyer 2000, Culling et al. 2005). For the migratory individuals, the spring migration to calving areas is fairly consistent across years, whereas fall migration is more variable and dependent on weather and snow conditions (Culling et al. 2005). Graham caribou favour alpine and subalpine ridges as movement corridors (52% of point locations during migratory periods) and tend to avoid valley bottoms (Culling et al. 2005). The authors of that study speculate that the avoidance of valley bottoms might be due to long-term exposure to predation risk since the area used by the Graham herd has historically had higher moose populations than other parts of the province (Culling et al. 2005).

The annual habitat use described above is supported by the biophysical attributes for the Northern Group of southern mountain caribou, identified in the federal Recovery Strategy. Attributes of critical habitat for Northern Group caribou include low predation risk, low sensory disturbance and access to forage resources (e.g., terrestrial and arboreal lichens, forbs, grasses, sedges, horsetails, emergent vegetation), as well as mineralized soils and wetlands (mineral licks) and minimal physical obstructions (to allow movement) (EC 2014).

### **8.3.2 Pink Mountain Caribou**

In 2000, the population estimate for the Pink Mountain herd was 850 individuals and the population trend is currently unknown (EC 2012a). Information on ecology and habitat use specific to Pink Mountain caribou is limited.



Available information indicates that seasonal movements of Pink Mountain caribou are dependent on snow conditions, as they spend the summer in high-elevation alpine and subalpine habitats and move to lower-elevation coniferous forests during winter. Winter forage consists primarily of terrestrial lichen (COSEWIC 2002).

#### 8.4 THREATS AND LIMITING FACTORS

Threats to southern mountain caribou identified in the federal Recovery Strategy, in descending order of direct impact on caribou population trend, are:

- predation
- habitat alteration from industrial activities
- roads and other linear features affecting direct mortality, habitat fragmentation and predation
- recreational activities causing displacement and facilitating predator access
- natural disturbance of habitat
- hunting

Other threats of lower concern include implications of climate change, avalanches, parasites and diseases, and stress responses associated with sensory disturbance (noise and light). Although the Pink Mountain herd is not covered under the Recovery Strategy, current literature suggests that threats to the Pink Mountain herd are likely similar to those listed for southern mountain caribou.

Apparent competition was identified as the likely causal pathway for woodland caribou population declines. As primary prey species (e.g., moose, deer) increase with increasing proportions of early seral habitat on the landscape, there is a corresponding increase in the numerical response of predators (BC MOE 2013; COSEWIC 2002; EC 2014; Latham 2009; Seip and Cichowski 1996; Wittmer et al. 2005). Wolves are considered the primary predator of caribou across northern Canada and predation by wolves was the most common cause of death for adult caribou in northeast Alberta (McLoughlin et al. 2003). Black bear could also be a common predator of caribou (Rettie and Messier 1998; Zager and Beechman 2006). Increases in predator numbers subject caribou to unsustainable levels of predation, causing population decline (Wittmer et al. 2005). Predator densities capable of causing caribou declines are usually sustained by abundant alternate prey sources, such as moose or white-tailed deer (COSEWIC 2002; Peters et al. 2013; Wittmer et al. 2005).

Predation on caribou is thought to be largely incidental, given the low densities of woodland caribou compared with much more abundant prey species (Wittmer et al. 2005).

The primary selection of peatlands and old-growth forest by caribou and the non-use of, or lack of positive habitat selection, for these areas by moose, wolves (Rettie and Messier 2000) and black bears (Latham et al. 2011) was determined to result in spatial separation (James et al. 2004). This strategy is believed to be used to combat the widespread influence that wolves have in an ecosystem (e.g., Ripple and Beschta 2004; Ripple et al. 2014). Removal or alteration of habitat (e.g., forest harvesting [McCutchen 2007]) can also reduce the spatial separation between caribou and primary prey (i.e., moose). Following forest harvest, moose and woodland caribou were more likely to use the same habitat, and woodland caribou suffered higher rates of wolf predation (Peters et al. 2013).

A recent study found that roads increased predation risk for mountain caribou, but early seral habitat and edge created by logging, power lines and wildfire did not (Apps et al. 2013). The study showed that with the exception of roads, early seral/edge habitats influence caribou predation risk less than habitat variables such as elevation, terrain conditions (i.e., complexity, slope) and variation in canopy cover (Apps et al. 2013). Vulnerability to predation for mountain caribou increases as they move to lower-elevation habitats that are selected by primary prey (i.e., moose and deer) regardless of habitat disturbance on the landscape (Apps et al. 2013).

Vulnerability has also been shown to increase in rugged terrain and narrow valleys rather than wide valleys or plateau areas (Apps et al. 2013). This suggests that aside from roads, the functional response of predators to habitat changes in the landscape is less relevant than the population-level numerical response of predators to their primary prey (Apps et al. 2013).

Similarly, the ultimate cost to caribou habitat suitability appears lower for linear feature-induced changes compared with forestry-induced (i.e., cutblocks) changes (DeCesare et al. 2012). Linear feature-induced changes have been previously linked to changes in predator functional response (predator kill rate) while forestry-induced changes have been previously linked to changes in predator numerical response (predator density). Evidence shows scale-dependent variation in caribou resource selection, where habitat selection at the population and individual seasonal home range scale is affected by forestry cutblocks (DeCesare et al. 2012), which are linked to increased predator densities (Latham et al. 2011). Conversely, caribou distribution is shown to be strongly influenced by linear disturbance at the finer (location level) scale (DeCesare et al. 2012). Over the long term, managing timber harvest practices in the winter ranges of early seral ungulates to reduce the continuous production of early seral habitat might have the most influential impact on recovery and sustainability of caribou populations (Apps et al. 2013).

Although landscape-scale habitat characteristics that influence ungulate and predator densities might have the greatest impact on caribou population sustainability and recovery (Apps et al. 2013), the influence of anthropogenic linear feature density on predation rates is an important factor for caribou mortality (Whittington et al. 2011).

Linear corridors provide improved access for predators such as wolves. Several studies have found that linear corridors are attractive to bears (McKay et al. 2014) and especially wolves as easy travel routes (James 1999; James and Stuart-Smith 2000; Stuart-Smith et al. 1997; Thurber et al. 1994; Whittington et al. 2011). As a result, linear disturbances might influence predator/prey dynamics (Bergerud et al. 1984; Edmonds and Bloomfield 1984; Rohner and Kuzyk 2000).

Wolves travel faster along linear disturbances (James 1999; McKenzie et al. 2012) and encounter rates between wolves and caribou have been shown to increase near linear features (Whittington et al. 2011). Furthermore, it is suggested that while wolves increase movement rates on linear disturbance features, their movement rates in close proximity to disturbance features decreases, implying behaviours closely associated with prey searching and hunting (Ehlers et al. 2014). However, modelling the dynamic use of the landscape by wolves, primary prey (moose) and caribou showed that wolves experience no additional advantage accessing caribou from linear features, although they do benefit in accessing primary prey species (McCutchen 2007). This is supported by a study that found that kill sites were no closer to linear features than random (Latham et al. 2011).

Caribou are sensitive to direct and indirect anthropogenic disturbance (e.g., industrial activity [Dyer et al. 2001, 2002]) and habitat alteration (e.g., forestry [Peters et al. 2013]), in addition to natural disturbance such as burns (Schaefer and Pruitt 1991). Specific to linear corridors, long-term reduction in habitat effectiveness adjacent to linear features might occur as caribou have been shown to partially avoid habitats near ROWs (Dyer 1999, Oberg 2001). This avoidance of habitat near linear disturbances, well sites, facilities and cutblocks leads to indirect habitat loss through reduced habitat effectiveness for caribou (Dyer et al. 2001), and is often referred to as a zone of influence. Methods and study populations vary between sources that demonstrate caribou avoidance of disturbances by varying distances: 70 m (seismic lines and maintained trails [DeCesare et al. 2012]), 250 m (roads and seismic lines [Dyer et al. 2001]) and 1,000 m (industrial developments such as well sites [Dyer et al. 2001]).

By calculating the spatial difference between potential and realized habitat, a study of northern mountain caribou in BC estimated that as a result of avoidance of the cumulative zone of influence around multiple developments, approximately 8% of high-quality habitat was indirectly lost in the study area in winter and 2% in summer (Polfus et al. 2011).

Despite an apparent reduction in habitat use in proximity to disturbance, studies have concluded that pipelines do not create a movement barrier to boreal caribou (Joint Pipeline Office 1999; Carruthers and Jakimchuk 1987 in Dyer et al. 2002), except where they parallel roads with traffic (Curatolo and Murphy 1986 in Dyer et al. 2002).

The federal Recovery Strategy for southern mountain caribou defines disturbance to critical habitat as the area affected by natural disturbances such as fire and avalanches or by human-caused disturbance, including a 500-m buffer around anthropogenic disturbance to account for avoidance by caribou (EC 2014). Critical habitat for southern mountain caribou is identified as all of the area of high-elevation winter and/or summer range; within the Northern and Central Groups that contain low-elevation winter range, a perpetual state of a minimum of 65% undisturbed habitat; and a matrix range that provides an overall ecological condition that will allow for low predation risk (EC 2014).

The Recovery Strategy considers at this time that “very minimal disturbance” for high-elevation winter and/or summer ranges is required for achieving recovery of local population units in all of the southern mountain caribou groups. For the Northern Group of southern mountain caribou (including the Graham herd), the federal Recovery Strategy identifies a minimum of 65% undisturbed habitat as a reference disturbance level for low-elevation winter ranges and Type 1 matrix range (EC 2014).

The threshold of 65% undisturbed habitat is derived from population response models developed for boreal woodland caribou ranges (EC 2011, 2012b), which, like the low-elevation and Type 1 matrix range for Northern Group southern mountain caribou, consist of fire-adapted ecosystems. The 65% threshold might be revisited on completion of studies to determine appropriate disturbance thresholds specific to low-elevation and Type 1 matrix range, or evidence that indicates the disturbance level is not supporting recovery of a caribou local population unit. Additional studies are needed to determine disturbance thresholds that will achieve recovery objectives for high-elevation ranges (EC 2014).

Until such thresholds are identified, disturbance in high-elevation ranges should be minimized and mitigated (EC 2014). In addition, maintaining functional Type 2 matrix range (outside the local population unit boundaries) is an essential component of recovery of southern mountain caribou local population units to self-sustaining levels (EC 2014). The habitat condition of Type 2 matrix habitat that is necessary for caribou recovery is identified as a wolf density of less than 3 wolves/1,000 km<sup>2</sup>. This target might be achieved through management of habitat disturbance levels or management of primary prey and predator abundance (EC 2014).

Woodland caribou populations are very low in many areas and, therefore, populations might not rebound due to increasing rates of inbreeding and other, well-defined detrimental effects of genetic drift that are characteristic of small, genetically isolated populations (Bijlsma et al. 2000; Frankham 2005; Hedrick and Kalinowski 2000; Keller and Waller 2002). This phenomenon, known as the Allee effect, was recently suggested to occur in the boreal population of woodland caribou in Alberta (Hervieux et al. 2013; Serrouya et al. 2012) and potentially to occur in the Southern Mountain population of woodland caribou (Wittmer et al. 2005).

## **8.5 CARIBOU RECOVERY AND HABITAT RESTORATION**

Restoration of disturbed habitat has become one of the key components for caribou conservation identified through the federal Recovery Strategy (EC 2012a, 2014) and in provincial mountain caribou recovery planning (BC MOE 2013). This section summarizes information from habitat restoration guidelines, previous caribou habitat restoration initiatives and published research. Information on restoration methods employed and effectiveness or success of restoration is included, where available.

Results of the literature review provide habitat restoration information specific to mountain caribou ranges. However, given the limited availability of literature specific to mountain caribou ranges, relevant literature from research and restoration initiatives in boreal woodland caribou range is included. This section is supplemented with further information specific to restoration initiatives completed in boreal woodland caribou range (Appendix A), which was considered as context within which to develop this Preliminary CHRP. This is supported by similarities in ecological characteristics, restoration objectives and silvicultural practices between the Project area in northern BC and boreal caribou ranges in Alberta where additional documentation for habitat restoration initiatives is available.

Both boreal and mountain woodland caribou require undisturbed habitats with mature and old coniferous forest, and lichen forage opportunities (EC 2012b, 2014). While there are similarities among these habitat requirements, mountain caribou are distinguished from boreal woodland caribou by seasonal migrations between low-elevation and high-elevation ranges (Heard and Vagt 1998; Spalding 2000; EC 2014). See Section 8.3 for further description of northern ecotype, mountain caribou ecology. In contrast, boreal woodland caribou inhabit boreal landscapes where terrain is lacking high-elevation features, and elevational migration between seasonal habitats does not occur. Despite differences in seasonal movements and habitat use between mountain and boreal woodland caribou, there is overlap in habitat types that occur in some northern ecotype mountain caribou ranges and boreal woodland caribou ranges.

The Project area in the Graham and Pink Mountain caribou ranges is mostly located in the transitional area between the Subboreal Interior and the Boreal Plains ecoprovinces of BC, east of the Rocky Mountains (Demarchi 2011). This area corresponds to the western fringe of the Boreal Plains Ecozone of Canada, which extends across the boreal region of western Canada (Smith and Marshall 1995) and overlaps many of the boreal woodland caribou ranges in western Canada. The northern part of the Kahta Section is characterized by a mosaic of forested (predominantly coniferous) wetlands and upland habitats, not unlike those in boreal regions. The rolling terrain along the Aitken Creek Section in the Graham caribou range is characterized by upland conifer and deciduous forests, with relatively little forested wetlands. The similarities in habitats between the Graham and Pink Mountain caribou ranges encountered by the Project and those encountered in some boreal woodland caribou ranges where habitat restoration is better understood, supports transfer of habitat restoration information between the regions.

The effects of linear developments are similar across caribou range, regardless of the caribou ecotype. Effects of linear disturbance on woodland caribou associated with loss of suitable old forest habitat features (e.g., loss of forage and cover habitat) is considered of lower consequence than indirect effects, due to the relatively small impact of clearing narrow linear features when considered in proportion to habitat availability at the range scale. The effects associated with regenerating early seral habitats and access, and the potential resultant indirect changes in predator–prey dynamics, similarly affect mountain and boreal woodland caribou.

The focus of mitigation and habitat restoration applied in boreal and mountain caribou ranges are similar. Namely, the objectives of habitat restoration initiatives include re-establishing natural vegetation communities that do not encourage highly palatable forage for primary prey, blocking motorized access to facilitate vegetation establishment and growth and limiting sightlines. When successfully implemented, these measures are expected to reduce residual effects of linear developments associated with predation risk. Given the similar objectives for caribou habitat restoration in boreal and mountain caribou ranges, similar measures are applied to restore habitat within linear disturbances, including silvicultural methods to establish vegetation (e.g., site preparation techniques and planting or seeding native vegetation) and measures to block access and line-of-sight.

#### **8.5.1 Guidelines Relevant to Habitat Restoration in Mountain Caribou Range**

*A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia (Interim Guidance)* (BC MFLNRO 2014) provides guidelines for habitat restoration in caribou range. The main objectives for habitat restoration are to restore habitats to a similar functional level as before disturbance and to develop monitoring and adaptive management plans to monitor the effectiveness of restoration measures.

This compendium provides a list of recommendations to achieve these objectives, as follows:

- restore habitat as soon as possible following development
- deactivate and restore linear features as soon as possible following development
- limit attracting predators and early-seral ungulates to the development area
- explore opportunities to restore areas not directly affected by development activities
- prevent the establishment and spread of invasive species
- develop monitoring plans to ensure that mitigation measures are implemented as planned and are effective at meeting measurable targets
- align the type and degree of monitoring with the degree of risk to caribou and the uncertainty around mitigation measures
- ensure that monitoring plans are planned and implemented by a qualified professional with knowledge of caribou ecology
- share all data with provincial regulatory agencies to facilitate future mitigation and caribou management
- ensure that monitoring plans include changes over time, a before-and-after control study design, habitat modelling and adaptive management

*A Compendium of Northern Caribou Winter Range Management Guidelines and Strategies in British Columbia* was prepared for the BC Ministry of Water, Land and Air Protection (MWLAP) in 2005 (Cichowski 2005). This report targets the northern caribou ecotype, which consists of both the Graham and Pink Mountain herds, along with 29 other herds. This compendium summarizes provincial strategies, guidelines and recommendations for management and recovery of northern caribou at landscape and stand-level scales, including strategies to address both forage and predator avoidance requirements, and management concerns specific to seasonal habitats.

Limiting disturbance and exposure to predators is identified as a key consideration for summer and calving habitat, high-elevation and low-elevation winter habitat, as well as matrix habitat (Cichowski 2005). This compendium states linear corridor development and access associated with industrial activities is one of the major threats to northern caribou, so considerable effort was put into developing linear corridor and access management strategies. The identified strategies include avoiding road development to alpine and subalpine habitats, on eskers, on south slopes or through travel/connectivity corridors, and avoiding extended sightlines (Cichowski 2005).

Numerous strategies related to road planning, construction and decommissioning are summarized in this compendium. Many of these strategies are relevant to pipeline construction and operation, and are adopted as industry best management practices, including:

- planning access development to minimize disturbance footprint
- coordinating shared access
- using temporary access
- decommissioning access as soon as site conditions and timing restrictions allow following construction
- implementing measures to reduce lines-of-sight (e.g., bends, retaining vegetation screens)
- reclaiming linear corridors
- minimizing snow plowing
- implementing access prevention measures
- timing restrictions

The *Ecological Restoration Guidelines for British Columbia* (BC MWLAP n.d.) provide guidance on how to plan a restoration program. This guidance includes establishing goals and objectives, effective monitoring programs and restoration priorities. The guidelines provide recommendations on issues to consider, such as planting prescriptions, species at risk, soil rehabilitation, slope instability and bioengineering. However, recommendations for specific mitigation measures that are best suited for specific habitat types are not provided.

The BC OGC (2013) recommends using Land Resource Management Plans and Sustainable Resource Management Plans as guidelines for end land use goals. The forestry industry guidebooks prepared under the BC *Forest and Range Practices Act* (previously *Forest Practices Code of British Columbia Act*) provide valuable information for silvicultural practices and techniques that are commonly used to restore vegetation in disturbed sites. Guidebooks reviewed for relevant information to support caribou habitat restoration planning for the Project include *Soil Rehabilitation Guidebook* (BC MOF 1997) and *Establishment to Free Growing Guidebook Prince George Forest Region* (BC MOF 2000). These guidebooks provide information relevant to mechanical site preparation for creating suitable microsite conditions for seedling establishment, seedling planting, stocking standards and species. This information is incorporated in the post-construction habitat restoration information provided in this Preliminary CHRP, including specifications and targets.



Although not directly intended for northern or mountain ecotype caribou ranges, the *Boreal Caribou Habitat Restoration Operational Toolkit for British Columbia* (Golder 2015), prepared under the SCEK Fund, provides a review of restoration tools for caribou habitat restoration that can be applied to caribou ranges for other ecotypes. Access management (human and predator) and recovery of natural vegetation are the stated objectives for caribou habitat restoration in the toolkit, which identifies mechanical site preparation (mounding or ripping), tree/shrub planting, spreading woody material, tree felling/bending and installing fences as restoration techniques to be considered for boreal caribou habitat restoration in BC. Until further information for habitat restoration in northern and mountain caribou ecotypes has been collected through monitoring of implemented restoration programs, much of the information available for caribou habitat restoration comes from restoration initiatives in boreal caribou ranges of Alberta.

Provincial guidance for restoration of wetlands was reviewed, because treed wetland habitat types occur along much of the Kahta Section in caribou range. These habitat types are known to naturally have very slow rates of vegetation establishment and growth, making tree seedling establishment and growth in the short- to medium term unpredictable. There is currently no overarching provincial policy for wetlands or wetland restoration in BC, although the *Forest Practices Code* protects wetlands on Crown land and the Ministry of Transportation has a no net loss of wetland policy (Wetland Stewardship Partnership 2010). While wetland restoration is a primary focus of the *Wetlands Action Plan*, no guidelines or recommendations are provided for restoration (Wetland Stewardship Partnership 2010).

## **8.6 VEGETATION REESTABLISHMENT**

Restoration of disturbed habitat has become one of the key components for caribou conservation. This section summarizes information from habitat restoration guidelines, previous caribou habitat restoration initiatives and published research. Information on restoration methods employed and effectiveness or success of restoration is included.

### **8.6.1 Tree Planting and Natural Regeneration**

Recent research has shown positive results for establishing native vegetation on seismic lines and other linear features using techniques such as planting tree and shrub seedlings, and site preparation to create microsite conditions (i.e., silvicultural methods) that are conducive to both planted seedling growth and natural vegetation encroachment (CRRP 2007b; COSIA 2012). Measures such as rollback can address site condition issues, including competition from non-target or undesired plant species, erosion, frost, and heat or moisture deficiencies (CRRP 2007b).

These methods are consistent with the approach adopted by NGTL in previous CHRPs, and in the recommended measures summarized in the *Boreal Caribou Habitat Restoration Operational Toolkit for British Columbia* (Golder 2015).

Natural revegetation and successful planting initiatives benefit from construction practices that minimize disturbance during development of the footprint. Minimum disturbance pipeline construction techniques that avoid grubbing and grading are effective at facilitating rapid regeneration of native vegetation within the ROW, in areas with a deciduous vegetation component (TERA 2011a,b, 2012). Implementation of minimum disturbance construction can be limited by such factors as terrain that requires grading, ground conditions (e.g., non-frozen soils) and construction methods (e.g., crossings of third-party dispositions).

A trial natural revegetation response inventory program in west-central Alberta reported that 85% of disturbed sites did not require artificial recovery, since a natural recovery projection was observed on previously disturbed sites (CRRP 2007c). Although regenerating conifers provide a better visual barrier, the faster growth rates of deciduous species provides for effective results more quickly (Diversified Environmental Services [DES] 2004). Recent research suggests that planting shrubs along with trees allows trees to grow healthier, faster and with less competition for nutrients and water from fast-growing grasses (COSIA 2012). It might also provide important habitat benefits for wildlife, compared with only planting tree seedlings, by providing hiding cover (Bayne et al. 2011).

Conventional seismic lines have been reported to have very slow reforestation rates (Revel et al. 1984; Osko and MacFarlane 2000), and recovery is strongly influenced by the characteristics of the adjacent forests (e.g., site productivity, tree and shrub species and heights) (Bayne et al. 2011). Conventional seismic lines cleared by bulldozer can take as long as 112 years to reach 95% recovery to woody vegetation in the absence of restoration efforts (Lee and Boutin 2006). Slow tree regeneration was attributed to root damage from the original disturbance, compaction of the soil in tire ruts, insufficient light reaching the forest floor, maintenance of apical dominance from surrounding stands, introduction of competitive species (i.e., planted seed mixes), drainage of sites (i.e., regeneration slowest on poorly drained sites with low nutrient availability such as bogs) and repeated disturbances (e.g., ATVs, animal browsing, repeated exploration) on seismic lines (Revel et al. 1984; MacFarlane 1999, 2003; Sherrington 2003; Lee and Boutin 2006).

Since tree regeneration on seismic lines is a key determinant of recovery success (MacFarlane 2003), factors that hinder revegetation efforts should be mitigated. Drawing parallels between regeneration success on seismic lines and pipeline ROWs should be done with caution.

Restoration success on seismic lines might not be comparable to that of pipeline ROWs given differences in disturbance mechanisms, degree of soil and vegetation disturbance, reclamation practices and width of the features (i.e., the wider openings of ROWs allow more light and insolation than narrow seismic lines, which might facilitate better vegetation regrowth).

At the 15th North American Caribou Conference (2014), positive scientific evidence was presented on winter tree planting and mechanically bending live trees into the ROW as emerging mitigation options for seismic lines in the oil sands region of Alberta. Tree bending could be particularly promising as it promotes natural revegetation by increasing cone deposition on the disturbance footprint and creating microsites through shading and dropped dead woody debris. These mitigation measures, however, have only initially been evaluated and their full utility remains unknown. Furthermore, these techniques were applied only on seismic lines, which are considerably narrower than pipeline ROWs and do not require continued operational activities, as do pipelines.

#### **8.6.2 Transplanting and Seeding**

Transplanting native vegetation appears to be difficult to implement on a large scale as part of a habitat restoration program for the following reasons (Golder 2012a):

- inconsistent availability of vegetation suitable for transplant;
- potential for degradation of neighbouring vegetation communities if transplants are sourced from adjacent stands
- transplanting programs often result in the storage of plant materials under less-than-ideal conditions due to uncontrollable factors (i.e., weather), which can reduce their viability
- other treatments, such as seeding and seedling planting, have been shown to be more successful in comparison

An alternative to salvage and transplanting vegetation is to seed disturbed areas using seed collected from the same geographic region as the restoration project. Broadcasting seed either aerially or using ground methods (by hand or mechanically) is also an option. However, since pipeline ROWs are relatively narrow openings (compared with cutblocks, for example), sufficient natural seed ingress from the adjacent undisturbed habitat can facilitate natural recovery without additional seed application. Logistically, the feasibility of seeding can be constrained where the reclamation project is a substantial distance from an airport or airfield (i.e., for aerial seeding), or where ground access during non-frozen conditions is restricted by wet soils. Furthermore, direct seeding of conifers is not a preferred reforestation technique, partly due to problems with seed predation (BC MOF 1997).

Transplanting or seeding lichen species has many of the same challenges as transplanting or seeding vascular plants. In addition, conditions required for successful establishment of terrestrial lichens may be limited along pipeline ROWs (e.g., adequate amounts of shade) or are not compatible with other habitat restoration measures or access management measures (e.g., presence of woody debris) (Gough 2010; Miede et al. 2001). The costs associated with lichen collection might be prohibitive (Roturier et al. 2007). Few studies have determined the effectiveness of lichen transplantation or seeding, and these have focused on regenerating cutblocks (Gough 2010; Roturier et al. 2007). Further studies are required before applying this method on a larger scale (Roturier et al. 2007).

## **8.7 EFFECTS OF HUMAN USE ON RESTORATION**

The ability of linear features to recover to a natural forested state is affected considerably by human use. In the Little Smoky caribou range, seismic lines that were allowed to revegetate naturally achieved an average height of 2 m across all ecosite types within 20 to 25 years, when they had not been recently disturbed by human activity such as re-clearing to ground level for winter access or seismic program use (Golder 2009). The average age of trees on linear disturbances that were repeatedly disturbed was only 10 years, and the trees achieved an average height of less than or equal to 0.5 m. These results suggest that sites that are continually disturbed or re-cleared by human activity take longer to regenerate. Restoration efforts have also failed when ATVs destroyed seedlings after planting (Enbridge 2010; Golder 2011, 2012b). The effect of repeated motorized access on vegetation establishment and regrowth supports the use of access management tools to enhance restoration success.

Subjective expert ratings suggest that the effectiveness of most physical access management measures (e.g., berms, excavations, rollback, visual screening) varies considerably between negligible and high effectiveness in managing human access (Golder 2007). Effectiveness of access management measures depends on suitable placement (e.g., placed to prevent detouring around an access management point), enforcement, and public education of the intent of the access management (AXYS Environmental Consulting Ltd. [AXYS] 1995). Public education (e.g., signs) facilitates respect for the purpose of, and compliance with, access management measures.

Mounding has been found to deter human access (i.e., truck and ATV) during snow-free periods and also creates microsites that improve vegetation establishment (review in Golder 2007). Excavator mounding is a well-researched and popular site-preparation technique in the silviculture industry (Macadam and Bedford 1998; Roy et al. 1999; MacIsaac et al. 2004). Target density of mounding for access management and/or microsite creation purposes can vary from 1,400 to 2,000 mounds/ha (Golder 2012a, 2015).

These mound densities, however, relate to restoring seismic lines that were not frozen-in to allow heavy equipment access. Given the challenges of the wet conditions and frost requirements for accessing the Project footprint (i.e., freezing-in the peat for access can make it difficult to excavate small mounds), the size of mounds potentially could be substantially larger than mounds achieved on previous seismic line restoration projects. Furthermore, mounds cannot be excavated within 5 m of the operating pipeline, which reduces the mound density relative to disturbances that do not have similar restrictions. As a result, the mound density that can realistically be achieved in pipeline ROWs is lower.

Human access on open and closed (i.e., gated, barriered and recontoured) roads was monitored using remote cameras (Switalski and Nelson 2011). That study found that the frequency of detection of humans on closed roads was significantly lower than on open roads, but not significantly different among road closure types. The monitoring results also indicated significantly higher levels of hiding cover and lower line-of-sight distances on barriered and recontoured roads compared to open roads (Switalski and Nelson 2011). A similar study investigated the effectiveness of different approaches (i.e., year-round closure, seasonal closure, deactivation, and deactivation and closure) at limiting motorized vehicle traffic on unpaved roads designed to support forestry operations (i.e., resource roads) (Hunt and Hupf 2014). Results demonstrated that closure and/or deactivation approaches significantly reduced traffic on resource roads (about 78%), with year-round closure being the least effective, whereas seasonal (i.e., hunting) closure was among the most effective approaches (Hunt and Hupf 2014). The effectiveness of different approaches did not depend on road quality (Hunt and Hupf 2014). Physical access management measures provide short-term solutions to manage access and allow for natural regeneration (Golder 2009). Once linear features have regenerated to a pole sapling or young forest structural stage, they no longer facilitate ATV access (Sherrington 2003).

The techniques described above to block human access also contribute to achieving sufficient revegetation to block line-of-sight. Short term management for access and line-of-sight blocking should ultimately lead to long-term access management by way of revegetation of disturbed areas (Golder 2007). Expediting growth of visual barriers along linear features can be achieved by concentrating restoration efforts on productive upland habitats, as woody vegetation species grow more quickly on these sites compared with lowland sites. Although regeneration of conifer species provides the best year-round visual barrier, their growth can be slow. Using combined plantings of conifer and fast-growing deciduous woody species in small areas (e.g., narrow strips of plantings across the ROW) can establish visual barriers in the short- to medium term, while maintaining the objective of regenerating conifer-leading vegetation in the long term.

Coarse woody material (rollback) can be effective at managing human access as well as at conserving soil moisture, moderating soil temperatures, providing nutrients as debris decomposes, limiting soil erosion, providing microsites for seed germination and protection for introduced tree seedlings (Pyper and Vinge 2012; Vinge and Pyper 2012).

Rollback is effective immediately following implementation, provided adequate material is available and properly applied. Debris should be spread evenly across the entire footprint width at a coverage/density that will not restrict ability to plant seedlings or limit planted or natural seedling growth. Where sufficient material is available, the target woody debris coverage at selected locations is 60 to 100 m<sup>3</sup>/ha on upland sites and 25 to 50 m<sup>3</sup>/ha on lowland sites, to mimic natural processes (Pyper and Vinge 2012; Vinge and Pyper 2012). Where sufficient material is available, woody debris coverage of 150 to 200 m<sup>3</sup>/ha along ROWs might be used to manage human and wildlife access (Vinge and Pyper 2012).

Storage and placement of woody debris needs to consider the presence of ladder fuels to reduce fire hazard (Pyper and Vinge 2012). Fire risk can be managed by implementing a 25 m fuel break every 250 m along linear features (Pyper and Vinge 2012). Short segments (i.e., <100 m) of rollback might be less effective at deterring human access since ATV and snowmobile riders might try to ride through the debris or traverse around it in adjacent forest stands (Vinge and Pyper 2012). Complete rollback (i.e., over an entire linear disturbance) could be used to prevent motorized access (Pyper and Vinge 2012) but availability of material is a limiting factor.

## **8.8 WILDLIFE USE OF REGENERATING LINEAR DISTURBANCE**

While there has been some effort to assess wildlife use of regenerating seismic lines (e.g., Bayne et al. 2011) and reclaimed areas in the Athabasca oil sands region (e.g., Hawkes 2011), few researchers have assessed natural habitat recovery and wildlife responses to recovery with respect to caribou.

A pilot study in the Little Smoky caribou range measured effects of revegetating linear disturbances on wildlife use and mobility (Golder 2009). Data were collected for a group of predators (i.e., cougar, wolf, coyote, lynx, grizzly and black bears) and prey (i.e., moose, deer and caribou). Results of the pilot study indicated that naturally revegetated seismic lines (i.e., minimum 1.5 m vegetation regrowth) were preferred by both predator and prey species compared with control lines (disturbed sites, cleared areas with minimal vertical cover of vegetation and vegetation regrowth of 0.5 m or less). The study also found that the control (disturbed) lines with minimal vegetation were used primarily for travel (i.e., both predators and prey species were constantly moving as opposed to standing or foraging). In addition, human use was almost exclusive to the control lines. The line-of-sight measured on the revegetating lines was typically less than 50 m long.

Moose and deer might have been attracted to the revegetated lines for forage availability and perceived cover protection (Golder 2009). The preference for regenerating seismic lines by wolves can be explained as a response to increased prey use of these lines (Golder 2009). The study also showed that caribou travelled more quickly (running more frequently) and did not engage in standing-related behaviours on control lines, whereas on revegetating lines running was rare and standing-related behaviours occurred more often.

Further to this, a study of displacement of Hart Range mountain caribou in east-central BC by snowmobiles reported that caribou were observed in all four mountain blocks (110 to 214 km<sup>2</sup>/block) of core winter range delineated for census with little or no snowmobile activity. However, during three of four census years, no caribou were observed in the only mountain block surveyed that had intensive snowmobile activity (Seip et al. 2007).

Another ongoing project in northern Alberta involving the Cold Lake boreal caribou herd is currently investigating the responses of predator and prey species to the deactivation or restoration of habitat disturbance features (McNay et al. 2014). The goal of the project is to determine how different species (wolves, bears, moose and caribou) use the landscape, and how the presence or absence of linear disturbances can influence the functional and numerical response of predators (McNay et al. 2014).

The project is still in its early stages, but preliminary results suggest among all species that seasonal and annual movements are variable with substantial overlap between the range extents of all four species. Also, in these range overlaps, were 19 instances where predator and prey could have encountered one another. Furthermore, preliminary results present 11 deaths of 94 collared animals: 2 caribou, 3 moose, 1 bear and 5 wolves. Predator kill sites were identified: 143 bear sites and 93 wolf sites. These kill sites were implicated in the deaths of 11 caribou, 22 moose and 6 deer. Ongoing data collection and processing will provide future results from scat analysis, prey body condition, habitat modelling and mapping. The project aims to address several management questions regarding the desired vegetative and spatial characteristics on the landscape to reduce caribou mortality, how silvicultural techniques and mitigation measures can be implemented to achieve these characteristics, the association between specific characteristics and predator efficiency and/or density, and when deactivated linear features can be considered to have lost their disturbance function (McNay et al. 2014). This project is associated with the RICC initiative.

Mechanically bending or felling live trees over a linear disturbance (often referred to as line-blocking, particularly when used in conjunction with other treatments such as mounding) is another potential measure that could have benefits for managing access and reducing wolf use. Trees are typically bent or felled from both sides of the linear disturbance. Tree felling entails cutting trees at the base from the edge of the linear disturbance, and allowing them to fall across the linear disturbance.

Tree bending requires mechanically bending trees from the base of the tree, partially exposing roots, so that the tree leans over the linear feature, close to the ground. Tree bending can be expensive and the process is time consuming. A preliminary assessment of tree felling along seismic lines to block access was conducted in the Little Smoky herd range in Alberta during the summer and fall of 2004 (Neufeld 2006). While results of that study showed no statistical significance between wolf use of blocked versus non-blocked seismic lines, there was an indication that wolves tended to use areas with unblocked seismic lines more often than areas with blocked seismic lines). Based on these results, it was concluded that if tree felling is to be used as a line-blocking measure, it should be investigated more thoroughly, and not relied on solely as a mitigation tool. Preferably, line-blocking should be used in combination with other management actions such as habitat restoration, and continue to be evaluated for effectiveness using an adaptive management approach.

From the 15th North American Caribou Conference (2014) some very preliminary results of linear feature blocking programs suggest that this type of mitigation can be effective at reducing wildlife use of linear features.

## **8.9 KNOWLEDGE GAPS AND LIMITATIONS OF THE LITERATURE REVIEW**

The following gaps in knowledge were identified during the literature review:

- scarcity of information on effective habitat restoration measures applicable to mountain caribou habitat
- restoration criteria (e.g., defined guidelines or measurable objectives) for restoration of mountain ecosystems for wildlife habitat values, in particular habitats that do not support merchantable timber (e.g., treed bogs and fens)
- functional responses of caribou, wolves and primary prey (e.g., moose, deer) to reclaimed habitats in various stages of successional progression, as well as to access and line of sight management
- long-term monitoring of vegetation recovery on linear disturbances and of predator response to access management measures

There is limited information available on the types and efficacy of habitat restoration techniques in mountain caribou ranges. This is compounded by the issue that results and documentation of recently initiated restoration projects are often unpublished, and proprietary information is difficult to obtain. Available information for restoration techniques in mountain caribou ranges is mostly limited to reclamation and revegetation of drastically disturbed industrial sites, in particular mines, or reforestation of commercially harvested stands.



The techniques used for these large polygonal disturbance types might not translate directly to restoration of linear developments (i.e., some modification is needed to address the different site conditions and objectives). Recommendations in the available literature specific to northern and mountain caribou ranges in BC typically include protection of high-elevation habitats and seasonal movement habitats necessary to maintain connectivity (Backmeyer 2000; Culling et al. 2005; Hatler 1986).

Results of the literature review provide habitat restoration information specific to mountain caribou ranges, where it is available. However, given the limited availability of literature specific to mountain caribou ranges, relevant literature from research and restoration initiatives in boreal woodland caribou range is included. As previously noted, this is supplemented by a table of historic and current restoration initiatives in caribou ranges that was considered as context to develop this Preliminary CHRP.

Despite differences in habitat use and forage selection between mountain and boreal woodland caribou, components of mitigation and restoration planning applied in boreal ranges is transferrable, particularly in low-elevation range and where boreal and mountain caribou have similar ecologies (e.g., fire regime, climate and biophysical attributes). This provides useful background information on restoration initiatives in caribou range and their reported successes and failures.



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## 9.2 GIS DATA AND MAPPING REFERENCES

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