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January 25, 2019

Filed Electronically

National Energy Board
Suite 210, 517 Tenth Avenue SW
Calgary, AB T2R 0A8

Attention: Ms. Sheri Young, Secretary of the Board

Dear Ms. Young:

**Re: NOVA Gas Transmission Ltd. (NGTL)
Peace River Mainline Abandonment (Project)
NEB Order ZO-N081-003-2018 (Order)
Condition 14: Revised Chinchaga Caribou Range Vegetation Restoration Plan (CRVRP)
NEB File OF-Fac-Gas-N081-2015-16 02**

On January 17, 2019, NGTL filed a revised CRVP in compliance with the National Energy Board (NEB or Board) letter dated December 11, 2018.¹

After filing the revised CRVP, NGTL noted it had inadvertently missed including minor details on additional project disturbance areas (PDAs) that were identified in NGTL's Project Update, also filed on January 17, 2019, with the Board.²

As such, NGTL is replacing the January 17, 2019, filed revised CRVP with the enclosed updated revised CRVP, in blackline to the original CRVRP, filed on May 17, 2018.³ NGTL has also provided a clean copy of the revised CRVRP.

If the Board requires additional information with respect to this filing, please contact me at (403) 920-2940 or by email at nicole_prince@transcanada.com.

Yours truly,
NOVA Gas Transmission Ltd.

Original signed by

Nicole Prince
Regulatory Analyst
Regulatory, Canadian Gas Pipelines

Enclosure

cc. Wayne Marshall, National Energy Board
Laura Harper, National Energy Board

¹ NEB Filing ID: A97396.

² NEB Filing ID: A97399.

³ NEB Filing ID: A92023.

Revised Condition 14
Chinchaga Caribou Range Vegetation Restoration Plan
Blacklined

1.0 INTRODUCTION AND ORGANIZATION

1.1 INTRODUCTION

On August 18, 2016, NOVA Gas Transmission Ltd. (NGTL), a wholly owned subsidiary of TransCanada PipeLines Limited, filed an application under section 74(1)(d) of the *National Energy Board Act* with the National Energy Board (NEB or Board) for the Peace River Mainline (PRML) Abandonment Project (the Project). The Board approved the application on March 14, 2018 in NEB Order ZO-N081-003-2018 (Order), and issued conditions of approval. Condition 14 of the Order requires NGTL to develop a Chinchaga Caribou Range Vegetation Restoration Plan (CRVRP), given that the Project partially overlaps with the Chinchaga caribou range.

On December 11, 2018 NGTL received a letter from the NEB indicating that the CRVRP, filed on May 17, 2018, needed additional information to satisfy the requirements of Condition 14 of the Order.¹ The NEB requested a revised CRVRP that includes:

- i) a summary of the consultation that occurred with the Provincial land manager during the creation of the Plan;
- ii) a detailed methodology, including the associated criteria and rationale for how the restoration locations chosen as required in part 14 (a) of the condition; and
- iii) the criteria that will be used during monitoring to evaluate the effectiveness of site restoration measures as per part 14 (d) of the condition.

NGTL has previously filed with the Board similar plans (e.g., Caribou Habitat Restoration Plans, Caribou Habitat Restoration and Offset Management Plans) for other projects requiring habitat restoration in caribou ranges.² This CRVRP is consistent with ~~these~~ those past plans, but differs from them because this Project is an end-of-life pipeline project located within an existing right-of-way (ROW) with advanced revegetation already present, and because little additional disturbance is ~~anticipated~~ needed to complete project abandonment activities.

¹ NEB Letter dated December 11, 2018 (NEB Filing ID: A96593), Chinchaga Caribou Range Vegetation Restoration Plan (NEB Filing ID: A92023) and Board Order ZO-N081-003-2018 (NEB Filing ID: A90576).

² Chinchaga Lateral Loop No. 3 Project (NEB Filing IDs: A69803, A71613, A75414), Northwest Mainline Expansion Project (NEB Filing IDs: A56798, A71613, A61246), Liege Lateral Loop 2 (Thornbury Section) and Leismer East Compressor Station Project (NEB Filing IDs: A69679, A72136, A74936-1), Leismer to Kettle River Crossover Project (NEB Filing IDs: A60689, A50823), Northwest Mainline Loop (Boundary Lake North Section) (NEB Filing ID: A88650-8), Smoky River Lateral Loop Project (NEB Filing ID: A88269).

~~NGTL consulted with Alberta Environment and Parks (AEP) on April 29, 2016 regarding the abandonment of PRML within the Chinchaga caribou range. During that discussion, AEP advised that because the Project parallels the operating NPS 30 PRML Loop pipeline for its entire length within caribou range, access management measures are unlikely to be effective until the entire shared ROW is abandoned. However, AEP requested that NGTL make efforts to install access management and/or complete other reclamation measures where it makes sense to do so (Pers. Comm. Luke Vander Vennen, Wildlife Biologist, Peace Region, April 29, 2016).~~

This CRVRP outlines NGTL's plan to restore caribou habitat within the Project ROW. This plan was developed in consideration of federal and provincial regulations, policies, and initiatives pertaining to caribou habitat restoration, and in consideration of NGTL and industry-related experience and emerging research on caribou habitat restoration. In particular, and as required by Condition 14, this CRVRP was prepared in consultation with the appropriate Provincial land manager (i.e., Alberta Environment and Parks [AEP]).

~~4.2 — Details of NGTL's consultations with AEP are provided in Section 1.3. However, NGTL notes one specific matter raised by AEP on April 29, 2016 regarding the abandonment of PRML within the Chinchaga caribou range. During that discussion, AEP advised that because the Project parallels the operating NPS 30 PRML Loop pipeline for its entire length within the caribou range, access management measures developed for the Project are unlikely to be effective until the entire shared ROW is abandoned. However, AEP requested that NGTL make efforts to install access management and/or complete other reclamation measures where it makes sense to do so (pers. comm. Luke Vander Vennen, Wildlife Biologist, Peace Region, April 29, 2016).~~

4.31.2 PROJECT DESCRIPTION

The Project is a 266 km-long pipeline, of which approximately 34 km overlaps with the Chinchaga caribou range (Figure 1-1). There are ~~nine-eleven~~ Project Disturbance Areas sites within the Chinchaga Caribou Range including ~~six-eight~~ located at near the Meikle River Compressor Station located at the north end of the Peace River Mainline Abandonment Project. The entire portion within caribou range parallels the NPS 30 NGTL PRML Loop, which is an operating natural gas pipeline. Where these pipelines overlap with the Chinchaga caribou range, they are oriented approximately north-south; the to-be-abandoned PRML NPS 20 pipeline is on the west side of the shared ROW, and the operating PRML NPS 30 Loop pipeline is on the east side of the shared ROW.

Most of the PRML pipeline will be abandoned-in-place; however, there are ~~nine~~ eleven Physical Disturbance Areas (PDAs) within the ROW and within the Chinchaga caribou range where physical abandonment activity will be required to

abandon the Project (e.g., valve removal, isolation). All physical abandonment activities within the Chinchaga caribou range will take place within the existing ROW and/or facility site boundaries. Once abandonment is complete, no further disturbance to the ROW is anticipated.

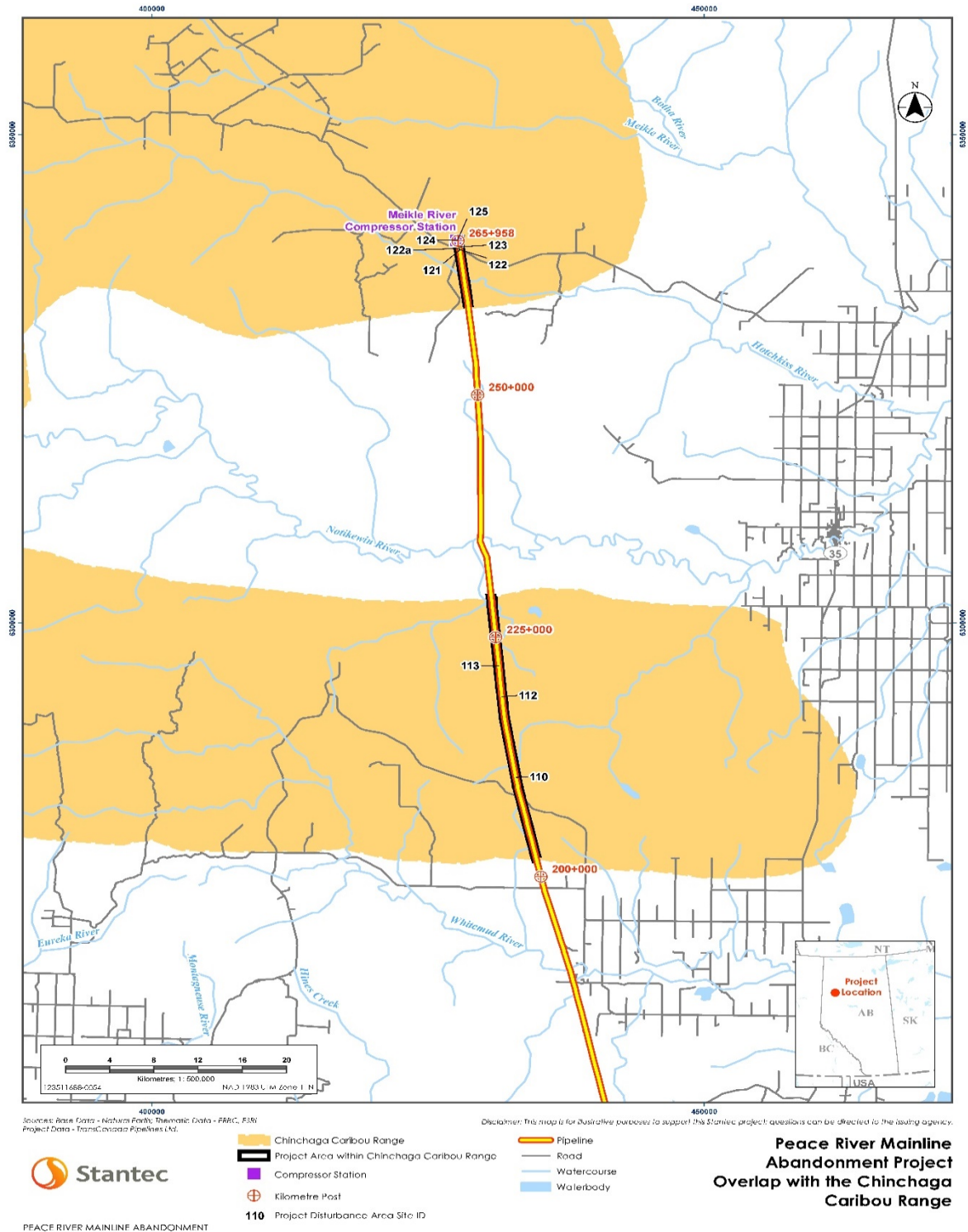


Figure 1-1: Peace River Mainline Abandonment Project Overlap with the Chinchaga Caribou Range

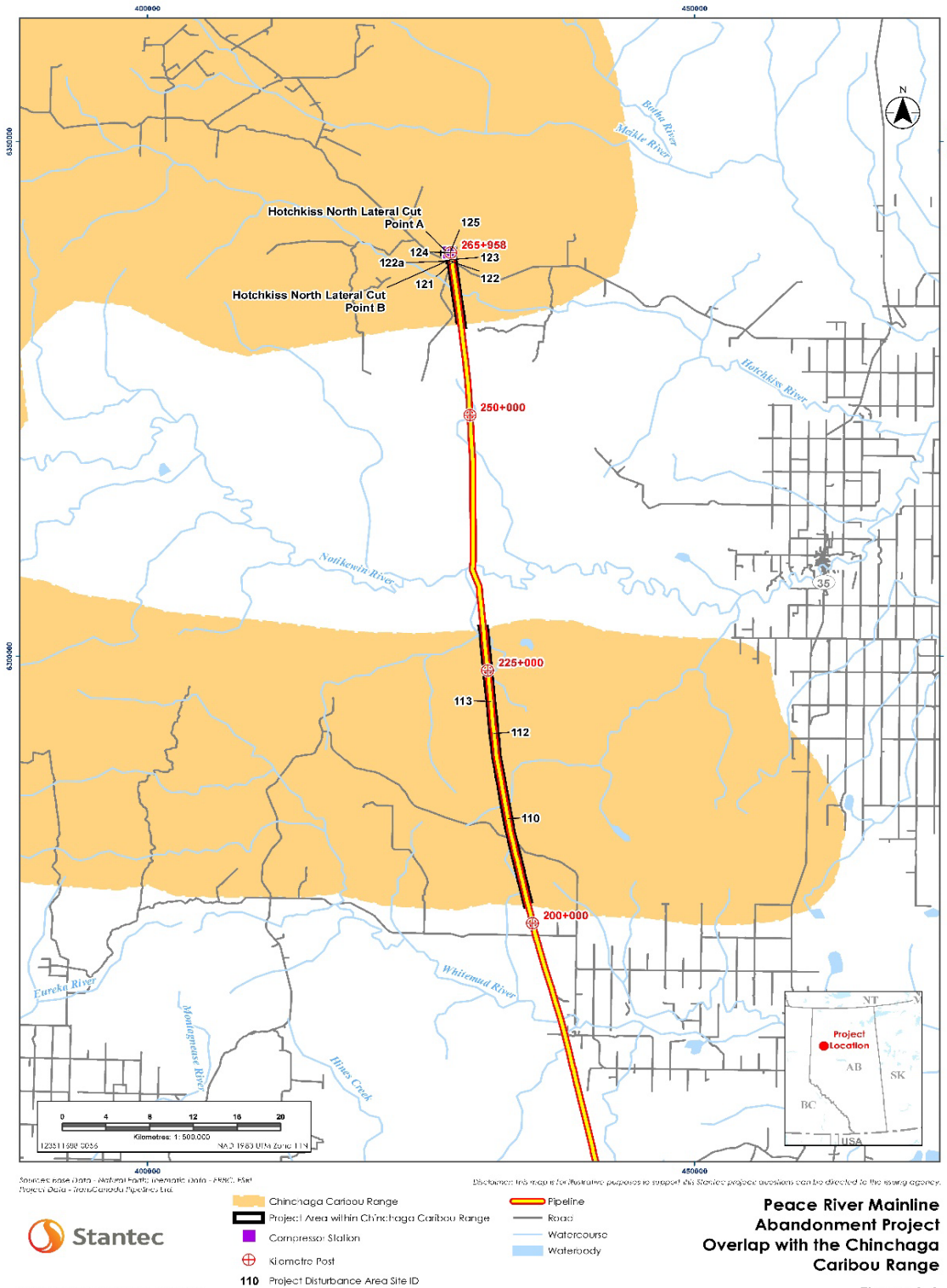


Figure 1-1: Peace River Mainline Abandonment Project Overlap with the Chinchaga Caribou Range

1.3 CONSULTATION SUMMARY

Table 1-1 provides a summary of NGTL’s consultations with the applicable regulators and Provincial land managers.

Table 1-1: Consultation Summary

<u>Date</u>	<u>Persons in Attendance</u>	<u>Discussion Items</u>
<u>November 4, 2015</u>	<u>Richard Goy, AEP, Dave Moyles, AEP, Christopher Grainger, AEP</u> <u>NGTL Representatives</u>	<u>NGTL met with AEP in Peace River Office to introduce the PRML project. NGTL asked what requirements would be for working in caribou range. AEP said that the caribou herd does winter close to the PRML line - they did not have concerns considering there is still an operating line in the ROW, if possible NGTL should restrict access to the ROW. AEP advised that they would get back to NGTL with further information about potential caribou mitigation.</u>
<u>November 10, 2015</u>	<u>Richard Goy, AEP, Dave Moyles, AEP, Christopher Grainger, AEP</u> <u>NGTL Representatives</u>	<u>NGTL sent an email to AEP as a follow up to November 4, 2015 meeting. NGTL provided the following further information: shapefile of PRML Pipeline, table summarizing preliminary physical disturbance locations, and a summary of the proposed physical disturbance locations within KWBZ and areas. NGTL requested input from AEP on mitigation and reclamation in caribou areas.</u>
<u>November 24, 2015</u>	<u>Luke Vander Vennen, AEP</u> <u>NGTL Representatives</u>	<u>AEP phoned NGTL in response to inquiries related to potential wildlife concerns related to PRML. AEP advised that they had received the information packages and had no major concerns about the project. LukeMr. Vander Vennen advised that he would be the AEP Wildlife Representative for the portion of the project north of the Peace River, and Jessica Lockhart would be the representative for the portion south of the Peace River. NGTL should make all efforts to abide by caribou and KWBZ timing constraints. NGTL asked whether there would be special restoration requirements in caribou range. AEP said they would consider the question and get back to NGTL. NGTL asked whether telemetry data could be made available to NGTL. AEP advised they would get back to NGTL on the request.</u>
<u>April 29, 2016</u>	<u>Luke Vander Vennen, AEP</u> <u>NGTL Representatives</u>	<u>AEP responded to previous emails and phone conversations about PRML within caribou range. AEP advised that the primary concern is the amount of human footprint on the landscape. Any efforts to remove industrial footprint via tree planting, closure of access, etc., can act to benefit caribou populations. AEP asked whether there are any opportunities for TransCanada to reclaim disturbed areas as part of the project. This could be done by planting seismic lines or old well pads, or by adding measures to block human access to the ROW. Otherwise, AEP did not see much opportunity for mitigation beyond standard operating conditions</u>

Table 1-1: Consultation Summary (cont'd)

<u>Date</u>	<u>Persons in Attendance</u>	<u>Discussion Items</u>
<u>April 29, 2016 (cont'd)</u>	<u>See above</u>	<u>within caribou range, including limiting human access to the area after during the restricted activity period (February 15 to July 15; Government of Alberta 2017a).</u>
<u>April 29, 2016</u>	<u>Luke Vander Vennen, AEP NGTL Representatives</u>	<u>NGTL telephoned AEP to discuss caribou mitigation for PRML on April 29, 2016. Later that day, NGTL provided an email summarizing the conversation and requesting AEP to verify that AEP's comments had been captured correctly. AEP had commented that the PRML ROW is heavily used by aboriginal and non-aboriginal hunters. AEP would prefer that the ROW be moved back towards a natural habitat type; and it would be great if NGTL could install access management measures, however, given that there will still be an operating pipeline in the ROW, AEP understood that partial access control would likely not be successful. AEP requested that NGTL abide by caribou and KWBZ timing restrictions.</u>
<u>April 29, 2016</u>	<u>Luke Vander Vennen, AEP NGTL Representatives</u>	<u>NGTL met with AEP regarding the abandonment of PRML within the Chinchaga caribou range. During this discussion, AEP advised that because the Project parallels the operating NPS 30 PRML Loop pipeline for its entire length within caribou range, access management measures are unlikely to be effective until the entire shared ROW is abandoned. AEP requested that NGTL make efforts to install access management and/or complete other reclamation measures where it makes sense to do so.</u>
<u>June 30, 2017</u>	<u>George Duffy, Caribou Range Planning Lead, AEP Dave Hervieux, Regional Resource Manager, AEP Robin Steenweg, Species at Risk Wildlife Biologist, AEP Monica Dahl, Planner, AEP Paul Grégoire, Wildlife Biologist, ECCC NGTL Representatives</u>	<u>NGTL met with ECCC and members of AEP to discuss use of existing ROWs for restoration and offset measures. ECCC supported this approach and locating offsets within existing caribou ranges.</u>
<u>July 18, 2018</u>	<u>George Duffy, Caribou Range Planning Lead, AEP Chad Wilms, Manager - Caribou Range Planning, AEP NGTL Representatives</u>	<u>General consultation on TransCanada caribou program, AEP caribou range planning priorities, and habitat restoration objectives.</u>
<u>October 10, 2018</u>	<u>Brian Makowecki, Executive Director, Planning, AEP Craig Dockrill, Director, Caribou Range Planning, AEP George Duffy, Caribou Range Planning Lead, AEP NGTL Representatives</u>	<u>Meeting to discuss general habitat restoration approaches on pipeline ROWs, vegetation management, and objectives of habitat restoration on pipelines.</u>

1.4 SCOPE

This CRVRP was developed to satisfy the first portion of Condition 14(a) through (d) of the first letter set of the Order that states:

NGTL shall file with the Board for approval, at least 60 days prior to commencing Physical Abandonment Activities, a Chinchaga Caribou Range Vegetation Restoration Plan (Plan), created in consultation with the appropriate Provincial land manager. The goal of the Plan is to apply active restoration techniques to further the relative succession of vegetation regeneration and enhance caribou habitat attributes, where possible, along the Project right of way (ROW) within the Chinchaga Caribou Range. The Plan shall include the following:

- a) a detailed methodology, including quantitative or measurable criteria and their rationale, to identify locations for active vegetation restoration and access control measures;*
- b) a list of potential restoration methods available for use, and their applicability to and effectiveness for different types of sites;*
- c) specifications for implementation and measurable objectives for restoration based on different types of sites; and*
- d) criteria that will be used during monitoring to evaluate the effectiveness of site restoration measures.*

NGTL shall also file with the Board, before 31 January after the first complete growing season following the completion of Physical Abandonment Activities, a complete list of the restoration sites and measures implemented, including:

- a) site locations by kilometre post and GPS coordinates (including approximate size)*
- b) proposed restoration method for each site;*
- c) criteria used to select the restoration method(s);*
- d) any locations and/or conditions that may present specific challenges; and*
- e) a schedule indicating when restoration methods will be initiated and completed.*

This CRVRP is organized to reflect the process logic of NGTL caribou habitat restoration planning. Table 1-42 provides concordance between the specific

requirements of the first portion of Condition 14 and their location within this CRVRP; additional sections (i.e., Section 1 and 6) are included for completeness.

Following completion of physical abandonment activities, a year-one habitat restoration monitoring report will be submitted to satisfy the second portion of Condition 14(a) through (e) of the second letter set, which is required for filing “before 31 January after the first complete growing season following the completion of Physical Abandonment Activities”, as stated in the Order.

Table 1-42: Concordance between NEB Condition 14 Requirements and the CRVRP

NEB Condition 14	CRVRP Section Reference
	Section 1: Introduction and Organization
<p>44) <i>NGTL shall file with the Board for approval, at least 60 days prior to commencing Physical Abandonment Activities, a Chinchaga Caribou Range Vegetation Restoration Plan (Plan), created in consultation with the appropriate Provincial land manager. The goal of the Plan is to apply active restoration techniques to further the relative succession of vegetation regeneration and enhance caribou habitat attributes, where possible, along the Project right of way (ROW) within the Chinchaga Caribou Range. The Plan shall include the following:</i></p>	<p>Section 1.3: Consultation Summary</p> <ul style="list-style-type: none"> This section summarizes the dates, persons attending, and discussions items that pertain to the Project and the development of the CRVRP <p>Section 2: Strategic Outcome, Objective, Goals and Targets</p> <ul style="list-style-type: none"> This section identifies NGTL’s strategic outcome, as well as the objective, goals, and targets that will be used to evaluate the performance and effectiveness of NGTL’s caribou habitat restoration measures. Specifically, this section identifies goals and targets designed to meet the stated objective of applying active restoration techniques to further the relative succession of vegetation regeneration and enhance caribou habitat attributes, where possible, along the Project ROW within the Chinchaga Caribou Range.
<p>14.a) <i>a detailed methodology, including quantitative or measurable criteria and their rationale, to identify locations for active vegetation restoration and access control measures</i></p> <p>14.b) <i>a list of potential restoration methods available for use, and their applicability to and effectiveness for different types of sites</i></p>	<p>Section 3: Habitat Restoration Plan</p> <ul style="list-style-type: none"> This section includes habitat restoration and access management decision frameworks that will be used to identify site-specific habitat restoration measures, including access control, for different types of sites using measurable criteria (e.g., stem density, percent cover). This section also describes the methods used to delineate habitat restoration units (i.e., upland, lowland, transitional, and wetland areas), assess current ROW conditions, and select restoration site locations based on habitat restoration unit-specific targets This section outlines a habitat restoration decision framework that will be used -to identify the most suitable habitat restoration measure based on abandonment activity, habitat restoration unit type, and existing site-specific conditions. This section provides a list of potential restoration measures and discusses their applicability.

Table 1-42: Concordance between NEB Condition 14 Requirements and the CRVRP (cont'd)

NEB Condition 14	CRVRP Section Reference
<u>See above</u>	<u>expected effectiveness, and limitations for the Project.</u>
14.c) <i>specifications for implementation and measurable objectives for restoration based on different types of sites; and</i>	Section 4: Performance Indicators <ul style="list-style-type: none"> • <u>This section describes quantitative performance indicators (i.e., measurable objectives) designed to measure restoration success for different types of sites.</u>
14.d) <i>criteria that will be used during monitoring to evaluate the effectiveness of site restoration measures.</i>	Section 5: Restoration Monitoring <ul style="list-style-type: none"> • <u>This section describes the content of the habitat restoration monitoring report including the performance indicators that will be used (as applicable)- to evaluate the effectiveness of habitat restoration.</u> • <u>This section also discusses how the CRVRP restoration measures will be adjusted if needed (i.e., adaptive management) based on restoration monitoring results.</u>
	Section 6: References

2.0 STRATEGIC OUTCOME, OBJECTIVE, GOALS AND TARGETS

This section identifies NGTL’s strategic outcome, as well as the objective, goals, and targets for the measures discussed throughout the CRVRP. These elements have been refined with experience gained from past NGTL projects and will be used to evaluate the performance and effectiveness of NGTL’s caribou habitat restoration measures.

2.1 STRATEGIC OUTCOME

Combined with the contributions of other parties, NGTL’s approach to caribou habitat restoration is to contribute meaningfully to the conservation and restoration of woodland caribou habitat in the Chinchaga caribou range.

2.2 OBJECTIVE

NGTL’s objective for caribou habitat restoration investments is to apply active restoration techniques to further the relative succession of vegetation regeneration and restore caribou habitat attributes in a manner that aligns with provincial and federal policies, management plans, and priorities.

2.3 GOALS AND TARGETS

Goal (G1) NGTL’s caribou habitat restoration measures are ecologically relevant, practically located, and designed to reduce the potential for re-disturbance by human activity.

Target (T1) Access onto the PRML ROW from intersecting linear features is lower at controlled intersections compared with uncontrolled intersections.

Target (T2) Continuous improvement of caribou habitat restoration methods and techniques based on past experience.

Goal (G2) NGTL’s caribou habitat restoration measures result in self-sustaining and ecologically appropriate vegetation communities that are on trajectory to the compatible surrounding landscape.

Target (T3) The species composition of revegetated restored areas regenerates on a typical path of ecological succession.

Target (T4) The sustained growth trend of revegetated restored areas is comparable to that of the surrounding landscape.

The goals and targets of the CRVRP are intended to guide NGTL in the selection and assessment of caribou habitat restoration measures, and to remain consistent with earlier, similar plans, which are driven by a commitment to continuous improvement. The targets define specific aims for each goal and will be measured by quantitative and qualitative performance indicators (see Section 4).

The goals and targets of this CRVRP are functionally similar to previously-filed NGTL caribou habitat restoration plans from other NGTL projects. However, for this Project, the ROW is in an advanced state of natural regeneration throughout much of its length (Stantec 2017a, NEB Filing A86153-2). Most of the Project will be abandoned-in-place within the Chinchaga caribou range. This approach will greatly reduce the amount of disturbance to established vegetation that ~~is~~ will be required as part of Project abandonment. As a result, this CRVRP differs from habitat restoration plans prepared for new build projects, which emphasize active restoration measures of recently disturbed areas (e.g., mounding, rollback, extensive planting of tree seedlings). Active restoration measures are included in the CRVRP for PDA locations and portions of the ROW that will require habitat restoration.

3.0 HABITAT RESTORATION PLAN

This section outlines the considerations and evaluation of caribou habitat restoration measures for the Project. It describes NGTL's decision framework that will be used for the Project to achieve the overarching objective of the CRVRP.

3.1 EXISTING CONDITIONS

The portion of the Project ROW within the Chinchaga caribou range, including the ~~nine~~ eleven PDAs, is previously-disturbed and does not currently support some of the habitat characteristics (e.g., biophysical attributes) required to carry out life processes necessary for survival and recovery of boreal caribou. However, with time and further forest succession, the Project ROW within the Chinchaga caribou range could support biophysical attributes of boreal caribou habitat.

Habitat restoration measures will be applied to the Project ROW in the Chinchaga caribou range where the recovery of natural vegetation is not currently on a trajectory to provide the biophysical attributes of caribou habitat. The Project ROW within Chinchaga caribou range is approximately 34 km-long and is entirely contiguous with the PRML Loop. Collectively, it is estimated that the amount of the Project ROW within the Chinchaga caribou range that will be revegetated following abandonment will be about 60 ha, of which approximately 58 ha will be from the abandoned-in-place segments, and 2 ha will be from the ~~nine~~ eleven PDAs. Some of this area will be infill planting to support existing, natural, regeneration, and some of this area will be newly planted.

3.1.1 Habitat Mapping

The most recent Alberta Vegetation Inventory (AVI) data available for site types adjacent to the ROW will be used to delineate habitat restoration units on the ROW. These habitat restoration units will be based on moisture regime and will be defined as either coniferous, deciduous or mixedwood upland, transitional, lowland, and/or wetland units based on guidance provided in the Boreal Caribou Habitat Restoration Operational Toolkit for British Columbia (Golder 2015a). These habitat restoration units will form the basis for establishing vegetation planting prescriptions (e.g., tree species and seedling densities) and restoration targets.

3.1.1.2 Abandonment-in-Place

Most of the Project will be abandoned-in-place, which will reduce the need to disturb existing and naturally regenerating vegetation along the ROW during abandonment activities. Vegetation on the Project ROW, which has not been recently maintained, consists of regenerating native trees and shrubs typical of the boreal forest region of

northwest Alberta (Stantec 2017a). In 2016, measurements of regenerating vegetation were taken from sample plots along the Project ROW within the Chinchaga caribou range. Tree stem densities ranged from 0 to 41,000 stems/ha (mean = 7,943 stems/ha) and tree height ranged from 0.5 to 10 m. The mean height of regenerating vegetation (trees and shrubs) on the Project ROW was 2.3 m (Stantec 2016, unpublished data; 2017a; 2017b). Regeneration tended to be more advanced where the Project ROW was adjacent to upland areas, compared to adjacent lowland and wetland areas. Deciduous trees and shrubs were the most common regenerating woody plants in the Project ROW although coniferous trees were present, primarily adjacent to treed lowlands and coniferous-dominated upland forests (Stantec 2017a; 2017b).

Restoration methods that will be used for the abandoned-in-place segments of the ROW will depend largely on the habitat restoration unit classification, but as necessary will also include on site-specific topography, soil, and vegetation characteristics, and adjacent habitat cover type(s). Where existing regeneration is considered insufficient to for meeting the temporal restoration targets, abandoned-in-place segments will be actively restored through the application of other habitat restoration measures.

3.1.23.1.3 Physical Disturbance Areas

There are ~~nine~~ eleven PDAs that range in size from 0.15 ha to 0.49 ha within the Chinchaga Caribou Range. Of these PDAs, ~~four~~ six are near the Meikle Compressor Station, two are within the Meikle Compressor Station, and one is near an all-season road. These ~~seven~~ nine PDAs are scheduled for physical abandonment activities in summer or fall, outside of the caribou restricted activity period (February 15 to July 15; Government of Alberta 2017a). Work at the remaining two PDAs is planned for early winter.

3.2 HABITAT RESTORATION MEASURES

Site-specific habitat restoration measures will be selected in part by using the Habitat Restoration Decision Frameworks (see Figures 3-1 and 3-2). Restoration measures may include natural regeneration, tree planting, and access management, ~~and which~~ are described in Sections 3.2.1 to 3.2.4. The decision frameworks include selecting restoration measures based on the habitat restoration unit, site-specific conditions, and availability of suitable materials. Habitat restoration measures will be applied across three broad categories:

1. Abandoned-in-place segments where existing natural revegetation will be maintained on the ROW and which may receive additional restoration measures depending on revegetation characteristics,

2. PDAs where physical abandonment activity (e.g., excavation, facility removal) will occur, and
3. Access management measures at appropriate locations along the ROW.³

For details on the list of potential restoration measures and discussion of their applicability, effectiveness, and limitations for the Project, see Table 3-1.

³ Note: In areas where the abandoned pipeline parallels the operational NPS 30 PRML Loop, access management may be limited to the abandoned site of the corridor.



Figure 3-1: Habitat Restoration Decision Framework

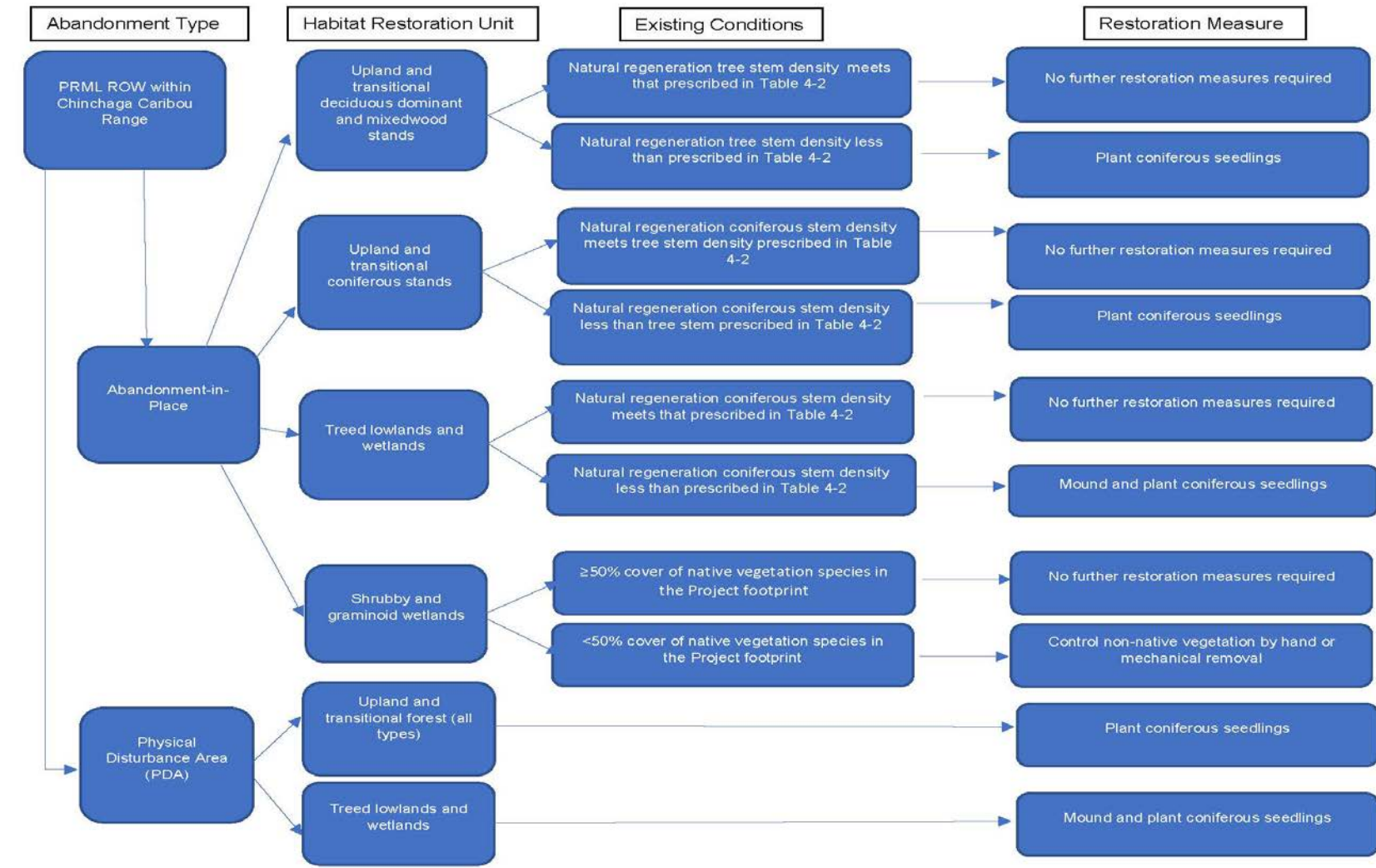


Figure 3-1: Habitat Restoration Decision Framework

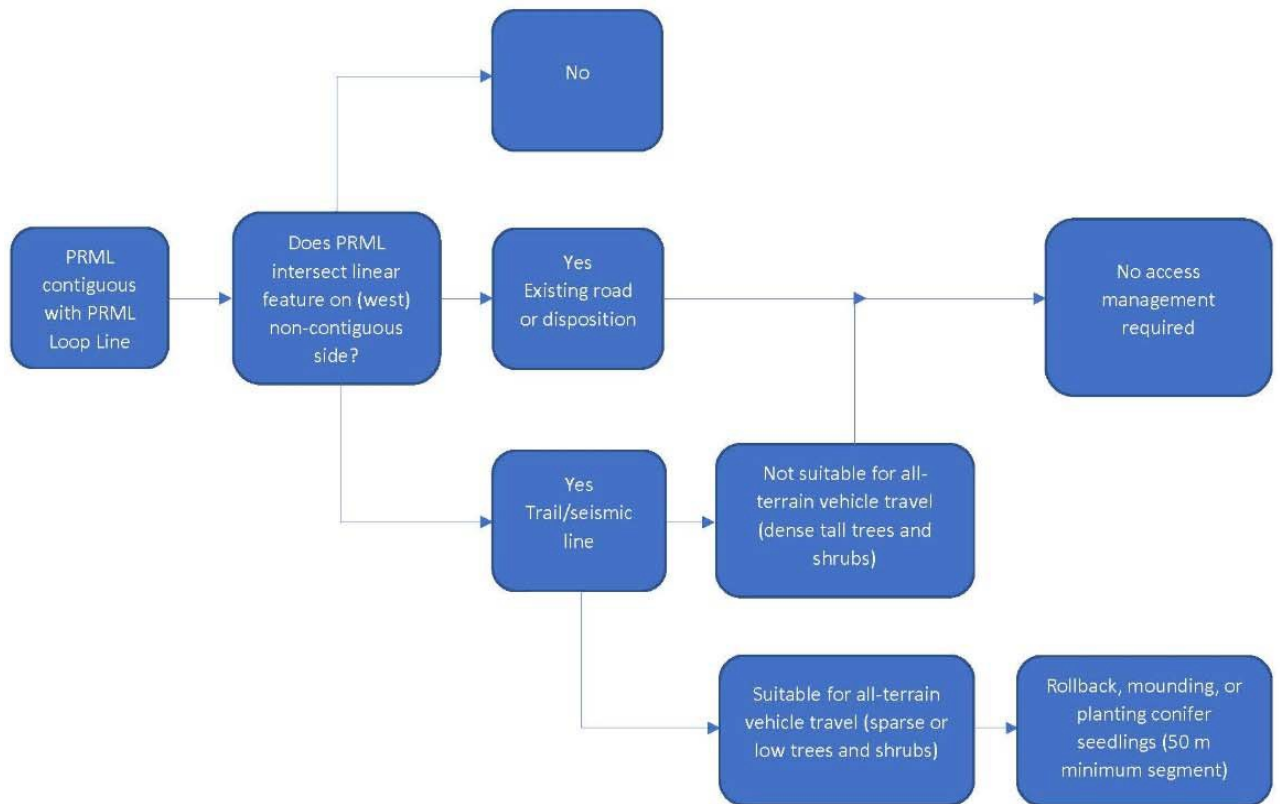


Figure 3-2: Access Management Decision Framework

Table 3-1: Habitat Restoration Measures

Restoration Measure	Purpose(s)	Considerations	Limitations
Protect established and site-appropriate natural regeneration	Primary: Habitat restoration Secondary: Reduce line of sight	<ul style="list-style-type: none"> • Primary restoration measure for abandoned-in-place segments of ROW • Where advanced natural regeneration has established, no further restoration measures may be required. • Community composition of naturally regenerating sites should be appropriate for the biogeographic region and site conditions. • Natural regeneration that meets growth criteria will be protected from further disturbance by NGTL. • Sites where natural regeneration is insufficient or inappropriate to site conditions will be considered for treatment using active habitat restoration measures. 	Some abandoned-in-place sections of the ROW may not have sufficient or suitable natural regeneration and will require additional restoration measures, such as seedling planting.
Minimal surface disturbance techniques	Primary: Facilitate Natural Regeneration Secondary: Reduce line of sight	Minimal surface disturbance techniques reduce impacts to soil structure and can lead to rapid regeneration of native vegetation. This method aids in achieving the goals of habitat restoration and access management, along with providing a visual barrier along the ROW. <ul style="list-style-type: none"> • Application limited to PDAs with abandonment activity occurring during winter conditions. • Reduces the need for soil salvage and grading. • Width of grubbing is limited to excavation area and where grading is required. • Reduced disturbance to vegetation and root systems by cutting, mowing or walking down; mulching shrubs and small diameter trees at ground level and freezing in the ROW (mulch depths no more than 3 to 5 cm). • Intact root systems and seed bed facilitates rapid regeneration of vegetation. • Snow padding or matting preserves shrubs and small trees. • Minimal surface disturbance techniques are constrained by existing ground topography and to ungraded areas. • Rapid regeneration of vegetation contributes to line-of-sight blocks on ROW. 	Of the nine <u>eleven</u> PDAs within the Chinchaga caribou range, two are scheduled for activity during frozen soil conditions (i.e., minimal surface disturbance techniques). The extent of minimal disturbance techniques is limited by scheduling to avoid the restricted activity period for caribou (February 15 to July 15) and also by existing ground topography.

Table 3-1: Habitat Restoration Measures (cont'd)

Restoration Measure	Purpose(s)	Considerations	Limitations
Coniferous seedling planting	<p>Primary: Habitat restoration</p> <p>Secondary: Access management Reduce line of sight</p>	<ul style="list-style-type: none"> • Application suitable for all PDAs and restored abandoned-in-place segments. • Coniferous seedling planting is considered a long-term habitat restoration measure, and an effective long-term access management and line-of-sight measure (it may take 10 or more years to achieve effectiveness, depending on site conditions). • Species selection (i.e., black spruce, white spruce, or pine) is determined based on the biophysical characteristics of the site, adjacent forest stand composition, and restoration targets. • Stem density of live coniferous trees is at least 1,000 stems/ha on upland sites, and 800 stems per/ha on lowland sites. 	<p>Coniferous seedling planting is a suitable habitat restoration measure and will be the main planting measure used for the Project.</p>
Woody debris rollback	<p>Primary: Access management</p> <p>Habitat restoration</p>	<ul style="list-style-type: none"> • Rollback can be effective immediately following implementation, provided adequate material is available and properly applied (Vinge and Pyper 2012, CRRP 2007a, b). Long rollback segments are more effective at managing access because ATV riders will be less inclined to try to ride through the debris or traverse around it in adjacent forest stands. • NGTL has found on previous caribou habitat restoration projects that material availability often limits the segment length that can be achieved to 50 m to 100 m (75 m on average). • Coverage ranging from 200–300 m³/ha can deter access while allowing sufficient spaces between the debris to allow seedling planting. • Placement of woody debris rollback can conserve soil moisture, moderate soil temperatures and provide nutrients as debris decomposes, prevent soil erosion, provide microsites for seed germination and protection for planted tree seedlings (Pyper and Vinge 2012; Vinge and Pyper 2012). • 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 Integrated Standards and Guidelines for the Enhanced Approval Process (AER 2013). 	<p>Woody debris rollback is a suitable habitat restoration measure to augment habitat restoration through the creation of microsites. The Project is contiguous with other developments in caribou habitat for its entire length, so opportunities to use woody debris rollback for access management may be limited.</p> <p>Woody debris material availability limits the segment lengths that can be achieved.</p> <p>Fire risk is a consideration when using or storing woody debris.</p>

Table 3-1: Habitat Restoration Measures (cont'd)

Restoration Measure	Purpose(s)	Considerations	Limitations
Mounding	Primary: Access management Habitat restoration (create microsites)	<ul style="list-style-type: none"> • Application suitable for linear feature intersects where access control measures will be applied and at PDAs and restored abandoned-in-place segments in treed lowland and wetland areas. • Mounding is used as an access management measure on pipeline ROWs, old roads, and on seismic lines to discourage off-road vehicle activity, and can be effective immediately following implementation. • For access management, mounds should be created using an excavator. Mounds are created by excavating to approximately 0.75 m depth and placing the excavated material immediately adjacent to the hole. • For the restored microsites for planted tree seedlings, mounding can be used in wet, low-lying areas to create better-drained microsites to restore seedling survival. • For previous NGTL caribou habitat restoration projects on pipeline ROWs, the achievable range in mound density was approximately 700 to 1,400 mounds/ha. Mound density is dependent on soil characteristics, extent of frost, and type of equipment used. • Mounding is often a suitable habitat restoration measure that is used in conjunction with coniferous seedling planting, using 2 to 3 seedlings per mound, depending on the form and orientation of the mound. • For previous NGTL caribou habitat restoration projects on pipeline ROWs, the achievable mound density was a at least 700 mounds/ha with 2 to 3 seedlings per mound. 	Mounding is a suitable habitat restoration measure that may be used in conjunction with coniferous seedling planting for the Project where ground conditions allow. The limitations include scheduling mounding for restoration during final cleanup, which typically requires freezing-in of soils, availability of specialized equipment and spatial separation of 5 m between the holes and the centreline of the operating pipeline.

3.2.1 Natural Regeneration

The natural regeneration of vegetation (i.e., establishment and succession) in linear features in the boreal forest is dependent on several factors, including site preparation techniques (COSIA 2017; Fuse Consulting 2014; Golder 2015b), use of minimal surface disturbance techniques (TERA 2011, 2012), slope position, time since disturbance and stage of succession, and characteristics of adjacent vegetation (e.g., site productivity, tree and shrub species and heights) (Bayne et al 2011; van Rensen 2014; van Rensen et al 2015). ~~Vegetation-Forest regrowth in-on~~ linear features that run through forested wetlands and coniferous lowlands and uplands tend to exhibit slower ~~growth-successional~~ rates than ~~vegetation-forest regrowth on linear features that run through~~ in deciduous uplands (Golder and Explor 2016; van Rensen et al 2015).

~~The majority of~~ Most of the Project ROW within the Chinchaga caribou range where the pipeline will be abandoned-in-place ~~comprises~~ has established vegetation ~~in various stages~~ that has been naturally regenerating for approximately 25 years. In some locations on the ROW, The stem density of naturally regenerating trees and shrubs ~~growth on the ROW~~ exceeds the indicators of restoration success as defined established in the *Provincial Restoration and Establishment Framework for Legacy Seismic Lines in Alberta* (Government of Alberta 2017b), ~~and~~ generally exceeds the planting guidelines for reclamation planting or caribou habitat restoration (e.g., *Reclamation Criteria for Wellsites and Associated Facilities for Forested Lands* [ESRD 2013] and the *Boreal Caribou Habitat Restoration Operational Toolkit for British Columbia* [Golder 2015a]) and the restoration performance indicators for stem density listed in Section 4, Table 4-2. Stem densities greater than those prescribed in planting guidelines may retard-suppress succession and maturation of a forest stand. However, although these exceedances ~~are~~ are evidently ~~effective at reducing~~ reduce line-of-sight, and likely reduce the potential for predator or human movement along the abandoned ROW.

At PDAs, where scheduling and site-specific conditions allow, methods that promote natural regeneration will be used. For example, minimal surface disturbance techniques can be used during abandonment activities to promote rapid natural revegetation within the local ecotypes. This technique relies on frozen conditions, which can prevent disturbance of surface soils where excavation or grading is not necessary, such as for mowing and mulching. Early winter abandonment activity is planned at two of the ~~nine~~ eleven PDAs (sites 112 and 113 in Figure 1-1) within the Chinchaga caribou range.

As minimal surface disturbance techniques are mitigation measures implemented during abandonment activities, they are not included directly in the caribou habitat restoration decision frameworks. However, minimal surface disturbance techniques lay the foundation for natural regeneration and rapid re-establishment of vegetation

on pipeline ROWs, and ROWs and will continue to be an important part of NGTL's overall caribou habitat restoration program.

3.2.2 Active Habitat Restoration/Tree Planting

Active habitat restoration is the use of site preparation techniques and planting of native tree or shrub seedlings to establish adequate vegetation in areas of the ROW where natural regeneration currently does not meet restoration targets.

Established reclamation practices will be applied to promote revegetation at PDAs and in abandoned-in-place segments that require restoration (i.e., not meeting restoration targets). Site preparation measures such as mounding, which promote tree growth and natural shrub establishment, will be considered at suitable areas (e.g., lowlands and forested wetlands). Tree species comparable to the surrounding landscape will be planted to be similar in natural variation and complexity by planting at appropriate densities and spacing at the feature level.

To identify areas along the ROW needing active restoration, NGTL will combine three datasets to determine which areas of the ROW are not currently meeting restoration targets. The first dataset will be the habitat restoration units; derived from AVI data, which classify the ROW into upland, transitional, lowland, or wetland units (see Section 3.1.1). The second dataset be derived from ~~Aerial surveys using aerial~~ LiDAR and high-resolution photography that will be ~~conducted~~ captured during the 2019 growing season but outside of the AEP restricted activity period for caribou range (February 15 to July 15). These data will be combined with a third dataset, the 2016 and 2017 ground-based vegetation sampling (Stantec 2017a; 2017b), to derive existing vegetation conditions for the entire ROW.

Systematically stratified sample plots will be derived from the aerial data and correlated with the ground-based vegetation survey data, and will ~~takeing~~ into account the time elapsed between ground-sampling and aerial imagery capture. The ground-based vegetation sampling completed in 2016 and 2017 included seventy-one plots placed approximately every 250 to 500 m along the ROW in different vegetation communities (Stantec 2017a; 2017b). Data gathered from the 10 m² plots included species composition, stem height, and stem density

All PDAs will receive active habitat restoration. Habitat restoration measures in the abandoned-in-place segments will be based on estimated average stem densities for each habitat- restoration unit. Where estimated average stem densities in a restoration unit do not meet the targets and performance indicators listed in Table 4-2 for that unit, active restoration measures will be applied to that section of ROW.

Restoration measures will be implemented as soon as practical for PDAs and abandoned-in-place habitat units that do not meet restoration targets. The type of active restoration measure that will be selected for implementation will be guided by

the decision frameworks as outlined in Figures 3-1 and 3-2 and as described in Table 3-1. Access to active habitat restoration sites will be mainly via the adjacent operational PRML Loop ROW.

3.2.3 Access Management

Access management for the Project within the Chinchaga caribou range will be planned to:

- manage human access onto the pipeline ROW from features intersecting the west side of the ROW (i.e., the to-be-abandoned portion of the ROW) in a manner that discourages motorized access
- maintain managed access necessary for the safe and continued operation of the NPS 30 PRML Loop (e.g., 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)

Site Selection and Monitoring

~~A Geographic Information System was used to identify potential access management and monitoring locations, and field verification was used to confirm site characteristics and establish baseline conditions (level of existing access).~~

A Geographic Information System was used to identify intersecting linear features that could potentially provide access onto the PRML ROW. Field visits in 2016 and 2017 characterized the state of the intersecting features (e.g., estimated vegetation height and line-of-sight distance from PRML ROW) and documented evidence of the level of human or wildlife use (Stantec 2017a; 2017b). These data will be used to identify candidate access management locations along the PRML ROW within the Chinchaga caribou range. Locations will be refined to consider operational access for the continued operation and maintenance of the adjacent PRML Loop. (i.e., access management will be not be effective if implemented on the east side of the PRML ROW where it is contiguous with the operational PRML Loop which provides unrestricted access). A complete list of restoration sites and measures implemented will be included in a report to be submitted to the Board before January 31 after the first complete growing season following completion of physical abandonment activities.

Access Management Measures

Access management measures are typically sited on a pipeline ROW at active intersections (e.g., perpendicular or near-perpendicular crossings) with other linear features such as roads, utility corridors, seismic lines, and watercourses such that

access onto the ROW from those linear features is reduced or deterred. Potential access management measures include:

- vegetation planting
- mounding
- rollback

Because the Project involves the abandonment and reclamation of an existing pipeline ROW, some access management measures appropriate for new-build ROWs may use materials (e.g., tree-bending) or planning methods (e.g., extended trenchless crossings) that are not available or applicable to restoration of the PRML ROW.

3.2.4 Line-of-Sight Blocking

During field visits in 2016 and 2017, line-of-sight was measured along the ROW approximately every 250 to 500 m in both directions at each ground-based vegetation plot in caribou range (see Section 3.2.2). Line-of-sight was estimated using a 1.2 m x 1.2 m cover board, divided into four black and white quadrants. The distance at which 50% and 100% of the cover board was obscured by vegetation or topography, from a sighting height of 1.2 m, was recorded (Stantec 2017a; 2017b).

Line-of-sight thresholds have already largely been achieved along the Project ROW through existing natural regeneration of vegetation. Line-of-sight distance may be further reduced as a secondary effect of other restoration measures (e.g., access control, restoration from tree-planting). The line-of-sight on the PRML ROW is currently considerably less than the ~~target threshold of ≤ 500 m target~~ used in other caribou habitat restoration plans (e.g., Stantec 2014; NGTL 2015). ~~For instance, during the 2016 and 2017 field surveys, 50% and 100% of a 1.2 x 1.2 m cover board was concealed on~~ The average distance at which 50% and 100% of the cover board was concealed on the Project ROW was a distance of 33.2 m and 67.5 m, respectively (Stantec 2016, unpublished data; 2017a; 2017b).

While line-of-sight blocking can be effective when implemented across the entire width of a ROW, it is considered ~~less effective~~ ineffective when implemented across only a portion of the width (e.g., implemented on an abandoned ROW that is contiguous with an operational ROW with no line-of-sight mitigation) (Northern Resource Analysts 2016). Therefore, because the ROW already has reduced line-of-sight and is contiguous with an operational ROW, ~~purposefully the purposeful installed installation of line-of-sight measures (e.g., fabricated screens) for the Project will not be used as a restoration measure for this Project.~~

3.3 DECISION FRAMEWORKS FOR HABITAT RESTORATION MEASURES

Two caribou habitat restoration decision frameworks, for habitat enhancement and access management, were have been designed to provide guidance on the selection of habitat restoration measures on the basis of site-specific characteristics

(Figures 3-1 and 3-2). The decision frameworks are principle-based logic models that inform restoration decisions to achieve the objective and goals of the CRVRP. They are based on NGTL's experience from developing and implementing similar frameworks for caribou habitat restoration following pipeline construction projects, and from information obtained from literature reviews, industry best management practices, and industry and regulatory consultation. NGTL continually reviews and updates its approach to designing decision frameworks as new information, and results from restoration monitoring reports, becomes available.

The decision frameworks will be applied prior to the commencement of abandonment activities to identify candidate sites for restoration measures on the Project ROW. Ongoing engagement with Aboriginal communities and stakeholders may identify the need to maintain access, and subsequently preclude access management, in some areas. As restoration measures are applied, the frameworks will be reviewed to confirm appropriate restoration measures are being used at selected sites on the Project ROW and at the ~~nine~~eleven PDAs during final cleanup.

4.0 PERFORMANCE INDICATORS

The performance indicators described in Tables 4-1 and 4-2 are used in combination with the decision frameworks to determine whether active restoration is needed. These performance indicators are also used during monitoring to determine whether habitat restoration is advancing as expected. After completion of the caribou habitat restoration measures, NGTL will implement a monitoring program to assess restoration performance in respect of the objective, goals, and targets described in Section 2 of this CRVRP. Thus, to achieve the stated objectives, goals and targets described in Section 2 of this CRVRP, the performance indicators in Tables 4-1 and 4-2 inform both the selection of access management and active restoration sites as well as the subsequent monitoring of restoration success.

The During monitoring, the success of the restoration measures will be described both quantitatively ~~or~~ and qualitatively by the performance indicators outlined in Tables 4-1 and 4-2. The 'primary measures' identified in Tables 4-1 and 4-2 are below are taken from derived from Table 3-1: Habitat Restoration Measures. The performance indicators are based on NGTL's experience with implementing and monitoring caribou habitat restoration measures for other projects.

Depending on the restoration measures implemented for the Project, additional performance indicators ~~could~~ may be developed. The final performance indicators will be described in ~~the~~ a subsequent habitat restoration monitoring report.

Table 4-1: Performance Indicators to Measure CRVRP Goals and Targets (G1)

Goal	Target	Primary Measures	Performance Indicator	Applicability to the Project
(G1) NGTL's caribou habitat restoration measures are ecologically relevant, practically located, and designed to reduce the potential for re-disturbance by human activity	<ul style="list-style-type: none"> (T1) Access onto the PRML ROW from intersecting linear features is lower from controlled intersections compared with uncontrolled intersects 	Implement access management <ul style="list-style-type: none"> Mounding Rollback Vegetation screens 	<ul style="list-style-type: none"> Access control not bypassed or destroyed and no evidence of access from blocked linear feature to ROW Vegetation on ROW not damaged by motorized vehicles 	<ul style="list-style-type: none"> Applicable to access onto ROW from seismic lines and trails Not applicable on the Project ROW as the Project is contiguous with the PRML Loop
	<ul style="list-style-type: none"> (T2) Continuous improvement of caribou habitat restoration methods and techniques based on past experience. 	<ul style="list-style-type: none"> Development and implementation of a NGTL caribou range vegetation monitoring plan or protocol to promote protection of habitat restoration efforts 	<ul style="list-style-type: none"> Long term monitoring shows the progression and protection of restoration measures 	<ul style="list-style-type: none"> Applicable to the Project

Table 4-2: Performance Indicators to Measure CRVRP Goals and Targets (G2)

Goal	Target	Primary Measures	Performance Indicator	Applicability to the Project
<p>(G2) NGTL's caribou habitat restoration measures result in self-sustaining and ecologically appropriate vegetation communities that are on a trajectory to the compatible surrounding landscape</p>	<ul style="list-style-type: none"> (T3) The species composition of revegetated restoration areas regenerates on a typical path of ecological succession (T4) The sustained growth trend of revegetated restoration areas is comparable to that of the surrounding landscape 	<p>Implement habitat restoration</p> <ul style="list-style-type: none"> Protect established appropriate natural revegetation Minimal surface disturbance Plant coniferous seedlings at PDAs and areas of natural regeneration requiring restoration 	<p>Based on published information and provincial guidance (Government of Alberta 2017b; 2017c), the following stem densities have been derived for areas of natural regeneration. Stem densities are based on ten-year establishment targets:</p> <ul style="list-style-type: none"> minimum live stem density of 1,000 stems/ha of tree species capable of reaching 5 m in height on upland sites <u>habitat restoration units</u> minimum live stem density of 800 stems/ha of tree species capable of reaching 5 m in height on treed lowland sites <u>habitat restoration units</u> <p>Upland and Transitional Deciduous Dominant and Mixedwood Forest Habitat Types <u>Habitat Restoration Units:</u></p> <ul style="list-style-type: none"> Sections with adequate natural regeneration have not sustained further disturbance Vegetation on ROW displays trajectory toward mature deciduous dominant or mixedwood forest type typical to region All restoration locations demonstrate sustained growth trends across $\geq 80\%$ of restoration locations within <u>at</u> 10 years following implementation of restoration measures <p>Upland and Transitional Coniferous Forest Habitat Types: <u>Habitat Restoration Units</u></p> <ul style="list-style-type: none"> Sections with adequate natural regeneration have not sustained further disturbance Where tree seedlings are planted, achieve $\geq 80\%$ survival rate for <u>of</u> planted seedlings within <u>at</u> 10 years following implementation of restoration measures All restoration locations demonstrate sustained growth trends across $\geq 80\%$ of restoration locations within <u>at</u> 10 years following implementation of restoration measures 	<p>Applicable to the Project</p>

Table 4-2: Performance Indicators to Measure CRVRP Goals and Targets (G2) (cont'd)

Goal	Target	Primary Measures	Performance Indicator	Applicability to the Project
			<p>Treed Lowland and Wetland Habitat Types Restoration Units:</p> <ul style="list-style-type: none"> • Sections with adequate natural regeneration have not sustained further disturbance • Where tree seedlings are planted (e.g., mounded sites), achieve $\geq 50\%$ survival rate for seedlings or transplants within <u>at</u> 10 years following planting • Demonstrate sustained growth trends across $\geq 50\%$ of restoration locations within <u>at</u> 10 years following implementation of restoration measures <p>Shrubby/Graminoid Wetland Habitat Types Restoration Units:</p> <ul style="list-style-type: none"> • Sections with adequate natural regeneration have not sustained further disturbance • Within <u>At</u> 10 years following implementation of restoration measures: <ul style="list-style-type: none"> ○ $\geq 50\%$ cover of native vegetation species in the Project footprint ○ no restricted weeds 	

Performance indicators for Goal 1 include parameters to define success of access management. Control measures to reduce access along the PRML ROW would be ineffective as nearly the entire length of the Project is contiguous with the operating PRML Loop. Additionally, Project access management cannot control those linear features suitable for human access which approach from the east side of the shared ROW (i.e., from the operating PRML Loop ROW). If future monitoring finds evidence of access onto the (western) PRML ROW at intersections where access management techniques were installed, or evidence of vegetation damage along the PRML ROW due to motorized vehicles, access management measures may be adjusted, if feasible.

As outlined in Table 4-2, the performance indicators for Goal 2 include parameters that relate to the habitat restoration units ~~types~~-affected and a corresponding reasonable timeline to achieve restoration success in ~~actively restored areas~~ the Project ROW. NGTL has chosen survival rate as a performance indicator because it is not species dependent. The growth rates of coniferous species can be variable and tree height over time can differ based on habitat characteristics and site-specific conditions. Given the differences in growing conditions between upland and lowland locations, and the potential for site-specific influences and factors to affect growth, tree height was not chosen as a monitoring metric.

4.1.1 Example of Habitat Restoration Decision Framework and Monitoring

Figure 4-1 describes, for a hypothetical site, the steps that will be taken to assess, select, implement, and monitor habitat restoration measures and locations for the PRML ROW within the Chinchaga Caribou Range.

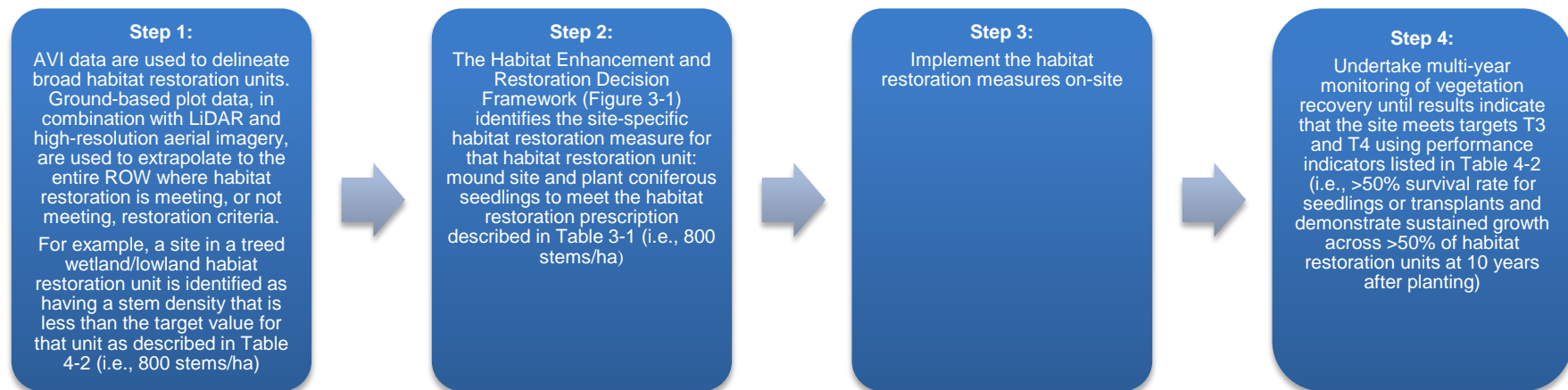


Figure 4-1: Example: Steps Taken to Assess, Select, Implement, and Monitor Habitat Restoration Measures and Locations

5.0 RESTORATION MONITORING

Monitoring can inform whether restoration investments are contributing meaningfully to the strategic outcome of conservation and recovery of woodland caribou. To this end, NGTL will develop a habitat restoration monitoring report for the Project that will describe the monitoring approach for evaluating the effectiveness of habitat restoration measures implemented.

As required by the second portion of Condition 14 of the Order, the monitoring report will be filed with the Board before January 31, following the first complete growing season subsequent to implementation of caribou habitat restoration measures. The monitoring report will be based on lessons learned from recent projects, ongoing monitoring programs, regulatory or policy changes, and ongoing consultation. The monitoring report will include details on monitoring (including ground-based, aerial and remote camera monitoring as appropriate). It will also include details pertaining to the monitoring design (i.e., methods, frequency, and duration) for the habitat restoration measures implemented. It will include information pertaining to the number and location of monitoring sites (i.e., ~~restored sites and reference sites~~), ~~definitions of quantitative and qualitative performance indicators and will provide criteria to evaluate the effectiveness of restoration measures.~~ method of access to monitoring sites (e.g., the operational PRML Loop), and evaluation of the effectiveness of restoration measures.

During restoration monitoring, the operational PRML Loop, which is parallel and adjacent to the PRML ROW within the Chinchaga caribou range, will be the primary means of access to habitat restoration sites.

The benchmarks for habitat restoration monitoring will be the same performance indicators used for initial restoration site selection defined in Tables 4-1 and 4-2 in Section 4. The habitat restoration measures will be considered successful when monitoring results indicate that restored areas have achieved, or are on a trajectory to achieve, the performance indicators and related goals and targets defined in Tables 4-1 and 4-2 in Section 4. No additional measures will be considered necessary after restoration measures are considered successful. If performance indicators ~~reveal~~ indicate that a target is not being achieved, an adaptive management framework will be used to evaluate which, if any, remedial measures can be implemented in order to achieve habitat restoration goals. If remedial measures are implemented, then restoration measures will be adjusted if feasible and monitoring of those measures will continue to be undertaken as part of evaluating habitat restoration success.

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6.1 — PERSONAL COMMUNICATION

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Revised Condition 14
Chinchaga Caribou Range Vegetation Restoration Plan
Clean Copy

1.0 INTRODUCTION AND ORGANIZATION

1.1 INTRODUCTION

On August 18, 2016, NOVA Gas Transmission Ltd. (NGTL), a wholly owned subsidiary of TransCanada PipeLines Limited, filed an application under section 74(1)(d) of the *National Energy Board Act* with the National Energy Board (NEB or Board) for the Peace River Mainline (PRML) Abandonment Project (the Project). The Board approved the application on March 14, 2018, in NEB Order ZO-N081-003-2018 (Order), and issued conditions of approval. Condition 14 of the Order requires NGTL to develop a Chinchaga Caribou Range Vegetation Restoration Plan (CRVRP), given that the Project partially overlaps with the Chinchaga caribou range.

On December 11, 2018, NGTL received a letter from the NEB indicating that the CRVRP, filed on May 17, 2018, needed additional information to satisfy the requirements of Condition 14 of the Order.¹ The NEB requested a revised CRVRP that includes:

- i) a summary of the consultation that occurred with the Provincial land manager during the creation of the Plan;
- ii) a detailed methodology, including the associated criteria and rationale for how the restoration locations chosen as required in part 14 (a) of the condition; and
- iii) the criteria that will be used during monitoring to evaluate the effectiveness of site restoration measures as per part 14 (d) of the condition.

NGTL has previously filed with the Board similar plans (e.g., Caribou Habitat Restoration Plans, Caribou Habitat Restoration and Offset Management Plans) for other projects requiring habitat restoration in caribou ranges.² This CRVRP is consistent with those past plans, but differs from them because this Project is an end-of-life pipeline project located within an existing right-of-way (ROW) with advanced revegetation already present, and because little additional disturbance is needed to complete project abandonment activities.

¹ NEB Letter dated December 11, 2018 (NEB Filing ID: A96593), Chinchaga Caribou Range Vegetation Restoration Plan (NEB Filing ID: A92023) and Board Order ZO-N081-003-2018 (NEB Filing ID: A90576).

² Chinchaga Lateral Loop No. 3 Project (NEB Filing IDs: A69803, A71613, A75414), Northwest Mainline Expansion Project (NEB Filing IDs: A56798, A71613, A61246), Liege Lateral Loop 2 (Thornbury Section) and Leismer East Compressor Station Project (NEB Filing IDs: A69679, A72136, A74936-1), Leismer to Kettle River Crossover Project (NEB Filing IDs: A60689, A50823), Northwest Mainline Loop (Boundary Lake North Section) (NEB Filing ID: A88650-8), Smoky River Lateral Loop Project (NEB Filing ID: A88269).

This CRVRP outlines NGTL's plan to restore caribou habitat within the Project ROW. This plan was developed in consideration of federal and provincial regulations, policies, and initiatives pertaining to caribou habitat restoration, and in consideration of NGTL and industry-related experience and emerging research on caribou habitat restoration. In particular, and as required by Condition 14, this CRVRP was prepared in consultation with the appropriate Provincial land manager (i.e., Alberta Environment and Parks [AEP]).

Details of NGTL's consultation with AEP are provided in Section 1.3. However, NGTL notes one specific matter raised by AEP on April 29, 2016 regarding the abandonment of PRML within the Chinchaga caribou range. During that discussion, AEP advised that because the Project parallels the operating NPS 30 PRML Loop pipeline for its entire length within the caribou range, access management measures developed for the Project are unlikely to be effective until the entire shared ROW is abandoned. However, AEP requested that NGTL make efforts to install access management and/or complete other reclamation measures where it makes sense to do so (pers. comm. Luke Vander Vennen, Wildlife Biologist, Peace Region, April 29, 2016).

1.2 PROJECT DESCRIPTION

The Project is a 266 km-long pipeline, of which approximately 34 km overlaps with the Chinchaga caribou range (Figure 1-1). There are eleven Project Disturbance Areas within the Chinchaga Caribou Range including eight located near the Meikle River Compressor Station located at the north end of the Peace River Mainline Abandonment Project. The entire portion within caribou range parallels the NPS 30 NGTL PRML Loop, which is an operating natural gas pipeline. Where these pipelines overlap with the Chinchaga caribou range, they are oriented approximately north-south; the to-be-abandoned PRML NPS 20 pipeline is on the west side of the shared ROW, and the operating PRML NPS 30 Loop pipeline is on the east side of the shared ROW.

Most of the PRML pipeline will be abandoned-in-place; however, there are eleven Physical Disturbance Areas (PDAs) within the ROW and within the Chinchaga caribou range where physical abandonment activity will be required to abandon the Project (e.g., valve removal, isolation). All physical abandonment activities within the Chinchaga caribou range will take place within the existing ROW and/or facility site boundaries. Once abandonment is complete, no further disturbance to the ROW is anticipated.

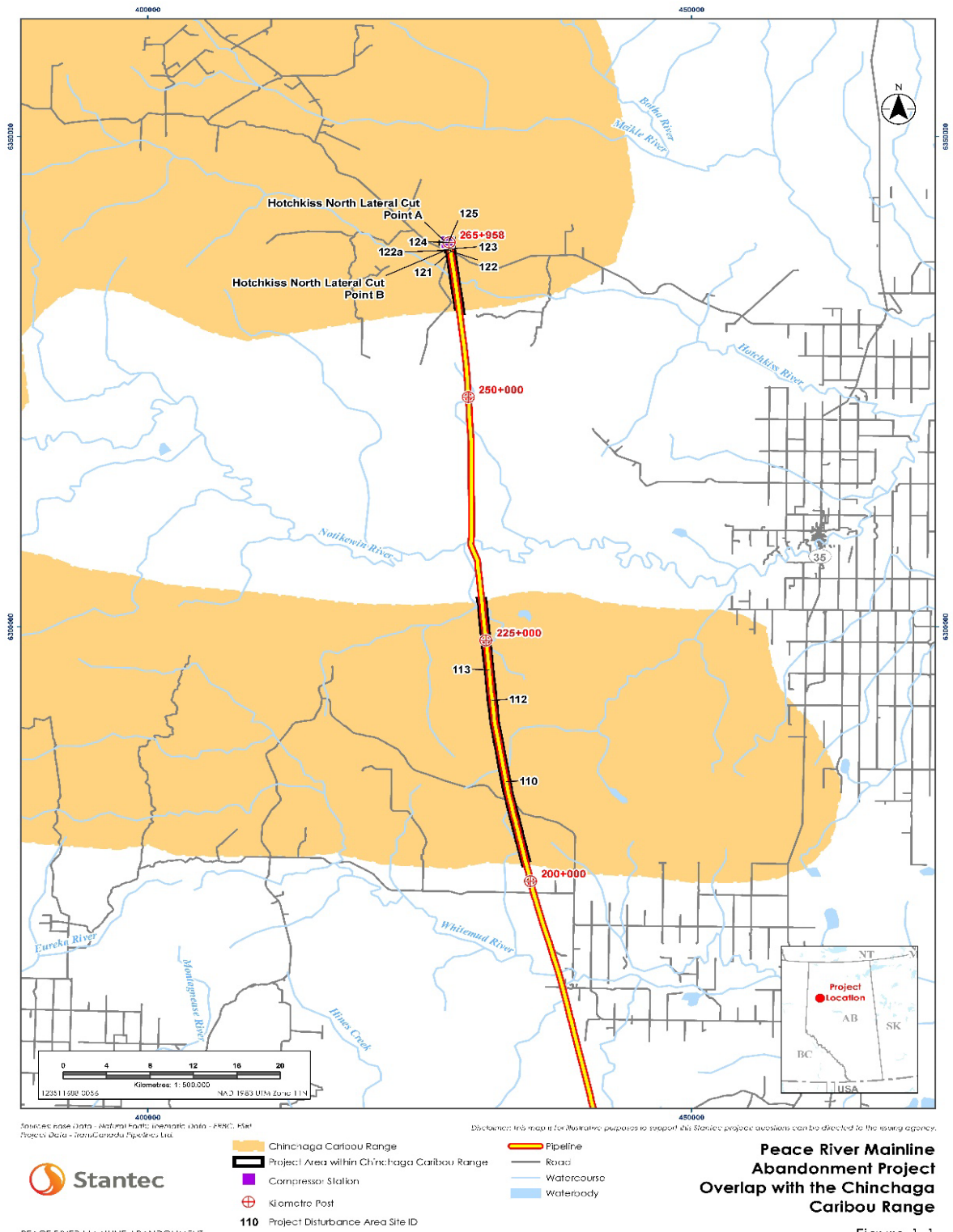


Figure 1-1: Peace River Mainline Abandonment Project Overlap with the Chinchaga Caribou Range

1.3 CONSULTATION SUMMARY

Table 1-1 provides a summary of NGTL’s consultations with the applicable regulators and Provincial land managers.

Table 1-1: Consultation Summary

Date	Persons in Attendance	Discussion Items
November 4, 2015	Richard Goy, AEP, Dave Moyles, AEP, Christopher Grainger, AEP NGTL Representatives	NGTL met with AEP in Peace River Office to introduce the PRML project. NGTL asked what requirements would be for working in caribou range. AEP said that the caribou herd does winter close to the PRML line - they did not have concerns considering there is still an operating line in the ROW, if possible NGTL should restrict access to the ROW. AEP advised that they would get back to NGTL with further information about potential caribou mitigation.
November 10, 2015	Richard Goy, AEP, Dave Moyles, AEP, Christopher Grainger, AEP NGTL Representatives	NGTL sent an email to AEP as a follow up to November 4, 2015 meeting. NGTL provided the following further information: shapefile of PRML Pipeline, table summarizing preliminary physical disturbance locations, and a summary of the proposed physical disturbance locations within KWBZ and areas. NGTL requested input from AEP on mitigation and reclamation in caribou areas.
November 24, 2015	Luke Vander Vennen, AEP NGTL Representatives	AEP phoned NGTL in response to inquiries related to potential wildlife concerns related to PRML. AEP advised that they had received the information packages and had no major concerns about the project. Mr. Vander Vennen advised that he would be the AEP Wildlife Representative for the portion of the project north of the Peace River, and Jessica Lockhart would be the representative for the portion south of the Peace River. NGTL should make all efforts to abide by caribou and KWBZ timing constraints. NGTL asked whether there would be special restoration requirements in caribou range. AEP said they would consider the question and get back to NGTL. NGTL asked whether telemetry data could be made available to NGTL. AEP advised they would get back to NGTL on the request.
April 29, 2016	Luke Vander Vennen, AEP NGTL Representatives	AEP responded to previous emails and phone conversations about PRML within caribou range. AEP advised that the primary concern is the amount of human footprint on the landscape. Any efforts to remove industrial footprint via tree planting, closure of access, etc., can act to benefit caribou populations. AEP asked whether there are any opportunities for TransCanada to reclaim disturbed areas as part of the project. This could be done by planting seismic lines or old well pads, or by adding measures to block human access to the ROW. Otherwise, AEP did not see much opportunity for mitigation beyond standard operating conditions

Table 1-1: Consultation Summary (cont'd)

Date	Persons in Attendance	Discussion Items
April 29, 2016 (cont'd)	See above	within caribou range, including limiting human access to the area after during the restricted activity period (February 15 to July 15; Government of Alberta 2017a).
April 29, 2016	Luke Vander Vennen, AEP NGTL Representatives	NGTL telephoned AEP to discuss caribou mitigation for PRML on April 29, 2016. Later that day, NGTL provided an email summarizing the conversation and requesting AEP to verify that AEP's comments had been captured correctly. AEP had commented that the PRML ROW is heavily used by aboriginal and non-aboriginal hunters. AEP would prefer that the ROW be moved back towards a natural habitat type; and it would be great if NGTL could install access management measures, however, given that there will still be an operating pipeline in the ROW, AEP understood that partial access control would likely not be successful. AEP requested that NGTL abide by caribou and KWBZ timing restrictions.
April 29, 2016	Luke Vander Vennen, AEP NGTL Representatives	NGTL met with AEP regarding the abandonment of PRML within the Chinchaga caribou range. During this discussion, AEP advised that because the Project parallels the operating NPS 30 PRML Loop pipeline for its entire length within caribou range, access management measures are unlikely to be effective until the entire shared ROW is abandoned. AEP requested that NGTL make efforts to install access management and/or complete other reclamation measures where it makes sense to do so.
June 30, 2017	George Duffy, Caribou Range Planning Lead, AEP Dave Hervieux, Regional Resource Manager, AEP Robin Steenweg, Species at Risk Wildlife Biologist, AEP Monica Dahl, Planner, AEP Paul Grégoire, Wildlife Biologist, ECCC NGTL Representatives	NGTL met with ECCC and members of AEP to discuss use of existing ROWs for restoration and offset measures. ECCC supported this approach and locating offsets within existing caribou ranges.
July 18, 2018	George Duffy, Caribou Range Planning Lead, AEP Chad Wilms, Manager - Caribou Range Planning, AEP NGTL Representatives	General consultation on TransCanada caribou program, AEP caribou range planning priorities, and habitat restoration objectives.
October 10, 2018	Brian Makowecki, Executive Director, Planning, AEP Craig Dockrill, Director, Caribou Range Planning, AEP George Duffy, Caribou Range Planning Lead, AEP NGTL Representatives	Meeting to discuss general habitat restoration approaches on pipeline ROWs, vegetation management, and objectives of habitat restoration on pipelines.

1.4 SCOPE

This CRVRP was developed to satisfy the first portion of Condition 14(a) through (d) of the first letter set of the Order that states:

NGTL shall file with the Board for approval, at least 60 days prior to commencing Physical Abandonment Activities, a Chinchaga Caribou Range Vegetation Restoration Plan (Plan), created in consultation with the appropriate Provincial land manager. The goal of the Plan is to apply active restoration techniques to further the relative succession of vegetation regeneration and enhance caribou habitat attributes, where possible, along the Project right of way (ROW) within the Chinchaga Caribou Range. The Plan shall include the following:

- a) a detailed methodology, including quantitative or measurable criteria and their rationale, to identify locations for active vegetation restoration and access control measures;*
- b) a list of potential restoration methods available for use, and their applicability to and effectiveness for different types of sites;*
- c) specifications for implementation and measurable objectives for restoration based on different types of sites; and*
- d) criteria that will be used during monitoring to evaluate the effectiveness of site restoration measures.*

NGTL shall also file with the Board, before 31 January after the first complete growing season following the completion of Physical Abandonment Activities, a complete list of the restoration sites and measures implemented, including:

- a) site locations by kilometre post and GPS coordinates (including approximate size)*
- b) proposed restoration method for each site;*
- c) criteria used to select the restoration method(s);*
- d) any locations and/or conditions that may present specific challenges; and*
- e) a schedule indicating when restoration methods will be initiated and completed.*

This CRVRP is organized to reflect the process logic of NGTL caribou habitat restoration planning. Table 1-2 provides concordance between the specific

requirements of the first portion of Condition 14 and their location within this CRVRP; additional sections (i.e., Section 1 and 6) are included for completeness.

Following completion of physical abandonment activities, a year-one habitat restoration monitoring report will be submitted to satisfy the second portion of Condition 14(a) through (e) of the second letter set, which is required for filing “before 31 January after the first complete growing season following the completion of Physical Abandonment Activities”, as stated in the Order.

Table 1-2: Concordance between NEB Condition 14 Requirements and the CRVRP

NEB Condition 14	CRVRP Section Reference
	Section 1: Introduction and Organization
<p><i>NGTL shall file with the Board for approval, at least 60 days prior to commencing Physical Abandonment Activities, a Chinchaga Caribou Range Vegetation Restoration Plan (Plan), created in consultation with the appropriate Provincial land manager. The goal of the Plan is to apply active restoration techniques to further the relative succession of vegetation regeneration and enhance caribou habitat attributes, where possible, along the Project right of way (ROW) within the Chinchaga Caribou Range. The Plan shall include the following:</i></p>	<p>Section 1.3: Consultation Summary</p> <ul style="list-style-type: none"> • This section summarizes the dates, persons attending, and discussions items that pertain to the Project and the development of the CRVRP <p>Section 2: Strategic Outcome, Objective, Goals and Targets</p> <ul style="list-style-type: none"> • This section identifies NGTL’s strategic outcome, as well as the objective, goals, and targets that will be used to evaluate the performance and effectiveness of NGTL’s caribou habitat restoration measures. • Specifically, this section identifies goals and targets designed to meet the stated objective of applying active restoration techniques to further the relative succession of vegetation regeneration and enhance caribou habitat attributes, where possible, along the Project ROW within the Chinchaga Caribou Range.
<p>14.a) <i>a detailed methodology, including quantitative or measurable criteria and their rationale, to identify locations for active vegetation restoration and access control measures</i></p> <p>14.b) <i>a list of potential restoration methods available for use, and their applicability to and effectiveness for different types of sites</i></p>	<p>Section 3: Habitat Restoration Plan</p> <ul style="list-style-type: none"> • This section includes habitat restoration and access management decision frameworks that will be used to identify site-specific habitat restoration measures, including access control, for different types of sites using measurable criteria (e.g., stem density, percent cover). • This section also describes the methods used to delineate habitat restoration units (i.e., upland, lowland, transitional, and wetland areas), assess current ROW conditions, and select restoration site locations based on habitat restoration unit-specific targets • This section outlines a habitat restoration decision framework that will be used to identify the most suitable habitat restoration measure based on abandonment activity, habitat restoration unit type, and existing site-specific conditions. • This section provides a list of potential restoration measures and discusses their applicability,

Table 1-2: Concordance between NEB Condition 14 Requirements and the CRVRP (cont'd)

NEB Condition 14	CRVRP Section Reference
See above	expected effectiveness, and limitations for the Project.
14.c) <i>specifications for implementation and measurable objectives for restoration based on different types of sites; and</i>	<p>Section 4: Performance Indicators</p> <ul style="list-style-type: none"> This section describes quantitative performance indicators (i.e., measurable objectives) designed to measure restoration success for different types of sites.
14.d) <i>criteria that will be used during monitoring to evaluate the effectiveness of site restoration measures.</i>	<p>Section 5: Restoration Monitoring</p> <ul style="list-style-type: none"> This section describes the content of the habitat restoration monitoring report including the performance indicators that will be used (as applicable) to evaluate the effectiveness of habitat restoration. This section also discusses how the CRVRP restoration measures will be adjusted if needed (i.e., adaptive management) based on restoration monitoring results.
	Section 6: References

2.0 STRATEGIC OUTCOME, OBJECTIVE, GOALS AND TARGETS

This section identifies NGTL’s strategic outcome, as well as the objective, goals, and targets for the measures discussed throughout the CRVRP. These elements have been refined with experience gained from past NGTL projects and will be used to evaluate the performance and effectiveness of NGTL’s caribou habitat restoration measures.

2.1 STRATEGIC OUTCOME

Combined with the contributions of other parties, NGTL’s approach to caribou habitat restoration is to contribute meaningfully to the conservation and restoration of woodland caribou habitat in the Chinchaga caribou range.

2.2 OBJECTIVE

NGTL’s objective for caribou habitat restoration investments is to apply active restoration techniques to further the relative succession of vegetation regeneration and restore caribou habitat attributes in a manner that aligns with provincial and federal policies, management plans, and priorities.

2.3 GOALS AND TARGETS

Goal (G1) NGTL’s caribou habitat restoration measures are ecologically relevant, practically located, and designed to reduce the potential for re-disturbance by human activity.

Target (T1) Access onto the PRML ROW from intersecting linear features is lower at controlled intersections compared with uncontrolled intersections.

Target (T2) Continuous improvement of caribou habitat restoration methods and techniques based on past experience.

Goal (G2) NGTL’s caribou habitat restoration measures result in self-sustaining and ecologically appropriate vegetation communities that are on trajectory to the compatible surrounding landscape.

Target (T3) The species composition of revegetated restored areas regenerates on a typical path of ecological succession.

Target (T4) The sustained growth trend of revegetated restored areas is comparable to that of the surrounding landscape.

The goals and targets of the CRVRP are intended to guide NGTL in the selection and assessment of caribou habitat restoration measures, and to remain consistent with earlier, similar plans, which are driven by a commitment to continuous improvement. The targets define specific aims for each goal and will be measured by quantitative and qualitative performance indicators (see Section 4).

The goals and targets of this CRVRP are functionally similar to previously-filed NGTL caribou habitat restoration plans from other NGTL projects. However, for this Project, the ROW is in an advanced state of natural regeneration throughout much of its length (Stantec 2017a, NEB Filing A86153-2). Most of the Project will be abandoned-in-place within the Chinchaga caribou range. This approach will greatly reduce the amount of disturbance to established vegetation that will be required as part of Project abandonment. As a result, this CRVRP differs from habitat restoration plans prepared for new build projects, which emphasize active restoration measures of recently disturbed areas (e.g., mounding, rollback, extensive planting of tree seedlings). Active restoration measures are included in the CRVRP for PDA locations and portions of the ROW that will require habitat restoration.

3.0 HABITAT RESTORATION PLAN

This section outlines the considerations and evaluation of caribou habitat restoration measures for the Project. It describes NGTL's decision framework that will be used for the Project to achieve the overarching objective of the CRVRP.

3.1 EXISTING CONDITIONS

The portion of the Project ROW within the Chinchaga caribou range, including the eleven PDAs, is previously-disturbed and does not currently support some of the habitat characteristics (e.g., biophysical attributes) required to carry out life processes necessary for survival and recovery of boreal caribou. However, with time and further forest succession, the Project ROW within the Chinchaga caribou range could support biophysical attributes of boreal caribou habitat.

Habitat restoration measures will be applied to the Project ROW in the Chinchaga caribou range where the recovery of natural vegetation is not currently on a trajectory to provide the biophysical attributes of caribou habitat. The Project ROW within Chinchaga caribou range is approximately 34 km-long and is entirely contiguous with the PRML Loop. Collectively, it is estimated that the amount of the Project ROW within the Chinchaga caribou range that will be revegetated following abandonment will be about 60 ha, of which approximately 58 ha will be from the abandoned-in-place segments, and 2 ha will be from the eleven PDAs. Some of this area will be infill planting to support existing, natural, regeneration, and some of this area will be newly planted.

3.1.1 Habitat Mapping

The most recent Alberta Vegetation Inventory (AVI) data available for site types adjacent to the ROW will be used to delineate habitat restoration units on the ROW. These habitat restoration units will be based on moisture regime and will be defined as either coniferous, deciduous or mixedwood upland, transitional, lowland or wetland units based on guidance provided in the Boreal Caribou Habitat Restoration Operational Toolkit for British Columbia (Golder 2015a). These habitat restoration units will form the basis for establishing vegetation planting prescriptions (e.g., tree species and seedling densities) and restoration targets.

3.1.2 Abandonment-in-Place

Most of the Project will be abandoned-in-place, which will reduce the need to disturb existing and naturally regenerating vegetation along the ROW during abandonment activities. Vegetation on the Project ROW, which has not been recently maintained, consists of regenerating native trees and shrubs typical of the boreal forest region of northwest Alberta (Stantec 2017a). In 2016, measurements of regenerating vegetation were taken from sample plots along the Project ROW within the Chinchaga caribou

range. Tree stem densities ranged from 0 to 41,000 stems/ha (mean = 7,943 stems/ha) and tree height ranged from 0.5 to 10 m. The mean height of regenerating vegetation (trees and shrubs) on the Project ROW was 2.3 m (Stantec 2016, unpublished data; 2017a; 2017b). Regeneration tended to be more advanced where the Project ROW was adjacent to upland areas, compared to adjacent lowland and wetland areas. Deciduous trees and shrubs were the most common regenerating woody plants in the Project ROW although coniferous trees were present, primarily adjacent to treed lowlands and coniferous-dominated upland forests (Stantec 2017a; 2017b).

Restoration methods that will be used for the abandoned-in-place segments of the ROW will depend largely on the habitat restoration unit classification, but as necessary will also include on site-specific topography, soil, vegetation characteristics, and adjacent habitat cover type(s). Where existing regeneration is considered insufficient for meeting the temporal restoration targets, abandoned-in-place segments will be actively restored through the application of other habitat restoration measures.

3.1.3 Physical Disturbance Areas

There are eleven PDAs that range in size from 0.15 ha to 0.49 ha within the Chinchaga Caribou Range. Of these PDAs, six are near the Meikle Compressor Station, two are within the Meikle Compressor Station, and one is near an all-season road. These nine PDAs are scheduled for physical abandonment activities in summer or fall, outside of the caribou restricted activity period (February 15 to July 15; Government of Alberta 2017a). Work at the remaining two PDAs is planned for early winter.

3.2 HABITAT RESTORATION MEASURES

Site-specific habitat restoration measures will be selected in part by using the Habitat Restoration Decision Frameworks (see Figures 3-1 and 3-2). Restoration measures may include natural regeneration, tree planting, and access management, which are described in Sections 3.2.1 to 3.2.4. The decision frameworks include selecting restoration measures based on the habitat restoration unit, site-specific conditions, and availability of suitable materials. Habitat restoration measures will be applied across three broad categories:

1. Abandoned-in-place segments where existing natural revegetation will be maintained on the ROW and which may receive additional restoration measures depending on revegetation characteristics,
2. PDAs where physical abandonment activity (e.g., excavation, facility removal) will occur, and

3. Access management measures at appropriate locations along the ROW.³

For details on the list of potential restoration measures and discussion of their applicability, effectiveness, and limitations for the Project, see Table 3-1.

³ Note: In areas where the abandoned pipeline parallels the operational NPS 30 PRML Loop, access management may be limited to the abandoned site of the corridor.

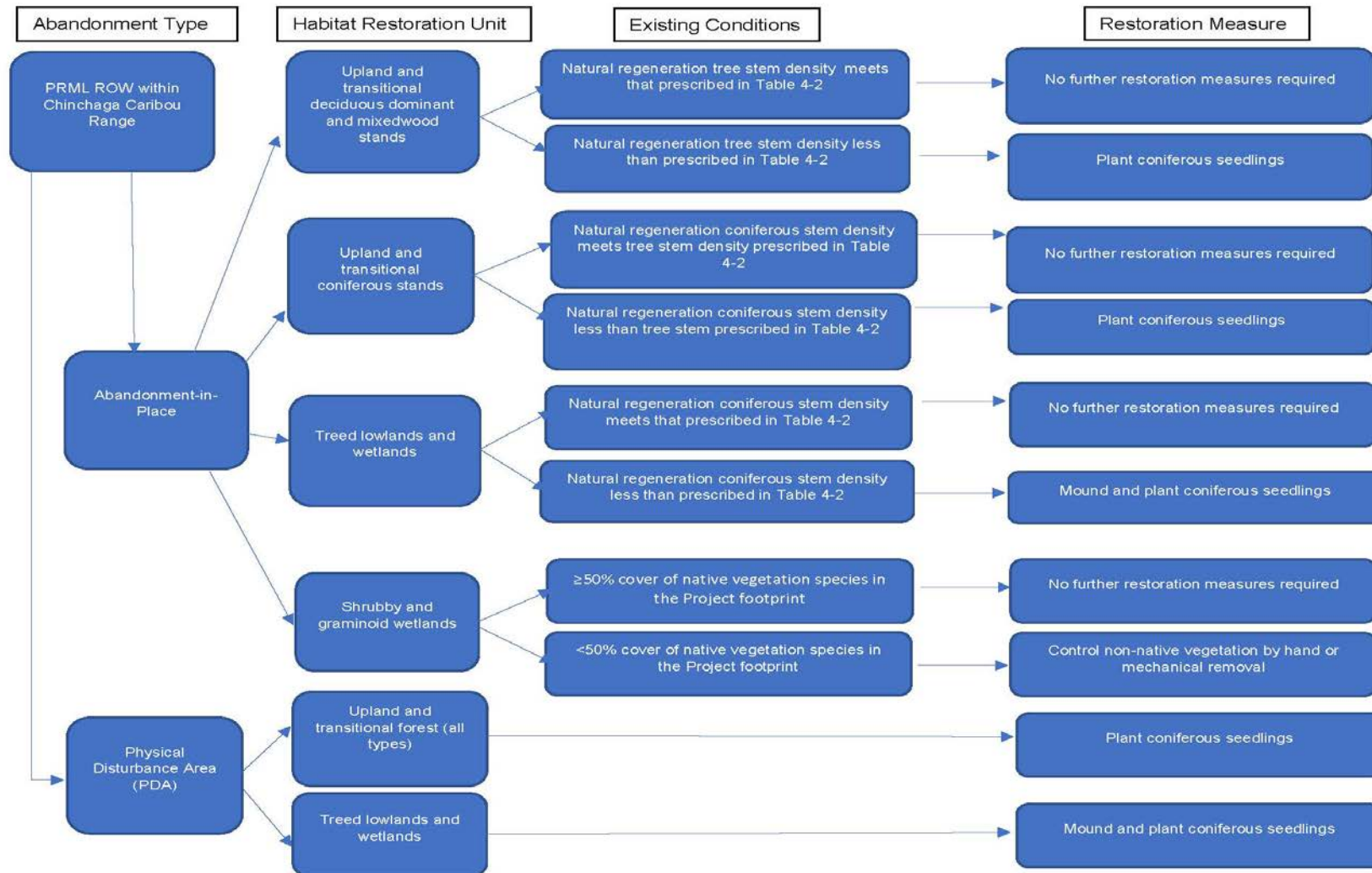


Figure 3-1: Habitat Restoration Decision Framework

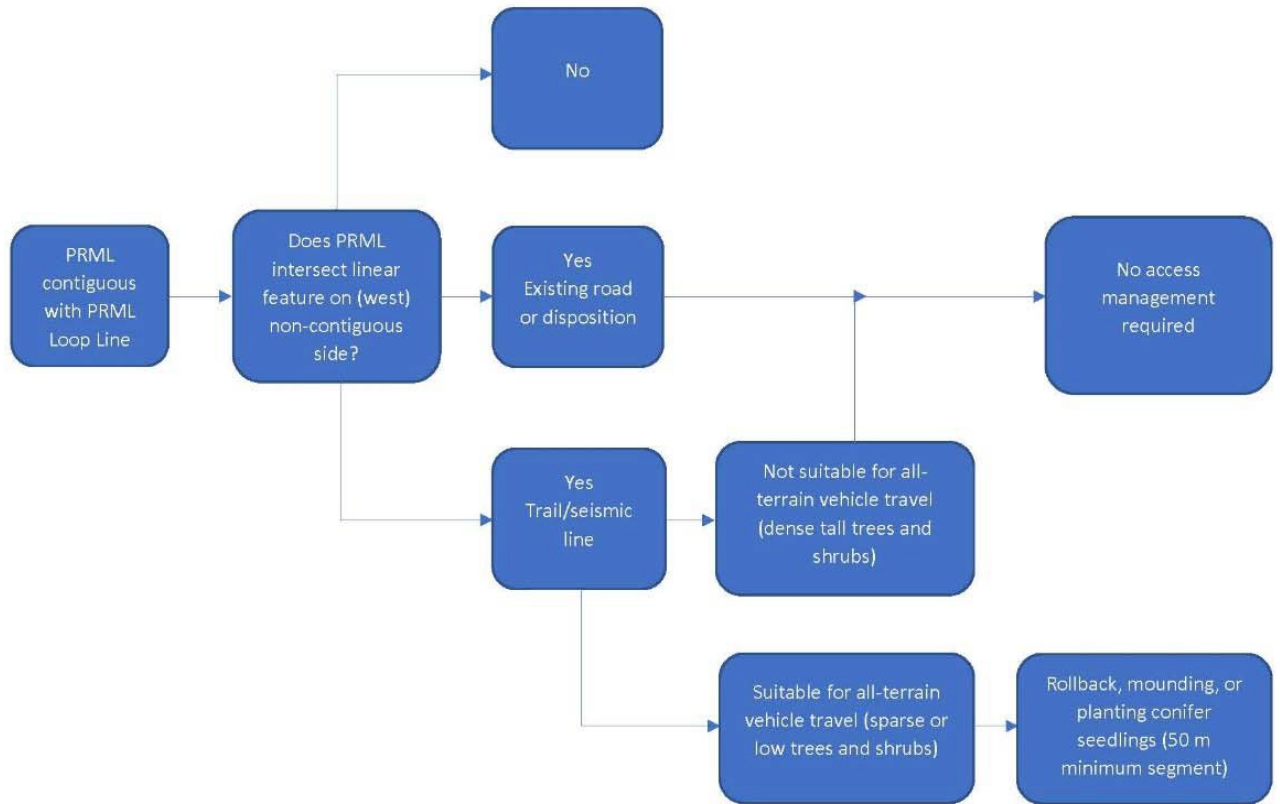


Figure 3-2: Access Management Decision Framework

Table 3-1: Habitat Restoration Measures

Restoration Measure	Purpose(s)	Considerations	Limitations
Protect established and site-appropriate natural regeneration	Primary: Habitat restoration Secondary: Reduce line of sight	<ul style="list-style-type: none"> • Primary restoration measure for abandoned-in-place segments of ROW • Where advanced natural regeneration has established, no further restoration measures may be required. • Community composition of naturally regenerating sites should be appropriate for the biogeographic region and site conditions. • Natural regeneration that meets growth criteria will be protected from further disturbance by NGTL. • Sites where natural regeneration is insufficient or inappropriate to site conditions will be considered for treatment using active habitat restoration measures. 	Some abandoned-in-place sections of the ROW may not have sufficient or suitable natural regeneration and will require additional restoration measures, such as seedling planting.
Minimal surface disturbance techniques	Primary: Facilitate Natural Regeneration Secondary: Reduce line of sight	Minimal surface disturbance techniques reduce impacts to soil structure and can lead to rapid regeneration of native vegetation. This method aids in achieving the goals of habitat restoration and access management, along with providing a visual barrier along the ROW. <ul style="list-style-type: none"> • Application limited to PDAs with abandonment activity occurring during winter conditions. • Reduces the need for soil salvage and grading. • Width of grubbing is limited to excavation area and where grading is required. • Reduced disturbance to vegetation and root systems by cutting, mowing or walking down; mulching shrubs and small diameter trees at ground level and freezing in the ROW (mulch depths no more than 3 to 5 cm). • Intact root systems and seed bed facilitates rapid regeneration of vegetation. • Snow padding or matting preserves shrubs and small trees. • Minimal surface disturbance techniques are constrained by existing ground topography and to ungraded areas. • Rapid regeneration of vegetation contributes to line-of-sight blocks on ROW. 	Of the eleven PDAs within the Chinchaga caribou range, two are scheduled for activity during frozen soil conditions (i.e., minimal surface disturbance techniques). The extent of minimal disturbance techniques is limited by scheduling to avoid the restricted activity period for caribou (February 15 to July 15) and also by existing ground topography.

Table 3-1: Habitat Restoration Measures (cont'd)

Restoration Measure	Purpose(s)	Considerations	Limitations
Coniferous seedling planting	<p>Primary: Habitat restoration</p> <p>Secondary: Access management Reduce line of sight</p>	<ul style="list-style-type: none"> • Application suitable for all PDAs and restored abandoned-in-place segments. • Coniferous seedling planting is considered a long-term habitat restoration measure, and an effective long-term access management and line-of-sight measure (it may take 10 or more years to achieve effectiveness, depending on site conditions). • Species selection (i.e., black spruce, white spruce, or pine) is determined based on the biophysical characteristics of the site, adjacent forest stand composition, and restoration targets. • Stem density of live coniferous trees is at least 1,000 stems/ha on upland sites, and 800 stems per/ha on lowland sites. 	<p>Coniferous seedling planting is a suitable habitat restoration measure and will be the main planting measure used for the Project.</p>
Woody debris rollback	<p>Primary: Access management</p> <p>Habitat restoration</p>	<ul style="list-style-type: none"> • Rollback can be effective immediately following implementation, provided adequate material is available and properly applied (Vinge and Pyper 2012, CRRP 2007a, b). Long rollback segments are more effective at managing access because ATV riders will be less inclined to try to ride through the debris or traverse around it in adjacent forest stands. • NGTL has found on previous caribou habitat restoration projects that material availability often limits the segment length that can be achieved to 50 m to 100 m (75 m on average). • Coverage ranging from 200–300 m³/ha can deter access while allowing sufficient spaces between the debris to allow seedling planting. • Placement of woody debris rollback can conserve soil moisture, moderate soil temperatures and provide nutrients as debris decomposes, prevent soil erosion, provide microsites for seed germination and protection for planted tree seedlings (Pyper and Vinge 2012; Vinge and Pyper 2012). • 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 Integrated Standards and Guidelines for the Enhanced Approval Process (AER 2013). 	<p>Woody debris rollback is a suitable habitat restoration measure to augment habitat restoration through the creation of microsites. The Project is contiguous with other developments in caribou habitat for its entire length, so opportunities to use woody debris rollback for access management may be limited.</p> <p>Woody debris material availability limits the segment lengths that can be achieved.</p> <p>Fire risk is a consideration when using or storing woody debris.</p>

Table 3-1: Habitat Restoration Measures (cont'd)

Restoration Measure	Purpose(s)	Considerations	Limitations
Mounding	Primary: Access management Habitat restoration (create microsites)	<ul style="list-style-type: none"> • Application suitable for linear feature intersects where access control measures will be applied and at PDAs and restored abandoned-in-place segments in treed lowland and wetland areas. • Mounding is used as an access management measure on pipeline ROWs, old roads, and on seismic lines to discourage off-road vehicle activity, and can be effective immediately following implementation. • For access management, mounds should be created using an excavator. Mounds are created by excavating to approximately 0.75 m depth and placing the excavated material immediately adjacent to the hole. • For the restored microsites for planted tree seedlings, mounding can be used in wet, low-lying areas to create better-drained microsites to restore seedling survival. • For previous NGTL caribou habitat restoration projects on pipeline ROWs, the achievable range in mound density was approximately 700 to 1,400 mounds/ha. Mound density is dependent on soil characteristics, extent of frost, and type of equipment used. • Mounding is often a suitable habitat restoration measure that is used in conjunction with coniferous seedling planting, using 2 to 3 seedlings per mound, depending on the form and orientation of the mound. • For previous NGTL caribou habitat restoration projects on pipeline ROWs, the achievable mound density was a at least 700 mounds/ha with 2 to 3 seedlings per mound. 	Mounding is a suitable habitat restoration measure that may be used in conjunction with coniferous seedling planting for the Project where ground conditions allow. The limitations include scheduling mounding for restoration during final cleanup, which typically requires freezing-in of soils, availability of specialized equipment and spatial separation of 5 m between the holes and the centreline of the operating pipeline.

3.2.1 Natural Regeneration

The natural regeneration of vegetation (i.e., establishment and succession) in linear features in the boreal forest is dependent on several factors, including site preparation techniques (COSIA 2017; Fuse Consulting 2014; Golder 2015b), use of minimal surface disturbance techniques (TERA 2011, 2012), slope position, time since disturbance and stage of succession, and characteristics of adjacent vegetation (e.g., site productivity, tree and shrub species and heights) (Bayne et al 2011; van Rensen 2014; van Rensen et al 2015). Forest regrowth on linear features that run through forested wetlands and coniferous lowlands and uplands tend to exhibit slower successional rates than forest regrowth on linear features that run through deciduous uplands (Golder and Explor 2016; van Rensen et al 2015).

Most of the Project ROW within the Chinchaga caribou range where the pipeline will be abandoned-in-place has established vegetation that has been naturally regenerating for approximately 25 years. In some locations on the ROW, stem density of naturally regenerating trees and shrubs exceed the indicators of restoration success as defined in the *Provincial Restoration and Establishment Framework for Legacy Seismic Lines in Alberta* (Government of Alberta 2017b), generally exceed the planting guidelines for reclamation planting or caribou habitat restoration (e.g., *Reclamation Criteria for Wellsites and Associated Facilities for Forested Lands* [ESRD 2013] and the *Boreal Caribou Habitat Restoration Operational Toolkit for British Columbia* [Golder 2015a]) and the restoration performance indicators for stem density listed in Section 4, Table 4-2. Stem densities greater than those prescribed in planting guidelines may suppress succession and maturation, although these exceedances evidently reduce line-of-sight and likely reduce the potential for predator or human movement along the abandoned ROW.

At PDAs, where scheduling and site-specific conditions allow, methods that promote natural regeneration will be used. For example, minimal surface disturbance techniques can be used during abandonment activities to promote rapid natural revegetation within the local ecotypes. This technique relies on frozen conditions, which can prevent disturbance of surface soils where excavation or grading is not necessary, such as for mowing and mulching. Early winter abandonment activity is planned at two of the eleven PDAs (sites 112 and 113 in Figure 1-1) within the Chinchaga caribou range.

As minimal surface disturbance techniques are mitigation measures implemented during abandonment activities, they are not included directly in the caribou habitat restoration decision frameworks. However, minimal surface disturbance techniques lay the foundation for natural regeneration and rapid re-establishment of vegetation on pipeline ROWs and will continue to be an important part of NGTL's overall caribou habitat restoration program.

3.2.2 Active Habitat Restoration

Active habitat restoration is the use of site preparation techniques and planting of native tree or shrub seedlings to establish adequate vegetation in areas of the ROW where natural regeneration currently does not meet restoration targets.

Established reclamation practices will be applied to promote revegetation at PDAs and in abandoned-in-place segments that require restoration (i.e., not meeting restoration targets). Site preparation measures such as mounding, which promote tree growth and natural shrub establishment, will be considered at suitable areas (e.g., lowlands and forested wetlands). Tree species comparable to the surrounding landscape will be planted to be similar in natural variation and complexity by planting at appropriate densities and spacing at the feature level.

To identify areas along the ROW needing active restoration, NGTL will combine three datasets to determine which areas of the ROW are not currently meeting restoration targets. The first dataset will be the habitat restoration units derived from AVI data, which classify the ROW into upland, transitional, lowland, or wetland units (see Section 3.1.1). The second dataset will be derived from aerial LiDAR and high-resolution photography that will be captured during the 2019 growing season but outside of the AEP restricted activity period for caribou range (February 15 to July 15). These data will be combined with a third dataset, the 2016 and 2017 ground-based vegetation sampling (Stantec 2017a; 2017b), to derive existing vegetation conditions for the entire ROW.

Systematically stratified sample plots will be derived from the aerial data and correlated with the ground-based vegetation survey data, and will take into account the time elapsed between ground-sampling and aerial imagery capture. The ground-based vegetation sampling completed in 2016 and 2017 included seventy-one plots placed approximately every 250 to 500 m along the ROW in different vegetation communities (Stantec 2017a; 2017b). Data gathered from the 10 m² plots included species composition, stem height, and stem density.

All PDAs will receive active habitat restoration. Habitat restoration measures in the abandoned-in-place segments will be based on estimated average stem densities for each habitat restoration unit. Where estimated average stem densities in a restoration unit do not meet the targets and performance indicators listed in Table 4-2 for that unit, active restoration measures will be applied to that section of ROW.

Restoration measures will be implemented as soon as practical for PDAs and abandoned-in-place habitat units that do not meet restoration targets. The type of active restoration measure that will be selected for implementation will be guided by the decision frameworks as outlined in Figures 3-1 and 3-2 and as described in Table 3-1. Access to active habitat restoration sites will be mainly via the adjacent operational PRML Loop ROW.

3.2.3 Access Management

Access management for the Project within the Chinchaga caribou range will be planned to:

- manage human access onto the pipeline ROW from features intersecting the west side of the ROW (i.e., the to-be-abandoned portion of the ROW) in a manner that discourages motorized access
- maintain managed access necessary for the safe and continued operation of the NPS 30 PRML Loop (e.g., 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)

A Geographic Information System was used to identify intersecting linear features that could potentially provide access onto the PRML ROW. Field visits in 2016 and 2017 characterized the state of the intersecting features (e.g., estimated vegetation height and line-of-sight distance from PRML ROW) and documented evidence of the level of human or wildlife use (Stantec 2017a; 2017b). These data will be used to identify candidate access management locations along the PRML ROW within the Chinchaga caribou range. Locations will be refined to consider operational access for the continued operation and maintenance of the adjacent PRML Loop (i.e., access management will not be effective if implemented on the east side of the PRML ROW where it is contiguous with the operational PRML Loop which provides unrestricted access). A complete list of restoration sites and measures implemented will be included in a report to be submitted to the Board before January 31 after the first complete growing season following completion of physical abandonment activities.

Access Management Measures

Access management measures are typically sited on a pipeline ROW at active intersections (e.g., perpendicular or near-perpendicular crossings) with other linear features such as roads, utility corridors, seismic lines, and watercourses such that access onto the ROW from those linear features is reduced or deterred. Potential access management measures include:

- vegetation planting
- mounding
- rollback

Because the Project involves the abandonment and reclamation of an existing pipeline ROW, some access management measures appropriate for new-build ROWs may use materials (e.g., tree-bending) or planning methods (e.g., extended trenchless crossings) that are not available or applicable to restoration of the PRML ROW.

3.2.4 Line-of-Sight Blocking

During field visits in 2016 and 2017, line-of-sight was measured along the ROW approximately every 250 to 500 m in both directions at each ground-based vegetation plot in caribou range (see Section 3.2.2). Line-of-sight was estimated using a 1.2 m x 1.2 m cover board, divided into four black and white quadrants. The distance at which 50% and 100% of the cover board was obscured by vegetation or topography, from a sighting height of 1.2 m, was recorded (Stantec 2017a; 2017b).

Line-of-sight thresholds have already largely been achieved along the Project ROW through existing natural regeneration of vegetation. Line-of-sight distance may be further reduced as a secondary effect of other restoration measures (e.g., access control, restoration from tree planting). The line-of-sight on the PRML ROW is currently considerably less than the 500 m target used in other caribou habitat restoration plans (e.g., Stantec 2014; NGTL 2015). The average distance at which 50% and 100% of the cover board was concealed on the Project ROW was 33.2 m and 67.5 m, respectively (Stantec 2016, unpublished data; 2017a; 2017b).

While line-of-sight blocking can be effective when implemented across the entire width of a ROW, it is considered less effective when implemented across only a portion of the width (e.g., implemented on an abandoned ROW that is contiguous with an operational ROW with no line-of-sight mitigation) (Northern Resource Analysts 2016). Therefore, because the ROW already has reduced line-of-sight and is contiguous with an operational ROW, the purposeful installation of line-of-sight measures (e.g., fabricated screens) for the Project will not be used as a restoration measure.

3.3 DECISION FRAMEWORKS FOR HABITAT RESTORATION MEASURES

Two caribou habitat restoration decision frameworks, for habitat enhancement and access management, have been designed to provide guidance on the selection of habitat restoration measures on the basis of site-specific characteristics (Figures 3-1 and 3-2). The decision frameworks are principle-based logic models that inform restoration decisions to achieve the objective and goals of the CRVRP. They are based on NGTL's experience from developing and implementing similar frameworks for caribou habitat restoration following pipeline construction projects, and from information obtained from literature reviews, industry best management practices, and industry and regulatory consultation. NGTL continually reviews and updates its approach to designing decision frameworks as new information, and results from restoration monitoring reports, becomes available.

The decision frameworks will be applied prior to the commencement of abandonment activities to identify candidate sites for restoration measures on the Project ROW. Ongoing engagement with Aboriginal communities and stakeholders may identify the need to maintain access, and subsequently preclude access management, in some

areas. As restoration measures are applied, the frameworks will be reviewed to confirm appropriate restoration measures are being used at selected sites on the Project ROW and at the eleven PDAs during final cleanup.

4.0 PERFORMANCE INDICATORS

The performance indicators described in Tables 4-1 and 4-2 are used in combination with the decision frameworks to determine whether active restoration is needed. These performance indicators are also used during monitoring to determine whether habitat restoration is advancing as expected. Thus, to achieve the stated objectives, goals and targets described in Section 2 of this CRVRP, the performance indicators in Tables 4-1 and 4-2 inform both the selection of access management and active restoration sites as well as the subsequent monitoring of restoration success.

During monitoring, the success of the restoration measures will be described both quantitatively and qualitatively by the performance indicators outlined in Tables 4-1 and 4-2. The ‘primary measures’ identified in Tables 4-1 and 4-2 are derived from Table 3-1: Habitat Restoration Measures. The performance indicators are based on NGTL’s experience with implementing and monitoring caribou habitat restoration measures for other projects.

Depending on the restoration measures implemented for the Project, additional performance indicators may be developed. The final performance indicators will be described in a subsequent habitat restoration monitoring report.

Table 4-1: Performance Indicators to Measure CRVRP Goals and Targets (G1)

Goal	Target	Primary Measures	Performance Indicator	Applicability to the Project
(G1) NGTL's caribou habitat restoration measures are ecologically relevant, practically located, and designed to reduce the potential for re-disturbance by human activity	<ul style="list-style-type: none"> (T1) Access onto the PRML ROW from intersecting linear features is lower from controlled intersections compared with uncontrolled intersects 	Implement access management <ul style="list-style-type: none"> Mounding Rollback Vegetation screens 	<ul style="list-style-type: none"> Access control not bypassed or destroyed and no evidence of access from blocked linear feature to ROW Vegetation on ROW not damaged by motorized vehicles 	<ul style="list-style-type: none"> Applicable to access onto ROW from seismic lines and trails Not applicable on the Project ROW as the Project is contiguous with the PRML Loop
	<ul style="list-style-type: none"> (T2) Continuous improvement of caribou habitat restoration methods and techniques based on past experience. 	<ul style="list-style-type: none"> Development and implementation of a NGTL caribou range vegetation monitoring plan or protocol to promote protection of habitat restoration efforts 	<ul style="list-style-type: none"> Long term monitoring shows the progression and protection of restoration measures 	<ul style="list-style-type: none"> Applicable to the Project

Table 4-2: Performance Indicators to Measure CRVRP Goals and Targets (G2)

Goal	Target	Primary Measures	Performance Indicator	Applicability to the Project
<p>(G2) NGTL's caribou habitat restoration measures result in self-sustaining and ecologically appropriate vegetation communities that are on a trajectory to the compatible surrounding landscape</p>	<ul style="list-style-type: none"> • (T3) The species composition of revegetated restoration areas regenerates on a typical path of ecological succession • (T4) The sustained growth trend of revegetated restoration areas is comparable to that of the surrounding landscape 	<p>Implement habitat restoration</p> <ul style="list-style-type: none"> • Protect established appropriate natural revegetation • Minimal surface disturbance • Plant coniferous seedlings at PDAs and areas of natural regeneration requiring restoration 	<p>Based on published information and provincial guidance (Government of Alberta 2017b; 2017c), the following stem densities have been derived for areas of natural regeneration. Stem densities are based on ten-year establishment targets:</p> <ul style="list-style-type: none"> • minimum live stem density of 1,000 stems/ha of tree species capable of reaching 5 m in height on upland habitat restoration units • minimum live stem density of 800 stems/ha of tree species capable of reaching 5 m in height on treed lowland habitat restoration units <p>Upland and Transitional Deciduous and Mixedwood Habitat Restoration Units:</p> <ul style="list-style-type: none"> • Sections with adequate natural regeneration have not sustained further disturbance • Vegetation on ROW displays trajectory toward mature deciduous dominant or mixedwood forest type typical to region • All restoration locations demonstrate sustained growth trends across $\geq 80\%$ of restoration locations at 10 years following implementation of restoration measures <p>Upland and Transitional Coniferous Habitat Restoration Units:</p> <ul style="list-style-type: none"> • Sections with adequate natural regeneration have not sustained further disturbance • Where tree seedlings are planted, achieve $\geq 80\%$ survival rate of planted seedlings at 10 years following implementation of restoration measures • All restoration locations demonstrate sustained growth trends across $\geq 80\%$ of restoration locations at 10 years following implementation of restoration measures 	<p>Applicable to the Project</p>

Table 4-2: Performance Indicators to Measure CRVRP Goals and Targets (G2) (cont'd)

Goal	Target	Primary Measures	Performance Indicator	Applicability to the Project
			<p>Treed Lowland and Wetland Habitat Restoration Units:</p> <ul style="list-style-type: none"> • Sections with adequate natural regeneration have not sustained further disturbance • Where tree seedlings are planted (e.g., mounded sites), achieve $\geq 50\%$ survival rate for seedlings or transplants at 10 years following planting • Demonstrate sustained growth trends across $\geq 50\%$ of restoration locations at 10 years following implementation of restoration measures <p>Shrubby/Graminoid Wetland Habitat Restoration Units:</p> <ul style="list-style-type: none"> • Sections with adequate natural regeneration have not sustained further disturbance • At 10 years following implementation of restoration measures: <ul style="list-style-type: none"> ○ $\geq 50\%$ cover of native vegetation species in the Project footprint ○ no restricted weeds 	

Performance indicators for Goal 1 include parameters to define success of access management. Control measures to reduce access along the PRML ROW would be ineffective as nearly the entire length of the Project is contiguous with the operating PRML Loop. Additionally, Project access management cannot control those linear features suitable for human access which approach from the east side of the shared ROW (i.e., from the operating PRML Loop ROW). If future monitoring finds evidence of access onto the (western) PRML ROW at intersections where access management techniques were installed, or evidence of vegetation damage along the PRML ROW due to motorized vehicles, access management measures may be adjusted, if feasible.

As outlined in Table 4-2, the performance indicators for Goal 2 include parameters that relate to the habitat restoration units affected and a corresponding reasonable timeline to achieve restoration success in the Project ROW. NGTL has chosen survival rate as a performance indicator because it is not species dependent. The growth rates of coniferous species can be variable and tree height over time can differ based on habitat characteristics and site-specific conditions. Given the differences in growing conditions between upland and lowland locations, and the potential for site-specific influences and factors to affect growth, tree height was not chosen as a monitoring metric.

4.1.1 Example of Habitat Restoration Decision Framework and Monitoring

Figure 4-1 describes, for a hypothetical site, the steps that will be taken to assess, select, implement, and monitor habitat restoration measures and locations for the PRML ROW within the Chinchaga Caribou Range.

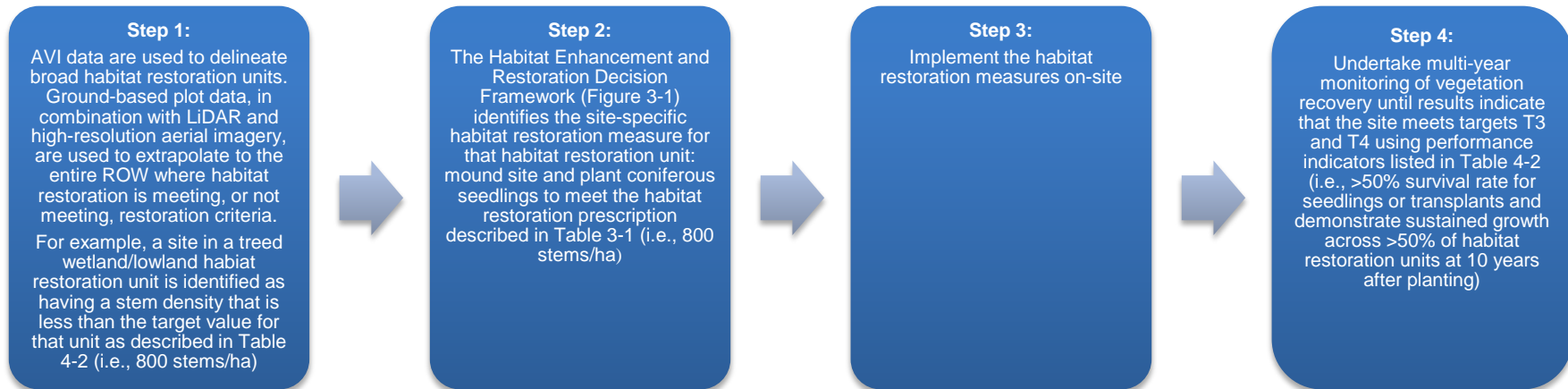


Figure 4-1: Example: Steps Taken to Assess, Select, Implement, and Monitor Habitat Restoration Measures and Locations

5.0 RESTORATION MONITORING

Monitoring can inform whether restoration investments are contributing meaningfully to the strategic outcome of conservation and recovery of woodland caribou. To this end, NGTL will develop a habitat restoration monitoring report for the Project that will describe the monitoring approach for evaluating the effectiveness of habitat restoration measures implemented.

As required by the second portion of Condition 14 of the Order, the monitoring report will be filed with the Board before January 31, following the first complete growing season subsequent to implementation of caribou habitat restoration measures. The monitoring report will be based on lessons learned from recent projects, ongoing monitoring programs, regulatory or policy changes, and ongoing consultation. The monitoring report will include details on monitoring (including ground-based, aerial and remote camera monitoring as appropriate). It will also include details pertaining to the monitoring design (i.e., methods, frequency, and duration) for the habitat restoration measures implemented. It will include information pertaining to the number and location of monitoring sites, method of access to monitoring sites (e.g., the operational PRML Loop), and evaluation of the effectiveness of restoration measures.

During restoration monitoring, the operational PRML Loop, which is parallel and adjacent to the PRML ROW within the Chinchaga caribou range, will be the primary means of access to habitat restoration sites.

The benchmarks for habitat restoration monitoring will be the same performance indicators used for initial restoration site selection defined in Tables 4-1 and 4-2 in Section 4. The habitat restoration measures will be considered successful when monitoring results indicate that restored areas have achieved, or are on a trajectory to achieve, the performance indicators and related goals and targets defined in Tables 4-1 and 4-2 in Section 4. No additional measures will be considered necessary after restoration measures are considered successful. If performance indicators indicate that a target is not being achieved, an adaptive management framework will be used to evaluate which, if any, remedial measures can be implemented in order to achieve habitat restoration goals. If remedial measures are implemented, monitoring of those measures will be undertaken as part of evaluating habitat restoration success.

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