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September 1, 2016

Filed Electronically

National Energy Board
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)
2017 NGTL System Expansion Project (Project)
GH-002-2015 Report
Appendix III, Condition 7 – Revised Caribou Habitat Restoration & Offset Measures Plan
NEB File: OF-Fac-Gas-N081-2014-20 02

In accordance with Condition 7 of the GH-002-2015 Report for the Project issued by the National Energy Board (NEB or Board) on June 1, 2016, NGTL encloses the Revised Caribou Habitat Restoration & Offset Measures Plan (CHR&OMP) for filing with the Board.

At the time the Project application was submitted, the proposed in-service date for the Project was April 1, 2017. In order for NGTL to facilitate the commercial in-service date, construction on the Project was planned to begin in the fourth quarter of 2016, subject to the proponent obtaining the required approvals. NGTL is filing these pre-construction condition items in advance of the issuance of a Certificate for the Project to satisfy the longer lead times associated with each Condition prior to starting construction activities.

Should you require additional information, please contact me at (403) 920-7942, or by email at tisha_homer@transcanada.com.

Yours truly,
NOVA Gas Transmission Ltd.

Original signed by

Tisha Homer
Regulatory Project Manager
Canadian Gas Pipelines

NATIONAL ENERGY BOARD

REVISED CARIBOU HABITAT RESTORATION AND OFFSET MEASURES PLAN

NOVA GAS TRANSMISSION LTD.

2017 NGTL SYSTEM EXPANSION PROJECT

September 2016

To: The Secretary
National Energy Board
517 Tenth Avenue SW
Calgary, Alberta
T2R 0A8

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1.0 INTRODUCTION AND ORGANIZATION

This section provides an introduction to and explanation of the organization of the integrated Caribou Habitat Restoration and Offset Measures Plan (CHR&OMP) for the Boundary Lake and Pelican Lake Sections of the 2017 NOVA Gas Transmission Ltd. (NGTL) System Expansion Project (Project). The preliminary CHR&OMP was submitted as part of NGTL's additional written evidence during the GH-002-2015 proceeding (NEB Filing ID: A4T8R1), allowing for public and regulatory review and feedback on the document. In accordance with Condition 7 of the National Energy Board's (NEB or Board) GH-002-2015 Report (Report), this version incorporates revisions based on evidence submitted during the hearing process as well as updates based on ongoing NGTL experience (refer to Tables 1-1 and 1-2).

1.1 INTRODUCTION

NGTL, a wholly owned subsidiary of TransCanada PipeLines Limited (TransCanada), applied to the Board on March 31, 2015 for approval under section 52 of the *National Energy Board Act* (NEB Act) for authorization to construct and operate the Project. The Boundary Lake and Pelican Lake Sections of the Project interact with the Chinchaga, West Side Athabasca River (WSAR) and East Side Athabasca River (ESAR) boreal caribou ranges (see Figures 1-1 and 1-2).

The integrated CHR&OMP outlines NGTL's plan to restore and offset the Project's residual effects on caribou habitat predicted to remain after mitigation, as detailed in the Environmental Socio-Economic Assessment (ESA) [NEB Filing IDs: A4K2R8 and A4K2R9].

The CHR&OMP outlines the method and preliminary quantification of the direct and indirect disturbance of caribou habitat for the Boundary Lake and Pelican Lake Sections. It also identifies caribou habitat restoration and offset measures to be considered. This CHR&OMP was developed from stakeholder feedback, NGTL and industry experience, emerging applied research and monitoring outcomes.

This document describes the assessment and selection process for restoration and offset measures. In accordance with Condition 31 of the Report, a Caribou Habitat Restoration Implementation Report and Status Update will be filed July 1 after the implementation of habitat restoration measures. In accordance with Condition 34 of the Report, the Caribou Habitat Offset Measures Implementation Report will be submitted March 31 after offset measures are implemented. In addition, as required by Condition 32 of the Report, the Caribou Habitat Restoration Offset Measures Monitoring Plan (CHROMMP) will be filed with the NEB November 1 after the first full growing season following implementation of caribou habitat restoration measures for the Boundary Lake and Pelican Lake Sections. In accordance with Condition 33

of the Report, associated monitoring reports will be submitted after each monitoring year, the schedule of which will be detailed in the CHROMMP.

1.2 CONDITION COMPLIANCE

Table 1-2 contains the concordance table for the revised CHR&OMP. NGTL will provide notifications of its filings with the Board related to the CHR&OMP to all Aboriginal groups who expressed interest in the CHR&OMP through the GH-002-2015 hearing process. NGTL will also provide notifications to representatives with Environment and Climate Change Canada and Alberta Environment and Parks in compliance with this Condition.

Anticipated timelines for compliance with the remaining caribou related Project conditions is provided in Section 5.0 Schedule for Implementation, Table 5-1.

Table 1-1: Revision Log - Revised CHR&OMP

Section of Revised CHR&OMP	Page	Revision	Rationale
All	All	Updated date "Revised" added to title Citations to Project conditions added	• Reflects current submission date to distinguish from September 2015 version • Continuity of phrasing regarding project components and condition requirements.
1.0	1-1	Added text regarding version history and references to Tables 1-1 and 1-2	• Explanation of version history. • Table 1-1 provides the detailed revision log as specified in Condition 7 of GH-002-2015 Report. • Table 1-2 provides concordance with evidence submitted during GH-002-2015 proceeding as incorporated into revised document.
1.1	1-1	Added text for related condition compliance	• Updated prior text to reflect GH-002-2015 Report conditions, which represent a new approach and direction for NGTL caribou management planning and reporting
1.3	1-5	Revised subsection	Preliminary CHR&OMP referred to draft NEB conditions.
3.1	3-1	Minor edits to paragraph 2	Adjustment to reflect revised version and GH-002-2015 Report conditions related to caribou.
3.2	3-2	Minor text edit; population of Table 3-2	Adjusted text to reflect planned implementation reports; inclusion of data in Table 3-2 as provided in the response to NEB IR 3.13.
3.4	3-6	Table 3-4 updated	Extensive update to Table 3-4 to reflect measures most likely to be employed on NGTL projects, and ordered to reflect the general importance/priority of measures. Content reduced to key information rather than incorporating full literature review details.
3.4.1	3-6	Minor text revision	Added "surface" to "minimal *surface* disturbance" to provide fuller description to objective of method.
3.4.2	3-7	Revision to text	Revised for clarity; added description regarding mimicking natural variation/complexity, as per responses to NEB IRs 4.17 and 5.5.
3.4.3	3-7	Added text regarding preliminary planning	Added a sentence to note the spring 2016 focused aerial reconnaissance to provide preliminary planning for access control locations on the Boundary Lake and Pelican Lake Sections.

Table 1-1: Revision Log - Revised CHR&OMP (cont'd)

Section of Revised CHR&OMP	Page	Revision	Rationale
3.4.3	3-8	Deleted bulleted text	Removed installation of berms and tree felling over ROW from measures. These means are not practically employed by NGTL as discussed in Section 8.3
3.4.4	3-8	Deletion of minor text in paragraph 1; addition to paragraph 3	Removed berms as measure and clarification of tree planting as measures, as discussed in Section 8.3. Added clarification regarding Enhanced Approval Process guidelines and applicability to NGTL projects, further detailed in Section 8.3. Content added per filed responses to NEB IRs 3.21 and 4.18.
3.5	3-11	Update of decision frameworks	Access control revised to address snow ramping and extension of bores as options. Line-of-sight content revised to reflect measures more accurately. Habitat restoration updated to clarify measure options and to remove grading from wetlands. All frameworks revised to illustrate progression to Initial Offset Value calculation stage.
4.2	4-1	Minor text revision	Clarification that final calculations will be in the implementation reports specified under Conditions 31 and 34 of the GH-002-2015 Report.
4.2	4-2	Minor bullet text addition Text added to paragraph 1 Table 4-1 populated	Added "direct" to "remaining direct disturbance" and "remaining to "remaining indirect disturbance" for clarity and accuracy. Added text to explain assumptions used to populate Table 4-1. Table 4-1 populated as per the filed response to NEB IR 3.13.
4.3	4-5	Subsection updated extensively	Addition of material to paragraph 1 regarding questionnaire approach. Clarification that NGTL will adjust multipliers if necessary to address future provincial frameworks. Addition of explanatory paragraph regarding adjustment of multipliers. Additional text pertaining to temporal multiplier and timing of offset implementation. Clarification of the application of spatial multipliers. Subsection updated to reflect filed responses to NEB IRs 3.14, 4.16, and 4.19.
4.4	4-8	Added table numbering Added text to introduce populated tables	Inclusion of populated calculation tables required the addition of Tables 4-3 to 4-5. Explanation of the populated tables and presentation of assumptions that support the calculations.

Table 1-1: Revision Log - Revised CHR&OMP (cont'd)

Section of Revised CHR&OMP	Page	Revision	Rationale
4.4	4-7	Inclusion of populated tables	Three tables included with provisional data population as per the filed response to NEB IR 3.13
4.5	4-12	Clarification text added	Text clarifying the need for offset areas to be permanently protected locations with limited existing access or use and that planning is in keeping with Alberta Environment and Parks range plan objectives per the filed response to NEB IRs 3.18 and 3.22.
4.5	4-12	Clarification text added	Text regarding timing of offset implementation as per the filed response to NEB IR 3.14
4.5.1	4-13	Clarification text added	Clarification of landscape and site specific scale/level selection criteria added per the filed response to NEB IR 4.21, and confirmation of alignment with Alberta Environmental and Parks priorities and restoration objectives per the filed response to NEB IR 4.22.
4.6	4-14	Minor edit	Correction to figure citations
4.7	4-14	Figure 4-3 updated	Figure modified to clarify landscape and site specific scale considerations, as per the filed response to NEB IR 4.21. Details of potential measures were removed as offset scenario is evaluated at the habitat unit level and is not necessarily comparable to a post-construction scenario in terms of material availability.
4.8	4-15	Added text and populated tables	Text added to contextualize provisional estimates provided in tables 4-6 to 4-8; three tables added with data per the filed response to NEB IR 3.13.
5.0	5-1	Updated Table 5-1	Revised schedule to reflect documents and timelines included in the Conditions included in the GH-002-2015 Report for the Project.
6.0	6-1	Minor edits to text	Revised paragraph 3 to reflect documents (implementation reports) outlined required under Conditions 31 and 34 of GH-002-2015 Report.
6.0	6-1 to 6-2	Updated Table 6-1	Removed primary measures that are not practical or commonly implemented by NGTL.
6.0	6-3	Added content	Included discussion regarding performance indicators as per the filed responses to NEB IRs 3.20, 3.21, 4.17 and 4.18.

Table 1-1: Revision Log - Revised CHR&OMP (cont'd)

Section of Revised CHR&OMP	Page	Revision	Rationale
7.0	7-1	Minor revision, added content	Included reference to GH-002-2015 Report Condition 32 and noted planned content per the filed response to NEB IR 3.12
8.0	8-1	Updated content	Subsection revised to summarize key content changes in updated CHR&OMP.
8.1	8-1 to 8-2	Added content	Additional content to discuss removal of some measures not practical or counterproductive and inclusion of beneficial measures in Section 3.4
8.2	8-3	Minor edit	Updated context of NGTL membership in Regional Industry Caribou Collaboration.
8.3	8-3 to 8-5	Added text	Updated subsection regarding recent related project consultation with regulators, removal of berms from restoration measures, reordering of bullet line-of-sight bullet to keep related items together, and inclusion of recent guidance from Alberta Environment and Parks regarding achievable line-of-sight intervals.
9.0	9-1	Updated text	Edits to reflect current state of consultation and reflect terminology of Project condition submissions (implementation reports, etc.)
9.1	9-1	Updated content	Updated to reflect current and planned consultation with Aboriginal communities..
9.2	9-1	Updated content	Added reference for Appendix C, moving previous Table 9-1 to the appendix to reduce main document content. Updated final paragraph to be reflective of current consultation with Alberta Environment and Parks and Environment and Climate Change Canada. Updated and moved Table 9-1 to Appendix C.
11.0	11-1	Added reference	Added reference (AEP 2016) relating to recent draft range plan for Little Smoky and La Peche caribou ranges.
11.0	11-4	Added reference	Added reference (CLMA and FPAC 2007) relating to questionnaire context from Section 4.3 Context of Multipliers.

Table 1-1: Revision Log - Revised CHR&OMP (cont'd)

Section of Revised CHR&OMP	Page	Revision	Rationale
App. A	All	Updated photos	Updated select photos
App B	All	Updated typical drawings	Updated select typical drawings
App C	All	Added section	Moved previous Table 9-1 from Section 9 to Appendix C to reduce non-specific content in body of document

Table 1-2: Concordance of Hearing Evidence in Revised CHR&OMP

NEB Information Request	Topic	Requested Information	Correlation to Revised Content in CHR&OMP
2.10	Critical Caribou Habitat – Quantification and Nature of Existing and Proposed Disturbances	Details regarding content of anticipated preliminary CHR&OMP	2.10a): See Section 3.2 (Quantification of Total Habitat Disturbance) 2.10b): See Sections 4.2 (Quantification of Remaining Disturbance), 4.4 (Calculating the Initial Offset Value), and 4.8 (Quantification of FOV) 2.10c): See Sections s to 2.2 (Objective), and 2.3 (Goals and Targets)
2.11	Caribou – Temporary Camps	Details regarding construction camps	Addressed in the IR response as filed. Information requested does not form part of CHR&OMP.
2.12	Caribou – Construction Schedule	Requested schedule considerations for adhering to Restricted Activity Period (RAP)	See simplified version of Table 5-1.
2.13	Caribou – Work in the RAP	Details of project execution not specific to CHR&OMP	Addressed in the IR response as filed. Information requested does not form part of CHR&OMP.
2.14	Caribou – Identification of Areas for Protection	Preliminary potential offset locations.	See Section 4.5 (Offset Selection and Implementation Plan).

Table 1-2: Concordance of Hearing Evidence in Revised CHR&OMP (cont'd)

NEB Information Request	Topic	Requested Information	Correlation to Revised Content in CHR&OMP
2.15	Access Management/ Line-of-Sight	a) confirmation of measures to be implemented and maintained; monitoring of measures b) measures to discourage human and predator access c) information on measures on contiguous right-of-way (RoW)	2.15a): See Sections 3.4 (Habitat Restoration Measures (and all subparts)), 3.5 (Decision Framework for Habitat Restoration Measures), 6.0 (Performance Indicators), 7.1 (Monitoring Program), and 7.2 (Adaptive Management) 2.15b): See Section 3.4.3 (Access Control) 2.15c): Addressed in the IR response as filed; response does not pertain to caribou habitat restoration or offset measures.
3.10	Updated Consultation Logs with Government Agencies	Update on government agency consultations pertaining to caribou	See Section 9.2 (Regulatory Consultation), summary table moved to Appendix C
3.11	Caribou Habitat – Boundary Lake Section - Doig River First Nation (DRFN) TLU – DRFN 2013 Caribou Study	Request to address DRFN 2013 caribou study area in CHR&OMP	Addressed in the IR response as filed. 10.2 (Regulatory Policy, Recovery Objectives and Guidelines for Boreal Caribou) specifies reliance on Environment Canada guidance regarding mapped caribou range.
3.12	Caribou Habitat – CHROMMP	Request for preliminary CHROMMP	Addressed in IR response as filed. Correction to Table 5-1 to remove "preliminary" CHROMMP as an error.
3.13	Caribou Habitat – Provision of Estimates	Request to populate all tables with provisional data	Updated Tables 3-2, 4-1, 4-3, 4-4, 4-5, 4-6, 4-7 and 4-8 are included in the revised CHR&OMP.
3.14	Caribou Habitat – Timing of Implementation of Direct Offset Measures	Consideration of early implementation of offsets, including potential for reduction in temporal multiplier	Addressed in the IR response as filed. Additionally, materials have been added to Sections 4.3 (Context of Multipliers) and 4.5 (Offset Selection and Implementation Plan).
3.15	Caribou Habitat – Boundary Lake and Pelican Lake Sections - Baseline	Clarification of baseline data collection.	Addressed in the IR response as filed; additional details added to Section 3.4.3 (Access Control, Baseline Data)

Table 1-2: Concordance of Hearing Evidence in Revised CHR&OMP (cont'd)

NEB Information Request	Topic	Requested Information	Correlation to Revised Content in CHR&OMP
3.16	Caribou Habitat – Boundary Lake and Pelican Lake Sections - Operational Width of the RoW	Details regarding need of operational access, including determination of width	Addressed in the IR response as filed (operational details). See Section 4.2 (Quantification of Remaining Disturbance) for added context.
3.17	Caribou Habitat – Boundary Lake and Pelican Lake Sections – Proposed Project RoW	Requested tabular summary of widths of existing and planned ROW for two project components	Addressed in the IR response as filed. Information requested are details of the Project not specific to the CHR&OMP.
3.18	Caribou Habitat – Boundary Lake and Pelican Lake Sections – Habitat Restoration and Offset Locations	Consideration of alternate offset locations beyond AEP priority areas	Addressed in the IR response as filed. Additional clarification has been added to Sections 4.5 (Offset Selection and Implementation Plan), and 4.5.1 (Offset Location Criteria).
3.19	Caribou Habitat – Boundary Lake and Pelican Lake Sections - Alternatives to clearing on RoW	Consideration of alternate construction methods to reduce clearing on RoW	Addressed in the IR response as filed. Information requested does not form part of CHR&OMP.
3.20	Caribou Habitat – Boundary Lake and Pelican Lake Sections - Performance Indicator for Access	Clarification regarding the performance indicators identified for monitoring access control measures	Addressed in the IR response as filed. Content has been added to Section 6.0 (Performance Indicators). Detailed information will be included in the CHROMMP as required under Condition 32 of the GH-002-2015 Report.
3.21	Caribou Habitat – Boundary Lake and Pelican Lake Sections - Performance Indicator for Line-of-sight	Expansion and clarification regarding line-of-sight targets set in CHR&OMP	Addressed in the IR response as filed. Content has been added to Section 6.0 (Performance Indicators).
3.22	Caribou Habitat - Boundary Lake and Pelican Lake Sections – Aboriginal Consultation on the CHR&OMP	Clarification regarding considerations of TLRU in offset areas and engagement efforts to avoid effects to TLRU relating to offset implementation	See additional text included in Sections 4.5 (Offset Selection and Implementation Plan) and 9.1 (Aboriginal Engagement).
4.11	Wetlands – Extended-Term Disturbance	Part b) requests confirmation that valve sites in caribou habitat would be included in offset planning	Addressed in the IR response as filed. Information requested does not form part of the CHR&OMP.

Table 1-2: Concordance of Hearing Evidence in Revised CHR&OMP (cont'd)

NEB Information Request	Topic	Requested Information	Correlation to Revised Content in CHR&OMP
4.13	Caribou and Caribou Habitat - Boundary Lake and Pelican Lake Sections – Proposed Schedule	Clarifications regarding the scheduling of final cleanup activities and limitations and timing of offset implementation.	Addressed in the IR response as filed. See additional clarification added to Section 4.5 (Offset Selection and Implementation Plan).
4.14	Caribou and Caribou Habitat - Boundary Lake and Pelican Lake Sections - Hydrostatic Water Testing - Access in Caribou Critical Habitat	Clarification sought regarding hydrostatic test sources and access needs within caribou range.	Addressed in the IR response as filed. Information requested does not form part of CHR&OMP.
4.15	Caribou and Caribou Habitat – Boundary Lake and Pelican Lake Sections - Aerial Flights Over Caribou Critical Habitat	Consideration of aerial patrol requirements relative to caribou and sensitive timing windows.	Addressed in the IR response as filed. Information requested does not form part of CHR&OMP.
4.16	Caribou and Caribou Habitat – Boundary Lake and Pelican Lake Sections - Rollback	Clarification sought on rollback intervals and application of multipliers.	Addressed in the IR response as filed. Updated content has been added to Tables 3-4, and additional content added to Section 4.3 (Context of Multipliers).
4.17	Caribou and Caribou Habitat – Boundary Lake and Pelican Lake Sections - Tree Planting	Additional details regarding planting strategies and densities requested.	Addressed in the IR response as filed. Updated content has been added to Table 3-4, and to Section 6.0 (Performance Indicators).
4.18	Caribou and Caribou Habitat – Boundary Lake and Pelican Lake Sections – Habitat restoration specifications	Clarification regarding specifications for habitat restoration and reconciling AEP standards.	Addressed in the IR response as filed. See additional text added to Sections 3.4.4 (Line of Sight Blocking), 6.0 (Performance Indicators) and 8.3 (Lessons from NGTL Habitat Restoration).
4.19	Caribou and Caribou Habitat – Boundary Lake and Pelican Lake Sections – CHR&OMP - Spatial Risk Multiplier	Clarification regarding the application of spatial multipliers	Addressed in the IR response as filed. See added content in Section 4.3 (Context of Multipliers).
4.20	Caribou and Caribou Habitat – Boundary Lake and Pelican Lake Sections - CHR & OMP – Estimated Offset Values and Maximum Multipliers	Requested examples of past NGTL project calculations of multipliers to illustrate range of potential maximum values relative to provisional values calculated for Project	Addressed in the IR response as filed. Information requested does not form part of CHR&OMP.

Table 1-2: Concordance of Hearing Evidence in Revised CHR&OMP (cont'd)

NEB Information Request	Topic	Requested Information	Correlation to Revised Content in CHR&OMP
4.21	Caribou and Caribou Habitat – Boundary Lake and Pelican Lake Sections - Offset Location Criteria	Clarification regarding offset location selection and Offset Measures Decision Framework	See additional content in Section 4.5.1 (Offset Location Criteria), and updated Figure 4-3 (Offset Measure Decision Framework)
4.22	Caribou and Caribou Habitat – Boundary Lake and Pelican Lake Sections - Offset Locations and Range Plans	Clarification regarding AEP priority locations in the caribou ranges affected, status of provincial range plans, and how new range plans may affect offset location selection	Addressed in the IR response as filed. See additional content in Sections 4.5 (Offset Selection and Implementation Plan), and 4.5.1 (Offset Location Criteria).
4.23	Caribou and Caribou Habitat – Boundary Lake and Pelican Lake Sections – Habitat Restoration – Duration of monitoring	Clarification requested regarding monitoring duration and outcomes, opportunities for use of aerial patrol information and proposed monitoring program details.	Addressed in the IR response on record. See additional text added to Sections 6.0 (Performance Indicators) and 7.0 (Monitoring and Adaptive Management)
5.4	Caribou and Caribou Habitat – Boundary Lake and Pelican Lake Sections – Hydrostatic Water Testing Options	Requested additional project execution details regarding hydrostatic test water sources and access needs	Addressed in the IR response as filed. Information requested does not form part of CHR&OMP.
5.5	Caribou and Caribou Habitat – Boundary Lake and Pelican Lake Sections – Tree Planting Densities	Confirmation of approximate planting spacings, factors influencing spacing of plantings and moundings, and inclusion of measurable specifications in decision framework updates.	Addressed in the IR response as filed.

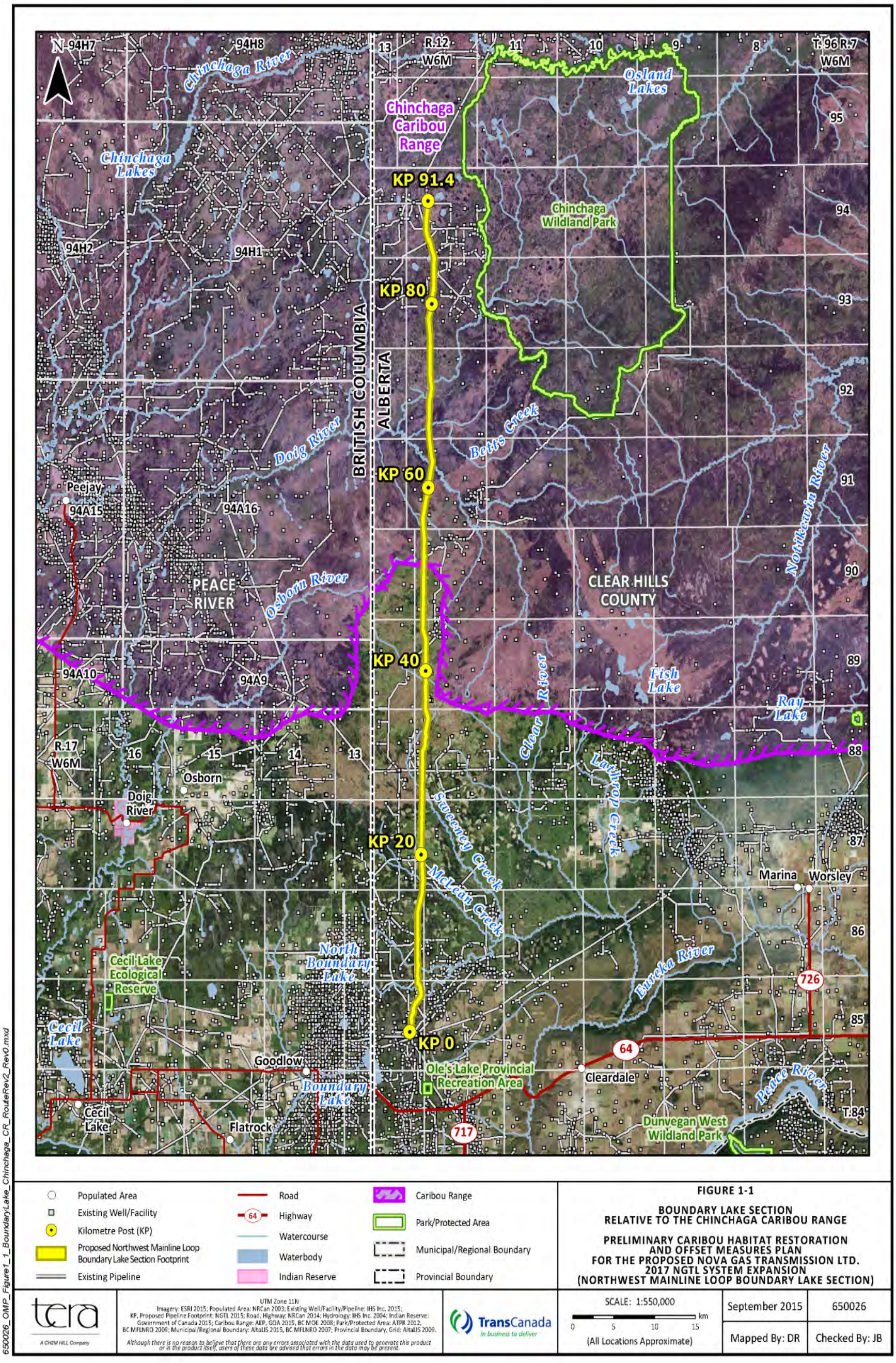


Figure 1-1: Boundary Lake Section Relative to the Chinchaga Caribou Range

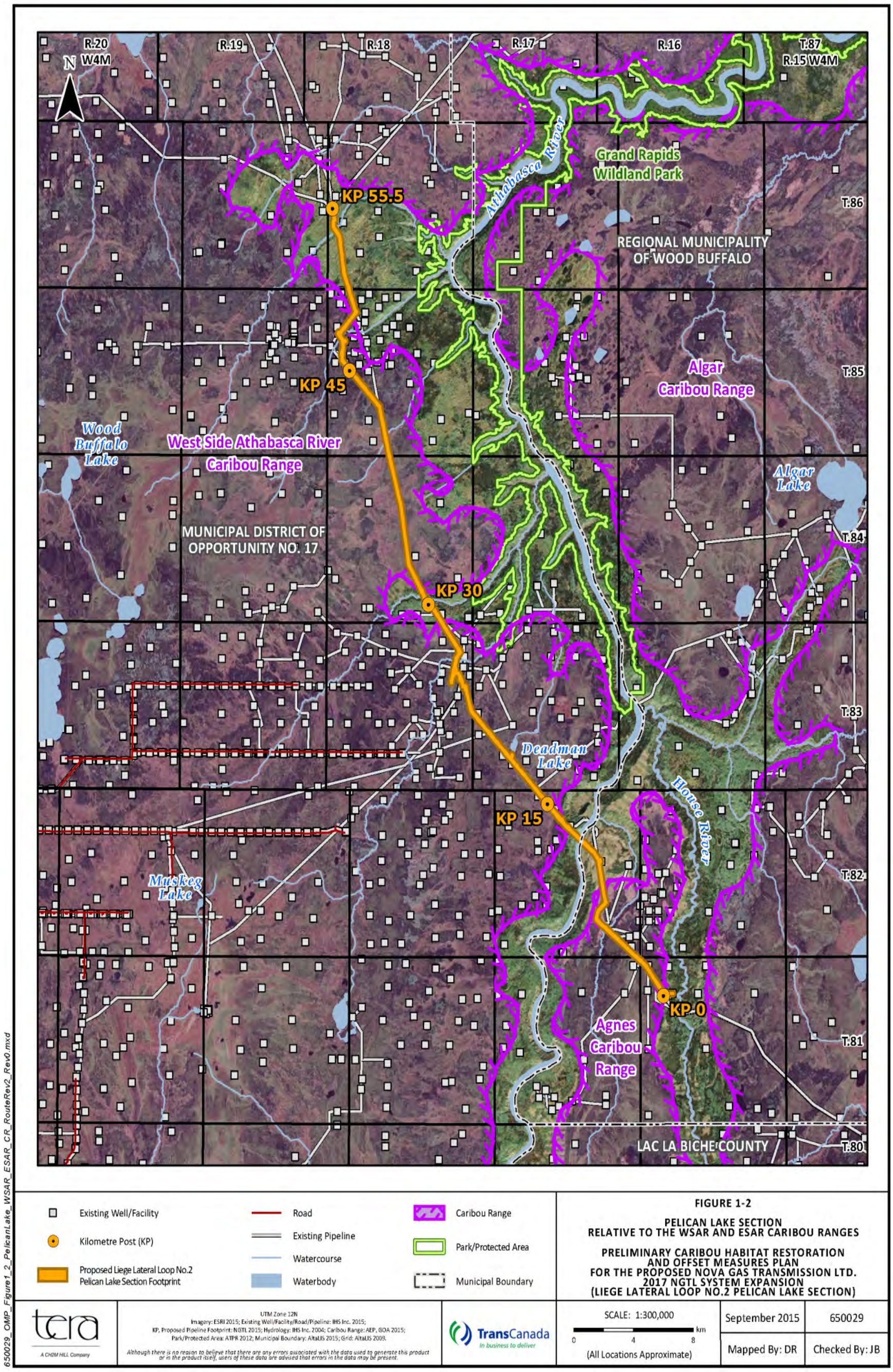


Figure 1-2: Pelican Lake Section Relative to the WSAR and ESAR Caribou Ranges

1.3 ORGANIZATION OF THE CHR&OMP

The CHR&OMP is organized to reflect the process logic of NGTL caribou habitat restoration and offset planning, and the evolution of caribou-related conditions for NGTL projects. The CHR&OMP is organized in 11 sections, as follows:

Section 1: introduces document and identifies organization.

Section 2: identifies the strategic outcome, objective, goals and targets.

Section 3: describes the caribou habitat restoration implementation plan.

Section 4: describes the offset selection and implementation plan.

Section 5: provides the proposed implementation schedule for restoration and offset activities.

Section 6: summarizes the performance indicators that will be used to monitor and evaluate the success in achieving the CHR&OMP targets, goals and objectives.

Section 7: describes the restoration and offset monitoring program.

Section 8: describes how field innovations and experience have been incorporated.

Section 9: provides a summary of caribou-specific consultation with federal and provincial regulators and Aboriginal groups to date, as well as a summary of how feedback was incorporated.

Section 10: is a literature review, on which the decision frameworks, selection of restoration and offset measures and locations, and determination of offset multipliers are based.

Section 11: cites references used throughout the document.

2.0 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 CHR&OMP (see Figure 2-1). These elements have been refined with experience gained across projects and will be used to evaluate the performance and effectiveness of NGTL's caribou habitat restoration and offset measures.

2.1 STRATEGIC OUTCOME

Combined with the contributions of other parties, NGTL's caribou habitat restoration and offset measures contribute meaningfully to the conservation and recovery of woodland caribou in Canada.

2.2 OBJECTIVE

NGTL's caribou habitat restoration investments reduce and offset the predicted residual Project effects and the Project's contribution to cumulative effects on caribou and caribou habitat 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 reasonably protected to minimize potential for redisturbance by human activity.

- **Target (T1)** Access is lower on controlled segments compared with uncontrolled segments.
- **Target (T2)** Sightline distance is limited to ≤500 m where compatible with the surrounding landscape.

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

- **Target (T3)** The species composition of revegetated restoration areas regenerates on a typical path of ecological succession.
- **Target (T4)** The sustained growth trend of revegetated restoration areas is comparable to that of the surrounding landscape.

The objective, goals and targets of the integrated CHR&OMP are intended to guide NGTL in the selection and assessment of caribou habitat restoration and offset measures, thus reflecting an evolution from earlier plans driven by commitment to continuous improvement. The targets define the specific aim for each goal but performance of habitat restoration measures selected to achieve each goal will be measured by quantifiable performance indicators described in Section 6.

The goals and targets of the integrated CHR&OMP are by function similar to previously filed NGTL caribou habitat restoration and offset plans, but have been realigned to reflect conventional definitions. In previous habitat restoration and offset measures plans habitat restoration, access control and line-of-sight blocking measures were defined as objectives. However, NGTL submits that habitat restoration, access control and line-of-sight blocking measures are the means to achieving the objective of reducing and offsetting predicted Project residual effects in a manner that aligns with provincial and federal policies, management plans and priorities.

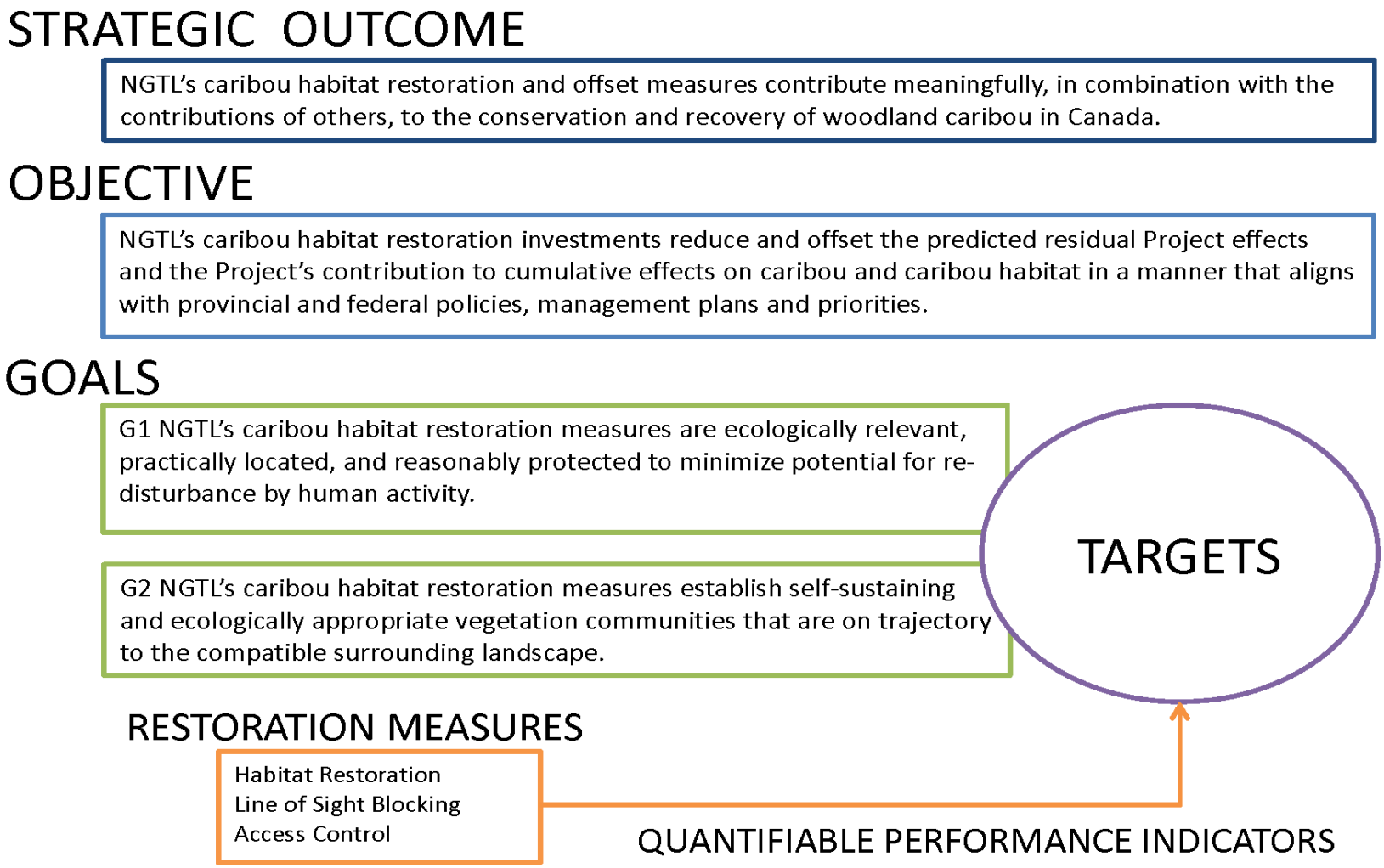


Figure 2-1: Relationship of Strategic Outcome, Objective, Goals, Targets, Measures and Performance Indicators

3.0 RESTORATION IMPLEMENTATION PLAN

This section details the considerations and evaluation of caribou habitat restoration measures for the Boundary Lake and Pelican Lake Sections of the Project, and describes NGTL's plan to implement a decision framework that will be used by the Project to achieve the overarching objective of the CHR&OMP. This section presents NGTL's plan to reduce residual and cumulative effects of the Project on caribou and affected caribou habitat.

3.1 PROJECT IMPACTS TO CARIBOU HABITAT

The Project's ESA (NEB Filing IDs: A4K2R8 and A4K2R9) identified potential direct and indirect effects of the Project on boreal woodland caribou and boreal woodland caribou habitat. Assessed effects relate to changes in caribou habitat conditions, movement and mortality. The cumulative effects assessment for the ESA determined that the Project will result in an incremental contribution to the overall cumulative effects in the WSAR, ESAR and Chinchaga caribou ranges.

The Project's linear disturbance (Table 3-1) reflects the Project design at the time this CHR&OMP was prepared. The Boundary Lake Section is located in the Chinchaga caribou range for approximately 40.1 km, of which 38.4 km (96%) parallels existing linear disturbance. The Pelican Lake Section is located in the WSAR caribou range for approximately 33.1 km and in the ESAR caribou range for approximately 8.6 km. The Pelican Lake Section parallels an existing linear disturbance in the WSAR range for 31 km (94%) and in the ESAR range for the entire 8.6 km (100%). The ROW width will vary based on workspace needed and will be provided in the implementation reports (Conditions 31 and 34 of the Report).

Table 3-1: Caribou Ranges that Interact with the Project

Caribou Range	Alberta Provincial and Federal Status Designation	Current Population Trend	Project Linear Disturbance in Caribou Range (km)		
			Total Length	Parallels Linear Disturbance	New Linear Disturbance[5]
WSAR	Threatened[1,2,3]	Declining[4]	33.1 km	31.0 km (94%)	2.1 km (6%)
ESAR			8.6 km	8.6 km (100%)	0 km (0%)
Chinchaga			40.1 km	38.4 km (96%)	1.7 km (4%)

Notes:
1. Alberta provincial status designation under the *Wildlife Act* (AESRD 2014).
2. Status designation under Schedule 1 of the *Species at Risk Act* (*SARA*) (Government of Canada 2015)
3. Status designation by COSEWIC (2015)
4. Population trend reported by Environment Canada (2012b).
5. The estimated length of new direct habitat disturbance is the area of the Project footprint excluding existing direct disturbances (i.e., anthropogenic disturbance).

3.2 QUANTIFICATION OF TOTAL HABITAT DISTURBANCE

The Project's total habitat disturbance is the spatial area of direct and indirect disturbance before implementation of habitat restoration measures. The Project's total disturbance to caribou habitat will be quantified using a method consistent with the *Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada* (Environment Canada 2011, 2012b).

Direct disturbance is calculated as the area of spatial disturbance within the Project footprint (Figure 3-1). Indirect disturbance is calculated as the area of spatial disturbance within a 500 m buffer from existing disturbance (Figure 3-2), including the Project's direct disturbance. Total disturbance is the sum of direct and indirect disturbance (Table 3-2). Overlapping permanent disturbances are removed from the calculation of the total habitat disturbance. Overlapping temporary disturbances are retained to reflect that these features are likely to regenerate to natural vegetation communities over time and might be at a successional stage that is contributing to functional caribou habitat. Table 3-3 provides an estimate and summary of the types of existing disturbance features that overlap with the Boundary Lake and Pelican Lake section footprints at the time of this report. Data will be revalidated and both tables updated in the implementation reports required by Conditions 31 and 34 of the Report.

Table 3-2: Direct and Indirect Disturbance to Caribou Habitat Before Implementation of Habitat Restoration Measures

Caribou Range	Area of Project Disturbance Before Habitat Restoration (ha)		
	Project Direct Disturbance	Project Indirect Disturbance	Project Total Disturbance
ESAR	25.7	0.9	26.6
WSAR	109.0	18.8	127.8
Chinchaga	99.9	11.2	111.1
Total	234.6	30.9	265.5

Table 3-3: Existing Disturbance Overlapping the Project Footprint in Caribou Range

Type of Existing Disturbance		Area (ha) Overlapping Boundary Section Footprint in Chinchaga Caribou Range	Area(ha) Overlapping Pelican Section Footprint in WSAR Caribou Range	Area (ha) Overlapping Pelican Section Footprint in ESAR Caribou Range	Included in Project Total Direct Disturbance (Y/N)
Duration	Feature Type				
Permanent/Long term	Settlement/community	--	--	--	N
Permanent/Long term	Airport	--	--	--	N
Permanent/Long term	Primary road	--	--	--	N
Permanent/Long term	Quarry	--	<1	--	N
Permanent/Long term	Facility	1.4	--	--	N
Permanent/Long term	Secondary road	--	0.2	--	N
Permanent/Long term	Railway	--	--	--	N
Permanent/Long term	Well site	0.4	2.2	--	N
Permanent/Long term	Tertiary road	1.0	3.0	--	N
Permanent/Long term	Building	--	--	--	N
Permanent/Long term	Recreational area	--	--	--	N
Permanent/Long term	Agriculture/cropland	--	--	--	N
Permanent/Long term	Pipeline	39.9	20.0	6.1	N
Permanent/Long term	Transmission line	--	--	--	N
Temporary	Cutline (seismic)	1.5	0.8	0.1	Y
Temporary	Recreational trail	--	--	<1	Y
Temporary	Cutblock	3.2	--	6.1	Y
Temporary	Fire <40 years	8.1	8.5	0.7	Y

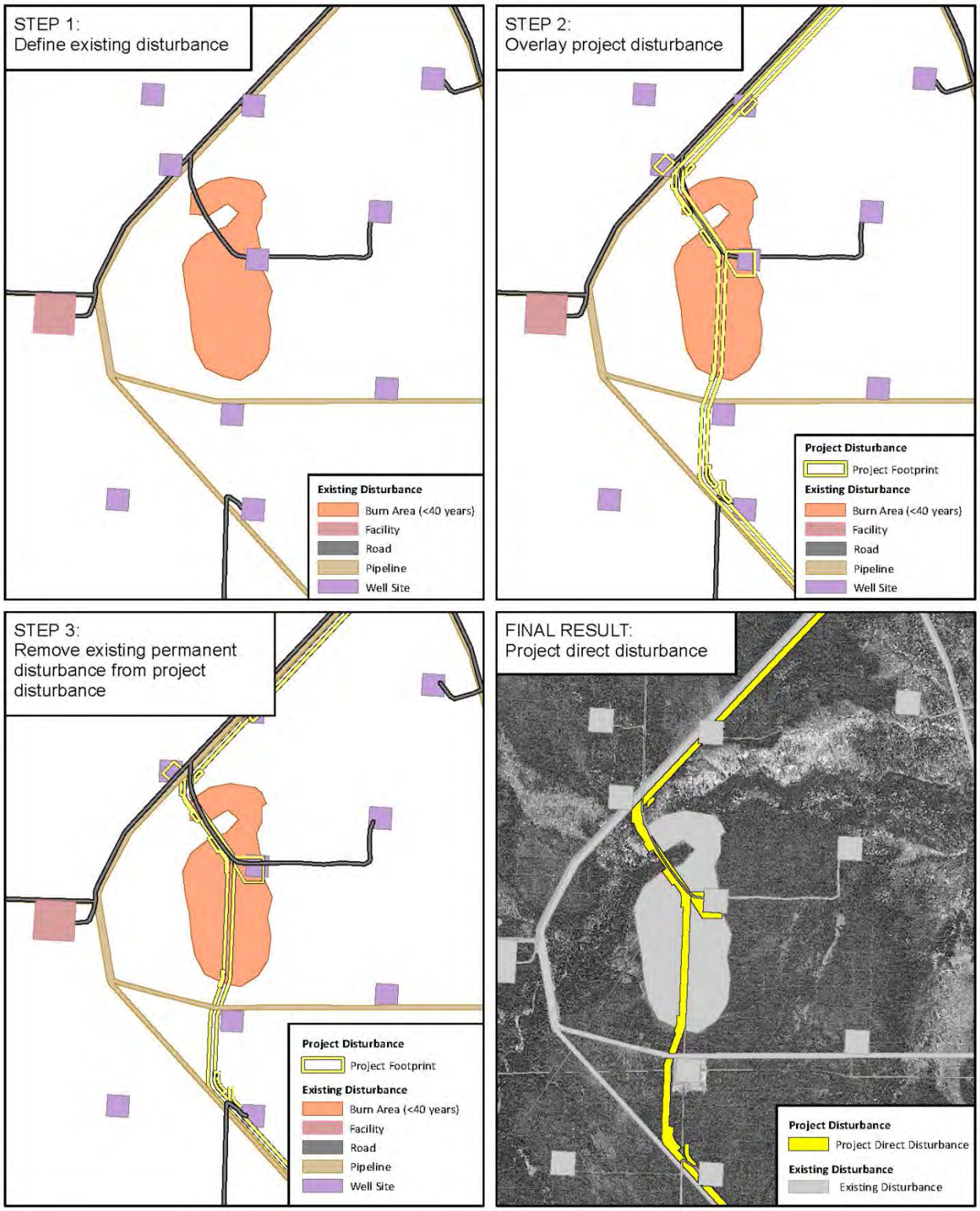


Figure 3-1: Quantification Method for the Project Total Direct Disturbance

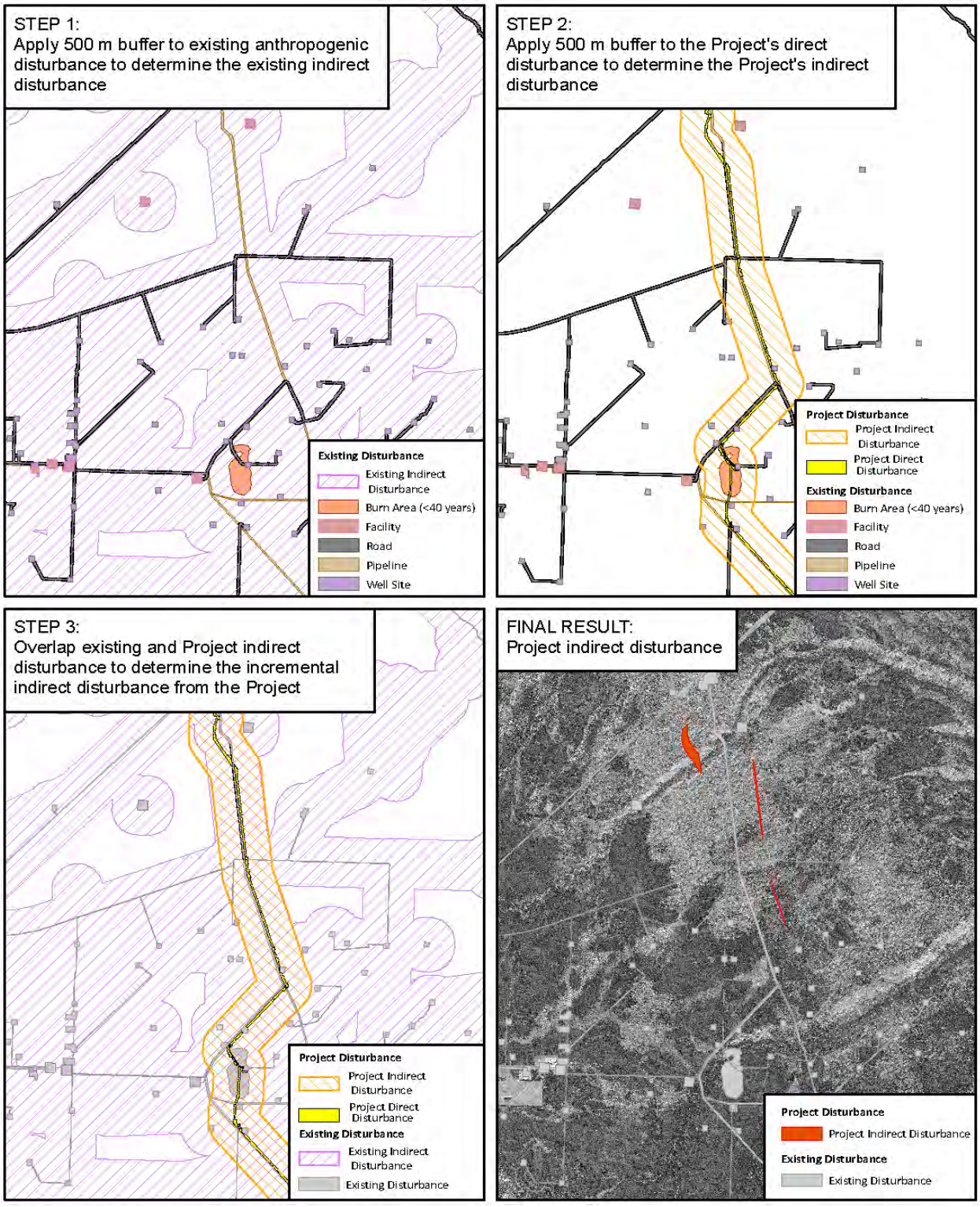


Figure 3-2: Quantification Method for the Project Total Indirect Disturbance

3.3 IDENTIFYING REMAINING HABITAT DISTURBANCE

Habitat restoration measures will be implemented in the Project footprint in caribou range to reduce the predicted residual effect of the Project on caribou and their habitat. The remaining habitat disturbance is calculated after habitat restoration is implemented. Remaining habitat disturbance is total disturbance less restoration area.

Restoration of disturbed habitat assumes caribou will habituate to use the restored habitat for movement. As a result, spatial separation from primary prey (moose and deer) and from predators will return to pre-disturbance function and level of mortality risk (Athabasca Landscape Team 2009). Restoration of anthropogenic disturbances is expected to reduce the degradation of functional habitat for caribou, since caribou will no longer exhibit reduced use on or near (i.e., in a zone of influence) the reclaimed disturbance (Oberg 2001). By addressing direct habitat disturbance through restoration measures, indirect disturbance will also be addressed.

For quantification of remaining habitat, see Section 4.2.

3.4 HABITAT RESTORATION MEASURES

Site-specific restoration measures will be selected under the guidance of Habitat Restoration Decision Frameworks (see Figures 3-3 to 3-5).These measures include tree planting, access control and line-of-sight blocking and are described in Sections 3.4.1 to 3.4.6. For photographs of examples of potential restoration measures, see Appendix A. For construction schematics (i.e., typicals) for commonly used restoration measures, see Appendix B.

Selection of restoration measures will be based on suitability, specific site conditions and availability of appropriate materials. For a list of potential restoration measures and discussion of their applicability, effectiveness and limitations, see Table 3-4.

3.4.1 NATURAL REGENERATION

Minimal surface disturbance pipeline construction techniques are effective at facilitating rapid regeneration of native vegetation, particularly in areas with a deciduous vegetation component. The technique relies on mowing/mulching and freezing in the ROW to avoid disturbance of surface soils, except where grading is necessary. While employed during construction as a general measure to promote rapid natural revegetation rather than a specific caribou habitat restoration measure, it provides the benefit of reducing lag in the establishment of vegetation consistent with the local ecotype.

3.4.2 TREE PLANTING

Established reclamation and forestry reforestation practices will be applied to promote revegetation. Restoration measures that incorporate tree planting techniques, such as mounding to create more favorable microsite conditions and planting trees/shrubs, will be considered where site conditions allow (including construction methods and level of disturbance). Tree species comparable to the surrounding landscape will be planted to mimic natural variation and complexity by optimizing density and spacing at the feature level.

3.4.3 ACCESS CONTROL

Access control for the Project in caribou habitat will be planned to:

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

Baseline Data

Geographic Information System (GIS) data were used to identify preliminary control and monitoring locations to establish the baseline condition for this Project. The locations were chosen based on a review of the Project's construction alignment sheets and proposed access control treatment locations. In addition, aerial reconnaissance was undertaken in spring 2016 to supplement inputs to preliminary access control location planning. Locations will be further refined during the construction phase to consider site-specific conditions and construction requirements. Performance indicators used to evaluate the effectiveness of access control measures will be included in the CHROMMP.

Access Control Measures

Access control measures are most effective when implemented on non-contiguous segments of the ROW and at intersections of the pipeline with existing perpendicular linear features relative to contiguous segments. Typically, access control measures are sighted on active intersections with other linear features such as roads, utility corridors, seismic lines or watercourses. Potential access control measures include:

- extended bored crossings
- vegetation screens
- rollback
- fencing and signs

- vegetation planting
- mounding

Rollback, mounding and planting are anticipated to be key access control measures implemented for the Boundary Lake and Pelican Lake sections.

3.4.4 Line of Sight Blocking

Line-of-sight blocking includes such measures as vegetation planting and fabricated or retained vegetation site screens. Line-of-sight blocking measures will be implemented on non-contiguous ROW in locations with sightlines ≥500 m, particularly where they intersect existing road access and in areas where sightlines are not blocked by terrain elevation or bends. Where conditions are suitable, trees could be planted in an alternating pattern across the pipeline centreline along portions of the ROW. Details on exact configuration of seedling planting to achieve line-of-sight blocks depend on as-built location of the pipe centreline, adjacent linear disturbances and landscape features.

Measures to reduce sightlines are expected to discourage access and decrease predator efficiency. In nature, sightlines are often longer in more open habitats of lowland muskeg communities compared with upland forest communities. As a result, line-of-sight distances can vary, depending on the location and structure of the adjacent vegetation community.

NGTL has implemented ≥500 m line-of-sight breaks to be consistent across provincial boundaries regardless of the location of the pipeline segment and has incorporated this approach in other Projects. Previously, NGTL evaluated line-of-sight and access control features at the interval suggested in the Alberta Energy Regulator (AER) Enhanced Approval Process (EAP). The EAP guidelines are intended for smaller scale upstream applications such as well sites and shorter small diameter pipelines with narrower ROWs. By nature of large diameter pipelines and the requisite wide ROWs associated with them, there are some specific Standards in the guidelines that cannot be met (see Section 8.3). NGTL nonetheless attempts to follow the Desired Outcomes and Best Management Practices outlined in the guidelines. NGTL notes variable practices by industry and jurisdiction for line-of-sight blocking. Past reclamation programs in Alberta targeted maximum sightlines of 400 m (Golder 2007; DES 2004). Operating practices for energy development in sensitive caribou range in BC (BC Ministry of Environment 2011) suggest implementing line-of-sight management every ≥500 m on linear features that do not share a ROW boundary with a road (see Section 8).

Table 3-4: Habitat Restoration Measures

Restoration Measure	Purpose	Considerations	Limitations
Minimal surface disturbance construction	Primary: Habitat restoration Reduce line of sight	• limited to construction during winter conditions • reduces the need for soil salvage and grading • width of grubbing is limited to the trench 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 • minimum disturbance construction is constrained by existing ground topography and to ungraded areas • extending the length of existing bores under roads can reduce the need for additional vegetation clearing at ROW access points. **Minimal surface disturbance construction methods reduce impacts to soil structure and leads to the rapid regeneration of native vegetation. This method aids in achieving the goals of habitat restoration and access control, along with providing a visual barrier along the ROW.**	Minimal surface disturbance construction will be the main CHRP measure for the Project, and will be implemented where scheduling, soil conditions (e.g., frozen), and topography allow. The extent of minimal disturbance construction is limited by scheduling to avoid the restricted timing window for caribou (February 15 to July 15) and also by existing ground topography.
Conifer seedling planting	Primary: Habitat restoration Secondary: Access control Reduce line of sight	• Conifer seedling planting is considered a long-term habitat restoration measure, effective access control and a line-of-sight measure (effectiveness is expected to take longer than 10 years). • Species selection (i.e., black spruce or pine) is determined based on the biophysical characteristics of the site, adjacent forest stand composition, and restoration objectives (e.g., low palatability for ungulates). **Based on published information and Alberta ecosystems, the following conifer planting densities have been formulated:** • **minimum live seedling density of 1,600-2,000 stems/ha on upland sites;** • **minimum live seedling density of 1,200-2,000 stems/ha on lowland sites**	Conifer seedling planting is a suitable CHRP measure and will be the main planting measure used for the Project.
Snow ramping/tree felling	Primary: Reduce line of sight Access Control Secondary: Habitat restoration	• Deciduous shrubs are walked down using construction equipment and piled with layers of snow to create a ramp for vehicle traffic, if there is enough snow cover during winter construction. • Small coniferous trees can also be walked down, but only in years when there is a higher than normal snow fall. • When the snow melts in the spring following construction, the trees and shrubs recover their original shape and create line-of-sight blocks, access control and provide habitat. • Tree felling is the process of deliberately cutting trees at the margin of a clearing to fall over the linear disturbance. Trees are felled from both sides of the linear disturbance to create line-of sight block and access control. It is mostly used in offset areas where seismic lines are being restored and sometimes used where adjacent trees are tall enough to cover the entire width of the ROW. • Tree felling can promote natural revegetation by increasing cone deposition onto the ROW, creating microsites through shading and dropped dead woody debris, and protecting planted seedlings from extreme weather, wildlife trampling and damage from access.	Snow ramping is a suitable CHRP measure for this project if there is adequate snowfall during winter construction and where the correct species are available in adjacent areas. Tree felling might be an option for habitat restoration if the ROW is narrow and if seismic lines are being restored in offset areas.
Woody debris rollback	Primary: Access control Secondary: Habitat restoration	• Rollback can be effective immediately following implementation, provided adequate material is available and properly applied (Vinge and Pyper 2012). (CRRP 2007). 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 to 100 m (75 m on average) • Coverage ranging from 200–300 m^3/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). **Previous caribou habitat restoration projects indicate that material availability limits the segment length that can be achieved to 50-100 m (75 m on average).**	Woody debris rollback is a suitable CHRP measure and will be the main access control measure used for the Project. Woody debris material availability often limits the segment lengths that can be achieved. Fire risk is a consideration when using or storing woody debris.

Bioengineering – shrub staking	Primary: Habitat restoration Secondary: Access control Reduce line-of-sight	• Willow and poplar cuttings are collected from adjacent areas during the growing season or during winter. These cuttings are inserted into the soil in a linear and staggered formation that will establish habitat, line-of-sight blocks and access control within one or two growing seasons. • Species used are based on available material in the adjacent forest stand and are dependent on restoration objectives. Combined plantings of shrub and tree seedlings can be appropriate, depending on site conditions and anticipated natural revegetation of both species. • Bioengineering in combination with stabilization measures (e.g., soil wraps) is also used at watercourses crossed with an open cut method. The installation of live shrub cuttings is used to stabilize and revegetate slopes and banks; however, it also provides line-of-sight blocks at these locations.	Bioengineering and shrub staking are a suitable CHRP measure where site conditions allow. It requires the correct vegetation to be present in adjacent areas and moist soils. Many shrub species can attract prey species such as moose and deer, which can attract wolves. Its application can be limited as these species can have a negative effect on caribou.
Mounding	Primary: Access control Secondary: Habitat restoration (create microsites)	• Mounding is used as an access control measure on pipelines, old roads and seismic lines to discourage off-road vehicle activity and can be effective immediately following implementation. • For access control purposes, mounds should be created using an excavator to approximately 0.75 m deep, and excavated material is placed right beside the hole (STDS-03-ML-05-314) • For the purposes of enhancing microsites for planted seedlings, mounding can be used in wet, low-lying areas to create better-drained microsites to enhance 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, amount of frost and type of equipment used (STDS-03-ML-05-314). • Mounding is often a suitable habitat restoration measure that is used in conjunction with conifer 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 range in mound density was a minimum of 700 mounds/ha and 2 to 3 seedlings per mound.**	Mounding is a suitable CHRP measure that may be used in conjunction with conifer 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.

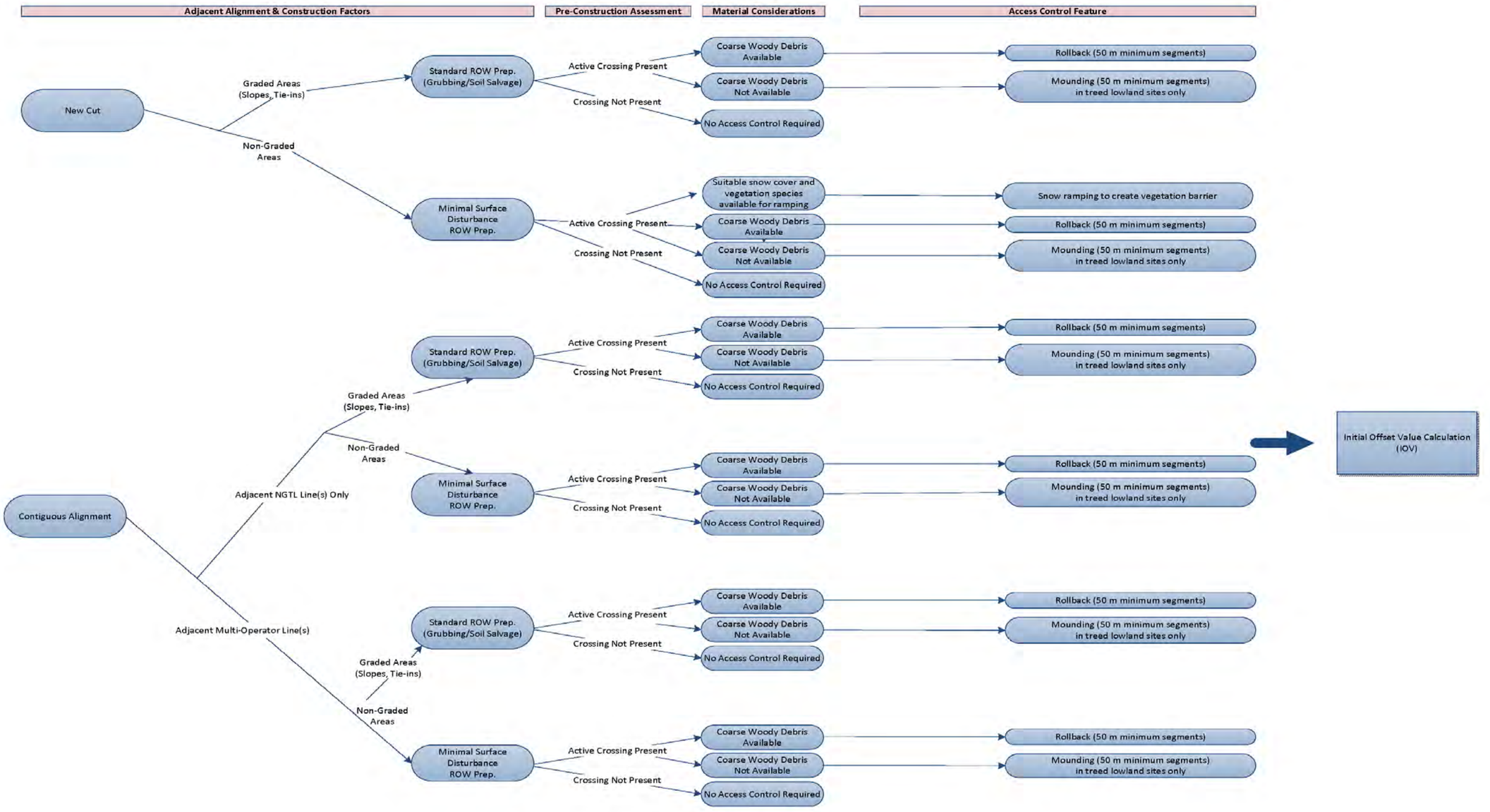
3.5 DECISION FRAMEWORK FOR HABITAT RESTORATION MEASURES

The caribou habitat restoration decision framework (see Figures 3-3, 3-4 and 3-5) will be applied to provide guidance on restoration measure selection based on site-specific characteristics. The decision framework is a principle-based logic model that informs restoration decisions to achieve the objective and goals of the CHR&OMP.

The decision framework was developed based on NGTL's pipeline construction experience, information obtained from literature reviews, industry best management practices and industry consultation. It reflects recent lessons learned from field experience on other NGTL projects that affected caribou habitat.

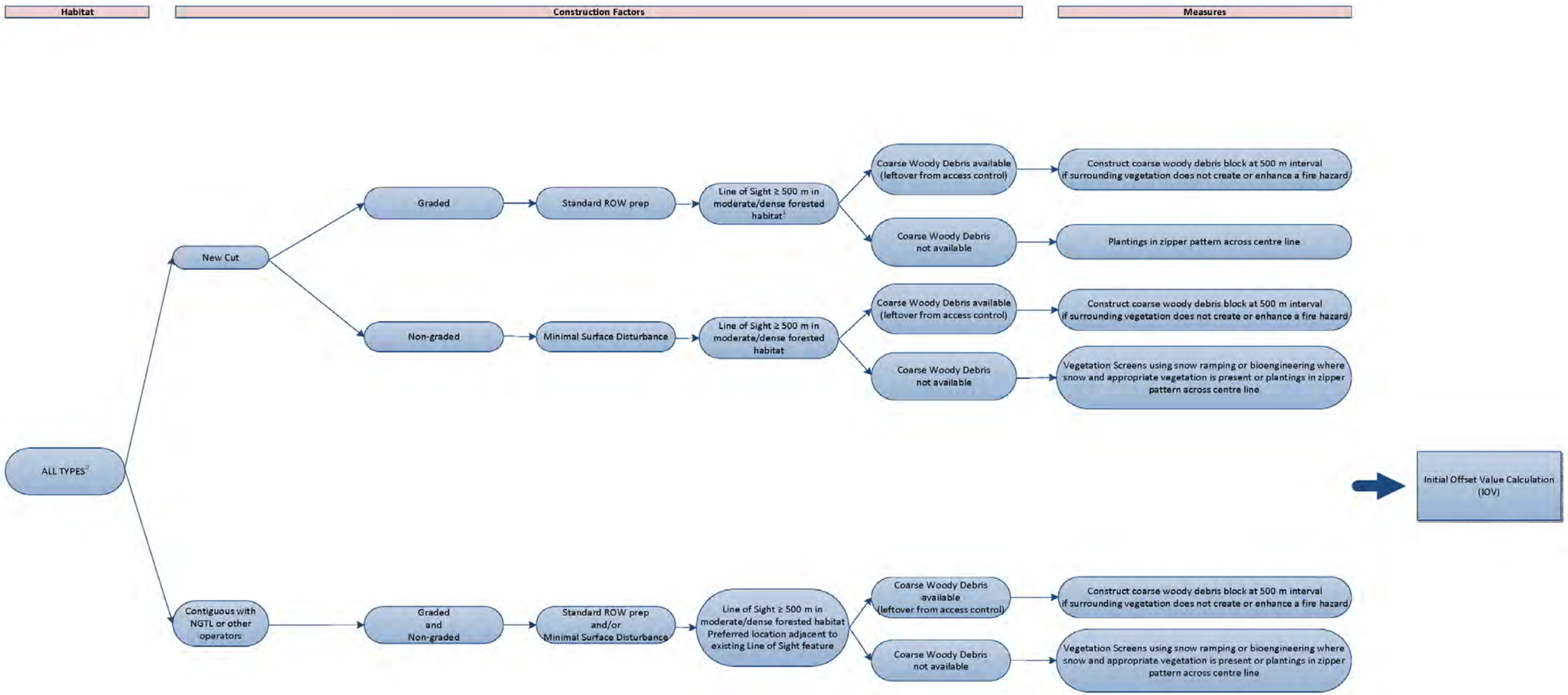
The decision framework will be applied at the start of construction to identify candidate sites for restoration measures on the Project footprint, and reviewed during construction to identify any changes in inputs. Measures will be applied during final cleanup on the Boundary Lake and Pelican Lake section footprints. The framework will also be used to select site-specific measures for offsets. This approach is described below.

Figures 3-3, 3-4 and 3-5 are presented in chronological order of implementation – access control, line-of-sight blocking and habitat restoration. The decision frameworks show the logic process for restoration measures or tools that can be applied to the Project footprint. However, only tools applicable to the Boundary Lake and Pelican Lake sections and suitable as restoration measures will be implemented.



Note: Where bore installation is planned and appropriate vegetation exists, feasibility of extending the bore to create access control will be considered.

Figure 3-3 Access Control Decision Framework



Note: (1) Line of Sight breaks will not be implemented in open habitat where line of sight naturally exists.
(2) Wetland or open habitats will be evaluated on a case-by-case basis.
(3) Where bore installation is planned and appropriate vegetation exists, feasibility of extending the bore to create a line-of-sight block will be considered.

Figure 3-4 Line of Sight Decision Framework

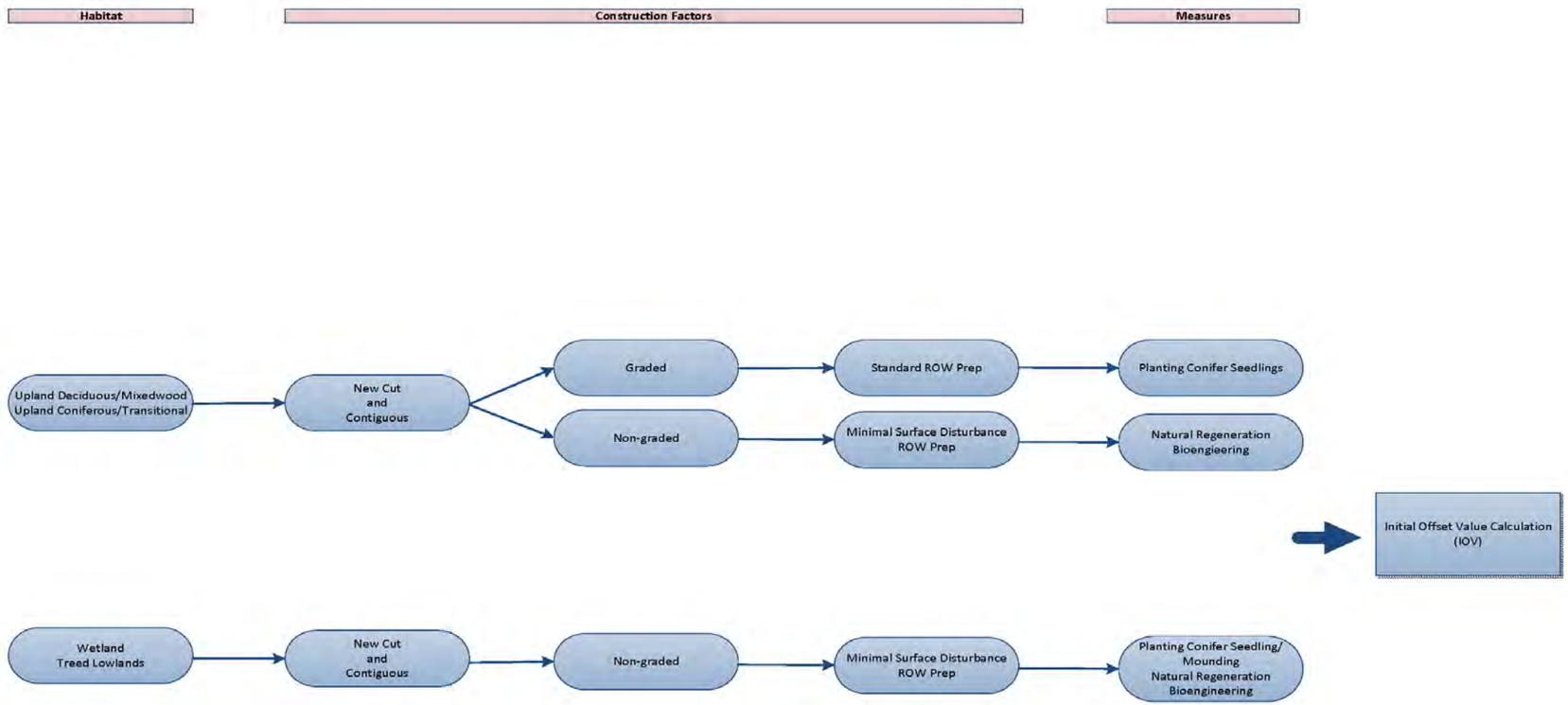


Figure 3-5 Habitat Restoration Decision Framework

4.0 OFFSET SELECTION AND IMPLEMENTATION PLAN

Conservation and biodiversity offsets are defined as measurable conservation outcomes or environmental values resulting from actions designed to compensate for residual adverse effects arising from a development after appropriate mitigation measures are applied. NGTL plans to minimize disturbance relating to construction of the Boundary Lake and Pelican Lake Sections of the Project wherever possible. However, based on the ESA findings, residual Project effects on caribou and caribou habitat are predicted (see Section 3.1). This offset strategy has been prepared to ensure the residual effects are offset in a manner that aligns with provincial and federal policies, management plans and priorities.

4.1 OFFSET STRATEGY AND FRAMEWORK

Supported by a literature review, NGTL developed this offset plan following a strategy consistent with conservation offset development, which focuses on the specific conservation needs of boreal caribou. The offset plan follows a like-for-like habitat restoration framework where offsets are directed to physical habitat restoration measures rather than indirect measures such contributions to research programs or other financial mechanisms. Indirect offset measures were not contemplated for this offset plan. Rather, NGTL anticipates implementing direct measures that are considered highest priority in the federal *Recovery Strategy for Woodland Caribou* (EC 2012b).

4.2 QUANTIFICATION OF REMAINING DISTURBANCE

As described in Section 3.3, remaining disturbance is quantified after habitat restoration is implemented in the Project footprint. Direct and indirect habitat disturbance, as well as areas of restoration, are included in the calculation of remaining disturbance and will be quantified in the implementation reports specified under Conditions 31 and 34 of the Report, following the method described in this section.

Post-construction as-builts of the Boundary Lake and Pelican Lake Sections will be used to calculate the final area directly and indirectly disturbed by the Project footprint to provide the baseline metrics from which the offset values will be calculated (see Table 4-1). The baseline metrics include:

- **Direct Disturbance:** is the total area of the Project footprint (ha) including the ROW, temporary workspace and log deck locations within caribou range (see Figure 4-1).
- **Restored Footprint**: is the total area along the Project footprint where habitat restoration measures will be implemented. It is assumed restoration measures will be effective on the portion of the footprint available for restoration.

- **Remaining Direct Disturbance**: is the area over the pipeline that must remain visible for aerial integrity inspections (approximately 10 m), and any other areas needed for operational access where restoration measures will not be applied.
- **Remaining Indirect Disturbance**: the indirect disturbance is calculated by applying 500 m buffers to all anthropogenic disturbances, including the Project remaining direct disturbance, and subtracting any areas accounted for by other existing disturbance buffers (see Figure 4-2).

During operations, NGTL will periodically manage vegetation within 5 to 10 m of the centreline of the operational pipeline, in accordance with TransCanada operational procedures for integrity monitoring under Canadian Standards Association (CSA) Z662-15 (CSA 2015). This area will be allowed to regenerate naturally, but will be periodically mowed or mulched to allow for inspection and operation access if needed. Managed operational access is considered a direct disturbance. Therefore, managed operational access points will be quantified and included in the calculation of the total remaining disturbance of caribou habitat for the Boundary Lake and Pelican Lake Sections. Table 4-1 provides provisional values for the restored footprint, assuming there is an area of active vegetation control extending 5 m from the ditchline. These values are based on assumptions, and the actual values will differ based on the final construction footprint, the implementation of habitat restoration measures, and as yet undetermined strategies regarding clearing over the centerline to allow for visibility for inspection purposes while maximizing restoration in caribou ranges.

The total remaining disturbance is carried further into the quantification of the initial offset value (IOV).

Table 4-1: Preliminary Quantification of the Remaining Direct and Indirect Project Disturbance of Caribou Habitat

Caribou Range	Area (ha)				
	Direct Disturbance (Before Restoration)	Restored Footprint	Remaining Direct Disturbance (After Restoration)	Remaining Indirect Disturbance	Total Remaining Disturbance
ESAR	25.7	19.6	6.1	0.3	6.4
WSAR	109.0	78.0	31.0	7.1	38.1
Chinchaga	99.9	72.3	27.6	2.3	29.9
Total	234.6	169.9	64.7	9.7	74.4

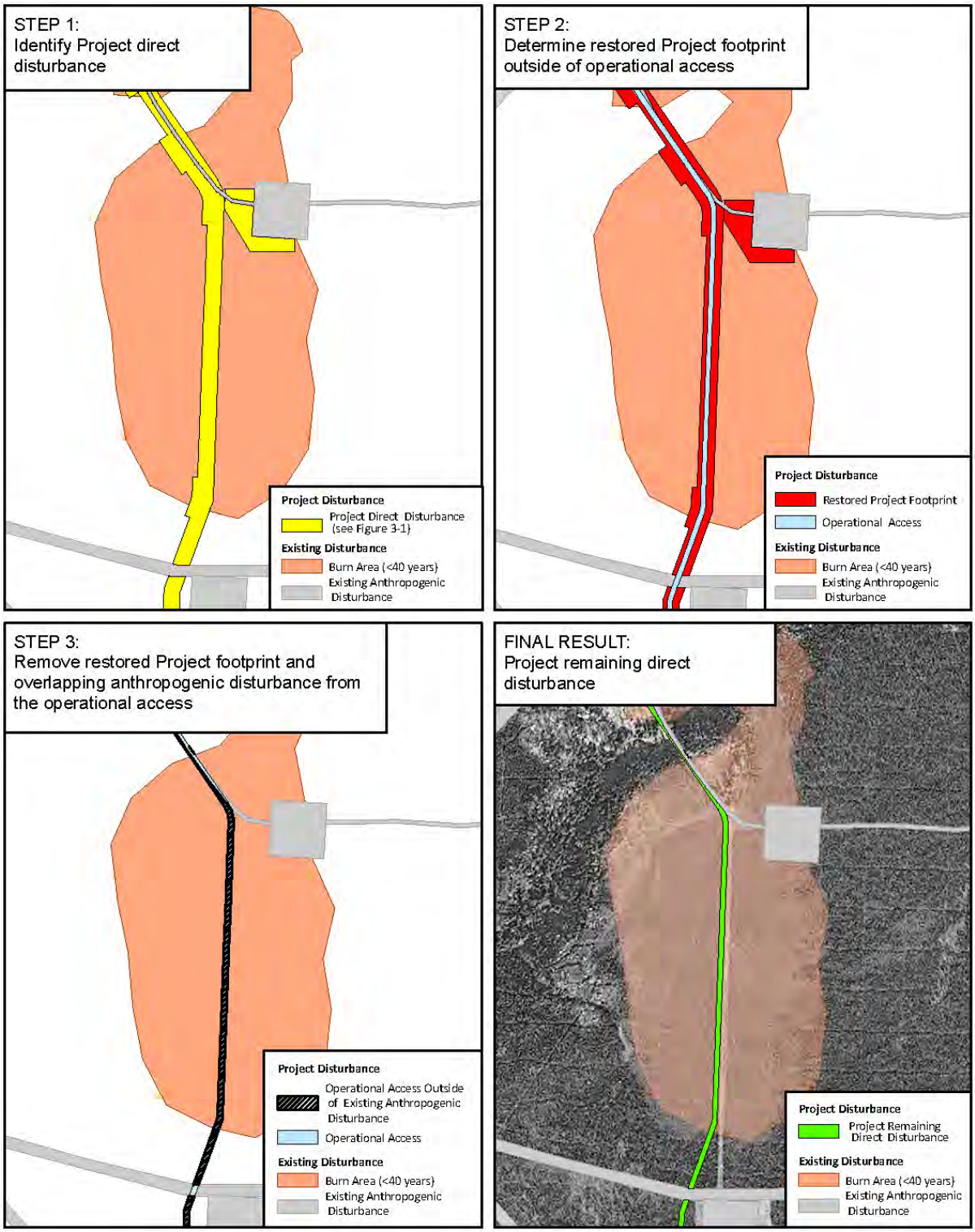


Figure 4-1: Quantification Method for the Project Remaining Direct Disturbance

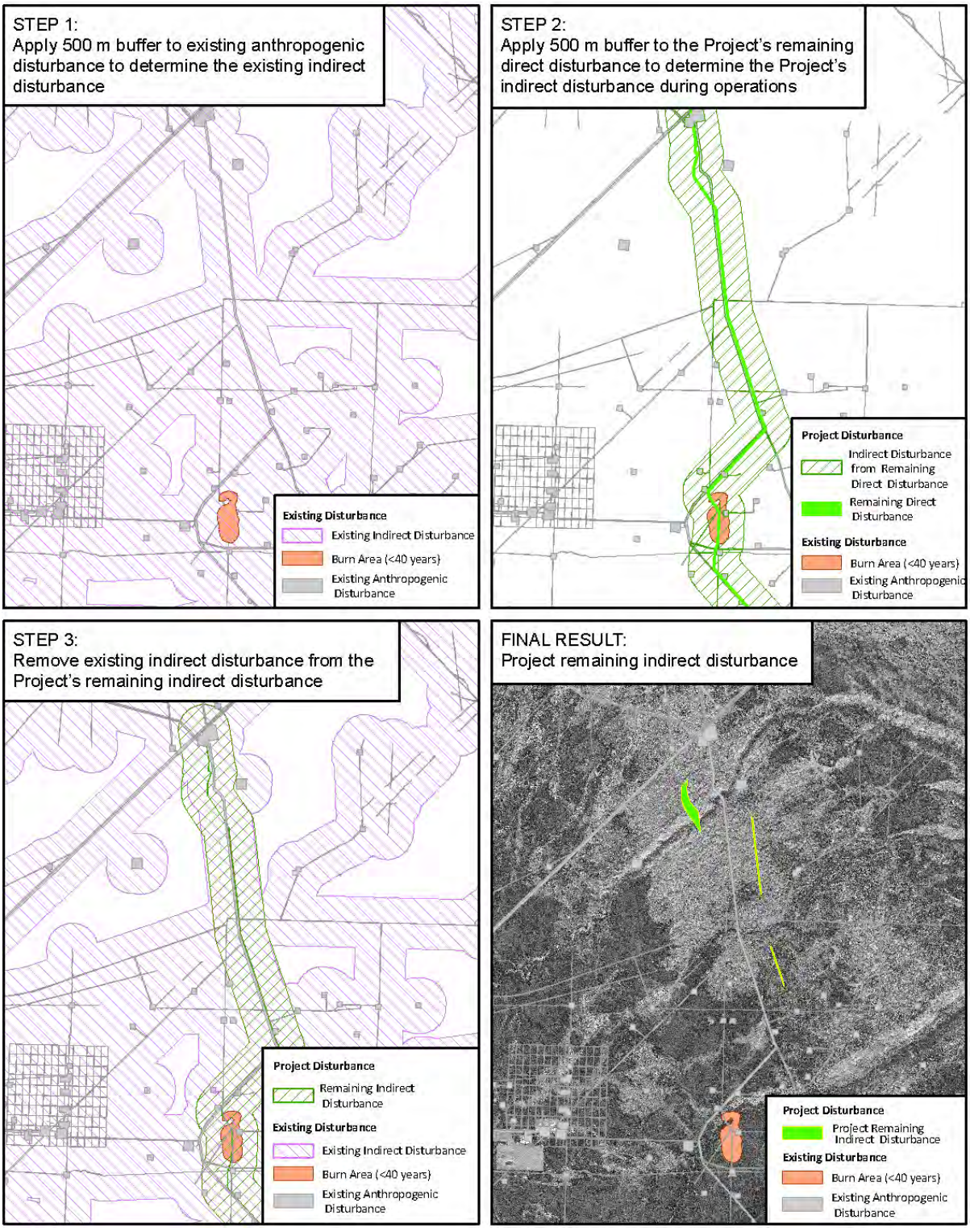


Figure 4-2: Quantification Method for the Project Remaining Indirect Disturbance

4.3 CONTEXT OF MULTIPLIERS

In the absence of provincial direction on offsetting, NGTL consulted subject matter experts in industry, government and expert agencies through a questionnaire to quantitatively evaluate the effectiveness and acceptance of caribou habitat restoration practices (Northern Resource 2014). The questionnaire was sent to 36 individuals representing government, industry, academia and other professionals, typically with a minimum of 10 years' experience in caribou planning, management or research. A previous study and questionnaire completed by the Caribou Landscape Management Association (CLMA) and Forest Products Association of Canada (FPAC) (2007) was used to inform the format and structure of NGTL's questionnaire. The details of the questionnaire are discussed in the Final Offset Measures Plan for Chinchaga Lateral Loop No. 3 prepared in accordance with GC-121 Condition 20(b), 20(c), and 20(d). The average effectiveness of habitat restoration measures, including their respective multipliers, was derived from research on restoration measures effectiveness in support of offset measure planning (Northern Resource 2014). When provincial offsetting frameworks and direction are available, NGTL will review the new guidance and, if necessary, modify multipliers as appropriate.

To address uncertainty and time lags associated with habitat restoration measures, NGTL applied the discrepancy risk approach suggested by the Department of Environment, Food and Rural Affairs (DEFRA) (2011). The underlying principles of the discrepancy approach were developed considering the risk factors associated with habitat restoration. Risk factors associated with habitat restoration measures employed in this offset plan are:

- delivery risks associated with the effectiveness and achievability of each measure (i.e., challenges and uncertainty of the restoration technique)
- spatial risks associated with the proximity of measures to affected caribou and caribou habitat (i.e., spatial relevance within caribou range)
- temporal risks associated with the ability of each measure to achieve full effectiveness (i.e., short or long-term time lags)

Multipliers help address the effectiveness and uncertainty of habitat restoration measures (i.e., achievability, spatial relevance and time lags). After applying multipliers to each habitat restoration measure, the effectiveness of the measure is quantified for both direct and indirect remaining Project disturbance.

For habitat restoration measure effectiveness, delay factors and multipliers, see Table 4-2. Spatial multipliers can be applied to the final offset value once the offset location has been chosen.

Table 4-2: Temporal and Delivery Risk Multipliers

Habitat Restoration Measure	Application	Degree of Intensity	Measure Effectiveness (Delivery Multiplier)	Delay Factor (Temporal Multiplier)
Discrete Barriers (Fences/Berms)	Discontinuous	250 m Intervals (High Intensity)	0.3 (3.3)	1.0
		500 m Intervals (Low Intensity)	0.3 (3.3)	1.0
	Continuous	250 m Intervals (High Intensity)	0.5 (2.0)	1.0
		500 m Intervals (Low Intensity)	0.4 (2.5)	1.0
Barrier Segments (Coarse Woody Debris/ Mounding)	Discontinuous	50 m Segments / 250 m Intervals (High Intensity)	0.3 (3.3)	1.0
		100m Segments / 500 m Intervals (Low Intensity)	0.3 (3.3)	1.0
	Continuous	50 m Segments / 250 m Intervals (High Intensity)	0.6 (1.6)	1.0
		100 m Segments / 500 m Intervals (Low Intensity)	0.5 (2.0)	1.0
Planting for Future Barrier	Discontinuous	250 m Intervals (High Intensity)	0.4 (2.5)	0.83 (Short-Term Delay = 1.2) 0.36 (Long-Term Delay = 2.8)
		500 m Intervals (Low Intensity)	0.4 (2.5)	0.83 (Short-Term Delay = 1.2) 0.36 (Long-Term Delay = 2.8)
Planting for Future Barrier	Continuous	250 m Intervals (High Intensity)	0.8 (1.25)	0.83 (Short-Term Delay = 1.2) 0.36 (Long-Term Delay = 2.8)
		500 m Intervals (Low Intensity)	0.8 (1.25)	0.83 (Short-Term Delay = 1.2) 0.36 (Long-Term Delay = 2.8)
Planting to Accelerate Reforest State	Continuous	Where Appropriate (Includes Minimum Surface Disturbance)	0.8 (1.25)	0.83 (Short-Term Delay = 1.2) 0.36 (Long-Term Delay = 2.8)

Note:
1. Habitat restoration measure effectiveness and delay factor multipliers were derived from Northern Resource 2014 – a high effectiveness value has a lower multiplier.
2. Multipliers associated with delay factors are derived from DEFRA 2011. A delay factor of 1.0 implies no penalty as the measure is assumed effective on implementation. Where delays are incremental through years (i.e., planting and minimum surface disturbance) short-term and long-term multipliers are used.

Multipliers address the effectiveness and uncertainty of habitat restoration measures. In the case of delivery, risks are associated with the effectiveness and achievability of each measure. Where there is greater uncertainty regarding the effectiveness or achievability of offset measures, higher multipliers are applied to accommodate for potential loss or failure of measures. These may include challenges relating to site specific conditions or restoration methods.

The implementation of offset measures will occur in the first appropriate season (late summer after the caribou RAP following ROW reclamation and restoration. This represents an anticipated and acceptable temporal delay and is addressed by the temporal multiplier. Should a delay of more than one appropriate actionable season occur, it is anticipated that the weight of the temporal multiplier would increase.

NGTL applies spatial multipliers to both the caribou habitat restoration measures (restoration activities applied to the Project ROW) and the offset measures (restoration activities off the Project ROW). Spatial multipliers applied for on-ROW

restoration measures are neutral, as the restoration activities applied on the Project ROW will directly benefit the caribou population where the Project disturbance (direct and indirect) occurred. For circumstances where offset measures are implemented outside the caribou range where the Project disturbance occurs, a higher multiplier would be applied. The greater the distance from the affected caribou range that the offset or habitat restoration measure is applied, the higher the spatial multiplier.

4.4 CALCULATING THE INITIAL OFFSET VALUE

The IOV is the area required to be offset after habitat restoration measures are implemented on the restored footprint, and include the area of remaining direct and indirect disturbance (Table 4-3). Effectiveness values for each measure and delay factors associated with time lags will be addressed by applying the multipliers suggested by DEFRA (2011) and presented above.

In Tables 4-3, 4-4 and 4-5, the IOV is calculated using the following process steps:

- categorize the restored Project footprint as new alignment or parallel alignment. Parallel alignment is assumed to have a lesser effect on caribou compared with new cut alignment due to existing effects on caribou habitat. For the purpose of quantification, parallel alignment is assigned a 20% inherent effect (Northern Resource 2014). New alignment is not afforded a reduction (100% inherent effect).
- categorize new and parallel alignment segments into their respective restoration units and subdivide each unit by the habitat restoration measures (ha) before applying delivery and temporal multipliers.
- apply multipliers to determine the residual post-restoration value (RPRV)
- calculate the residual direct disturbance value (RDDV) by determining the area of parallel and new alignment of direct disturbance and applying the inherent effect multiplier.
- calculate the residual indirect disturbance value (RIDV) by applying 500 m buffers to all anthropogenic disturbances, including the Project remaining direct disturbance, and subtracting any areas accounted for by other existing disturbance buffers.

The IOV determined through Calculation 4-1 will be carried forward to calculate the final offset value (FOV) after offset implement location(s) have been determined.

Calculation 4-1:

$$\mathbf{IOV\ (ha)} = \sum (\mathbf{RDDV} + \mathbf{RIDV} + \mathbf{RPRV})$$

$$\text{RDDV} = \sum (\text{parallel (ha) x } 0.2) + (\text{new cut (ha) x } 1)$$

$$\text{RIDV} = (500\text{ m buffer (ha)} - \text{all other indirect buffers (ha)})$$

$$\text{RPRV} = \sum (\text{restoration units by habitat restoration measure (ha)}) \text{ x } (1 - 1/(\text{delivery multiplier x temporal multiplier}))$$

Tables 4-3, 4-4 and 4-5 provide preliminary calculations of the IOV. The WSAR, ESAR and Chinchaga ranges have been presented as separate tables to calculate the distinct effects to the different caribou ranges. Understanding the habitat types within each range is necessary to determine the type of restoration that can occur in that area (e.g., planting is sometimes not successful in very wet, lowland areas therefore other measures are applied).

For the purpose of this example, the following suppositions were made regarding the IOV:

- The proportion of lowland/upland habitat assumed 60% lowland / 40% upland.
- The proportions of restoration treatments, assumed 90% planting / 10% mounding/course woody debris (CWD) placement for both upland and lowland.

For offsets, it is assumed the site selected is located in a reasonably protected area where non-contiguous linear features can be restored. Multipliers were derived from previously filed and approved Offset Measures Plans (OMPs).

Table 4-3: IOV Quantification for WSAR

Restoration Unit Description (Project ROW)			Direct Project Disturbance (ha)	Inherent Effect	Delivery Risk Multiplier	Spatial Risk Multiplier	Temporal Risk Multiplier	IOV (ha)
Habitat	**Restoration Measure**	**ROW Alignment**						
Upland	Seedling Planting	Parallel	36.49	0.2	1.25	1	1.2	2.43
		New	2.75	1	1.25	1	1.2	0.92
Upland	Tree Felling/CWD	Parallel	4.06	0.2	3.3	1	1	0.57
		New	0.3	1	1.6	1	1	0.11
Lowland	Seedling Planting	Parallel	54.74	0.2	1.25	1	2.8	7.82
		New	4.12	1	1.25	1	2.8	2.94
Lowland	Mounding	Parallel	6.08	0.2	3.3	1	1	0.85
		New	0.46	1	1.6	1	1	0.17
Operational Access (10 m Ditchline)	Natural Regeneration	Parallel	30.78	0.2	NA	NA	NA	6.16
		New	2.32	1	NA	NA	NA	2.32
Total Project Residual Effect (ha) [excludes Indirect Disturbance]								**24.29**
Indirect Disturbance (500 m Buffered Area)	NA	NA	NA	NA	NA	NA	NA	18.80
Initial Offset Value (ha)								**43.09**

Table 4-4: IOV Quantification for ESAR

Restoration Unit Description (Project ROW)			Direct Project Disturbance (ha)	Inherent Effect	Delivery Risk Multiplier	Spatial Risk Multiplier	Temporal Risk Multiplier	IOV (ha)
Habitat	**Restoration Measure**	**ROW Alignment**						
Upland	Seedling Planting	Parallel	9.25	0.2	1.25	1	1.2	0.62
		New		1	1.25	1	1.2	0.00
Upland	Tree Felling/CWD	Parallel	1.03	0.2	3.3	1	1	0.14
		New		1	1.6	1	1	0.00
Lowland	Seedling Planting	Parallel	13.88	0.2	1.25	1	2.8	1.98
		New		1	1.25	1	2.8	0.00
Lowland	Mounding	Parallel	1.54	0.2	3.3	1	1	0.21
		New		1	1.6	1	1	0.00
Operational Access (10 m Ditchline)	Natural Regeneration	Parallel	8.6	0.2	NA	NA	NA	1.72
		New		1	NA	NA	NA	0.00
Total Project Residual Effect (ha) [excludes Indirect Disturbance)								**4.68**
Indirect Disturbance (500 m Buffered Area)	NA	NA	NA	NA	NA	NA	NA	0.90
Initial Offset Value (ha)								**5.58**

Table 4-5: IOV Quantification for Chinchaga Range

Restoration Unit Description (Project ROW)			Direct Project Disturbance (ha)	Inherent Effect	Delivery Risk Multiplier	Spatial Risk Multiplier	Temporal Risk Multiplier	IOV (ha)
Habitat	**Restoration Measure**	**ROW Alignment**						
Upland	Seedling Planting	Parallel	34.16	0.2	1.25	1	1.2	2.28
		New	1.8	1	1.25	1	1.2	0.60
Upland	Tree Felling/CWD	Parallel	3.8	0.2	3.3	1	1	0.53
		New	0.2	1	1.6	1	1	0.08
Lowland	Seedling Planting	Parallel	51.25	0.2	1.25	1	2.8	7.32
		New	2.7	1	1.25	1	2.8	1.93
Lowland	Mounding	Parallel	5.69	0.2	3.3	1	1	0.79
		New	0.3	1	1.6	1	1	0.11
Operational Access (10 m Ditchline)	Natural Regeneration	Parallel	38.1	0.2	NA	NA	NA	7.62
		New	2	1	NA	NA	NA	2.00
Total Project Residual Effect (ha) [excludes Indirect Disturbance)								**23.26**
Indirect Disturbance (500 m Buffered Area)	NA	NA	NA	NA	NA	NA	NA	11.20
Initial Offset Value (ha)								**34.46**

4.5 OFFSET SELECTION AND IMPLEMENTATION PLAN

This section identifies the criteria used to select locations for offset measures for the Boundary Lake and Pelican Lake sections, the amount of offset area required and outlines a preliminary schedule for measures to be implemented.

NGTL followed the selection criteria outlined in BBOP (2012a), where the preferred approach to implementing offsets considers the regulatory policies and frameworks under which offsets might be structured. Several challenges to using this approach were identified for this Project:

- absence of an established offset policy or other regulatory mechanism for developing offsets for caribou and caribou habitat
- absence of provincial range plans, directives or preliminary guidance for priority caribou management/conservation areas in Alberta
- limited availability of suitable offset locations within caribou range that offer long-term protection

In light of these challenges, NGTL took guidance from the Recovery Strategy (EC 2012b), which identified range intactness, reducing total disturbance and improving habitat condition as priorities. As these priorities relate to the listed woodland caribou ranges defined in EC 2012b, NGTL will consider offset opportunities in all caribou ranges in Alberta.

The selection of offset locations will be completed at two scales: landscape (or regional) scale and site-specific scale. Considerations for selection of offset locations at the landscape scale include risks associated with offset permanence, caribou conservation benefits and spatial context. These risks can be mitigated through:

- regulatory mechanisms (e.g., legislative protection, conservation easements) for protection of an area result in a higher degree of certainty in the permanence of the offsets.
- selecting offset locations that provide incremental conservation benefits, (adding to existing programs, land-use plans or funding).
- selecting locations in the same boreal caribou range to provide ecological benefit to the affected herd.

At the site-specific scale, permanence considerations relate to operational access requirements and minimal active use, including recreational, industrial and traditional access needs. These considerations are intended to increase success rates for offset measures in areas where re-disturbance is less likely. Appropriate locations will also reduce the potential for negatively affecting ongoing traditional use by ensuring traditional access is not impeded by restoration measures. Lease holder or disposition

agreements that permit application of offset measures and restrict further access are also site-specific considerations that might affect the permanence of offsets.

NGTL has been working collaboratively with Alberta Environment and Parks (AEP) to identify, prioritize and select candidate caribou habitat restoration areas in priority caribou ranges for this Project and other ongoing projects in caribou range in Alberta. Selection criteria consider AEP's priority caribou restoration areas, degree of existing disturbance, opportunities for collaborative partnerships and ease of access. Selection of candidate areas has progressed and several potential areas were short listed in June 2015. The candidate sites identified are in established Wildland Parks in northeastern Alberta that overlap with priority caribou habitat restoration areas identified by the province to enable permanence of caribou habitat restoration and contribute to Recovery Strategy goals and objectives. NGTL will continue to work with AEP, and its partners (e.g., Forest Management Agreement holders) and stakeholders to select specific locations to meet shared objectives. NGTL anticipates ongoing cooperation with AEP as range plans are released. The Province of Alberta is in the early stages of developing a framework for conservation offsets. Recently, a draft plan for Little Smoky and La Peche Caribou ranges was released for public comment (AEP 2016 citation). Range plans for the herds affected by this Project have not been released. Through ongoing consultation with AEP, NGTL is confident that offset planning will align with anticipated provincial range plans.

Conceptually, early implementation of offset measures is a desirable outcome but there are a number of factors to be considered. Construction of the Project cannot proceed without regulatory approval. Following regulatory approval, the necessary spatial data will not be available to accurately calculate the direct and indirect residual effects until after construction. These calculations are required to determine the initial and final offset values. Speculative spatial estimates may be of some value for initial planning purposes; however, the costs related to implementing offsets are significant. It is not preferable to begin incurring these costs in advance of the Project receiving the necessary approvals to proceed and before knowing the actual residual effects of the Project on caribou and caribou habitat.

4.5.1 Offset Location Criteria

For the offset plan, landscape level offset location selection criteria will include:

- range planning considerations specific to boreal caribou recovery efforts and management from discussions and consultation with provincial and federal authorities and available caribou location data
- areas with no or minimal active traditional, recreational or industrial use needs
- areas adjacent, or in close proximity to monitoring programs or other wildlife/landscape management objectives (e.g., Algar Restoration Project and LiDea Project [COSIA 2014])

- areas that fall in provincial parks or other locations afforded long-term protection from future development (these sites will be prioritized with the province to determine overlaps in provincial planning priorities and caribou restoration priorities)

NGTL gives preference to locating offsets within the affected caribou range. However, final offset placement will be a compromise between the priorities of the provincial regulators and/or available and appropriate offset areas. At present, NGTL has not finalized the agreements regarding offset locations for this project.

After identifying and securing a location at the landscape scale, the site specific scale is evaluated for restoration potential. Once this area has been investigated and caribou habitat considerations such as connectivity of caribou habitat and overall patch size have been taken into account, habitat restoration units are identified and characterized. After habitat restoration units have been characterized, appropriate restoration applications are then implemented.

4.6 POTENTIAL OFFSET MEASURES

Potential offset measures that will be implemented for the Project align with the habitat restoration measures presented in Section 3. The caribou habitat restoration decision frameworks will be used to select suitable offset measures (Figures 3-3 to 3-5). Offset measures will be selected considering NGTL's experience with previous caribou habitat offset initiatives, as well as the site characteristics in the areas to be offset (e.g., habitat type, moisture and nutrient regime, aspect, soils, climatic conditions, land use).

4.7 OFFSET DECISION FRAMEWORK

The offset decision framework (see Figures 4-3) will be applied to provide guidance on selection of offset locations and implementation of appropriate offset measures. The decision framework is a principle-based logic model that informs offset decisions to achieve the objective and goals of the CHR&OMP.

The decision framework will be applied after the implementation of caribou habitat restoration measures on the ROW and the IOV has been calculated. The decision framework will guide the selection of the offset locations which will allow calculation of the Final Offset Value (FOV) and selection of appropriate offset restoration measures. The quantification of the FOV is detailed below.

4.8 QUANTIFICATION OF FOV

The FOV is calculated once offset locations and offset measures have been identified. Risk multipliers specific to the habitat and habitat restoration measures are applied to account for uncertainty in implementation and time lag.

The FOV is calculated in a manner similar to the IOV. Identified offset locations are categorized by habitat type and habitat restoration measures, identified as restoration units. .

Multipliers are applied to the IOV for delivery, spatial and temporal risks specific to the proposed offset habitat and habitat restoration measures. The resulting offset area for each restoration unit is then summed to calculate the FOV, using the equation in Calculation 4-2.

Calculation 4-2:

$$FOV = \sum Offset\ HRU_i\ (ha)\ x\ delivery\ risk_i\ x\ spatial\ risk_i\ x\ temporal\ risk_i$$

Tables 4-6, 4-7 and 4-8 provide hypothetical calculations of the FOV. The FOV can only be calculated once the offset locations have been identified and the appropriate offset measures specific to the offset location have been planned. Hypothetical values have been created for an example to illustrate how the calculations will be applied.

Table 4-6: Quantification of FOV for WSAR

Restoration Unit Description (Offset Location)			Proportion of IOV (ha)	Inherent Effect Multiplier	Delivery Risk Multiplier	Spatial Risk Multiplier	Temporal Risk Multiplier	FOV (ha)
Habitat	**Restoration Measure**	**Linear Feature**						
Upland	Seedling Planting	Contiguous		5	1.25	1	1.2	0.00
		Non-Contiguous	40	1	1.25	1	1.2	60.00
Upland	Tree Felling/CWD	Contiguous		5	3.3	1	1	0.00
		Non-Contiguous	3.09	1	1.6	1	1	4.94
Lowland	Seedling Planting	Contiguous		5	3.3	1	2.8	0.00
		Non-Contiguous		1	1.6	1	2.8	0.00
Final Offset Value (ha)								**64.94**

Table 4-7: Quantification of FOV for ESAR

Restoration Unit Description (Offset Location)			Proportion of IOV (ha)	Inherent Effect Multiplier	Delivery Risk Multiplier	Spatial Risk Multiplier	Temporal Risk Multiplier	FOV (ha)
Habitat	**Restoration Measure**	**Linear Feature**						
Upland	Seedling Planting	Contiguous		5	1.25	1	1.2	0.00
		Non-Contiguous	4	1	1.25	1	1.2	6.00
Upland	Tree Felling/CWD	Contiguous		5	3.3	1	1	0.00
		Non-Contiguous	1.58	1	1.6	1	1	2.53
Lowland	Seedling Planting	Contiguous		5	3.3	1	2.8	0.00
		Non-Contiguous		1	1.6	1	2.8	0.00
Final Offset Value(ha)								**8.53**

Table 4-8: Quantification of FOV for Chinchaga Range

Restoration Unit Description (Offset Location)			Proportion of IOV (ha)	Inherent Effect Multiplier	Delivery Risk Multiplier	Spatial Risk Multiplier	Temporal Risk Multiplier	FOV (ha)
Habitat	**Restoration Measure**	**Linear Feature**						
Upland	Seedling Planting	Contiguous		5	1.25	1	1.2	0.00
		Non-Contiguous	30	1	1.25	1	1.2	45.00
Upland	Tree Felling/CWD	Contiguous		5	3.3	1	1	0.00
		Non-Contiguous	4.46	1	1.6	1	1	7.14
Lowland	Seedling Planting	Contiguous		5	3.3	1	2.8	0.00
		Non-Contiguous		1	1.6	1	2.8	0.00
Final Offset Value (ha)								**52.14**

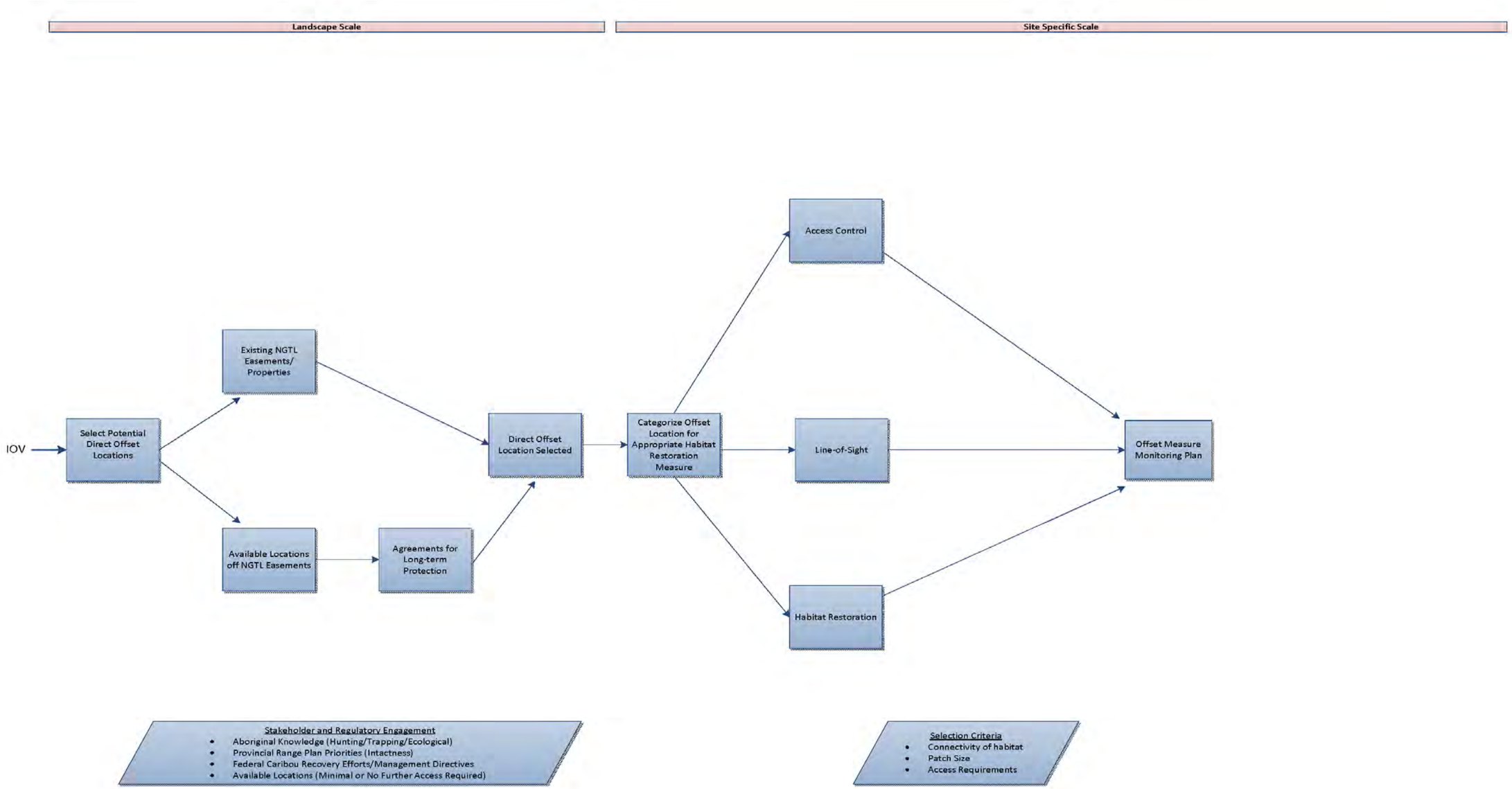


Figure 4-3 Offset Measures Decision Framework

5.0 SCHEDULE FOR IMPLEMENTATION

Final cleanup activities are expected to be completed in the winter following construction of the Boundary Lake and Pelican Lake Sections of the Project. Caribou habitat restoration measures within the Boundary Lake and Pelican Lake Section footprints will be implemented with final cleanup activities. As-built construction information will be compiled to document spatial data of areas where restoration measures were implemented and remaining direct disturbance.

The offset plan is implemented after restoration measures have been completed. Offset measures will be implemented once final offset location(s) are determined through ongoing engagement with regulators and stakeholders.

For a preliminary proposed schedule for construction, habitat restoration and offset activities, see Table 5-1.

5.1.1 Caribou Timing Restriction

NGTL has considered the seasonal sensitivity of caribou and has developed the habitat restoration and offset schedules for the Boundary Lake and Pelican Lake Sections with this timing in mind. Final cleanup, habitat restoration and offset implementation are scheduled to occur outside the February 15 to July 15 timing restriction.

Table 5-1: Proposed Schedule, Boundary Lake and Pelican Lake Sections Construction, Habitat Restoration and Offset Measures

Timelines and Milestones	Anticipated Dates*
Construction	
Clearing	November to December 2017
Pipeline (Mainline) Construction	December 2016 to February 2017
Machine Cleanup/validation testing/tie-ins	February 2017 to April 2017
Final Cleanup	November 2017 to February 2018
Caribou Restoration and Offset Planning	
Submission of Preliminary CHR&OMP to the NEB	September 30, 2015
Submission of Revised CHR&OMP to the NEB (Condition 7)	September 1, 2016
Implementation of Access Control & Line of Sight	September 2017 to February 2018
Implementation of on ROW Caribou Habitat Restoration	July 15 to September 1, 2018
Submission of Caribou Habitat Restoration Implementation Report and Status Update (Condition 31)	July 1, 2019
Submission of CHROMMP (Condition 32)	November 1, 2020
Selection of Direct Offset Location(s)	ongoing
Implementation of Direct Offset Measures	2019 to 2020
Submission of Caribou Habitat Offset Measures Implementation Report (Condition 34)	March 31, 2021
Implementation of CHROMMP	Q3 2021
Submission of first Caribou Monitoring Report (Condition 33)	Q1 2022,
* Dates are tentative and subject to schedule impacts of when regulatory approval is received.	

6.0 PERFORMANCE INDICATORS

After implementation of the caribou habitat restoration and offset measures, NGTL will monitor to ensure the objectives, goals and targets outlined in Section 2 of this CHR&OMP are achieved.

The success of the restoration and offset measures will be quantified by the performance indicators outlined in Table 6-1. The primary measures below are taken from Table 3-4; measures may have a secondary function. The performance indicators are based on NGTL's experience with restoration measures. They are expected to be appropriate for the measures implemented for the Boundary Lake and Pelican Lake Sections of the Project.

Depending on the implemented restoration measures specific to the Project, additional performance indicators could be developed. The final performance indicators will be detailed in the implementation reports.

Table 6-1: Performance Indicators to Measure CHR&OMP Goals and Targets

Goal	Target	Primary Measures	Performance Indicator
(G1) NGTL's caribou habitat restoration measures are ecologically relevant, practically located, and reasonably protected to minimize potential for re-disturbance by human activity.	• (T1) Access is lower on controlled segments compared with uncontrolled segments.	Implement access control • Woody debris rollback • Mounding • Snow ramping/tree felling	• <20% increase in access (e.g., rate, proportion, count) from the baseline assessment as measured by remote cameras • Access (rate, proportion, count) on controlled segments is lower than uncontrolled segments
	• (T2) Sightline distance is limited to ≤ 500 m where compatible with the surrounding landscape.	Implement line-of-sight blocking • Minimal disturbance (vegetation screening) • Snow ramping/tree felling • Bioengineering/willow staking	• Along the Project ROW, in areas of new cut or contiguous Project ROW with NGTL lines only, achieve sightline distance of ≤ 500 m • Along the Project ROW, in areas of new cut or contiguous Project ROW with NGTL lines only, where planting for future vegetation screens with or without rollback have been installed, achieve ≥80% survival rate for planted seedlings intended as line of sight blocks

Table 6-1: Performance Indicators to Measure CHR&OMP Goals and Targets (cont'd)

Goal	Target	Primary Measures	Performance Indicator
(G2) NGTL's caribou habitat restoration measures establish self-sustaining and ecologically appropriate vegetation communities that are on a trajectory to the compatible surrounding landscape	• (T3) The species composition of revegetated restoration areas regenerates on a typical path of ecological succession.	Implement habitat restoration • Minimal surface disturbance • Seedling planting • Bio-engineering	Upland and Transitional Forest Habitat Types: • Achieve ≥80% survival rate for planted seedlings within 10 years following implementation of restoration measures; and • Demonstrate sustained growth trends across ≥80% of restoration locations within 10 years following implementation of restoration measures. Treed Wetland/Lowland Habitat Types: • Where tree seedlings are planted (e.g., mounded sites), achieve ≥50% survival rate for seedlings/ transplants within 10 years following planting • Demonstrate sustained growth trends across ≥50% of restoration locations within 10 years following implementation of restoration measures Shrub/Graminoid Wetland Habitat Types: Within 10 years following implementation of restoration measures: • ≥50% cover of native vegetation species in the footprint • no restricted weeds
	• (T4) The sustained growth trend of revegetated restoration areas is comparable to that of the surrounding landscape.	Implement habitat restoration • Minimal surface disturbance • Seedling planting • Bio-engineering	

The performance indicator for Goal 1 includes measurable parameters to define success of access control and line-of-sight measures. NGTL considered a performance indicator for Target 1 of no increase (0%) in access after construction to be unrealistic. Recognizing a 0% increase is unrealistic but needing to establish an

acceptable increase in access, NGTL established an increase in access of <20%. This performance indicator is intended to address a range of access changes between 0 to <20%. If it is found that access has increased beyond 20% in areas where caribou restoration measures have been applied, adaptive management measures will be employed at locations where access control is deemed necessary.

For Target 2 of Goal 1, NGTL notes different line-of-sight targets have been proposed by AEP under the Enhanced Approval Process intended for upstream oil and gas developments. However, NGTL maintains that attempting to achieve 200 to 400 m line-of-sight blocks is unrealistic given materials to construct line-of-sight blocks are often not available, there are conflicting interests for timber and woody materials and operational concerns. NGTL can realistically achieve a 500 m line-of-sight interval.

The performance indicators for Goal 2 include measurable parameters that reflect the habitat type affected and a reasonable timeline to achieve restoration success. NGTL has chosen survival rate as the measure because it is not species dependent. The growth rates of conifer species can be variable and tree height over time can differ based on habitat characteristics and site specific conditions. Given the differences in site conditions between upland and lowland locations and the potential for site specific influences and factors, tree height was not chosen as a monitoring metric.

7.0 MONITORING AND ADAPTIVE MANAGEMENT

Monitoring and adaptive management are important elements to inform whether restoration and offsets investments are contributing meaningfully to the strategic outcome of conservation and recovery of woodland caribou. To this end, NGTL will develop a CHROMMP for the Boundary Lake and Pelican Lake Sections of the Project to monitor effectiveness of planned habitat restoration and offset measures. In compliance with Condition 32 of the Report, the CHROMMP will be submitted to the NEB after the first complete growing season subsequent to implementation of caribou habitat restoration measures. The CHROMMP will include details on monitoring (including ground-based, aerial and remote camera monitoring) and adaptive management. It will also include details pertaining to the design of the monitoring periods (methods, frequency and duration) for the habitat measures implemented. It will include information pertaining to the number and location of monitoring and control sites, evaluation criteria and definition of quantifiable performance indicators.

7.1 MONITORING PROGRAM

NGTL will use a combination of monitoring approaches in the CHROMMP. Habitat restoration (revegetation) will be monitored against performance indicators using:

- ground-based sampling within stratified monitoring plots established in the restoration areas
- aerial monitoring to collect high-resolution 360° geo-referenced photography in conjunction with high-resolution light detection and ranging (LiDAR) imagery; the resultant data will enable both spatial and temporal assessment of restoration performance

Access control and line-of-sight blocking will be monitored against performance indicators using:

- ground and aerial inspections to verify evidence of access at habitat restoration, access control and line-of-sight locations
- non-intrusive ground-based monitoring with strategically placed remote cameras
- aerial monitoring to collect high-resolution 360° geo-referenced photography in conjunction with high-resolution LiDAR imagery to collect evidence of access at restoration locations

The CHROMMP will be designed to identify and manage issues requiring supplemental or remedial action to achieve restoration goals.

7.2 ADAPTIVE MANAGEMENT

Adaptive management is the systematic process of monitoring and assessing outcomes and modifying habitat restoration measures if necessary. NGTL will implement adaptive management by adjusting and/or supplementing offset measures, where warranted, to achieve the targets and goals, and ultimately, the objective of the CHR&OMP using quantifiable performance indicators. Adaptive management is intended to:

- evaluate restoration and offset measures, performance and effectiveness
- identify the cause of any underperforming measures (i.e., microsite conditions that are either not conducive or suitable for establishment of target vegetation)
- address underperforming measures requiring supplemental or remedial action

The habitat restoration measures are considered successful when monitoring results indicate restoration has achieved or is on trajectory to achieving the performance indicators and, thereby, the CHR&OMP targets. No additional measures will be considered necessary at that point. If performance measures indicate that targets are not on trajectory, restoration measures will be adjusted as soon as feasible and monitoring will continue until a positive trajectory is achieved.

8.0 CONTINUAL IMPROVEMENT

Continual improvement reflects the refinements of the quantification methodology and the incorporation of new information developed through the following:

- available literature
- research from industry associations
- lessons learned from other NGTL projects
- consultation with applicable regulators
- resource managers and Aboriginal communities
- evidence from the hearing process
- adaptive management practices in the field

NGTL submitted the preliminary integrated CHR&OMP as evidence in the GH-002-2015 proceeding for the Project to detail the full process planned for addressing Project residual effects to caribou and caribou habitat on public record (NEB Filing ID: A4T8R1). The preliminary CHR&OMP outlined the underlying concepts and processes used to quantify Project residual disturbance and offset calculations. In prior NGTL documents, quantification equations were less clear and parts of the processes were footnoted. Equations have been reworked, with distinct and consistently applied terms, which are more easily understood and calculated. The revised CHR&OMP incorporates inputs reflective of additional information provided through the NEB hearing process including:

- refinement of descriptions of restoration measures and removal of measures that are not practically implemented;
- update of decision frameworks to improve scenario accuracy;
- provision of preliminary calculations for quantification tables;
- expansion on the concept of multipliers;
- clarification of the selection criteria and rationale for offset locations; and
- clarification regarding the selected performance indicators

8.1 CARIBOU HABITAT INITIATIVES

NGTL recognizes restoration ecology specific to caribou habitat is a relatively new science. Caribou research is a growing field and it is anticipated methods to restore habitat will continue to be tested, modified, and improved. NGTL will continue to incorporate new information on caribou mitigation and habitat restoration planning and implementation. If new research identifies success with alternative methods of caribou restoration, NGTL will determine if the methods are applicable for use on pipeline ROWs. Where appropriate and applicable, new restoration measures will be incorporated in the toolbox of measures available to NGTL to restore caribou habitat. In this revised CHR&OMP, NGTL has added the extension of bored installations as a

potential habitat conservation/restoration measure where conditions are suitable and the installation method is appropriate. Bore extensions are commonly used to preserve vegetation at certain crossings but had not been clearly noted in prior NGTL caribou habitat restoration documents. Similarly, measures that prove to be ineffective will be removed from the toolbox and the decision frameworks. In this revised CHR&OMP, NGTL has removed earth and woody debris berms as a restoration measure, in part because these features can be counter-effective, affording predators with improved viewsheds. Earth and woody berms also require large amounts of material that are not readily available under normal pipeline construction and therefore deemed impractical. Wood berms have also been deemed a fire hazard by local forestry officers.

Some key initiatives have identified important lessons learned related to oil and gas development in caribou range. Common among many of these initiatives are lessons learned on which plant species to use, when and where to replant, development of effective techniques to promote natural revegetation and a better understanding of methods to manage access. Key initiatives focused on revegetation and access management, as well as limiting growth and establishing plant species favourable to primary prey (e.g., CRRP 2007a, CRRP 2007b; Golder 2010; Osko and Glasgow 2010). Projects also included tree planting initiatives, coarse woody debris management best practices, habitat enhancement programs and habitat restoration trials in caribou range (COSIA 2015; CRRP 2007a, b; Enbridge 2010; Golder 2010, 2011). Large-scale habitat restoration projects near Grande Prairie, Cold Lake and Fort McMurray, Alberta, as well as NGTL's projects in caribou habitat have incorporated learnings from these initiatives.

8.2 INDUSTRY COLLABORATION

Canada's Oil Sands Innovation Alliance (COSIA) includes four key focus areas: tailings, water, land and greenhouse gases. Within COSIA's land focus area is a caribou habitat restoration initiative with the goal of improving woodland caribou habitat quality and herd survival through restoration of historic linear disturbances.

COSIA has developed the following habitat restoration initiatives:

- Determining effectiveness of different restoration techniques such as winter tree planting, mounding, seeding and placement of coarse woody debris. The winter tree planting trial was set up to determine the effectiveness of planting black spruce seedlings in wetland areas during winter. Results of the tree planting trial indicated 90% survival of the 900 seedlings planted.
- Development of the Landscape Ecological Assessment Planning (LEAP) tool to provide baseline levels of varying land use. LEAP can be used to determine the long-term effects of restoration in a given area, which can help guide planting initiatives.

- The Algar Historic Restoration Project takes an integrated regional approach, with six companies working together to repair fragmented habitat across an area of land outside their actual licence areas. This is a five-year program to replant trees and shrubs along the linear footprint in the Algar Region, covering an area approximately 570 km^2.
- The LiDea Project aims to restore linear disturbances using mounding and tree felling. Rigorous monitoring and measurement programs have been designed for the life of the project, and currently include 37,000 ha of active treatment area. During spring and summer, conifer seedlings are planted along older, mounded seismic lines. LiDea is also experimenting with forest stand modification, which involves bending tree stems from the adjacent forest across the seismic line to create physical barriers and reduce sightlines along the linear corridor.

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

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

8.3 LESSONS FROM NGTL HABITAT RESTORATION

Preliminary and final caribou habitat restoration plans were completed for NGTL's Northwest Mainline Expansion Project (NWML), Leismer to Kettle River Crossover Project (Leismer) and Chinchaga Lateral Loop No. 3 Project (Chinchaga). Additional feedback on restoration measures was gained through recent consultation with the NEB and AEP throughout the construction of Liege Lateral Loop No. 2 – Thornbury Section. Based on NGTL's experience with these projects, the following lessons learned were incorporated in this CHR&OMP:

- Rollback was used as firewood by land users when stacked as ladders. A more random arrangement of wood piles to discourage wood removal is currently being tested.
- Earth berms have been removed as a restoration measure because they have been found to be ineffective. Over time they settle and compact and do not perform as line-of-sight breaks. Predators have been observed by field personnel using these features as vantage points, providing a clear view of the surrounding landscape. Also, earth berms require large volumes of material that are generally not

available during pipeline construction, particularly when minimal surface disturbance techniques are being implemented.

- Tree planting on a linear corridor can have shading issues that are not seen on cutblocks (typical silvicultural practices). This could result in changes to the planting densities and planting considerations and configurations may be modified as the monitoring program progresses to reflect those site specific conditions.
- Restricted access control cannot be absolute because of safety, operating and maintenance activities that must occur. On previous NGTL projects, lack of access resulted in restoration measures (specifically, access control measures) being destroyed or removed to access the ROW. In the future, access-control locations will be strategically placed to allow for maintenance and traditional use access.
- Where restoration measures have failed or been removed, they have been and will be replaced as part of adaptive management.
- Line-of-sight breaks and access control on co-located ROWs may be less effective because of unrestricted access on parallel ROWs. NGTL has learned that such methods are better implemented on non-contiguous ROWs.
- NGTL has attempted to apply line-of-sight/access control features on the landscape as suggested in the Integrated Standards and Guidelines for the Enhanced Approval Process (EAP) (AER 2013). NGTL past project experience where the recommended interval was attempted (Leismer, NWML, Chinchaga) was unsuccessful. Some of the reasons the EAP recommended intervals are not generally achievable include:
  - materials to construct line-of-sight blocks are often not available:
    - insufficient woody material to implement line-of-sight blocks, even using merchantable timber, to construct these features every 200 m to 400 m
    - often not enough suitable material to implement rollback at the EAP-recommended intervals
    - limited opportunities to implement mounding due to the unsuitability of soil types and ecosite types
  - conflicting interests for timber and woody materials:
    - timber salvage waivers must be approved before construction and acceptable to the Forest Management Agreement (FMA) holder
    - merchantable timber is prioritized first and used for access control then remaining materials go to FMA

    - any woody materials remaining must be distributed efficiently among the locations where restoration measures are required (line-of-sight blocks, mounding)

- operational concerns:

    - from a safety and maintenance perspective, implementing restoration measures at 200 m and/or 400 m makes operational access difficult and potentially unsafe (in emergency situations, time would be lost removing the access control and line-of-sight measures)

    - during the Leismer project, NGTL personnel had issues gaining access to the ROW as a result of access control measures (the rollback was removed to gain access but the integrity of the wood had degraded; no replacement materials were available to reconstruct the access control measure)

- As a result of ongoing consultation with AEP, NGTL is no longer expected to adhere to the 200 m line-of-sight breaks outlined in the EAP guidelines, and ≥500 m line-of-sight breaks are considered acceptable.

9.0 CONSULTATION

NGTL has engaged with Aboriginal communities, Environment and Climate Change Canada (formerly Environment Canada) and AEP on the Boundary Lake and Pelican Lake Sections of the Project regarding potential effects to caribou and caribou habitat, as well as on plans to develop a conservation management plan, included as part of this revised CHR&OMP. NGTL committed to engage with potentially affected Aboriginal communities on the CHR&OMP following the filing of the preliminary CHR&OMP in September 2015 (NEB Filing ID: A4T8R1). NGTL will provide continued opportunities for input on the ongoing planning and implementation of caribou habitat restoration measures for the Boundary Lake and Pelican Lake Sections of the Project. NGTL will continue to work with provincial and federal regulators to align the caribou habitat restoration and offset measures with provincial and federal policies. The implementation plans and the CHROMMP will include updated consultation records.

9.1 ABORIGINAL ENGAGEMENT

The CHR&OMP incorporates feedback from Aboriginal communities collected during NGTL's consultation on caribou habitat restoration and offset measures for past projects. Aboriginal communities have provided feedback to NGTL on the CHR&OMP through the NEB application review process. Concerns regarding caribou and caribou habitat identified in traditional land use studies provided to NGTL were reviewed and mitigation measures provided through response tables to each Aboriginal community as applicable. These mitigation measures are reviewed and discussed through ongoing engagement activities.

Aboriginal community consultation will continue through NGTL's direct ongoing engagement programs both in terms of ROW restoration and potential offset locations. NGTL will provide notification to interested Aboriginal communities for all caribou related submissions in compliance with the Board's Report for the Project. A key goal of ongoing engagement is to ensure that planning is compatible with existing traditional land use practices. Inclusion of traditional land use information gained through engagement and consultation will ensure measures are implemented in a manner that avoids or minimizes disruption to traditional activities in the restoration areas.

9.2 REGULATORY CONSULTATION

For a summary of past consultation with federal and provincial agencies, see Appendix C. NGTL has built upon this history of consultation for the Boundary Lake and Pelican Lake Sections. NGTL is committed to continuing consultation specific to this CHR&OMP through the planning and implementation stages.

A conference call was held between NGTL and AEP on September 9, 2015 to review the proposed approach for the CHR&OMP and to obtain feedback from AEP. Key discussion questions and recommendations from AEP during the conference call included the following:

- whether NGTL will select offset locations on their own properties or other properties
- chosen restoration areas should align with Regional Land Management Plans when they are finalized (i.e., Lower Athabasca Regional Plan (LARP), which prioritizes caribou management areas)
- calculations used to determine offsets
- site-specific restoration and offset measures should be chosen on a project-specific basis, rather than on overarching strategies and concepts
- recognition that the decision frameworks demonstrate specific restoration measures in each scenario and rationale for choices
- use of vegetation screening (walking down vegetation and piling with snow) for mitigation (i.e., ramp-overs) was considered a valuable restoration measures

As a result of the September 9, 2015 meeting, a susbsequent meeting was held with AEP and ECCC personnel on October 7, 2015 to continue discussions specific to the CHR&OMP. Appendix C includes consultation summaries of these meetings.

10.0 LITERATURE REVIEW

A literature review was conducted to provide regulatory and ecological context relevant to boreal caribou and specifically to the WSAR, ESAR and Chinchaga caribou ranges, including threats and management considerations for recovery of boreal caribou. This context provides an understanding of the current knowledge of the value and purpose of habitat restoration and offset measures in caribou range.

In addition, available information on habitat restoration measures and habitat restoration methods was compiled and summarized in Section 3 (Table 3-4). This summary was used to provide the foundation for the toolbox of habitat restoration and offset measures available to NGTL to effectively mitigate potential Project effects on caribou and caribou habitat. Knowledge gaps that contribute to uncertainty in caribou habitat restoration are identified in Section 10.15. Based on the results of the literature review, the habitat restoration and offset measures best suited for caribou range are identified.

10.1 LITERATURE REVIEW METHODS

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

A literature review of primary literature, “grey literature” and guidance documents was conducted specific to offsets and referenced in the development of this plan to offset residual Project-related effects to caribou habitat. The following presents further details on the approach, rationale and method used to conduct the literature review to inform NGTL offset measures planning decisions including scientifically-based definitions, mitigation hierarchy, offset measures, design elements and multipliers.

The literature review of habitat restoration and offset measures was completed using a systematic approach and standard research techniques, which enabled NGTL to consider the most recent published knowledge of caribou habitat restoration in the preliminary CHR&OMP. Literature reviewed included federal and provincial recovery strategies and management plans, peer-reviewed primary scientific articles, previously submitted NGTL caribou habitat restoration and offset filings, publically available government reports, in house reference material, guidance documents from expert individuals/agencies, and established offset policies and emerging offset policies from provincial, state and federal agencies in Canada and internationally.

The literature review for the preliminary CHR&OMP included a systematic search of the following internet, industry and scholarly databases for queried keywords and phrases:

- Google
- Google Scholar
- Cumulative Environmental Management Association (CEMA) database, including Oil Sands Leadership Initiative (OSLI) historic filings
- ScienceDirect (sciencedirect.com), JSTOR (jstor.org), ISI Web of Science (https://isiknowledge.com/) and ELSEVIER (elsevier.com) for biological and environmental science journal databases, including other related research fields and disciplines
- provincial, state and federal government agency websites for established or emerging offset policies and frameworks (countries included: Australia, Brazil, Canada, New Zealand, UK and the United States)
- expert agency websites that provide scientific review and best-practice guidance and frameworks for established and emerging offset programs (organizations included: Alberta Conservation Association, Business Biodiversity Offset Programme, Commonwealth Scientific and Industrial Research Organization, International Union for Conservation of Nature, Pembina Institute and the United Nations Convention on Biological Diversity)
- expert individual websites (author-specific, where available) for published articles and associated links or documents related to the aforementioned sources

The following search terms were used in the literature review:

- caribou habitat restoration
- boreal caribou
- boreal forest and forested wetlands restoration
- linear corridor restoration/reclamation
- linear feature restoration in boreal forest and forested wetlands
- Alberta caribou recovery/range plan/policy/action plan
- offset and associated modifiers, such as environmental, conservation, biodiversity, allowance, compensatory, mitigation, bio-banking, direct, indirect, in-kind, out-of-kind, like for like, multiplier and ratio

COSIA's website (COSIA 2015) was searched to gather knowledge on current habitat restoration measures, including the LiDea Project, the Algar Historic Restoration Project and OSLI environmental performance projects.

Several technical sessions related to habitat restoration for caribou were presented at the 15th North American Caribou Workshop (2014). Relevant information for caribou habitat restoration planning related to use of rollback and monitoring wildlife use of restored linear features is summarized in the relevant sections of the literature review.

Caribou habitat restoration is receiving increasing research attention and it is anticipated that methods to restore habitat will continue to be tested and modified in the near future. NGTL will continue to incorporate this new information in the CHR&OMP and post-construction monitoring.

10.2 REGULATORY POLICY, RECOVERY OBJECTIVES AND GUIDELINES FOR BOREAL CARIBOU

The Project's preliminary CHR&OMP was developed considering current regulatory policies specific to boreal caribou. The identified regulatory policy and management documents considered to develop the Project CHR&OMP include:

- *Alberta Woodland Caribou Recovery Plan*, 2004/05 to 2013/14 (Alberta Woodland Caribou Recovery Team 2005)
- *A Woodland Caribou Policy for Alberta* (Government of Alberta 2011)
- federal *Recovery Strategy for the Woodland Caribou* (Rangifer tarandus caribou)*, Boreal Population, in Canad*a (Environment Canada 2012b)

Further information on each of the documents listed above is summarized in the following paragraphs. NGTL began consultation and working collaboratively with provincial regulators, Aboriginal communities, stakeholders and industry partners in the early planning stages of the Project. NGTL will continue to work with provincial and federal regulators to align the CHR&OMP measures with current provincial and federal policies.

The Woodland Caribou Policy for Alberta (Government of Alberta 2011) identifies recovery strategies that include maintenance and restoration of caribou habitat, establishment of range-specific habitat objectives, management of other wildlife populations (predators and primary prey), adaptive management, as well as legislative and social considerations. A key strategy adopted by the Woodland Caribou Policy for Alberta is the development of range-specific assessments and objectives (i.e., action plans), which builds on the work of previous recovery strategies, such as the Alberta Woodland Caribou Recovery Plan 2004/05 – 2013/14 (Alberta Woodland Caribou Recovery Team 2005).

Similar to the provincial policy, the Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada (Environment Canada 2012b) stresses the importance of landscape level planning, such as planning

development activities at appropriate temporal and spatial scales, incorporating caribou habitat requirements in fire management plans, establishing key protected areas and incorporating adaptive management. One of the management approaches suggested in the federal Recovery Strategy to address effects of habitat alteration on boreal caribou is to undertake coordinated actions to reclaim boreal caribou habitat through restoration efforts.

This might include restoration of industrial features such as roads, seismic lines, pipelines, cut lines and clearings (Environment Canada 2012b). The preliminary CHR&OMP adopted the definition of caribou habitat provided in the Recovery Strategy (i.e., habitat in defined caribou ranges that is necessary to maintain or recover self-sustaining local populations throughout their distribution).

NGTL is continuing to work with AEP to align the CHR&OMP measures with the provincial caribou policy and future provincial Caribou Action Plans for the WSAR, ESAR and Chinchaga caribou ranges. Range-specific Caribou Action Plans are required as part of the province's commitment to the proposed federal Recovery Strategy. A range-specific assessment or recovery plan for the WSAR, ESAR and Chinchaga caribou ranges have not yet been developed by the province.

The goal of the Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada is to achieve self-sustaining local populations in all boreal caribou ranges throughout their current distribution in Canada, to the extent possible (Environment Canada 2012b). Population and distribution objectives identified in the Recovery Strategy include, to the extent possible:

- maintain current status of the 14 existing self-sustaining local populations
- stabilize and achieve self-sustaining status for the 37 non self-sustaining local populations (a group that includes the WSAR, ESAR and Chinchaga caribou ranges)

The federal Recovery Strategy identifies critical habitat for the boreal woodland caribou as:

- the area within the boundary of each caribou range that provides an overall ecological condition that will allow for an ongoing recruitment and retirement cycle of habitat, which maintains a minimum of 65% of the area as undisturbed habitat
- biophysical attributes required by boreal caribou to carry out life processes (Environment Canada 2012b)

Therefore, the habitat threshold that provides a measureable probability for a local caribou population to be self-sustaining is considered to be 65% undisturbed habitat in the range (Environment Canada 2012b).

In addition to the recovery planning and policy documents described above, NGTL considered the Integrated Standards and Guidelines – Enhanced Approval Process (EAP)(AER 2013) to develop caribou-specific habitat restoration measures.

Both the approval standards and recommended best management practices provided in the EAP are intended to achieve the following desired outcomes for caribou range:

- reducing all sources of human-caused direct mortality associated with anthropogenic features
- reducing excessive predator-caused mortality
- reducing habitat loss
- reducing the partial avoidance demonstrated by caribou in relation to industrial features
- reducing potential increases in distribution and productivity of other prey species

10.3 BOREAL WOODLAND CARIBOU ECOLOGY

The boreal population of woodland caribou is listed as Threatened on Schedule 1 of *SARA*, by COSEWIC and under the Alberta *Wildlife Act* (AESRD 2014; COSEWIC 2015; Government of Canada 2015).

Woodland caribou in Alberta are found in bogs and fens with low to moderate tree cover and tend to avoid marshes, uplands, heavily forested wetlands, water and areas of human use (Thomas and Gray 2002). Local caribou population ranges encompass areas large enough for all life processes (calving, rutting, wintering). Therefore, woodland caribou require large tracts of continuous undisturbed habitat, as they disperse when calving to reduce predation risk (Environment Canada 2011, Vistnes and Nellemann 2001). Preferred habitat is typically mature coniferous forest (e.g., jackpine and black spruce) with abundant lichen, muskeg and peatlands intermixed with upland or hilly areas (Bradshaw et al. 1995; Brown et al. 2007; Brown et al. 1986; Courtois and Ouellet 2007; Neufeld 2006; O'Brien et al. 2006; Rettie and Messier 2000; Stuart-Smith et al. 1997).

Sufficient canopy cover or wind exposed areas are required to keep snow depth at low enough levels to allow foraging (Collins and Smith 1991; LaPerriere and Lent 1977; Schaefer and Pruitt 1991).

Boreal woodland caribou do not undergo seasonal migrations and remain in forest and peat habitats throughout the year (Alberta Woodland Caribou Recovery Team 2005). Forested peat complexes are the primary habitat for boreal caribou and they require large contiguous tracts of this preferred habitat to maintain low population densities across their range as an anti-predator tactic (Alberta Woodland Caribou Recovery Team 2005). Boreal caribou maintain spatial separation from other

ungulates by occupying habitat that has a lower density of other ungulate species (ASRD and ACA 2010).

The rutting season occurs in early to mid-October, and caribou have a gestation period of approximately 7.5 to 8 months. In northern Alberta, most calves are born in the first two weeks of May (ASRD and ACA 2010).

Compared with other forest-dwelling ungulate species, woodland caribou exhibit low reproductive potential. Adult cows are typically three years old before they begin producing young and only produce a single calf annually (ASRD and ACA 2010).

The ESAR caribou range is located east of the Athabasca River, and includes seven small populations of caribou that are largely independent from each other: Algar, Egg–Pony, Agnes, Wandering, Wiau, Bohn and Christina (ASRD and ACA 2010). The Project is located in the Agnes herd. Radio telemetry data indicate that very little movement occurs between caribou ranges (ASRD and ACA 2010). . The WSAR caribou range is located on the west side of the Athabasca River and the Chinchaga caribou range is located in northwest Alberta and northeast BC.

Estimated caribou population size in the ESAR caribou range is 90 to 150 individuals and the population trend is declining (Environment Canada 2012b). The ESAR caribou range is 1,315,980 ha in area (Environment Canada 2012b). The population growth for the ESAR caribou range was 0.81 in 2007/2008, with calf recruitment between 12.6 and 16.1 calves per 100 cows. A total of 116 caribou were observed in the ESAR caribou range during the 2008 caribou/calf surveys (ASRD and ACA 2010). The population of the ESAR caribou range was stable to declining between 1992/1993 and 1999/2000, but has consistently declined since (Athabasca Landscape Team 2009). Environment Canada (2012b) reports that 81% of the ESAR caribou range is affected by anthropogenic and fire disturbance, which exceeds the threshold level of disturbance (35%) that will support a self-sustaining caribou population.

The estimated population size in the WSAR caribou range is 204 to 272 individuals and is also on a declining population trend (Environment Canada 2012b). The WSAR caribou range is 1,572,652 ha in area of which 69% was reported in the federal Recovery Strategy to be affected by anthropogenic and fire disturbance (Environment Canada 2012b). The population of the WSAR caribou range was stable to declining between 1992/1993 and 2001/2002, but has consistently declined since (Athabasca Landscape Team 2009).

The estimated population size in the Chinchaga caribou range is 250 individuals, which includes the BC portion of the range, and is on a declining population trend (Environment Canada 2012b). The Chinchaga caribou range is 3,162,612 ha in area of which 76% was reported in the federal Recovery Strategy to be affected by anthropogenic and fire disturbance (Environment Canada 2012b).

10.4 THREATS AND LIMITING FACTORS

Threats to boreal woodland caribou identified by the federal Recovery Strategy (Environment Canada 2012b), in descending order of direct impact on caribou population trend, are:

- predation
- habitat alteration from human land-use activities
- natural disturbance of habitat
- hunting
- climate change and severe weather

Other threats considered to have a lower level of concern include parasites and disease, stress responses associated with sensory disturbance (noise and light), vehicle collisions and pollution.

Available literature supports apparent competition as the likely causal pathway for woodland caribou population declines, whereby primary prey species (e.g., moose, deer) increase with increasing proportions of early seral habitat on the landscape, causing a numerical response of predators (Environment Canada 2012b; Latham 2009; Seip and Cichowski 1996; Thomas and Gray 2002; Wittmer et al. 2005). Wolves are considered the primary predators of caribou across northern Canada and predation by wolves was implicated as the most common cause of death for adult caribou in northeastern Alberta (McLoughlin et al. 2003). Black bear can also be a common predator of caribou (Rettie and Messier 1998; Zager and Beecham 2006).

Increases in predator numbers subject caribou to unsustainable levels of predation, causing population decline (Wittmer et al. 2005). Predator densities capable of causing caribou declines are usually sustained by abundant alternate prey sources, such as moose or white tailed deer (Peters et al. 2013; Thomas and Gray 2002; Wittmer et al. 2005). Predation on caribou is thought to be largely incidental, given the low densities of woodland caribou compared with much more abundant prey species (Wittmer et al. 2005).

The selection of peatlands and old-growth forest by caribou, and non-use of these areas by moose, wolves (Rettie and Messier 1998) and black bears (Latham et al. 2011) was determined to result in spatial separation (James et al. 2004). This strategy is believed to be used to combat the widespread influence that wolves have in an ecosystem (Ripple and Beschta 2004; Ripple et al. 2014). Removal or alteration of habitat (e.g., forest harvesting [McCutchen 2007]) will dissolve what spatially separates caribou and primary prey (e.g., moose). Following forest harvest, moose and woodland caribou were more likely to use the same habitat, and woodland caribou suffered higher rates of wolf predation (Peters et al. 2013).

The influence of anthropogenic linear feature density on predation rates might be equally as important to caribou mortality as the density of predators (Whittington et al.

2011). The ultimate cost to caribou habitat suitability appears lower for linear feature induced changes compared with forestry induced changes (i.e., cutblocks) (DeCesare et al. 2012).

Linear feature-induced changes have been previously linked to changes in predator functional response (predator kill rate) while forestry induced changes have been previously linked to changes in predator numerical response (predator density).

Evidence shows scale dependent variation in caribou resource selection, where habitat selection at the population and individual seasonal home range scale is affected by forestry cutblocks (DeCesare et al. 2012). Forestry cutblocks are linked to increased predator densities (Latham et al. 2011). Conversely, caribou distribution is shown to be strongly influenced by linear disturbance at the finer (location level) scale (DeCesare et al. 2012).

Linear corridors provide improved access for predators such as wolves. Several studies have found that linear corridors are attractive to bears (McKay et al. 2014) and especially wolves as easy travel routes (James 1999, James and Stuart-Smith 2000, Stuart-Smith et al. 1997, Thurber et al. 1994, Whittington et al. 2011). As a result, linear disturbances can influence predator/prey dynamics (Bergerud et al. 1984; Edmonds and Bloomfield 1984; Rohner and Kuzyk 2000). Wolves travel faster along linear disturbances (James 1999; McKenzie et al. 2012) and encounter rates between wolves and caribou have been shown to increase near linear features (Whittington et al. 2011).

Furthermore, it is suggested that while wolves increase movement rates on linear disturbance features, their movement rates decrease in proximity to disturbance features. This implies behaviour closely associated with prey searching and hunting (Ehlers et al. 2014). However, modelling the dynamic use of the landscape by wolves, primary prey (moose) and caribou showed that wolves experience no additional advantage accessing caribou from linear features, although they do benefit in accessing primary prey species (McCutchen 2007). This is supported by a study that found that kill sites were no closer to linear features than random (Latham et al. 2011).

Caribou are sensitive to anthropogenic disturbance (e.g., industrial activity [Dyer et al. 2001], Dyer et al. 2002) and habitat alteration (e.g., forestry [Peters et al. 2013]), and to natural disturbance (e.g., burns [Schaefer and Pruitt 1991]). Long-term reduction in habitat effectiveness adjacent to linear features can occur as caribou have been shown to partially avoid habitats near ROWs (Dyer 1999; Oberg 2001). Avoidance of habitat near anthropogenic disturbances leads to indirect habitat loss through reduced habitat effectiveness for caribou (Dyer et al. 2001).

Methods and study populations vary among research studies that demonstrate caribou avoidance of disturbances by varying distances: 70 m (seismic lines and maintained trails [DeCesare et al. 2012]), 250 m (roads and seismic lines [Dyer et al. 2001]) and

1,000 m (industrial developments such as well sites [Dyer et al. 2001]). The federal Recovery Strategy for boreal caribou defines disturbance of critical habitat as the area affected by human-caused disturbance, including a 500 m buffer around the disturbance to account for avoidance by caribou, and the area affected by fire less than 40 years old (Environment Canada 2012b).

Restoration of disturbance assumes that caribou will return to being spatially separated from primary prey (moose, deer) and predators, and hence natural levels of mortality risk (Athabasca Landscape Team 2009). Management of boreal caribou habitat to maintain viable populations over time will require both minimizing the impact of future development and recovery of the existing industrial footprint.

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

10.5 CARIBOU RECOVERY AND HABITAT RESTORATION

Boreal lowland habitat types naturally have very slow rates of vegetation establishment and growth, making tree seedling establishment and growth in a 15 year period unpredictable. Guidelines for wetland restoration associated with oil sands mining(CEMA 2014) focus on disturbance types that are not applicable to pipeline construction and operation. Furthermore, reclamation of bogs and fens is in experimental stages and is not addressed in the current guidelines. The *Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region* includes specifications for various indicators using an end land use approach that targets reclamation to commercial forests, which conceptually provide other ecosystem functions including wildlife habitat (AENV 2010).The application of these guidelines to the CHR&OMP needs to be approached with caution, since they relate to a very different disturbance type (i.e., bitumen mining vs. pipeline ROW) and are developed for different objectives.

With these limitations in mind, it is recognized that the AENV guidelines for oil sands reclamation are developed for boreal forests with similar attributes to those on the Project and, therefore, some of the thresholds and indicators were used to guide the development of targets and performance indicators for the CHR&OMP.

In particular, the quantifiable targets associated with treed lowland and shrubby/graminoid lowland habitat types incorporated the concept of plant community composition as an appropriate indicator to assess reclamation status and

progress in these wetland habitats (AENV 2010). This is supported by the suggestion that the number and abundance of characteristic species (i.e., species typically found in undisturbed native wetland plant communities) and the number of restricted weeds are measures for plant community health (Ciborowski et al. 2012).

There are no existing specifications for design and implementation of caribou habitat restoration measures. As a result, restoration criteria and guidelines for forested areas in Alberta and reforestation standards in Alberta specific to the Project area (AENV 2001, 2008, 2010; AESRD 2013a, b, c) were used to develop appropriate specifications for the CHR&OMP habitat restoration measures.

A common approach in reclamation of forested land in Alberta is the application of provincial standards developed to achieve equivalent land capability to support target end land uses, often with a focus on merchantable forest stands (e.g., AENV 2010; AESRD 2013a). In relation to oil sands mining in northeastern Alberta, Straker and Donald (2011) and (Hawkes 2011) have suggested that current reclamation standards might not be suitable where there is a broader set of management objectives such as maintenance of biodiversity, creating functional forest ecosystems or restoration of species specific wildlife habitat.

The Reclamation Assessment Criteria for Pipelines (AENV 2001) recommends that equivalent land capability should take into account natural variability, which considers the range of landscape attributes that are encountered and influenced by slope, drainage, coarse fragments, vegetation growth and composition, and soil colour, texture, aggregate strength and size.

The Reclamation Criteria for Wellsites and Associated Facilities for Forested Lands (AESRD 2013a) provides reclamation criteria that apply to well site leases and access roads, and associated facilities such as pits, campsites and offsite sumps. Criteria are provided to determine whether a reclaimed site meets equivalent land capability, based on function and operability of the land to support the production of goods and services consistent in quality and quantity with the surrounding landscape. A minimum 25% cover of herbaceous and of woody species is recommended for naturally regenerating and planted sites in forested lands. The document suggests that ecosystem function can be determined when natural processes are evident, such as proper drainage, moisture retention and cycling, soil and site stability, and nutrient cycling (i.e., litter formation). Recommendations for assessing reclamation success are provided for various factors such as drainage, erosion, soil stability, woody debris, plant community composition and cover, litter and LFH development, and soil characteristics.

The Alberta Regeneration Standards for the Mineable Oil Sands (AESRD 2013b) are similarly applicable to reforestation of oil sands mines. The standards outline protocols for establishment and performance surveys to determine reforestation establishment and continued growth, where commercial forestry is the end land use.

Seedling planting or target densities are not specified. The standard does, however, provide guidance on determining poorly revegetated areas based on the size (≥0.5 ha) and proportion (≥25%) of trees affected by mortality, foliage loss/discolouration, missing or low density, physical damage, or poor form or vigour.

10.6 VEGETATION REESTABLISHMENT

Restoration of disturbed habitat has become one of the key components for caribou conservation identified through the federal Recovery Strategy (Environment Canada 2012b) and in provincial boreal caribou recover planning (Alberta Woodland Caribou Recovery Team 2005; Government of Alberta 2011). This section summarizes information from habitat restoration guidelines, previous caribou habitat restoration initiatives and published research. Information on restoration methods employed and effectiveness or success of restoration is included. This section is supplemented with information specific to restoration initiatives already completed in boreal woodland caribou range (see Appendix C), which was considered as context in the development of the CHR&OMP.

10.6.1 Tree Planting and Natural Regeneration

Recent research has shown positive results for establishing native vegetation on seismic lines and other linear features using techniques such as planting tree and shrub seedlings, and site preparation to create microsite conditions (i.e., tree planting methods) that are conducive to both planted seedling growth and natural vegetation encroachment (COSIA 2015; CRRP 2007a). Measures such as rollback can address site condition issues, including competition from non-target or undesired plant species, erosion, frost, and heat or moisture deficiencies (CRRP 2007a). These methods are consistent with the approach adopted by NGTL in previous caribou habitat restoration initiatives.

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

A trial natural revegetation response inventory program in west–central Alberta reported that 85% of disturbed sites did not require artificial recovery, since a natural recovery projection was observed on previously disturbed sites (CRRP 2007b).

Although regenerating conifers provide a better visual barrier, the faster growth rates of deciduous species provides for effective results more quickly (Diversified Environmental Services 2004). Recent research suggests that planting shrubs along with trees allows trees to grow healthier, faster and with less competition for nutrients and water from fast-growing grasses (COSIA 2015). It might also provide important habitat benefits for wildlife, compared with only planting tree seedlings, by providing hiding cover (Bayne et al. 2011).

Conventional seismic lines have been reported to have very slow reforestation rates (Osko and MacFarlane 2000; Revel et al. 1984), and recovery is strongly influenced by the characteristics of the adjacent forests (e.g., site productivity, tree and shrub species and heights) (Bayne et al. 2011). Conventional seismic lines cleared by bulldozer can take as long as 112 years to reach 95% recovery to woody vegetation in the absence of restoration efforts (Lee and Boutin 2006). Slow tree regeneration has been attributed to root damage from the original disturbance, compaction of the soil in tire ruts, insufficient light reaching the forest floor, maintenance of apical dominance from surrounding stands, introduction of competitive species (i.e., planted seed mixes), site drainage (i.e., regeneration slowest on poorly drained sites with low nutrient availability such as bogs) and repeated disturbances (e.g., all-terrain vehicles [ATVs], animal browsing, repeated exploration) on seismic lines (Lee and Boutin 2006; MacFarlane 1999, 2003, Revel et al. 1984; Sherrington 2003). However, tree regeneration on seismic lines is a key determinant of recovery success (MacFarlane 2003) and, therefore, factors that hinder revegetation efforts should be mitigated. Although seismic lines and pipeline ROWs are both linear disturbances, drawing parallels between regeneration success on these different features should be done with caution. Restoration issues on seismic lines might not be comparable to pipeline ROWs, given differences in disturbance mechanisms, degree of soil and vegetation disturbance, reclamation practices and width of the features (i.e., the wider openings of ROWs allow more light and insolation than narrow seismic lines, which might facilitate better vegetation regrowth).

Evidence presented at the 15th North American Caribou Workshop demonstrated winter tree planting and mechanically bending live trees into a linear disturbance are emerging mitigation options that are currently being implemented in the Alberta oil sands region (North American Caribou Workshop 2014). Tree bending might be particularly promising as it promotes natural revegetation by increasing cone deposition onto the disturbance footprint and creating microsites through shading and dropped dead woody debris. However, these habitat restoration measures are only initially being evaluated and their utility remains unknown. Furthermore, they were applied on seismic lines that are substantially narrower than pipeline ROWs and do not require continued operation activities, as do pipelines.

10.7 TRANSPLANTING AND SEEDING

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

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

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

10.8 EFFECTS OF HUMAN USE ON RESTORATION

The ability of linear features to recover to a natural forested state is affected considerably by human use. Recovery of conventional seismic lines to functioning mountain caribou habitat was identified to occur within 20 years following disturbance in west–central Alberta (Oberg 2001).

Seismic lines in the Little Smoky caribou range that were allowed to revegetate naturally reportedly achieved an average height of 2 m across all ecosite types, within 20 to 25 years, when they had not been recently disturbed by human activity (e.g., recleared to ground level for winter access or seismic program use [Golder 2009]). The average age of trees on the control lines (disturbed sites, cleared areas with minimal vertical cover of vegetation and vegetation regrowth of 0.5 m or less) was only 10 years, suggesting sites that are continually disturbed or re-cleared by human activity take longer to regenerate.

Restoration efforts have also failed when ATVs destroyed seedlings after planting (Enbridge 2010; Golder 2011, 2012b). Evidence of the effects of repeated motorized

access on vegetation establishment and regrowth supports the use of access management tools to enhance restoration success.

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

Public education (e.g., signs) facilitates respect for the purpose of, and compliance with, access management measures.

Mounding has been found to discourage human access (i.e., truck and ATV) during snow-free periods and also creates microsites that improve vegetation establishment (reviewed in Golder 2007). Excavator mounding is a well-researched and popular site preparation technique in the silviculture industry (Macadam and Bedford 1998; MacIsaac et al. 2004; Roy et al. 1999). Target density of mounding for access management and/or microsite creation purposes can vary from 1,400 to 2,000 mounds/ha (AENV 2010; Golder 2012a). However, these mound densities relate to restoring seismic lines that were not frozen-in to allow heavy equipment access. Given the challenges of the wet conditions and frost requirements for accessing the Project footprint (i.e., freezing-in the peat for access can make it difficult to excavate small mounds), the size of mounds could potentially be substantially larger than mounds achieved on previous seismic line restoration projects. Furthermore, mounds cannot be excavated within 5 m of the operating pipeline, which reduces the mound density relative to disturbances that do not have similar restrictions. As a result, the mound density that can realistically be achieved in pipeline ROWs is lower.

Human access on open and closed (i.e., gated, barriered and recontoured) roads was monitored using remote cameras (Switalski and Nelson 2011). That study found that the frequency of detection of humans on closed roads was significantly lower than on open roads, but not significantly different among road closure types. The monitoring results also indicated significantly higher levels of hiding cover and lower line of sight distances on barriered and recontoured roads compared with open roads (Switalski and Nelson 2011). A similar study investigated the effectiveness of different approaches (i.e., year-round closure, seasonal closure, deactivation, and deactivation and closure) at limiting motorized vehicle traffic on unpaved roads designed to support forestry operations (i.e., resource roads) (Hunt and Hupf 2014).

Results demonstrated that closure or deactivation approaches significantly reduced traffic on resource roads (about 78%), with year-round closure being the least effective while seasonal (i.e., hunting) closure was among the most effective

approach (Hunt and Hupf 2014). The effectiveness of different approaches did not depend on road quality (Hunt and Hupf 2014). Physical access management measures provide short-term solutions to manage access and allow for natural regeneration (Golder 2009). Once linear features have regenerated to a pole sapling or young forest structural stage, they no longer facilitate ATV access (Sherrington 2003).

The techniques described above to block human access also contribute to achieving sufficient revegetation to block line of sight. Short term management for access and line of sight blocking should ultimately lead to long term access management by way of revegetation of disturbed areas (Golder 2007).

Expediting growth of visual barriers along linear features can be achieved by concentrating restoration efforts on productive upland habitats, since woody vegetation species grow more quickly on these sites compared with lowland sites. Although regeneration of conifer species provides the best year-round visual barrier, their growth can be slow. Using combined plantings of conifer and fast-growing deciduous woody species in small areas (e.g., narrow strips of plantings across the ROW) can establish visual barriers in the short to medium term, while maintaining the objective of regenerating conifer leading vegetation in the long term.

Coarse woody material (rollback) can be effective to manage human access as well as to conserve soil moisture, moderate soil temperatures, provide nutrients as debris decomposes, limit soil erosion, provide microsites for seed germination and protection for introduced tree seedlings (Pyper and Vinge 2012; Vinge and Pyper 2012). Rollback is effective immediately following implementation, provided adequate material is available and properly applied. Debris should be spread evenly across the entire footprint width at a coverage/density that will not restrict ability to plant seedlings or limit planted or natural seedling growth. Where sufficient material is available, the suggested woody debris coverage at selected locations is 60-100 m^3/ha on upland sites and 25-50 m^3/ha on lowland sites, to mimic natural processes (Pyper and Vinge 2012, Vinge and Pyper 2012). Where sufficient material is available, woody debris coverage of 150-200 m^3/ha along ROWs can be used to manage human and wildlife access (Vinge and Pyper 2012). The storage and placement of woody debris must consider reducing ladder fuels to reduce fire hazard (Pyper and Vinge 2012). Short segments (i.e., <100 m) of rollback might be less effective at deterring human access because ATV and snowmobile riders might try to ride through the debris or traverse around it in adjacent forest stands (Vinge and Pyper 2012). Complete rollback (i.e., over an entire linear disturbance) could be used to prevent motorized access (Pyper and Vinge 2012), however, availability of material is a limiting factor. The Integrated Standards and Guidelines for the Enhanced Approval Process recommend a 25 m rollback-free fuel break be placed every 250 m along segments of rollback (AER 2013).

10.9 WILDLIFE USE OF REGENERATING LINEAR DISTURBANCE

While there has been some effort to assess wildlife use of regenerating seismic lines (e.g., Bayne et al. 2011) and reclaimed areas in the Athabasca oil sands region (e.g., Hawkes 2011), few researchers have assessed natural habitat recovery and wildlife responses to recovery with respect to caribou. A pilot study in the Little Smoky caribou range measured effects of revegetating linear disturbances on wildlife use and mobility (Golder 2009). Data were collected for a group of predators (i.e., cougar, wolf, coyote, lynx, grizzly and black bears) and prey (i.e., moose, deer and caribou).

Results of the pilot study indicated that revegetated seismic lines (i.e., minimum 1.5 m vegetation regrowth) were preferred by both predator and prey species compared with control lines (i.e., vegetation regrowth of 0.5 m or less), and control lines were used primarily for travel (i.e., both predators and prey species were constantly moving as opposed to standing or foraging).

In addition, human use was almost exclusively limited to the control lines. The line of sight measured on the revegetating lines was typically less than 50 m long. It was suggested that moose and deer might have been attracted to the revegetated lines for forage availability and perceived cover protection (Golder 2009). The preference for regenerating seismic lines by wolves can be explained as a response to increased prey use of these lines (Golder 2009). The study also showed that caribou travelled more quickly (running more frequently) and did not engage in standing-related behaviour on control lines, whereas on revegetating lines, running was rare and standing related behaviour occurred more often.

Another ongoing project in northern Alberta involving the Cold Lake caribou herd (Multi-Scale Responses by Predators and Prey to Deactivation/Restoration of Habitat Disturbance Features: Individual and Population Components [McNay et al. 2014]) is currently investigating the responses of predator and prey species to the deactivation or restoration of habitat disturbance features. The goal of the project is to determine how different species (wolves, bears, moose and caribou) use the landscape, and how the presence or absence of linear disturbances might influence the functional and numerical response of predators (McNay et al. 2014). Preliminary results suggest that among all species seasonal and annual movements are variable, with substantial overlap between the range extents of all four species. Additionally in these range overlaps, were 19 instances where predator and prey could have encountered one another. Furthermore, preliminary results present 11 deaths of 94 collared animals: 2 caribou, 3 moose, 1 bear and 5 wolves. Predator kill sites identified included 143 bear sites and 93 wolf sites. These kill sites were implicated in the deaths of 11 caribou, 22 moose and 6 deer. Ongoing data collection and processing will provide future results from scat analysis, prey body condition, habitat modelling and mapping.

The Multi-Scale Responses project aims to address several management questions regarding the desired vegetative and spatial characteristics on the landscape to reduce caribou mortality, how silvicultural techniques and habitat restoration measures can be implemented to achieve these characteristics, the association between specific characteristics and predator efficiency and/or density, and when deactivated linear features can be considered to have lost their disturbance function (McNay et al. 2014). This project is associated with the RICC initiative.

Mechanically bending or felling live trees over a linear disturbance (often referred to as line blocking, particularly when used in conjunction with other treatments such as mounding) is another potential measure that might have benefits for managing access and reducing wolf use.

Trees are typically bent or felled from both sides of the linear disturbance. Tree felling entails cutting trees at the base from the edge of the linear disturbance, and allowing them to fall across the linear disturbance.

Tree bending requires mechanically bending from the base of the tree, partially exposing roots, so that the tree leans over the linear feature, close to the ground. Tree bending can be expensive and the process is time consuming. A preliminary assessment of tree felling along seismic lines to block access was completed in the Little Smoky herd range in Alberta during summer and fall 2004 (Neufeld 2006). While results of that study showed no statistical significance between wolf use of blocked versus non-blocked seismic lines, there was an indication that wolves tended to use areas with unblocked seismic lines more often than areas with blocked seismic lines (Neufeld 2006).

Based on these results, it was concluded that if tree felling is to be used as a line blocking measure, it should be investigated more thoroughly, and not relied on solely as a mitigation tool (Neufeld 2006). Preferably, line blocking should be used with other management actions such as habitat restoration (Neufeld 2006), and continue to be evaluated for effectiveness using an adaptive management approach. As previously described, tree felling or bending is often completed in conjunction with other measures, such as mounding, spreading coarse woody debris or seedling planting to achieve line-blocking.

As presented at the 15th North American Caribou Workshop, preliminary results of linear feature blocking programs suggest that this type of mitigation can be effective in reducing wildlife use of linear features (North American Caribou Workshop 2014).

10.10 OFFSET DEFINITIONS

Conservation and biodiversity offsets are generally defined as measurable conservation outcomes or environmental values resulting from actions designed to

compensate for residual adverse effects arising from a development after appropriate habitat restoration measures are applied. Conservation offsets generally refers to an increased quantity, quality, or security of specific environmental values outside the project footprint to compensate for residual adverse effects arising from the development activity (Croft et al. 2011; DSEWPC 2012a; Environment Canada 2012a). Conservation offsets are generally applied in circumstances where the environmental values are specific to either individual species or plant communities under threat. Parameters can range from numbers of individuals of a threatened species or characteristics of its habitat, to the area and quality of threatened communities or ecotypes (Bull et al. 2013a; DSEWPC 2012a; Gibbons and Lindenmayer 2007).

Some literature suggests that the potential overlapping benefit of conservation offsets might be the indirect conservation of localized biodiversity values where offsets are implemented (Bull et al. 2013b; Croft et al. 2011; DSEWPC 2012a).

Alternatively, biodiversity offsets are discussed primarily in the context of ensuring either no net loss or a net gain of biodiversity value opposed to more generalized environmental values associated with conservation offsets (BBOP 2012c; Calvet et al. 2015; Department of Conservation 2010; Doswald et al. 2012; Maron et al. 2012; McKenney and Kiesecker 2010; Pilgrim and Ekstrom 2014; Sustainable Prosperity 2014; ten Kate and Crowe 2014; TEEB 2010). Habitat offset aimed at achieving and detecting no net loss can only be successful where the offset ratio is large, monitoring is long-term, robust and precise and funding is available to substantially increase the amount of habitat if monitoring indicates that this is necessary (Pickett et al. 2013). Biodiversity offsets imply broader considerations of a landscape's ability to maintain biodiversity, while still acknowledging the application might be focused on specific objectives (BBOP 2012c; Kiesecker et al. 2009; McKenney 2005; Poulton 2014).

The CHR&OMP follows an approach consistent with the adopted design elements for the development of conservation offsets (offsets) recognizing that the environmental values of concern are specific to the threats and unique conservation needs of caribou and their habitat. Literature reviewed suggests a strong preference for equivalency between the nature of the residual effects and the value added by an offset measure (i.e., like for like) (Bull et al. 2013a; Habib et al. 2013; Poulton 2013). This approach is particularly relevant when offsets target specific environmental values rather than a more general mandate that might suit higher-level biodiversity management objectives (Bull et al. 2013b; Gibbons and Lindenmayer 2007).

10.11 MITIGATION HIERARCHY

The sequence of actions to identify the need, availability and suitability of offsets is outlined in the Standard on Biodiversity Offsets (BBOP 2012c). Under this accepted standard, potential effects of a proposed development activity are assessed in context

of a mitigation hierarchy. The mitigation hierarchy includes four steps: avoid, minimize, restoration/rehabilitation and offset (BBOP 2012c).

Maximizing the degree to which each step is pursued before continuing to the next is the recommended practice to reduce residual effects and the potential need for offsets (BBOP 2012c; DSEWPC 2012a; Environment Canada 2012a). Offsets are a measure of last resort within the mitigation hierarchy, as their ability to counterbalance ecological losses outside the project footprint is more uncertain and of greater risk than habitat restoration measures applied to the project footprint (Bull et al. 2013a; Gibbons and Lindenmayer 2007; Morris et al. 2006). Offsets counterbalance residual effects by replacing equivalent ecological mechanisms.

In the context of caribou habitat restoration measures that will be applied to the Project footprint, the first steps of the mitigation hierarchy can be described as:

- **Avoid**: measures taken during Project planning stages to avoid potential effects (i.e., route selection, locating temporary workspaces and facilities outside of caribou range).
- **Minimize**: measures taken to reduce the intensity, extent and/or duration of potential effects (including direct, indirect and cumulative effects, as appropriate) that cannot be completely avoided, as far as is practically feasible (i.e., reduction of footprint size, minimum ground disturbance construction methods, activity scheduling, using existing access and minimizing vegetation clearing).
- **Restore**: measures taken to rehabilitate or restore equivalent ecological mechanisms following construction.

In the context of the mitigation hierarchy, this CHR&OMP reflects the final measures taken to address the residual Project effects on caribou habitat.

10.12 OFFSET MEASURES

In referenced literature, including Environment Canada (2012a) guidance, existing offset programs commonly use the design elements and frameworks recommended by BBOP (2012c) as the standard best practice, and therefore, the selected approach was applied to this CHR&OMP. Under BBOP, initial planning stages first consider the legal framework and/or policy requirement for an offset. Currently, there is minimal guidance or policy specific to caribou recovery or offsets in general in Alberta (Poulton 2014). Notwithstanding, offset criteria, guidelines and frameworks referenced in the development of the CHR&OMP considered examples and applications presented in primary literature, as well as currently available but emerging science to address the unique conservation needs of caribou and their habitat.

According to BBOP (2012c), as well as DSEWPC (2012a), BC MOE (2014b), Calvet et al. (2015), Croft et al. (2011), Environment Canada (2012a), McKenney (2005), Poulton (2015), Sustainable Prosperity (2014), Schneider (2011), ten Kate et al. (2004) and Weber (2011), offset measures can be categorized as:

Direct Offsets

- Like for like habitat restoration or various methods of land securement such as land acquisition, provincial protective notations, rezoning and transfer of development rights.
- Population management measures such as fish restocking programs as defined by DFO (2013b), or other programs that provide benefit to species conservation and management.

Indirect Offsets

- Financial offset mechanisms such as bio-banking systems, trust funds or other trading programs where contributions are made in advance of the project development proceeding.
- Research and monitoring programs such as financial contributions to develop the scientific knowledge concerning the environmental value or ecological mechanisms.

A habitat-based rationale specifies that direct offsets are distinct from indirect offsets based on whether habitat is, or will be, directly modified (Bull et al. 2013a; BBOP 2012a). Direct offsets in the form of land securement for habitat have been used recently by proponents of other industrial projects, including the Joslyn North Mine Project (Total E&P Canada Ltd.), the Roman Coal Mine (Peace River Coal Inc.), the True North Forest (Shell Canada), Trans Mountain Pipeline (Kinder Morgan Canada) (Poulton 2015) and a recent Canadian Boreal Forest Agreement (CBFA 2012).

Indirect offsets are considered measures that contribute to research programs, industry-specific knowledge gaps concerning uncertainty of environmental values or ecological mechanisms, and financial compensatory mechanisms through established banking trusts (BBOP 2012c; Croft et al. 2011; DSEWPC 2012a; Schneider 2011; ten Kate et al. 2004).

Financial offsets ensure greater ecological effectiveness of offsets than the direct approach (Calvet et al. 2015). However, in terms of ecological and geographical equivalence, the direct offsets approach is better at taking specific ecological features into account. From an economic perspective, the banking mechanism is more efficient than the direct offsets approach, but the economic constraints behind this mechanism can lead to inappropriate biodiversity conservation outcomes.

10.12.1 Canadian Examples

In Canada, compensating for lost fish habitat was first introduced by Fisheries and Oceans Canada (DFO) as a policy objective to achieve net gain of habitat within its 1986 Policy for the Management of Fish Habitat (DFO 1986). In 2013, DFO amended the *Fisheries Act*, embedding a modernized approach to offsetting into regulation. *Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting* (DFO 2013a), requires proponents of projects that cause serious harm to fish and fish habitat to offset that harm to maintain and enhance the ongoing productivity of important fisheries serving the public interest.

Offset measures include habitat restoration and enhancement, habitat creation, chemical or biological manipulations (stocking of fish or control of aquatic invasive species), complementary measures (contributions to scientific research to maintain or enhance productivity of fisheries) and habitat banking in advance of the project's impact.

Provincial requirements for compensation of the permanent loss of wetlands are discussed in Alberta's Wetland Policy (Government of Alberta 2013). Where permanent losses occur, the policy employs restorative and non-restorative replacement objectives where offset ratios consider the value of wetland lost versus the value of wetland replaced. Wetland evaluation criteria include biodiversity, water quality improvement, flood reduction, human value and relative abundance (current versus historical). Offsets for wetlands in Alberta are reviewed on a case-by-case basis and follow guidance documents and frameworks for other wetland compensation programs in Canada (Cox and Grose 2000). A proponent is offered the options of reducing their own impact, implementing restorative treatment, which could take the form of the developer's own restoration, enhancement or construction of another wetland, or paying an in-lieu fee into a government-authorized fund (Poulton 2015).

The *Alberta Land Stewardship Act* has provisions that endorse in general terms the research and development of new legal and policy tools to pursue objectives and regional plans (Poulton 2015). Among these are offsets.

Conservation offset policy is very much in early development in Alberta. However, the Government of Alberta has committed to interested stakeholders to examine a number of regulatory instrument options, including a regulation-based biodiversity offset policy, available under the *Alberta Land Stewardship Act*. In Canada, both federally and provincially, there is generally a lack of frameworks that enable best practices on offsets (Sustainable Prosperity (2014). Alberta is focusing its policy development upon adapting a model of conservation offsetting which was developed in Alberta originally for greenhouse gases and wetlands (Poulton 2015). NGTL will continue its participation in this and other stakeholder consultation opportunities provided by the Government of Alberta into the future.

The British Columbia Ministry of Environment (BC MOE) Policy for Mitigating Impacts on Environmental Values (Environmental Mitigation Procedures) (BC MOE 2014a) consider design elements in terms of environmental value and ecological equivalency (BC MOE 2014a). The Procedures for Mitigating Impacts on Environmental Values (Environmental Mitigation Procedures) recognize the importance of the best available data and information to be used for developing procedures for specific environmental values, associated components and risks (BC MOE 2014b). Environmental values and risks are reviewed in the context of the mitigation hierarchy; offsets are judged on a case-by-case basis in consideration of the residual effects.

BC MOE (BC MOE 2014b) introduce the concept of environmental indicators as the metrics to trend and report on the processes affecting environmental components. Environmental risks are considered in terms of probability of occurrence and consequence to the environmental value and graded using a qualitative matrix (BC MOE 2014b).

British Columbia's new *Water Sustainability Act* is expected in early 2016, but the regulations supporting it are under development. Ontario's *Endangered Species Act* allows for a form of offsetting through the use of overall benefit permits. The overall benefit permit authorizes a person, company or organization to perform a harmful activity, as long as they provide an overall benefit to the species or environmental resource through impact monitoring, effectiveness monitoring and supplementary actions to achieve the overall benefit (i.e., offset measures). Examples such as these demonstrate how several provinces have regulatory and policy regimes incorporating the mitigation hierarchy and the concepts of habitat offsets or compensation.

Although offset mechanisms can be found in various policies and pieces of legislation in Canada, implementation is in early stages and policy-makers and program operators are still interpreting what the policies mean for how best to implement offsets in practice. While many are cautiously optimistic that offsets will achieve positive outcomes, it remains too early to say conclusively if they are indeed being applied in ways that support conservation goals and protect biodiversity and habitat (Sustainable Prosperity 2014).

10.12.2 International Examples

In the United States, early examples of offset policies include the *Clean Water Act* (1972) and the *Endangered Species Act* (1973). Compensatory mechanisms under these legislative acts (as they evolved) generally consider the type, degree and scale of habitat disturbance, where compensation ranges from habitat restoration activities through financial contributions to trusts or other conservation programs. Previously, the United States Department of the Interior had an Instruction Memorandum, which outlined offsite mitigations where Project effects could not be mitigated to an acceptable level onsite (1740/1790 [310/230] P, Instruction Memorandum

No. 2008-204). The United States wetland and stream mitigation policies are well-established offset programs. Conservation banks for wetlands, stream mitigations and threatened species management have seen modest increases at both state and federal jurisdictions in the Unites States within the last five years (Environmental Law Institute 2002). Some of these programs follow no net loss design elements within environmental impact assessment criteria, while others provide indirect contributions to specific conservation programs. Similar offset models are observed in Africa, the European Union and South America, which are either emerging policies or voluntary contributions (Madsen et al. 2011).

Madsen et al. (2011) documented at least 45 existing compensatory mitigation programs, ranging from banking of biodiversity credits through allocation of development fees, to policies that drive one-time offsets. At time of publication, there were another 27 programs in various stages of development (Madsen et al. 2011). Countries with offset policies enabled through legislation include Australia, Brazil, Canada, New Zealand, Sweden and the United States (Bovarnick et al. 2010; DEFRA 2013; DSEWPC 2012a; Government of Western Australia 2011; Madsen et al. 2011; NSW Government 2014; Queensland Government 2014).

Offset policies in Australia and New Zealand generally follow the mitigation hierarchy with no net loss objectives (Department of Conservation 2010; DSEWPC 2012a; Government of Western Australia 2011; NSW Government 2014; Queensland Government 2014). With established policies dating back nearly 20 years, offset programs are relatively diversified with established bio-banking trust funds (or conservation banks) and other offset mechanisms under the *Environmental Protection and Biodiversity Conservation Act* (Australia) and *The Conservation Act* (New Zealand). Bio-banking trust funds have provided flexibility to align offsets toward the priority conservation objectives. A prominent example is The Reef Trust, with the strategic objective of improving water quality, habitat, managing invasive species and protecting threatened species in The Great Barrier Reef World Heritage Area (Commonwealth of Australia 2015).

10.12.3 Challenges

Where offset policies are established, some have been acknowledged as imperfect, uncertain or ineffective in maintaining environmental values (Bull et al. 2013a; DEFRA 2013; Gibbons and Lindenmayer 2007; Madsen et al. 2011; Morris et al. 2006). One of the most common criticisms levelled at offsets is that they exchange certain and almost immediate losses for uncertain future gains. In the case of restoration offsets, gains might be realized after a time delay of decades, and with considerable uncertainty (Laitila et al. 2014). Offsets are perceived as more remote and uncertain than actions directly applied to prevent, reduce or repair a development's effects. Offsets cannot make unacceptable development acceptable; they simply provide an additional tool that can be used during the environmental

impact assessment process (BBOP 2012c; DEFRA 2013; Department of Conservation 2010; DSEWPC 2012a).

Bull et al. (2013a) provides a recent review of the theoretical and practical challenges of offset guidelines, frameworks and policy, and identifies the importance of an established policy or legal framework to direct, protect and sustain offsets programs. Additional recommendations for offset criteria include, objectives (i.e., equivalency, permanency and uncertainty) and the degree of financial investment necessary to achieve gains (i.e., multipliers) be based on scientific research, rather than a priori assumptions of offset effectiveness (Bull et al. 2013a).

Despite the complex and inter-relating challenges associated with offset design, objectives, implementation and compliance, they are not considered sufficiently flawed to be dismissed as a policy instrument. In the absence of conclusive scientific research to provide guidance, adaptive management is suggested to provide an opportunity to reduce uncertainty risk for specific circumstances where offset response cannot be adequately predicted or does not achieve gains (Gibbons and Lindenmayer 2007).

10.13 OFFSET DESIGN ELEMENTS

Design elements are offset selection factors chosen in consideration of the potential environmental effects of the project, as well as the unique conservation needs, including equivalency, additionality, location, timing, duration and accountability. Design elements consider the environmental values, available offset measures, their effectiveness and the achievability of objectives (Bull et al. 2013a; BBOP 2012c; DSEWPC 2012b; McKenney 2005; McKenney and Kiesecker 2010).

Proponents advocate offsets as an effective and operationally efficient mechanism for enhancing environmental values and achieving important conservation objectives (Bovarnick et al. 2010; BBOP 2013; Croft et al. 2011; Dyer et al. 2008; McKenney 2005; McKenney and Kiesecker 2010; Pickett et al. 2013; Sustainable Prosperity 2014). Offsets in their various forms (e.g., like for like mitigation, banking or trading programs, and land securement) provide flexibility for stakeholders, industry and regulatory authorities to exercise a number of measures where legislative frameworks and policy exist. However, a large amount of effort is required for successful outcomes (Pickett et al. 2013). The reasons why offsets are undertaken vary. Offsets can be undertaken voluntarily or can be a regulatory requirement imposed as a condition of approval before receiving a permit for a specific project (Calvet et al. 2015; Doswald et al. 2012; Poulton 2015; Sustainable Prosperity 2014). A key benefit of offsets is that they allow both offset purchasers and offset creators flexibility. Developers will look at the cost of complying with offset requirements and will factor that cost into project costs, ultimately deciding whether or not to proceed with their proposed project or whether

to redesign the project to lessen impacts on environmental values (Sustainable Prosperity 2014).

International best practices suggest that offset design elements should be considered on a case-by-case basis and reflective of the legislative framework governing the offset requirement. Furthermore, offset design elements should address residual effects of the development and provide benefit to environmental values or equivalent ecological mechanisms affected (BBOP 2012c; 2013; DEFRA 2013; DSEWPC 2012a; Environment Canada 2012a; ten Kate et al. 2004).

Monitoring of habitat offset projects is required pre- and post-development to determine success, and long-term monitoring is required to evaluate sustainability (Pickett et al. 2013; Quintero and Mathur 2011).

The following design elements are identified as a starting point for the development conservation allowances or conservation offsets (Doswald et al. 2012; EnvironmentCanada 2012a; Pilgrim and Ekstrom 2014; Sustainable Prosperity 2014):

- **Effectiveness**: the likelihood that the objective of the offset will be achieved, and that the chance of failure is minimized.
- **Equivalency**: offsets should compensate for adverse impacts by protecting, enhancing or restoring equivalent ecological mechanisms at another site.
- **Additionality**: offsets should provide ecological protection beyond what would be provided under a business-as-usual scenario.
- **Location**: the location of offsets should have comparable ecosystem values, such as species composition and habitat structure, and should be determined based on an assessment of the relevant species and habitat/ecosystem context.
- **Timing**: the preference is for offsets that can be implemented before the adverse impacts of proposed development occur.
- **Permanence**: the positive effects of offsets should last an appropriate amount of time (ideally, in perpetuity) to compensate for the duration of the ecological loss resulting from the project.
- **Accountability**: offsets should be formalized through written documentation, or, where possible, formalized through permitting or other conditions.

Additional offset design elements described by Environment Canada (2012a) include:

- Providing an operational framework relevant to the jurisdiction within which the project is located.
- Adherence to the mitigation hierarchy and international best practice suggested by BBOP (2012c, 2013) and other offset policies (Department of Conservation 2010; DSEWPC 2012a; Government of Western Australia 2011; NSW Government 2014).

- Alignment of environmental values with the unique conservation needs of caribou and federal recovery strategy objectives (e.g., (Environment Canada 2012b) and provincial guidelines (Government of Alberta 2011).
- Providing consistency with current federal and provincial position statements and expert agency recommendations concerning offsets (Croft et al. 2011; DEFRA 2011; Dyer et al. 2008; Poulton 2014; Schneider 2011; Weber 2011).

10.14 OFFSET RISK AND UNCERTAINTY

Multipliers for offset measures are used to address the risks and uncertainties associated with different types of offset measures (Australian Government 2012; BBOP 2012c; Croft et al. 2011; DEFRA 2012; Dyer et al. 2008; McKenney and Kiesecker 2010; Moilanen et al. 2009). Within the literature, multipliers vary considerably between regulatory jurisdictions and agencies, including the methods used to calculate an appropriate multiplier (Australian Government 2012; BBOP 2012b; Cole 2010; Croft et al. 2011; Department of Environmental Affairs and Development Planning 2007; Government of Alberta 2013; Moilanen et al. 2009; Queensland Government 2014). Offset measures based on scientific knowledge or proven techniques reduce the need for higher multipliers as uncertainty and risk concerning offset effectiveness are predictable (BBOP 2013; Cox and Grose 2000; Croft et al. 2011; DSEWPC 2012a; Moilanen et al. 2009). Higher multipliers are employed to discourage development activities where the permanent loss of environmental values or ecological mechanisms may occur, or in areas that are considered more at risk or of higher value (Cox and Grose 2000; Croft et al. 2011; DSEWPC 2012a; Government of Alberta 2013; Moilanen et al. 2009). Indirect offsets (e.g., research programs) generally incur higher multipliers where equivalency to the environmental values or ecological mechanisms could not be achieved (Cox and Grose 2000; DSEWPC 2012a; Government of Alberta 2013; Moilanen et al. 2009).

A minimum multiplier of 1 has been proposed for direct offsets (i.e., like for like measures) to achieve no net loss for equivalent environmental values or ecological mechanisms (Croft et al. 2011; DEFRA 2012; DSEWPC 2012a). However, several studies investigating the effectiveness of offset programs indicate that compliance and monitoring are currently insufficient to achieve no net loss, and suggest that a higher offset ratio might be required, even with improved compliance (Harper and Quigley 2005a, b; Quigley and Harper 2006). Examples of multipliers previously proposed or published are provided below.

A like for like model for offset multipliers in Alberta was developed, using ecosite rarity as a surrogate for biodiversity (Croft et al. 2011). Ecosites were chosen as the preferred unit of measure since they provide a coarse filter representation of ecosystem form and function across the landscape, are well understood and are

relatively easily identified using remote sensing techniques and existing predictive models. The relative abundance or rarity of ecosites across the landscape provides a reliable and defendable measure of relative biodiversity value. Offset ratios ranged from 1:1 to 4:1, depending on the respective rarity of the ecosite being disturbed and the ecosite where offsets were located. An offset ratio of 1:1 was proposed for offsets located in ecosites of equal or greater rarity than the disturbed ecosite, and the offset ratio increased to 4:1 if more common ecosites were offset (Table 10-1).

In situations where offsets are required outside of the natural subregion where the residual effects occurred, proposed multipliers are either doubled (ecosite exists in the subregion where the disturbance occurred) or increased to 10 (ecosite does not exist within the natural subregion where the disturbance occurred). Successional stage was not considered when determining equivalency as it was assumed that if two locations (i.e., project footprint and offset location) are classified as the same ecosite then the characteristics unique to the ecosite (e.g., species composition) will be the same at some point in time (Croft et al. 2011).

Table 10-1: Multipliers Based on Ecosite Rarity

		Disturbance Ecosites			
Offset Ecosites		e,f,g	c,g	a,b	d
	e,f,g	1:1	1:1	1:1	1:1
	c,g	2:1	1:1	1:1	1:1
	a,b	3:1	2:1	1:1	1:1
	d	4:1	3:1	2:1	1:1

Source: Croft et al. (2011)

The *Alberta Wetland Policy* (Government of Alberta 2013) uses incremental multipliers that consider restorative and non-restorative objectives for the permanent loss of wetlands. Based on the Wetland Replacement Matrix (Table 10-2), multipliers vary from 0.125 to 8, based on the value of wetland lost versus the value of the wetland replaced (Government of Alberta 2013). Wetland evaluation criteria include biodiversity, water quality improvement, flood reduction, human value and relative abundance (i.e., current versus historical, where data exists). A midpoint multiplier of 3 is the suggested multiplier necessary to achieve the goals of the policy, and takes into account factors such as decreased function of a restored versus natural wetland, time lag between restoration and return of function and failure of some proportion of restored wetlands (Government of Alberta 2013).

Table 10-2: The Wetland Replacement Matrix

	Value of Replacement Wetland				
Value of Lost Wetland		D	C	B	A
	A	8:1	4:1	2:1	1:1
	B	4:1	2:1	1:1	0.5:1
	C	2:1	1:1	0.5:1	0.25:1
	D	1:1	0.5:1	0.25:1	0.125:1

Source: Government of Alberta (2013)

Notes: Value of wetlands goes from A (highest) to D (lowest)

The *Queensland Environmental Offsets Policy* (Queensland Government 2014) prescribes multipliers up to a maximum of 4, except where connectivity is impacted (multiplier set at 1) or for disturbance on protected areas (multipliers may be as high as 10). In South Africa, offset ratios are based on the status of the ecosystem being disturbed (Table 10-3), and could be adjusted depending on the condition of the affected habitat, the presence of threatened species, the presence of special habitats, the biodiversity process value of the affected habitat, and the importance of biodiversity underpinning valued ecosystem services Department of Environmental Affairs and Development Planning (2007).

Table 10-3: Basic Offset Ratios Based on Ecosystem Status

Ecosystem Status	Offset Ratio
Critically endangered (only under exceptional circumstances where offsets are appropriate)	30:1
Endangered	20:1
Vulnerable	10:1
Least threatened	1:1

Source: Department of Environmental Affairs and Development Planning (2007)

A theoretical analysis of offset multiplier requirements using a probabilistic modelling approach concerning offset delivery, ability to achieve no net loss and uncertainty risks associated with habitat restoration has been developed (Moilanen et al. 2009). Multipliers rapidly move from 2 to greater than 100 where the predicted probability of restoration failure exceeds 0.5 (i.e., greater than 50%) and the information gap concerning uncertainty of habitat restoration is moderate to high (i.e., $\alpha > 0.4$) (Moilanen et al. 2009). Moilanen et al. (2009) suggest that if improvements to the conservation value through habitat restoration is slow (i.e., within a 150 year planning horizon), it is questionable whether the habitat should be considered restorable at all. Uncertainty may be partially alleviated by establishing several areas with variable offsets, rather than a single, large area with only one type of offset (i.e., bet-hedging) (Moilanen et al. 2009).

Where uncertainty and time lags exist, the Department of Environment, Food and Rural Affairs (DEFRA) in the United Kingdom (DEFRA 2012) proposes multipliers for discrepancies or risks based on the model developed by Moilanen et al. (2009). These risks, as they relate to this Project, are defined below.

- **Delivery Risk**: the key factors that contribute to delivery risk include effectiveness (i.e., probability of failure or underperformance), additionality (i.e., is the offset contributing to habitat above and beyond what is required or already in place) and permanence (i.e., protection from future disturbance). There is an inverse relationship between these categories and the delivery risk ratings (e.g., as effectiveness improves, delivery risk declines).
- **Spatial Risk**: the key factors that contribute to spatial risk include proximity to the population or herd affected, and equivalence of the habitat disturbed by the Project and the offset habitats. Spatial risk increases as the proximity of offset habitat to disturbance habitat increases.
- **Temporal Risk**: temporal risk is associated with delay factors, such as the time required for habitat restoration measures to achieve the offset objective and goals.

Multipliers can be applied to address risks associated with the delivery of the restoration or offset measure. While multipliers may compensate for uncertainty associated with the delivery of restoration or offset measures, multipliers will not compensate for complete failure of these measures (DEFRA 2012). The approach of implementing a variety of measures in more than one location (i.e., bet-hedging) is suggested to achieve a more reliable outcome (Moilanen et al. 2009).

Effectiveness of restoration and offset measures is based on the likelihood that the implemented measure will achieve the offset objective and goals, or the potential for failure or underperformance. Limited empirical data and long-term studies are available that demonstrate habitat restoration and offset measures will be effective (IUCN 2014; Rey Benayas et al. 2009). A meta-analysis of studies on ecological restoration indicated that restored habitats had lower biodiversity and provision of ecosystem services than did reference systems (86 and 80%, respectively) (Rey Benayas et al. 2009). Another study on the effectiveness of fish habitat compensation in Canada determined that approximately two-thirds of compensation projects resulted in net losses in habitat productivity (Quigley and Harper 2006). Within this study, artificially increasing the offset ratio to 2:1 was not sufficient to achieve no net loss for a substantial proportion of projects, and projects that achieved a net gain in habitat had offset ratios of approximately 5:1 (Quigley and Harper 2006).

Due to the uncertainty in the effectiveness of habitat restoration measures, a qualitative approach was taken in this CHR&OMP to determine offset multipliers, based on the factors contributing to delivery risk noted above. Effectiveness of habitat restoration measures will be categorized based on the best available literature and learning from past NGTL restoration programs and other industry initiatives.

10.15 KNOWLEDGE GAPS AND LIMITATIONS OF THE LITERATURE REVIEW

The literature review provided the opportunity to identify the following knowledge gaps:

- restoration criteria (e.g., defined guidelines or quantifiable objectives) for restoration of boreal ecosystems for wildlife habitat values, in particular habitats that do not support merchantable timber (e.g., treed bogs and fens)
- functional responses of caribou, wolves and primary prey (e.g., moose, deer) to reclaimed habitats in various stages of successional progression, as well as to access and line of sight management
- long-term monitoring of vegetation recovery on linear disturbances and of predator response to access management measures
- uncertainty risk for specific circumstances where offset response cannot be adequately predicted or does not achieve gains

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Appendix A

Photoplates

Plate 1: Example of the effectiveness of minimal disturbance construction in forested areas. Photo shows growth after one growing season. Photo source: NGTL.

Plate 2: Example of coarse woody debris rollback for access management on a non-parallel pipeline ROW. The debris also creates microsites to enhance vegetation establishment and growth. Photo source: NGTL.

Plate 3: Example of conifer seedling planting on a pipeline ROW. The upland area has sufficient drainage and suitable soils for seedling establishment and growth. Photo source: CH2M HILL.

Plate 4: Example of access control implemented on a ROW with parallel developments. Note the ATV tracks that divert around the woody debris rollback. Photo source: NGTL

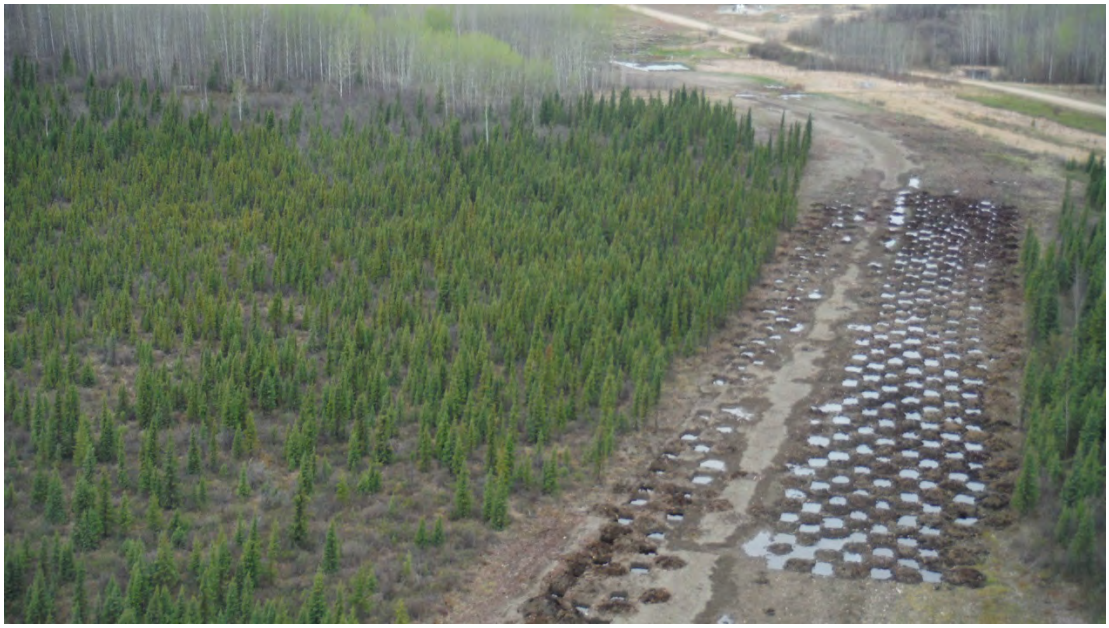


Plate 5: Aerial view of mounding in lowland on a non-parallel portion of the ROW. Photo source: NGTL.

Plate 6: Aerial view of combination rollback and mounding as access control on a non-parallel portion of the ROW. Photo source: NGTL.

Plate 7: Example of a wood berm designed to deter access and reduce line-of-sight. This measure is no longer used due to the risks associated with forest fires. Photo source: NGTL.

Plate 8: Example of a vegetation screen retained along edge of pipeline right-of-way at intersection with an existing linear disturbance. Vegetation screens block line-of-sight and can effectively manage access. Photo source: CH2M HILL.

Plate 9: Example of a ramp-over area where a snow ramp was packed over vegetation in a treed lowland. The resultant vegetation screen will also contribute to natural regeneration. This measure can only be used in seasons with high snowfall. Photo source: CH2M HILL.

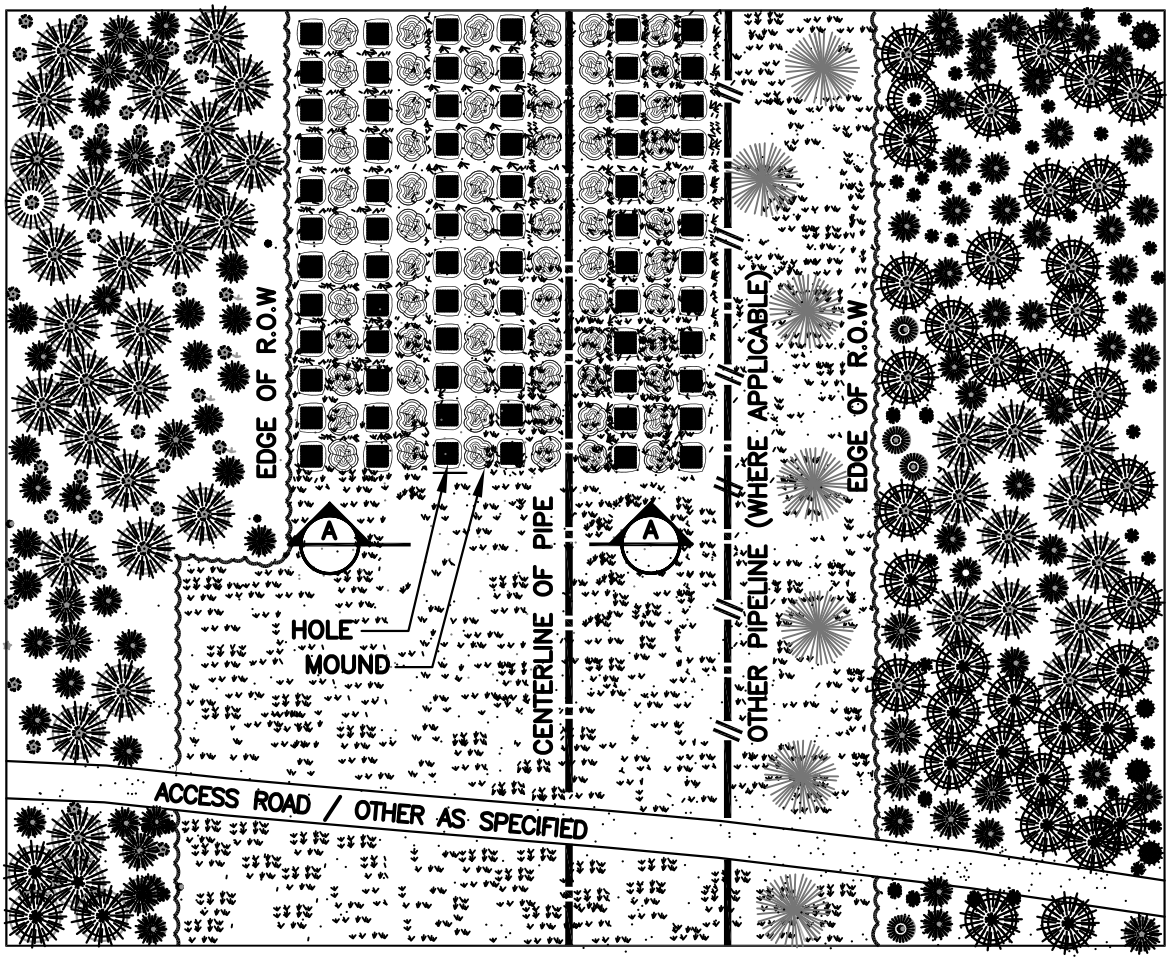
Plate 10: Fabricated line-of sight on a ROW paralleled by another ROW and a power line. This measure is not fully effective due to the presence of adjacent developments where no line-of-sight measures are implemented. Photo source: NGTL

Plate 11: Example of mounding combined with conifer seedling planting on a ROW. The combination of measures is intended to manage access, and facilitate revegetation of conifers. Photo source: NGTL.

Plate 12: Example of bioengineering (willow staking) in the riparian area at a watercourse crossing. Photo source: NGTL

Appendix B

Construction Schematics for Commonly Used Restoration Measures



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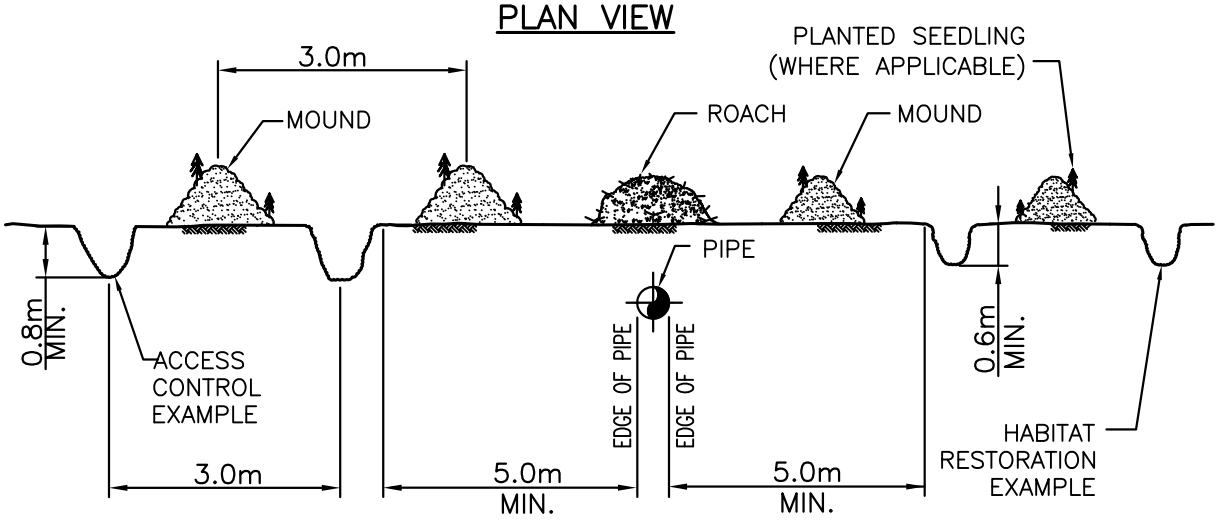

CROSS SECTION A–A

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DESIGNER:
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DESIGN STANDARD

FIA #	CHAINAGE:	DISCIPLINE #
STDS		03

TITLE: MOUNDING AND HABITAT RESTORATION (SHEET 1 OF 2)

SCALE	DWG No	REV
N.T.S.	STDS-03-ML-05-314	B

TC_A4_EE.DWG 210X280

CADD DRAWING: DO NOT MAKE MANUAL REVISIONS

NOTES:

1. MOUNDING WILL BE USED PRIMARILY FOR ACCESS CONTROL IN AREAS SPECIFIED ON PROJECT PLANS, AND AS DIRECTED BY THE COMPANY. MOUNDING WILL BE COMBINED WITH HABITAT RESTORATION MEASURES WHERE INDICATED IN PROJECT PLANS, AND AS DIRECTED BY THE COMPANY.
2. EXCAVATIONS SHALL NOT BE CONDUCTED WITHIN 5m OF THE TRANSCANADA PIPELINE. ENSURE APPLICABLE COMPANY AND THIRD PARTY PERMITS AND AGREEMENTS ARE IN PLACE AND ADHERED TO.
3. THE EDGE OF THE EXCAVATION SHALL BE JUST BEYOND THE 5m BUFFER LIMIT AND THE MOUND SHALL BE PLACED WITHIN THE 5m BUFFER LIMIT ADJACENT THE TRANSCANADA PIPELINE.
4. FOR ACCESS CONTROL PURPOSES, THE EXCAVATED AREA SHALL BE MINIMUM 0.8m DEEP AND APPROXIMATELY 1m IN DIAMETER, WHERE SITE CONDITIONS ALLOW.
5. WHERE MOUNDING IS COMBINED WITH HABITAT RESTORATION MEASURES, THE EXCAVATED AREA SHALL BE APPROXIMATELY 0.6m DEEP AND APPROXIMATELY 1m IN DIAMETER, WHERE SITE CONDITIONS ALLOW.
6. THE EXCAVATED MATERIAL IS PLACED BESIDE THE HOLE TO CREATE THE MOUND.
7. MOUNDS SHALL BE SPACED APPROXIMATELY 3m APART, WITH FINAL SPACING IMPLEMENTED TO ENSURE ACCESS BY OFF-ROAD VEHICLES IS DETERRED.
8. DENSITY SHALL BE A MINIMUM OF 700 MOUNDS/HA. MOUND DENSITY IS DEPENDENT ON SOIL CHARACTERISTICS, AMOUNT OF FROST AND TYPE OF EQUIPMENT USED.
9. WHERE MOUNDING IS COMBINED WITH HABITAT RESTORATION MEASURES, LIVE SEEDLING PLANTING DENSITY SHALL BE A MINIMUM OF 2 SEEDLINGS PER MOUND, OR 1,400 TO 2,000 SEEDLINGS/HA.
10. IF SITE CONDITIONS WARRANT MODIFICATIONS TO THE PROCEDURE, THE COMPANY'S AUTHORIZED REPRESENTATIVE SHALL ENSURE THE MODIFICATIONS MEET THE INTENT OF THE MITIGATION MEASURE.

GENERAL:

- MOUNDING IS TYPICALLY CONDUCTED DURING FINAL CLEANUP AND NOT IN THE SAME SEASON AS CONSTRUCTION/ INTERIM CLEANUP.

- PRECAUTIONS SHALL BE TAKEN TO MINIMIZE FROST PENETRATION WHERE PRACTICAL IN AREAS WHERE MOUNDING IS SPECIFIED. DEEPER FROST PENETRATION CAN LIMIT THE ABILITY TO EXCAVATE HOLES AND SUBSEQUENT EFFECTIVENESS OF THE MITIGATION MEASURES.

- SITE SPECIFIC SOIL PROPERTIES (E.G. SUBSTRATE AND DRAINAGE) MAY AFFECT THE HOLE AND MOUND SIZE, STABILITY AND OVERALL STRUCTURE.

- MOUNDING MAY ALSO BE USED IN COMBINATION WITH HABITAT RESTORATION BY CREATING MICROSITES FOR PLANTED SEEDLINGS.

REVISIONS | B | ISSUED FOR REVIEW (2015-12-12) KPL | - | -

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TIME

DESIGNFILE

TransCanada

DESIGNER:
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DESIGN STANDARD

FIA # STDS	CHAINAGE:	DISCIPLINE # 03

TITLE: MOUNDING AND HABITAT RESTORATION (SHEET 2 OF 2)

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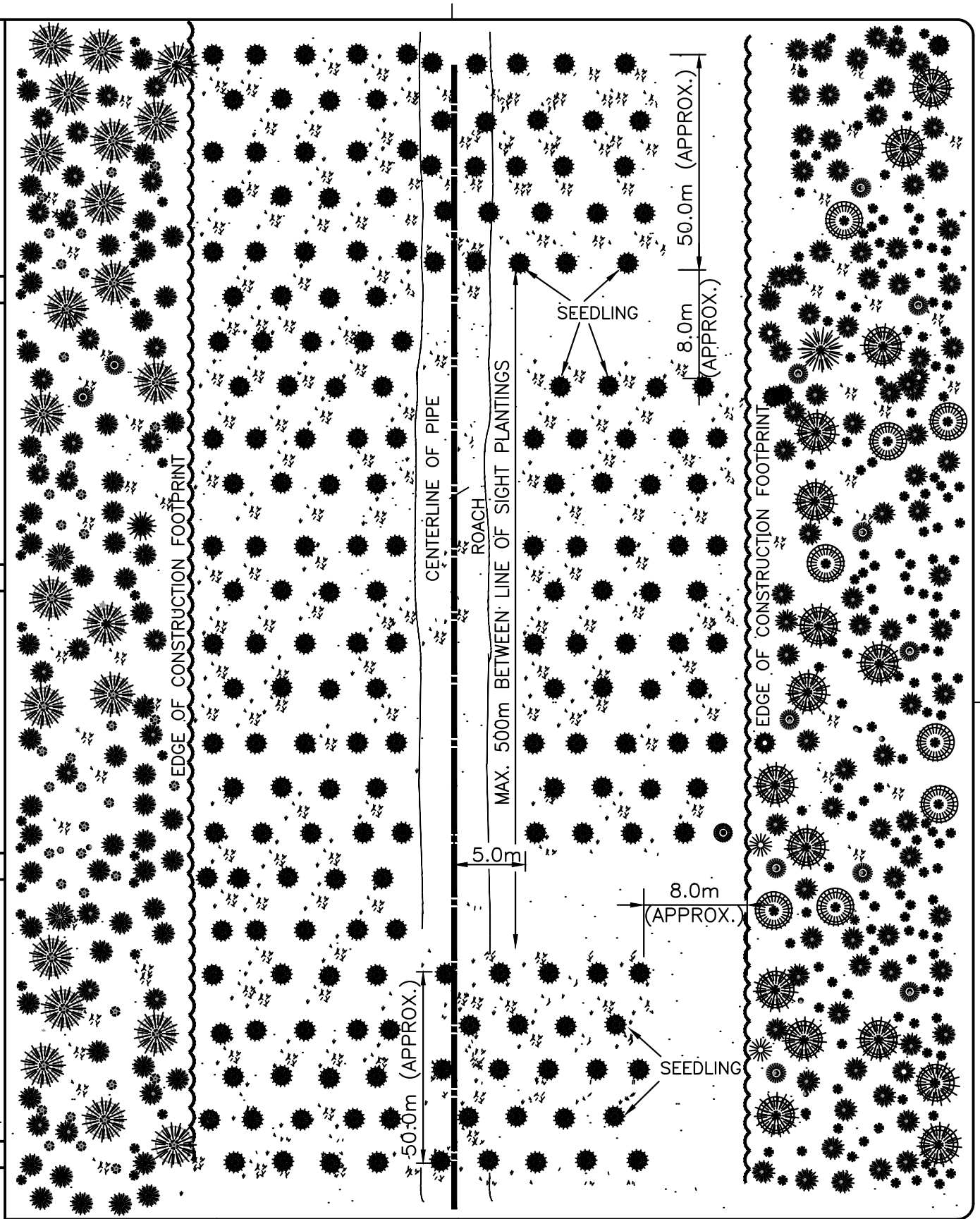

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DESIGN STANDARD

FIA #	CHAINAGE:	DISCIPLINE #
STDS		03

TITLE
HABITAT RESTORATION
SEEDLING PLANTING FOR LINE OF SIGHT

SCALE	DWG No	REV
N.T.S.	STDS-03-ML-05-316	A

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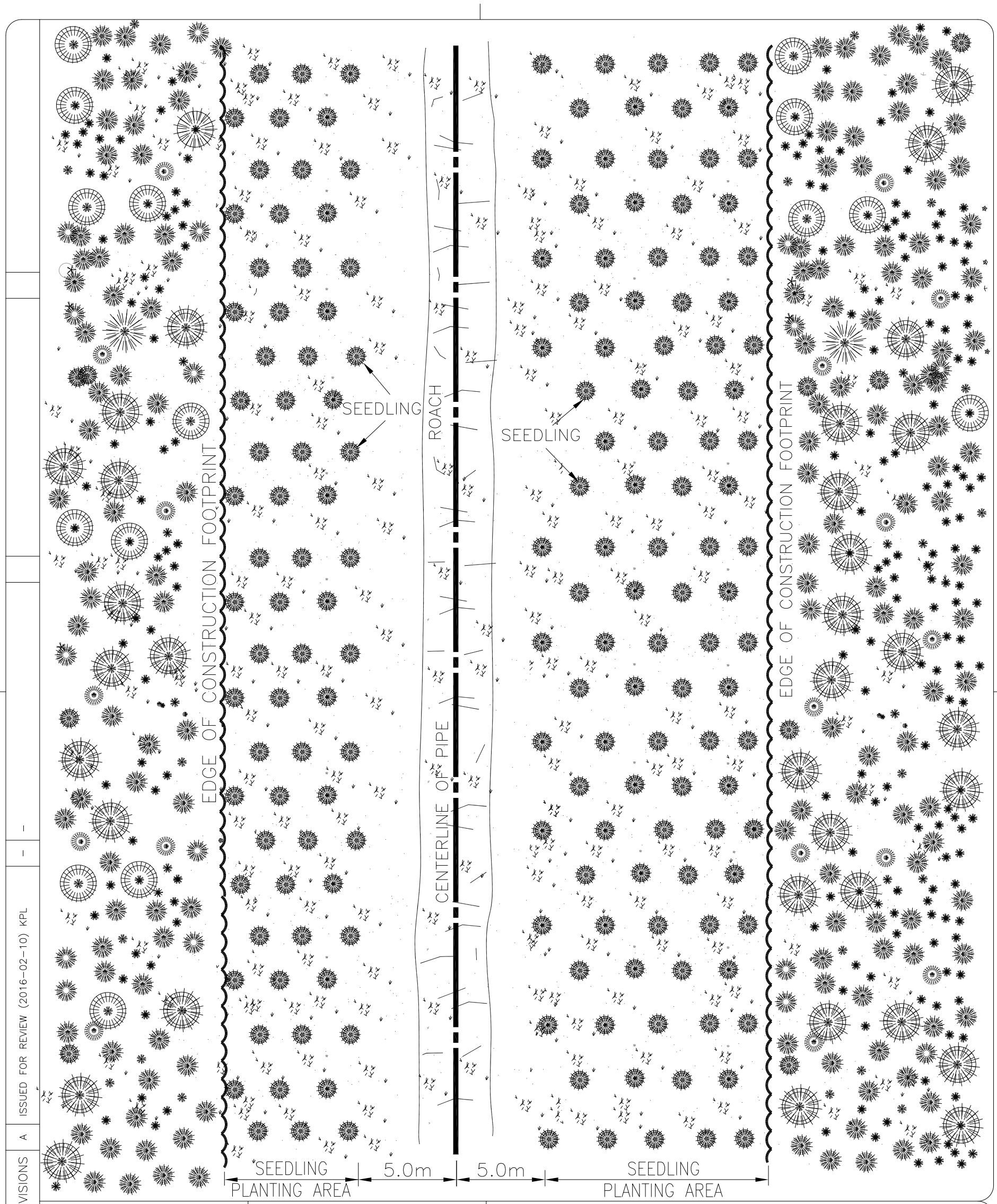
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SEEDLING
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NOTES:

1. CONDUCT SEEDLING PLANTING FOR HABITAT RESTORATION AND LINE OF SIGHT WHERE INDICATED IN PROJECT PLANS, AND AS DIRECTED BY THE COMPANY. FIELD SUPERVISION OF SEEDLING PLANTING MUST BE CONDUCTED BY A REGISTERED FOREST PRACTITIONER.

2. ENSURE APPLICABLE COMPANY AND THIRD PARTY AGREEMENTS ARE IN PLACE AND FOLLOWED.

3. SEEDLING PLANTING SHALL BE CONDUCTED IN NON–FROZEN GROUND CONDITIONS IN THE SEASON FOLLOWING WINTER FINAL CLEANUP, AND OUTSIDE OF APPLICABLE RESTRICTED ACTIVITY PERIODS WHERE WAIVERS ARE NOT OBTAINED.

4. DO NOT PLANT IN THE SEASON FOLLOWING CONSTRUCTION/ INTERIM CLEANUP UNLESS APPROVED IN PROJECT PLANS OR DIRECTED BY THE COMPANY.

5. SEEDLING PLANTING DENSITY SHALL BE (A) 1,600–2,000 STEMS PER HA IN UPLAND (CONIFER /DECIDUOUS); (B) 1,200–2,000 STEMS PER HA IN LOWLAND (CONIFER ONLY). PLANT IN A STRAIGHT LINE PARALLEL TO THE ROACH. OFF–SET THE ADJACENT PARALLEL LINE OF PLANTING TO AVOID A GRID PATTERN.

6. WHERE THE LINE OF SIGHT PROCEDURE IS REQUIRED, IT SHOULD BE IMPLEMENTED AT MAXIMUM 500m SPACING OR AS DIRECTED BY THE COMPANY. TO ADDRESS ACCESS REQUIREMENTS DURING PIPELINE OPERATIONS, THE LINE OF SIGHT PLANTING PATTERN SHALL ENSURE AN APPROXIMATE 8m WIDE GAP IS LEFT UNPLANTED ADJACENT TO THE EDGE OF THE CONSTRUCTION FOOTPRINT. WHERE ACCESS IS REQUIRED ADJACENT TO THE OPERATING PIPELINE, PLANTING SHALL NOT BE CONDUCTED WITHIN 5m OF THE PIPELINE.

7. SEE DRAWING STDS–03–ML–05–316 AND STDS–03–ML–05–317 FOR EXAMPLES OF THE ALTERNATING PLANTING PATTERN AND LAYOUT TO BE APPLIED FOR HABITAT RESTORATION AND LINE OF SIGHT LOCATIONS.

8. IF SITE CONDITIONS WARRANT MODIFICATIONS TO THE PROCEDURE, THE COMPANY'S AUTHORIZED REPRESENTATIVE SHALL ENSURE THE MODIFICATIONS MEET THE INTENT OF THE HABITAT RESTORATION MITIGATION MEASURES.

REVISIONS	ID	
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TransCanada

DESIGNER: NAME DATE

CHECKED BY: DESIGN CHECKER:

DESIGN STANDARD

FIA # STDS | CHAINAGE: | DISCIPLINE # 03

TITLE HABITAT RESTORATION AND LINE OF SIGHT SEEDLING PLANTING NOTES

SCALE N.T.S. | DWG No STDS–03–ML–05–318 | REV A

TIME DESIGNFILE

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CADD DRAWING: DO NOT MAKE MANUAL REVISIONS

Appendix C

Summary of Consultation with Federal and Provincial Agencies Related to Caribou

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
National Energy Board				
Louise George Assistant Secretary of the Board on behalf of Sheri Young, Secretary of the Board, Calgary, AB	July 17, 2015; emailed letter of acceptance	The NEB approved Condition 6(a), with the exception of 6(a)(iv) for the preliminary CHRP of the Liege Lateral Loop No. 2 (Thornbury Section) and Leismer East Compressor Station Project. The Board found that NGTL's quantifiable targets and performance measures did not satisfy Condition 6(a)(iv). In particular, the Board had concerns with the following:	--	--
		The Board directed NGTL to include the area of operational access as a spatial residual effect.	Section 4.2	The quantitative methods of the CHR&OMP incorporate the operational access into the calculation of the residual effect, and NGTL has enhanced the language to clearly articulate the spatial residual effects as they relate to operational access.
		The Board directed NGTL to clearly define how baseline data on access control will be determined and provide defensible justification for this.	Sections 3.4.3 and 7.	NGTL has added Section 3.4.3 to clearly articulate how baseline data on access control will be determined and in Section 7, how it will be measured.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Louise George Assistant Secretary of the Board on behalf of Sheri Young, Secretary of the Board, Calgary, AB (cont'd)		The Board directed NGTL to incorporate 200 m or 400 m line of sight distances as quantifiable targets. The Board also directed NGTL to either meet the Alberta Energy Regulator Enhanced Approval Process (EAP) or explain why it is not meeting the EAP for the quantifiable target, given that both NGTL's decision framework and the provincial EAP specify shorter distances.	Figure 3-4 and Sections 3.4, 6 and 8.	Recent lessons learned from implementing restoration measures for the Chinchaga Project have demonstrated that implementing line of sight blocks at these distances is not feasible. Therefore, it is likely that the EAP targets would be unattainable. NGTL has, therefore, substantially revised the decision framework figures in Section 3 to incorporate recent experience gained from the Chinchaga Project. Figure 3-2 of the decision framework now clearly prescribes 500 m intervals, which is consistent with the performance indicators in Section 6. Section 3.3 and Section 8 have also been modified to explain why NGTL will not be implementing sightline distances less than 500 m.
		The Board directed NGTL to develop immediate/short-term quantifiable targets, and reminded NGTL that any temporal lags need to be factored into the calculations for its offset measures.	Sections 4.2, 4.3, 4.4, 4.8 and 6.	NGTL considers the "short term" to mean equal to or less than five years and that "immediate" in this context would occur as soon as line of sight blocks have been constructed. Short and long-term measures will be implemented to block line of sight. These are related to performance indicators in Section 6. Sections on calculating residual effects (Section 4.3) and calculating offset area (Sections 4.4 ans 4.8) explicitly include the calculation of temporal risk and associated time lags. Sections 4.3 and 6 discuss temporal risk in greater detail.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Alberta Environment and Sustainable Resource Development				
Dave Hervieux Regional Resource Manager Grande Prairie, AB	December 17, 2012 Telephone	AESRD noted that it expects it will be the owner for the caribou Range Plans, as called for under the Federal Recovery Plan and the Alberta Caribou Policy. The Range Plans will be components of broader Action Plans. Range Plans will focus on habitat and Action Plans will extend from habitat to other elements, such as population management. Range Plans will work to move caribou range from the current state to that which facilitates the persistence of caribou, by including conservation and phased development. AESRD intends to develop the Range and Action Plans in communication with key industry partners (e.g., industry working groups). AESRD noted that there are several pilot projects underway, or soon to be underway, by oil and gas production companies to do restoration work on linear and polygonal features (i.e., old industrial features that are not their holdings). The objective of the habitat restoration is to establish tree growth of equivalent capacity to adjacent lands.	Section 8	The CHR&OMP objective aligns with the objectives of other provincial habitat restoration pilot projects. Caribou habitat restoration is receiving increasing research attention and it is anticipated that methods to restore habitat will continue to be tested and modified in the near future. NGTL will continue to incorporate this new information in the final CHR&OMP and post-construction monitoring.
		AESRD advised NGTL to strive to enable regrowth on substantial portions of their Project footprint (length and width) to that equivalent to the adjacent forest. AESRD indicated that regrowth of herbaceous and deciduous species is not beneficial for caribou and noted that there should be consideration given to how this would be managed. AESRD also indicated that caribou are not forage-limited and there is no science to support line of sight measures affecting predator travel. However, line of sight breaks and rollback are effective measures to block access and use, and rollback is helpful for re-vegetation. Overall comments regarding habitat restoration included: • Habitat restoration measures are good. • Controlling/blocking access is valuable.	Sections 2, 3.4, 3.5, 6, 7 and 8	The goals and targets (Section 2) strive to enable regrowth on substantial portions of the Project footprint, using a toolbox of restoration measures (Section 3.4) to be implemented using the restoration frameworks (Section 3.5), and monitored (Section 7) to measure success against performance indicators (Section 6). NGTL will continue to improve measures with experience and new information (Section 8).

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Dave Hervieux Regional Resource Manager Grande Prairie, AB (cont'd)		• Line of sight breaks can be advantageous to some extent; a good restoration project will, in time, address line of sight. • The role of companies is to monitor the success of restoration planting, to assess what worked, what needs to be corrected or done differently. • Even with extensive planting, there would be negative effects on caribou.		
Dave Moyles Senior Wildlife Biologist Peace River, AB	April 29, 2013 Email	In their review of the preliminary CHRP for the Chinchaga Lateral Loop No.3 Project, AESRD advised that on a broad scale, upland forested areas (pine-dominated and mixedwood) that are close to treed muskegs are important habitat. Caribou in the Chinchaga range move into these upland forests particularly during winters of early, deep snow (i.e., snow depths approaching a meter by early December). "Wet" white spruce (AVI classification) is also used by caribou throughout the year. During the rut in fall, caribou in the Chinchaga range frequent open wetlands composed of willows and sedges. The openness of this habitat is ideal for bull caribou "showing off" their attributes. AESRD expressed concern with natural regeneration of deciduous-dominated vegetation communities and use of willow and poplar cuttings, both of which provide good habitat for moose and deer. AESRD recommended NGTL to consider restoration measures to restore upland areas to conifer-dominated stands by planting conifers.	Section 3.4.	NGTL will be considering restoration measures using established reclamation and forestry reforestation practices to promote revegetation where natural regeneration might not achieve the performance indicators. Planting conifers is part of this plan.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Bob Yowney Forest Officer Athabasca, AB	June 6, 2013 Telephone	NGTL inquired about the opportunity to locate offset measures on seismic lines. AESRD indicated seismic lines do not show up on land standing reports and they are governed by confidential agreements. Their surface dispositions are renewed every year, and increasingly companies are re-entering old lines and reshooting, sometimes on an annual basis. For these reasons, implementing offset measures on a seismic line may be challenging. NGTL inquired about the opportunity to locate offset measures on logging roads or oil and gas roads. AESRD indicated these industries would have reclamation conditions associated with their surface dispositions. AESRD suggested NGTL could implement measures on temporary workspace associated with NGTL pipelines in the caribou range. AESRD indicated that the human presence on the landscape is a primary concern (more so than predators) and NGTL should focus offset measures on restricting access. AESRD indicated animals will travel though the land, wherever they want, and that nothing effective can be done to stop or slow down their movement. AESRD advised NGTL to consider access to the locations of the offset measures, and noted that a surface disposition such as an LOC for upland habitat management should be applied for where the offset measures are located. AESRD indicated that there was concern regarding the amount of merchantable timber held back on the Leismer to Kettle River Crossover Project for use as rollback and indicated that NGTL needs to be aware of the interest of others to ensure that all merchantable timber goes to market.	Section 4.5	NGTL has been working collaboratively with AEP to identify, prioritize and select candidate caribou habitat restoration areas in priority caribou ranges. Selection criteria consider AEP's priority caribou restoration areas, degree of existing disturbance, opportunities for collaborative partnerships and ease of access. Selection of candidate areas has progressed and several potential areas were short listed in June 2015. NGTL's candidate sites are in established Wildland Parks in northeastern Alberta and overlap with AEP's priority caribou habitat restoration areas to enable permanence of caribou habitat restoration and contribute to Recovery Strategy goals and objectives. NGTL will continue to work with AEP, and its partners (e.g., Forest Management Agreement holders) and stakeholders to select specific locations to meet shared objectives.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Dave Hervieux Regional Resource Manager Grande Prairie, AB	June 10, 2013 Telephone	During consultation regarding the development of the final OMP for the Northwest Mainline Expansion Project, AESRD indicated that they are not entirely supportive of the concept of range utility, and are more focused on replanting. AESRD noted other methods such as access management (coarse woody debris, tree felling, mounding) that are effective. AESRD is also supportive of habitat restoration and access management on existing/active pipeline ROWs. AESRD noted that a few companies are doing work on old ice roads, dry weather roads, active pipelines, and seismic lines. AESRD noted that NGTL would need approval to get a provincial disposition for this work.	Sections 2, 3.4 and 4.5	NGTL has refocused the concept of range utility to frame CHR&OMP objective and goals around reducing the Project's residual and cumulative effects by restoring habitat and reducing predation risk for caribou through habitat restoration (revegetation), access control and line of sight measures. NGTL is working with AEP and Aboriginal communities to identity preferred offset locations.
Dave Moyles Senior Wildlife Biologist Peace River, AB	June 13, 2013 Telephone	AESRD requested a coordinated approach to caribou protection planning across NGTL's projects.	Section 8	This CHR&OMP was developed from insights considered from stakeholder feedback, NGTL and industry experience, emerging applied research, and monitoring outcomes. NGTL is coordinating its caribou protection planning across projects within the bounds of existing regulatory conditions, and with the objective of maintaining consistency as well as continual improvement.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Dave Moyles Senior Wildlife Biologist Peace River, AB Don Williams Operations Unit Head Manning, AB	June 26, 2013 Meeting	In their review of the preliminary CHRP for the Northwest Mainline Expansion Project, AESRD (Dave Moyles) agreed with the "like for like" restoration approach of planning restoration to match the existing landscape of upland and lowland/wetland vegetation and the mounding approach for line of sight especially in lowland/black spruce areas. AESRD recommended that a Project restore as much of the footprint as possible in caribou range and reduce the level and ease of access for humans and predator movement. AESRD noted that range plans have not been developed for the Chinchaga range therefore they do not want to commit to any "special areas" of concern or priority for offset measures at this time. AESRD requested to be consulted and possibly work with NGTL to explore more site specific locations for offsets. AESRD (Don Williams) was unsure of how the offset measures strategy and the existing land disposition system will work together and suggested there may be issues with attempting to plant trees or implement line of sight on other dispositions.	Sections 3.4, 4.1 and 4.5	NGTL has incorporated like for like measures that include planting to accelerate regeneration and access control. As noted, NGTL has been working collaboratively with AEP to identify, prioritize and select candidate caribou habitat restoration offset areas in priority caribou ranges.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Bob Yowney Forest Officer Athabasca, AB	July 11, 2013 Meeting	In their review of the caribou habitat restoration measures on the Leismer to Kettle River Crossover Project, AESRD had no concerns with the measures proposed by NGTL. AERSD noted that NGTL needs to ensure that the measures that are implemented align with provincial policy, specifically Section 20 of the *Public Lands Act* (PLA). AESRD also noted that the Environmental Field Reports and Caribou Protection Plan serve as the "terms and conditions" and must be complied with otherwise it is viewed as a contravention of the PLA. AESRD stated that if caribou habitat restoration measures are not implemented in a satisfactory manner, they would be viewed as an outstanding reclamation item. Regarding offset measures, AESRD noted that they do not allow overlapping dispositions and therefore a PNT or other disposition to protect habitat measures is not necessary. AESRD indicated that if another party wants to cross a disposition, they are obligated to contact the disposition holder, who would have a duty to communicate the need to avoid/protect/replace the habitat measures.	Section 4.5	As noted, NGTL has been working collaboratively with AEP to identify, prioritize and select candidate caribou habitat restoration offset areas in priority caribou ranges.
Dave Moyles Senior Wildlife Biologist Peace River, AB Don Williams Operations Unit Head Manning, AB Alan Carson Forest Officer Rainbow Lake, AB	August 29, 2013 Telephone	In review of the preliminary CHRP for the Northwest Mainline Expansion Project, AESRD noted that rollback is useful for access control. The log berms on the Cranberry Section where reviewed by the Forest Officer and since they are isolated features, they are likely not enough to create a continuous barrier or fire hazard. AESRD suggested that it is comparable to the brush piles that forest harvest operators leave in cutblocks without issue. Regarding habitat restoration, AESRD noted that in general, 1,200-1,600 stems/ha is common in the forest industry for planting densities, depending on the species and site. AESRD recommended avoiding the hinge of the mound pile for planting (variable with site conditions and species). From	Section 3. 4, 4.1 and 4.5	NGTL has incorporated like for like restoration measures that include planting to accelerate regeneration, line of sight and access control. Minimum disturbance construction techniques, including ramp-overs, will be used in areas where grading is not required.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Dave Moyles Senior Wildlife Biologist Peace River, AB Don Williams Operations Unit Head Manning, AB Alan Carson Forest Officer Rainbow Lake, AB (cont'd)		From a wildlife management perspective, AESRD recommended that the focus should be on avoiding attraction of wildlife to the ROW and noted that there have been issues with seeded barley along the Chinchaga Trunk Road attracting bears and ungulates. AESRD noted that herbicide application is a viable option to control graminoid species competing with seedlings and should be used with caution and in consideration of sensitivities (proximity to water). AESRD noted that ramp-over areas in black spruce lowlands are a good measure and recommended protecting these areas during winter clean-up and not planting anything to extend them (unlikely success of tree seedlings; do not introduce willow). AESRD also noted that natural regeneration as a revegetation method in the lowland areas makes sense and that targeting regeneration of natural vegetation (% cover) as opposed to tree stem density is logical. AESRD also noted that no noxious weeds is a good target. AESRD advised that like for like restoration is ideal. Where willows are present, willow staking is a viable option. Do not plant willows in areas where they do not currently grow. Willow staking in bio-engineered riparian banks should be done in a manner that will not compromise the effectiveness of erosion control measures (e.g., soil wraps). AERSD noted that open sight-lines are the nature of the vegetation communities in the lowland areas and concern with line of sight is relevant to the upland forest areas. AESRD recommends access control and line of sight measures be implemented where they make sense; control measures are not warranted where they will be ineffective (e.g., adjacent to roads) for the purpose of breaking the line of sight every 500 m. AESRD encourages trying different measures and		

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
		monitoring to see what is effective.		
Tim Vinge Provincial Landscape Ecology Specialist Major Industrial Applications and Reclamation Section	January 22, 2014 Meeting	Mr. Vinge outlined a possible process for `selecting the right lines' while planning a restoration project. Appropriate data, potential sources and analysis were discussed including use of LiDAR imagery to detect current condition of linear features in terms of regenerating vegetation that may be present as well as light levels. The importance of microsite creation and site treatment was emphasized, particularly in legacy sites that have not been recently disturbed. These sites are particularly challenging. It is important to determine the reason(s) that vegetation may not be re-established and determine what silvicultural or other tools are available to ameliorate the site condition and create a hospitable site for planting or natural regeneration. Emphasized that this is more than a tree planting exercise and several, varied methods of restoration and access management are needed to enhance potential for success.	Section 3.4.	NGTL will coordinate with silviculture specialists to develop the restoration plan and planting prescriptions for offset measures. Plans will be based on education and professional knowledge of practices. Restoration plans will consider the most suitable species for a specific location, which include mixed coniferous species and deciduous species. Opportunities and constraints to restoration measures are described in Section 3.4.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Tim Vinge Provincial Landscape Ecology Specialist Major Industrial Applications and Reclamation Section	February 27, 2014 Meeting	Continued the discussion with Mr. Vinge in terms of challenges and opportunities for effective restoration activities along linear features in caribou habitat. Several documents, a slide presentation, treatment matrix and alternative approaches were provided/discussed. The importance of assisting sites that were not currently regenerating was emphasized. For wetter soils, such as lowland sites where mounding is prohibitive due to access constraints and costs, an application of coarse woody debris to create microsites and promote the development of the `hump and hollow' topography was suggested.. This creates microsites and variability while avoiding mechanical site preparation. . The utility of a linear inventory (e.g., Greenlink forestry methodology used for CEMA project) would be high for the Dillon area due to the length of time since disturbance and the variable regeneration response throughout the area. The linear inventory will provide information on percent cover and height classes of vegetation along the linear feature as well as other site characteristics.	Sections 3.4 and 4.6	NGTL will coordinate with silviculture specialists to develop the restoration plan and planting prescriptions for offset measures. Plans will be based on education and professional knowledge of practices. Restoration plans will consider the most suitable species for a specific location, which include mixed coniferous species and deciduous species. Offsets focus on upland areas; some coarse woody debris treatments will be applied at strategic locations for access control in lowland areas.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Joann Skilnick Senior Wildlife Biologist Fort McMurray, AB	November 28, 2014 Meeting	NGTL introduced the draft Caribou Mitigation Plan (CMP) for the Liege Lateral Loop No. 2 (Thornbury Section) and Leismer East Compressor Station Project to AESRD and discussed the differences between a CMP and a CHRP. AESRD recommended: • specifically linking mitigation to the desired outcomes listed in the EAP guidelines • demonstrating clearly how they link back, as opposed to the current EPP format used • including monitoring plans (wolf densities or wildlife cameras) • avoiding use of following terms, “if practical,” “if feasible” or “if possible”, and identify when it will or won’t be used specifically • include information on helicopter protocols • include restoration AESRD requested that NGTL address access management. AESRD also advised that all areas have “facilitated” restoration unless evidence of where natural recovery is appropriate. Lastly for restoration, AESRD recommended that NGTL follow CEMA Restoration Guidelines (Stony Mountain Linear Restoration Project).	Sections 2, 3.4 and 3.5, 4, 6 and 7.	EAP guidelines were considered in development of CHR&OMP measures. Factors that constrain implementation are listed, where mitigation or restoration commitments include qualifiers such as “where site conditions allow.” The CEMA Stony Mountain linear footprint and access management multi stakeholder planning pilot project (Ohlson 2014) was reviewed. Intent of the project was to provide regional-scale recommendations amenable to a broad range of stakeholders, and inform design and implementation of future multi-stakeholder subregional planning processes undertaken as part of implementing the Lower Athabasca Regional Plan. The report provided high level considerations and recommendations for planning multi stakeholder restoration projects and managing linear features and access at the regional scale. The CHR&OMP aligns with the applicable linear footprint and access management actions listed. The habitat and site-condition approach to selecting restoration methods and locations for the CHR&OMP align with CEMA’s suggested ecosystem-based revegetation matrix that was developed to support prioritization of linear features for treatment and evaluation of reclamation performance.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Grant Chapman Senior Wildlife Biologist Lac La Biche, AB	December 12, 2014 Telephone	AESRD noted that NGTL is continuing to uphold their commitments on the Leismer to Kettle River Crossover Project and recommended that NGTL follow a similar approach for consistency, particularly regarding caribou (e.g., mitigation and monitoring, offset measures plan). AESRD noted that caribou range plans may become available before the Project is submitted. AESRD suggested that access control is the biggest legacy impact of pipeline projects that AESRD is concerned with in boreal caribou range and that recent mitigation for transmission lines in the Conklin area included leaving vegetation up to 3 m tall in some areas, although AESRD recognized that mitigation options for pipelines are more limited. AESRD noted that the appropriate use of wood for rollback is complex given the different interests of forestry, fire protection, and wildlife. Lac La Biche has developed the first fire management plan and AESRD suggested NGTL review before construction to assist in the development of the timber salvage plan. AESRD recommended the following regarding mitigation measures: • 4:1 ratio for offset measures for caribou habitat • Consider access management during the planning phase for construction and restoration/reclamation including mitigation measures to achieve access control (i.e., prevent ATV and snowmobile use in the future) • Narrow the ROW where possible to create pinch points (i.e., narrow to width of ditch line and lower pipe in from other side) • Limit duration of construction and avoid spreading construction over two seasons AESRD noted that COSIA is conducting a literature review and extensive consultation regarding caribou restoration provincially and suggested NGTL review once available.	Section 3, 4 and 8.	The integrated approach to restoration and offsets planning and refinements to the quantification methodology in this CHR&OMP reflects continual improvements and will be updated as new information becomes available such as range plans. Section 3 describes how NGTL has incorporated like for like measures that include planting to accelerate regeneration, narrowing the ROW where possible and access control. NGTL has provided an explanation of why the proposed method of offset multipliers based on available conservation and biodiversity offset literature was selected rather than the 4:1 offset ratio suggested by EC and AEP.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Dave Moyles Senior Wildlife Biologist Peace River, AB	December 19, 2014 Telephone	NGTL inquired about caribou range planning in the province. AESRD noted that the status of current range planning (e.g., the Little Smoky Range Plan) is uncertain and that drafting of a range plan for the East Side of the Athabasca River (ESAR) will begin in 2016. AESRD stated that there is currently no tentative date for a range plan for the Chinchaga caribou range. AESRD noted that the timetable for the regional plan framework has been modified and that the Lower Peace Region has been fast tracked which will have implications for caribou. Timber harvesting companies like Manning Diversified and DMI are trying to incorporate caribou into management plans (*e.g.* avoiding the commercially viable black spruce, white spruce in wet areas within caribou range), as well as monitoring young seral forest in and adjacent to caribou range, with a target of keeping young forest (< 30 years) to less than 20% of the forested landscape.	Section 4.5	The integrated approach to restoration and offsets planning and refinements to the quantification methodology in this CHR&OMP reflects continual improvements and will be updated as new information becomes available such as range plans. As noted, NGTL has been working collaboratively with AEP to identify, prioritize and select candidate caribou habitat restoration offset areas in priority caribou ranges.
Joann Skilnick Senior Wildlife Biologist Fort McMurray, AB	January 8, 2015 Telephone	AESRD stated that paralleling existing disturbances is no longer enough for mitigation in caribou range. Although paralleling minimizes disturbance, it still results in loss of habitat (i.e., for caribou the habitat loss is the area cleared as well as the 500 m of indirect disturbance identified by EC). AESRD recommended a 4:1 offset ratio in caribou habitat. AESRD indicated concerns regarding the use of EAP standards and exemptions for timing restrictions while not considering the ROW width. AESRD stated the EAP guidelines were not designed for lengthy ROWs and large pipe diameters resulting in wider ROWs.	Sections 4, 6, 8 and 10	EAP guidelines were considered in development of CHR&OMP measures. NGTL has provided an explanation of why the proposed method of offset multipliers based on available conservation and biodiversity offset literature was selected rather than the 4:1 offset ratio suggested by EC and AEP.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Joann Skilnick Senior Wildlife Biologist Fort McMurray, AB Ed Barnett Forest Officer Wandering River, AB	January 7-February 2, 2015 Email	In their review of the preliminary CHRP for the Liege Lateral Loop No. 2 (Thornbury Section) and Leismer East Compressor Station Project, AESRD stated that it is their expectation that the timing restriction in caribou range be adhered to. AESRD will not be in favour of providing extensions for construction activities into this timing restriction.	Section 5	Timing windows and scheduling are discussed in Section 5.
Joann Skilnick Senior Wildlife Biologist Fort McMurray, AB Ed Barnett Forest Officer Wandering River, AB Grant Chapman Senior Wildlife Biologist Lac La Biche, AB	March 26, 2015 Meeting	In their review of the preliminary CHRP for the Liege Lateral Loop No. 2 (Thornbury Section) and Leismer East Compressor Station Project, AESRD recommended the option of transplanting trees, creating vegetation screens every 200 m, which provides immediate restoration in black spruce areas, line of sight control and restores connectivity. AESRD recommended minimum disturbance and boring techniques. NGTL mentioned that these activities increase duration of construction. AESRD stated that the timing restrictions should not be used as an excuse not to minimize more impacts. AESRD requested that NGTL coordinate with Grand Rapids on caribou habitat restoration treatments. AESRD requested that NGTL talk to COSIA regarding provincial assessment of CHRPs/effectiveness published in winter 2014/15. NGTL discussed the OMP condition from the NEB and asked if AESRD had any offset ideas. AESRD's preference is for NGTL to restore habitat in the ESAR and on existing ROWs and would prefer that NGTL spend money on minimizing and restoring, and then offsetting on their ROW or neighbouring ROWs. AESRD stated preference of 4:1 ratio.	Section 3	This preliminary CHR&OMP incorporates feedback from previous CHRPs and consultation with AESRD. Transplanting native vegetation is not a suitable CHR&OMP measure since it has been shown to be a difficult technique to implement on a large scale, with marginal results and multiple limitations. In forested areas of the Project footprint where sight lines are 500 m long or more, line of sight blocks will be established. Minimum disturbance construction is a suitable CHR&OMP measure, and will be implemented where scheduling and soil conditions (i.e., frozen) allow. NGTL is considering extending the length of bored crossings to retain vegetation screens though logistical constraints (e.g., alternate access, technology capacity, pipe requirements) might inhibit implementation of this measure. NGTL states commitment to working with Grand Rapids and sharing information to facilitate this.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Alberta Environment and Parks				
Joana Burgar Wildlife Biologist on behalf of Joann Skilnick Senior Wildlife Biologist Fort McMurray, AB	June 17, 2015 Email	In their review of the preliminary CHRP for the Liege Lateral Loop No. 2 (Thornbury Section) and Leismer East Compressor Station Project, AEP suggested that ambiguous terms should be removed from the CHRP. Specify how mitigation measures criteria will be evaluated. EAP standards will be considered for this Project only if all EAP standards, guidelines and best management practices are considered, including Section 8: Wildlife, which states that in forested areas, line of sight should be limited to 200 m on non-roadway linear features. Until a detailed rationale for 500 m line of sight break is provided and deemed effective in mitigating impacts on caribou, target line of sight distance should be no greater than 200 m in forested segments. AEP requested NGTL provide rationale for natural revegetation vs active restoration. AEP expressed concern about activity within the caribou RAP and will not permit this if NGTL has not shown due diligence in completing work outside the RAP. AEP plans status meetings with NGTL every two weeks during construction. AEP expressed concerns about caribou mitigation measures during construction. AEP recommended a caribou monitoring project for the duration of CHRP.	Sections 3, 6, 7 and 8	NGTL has revised this CHR&OMP to be more specific and clear in its approach. Recent lessons learned from implementing restoration measures for the Chinchaga Project have demonstrated that implementing line of sight blocks at these distances is not feasible. Therefore, it is likely that the EAP targets would be unattainable. NGTL has, therefore, substantially revised the decision framework figures in Section 3.5 to incorporate recent experience gained from the Chinchaga Project. Figure 3-4 of the decision framework now clearly prescribes 500 m intervals, which is consistent with the performance indicators in Section 6. Section 3.4 and Section 8 have also been modified to explain why NGTL will not be implementing sightline distances less than 500 m. Active restoration (e.g., tree planting) will be promoted in areas where natural revegetation is not expected to be effective (i.e., in areas where grading will occur).

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Joanna Burgar Wildlife Biologist Fort McMurray, AB Dave Moyles Senior Wildlife Biologist, Peace River, AB	September 9, 2015 Conference call	On learning of the combined CHR&OMP for Project , AEP inquired about the Liege Lateral Loop No. 2 (Thornbury Section) and Leismer East Compressor Station Project CHRP and OMP and why it was not combined.	Section 1	NGTL explained that the Liege Project was already conditioned with the requirement to provide the documents separately. SXP has prepared the CHR&OMP pre-emptively to create efficiencies in the documentation process, gather stakeholder input and obtain NEB feedback before project approval. This is an evolution in the process that NGTL is proposing to the NEB.
		AEP requested whether NGTL will be selecting offset locations on their own properties or on other properties. AEP provided guidance that chosen restoration areas should align with Regional Land Management Plans when they are finalized. i.e., LARP, which prioritize caribou management areas. AEP inquired about what calculations are used in determining offsets.	Section 4.5	NGTL commented that they have worked with AEP to determine areas of offsets that are higher priority habitat restoration areas, and is trying to focus offset efforts in these areas.
		AEP recommended that that site specific measures and offsets that are chosen on a project specific basis are preferred, rather than the overarching strategies and concepts. AEP noted it was beneficial to demonstrate the specific mitigation choices in each situation and their rationale, such as the decision framework in the revised Liege Lateral Loop No. 2 (Thornbury Section) and Leismer East Compressor Station Project CHRP.	Sections 3.5 and 4.5	NGTL briefly described the history of the process and it was suggested AEP review the final OMP for Chinchaga for more detail. The decision framework figures have taken AEP guidance and aimed to visualize the choices and rationale for both restoration and offset measures.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Joanna Burgar Wildlife Biologist Fort McMurray, AB Dave Moyles Senior Wildlife Biologist, Peace River, AB (cont'd)		AEP expressed interest in NGTL using vegetation screening (walking down vegetation and piling with snow) based on experience on the Northwest Mainline Expansion Project which AEP considered to be a valuable mitigation strategy.	Table 3-4	NGTL confirmed that they continue to work on creative ways to maintain vegetation screens in all habitat types. The work on the Northwest Mainline Expansion Project L was done on Timberwolf and it was a trial in the wet black spruce area. It was successful and NGTL would attempt to do it again, however, there are operational constraints (apply to small sections; require cold weather for freezing, high snowfall), and therefore wide spread application is not feasible. Section 3.4 (Table 3-4) explains that vegetation screening (walking over/ramping over vegetation) is considered within the toolbox of restoration measures.
Joanna Burgar AEP, Wildlife Biologist Fort McMurray, AB Grant Chapman AEP, Senior Wildlife Biologist Lac La Biche, Alberta Paul Gregoire EC, Head Program and Planning Coordination CWS	October 7, 2015 In Person Meeting (teleconference support)	Following up to meeting of September 9, 2015. Meeting was held with regional AEP Wildlife Biologists for the Project and the Liege Lateral Loop No. 2 [Thornbury Section] and Leismer East Compressor Station Project. AEP suggested that offset areas would be best placed in the range or the herd that the Project has taken place. AEP inquired whether offsets can be implemented on old NGTL/TCPL lines.	Section 4.5	NGTL chooses offset locations where there is certainty that the area will be preserved in perpetuity. NGTL can often not guarantee that old lines will not be disturbed in the future. NGTL noted they have worked with another department in AEP to determine areas of offsets that are priority habitat restoration areas and will focus offset efforts in these areas.
		AEP noted NGTL's use of photographs and schematics that were presented in the Project CHR&OMP.	Sections 3.4 and 8	Photos and schematics will be included in future documents and will be updated as measures are modified and improved.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
		AEP expects that all companies match each other's best practices across industries.	Section 8.2	NGTL participates in industry research groups where practices are shared across companies. NGTL will continue to incorporate results from scientific studies into restoration and offset measures.
		AEP noted if OMP monitoring is not demonstrating effectiveness, then the monitoring approach must be modified.	Section 7.2	NGTL is committed to the process of adaptive management and will amend monitoring programs and measures if goals are not being achieved.
		AEP and EC representatives were provided paper copies of the Project CHR&OMP for review and future follow up.		

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Environment Canada (now Environment and Climate Change Canada)				
--	April 2, 2012 Meeting	NGTL inquired regarding the alignment of the environmental assessment for the Chinchaga Lateral Loop No. 3 with the Recovery Strategy for caribou. EC indicated that they would be interested in participating in future discussions relating to how Project effects on caribou will be mitigated, and specifically are interested in reviewing and offering advice on reclamation, restoration, and offsetting plans. EC is bound to uphold the Recovery Strategy for caribou.	Section 2	The strategic outcome of the preliminary CHR&OMP is to ensure that habitat restoration and offset measures contribute meaningfully to the conservation and recovery of woodland caribou in Canada. The preliminary CHR&OMP will incorporate feedback from EC that has been gathered from NGTL's consultation regarding caribou habitat offsets for past projects. In addition, NGTL is committed to undertaking direct consultation with EC in relation to the evolution of the planning for the mitigation and offset measures that will be introduced in the CHR&OMP. EC will have opportunity to provide feedback to NGTL on the plan through both the NEB application review process and through NGTL's direct ongoing consultation.
Paul Gregoire Head Program and Planning Coordination CWS	January 17, 2013 Telephone	NGTL provided a history on the development of caribou documents including the CPP, CHRP and OMP. EC informed NGTL of its Conservation Allowances policy and that the Recovery Strategy lays out advice and approach for recovery. EC requested that NGTL focus on critical habitat and guidance from the provincial regulator. EC also informed NGTL that they are not in a position to decide or inform whether critical habitat is/will be restored/offset. EC cannot support destruction of critical habitat but requested to be informed of Projects and that NGTL consult with the provincial regulator.	Sections 4.4 and 4.5	NGLT explicitly incorporates the Conservation Allowances policy directly to calculations of offset area. NGTL continues to work with AEP.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Paul Gregoire Head Program and Planning Coordination CWS	January 23, 2013 Email	EC recommended addressing time delay in context of the ability of restoration to benefit caribou (time sensitive, given current population trends). Given the Threatened status of caribou, greater accountability and due diligence must be reflected accordingly. A mechanism to demonstrate the effectiveness of restoration is warranted.	Sections 4.4 and 4.6	Time delays and the effectiveness of restoration measures have been incorporated into the determination of offset area through application of temporal risk multipliers.
Paul Gregoire Head Program and Planning Coordination CWS	December 6, 2013 Email	In response to the draft final CHRP for the Northwest Mainline Expansion and Leismer to Kettle River Crossover pipeline projects, EC provided written comments on the definition of critical habitat under the Federal *Species at Risk Act* and how it is to be defined within a range, and discussed future Project review documentation needs around boreal caribou critical habitat. EC also outlined mitigation principles and the application of these principals in the hierarchical sequence of avoidance, mitigation and compensation/offsets for any residual environmental effects that cannot be avoided or sufficiently minimized and will not result in the destruction of critical habitat and/or jeopardize the survival or recovery of the species. EC identified that for the Project-specific cases of the Northwest Mainline Expansion and Leismer to Kettle River Crossover pipeline projects, that the application, approval and construction of the projects occurred during a period of transition between the Draft Recovery Strategy for Boreal Caribou (released August 26, 2011) and the final Recovery Strategy (October 5, 2012). The draft Recovery Strategy did not identify the Project areas as critical habitat, whereas the final Recovery Strategy identified the area as likely critical habitat. EC reviewed the draft final CHRP for these Projects and overall agrees with the approaches. EC notes that NGTL will continue consultations with AESRD on the finer details. The biggest challenge identified by EC is in the successful timely implementation of restoration and offset measures.	Section 5	NGTL acknowledges the concerns regarding critical habitat and considers all habitat within a caribou herd range as critical habitat. A schedule of restoration and offset activities in relation to the Project's construction activities is provided in Section 5..

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Paul Gregoire Head Program and Planning Coordination CWS	December 20, 2013 Email	In their review of the preliminary OMP for the Chinchaga Lateral Loop No. 3 Project, EC's comments are as follows: 1. The proponent discusses indirect offsets in the form of Research and Monitoring Programs or other Financial Mechanisms. The estimated population size for the Chinchaga population is 250 animals and is declining and deemed not self-sustaining (Boreal Caribou Recovery Strategy). Only 24% of the habitat is undisturbed. For all populations with less than 65% undisturbed habitat all remaining habitat is considered potential critical habitat unless otherwise identified in a range plan or equivalent evidence. The predicament for the Chinchaga caribou is time sensitive. Although research and monitoring, and other means are important they should not be considered as part of any offset measures for this population. Offsets should be habitat offsets. Critical habitat is habitat necessary for the survival or recovery of the species and should not be destroyed. The final determination on whether critical habitat was destroyed will be made in a Provincial Range Plan, which has yet to be released. It is imperative that all development adhere to the Recovery Strategy goals and objectives. Project review documentation needs to be clear on how boreal caribou critical habitat is being protected and demonstrate, with the support of necessary provincial evidence, that the project will not: • compromise the ability of a range to be maintained at 65% undisturbed habitat • compromise the ability of a range to be restored to 65% undisturbed habitat • reduce connectivity within a range • increase predator and/or alternate prey access to undisturbed areas	Section 4, 10	Indirect offsets in the form of financial mechanisms or population management measures are not considered in the CHR&OMP. Like for like measures in the form of direct habitat restoration or other physical measures that reduce effects of caribou and caribou habitat are considered viable offset measures. NGTL has revised the approach to quantifying effectiveness of offset measures, as well as the calculation of multipliers to address delivery, spatial and temporal risk. The criteria used to determine the multipliers is supported by the literature, previous experience and expert knowledge. The final CHR&OMP will contain the total hectares (ha) that were restored, left for natural regeneration and the direct residual habitat disturbance. Included in the preliminary CHR&OMP are the methods that will be used to calculate residual effect and offset area.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Paul Gregoire Head Program and Planning Coordination CWS (cont'd)		• remove or alter biophysical attributes necessary for boreal caribou 2. EC notes that the proponent has created a model to assess the effects to caribou and to calculate an offset number in hectares. The model is new and, in spite of the survey, the criteria for inherent residual effect, effectiveness, delay penalty, residual calculation, have not been adopted by wildlife management agencies. Therefore EC does not endorse the use of this model. 3. EC requests the proponent provide the hectares that will be restored on the ROW, the hectares on the ROW that will be left to natural regeneration, and the hectares of direct (non-modeled) residual habitat disturbance (e.g., including but not limited to the 6-10 m ROW that must be maintained). EC maintains that a 4:1 offset ratio for residual habitat disturbance/loss is the minimum appropriate for this population to address effectiveness, delay and the threatened status of this population. 4. EC acknowledges in the proponent's preliminary CHRP, where it is determined after 5 years following start of operations that habitat restoration is underperforming and will not reach predetermined goals/trajectory in a timely fashion, that this additional residual disturbance will be added to the total residual habitat disturbance for the purposes of the offsets plan. 5. The approach for the Offset Selection Criteria appears reasonable, save for the above-noted concern with indirect offsets.		

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Paul Gregoire Head Program and Planning Coordination CWS	June 18, 2014 - February 4, 2015; Email	EC clarified that existing habitat is the entire boreal caribou range area minus permanent alterations. Permanent alterations are existing features found within a range, such as industrial and urban developments, permanent infrastructure, and graded or paved roads that do not currently possess or have the potential to possess the biophysical attributes of critical habitat for boreal caribou. For example, forest cut blocks, seismic lines and fire disturbance are not considered permanent alterations.	Sections 3.2 and 3.6	NGTL used this information for the Project disturbance calculations in Section 5.2.
		Determination of whether an activity is likely to result in the destruction of critical habitat will be facilitated by a Provincial range plan. The final determination on whether critical habitat was destroyed will be made in a Provincial Range Plan, which has yet to be released Range plans will outline how the given range will be managed to attain a minimum of 65% undisturbed habitat over time. Without the range plan or equivalent evidence it is not possible to determine if destruction of existing habitat will destroy critical habitat or compromise the ability of the range to be restored to 65% undisturbed habitat. Project review documentation needs to be clear on how boreal caribou critical habitat destruction is avoided and demonstrate, with the support of necessary provincial evidence, that the project will not: • compromise the ability of a range to be maintained at 65% undisturbed habitat • compromise the ability of a range to be restored to 65% undisturbed habitat • reduce connectivity within a range • increase predator and/or alternate prey access to undisturbed areas • remove or alter biophysical attributes necessary for the critical habitat of boreal caribou	Sections 2 and 10	NGTL's caribou habitat restoration investments reduce and offset the predicted residual Project effects and the Project's contribution, in combination with the contributions of others, to cumulative effects on caribou and caribou habitat in a manner that aligns with provincial and federal policies, management plans and priorities.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Paul Gregoire Head Program and Planning Coordination CWS	February 3, 2015 Email	After informing EC of NEB approval for the preliminary CHRP for the Liege Lateral Loop No. 2 (Thornbury Section) and Leismer East Compressor Station Project, NGTL requested EC's preferred method of consultation regarding the CHRP, OMP and CHROMMP. EC requested review of all caribou management plans and management initiatives.	--	The preliminary CHR&OMP incorporated feedback from EC that has been gathered from NGTL's consultation regarding caribou habitat offsets for past projects. Once filed with the NEB, the CHR&OMP will be available for public review and comment through the regulatory review process. In addition, NGTL is committed to undertaking direct consultation with EC in relation to the evolution of the planning for the mitigation and offset measures that will be introduced in the CHR&OMP. EC will have opportunity to provide feedback to NGTL on the plan through both the NEB application review process and through NGTL's direct ongoing consultation.
Paul Gregoire Head Program and Planning Coordination CWS	April 17, 2015 Email	In their review of the preliminary CHRP for the Liege Lateral Loop No. 2 (Thornbury Section) and Leismer East Compressor Station Project, EC had few concerns overall. EC identified concern regarding the method used to quantify residual effects in burned areas, and the implications for quantifying offsets. EC advises that some burned areas might be only 10 years from providing good habitat and the Project could set this area back another 30 years. Therefore, burned areas should not be excluded entirely from the quantification of residual effects and offsets. Additionally, EC advised that there will be a considerable time lag before the plantings in restored areas are effective, and this should be considered in the determination of residual effects and offsets.	Sections 3.7 and 4.4.3	NGTL has quantified direct and indirect spatial residual effects based on preliminary Project information. Final quantification of residual effects will be provided in the final CHR&OMP. The method to quantify residual effects has been refined and outlined in Section 3.7. The temporal aspect of the residual effects is discussed in Sections 3.7 and 4.4.3, and is incorporated in the method used to determine offsets (e.g., offset ratios reflect time lag considerations) as well as residual effects.

Table 1: Summary of Consultation with Federal and Provincial Agencies Related to Caribou (cont'd)

Name and Title	Date and Method	Consultation Related to Caribou	Section in CHR&OMP	Comments and Rationale
Paul Gregoire Head Program and Planning Coordination CWS	May 7, 2015 Email	EC informed NGTL that the project will intersect critical habitat for the ESAR and WSAR ranges which are only 19% and 31 % undisturbed respectively and deemed unsustainable. EC requests to be apprised of matters related to mitigation of caribou habitat destruction in the ERAR and WSAR ranges associated with the Grand Rapids pipeline project. More specifically EC would like to receive and review any Caribou Protection Plans, Habitat Restoration Plans and Critical Habitat Offset plans prepared by NGTL.	--	A preliminary CHR&OMP will be filed with the NEB on September 30, 2015 and will incorporate feedback from EC that has been gathered from NGTL's consultation regarding caribou habitat offsets for past projects. Once filed with the NEB, the CHR&OMP will be available for public review and comment through the regulatory review process. In addition, NGTL is committed to undertaking direct consultation with EC in relation to the evolution of the planning for the mitigation and offset measures that will be introduced in the CHR&OMP. EC will have opportunity to provide feedback to NGTL on the plan through both the NEB application review process and through NGTL's direct ongoing consultation.
Paul Gregoire Head Program and Planning Coordination CWS	June 18, 27, 2014 Email	In their review of the preliminary CHRP for the Liege Lateral Loop No. 2 (Thornbury Section) and Leismer East Compressor Station Project, EC stated that mitigation principles should be in accordance with the following hierarchical sequence: avoidance, mitigation and compensation/offset for any residual environmental effects that cannot be avoided or sufficiently minimized.	Figure 1-3	The mitigation hierarchy is applied to the CHR&OMP.
Paul Gregoire Head Program and Planning Coordination CWS (with AEP)	October 7, 2015	Please refer to consultation summary for AEP for October 7, 2016.		See consultation summary for AEP October 7, 2015