NOVA Gas Transmission Ltd.

Leismer to Kettle River Crossover

Pre-Construction Conditions

Attachment 2

Condition 10(a) – Preliminary Habitat Restoration Plan

PRELIMINARY CARIBOU HABITAT RESTORATION PLAN FOR THE LEISMER TO KETTLE RIVER CROSSOVER PROJECT

October 2012

NOVA Gas Transmission Ltd.

A Wholly Owned Subsidiary of TransCanada PipeLines Limited
Calgary, Alberta

ACKNOWLEDGEMENTS

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1.0 INTRODUCTION

NOVA Gas Transmission Ltd. (NGTL), a wholly owned subsidiary of TransCanada PipeLines Limited, received approval of Certificate GC-120 by Governor in Council on September 20, 2012 for the Leismer to Kettle River Crossover Project (the Project). The Project consists of 77 kilometres (km) of 30 inch (762 mm) outside diameter buried pipeline to expand NGTL's Alberta System to transport sweet natural gas from NGTL's Leismer Compressor Station at LSD 3-4-81-13 W4M to the east tie-in point on the existing NGTL Kettle River Lateral and Kettle River Lateral Loop at LSD 14-26-80-6 W4M, 77 km to the east. Approximately 63 km of this pipeline will be constructed within the provincially-recognized Egg-Pony Caribou Area (Figure 1).

NGTL has prepared this Preliminary Caribou Habitat Restoration Plan (CHRP) in accordance with Certificate Condition 10a (Table 1). The Preliminary CHRP utilizes lessons learned from existing literature on habitat restoration to focus the strategies and actions that can be put in place to promote restoration of disturbed caribou habitat within the boundaries of the Project footprint (i.e., the construction right-of-way [RoW] and temporary workspace [TWS]) in the Egg-Pony caribou area. Based on the literature review, a suite of measures potentially suitable for implementation were identified, and a conceptual guide was developed to identify sites within the Project footprint where certain restoration measures would be appropriate.

This Preliminary CHRP will be followed by a Final CHRP, which will address Certificate Condition 10b. The Final CHRP will expand on the Preliminary CHRP to provide more specific information on the location of restoration sites and specific restoration measures selected, as well as an assessment of residual effects of the Project on caribou habitat. An Offset Measures Plan (Preliminary and Final as per Certificate Condition 18), a Caribou Habitat Restoration and Offset Measures Monitoring Plan (as per Certificate Condition 19), and Monitoring Reports outlining the results of the monitoring plan (as per Certificate Condition 20) will be prepared and filed separately in accordance with the timelines outlined in the NEB Certificate Conditions.

TABLE 1

Certificate Condition 10 – Caribou Habitat Restoration Plan

CARIBOU HABITAT RESTORATION PLAN APPROVAL CONDITION
10. Caribou Habitat Restoration Plan NGTL shall file with the Board for approval, as per the timelines below, preliminary and final versions of a CHRP.
a) A Preliminary CHRP – to be submitted at least 60 days prior to commencing construction. This version of the CHRP shall include, but not be limited to: i) the goals and measurable objectives of the CHRP ii) identification of any suitable immediate, medium-term and long-term caribou habitat restoration methodologies, as well as a literature review and discussion of the effectiveness of the different potential methods; iii) the framework that will be used to identify potential caribou habitat restoration sites and the decision-making criteria that will be used for final site selection; iv) the criteria that will be used to evaluate the effectiveness of the CHRP to determine whether goals have been met; v) a tentative schedule indicating when measures will be initiated and completed; and vi) evidence of consultation with Environment Canada (EC) and Alberta Environment and Sustainable Resource Development (AESRD) regarding the CHRP.
b) A Final CHRP – to be submitted on or before 1 November after the first complete growing season following the commencement of operation of the Project. This updated version of the CHRP shall include, but not be limited to: i) the preliminary CHRP, with any updates highlighted in a revision log; ii) a complete list of the proposed sites for caribou habitat restoration, including a description of the site-specific restoration activities and maps or Environmental Alignment Sheets showing the locations of the sites; iii) confirmation of the rationale used to select the caribou habitat restoration sites; iv) a discussion of the locations or conditions that may present specific challenges; v) a schedule indicating when measures will be initiated and completed; vi) evidence and summary of consultation with EC and AESRD regarding the final CHRP; and vii) a quantitative and qualitative assessment of the area of caribou habitat that was directly and indirectly disturbed as a result of construction of the Project. The assessment shall identify and assess the caribou habitat to be mitigated for as a result of the implementation of the CPP and CHRP, as well as identify the remaining residual effects for which offset measures will be developed as part of Condition 18.

1.1 Guidelines for Boreal Caribou

The CHRP has been developed in consideration of the current regulatory policies specific to caribou. 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, 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 2012) stresses the importance of landscape level planning, such as planning development activities at appropriate temporal and spatial scales, incorporating caribou habitat requirements into fire management plans, establishing key protected areas and 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 2012).

NGTL is continuing to work with ESRD to ensure caribou habitat restoration plans undertaken for this Project align with the provincial caribou policy and the expected provincial implementation plan for caribou within the Athabasca Region. Caribou range plans or action plans will be required as part of the province's requirements under the federal Recovery Strategy.

1.2 Organization of the Preliminary CHRP

This preliminary CHRP is organized into the following Sections to address Certificate Condition 10a:

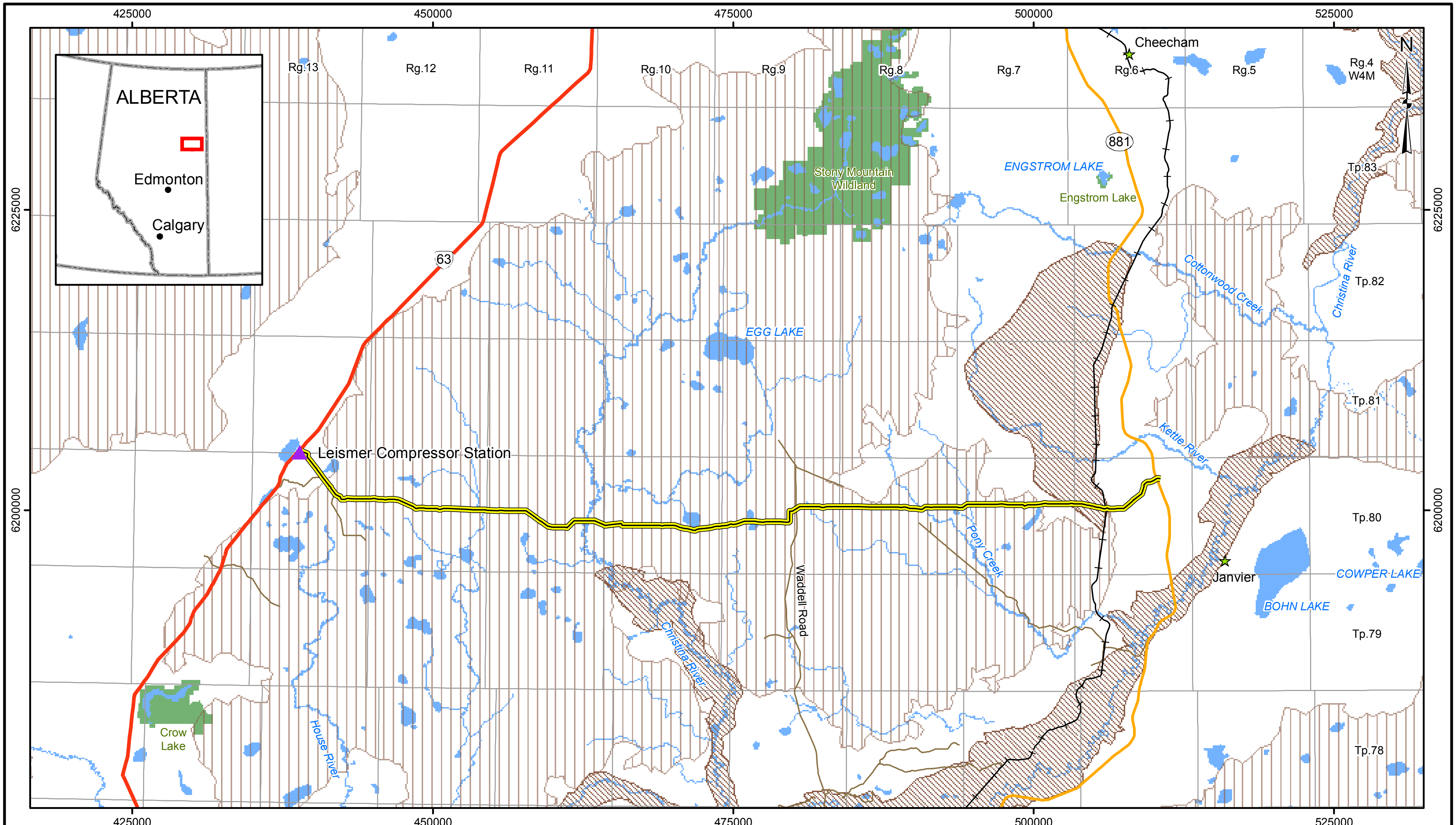
- Section 2.0: introduces the goals and measurable objectives, as well as NGTL's intention to develop a study design that will evaluate the measurable objectives. Greater detail on the measurable objectives is provided in Section 5.0.

- Section 3.0: provides a literature review, which identifies previous and ongoing habitat restoration initiatives and techniques, and their reported successes and failures. Based on the results of the literature review, key results and measures best suited for caribou range are identified. Application of restoration measures will be Project-specific depending on site conditions and not all measures discussed in Section 3.0 may be practical for a particular Project.

- Section 4.0: provides information that is beneficial for planning a CHRP and includes a conceptual framework, as well as Project-specific planning considerations for both pre- and post-construction phases of the Project.

- Section 5.0: provides the measureable objectives and the criteria by which the effectiveness of the proposed habitat restoration measures can be evaluated. Limitations and assumptions specific to the Project are provided in this section.

The Preliminary and Final CHRPs are intended to supplement the measures provided in the Project Environmental Protection Plan (EPP), Caribou Protection Plan (CPP), and the Environmental Alignment Sheets (EAS). The EPP, CPP and EAS were developed in consideration of the Project location within caribou range and, therefore, incorporate the standard best practices for working in caribou range. The CHRP builds on those caribou protection measures to provide detail on NGTL's commitment to restore the Project footprint in the Egg-Pony caribou range and provides potential measures, objectives and criteria for their evaluation.



LEGEND

- FACILITY
- HAMLET
- PIPELINE ROUTE *
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- UNIMPROVED ROAD/TRAIL
- RAILWAY
- WATERCOURSE
- CARIBOU AREA
- KEY WILDLIFE BIODIVERSITY - UNGULATE (MOOSE)
- PARK OR PROTECTED AREA
- WATERBODY

10 0 10

SCALE 1:450,000 KILOMETRES

REFERENCE * NOTE: ROUTE OPTION 1 REVISION 2-7 JULY 19, 2012 .

Alberta digital base datal obtained from AltaLIS Ltd, (2004). First Nations Reserve and Railway data obtained from IHS Energy Inc. Populated places and Transportation data © [2011] DMTI Spatial Inc.Waterbody, Watercourse,Parks and Protected areas © Government of Alberta 2008. All rights reserved. Provincial boundary obtained from GeoGratis,© Department of Natural Resources Canada. All rights reserved. Projection: UTM Zone 12N Datum: NAD 83

PROJECT

TransCanada
In business to deliver

LEISMER TO KETTLE RIVER CROSSOVER PROJECT

TITLE

PROJECT LOCATION WITHIN THE EGG-PONY CARIBOU AREA

Golder Associates
Calgary, Alberta

PROJECT No. 10-1334-0049			SCALE AS SHOWN	REV. 0
DESIGN	BC	10 Jan. 2012	**FIGURE: 1**	
GIS	HP	23 Aug. 2012		
CHECK	BC	23 Aug. 2012		
REVIEW	PB	23 Aug. 2012		

2.0 GOALS AND MEASURABLE OBJECTIVES

The Project will potentially affect caribou in the Egg-Pony caribou area as a result of direct loss of habitat, reduction in habitat effectiveness, and higher mortality risk due to increased access and travel efficiency by humans and predators. The intent of the Preliminary CHRP is to provide information on the potential restoration techniques available, their expected effectiveness and potential suitability for application to the Project footprint to reduce residual effects of the Project on caribou and caribou habitat.

The goals that were identified to reduce the residual effects are:

- Habitat restoration: promote habitat restoration (i.e., native vegetation re-establishment) within the Project footprint in a manner that will achieve successional trajectories toward natural ecosystem types.
- Access control: control access along the Project RoW.
- Line-of-sight blocking: Establish line-of-sight blocks within the Project RoW.

Restoration through accelerated revegetation will address habitat directly disturbed by the Project. By addressing direct habitat loss through revegetation, indirect effects on habitat effectiveness in surrounding habitats are also addressed. Restoration will be achieved by a variety of measures, including construction measures, natural regeneration, site preparation, seeding with woody vegetation species, bio-engineering, seedling planting, etc., which will revegetate the Project footprint with native species.

Measurable objectives provide a means by which the effectiveness of the CHRP measures can be evaluated through monitoring. The following measurable objectives were identified for each of the three goals of the CHRP.

1. Habitat restoration: Restoration measures will be implemented over the entire Project footprint, with the measurable objective of revegetation to achieve successional trajectories toward natural ecosystem types and equivalent land capability in the long-term. However, the amount of the Project footprint available for restoration will be limited in order to align with maintenance practices and Canadian Standards Association [CSA] Z-662-11 (CSA 2011) requirements along the pipe centerline (6 to 10 m).
2. Access control: achieve effective human access control within the Project footprint.
3. Line-of-sight blocking: reduce lines-of-sight along the Project footprint using a combination of long-term techniques (e.g., vegetation screens), and measures that are more effective in the short to medium-term (e.g., constructed visual barriers such as berms combined with vegetation plantings).

Section 5.0 provides detail on the rationale, variables and assumptions associated with the development of the measureable objectives, the criteria by which the effectiveness of the proposed measures can be evaluated, and NGTL's commitments regarding habitat restoration, access control and sight-line management within the Project footprint.

2.1 Preliminary Study Design

In order to evaluate the measurable objectives, NGTL has initiated development of a habitat restoration monitoring study design which will make use of a quantitative assessment framework (Applied Reliability Solutions Ltd. 2012 *draft*). The measurable objectives have been developed to provide overlapping benefits for the assessment of the CHRP goals. For example, habitat restoration treatments will be evaluated for the success of vegetation recovery, as well as for line-of-sight blocking; and access control and visual barriers contructed at specific/strategic locations within the Project footprint will be evaluated using site-specific measures associated with their ongoing function as a sufficient barrier/deterrent.

As the Project traverses a variety of ecosite phases within the Egg-Pony caribou area, and as these ecosite phases will likely require variable treatments and response to those treatments, the restoration treatments will be broke down into restoration units for monitoring purposes The habitat restoration monitoring plan will include both a coarse-scale monitoring component as well as fine-scale monitoring.

Coarse-scale monitoring of the entire Project footprint will be conducted via aerial surveys. The objectives of the coarse-scale monitoring will include:

- identification of site-specific areas, or linear segments along the footprint, that require restoration treatment enhancement, adjustment or additional mitigation (e.g., for erosion or stability issues);
- will provide a baseline assessment of vegetation re-establishment performance and categorize within-treatment condition; and
- will assess localized biophysical features that may affect vegetation re-establishment and performance (i.e., slope, aspect).

Fine-scale monitoring will be conducted on the ground in pre-determined sampling plots within each treatment category and within control plots within adjacent ecosite phases. The objectives of fine-scale monitoring include:

- provide relevant details of vegetation re-establishment for evaluation of growth characteristics and trajectories; and
- to ground truth coarse-scale monitoring observations and confirm coarse-scale data collected on condition of treatment unit.

Fine-scale monitoring will provide the primary mechanism for evaluating the effectiveness of the CHRP. Measureable objectives used to evaluate vegetation re-establishment and performance will be monitored using a repeated measures design over this Project, and likely over several concurrent TCPL Projects (e.g., Northwest Mainline) which have similar caribou habitat restoration plans, to provide statistically suitable data to assess the effect of treatment over year interaction.

Further detail on the study design will be provided in the Final CHRP and the Caribou Habitat Restoration and Offset Measures Monitoring Plan.

3.0 LITERATURE REVIEW

Restoration of disturbed habitat has become one of the key components for caribou conservation identified through the federal Recovery Strategy (Environment Canada 2012) and through provincial boreal caribou recovery planning efforts (Government of Alberta 2011, BC Ministry of Environment 2011). This literature review is intended to provide an understanding of the current knowledge of the value and purpose of habitat restoration in caribou areas, as well as previous and ongoing habitat restoration initiatives, techniques implemented and their reported successes and failures.

3.1 Current Information on Woodland Caribou, Habitat and Human Use

Fitness costs for woodland caribou have been associated with proximity to linear features (James and Stuart-Smith 2000, Whittingham *et al.* 2011, DeCesare *et al.* 2012) and linear features may also factor into the numerical response of caribou populations (Lee and Boutin 2006). Linear features (e.g., roads, pipeline and transmission rights-of-way, seismic and cut lines), in particular, have been associated with increased predator mobility and caribou are, therefore, potentially at greater risk of predation when near or on these features (James 1999, Whittington *et al.* 2011). However, McCutchen (2006) modelled dynamic use of the landscape by wolves, primary prey (moose) and caribou, and concluded that wolves experience no additional advantage accessing caribou from linear features, although they do benefit in accessing primary prey species (i.e., moose). Latham *et al.* (2009) supports this by finding that kill sites were no closer to linear features than random. Habitat is also less effective as it may be partially avoided around access rights-of-way (Dyer 1999, Oberg 2001). DeCesare *et al.* (2012) reported a scale-dependent trade-off such that the ultimate costs to caribou habitat suitability appear relatively less for linear feature-induced changes to the predator functional response (predator kill rate) than forestry-induced changes to the predator numerical responses (predator density). This supports work by Latham (2009) where forest harvest leading to early seral stage regeneration was suggested as one factor leading to increased primary prey abundance (moose and deer), with numerical responses in wolf populations, increased forays into caribou range and subsequent higher predation risk to caribou.

Older forests (40+ years) in peatland complexes are considered primary caribou habitat in the boreal forest. While caribou show a preference for these habitats (Anderson 1999, Bradshaw *et al.* 1995, Culling and Culling 2006, Stuart-Smith *et al.* 1997, Schneider *et al.* 2000, Thomas *et al.* 1996, Tracz 2005), they also use other areas with high lichen cover such as upland jackpine and lodgepole pine stands (Dzus 2001) and areas of lake clusters (Culling and Culling 2006). Caribou evolutionary strategy is understood as selection of low-productivity wintering habitat, (i.e., large continuous peatland areas), creating a spatial separation from other prey species (commonly moose), as a strategy to limit predation risk (Bergerud et al. 1984, Bergerud 1988, Holt and Lawton 1994, Johnson et al. 2001, James et al. 2004, Environment Canada 2008). Indirect habitat loss occurs when good quality habitat is avoided as a result of human disturbance (i.e., reduced habitat effectiveness). For example, some analyses demonstrated that caribou avoidance of areas with human presence/activity may not be temporary (e.g., exploration activities as investigated in Bradshaw *et al.* 1997) but may be longer lasting through avoidance of physical disturbance features (Dyer 1999, Neufeld 2006, Smith 2004). This avoidance of habitat near linear disturbances, wellsites, facilities and cutblocks leads to indirect habitat loss through reduced habitat effectiveness for caribou (Dyer et al. 2001). Wasser *et al.* (2011) (rebuttal in Boutin *et al.* 2012) reported in the East Side of the Athabasca River (ESAR) caribou range that base resource selection probability functions (RSPF) for caribou indicate a positive selection for wetlands, less topographically complex terrain (flatter locales), locations farther from primary roads, linear features associated with no or unknown levels of human use, areas of open black spruce tree cover and pine-lichen ecosystems. In this study, caribou selected areas more for security than nutrition, moose selected for forage cover over security and wolf selected for linear features and deer habitat. Deer and caribou habitat were strongly negatively correlated. Rehabilitation of existing anthropogenic disturbances not currently in use within caribou range is expected to reduce the degradation of functional habitat over the long-term, since caribou will no longer exhibit reduced use on or near (i.e., within a zone of influence) a land-use feature (e.g., Oberg 2001). Restoration of disturbances also 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.

3.2 Recovery and Restoration of Habitat

Mitigating the effects of industrial development (e.g., forestry, seismic, oil and gas, and mining) in the boreal forest has a common challenge: reclamation/restoration of a development footprint that is either a linear feature (e.g., pipeline) or a polygon (e.g., cutblock, mine). A common approach in reclamation of forested land 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, AENV 2011). In relation to oil sands mining in northeastern Alberta, Straker and Donald (2011) and Hawkes (2011) have suggested that current reclamation standards may 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.

Although restoration ecology specific to caribou habitat is a relatively new science, some key initiatives have identified important learnings related to oil and gas development in caribou range. Initiatives have generally focused on revegetation and access control, as well as limiting growth and establishment of plant species favourable to primary prey (e.g., Caribou Range Restoration Project [CRRP] 2007a,b, Golder 2010, Osko and Glasgow 2010). These included tree planting initiatives, coarse woody debris management best practices, habitat enhancement programs and habitat restoration trials in caribou range (CRRP 2007a,b, Enbridge 2010, Golder 2010, 2011, Oil Sands Leadership Initiative [OSLI] 2012). Blocking line-of-sight has been implemented through land use guidelines as a tool aimed at mitigating increased risk of predation in the short-term, while longer term goals of revegetation of lines are achieved. Common among many of these initiatives are learnings on: which plant species to use, and when and where to replant; development of effective techniques to promote natural revegetation; and a better understanding of methods to control access. Lessons learned from these initiatives have been incorporated into large scale habitat restoration projects near Grande Prairie, Cold Lake and Fort McMurray, Alberta.

Table 2 provides a summary of habitat restoration initiatives and the accomplishments and lesson learned.

TABLE 2

Historic and Current Habitat Restoration Initiatives

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
Consortium composed of oil/gas companies, Environment Canada, Alberta Conservation Association, the Alberta Caribou Committee, and Alberta Environment and Sustainable Resource Development [AESRD]) (previously referred to as Alberta Sustainable Resource Development[ASRD])	Caribou Range Restoration Program (CRRP)	Program active from 2001 to the end of 2007. • Mandate was to use an adaptive management approach to restoring caribou habitat while testing methods to speed recovery of man-made linear disturbance. • Involved trials to increase the recovery path of seismic and other linear corridors to treed cover, studying the effect of access management techniques on wildlife and humans, performing a cost/benefit analysis, and drafting recommended operating practices and planning strategies from the construction through to the reclamation phases of oil and gas developments. • Field treatments included: transplanting trees and shrubs, seeding, tree seedling planting, using planting enhancements, soil decompaction, mounding, slash rollback, and installation of wooden fences for line-of-site breaks. • Planning strategies included the use of aerial imagery for collecting vegetation inventories, and developing logistical best practices for tree seedling planting in wetland areas during the summer.	• Tested site preparation techniques as they pertain to promoting revegetation and limiting human use of linear corridors, including excavator mounding, decompaction and slash rollback. • Planted different species of tree and alder seedlings on a number of ecosites on seismic lines and pipelines. Follow-up surveys have shown good survival of most species when planted on native site conditions. • Researched and tested the use of aerial imagery and LiDAR for collecting vegetation inventories on linear disturbances, of which aerial imagery was proven to be successful and adopted for other habitat restoration programs. • Managed the macro-scale Suncor/ConocoPhillips Caribou Habitat Restoration Pilot implemented within the Little Smoky caribou range in 2006: - over 100 km of linear corridors treated, encompassing several townships; - included site preparation techniques (excavator mounding and slash rollback); - included planting of tree seedlings on a variety of different ecosites, treatment types and disturbances. Effectively used helicopters and slings to plant seedlings in predominately wetlands sites and along seismic lines; - included the installation of wooden fences at the beginning of linear corridors to serve as line-of-sight breaks; - focused on access management by using excavator mounding at the beginning of linear corridors; and - installation of signs at treatment sites. • Produced an unpublished draft document on recommended practices for implementing a habitat restoration program, from the planning through to the treatment and monitoring phases. • Produced an unpublished monitoring manual for collecting revegetation data on linear corridors. • Successfully transplanted trees and shrubs during planting trials during winter and summer conditions, on a number of ecosites including treed wetlands. • Sponsored trials of frozen tree seedling planting. Note, since this showed promise, OSLI has sponsored further research and this technique is being implemented as part of the Algar Reclamation Program. • Sponsored trials for the use of encapsulated seed products for reclamation purposes. • Sponsored a line-blocking study, as part of L. Neufeld's Master's Thesis on wolf/caribou dynamics in the Little Smoky caribou range.	CRRP 2007a,b,c,d Neufeld 2006

TABLE 2

Historic and Current Habitat Restoration Initiatives (continued)

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
Suncor Energy	Accelerated Seismic Line Restoration	Program initiated in 2000. • Objective was to promote revegetation of seismic lines through the use of tree seedling planting, bioengineering (willow staking) and transplanting existing vegetation. • Techniques tried on upland, transitional wetlands and wetland ecosites. • No follow-up monitoring beyond this program.	Four years post-treatment: • upland black spruce transplants survived but showed signs of stress; • black spruce and willow plugs worked better than transplants; • poor results for lines with mulch on them; • transitional wetland black spruce transplanting showed high survival but low growth or vigour rate; and • wetland black spruce and willow transplants and plugs had poor survival, but slightly better survival when planted in elevated microsites.	Golder 2005
Canadian Natural Resources Limited (CNRL), Diversified Environmental Services	Ladyfern Pipeline Re-vegetation Program (natural gas pipeline running from northeast BC into northwest Alberta)	Pipeline construction occurred in 2002. • Promoted revegetation on a pipeline development by: minimizing root disturbance during construction; mechanical seeding of the right-of-way (RoW) on areas of erosion concern only; promoting the growth of native species from seed; planting of tree seedlings; and transplanting of existing trees. • Goal was to create line-of-sight breaks as introduced trees grow over time. • Upland habitat: tree seedlings were planted primarily with white spruce and lodgepole pine. • Lowland habitat: planted larger, locally collected and transplanted black spruce.	• Annual monitoring of species composition and percent vegetation ground cover was conducted for two growing seasons. • Survival rates were higher in upland sites than lowland sites (focus on lowland sites was black spruce transplants). • Poor survival of locally collected transplanted black spruce. • Coniferous tree seedling (nursery stock white spruce and lodgepole pine) survival and growth appeared to be more successful than using locally collected transplants. • Natural regeneration in both upland and lowland sites was noted in areas that had minimized root disturbance during construction of the pipeline and where there was no mechanical seeding of grass seed. • Re-colonization of coniferous species provided the best visual barrier; deciduous species effective more quickly. • Recommended that transplants should be conducted in the fall when trees are dormant, but still have sufficient time to establish roots. • Recommended that the most effective method for establishing a line-of-sight break is to concentrate efforts on productive uplands. • Recommended that smaller trees (20-30 cm) be selected for further transplants.	Canadian Natural Resources Limited (CNRL), Diversified Environmental Services

TABLE 2

Historic and Current Habitat Restoration Initiatives (continued)

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
AXYS Environmental	Recommended Peatland Restoration Techniques for Oil and Gas in Boreal Forest	AXYS conducted a literature review of successfully used peatland reclamation techniques within wildlife habitats in the boreal forest.	• A mean water table level higher than 40 cm and preferably within 20 cm promotes peatland growth[1]. • Removing drainage ditches following decommissioning will help restore peatlands[2]. • Water table management is essential to ensure successful re-vegetation of peatlands and to guide the direction of re-vegetation. Soil chemistry adjustment may be required for problem soils[3]. • To achieve improved black spruce seedling growth and environmental quality, use selected mycorrhizal fungi when reclaiming dense black spruce bogs[4]. • Re-establish site hydrology, site topography, and appropriate bog vegetation to reclaim raised bogs. • Patches of discontinuous permafrost (e.g., in northeastern Alberta) are not yet possible to reclaim[5].	AXYS 2003 [1]Tedder and Turchenek 1996 [2]Girard *et al*. 2002 [3]Naeth *et al*. 1991 [4]Khasa *et al*. 2001 [5]Robinson and Moore 2000 [5]Turetksy *et al*. 2000 [5]Camill 1999
Enbridge Pipelines (Athabasca)	Waupisoo Pipeline Habitat Restoration	Pipeline construction occurred in the winter of 2007/08. • Promoted revegetation on a pipeline development within critical moose and caribou habitat by: mechanical seeding of the RoW on areas of erosion concern only; promoting the growth of native species from seed; planting tree and shrub seedlings; transplanting existing shrubs; and using slash rollback for access control and micro-site creation for seedling and seed establishment. • Goal was to use growth of planted trees to create line-of-sight breaks, directly restore habitat and control access.	• Approximately 250,000 seedlings were planted at strategic locations over 3 summers. Locations included: - intersections with other linear corridors; - upland sites to create line-of-sight breaks; and - riparian areas. • Slash rollback was applied on some steeper slopes and at some intersections with all-season and winter roads. • Shrub species (alder and willow) transplanted successfully on the banks of the Christina River during the winter. • Planting sites were subject to monitoring over a five year period. • Good survival of seedlings was observed on all classes of eco-sites. • Vegetation ingress of clover and native grasses has had a negative impact on seedling survival in some areas. • Where no access control measures were applied, human use of the RoW by ATV damaged many seedlings. • Seedlings planted in conjunction with slash rollback were not damaged.	Enbridge 2010 Golder 2011

TABLE 2

Historic and Current Habitat Restoration Initiatives (continued)

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
Canadian Natural Resources Limited, Wolf Lake	Interconnect Pipeline	Pipeline construction occurred during the winter of 2007/08. • Promoted revegetation on a pipeline development adjacent to the Cold Lake Air Weapons Range (CLAWR) by planting of tree and shrub seedlings. • Goal was to use growth of planted tree species to create line-of-sight breaks, limit the overall width of the developed corridor that the pipeline parallels, directly restore habitat and control access.	• Approximately 60,250 seedlings planted at strategic locations over 2 summers. Locations included: - intersections with other linear corridors; - upland sites to create line-of-sight breaks; and - riparian areas. • Planting sites are currently subject to monitoring over a five year period. • Good survival of seedlings where mechanical seeding of grasses was avoided. • Areas mechanically seeded to native grass mixtures had lower survival and vigour of planted seedlings, possibly due to increased competition for sunlight, water and nutrients, and graminoid vegetation laying over and choking out the seedlings when snowfall occurs. • Damage to seedlings from ATV use in many monitoring plots. • Other environmental factors such as frost and wetland encroachment possibly contributing to seedling mortality.	Golder 2012a
University of Alberta led project, supported by a number of oil/gas companies, Canadian Association of Petroleum Producers (CAPP), Forest Resource Improvement Association (FRIA), and Alberta-Pacific Forest Industries Inc. (ALPAC)	Integrated Land Management	• Ongoing study began in 2004 and focused on contributing to best practices for wellsite construction and reclamation on forested lands in the Green Area of northeastern Alberta. Techniques to enable appropriate revegetation and accelerate recovery of ecological processes after disturbance were studied. • Old wellsites component involved monitoring soils and vegetation. • New wellsites component researched methods to use during well-site construction that will promote the prompt revegetation of the site during the reclamation phase.	• Report produced in 2010, “Recommended Practices for Construction and Reclamation of Wellsites on Upland Forests in Boreal Alberta”, that evaluated soil and vegetation responses to different winter construction and reclamation techniques. • Recommendations included: - maximizing low disturbance construction practices; - use of snow/water to level sites as opposed to stripping; - retain root zone when stripping and store soil layers in separate piles; - plant seedlings promptly after reclamation to lessen impact of native vegetation competition; - slash rollback is preferable to mulching; - mulch layers need to be less than 10 cm thick when present; - avoid planting tree and shrub species that may impact predator/prey dynamics and do not occur naturally in the area. For example, planting of species palatable to moose in caribou areas should be avoided; and - pre-disturbance assessments and prescription planning can pay dividends at the reclamation stage.	Osko and Glasgow 2010

TABLE 2

Historic and Current Habitat Restoration Initiatives (continued)

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
OSLI	Faster Forests	Ongoing since 2007, planting trees to increase the pace of reclamation.	• Planting shrubs along with trees allows for trees to grow healthier, faster and with less competition for nutrients and water from fast-growing grasses. • Planted 143,850 seedlings on 113 sites in 2009. • Planted 238,632 seedlings on 120 sites in 2010. • Planted >600,000 seedlings in 2011 on 200 sites (included 4 tree species, 7 shrub species).	OSLI 2012
	Winter Wetland Planting Trial	• Wetlands re-vegetation trials consisting of winter planting of black spruce seedlings to address challenges involved with planting disturbed wetland sites during the summer months. • Goal is to improve reclamation performance.	• Planted 900 trees in winter 2011. - >90% survival rate in spring 2011. • Findings were used to help develop a larger scale frozen seedling program for the on-going Algar Reclamation Program.	
	Algar Reclamation Program	• Program targeting the restoration of seismic lines through re-vegetation and access control to improve wildlife habitat in a caribou area with historic seismic disturbance. • The Algar area of northeastern Alberta covers approximately six townships (each township is 6 miles by 6 miles).	• Inventory of linear disturbance completed using remote sensing methods. • Detailed restoration plan developed. • Stakeholder consultation led by AESRD on the closure of selected seismic lines to the general public (i.e., to provide some level of protection to areas with restoration treatments). • Macro-scale restoration activities concluded in winter 2011/2012 included: • excavator mounding; • slash rollback; and • frozen tree seedling planting. - ~95% survival rate in fall 2012.	

TABLE 2

Historic and Current Habitat Restoration Initiatives (continued)

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
Alberta School of Forest Science and Management / OSLI	Coarse woody debris management - best practices	• Goal is to come up with consistent standards that industry users can implement when spreading woody debris on reclaimed sites.	• Developed a guide for improved management of coarse woody debris materials as a reclamation resource. • Best practices manual was prepared through consultation with resource managers and operators, consideration of economic and ecologic requirements, and synthesis of the most relevant and current scientific knowledge. • Wood mulch depths exceeding 3-4 cm form an insulating layer over the soil surface limiting plant growth. • Use of whole logs enhances forest recovery by creating microsites, which creates improved conditions for vegetation to establish and grow. • Total rollback of material along the entire length of exploration and access features is the most effective way to discourage recreational use of linear features. • Well designed scientific monitoring of wildlife use is needed to provide managers with an understanding of treatment effectiveness.	OSLI 2012

TABLE 2

Historic and Current Habitat Restoration Initiatives (continued)

Company or Group	Initiative Name or Goal	Description	Accomplishments and/or Learnings	Key Reports
Canadian Natural Resources Ltd. (CNRL)	Habitat Enhancement Program	• Program is part of the Terms and Conditions of the *Environmental Protection and Enhancement Act* (*EPEA*) approval for the construction, operation and reclamation of the Canadian Natural Primrose and Wolf Lake (PAW) Project. • Program targeted the restoration of seismic lines, old lease roads, and abandoned well and core hole sites through re-vegetation and access control to improve wildlife habitat on a caribou range within the CLAWR. • Focused on restoration of historic (pre-oil sands development) features on the landscape that are recovering poorly, either due to environmental conditions (cold, wet soils), historical clearing and reclamation practices, or recent clearing for winter access. • Focused on areas outside of 10 year development plan to avoid re-entry into areas where restoration treatments are placed.	• Used aerial imagery to conduct linear corridor vegetation inventories on all of CNRL's CLAWR operations, encompassing approximately nine townships. • Detailed restoration plan developed. • Ground-truthed sites that appeared on aerial imagery as having little to no woody plant regeneration. • Focused on access control and micro-site creation for introduced tree seedlings, using the following three treatments: - mounding; - tree seedling planting; and - slash rollback. • Planting sites are subject to monitoring over a five year period. • To date, monitoring has only occurred for black spruce seedlings planted in the summer on sites treated in the winter with excavator mounding in treed bog and fen sites. • Excellent survival and vigour of seedlings after one growing season at all monitored sites. • Additional site preparation and seedling planting scheduled for 2013.	Golder 2010
ConocoPhillips, Suncor Energy, and the Canadian Association of Petroleum Producers	Caribou Habitat Restoration Pilot Study	• Remote camera study (summer 2008) initiated within the Little Smoky caribou range in Alberta. Objectives included comparing wildlife (caribou, deer, moose, bear, wolf, coyote, cougar and lynx) presence and use between naturally restored seismic lines and open cutlines.	• Pooled prey species (caribou, deer, moose) preferentially select restored seismic lines (>1.5 m vegetation heights, average age of trees 23 years) over non-vegetated sites. • Deer had the strongest preference for restored sites, with the preference attributed to the increased forage within the restored sites, as well as reduced line-of-site and potentially predator avoidance. • Caribou were shown to have a slight preference for re-vegetated seismic line sites over non-vegetated sites, but with limited data there was no statistical difference. However, caribou on control sites were observed to be running much more frequently than on re-vegetated sites and engaged in standing related behaviours only while on re-vegetated sites. Data indicate that caribou are more likely to travel quickly through open seismic lines, which may be a response to the minimal vegetation cover.	Golder 2009

Note: Table modified from Golder 2012b.

3.2.1 Key Results

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 creating microsite conditions (i.e., mounding) that are conducive to seedling growth and natural vegetation encroachment (CRRP 2007b, OSLI 2012). Measures such as slash rollback can address site condition issues including competition from non-target or undesired plant species, erosion, frost, and heat or moisture deficiencies (CRRP 2007b). Natural revegetation and successful planting initiatives have also benefited from construction practices that minimize disturbance during development of the footprint. Minimal disturbance pipeline construction techniques that avoid grubbing and grading are effective at facilitating rapid regeneration of native vegetation within the RoW, in particular in deciduous habitats (TERA Environmental Consultants [TERA], 2011, 2012). A trial natural revegetation response inventory program in west central Alberta reported that 85% of disturbed sites did not require artificial recovery, since a natural recovery projection was observed on previously disturbed sites (CRRP 2007c). Although regenerating conifers provide a better visual barrier, the faster growth rates of deciduous species provides for effective results more quickly (Diversified Environmental Services [DES] 2004). Recent research suggests that planting shrubs along with trees allows trees to grow healthier, faster and with less competition for nutrients and water from fast-growing grasses (OSLI 2012). It may also provide important habitat benefits for wildlife, compared to only planting tree seedlings, by providing hiding cover (Bayne *et al.* 2011).

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 2012b):

- 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); and
- other treatments, such as seeding and seedling planting, have been shown to be more successful in comparison.

Seismic lines have been reported to have very slow reforestation rates (Revel *et al.* 1984, Osko and MacFarlane 2000), and recovery is strongly influenced by the characteristics of the adjacent forests (e.g., site productivity, tree and shrub species and heights) (Bayne *et al.* 2011). Conventional seismic lines cleared by bulldozer may 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), drainage of sites (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 (Revel *et al.* 1984, MacFarlane 1999, 2003, Sherrington 2003, Lee and Boutin 2006). 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.

The ability of linear features to recover to a natural forested state is affected considerably by human use. Oberg (2001) identified that recovery of conventional seismic lines to functioning mountain caribou habitat occurs within 20 years following disturbance in west-central Alberta. Golder (2009) reports that in the Little Smoky caribou area, seismic lines that were allowed to regenerate naturally achieved an average height of 2 m, across all ecosite types, within 20 to 25 years, when they had not been recently disturbed by human activity (e.g., re-cleared to ground level for winter access or seismic program use). The average age of trees on the control lines 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, 2012a).

Subjective expert ratings suggest that effectiveness of most physical access control measures (e.g., gates, berms, excavations, rollback, visual screening) vary considerably between negligible and high effectiveness in controlling human access (Caribou Landscape Management Association [CLMA] and the Forest Products Association of Canada [FPAC] 2007). Effectiveness of access control measures are likely dependent on suitable placement (e.g., placed to prevent detouring around access control point), enforcement, and public education of the intent of the access control, which facilitates respect of the control measures (AXYS 1995). 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 (review in CLMA and FPAC 2007). Excavator mounding is a well researched and popular site preparation technique in the silviculture industry (Macadam and Bedford 1998, Roy *et al.* 1999, MacIsaac *et al.* 2004). Target density of mounding for access control and/or microsite creation purposes can vary from 1,400 to 2,000 mounds/ha (AENV 2011). Switalski and Nelson (2011) monitored human access on open and closed (i.e., gated, barriered and recontoured) roads using remote cameras, and 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. Results of that study also indicated significantly higher levels of hiding cover and lower line-of-sight distances on barriered and recontoured roads compared to open roads (Switalski and Nelson 2011). Physical access control 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, Sherrington (2003) suggested they no longer facilitate ATV access.

The above techniques to block human access also contribute to initiatives to block line–of–sight. Short-term management for access and line-of-sight blocking should ultimately lead to long-term access control by way of regeneration within disturbed areas (CLMA and FPAC 2007). Expediting growth of visual barriers along linear features can be achieved by concentrating reclamation efforts on productive upland habitats, since conifer and shrub (e.g., alder) species grow more quickly on these sites compared to lowland sites. Although regeneration of conifer species provides the best year round visual barrier, their growth can be slow. Therefore, encouraging deciduous woody species growth is important to quickly establish visual barriers in the short-term.

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 was conducted in the Little Smoky caribou area to measure the 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 to control lines (i.e., vegetation regrowth of 0.5 m or less), and in general, control lines were used primarily for travel (i.e., both predators and prey species were constantly moving as opposed to standing, foraging, etc.). 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. Golder (2009) suggested that moose and deer may have been attracted to the revegetated lines for forage availability and perceived cover protection. The preference for regenerating seismic lines by wolves may be explained as a response to increased prey use of these lines (Golder 2009). The study also showed that caribou travelled more quickly (running more frequently) and did not engage in standing-related behaviours on control lines, whereas on revegetating lines running was rare and standing-related behaviours occurred more often.

To date, vegetation recovery in the medium and long-term following the creation of pipeline rights-of-way or other industrial activity has been poorly documented. Lack of time sequence recording for regenerating seismic lines and other developments reduces the ability to estimate natural rates and types of vegetation recovery. The focus of most initiatives has been on establishing vegetation along pipelines or seismic lines, with the goals of creating line-of-sight breaks, directly restoring habitat with transplanted vegetation, planting shrub and tree seedlings, sowing native shrub and tree seed, and controlling human access to reclaimed areas to allow undisturbed vegetation growth. Due to the lack of monitoring and the time lag that exists to restore caribou habitat, there is currently no direct link to indicate that implemented restoration treatments are having a positive effect on caribou populations. However, based on modelling scenarios of management options for caribou, restoration of habitat should have benefits in the long-term by contributing to the restoration of large contiguous habitat patches that are preferred by caribou.

3.2.2 Best Suited Restoration Methods and Knowledge Gaps

Based on the review of industry initiatives in habitat restoration, a suite of habitat restoration measures that are considered best suited for caribou areas have been identified and are provided in Table 3. Transplanting of native vegetation has not been included since it has been shown to be a difficult technique to implement on a large scale with marginal results.

The literature review also provided the opportunity to identify knowledge gaps. These have been identified as:

- reclamation criteria (e.g., defined guidelines or measurable 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 control and line-of-sight management; and
- long-term monitoring of vegetation recovery on linear disturbances.

TABLE 3

Habitat Restoration Methods Best Suited for Caribou Area

Type of Mitigation Prescription	Objective(s)	Specifications	Comments	References
Minimum disturbance construction	• erosion control • reduce line-of-sight • facilitate rapid revegetation of native vegetation • maintain natural drainage	Grubbing on the right-of-way (RoW) is restricted to the trench width, allowing the integrity of the root layer to be maintained on the majority of the RoW, and allowing rapid recovery of herbaceous and deciduous woody vegetation species. Snow padding or matting on work areas of the right-of-way can be used to avoid the need for grubbing, and protect shrubs and small trees.	Construction during winter conditions reduces the need for soil salvage and grading, and the width of grubbing is limited to the trench area. Reduced disturbance to vegetation and root systems by cutting, mowing or walking down shrubs and small diameter trees at ground level facilitates rapid regeneration of vegetation. Use of snow padding or matting in select locations limits the need for cutting or mowing shrubs and small trees, and facilitates regeneratioin of native vegetation.	Results of preliminary field evaluation one growing season following construction on the Horn River Pipeline Project (TERA 2012).
Excavator mounding	• create microsites in areas where it is deemed to be effective for enhanced survival and growth of planted seed and seedlings, and natural regrowth of woody species • access control	For access control purposes, mounds should be created using an excavator. Mounds should be approx. 0.75 m deep, if feasible. The excavated material is positioned right beside the hole. Target density of mounding for access control and/or microsite creation purposes can vary from 1,400 to 2,000 mounds/ha.	For the purposes of enhancing microsites for planted seedlings, mounding is a well researched and popular site preparation technique in the silviculture industry. It is commonly used in wetter, low-lying areas to create higher, better-drained microsites for seedlings. Mounding treed fen and bog areas can enhance a site to promote natural revegetation over time, as higher, drier spots are created that seed can eventually settle into and germinate. Mounding has been used as an access control measure on old roads and seismic lines to discourage off-road vehicle activity. It is effective immediately following implementation.	Macadam and Bedford 1998 Roy *et al.* 1999 MacIsaac *et al.* 2004 Golder 2010 OSLI 2012
Bio-engineering	• access control • erosion control • reduce line-of-sight • restore habitat	Species of vegetation and densities utilized are site dependent.	Bio-engineering is the use of existing live vegetation to revegetate a site (e.g., transplants; installing cuttings). Vegetation used is either found at the site to be treated, or collected nearby in the form of cuttings. Willows and poplar can be used as cuttings. Both species are fast growing, which establishes line-of-sight breaks quickly and works well for riparian restoration. Bio-engineering is considered a medium to long-term restoration treatment.	DES 2004 Golder 2005, 2011 Polster 2008
Tree/shrub seeding	• access control • erosion control • reduce line-of-sight • restore habitat	Species and application rates required are site dependent.	Seeding is considered a long-term restoration treatment. Application rates and preferred sites for seeding require further investigation.	CRRP 2007a Golder 2012a

TABLE 3

Habitat Restoration Methods Best Suited for Caribou Area (continued)

Type of Mitigation Prescription	Objective(s)	Specifications	Comments	References
Tree/shrub seedling planting	• access control • erosion control • reduce line-of-sight • restore habitat	Determination of which species to plant is determined at the planning stage of a restoration program. Species are determined based on the adjacent forest stand and restoration objectives (e.g., low palatability for ungulates). Appendix A summarizes reclamation considerations specific to a selection of potentially suitable tree and shrub species. Shrub and tree seedlings are often planted together, depending on site conditions and anticipated natural revegetation of both species.	Seedling planting is considered a long-term restoration treatment due to the length of time it takes to establish effective line-of-sight breaks, hiding cover and access deterrents.	AENV 2010, 2011 CRRP 2007a DES 2004 Golder 2005, 2010, 2011, 2012a OSLI 2012
Berms	• access control • reduce line-of-sight • create microsites and protection for natural seed ingress and vegetation growth	Berms may be constructed of slash and timbers, or a combination of slash and earth. Supported berms are constructed using timber cleared from the RoW. Construct berms to an approximate height of 2 m. Promote rapid shrub/tree regeneration at ends of berms (e.g., bio-engineering, seedling planting) to increase effectiveness as access control.	Feasibility of slash/timber berms is dependent on approval from provincial authorities to retain and pile slash onsite, and retention of sufficient quantities of slash onsite during construction. Availability of source material is unlikely sufficient for earth berm construction in areas where minimal disturbance construction techniques are employed. Earth berms should not be located in peatlands to avoid potential for settling and alteration of surface hydrology. Berms are effective immediately following implementation.	Tera 2011 Westland Resource Group 2011

TABLE 3

Habitat Restoration Methods Best Suited for Caribou Area (continued)

Type of Mitigation Prescription	Objective(s)	Specifications	Comments	References
Slash rollback	• control of human access during snow free periods • erosion control, particularly along steep slopes • protect planted seedlings from extreme weather, wildlife trampling, and damage from off-road vehicles (human access) • provide nutrients to introduced planted seedlings as the slash decomposes over time • provide microsites for natural seed ingress	Spread slash evenly across the entire RoW width. Ensure woody debris is consistently dense enough on the ground to discourage ATV use along a RoW. Osko and Glasgow (2010) recommend slash loads do not exceed 400 tonnes/ha. Locations where slash rollback are considered effective include the following: • on each side of an intersection with a linear feature that is not an all season road; • for 100 to 200 m or more on each side of roads and permanent watercourses crossed by the RoW; • on segments of the RoW that deviate from paralleling existing linear features (i.e., new cut) to discourage new access trails from developing; • on slopes > 10%; and • on temporary access (i.e., shoo-flies) and false rights-of-way created for vehicle crossings of watercourses. Implement along segments left for natural recovery (e.g., areas that are not graded, have low erosion potential, are located within wetlands), as well as segments that are seeded and/or planted with seedlings (e.g., upland areas that are graded, upland and lowland areas where adjacent vegetation is characterized by a treed component).	The length of a slash rollback segment is dependent on sufficient quantities of slash during clearing of new disturbance and the trade-off between its use and the ability/space to store it during construction. Longer segments are a more effective treatment at controlling human access since ATV riders will be less inclined to try to ride through the slash or traverse around the slash in adjacent forest stands if slash continues for an extended distance. Slash rollback can also conserve soil moisture, moderate soil temperatures and provide nutrients as slash rollback decomposes, prevent soil erosion, provide a source of seed for natural revegetation, provide microsites for seed germination and protection for introduced tree seedlings, and protect seedlings from wildlife trampling and browsing. Slash rollback is effective immediately following implementation.	CRRP 2007b Enbridge 2010 Osko and Glasgow 2010 Golder 2010, 2011 Government of Alberta 2012 OSLI 2012

4.0 PLANNING CONSIDERATIONS

4.1 Habitat Restoration Measures and Site Selection

Preliminary conceptual and Project-specific frameworks were developed to guide the process of identifying areas for habitat restoration measures in caribou range. These frameworks considered best management practices, Project design and construction techniques, industry standards (i.e., CSA Z-662-11), and preliminary habitat information.

Conceptual Framework: A preliminary decision framework that identifies suitable habitat restoration measures that could be applied to pipeline projects in caribou range (Figure 2). Dependent on the habitat type and construction factors present on a particular project, potentially suitable restoration measures were identified. The conceptual framework outlined in Figure 2 demonstrates the conditions that can be encountered and the corresponding restoration measures that can be applied for any pipeline project in boreal caribou range. The conceptual framework identifies an iterative process between the restoration measures and monitoring and adaptive management. Monitoring and adaptive management will facilitate identification of unsuccessful restoration techniques, microsite conditions that are either not conducive or suitable for establishment of vegetation, and measures that need to be adjusted or supplemented to achieve the goals of the CHRP. Refer to Section 5.4 for additional details on Monitoring and Adaptive Management.

Project-specific Framework: Initial restoration units and associated suitable restoration measures were identified using Project information specific to the Egg-Pony caribou area. The purpose was to identify Project-specific habitat types, construction factors and potential restoration measures that may be applied based on the conceptual framework (Figure 2). Details on the restoration units identified for the Project within the Egg-Pony caribou area are provided in Appendix B, Table B. This information was used as the basis for developing a measurable objective for restoration of the Project footprint for the Preliminary CHRP, and will be further refined for the Final CHRP.

4.1.1 Project Considerations

Certain opportunities and constraints exist for applying site-specific restoration measures for the Project. Site-specific factors that may influence restoration measures and locations include the following:

- monitoring and access requirements for operation and maintenance;
- locations that are identified by other resource users for future developments (i.e., publicly disclosed, applied for and/or approved but not yet completed projects) that would require habitat disturbance within or adjacent to the Project footprint;
- locations that are considered traditional access;
- intersections of the Project footprint with other linear features where access control and line-of-sight breaks will be applied;
- locations adjacent to watercourse crossings, where extending riparian construction methods and restoration efforts beyond the riparian area is feasible;
- moderate to high suitability caribou habitat (e.g., suitable forage, adequate cover/security, located away from human disturbance);
- areas that are accessible by the restoration crews and equipment; and
- the availability of suitable material and provincial regulatory approval for rollback and berms.

Final site selection for the habitat restoration measures will require as-built construction information to allow for validation of site-specific conditions, and input from the NGTL construction and operation/maintenance staff, Project biologists and reclamation specialists, as well as AESRD representatives. A thorough review of site characteristics will facilitate determination of the suitability of particular sites for restoration, and selection of appropriate restoration treatments.

4.2 Access Control and Line-of-Sight Blocking

Techniques that reduce human access and lines-of-sight also contribute to restoration of habitat in caribou range. These are discussed below and are part of the framework on Figure 2.

Access Control

Access control measures along the Project RoW will include rollback, vegetation planting, mounding or installation of berms (Figure 2). Locations for access management measures will focus on intersections with other linear features, such as roads, utility right(s)-of-way, seismic lines or watercourses. For the segment of the RoW within the Egg-Pony caribou area where the Project is contiguous with another NGTL pipeline RoW for 14.3 km, existing access control measures on the adjacent RoW should be extended to include the Project footprint. Since public awareness of the reasons for access restrictions may influence the effectiveness of access control measures, signs will be installed in appropriate locations to facilitate understanding and respect for access closures.

Planning considerations during the preconstruction phase include limiting the creation of new access for construction activity and identifying existing intersecting linear features. Preliminary locations for retention of rollback will be reviewed and refined in the field prior to construction by the Environmental Inspector and construction manager, based on factors such as availability of material and storage space.

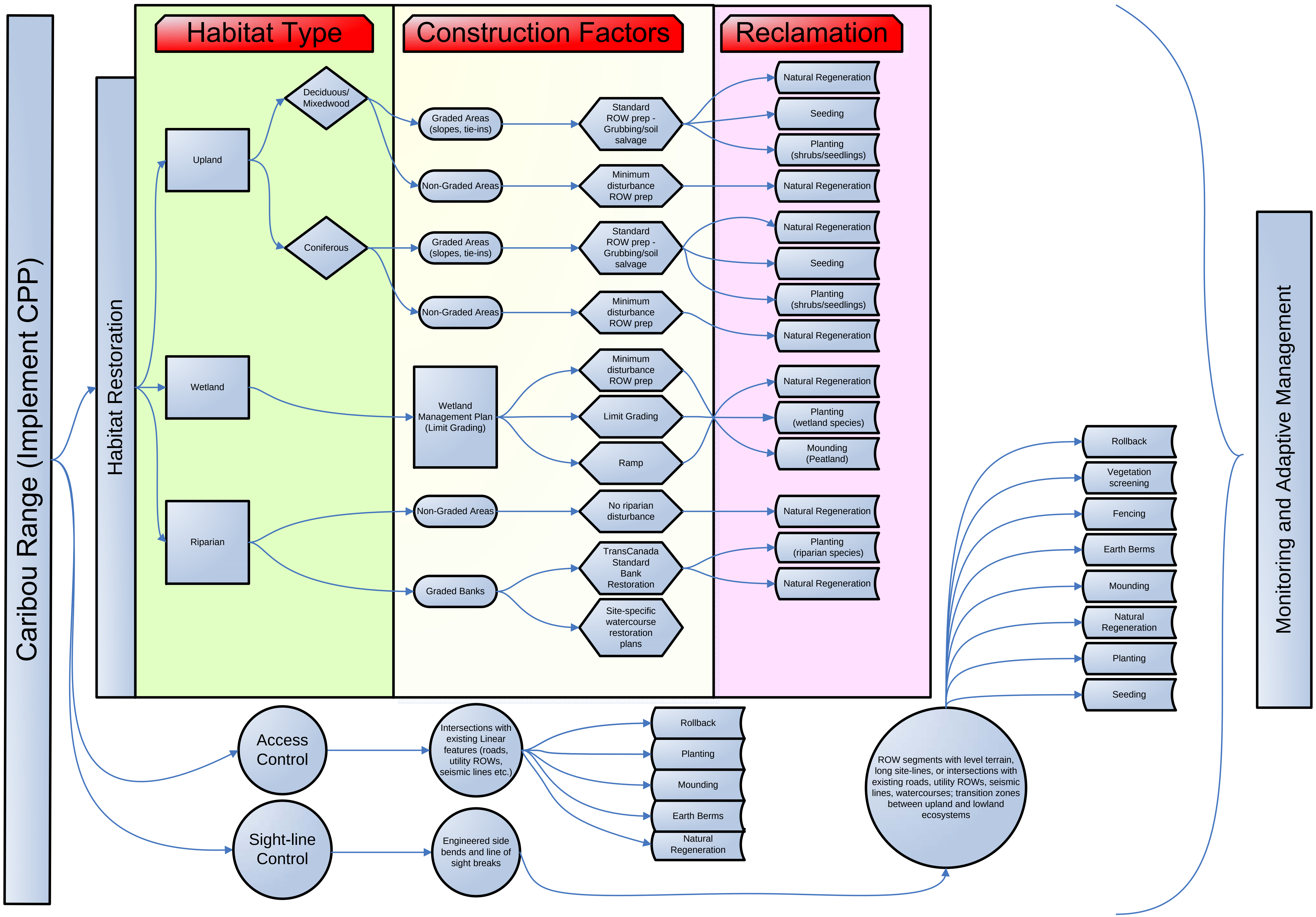
Line-of-Sight Management

Measures to reduce sight-lines may discourage human use and may also decrease predator efficiency. Appropriate locations for line-of-sight blocks include transition zones between upland forest and muskeg/black spruce forest, areas with level terrain that have long sight-lines, and where the pipeline loop intersects an existing road or other linear feature. Bends in the right-of-way (e.g., dog-legs) are an effective method of limiting line-of-sight distances. Line-of-sight can also be reduced through the use of short-term measures (e.g., slash or earth berms constructed to an approximate height of 2 m; fences) and/or long-term measures (e.g., vegetation screening). Although slash berms and fences can be an effective measure to create immediate breaks in lines-of-sight (Tera 2011, Westland Resource Group 2011), the feasibility of their use is limited by increased fire hazard and pest outbreak risks. Berms and fencing may not be feasible in some situations such as lowland (e.g., muskeg) areas where surface drainage may be affected and/or the peat substrate does not support fencing material. Earth berms may also be impractical if sufficient source material is not available, which is often the case in locations where minimal disturbance construction is employed (i.e., reduced surface disturbance and grading). Spreading of weed seeds is also a concern associated with earth berms that are constructed using imported material. In consideration of these factors, the installation of earth berms is not a practical approach in many cases. Vegetation screening, combined with bends in the right-of-way, are better suited for reducing line-of-sight in caribou range. In addition to natural regeneration, vegetation screens that avoid forage species (e.g., willows, legumes) attractive to ungulates can be planted across the RoW.

Planning considerations during the preconstruction phase for the Project include the feasibility of dog-legs and identifying potential candidate sites for short-term (e.g., slash, fences or berms) and/or long-term measures (e.g., vegetation screening) for line-of-sight blocks. Based on previous experience (i.e., NGTL Horn River Project), the final locations for slash, berms or vegetation screening are most effectively determined post-construction when final clearing is complete.

For this Project, the final locations where access control and line-of-sight measures will be implemented and/or improved will be included in the Final CHRP, in accordance with Certificate Condition 10b(ii).

Figure 2 Conceptual Guide for Habitat Restoration Measures in Caribou Range



5.0 CRITERIA TO EVALUATE EFFECTIVENESS

This section provides additional detail on the measurable objectives, including criteria for evaluating the measurable objectives, as well as a discussion of the rationale for the identified objectives and criteria, and associated uncertainties. A summary of the measurable objectives identified for the Project and evaluation criteria are provided in Table 4. In the event that provincial guidelines related to restoration objectives and measures are updated, Table 4 will be re-evaluated for the Final CHRP in consideration of any updates.

5.1 Habitat Restoration

NGTL's commitments to caribou habitat restoration for the Egg-Pony caribou area are summarized in Table 4. The restoration units used to derive the initial restoration targets in Table 4 are provided in Appendix B, Table B.

The Reclamation Assessment Criteria for Pipelines (AENV 2001, AENV 2010) 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, vegetation composition and organic matter (etc.). Evaluation criteria have been identified (Table 4), and are expected to vary depending on the site conditions. For example, the target stem density will vary for different sites, depending on the characteristics of the location and adjacent habitat (e.g., lower stem density naturally occurs in some lowland forests).

Based on the literature review (Section 3.0), previous project experience and NGTL's commitment to implement minimal surface disturbance construction techniques, the Project footprint is expected to revegetate naturally in areas of upland deciduous and mixedwood forests, and in graminoid and shrub-dominated wetland communities. Additional restoration treatment measures such as site preparation (e.g., mounding) and planting trees/shrubs will be implemented in transitional and treed lowlands, and potentially in graded areas, to accelerate revegetation and achieve the measurable objectives of habitat restoration. The actual proportions will be defined in the Final CHRP.

The measurable objectives in Table 4 specifically related to habitat restoration should be considered preliminary and subject to change. Restoration targets and evaluation criteria are affected by variables such as the extent of grading, the potential need for clearing of access over the centreline of pipe (i.e., 6 to 10 m wide area centred over the pipeline) and shared workspace on adjacent existing linear corridors. Assumptions are made in order to address uncertainty. Table 4 includes a summary of rationale and assumptions included in the development of measurable objectives and effectiveness criteria for habitat restoration. Additional variables that may be encountered over the course of this process and identified through consultation with AESRD and Environment Canada will be addressed in the Final CHRP.

Some grading is expected to facilitate Project construction. The extent of grading is influenced by a number of factors such as terrain variability and weather conditions. A detailed grade plan cannot be completed until clearing of the RoW is completed. The grade plan will be prepared by the contractor and approved by NGTL. The implementation of measures outlined in the EPP designed to limit grading to the maximum extent feasible are expected to reduce the extent of grading. Areas of grading will be delineated in the grade plan and identified and addressed in the Final CHRP.

5.2 Access Control

Access control measures are most effective, and strategic from a linear feature re-vegetation perspective, when implemented at intersections of the Project RoW with existing perpendicular linear features (e.g., roads, utility corridors, seismic lines, etc.). Given that the pipeline parallels or overlaps existing rights-of-way and seismic corridors for nearly 100 % of the RoW within the Egg-Pony caribou area, with new cut restricted to small lengths for river crossing purposes, avoiding existing infrastructure (e.g. well-sites), or line-of-sight break creation, the issues associated with the creation of new access opportunities are avoided. Subjective criteria ratings (Table 4) were developed to evaluate the effectiveness of access control measures.

TABLE 4

Evaluation Criteria for Measurable Objectives

Measureable Objective/Project Implementation[1]	Rationale / Limitations / Assumptions	Evaluation Criteria
• Based on a review of the restoration units (Appendix B, Table B), preconstruction survey drawings, and NGTL's commitment to minimum disturbance construction, NGTL estimates the following proportion of restoration measures will be undertaken on the Project footprint: ◦ ~8 % of the available[2] footprint = natural regeneration (upland deciduous and mixedwood areas); ◦ ~24 % of the available[2] footprint = combination of natural encroachment/revegetation from the existing adjacent seed bank and strategic seeding/planting of coniferous species (upland coniferous areas); ◦ ~46 % of the available[2] footprint = combination of natural regeneration, site preparation techniques (e.g., mounding and slash rollback to create microsites) and strategic seeding/planting of tree/shrub species (transitional and treed lowlands); and ◦ ~21 % of the available[2] footprint = natural regeneration (wetlands including open water wetlands and graminoid or shrub-dominated lowlands).	• Successful native vegetation re-establishment through the set of habitat restoration measures proposed will achieve trajectories toward natural ecosystem types, which will eventually re-establish native wildlife habitat. • NGTL's operation and maintenance practice includes vegetation control over the pipe centreline (approximately 6-10 m wide area centred over the pipeline) (TCPL 2011) as a corporate mechanism to meet compliance with CSA-Z662-11. This Standard requires that vegetation shall be controlled along rights-of-way to maintain clear visibility from the air and provide ready access for maintenance crews (CSA 2011). Although there is flexibility in NGTL's vegetation control practice to allow for wildlife habitat objectives yet remain in compliance with CSA-Z662-11, NGTL acknowledges limitations for sustained revegetation success along the pipe centreline while the pipeline is in operation. NGTL understands its obligations for achieving equivalent land capability at the end-of-life of the pipeline. • Although restoration measures will be undertaken across the entire Project footprint, given the expectations for intermittent maintenance on the pipe centreline (discussed above), NGTL anticipates that approximately 70 % to 82 %[3] of the footprint will be available for sustained revegetation during the operational life of the pipeline. • The length of right-of-way requiring grading cannot be accurately determined prior to clearing, however, the extent of grading is anticipated to be limited given the low-grade nature of the terrain. Therefore, the proportion of the right-of-way requiring grading is excluded from the estimated restoration for the purposes of this Preliminary CHRP. • Areas of the Project footprint that parallel existing footprints with grass cover may have limited successful survival of planted species, due to competition from species ingress from adjacent disturbance. • Overlapping dispositions such as a gravel roads or facilities may limit long-term restoration prior to end-of-life.	• A statistical analysis, such as repeated measures design, will be used to assess regeneration success within each regeneration treatment type. Quantitative measures of success will include comparisons of regeneration parameters (e.g., vigour, height, percent cover, species composition) between years 1, 3 and 5 post-construction with the objective of ensuring the natural growth trajectory of each habitat type. and a trend towards achieving equivalent land capability • GPS location, number and type of restoration treatments and the frequency of monitoring sessions will be defined and mapped in the Final CHRP.

TABLE 4

Evaluation Criteria for Measurable Objectives (continued)

Measureable Objective/Project Implementation[1]	Rationale / Limitations / Assumptions	Evaluation Criteria
• Access control measures will include rollback, vegetation planting, mounding or installation of berms (Figure 2). Refer to Section 4.2 for additional information.	• Access control measures are most effective when implemented at intersections of the Project right-of-way with existing perpendicular linear features (e.g., roads, utility corridors, seismic lines, etc.). Approximately 70 of these sites have been identified as candidates for access control measures and are identified on the Environmental Alignment Sheets prepared for the Project. Final locations for treatment will be determined during and/or following construction when more is known about site conditions and available materials that may be required to create access controls. • Access by NGTL staff and contractors, including operation personnel as well as reclamation and monitoring crews, will be recorded and monitored. Access by Project personnel within the footprint in caribou range will be limited to the extent practical. • Current summer access by ATV and winter access for industrial purposes is considered high. Existing corridors that the RoW will parallel or overlap have well worn ATV trails in them and/or have been recently cleared for winter access purposes.	• Evidence and level of vehicular (ATV, truck) use along the Project right-of-way using subjective criteria ratings such as: - access evident: yes/no; - access type: ATV/ truck/ snowmobile/ other; - access level: low (e.g., tracks/ trail evident but difficult to discern or appear to be infrequently used)/ high (tracks/ trails appear to be well used; vegetation is trampled down, bare ground may be visible from frequent use). An evaluation of whether the measurable objective for access control is achieved will consider all of the criteria ratings and will be compared to untreated control sites.

TABLE 4

Evaluation Criteria for Measurable Objectives (continued)

Measureable Objective/Project Implementation[1]	Rationale / Limitations / Assumptions	Evaluation Criteria
• Appropriate locations for line-of-sight blocks will be identified post-construction when final clearing is complete. • A combination of measures including dog-legs in the right-of-way, vegetation screening, rollback and mounding will be applied. Feasibility of installing berms or fencing will be investigated further.	• There are no provincial guidelines in Alberta for line-of-sight management for linear features. Reclamation programs for previous developments in Alberta have targeted maximum sight lines of 400 m (Golder 2007, DES 2004). Operating practices for energy development in sensitive caribou range in BC (BC Ministry of Environment 2011a) suggest implementing line-of-sight management every 500 m on linear features that do not share a right-of-way boundary with a road. • Bends in the pipeline (doglegs) will reduce line-of-sight. • Wetlands and some treed lowlands encountered by the Project footprint naturally have low and/or open vegetation structure. The line-of-sight distance in these areas is naturally long and, therefore, sight-line management techniques are not practical for these locations. • Limitations associated with construction of slash and earth berms or fencing to reduce sight lines in the short-term include concern from provincial regulators regarding fire hazard and forest health (pathogen spread), availability of material, suitability of substrate to support structures (i.e., peat does not support fencing), introduction of weeds from imported material, and potential for alteration in surface hydrology (particularly from earth berms). • Fewer limitations are associated with using vegetation screening to reduce line-of-sight. However, this method is a long-term solution (refer to Table 3). • Paralleling an existing linear corridor presents challenges for line-of-sight where the adjacent line is owned by a different company. Application of sight-line management techniques should extend across the width of the Project footprint and adjacent disturbance to be effective.	Establish line-of-sight blocks in forested areas of the footprint within caribou range that will achieve a sight-line distance of 500 m or less. When vegetation screens are implemented to establish line-of-sight blocks, monitoring and adaptive management will be used as to achieve this target within expected time frames for a chosen eco-site. The time frame to attain an effective block will vary dependent on the eco-site and will be documented during monitoring. This will minimize uncertainties around time frames which currently exist for line-blocking treatments.

Note: 1 Measureable restoration objectives will continue to be evaluated for the Final CHRP to consider any updated consultation with AESRD or other information that becomes available.

2 Available footprint is the area of the Project footprint that is not anticipated to be disturbed by future operation and maintenance activities during the life of the Project.

3 % of the footprint available for sustained revegetation is based on the total hectares of footprint within the caribou area minus the area over the centerline that would not be actively revegetated:

- 10 m hotline = 70 % available
- 6 m hotline = 82 % available

Observations from field studies conducted for the Project indicate that current industrial footprint and access into the Egg-Pony caribou area is high (vehicular access for oil sands exploration programs), particularly along the existing RoWs in the western portion of the Project. The pipeline RoW parallels or overlaps existing corridors that have either been recently cleared for winter access purposes, or have some level of vegetation regeneration with well used ATV trails. Vehicular access along the old Conklin Road is also high, particularly during the winter months, as a primary access route into the area. Relating changes in access to the Project can be difficult, given the potential for increased access associated with other developments and activities in the Project Regional Study Area. However, the success of access control measures within the Project RoW can be evaluated using the subjective criteria developed for the CHRP (Table 4). Although the importance of access control in establishment and growth of vegetation on reclaimed sites is well understood (refer to Section 3.0), there is uncertainty related to the functional response of caribou, predator and primary prey populations to access control measures, given the lack of empirical studies and published literature on this topic (CLMA and FPAC 2007).

5.3 Line-of-Sight

In forested areas of the Project footprint where sight-lines are 500 m long or greater, light-of-sight blocks will be established. Since lines-of-sight are often naturally longer in the more open habitats of lowland muskeg communities compared to upland forest communities, line-of-sight distances will vary, depending on the location and structure of the adjacent vegetation community.

Similar to access control, evaluating the success of line-of-sight reduction is challenging. Paralleling an existing linear corridor presents challenges for line-of-sight management. The evaluation criteria (Table 4) will allow determination of whether sight-line management objectives within the Project are achieved, however, there is uncertainty related to the functional response of caribou, predator and primary prey populations to reduced lines-of-sight, given the lack of empirical studies and published literature on this topic (CLMA and FPAC 2007).

5.4 Monitoring and Adaptive Management

Given the inherent uncertainty associated with caribou habitat restoration, assumptions are made in the development of measurable objectives and evaluation criteria. The ability to successfully achieve the CHRP goals is uncertain. Monitoring and adaptive management provide the means by which this uncertainty can be addressed.

The Caribou Habitat Restoration and Offset Measures Monitoring Program as required in Certificate Condition 19 (see Section 2.1) will provide further detail on the criteria and protocols by which the effectiveness of the CHRP and offset measures will be evaluated.

The adaptive management component of the monitoring program will facilitate identification of unsuccessful restoration treatments, microsite conditions that are either not conducive or suitable for establishment of vegetation, and measures that need to be adjusted or supplemented to achieve the goals of the CHRP.

6.0 SCHEDULE

Scheduling and logistical coordination prior to restoration field work will consider seasonal access constraints, sensitive periods for caribou and other wildlife, lead time needed for collection of seed and production of nursery seedlings, and appropriate timing for restoration efforts. Initial clean-up and reclamation activities are expected to begin immediately following construction (i.e., winter 2012/2013). Final site selection for caribou habitat restoration treatments and seed collection, if required, will be completed during the first summer following construction (July/August 2013). Scheduling of caribou habitat restoration measures will be coordinated with final clean-up and reclamation of the Project footprint (winter 2013/2014).

Coarse-scale monitoring will be conducted across the entire Project Footprint during years 1 (winter 2013/2014), 3 and 5 following Project completion.

Fine-scale monitoring will be conducted within predefined sample plots within treatment types during years 1, 3 and 5 following Project completion.

7.0 CONSULTATION

Table 5 provides a summary of consultation related to the CPP, CHRP, offset measures and monitoring for the Project. Consultation for the Project will continue with Environment Canada and ESRD during the development and implementation of the CHRP and offset and monitoring plans.

TABLE 5

Summary of Consultation with Federal and Provincial Authorities

Agency	Name and Title	Date and Method	Details
ESRD	Traci Morgan, Wildlife Biologist Danielle Cross, Wildlife Biologist Dave Lind, Land Management Specialist Alicia Pruden-Beiunk, Aquatics Specialist	March 30, 2011	Meeting with ESRD at the Lac La Biche provincial building. Attending were Craig Schell, Frank Osterwald, Rebekah Jansen (NGTL), and Brian Coupal, Corey Stefura (Golder). Discussion regarding: • Routing options for the pipeline, taking into account all environmental factors and First Nations consultation; • mitigation options NGTL is considering for wildlife purposes; • crossing methods and locations for creeks and rivers; • helicopter fly-over of the pipeline route with TCPL and ESRD representatives; • ESA 548 and how it relates to routing options; and • research permit requirements for wildlife surveys.
ESRD and Environment Canada (EC)	Dave Lind, Land Management Specialist Grant Chapman, Wildlife Biologist Neil Timm, Land Officer, Alicia Pruden-Beiunk, Aquatics Specialist Paul Gregoire, Andrew Phelps (EC)	November 25, 2011 Office meeting and teleconference	Meeting with ESRD at the Lac La Biche provincial building. Attending were Craig Schell, Frank Osterwald, Rebekah Jansen (NGTL), and Brian Coupal, Shanon Leggo, Curtis Campbell (Golder). EC representatives called in. Discussion regarding: • Different route options for the pipeline and the implications each route may have on water and wildlife; • vegetation regrowth along the existing RoW/seismic lines; • reclamation challenges in old burned areas of the RoW; • forest officers discretion as to crossing methods over major waterways; • challenges of constructing pipeline within the timing restrictions within caribou and ungulate areas (i.e. two season construction vs one); • trade-off assessments between two and one season construction; • reclamation off-set ideas; • monitoring of reclamation success of current TCPL pipeline RoWs in the area; • developing a site specific restoration plan based on a ‘shopping list’ of options available; • specific methods and locations of mitigation; • mapping of primary habitat along the RoW of SAR and appropriate off-set locations; and • further research opportunities such a rollback study by Tim Vinge (ESRD) and research committee in Fort McMurray looking at linear disturbance re-growth.

TABLE 5

Summary of Consultation with Federal and Provincial Authorities (continued)

Agency	Name and Title	Date and Method	Details
ESRD	Grant Chapman, Wildlife Biologist Joann Skilnick, Wildlife Biologist	May 14, 2012 Helicopter fly-over	Helicopter fly-over of the route with Craig Schell (NGTL) and Brian Coupal (Golder) flying with ESRD to look at the proposed pipeline routing in regards to: • Current revegetation status of the existing linear corridors to be overlapped and/or paralleled; • location of caribou home range where the pipeline traverses; • off-set (off RoW restoration initiatives) opportunities within the region; • current revegetation status of NGTL owned pipelines off the proposed RoW in regards to potential offsets planning; and • potential crossing locations for the Christina River HDD.
ESRD	Bob Yowney, Grant Chapman and Joanne Skilnick (ESRD)	June 13, 2012 Office meeting and teleconference	Teleconference with NGTL, Golder, ESRD. Attending via conference call were Craig Schell, Bob Hudson, Frank Osterwalk, Jason Pizzey and Nelson Jalotjot (NGTL), and Curtis Campbell (Golder). ESRD members attended from their office in Athabasca. Discussed: • Review of the route; • EFR process for crown held temporary access requirements; • restoration initiatives; • Christina River equipment crossing location; • consultation with other disposition and reservation holders; • wildlife sensitivities and mitigation; • caribou and wildlife zones and timing; • security on the RoW; • HWY 881 Crossing and implications for future highway widening; and • the Caribou Protection Plan and EFR submissions.
ESRD	David Lind Land Management Specialist Sustainable Resource Development Lac La Biche	September 21, 2012 Email	ESRD provided the Caribou Protection Plan Acceptance Number (NE1-015-TransCanada-LKXO-12-13) to NGTL
EC	Amy Sanderson (Wilker) (EC)	October 23, 2012 Letter from EC to the NEB	EC acknowledges that final siting will involve consultation with Alberta ESRD. EC has found the plan (CHRP) comprehensive and looks forward to receiving the Final CHRP and Offset Measures Plan.

TABLE 5

Summary of Consultation with Federal and Provincial Authorities (continued)

Agency	Name and Title	Date and Method	Details
The following consultation occurred with Environment Canada and the NEB regarding NGTL's Northwest Mainline Expansion Project and its potential impacts on local caribou areas. Discussions held apply directly to other NGTL proposed pipelines within caribou areas, including the Leismer to Kettle River Project.			
Environment Canada	Paul Gregoire, Wildlife Biologist	October 18, 2011 Teleconference	TERA provided a summary of the Northwest Mainline Expansion Project. Environment Canada noted they had reviewed the CPP and the Supplemental Wildlife Report prepared for the Project. A summary of consultation with ESRD related to caribou and caribou habitat was provided. Environment Canada noted that they look to the province (ESRD) to identify any concerns related to caribou and caribou habitat. If ESRD has been actively engaged and have accepted the CPP, then Environment Canada has no specific concerns. The *draft* Recovery Strategy for Woodland Caribou was discussed. Environment Canada noted that they would rely on ESRD to provide input on the requirement for Project-specific habitat restoration. Environment Canada noted that habitat restoration was an expectation and it was not restricted to the immediate area of the Project and could be applied to abandoned sites elsewhere in the Chinchaga caribou area. Environment Canada noted that ESRD are better suited to comment on local habitat restoration requirements and locations.

TABLE 5

Summary of Consultation with Federal and Provincial Authorities (continued)

Agency	Name and Title	Date and Method	Details
Environment Canada	Paul Gregoire, Wildlife Biologist	May 14, 2012 Teleconference May 30, 2012 Follow-up Email	Conference call to discuss caribou-related Northwest Mainline Expansion Project Certificate Conditions 7, 23 and 24. The following is a summary of Environment Canada's comments. Environment Canada's position is to balance conservation and development, so that we might improve habitat while still allowing development. Restoration and offsets is a way to achieve that balance, and we are experimenting to see what will work. Environment Canada greed that CHRP goals/measurable objectives might include: no net increase in access (NGTL can only be responsible for their own access activities); habitat restoration; and blocking line-of-sight. There are different approaches to restoration of linear features. Restoration with species similar to adjacent lands can be slow (e.g., black spruce peatlands); planting quicker-growing tree/shrub species that may not be representative of the local vegetation can achieve suitable height for visual blocking faster. A combination of these approaches might be preferred. Location of measures is important. Involve ESRD in prioritizing locations and placement of different methods. Environment Canada advised that when direct disturbance is reclaimed, indirect habitat loss is addressed. Residual caribou habitat disturbance should be quantified as the area of new direct disturbance within the caribou area that is not reclaimed as part of the CHRP, assuming reclamation is successful. Short-term monitoring can provide information on whether plantings are successful. Predicting the effectiveness and value of restoration measures is challenging in practice. Goals may be achieved through monitoring and adaptive management. Implementing multiple measures may increase effectiveness and provide information to support adaptive measures. Environment Canada advised that an offset ratio >1:1 addresses uncertainty with restoration. Ratio of 4:1 is being used on other projects (e.g., Northern Gateway). Since caribou populations are at a critical point, aggressive action is warranted and trying to achieve a 4:1 target offset ratio is recommended. Options for offset measures should focus on restoration of habitat in the affected caribou area as the priority. Offsets should apply within the affected herd's range, and preferably within the core areas of the range (i.e., not on other ranges). Alternate measures such as funding research or regional monitoring are less preferable, and may be considered only after significant effort is made to identify on-the-ground habitat restoration locations and measures to make up the entire target offset. ESRD should be involved in selecting offset locations/measures. Environment Canada suggested that monitoring and adaptive management be incorporated in the assessment. Effectiveness of restoration measures will depend on the right microsite conditions to establish vegetation. Monitoring allows a feedback loop for adaptive measures on sites that are not successfully revegetating.

TABLE 5

Summary of Consultation with Federal and Provincial Authorities (continued)

Agency	Name and Title	Date and Method	Details
Environment Canada	Amy Wilker Environmental Assessment Coordinator	June 28, 2012 Letter	Environment Canada reviewed a draft version of the Preliminary Caribou Habitat Restoration Plan (Part I) for the NGTL Northwest Mainline Expansion. Regarding provincial and federal responsibility for providing guidance related to caribou, Environment Canada clarified that although day to day management of caribou falls under the purview of the Province, the federal government has a responsibility under the *Species at Risk Act* to ensure that the species is being effectively protected; as such, Provincial approval may not necessarily address federal responsibilities. Environment Canada noted that the plan does not refer to offsets, and recommended the plan discuss habitat restoration ratios and logistics of how to achieve them.
Environment Canada	Amy Wilker Environmental Assessment Coordinator	June 29, 2012 Follow-up Email	A follow-up email was sent in response to voice mail from EC on June 28, 2012 requesting information about the CPP. The NEB file number and AESRD approval reference numbers, as well as a link to the CPP on NEB website were provided.
ESRD	Bill Johnson, Wildlife Biologist, Peace River	July 15, 2011 Telephone	ESRD encourages industry to start work as early as possible in the fall so work can be completed early in the winter. Mitigation recommended by ESRD in caribou areas includes the following. - Line-of-sight: prefer line-of-sight measures to be installed at regular intervals along rights-of-way. ESRD encourages companies to implement line-of-sight measures on new linear corridors as well as where rights-of-way parallel existing corridors. Line-of-sight measures typically include vegetated visual screens made up of transplanted vegetation or nursery seedlings, or earth berms. - Access management: the purpose is to deter humans from driving on rights-of-way with trucks, ATVs or snowmobiles. ESRD noted that appropriate locations for rollback in the Project area are likely limited given the nature of the forest cover, and since it is not effective to deter access for very long. ESRD suggests earth berms (2 m high) be installed at intersections of the proposed pipeline rights-of-way with existing corridors. Vegetated screens can also be used.
Environment Canada	Amy Wilker Environmental Assessment Coordinator	August 14, 2012 Email	Environment Canada was e-mailed a revised Preliminary CHRP for review.
Environment Canada	Amy Wilker Environmental Assessment Coordinator	August 15, 2012 Letter	Environment Canada reviewed the Preliminary CHRP and has no further feedback at this time and will await the Final CHRP.

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APPENDIX A

Restoration Considerations for Select Reclamation Species

Species	Restoration Considerations
Black Spruce	Black spruce appears to grow well when there is sufficient sunlight and on well-drained upland sites, particularly in mixedwood forests, and on wider corridors where greater exposure to the sun may warm soils, and where enhanced microsites are created by mounding or slash rollback (CRRP 2007b). Black spruce seedling growth may be limited by nutrient deficiency common in treed muskegs. The OSLI has reported positive results with planting frozen nursery-grown black spruce seedlings during winter in wetland areas of northeastern Alberta (OSLI 2012), although longer term monitoring is required to attain conclusive results.
White Spruce	White spruce requires well-drained and nutrient rich soils to grow, such as some upland mixedwood forests. Disturbance or reduction of surface organic soils as a result of construction affects success of restoration using white spruce on disturbed areas (CRRP 2007b).
Lodgepole Pine	Pine grows well in a variety of site types, despite limitations such as low light and lack of nutrient rich soils (CRRP 2007b). Soils must be relatively well drained.
Alder	Many shrub species (e.g., willow) are not considered suitable for planting to restore caribou habitat due to their high palatability for primary prey (CRRP 2007b). Alder generally has low browse value for ungulates such as moose and deer. Sites that are difficult to treat using mechanical site preparation methods (e.g., mounding) can benefit from inter-planting alder with conifers. When alder is interspersed with conifer plantings, human access on linear features can be reduced over the medium-term (i.e., alder's faster growth compared to conifers helps to reduce visibility and make travel difficult), and the nitrogen-fixing characteristics of alder will provide soil enhancement (Sanborn *et al*. 2001, Sweeney 2001), potentially promoting improved conifer growth over the long-term (Simard and Heineman 1996, BC Forest Service 2001). Additional benefits of planting alder include: its ability to increase soil porosity by reducing soil compaction; quick growth (relative to conifers), which can assist with soil stabilization where erosion may be a problem; and leaf litter, which helps re-establish the forest floor where extensive disturbance to surface soils is a problem (Robb 2001, CRRP 2007b). However, the fast growth of alder may reduce growth rates of conifer plantings due to competition when alder densities are high (Simard and Heineman 1996, CRRP 2007b).
Hardwood Trees (e.g., aspen, poplar, cottonwood)	Similar to shrubs, hardwood trees have relatively fast growth rates. Since their growth is less dense than shrubs such as alder, hardwood trees are less likely to out-compete conifers. The fast root growth of hardwood trees can effectively reduce soil compaction, which provides a natural alternative to costly and highly disruptive mechanical site preparation. They are also better adapted to unfavourable site conditions (e.g., wet or compacted areas) than conifers. Deciduous trees provide leaf litter to enhance surface soil properties. They may also improve conifer growth in mixed plantings by deflecting browse and moderating temperatures, although their fast growth can out-compete or slow conifer growth. Seed and nursery stock for hardwood trees is not as readily available as for conifers, and less information on site characteristics, propagation and planting requirements are available for some hardwood species compared to conifers (CRRP 2007b).

APPENDIX B

Leismer to Kettle River Crossover
Restoration Units in Egg-Pony Caribou Area

Restoration Unit[1]	Ecosite Phase	Length (km)	Proportion of Route within Egg-Pony Caribou Area (%)
Upland Deciduous/ Mixedwood	B1 – blueberry / jack pine – aspen (white birch)	2.3	4
	D1 – low-bush cranberry / aspen	1.3	2
	D2 – low-bush cranberry / aspen – white spruce – black spruce	1.4	2
	Upland Deciduous/Mixedwood Total	*5.0*	*8*
Upland Coniferous	A1 – lichen – jack pine	0.3	<1
	B3 - blueberry / white spruce - jack pine	0.2	<1
	C1 – common Labrador tea / mesic jack pine – black spruce	14.2	23
	D3 – low-bush cranberry – white spruce	0.2	<1
	Upland Coniferous Total	*15.0*	*24*
Transitional[2]	G1 – common Labrador tea / moist black spruce – jack pine	9.7	16
Treed Lowlands[2]	Treed fen (FTNN)	6.6	11
	Treed bog (BTNN)	12.2	20
	Forested bog (BFNN)	0.1	<1
	Treed swamp (STNN)	0.2	<1
	Transitional and Treed Lowlands Total	*28.8*	*46*
Open water wetlands, graminoid and shrub-dominated lowlands[2]	Shrubby fen (FONS)	11.7	19
	Shrubby swamp (SONS)	0.7	1
	Graminoid fen (FONG)	0.7	1
	Wetland/Lowland Total	*13.1*	*21*
Disturbance		0.3	<1

Notes: 1 Restoration Treatment Units correspond to the Habitat Types in Figure 2: Conceptual Guide for Habitat Restoration Measures in Caribou Range. Treed lowlands, open water wetlands, gramiod and shrub-dominated lowlands correspond to the Wetland habitat type in Figure 2. Transitional areas are variable; site characteristics may tend to be more like upland coniferous sites, or treed lowlands, and therefore, restoration methods will vary accordingly.