7.0 EFFECTS ASSESSMENT AND MITIGATION

7.1 INTRODUCTION

This chapter includes the following sections, which identify and assess the environmental effects of the Keeyask Transmission Project (the Project) and proposed mitigation to avoid, minimize or remedy potential adverse environmental effects:

- Biophysical and Socio-economic Effects of the Project
- Accidents and Malfunctions
- Residual Effects
- Cumulative Effects
- Monitoring and Follow-up

The Environmental Assessment (EA) Report summarizes anticipated effects related to construction, operation, maintenance and any decommissioning of the transmission facilities and other infrastructure, and assesses all components of the environment (e.g., physical, aquatic, terrestrial and socio-economic environments, and heritage resources) in the Project Study Area (Maps 4-1 and 4-7). Environmental effects and mitigation are identified and assessed separately with regard to construction and operation phases for the Project, using the assessment approach and sources of information described in Chapter 3. The following key criteria were used to evaluate and compare the significance of adverse residual effects of the proposed Project:

- Nature
- Magnitude
- Geographic extent
- Duration
- Frequency
- Ecological Context

The environmental assessment incorporates and evaluates information from the public and stakeholder consultation activities carried out in accordance with the Project Public Involvement

Program (PIP) as described in Chapter 5. The assessment also considers scientific analysis of ecosystem effects, along with Aboriginal Traditional Knowledge (ATK) and local knowledge in determining the significance of potential effects of the Project. The mitigation measures outlined in this chapter correspond to the relevant phase of the Project clearing, construction, operations and maintenance.

Specific biophysical and socio economic environmental components that could potentially be affected by the Project are identified as Valued Environmental Components (VECs) to facilitate assessment of the interactions between the Project components and specific valued components on the environment. In addition to the evaluation provided on VECs, the assessment considers the potential Project effects associated with other components of the biophysical and socio-economic environments.

Predicted positive and negative residual environmental effects (i.e., effects on VECs after mitigation) are identified in the assessment and the regulatory significance of these residual effects using the framework and approach described in Chapter 3.

Consideration of cumulative effects is implicit in good environmental assessment and is described in this chapter with respect to Project effects that overlap in space and time with the effects of past and current projects and activities, as well as reasonably foreseeable future projects. This chapter also provides a summary of follow up and monitoring activities related to each major environmental component.

Careful selection of the proposed routes has helped to minimize potential biophysical and socioeconomic effects. Manitoba Hydro's general environmental protection practices for the construction, operation and maintenance of its transmission facilities will be applied to the Project. Ongoing incorporation of traditional knowledge and local input into the Environmental Protection Plan and monitoring program development will also assure that potential Project effects are avoided or minimized.

The mitigation measures are consolidated and organized into a Draft Environmental Protection Plan (EnvPP) which accompanies this Environmental Assessment Report (Chapter 8, Appendix F). The Environmental Protection Plan will prescribe measures and practices to avoid and minimize potential environmental effects of the proposed Project. Mitigation measures are based on applicable legislation, standards, guidelines, best practices, experience, and other recognized sources. The final EnvPP will be revised and submitted to the regulatory authorities following the environmental assessment review and approval process and prior to Project construction.

7.2 BIOPHYSICAL EFFECTS ASSESSMENT

This section of the EA Report focuses on effects of the project on the following biophysical components of the environment:

- Terrain and Soil
- Groundwater
- Climate, Air Quality and Noise
- Aquatic Environment
- Terrestrial Habitat
- Terrestrial Ecosystems
- Terrestrial Plants
- Terrestrial Invertebrates
- Amphibian and Reptiles
- Birds
- Mammals

The assessment of Project effects is based on the existing environment described in Chapter 4. The effects assessment considers Project effects on the environment by evaluating linkages and pathways between the biophysical environment and changes caused by the Project. The approach used to conduct the technical assessment varied with the component, as described in the associated Technical Reports. Potential effects were generally identified and assessed based on a combination of scientific knowledge of causal relationships (e.g., how terrestrial habitat and soils are affected by microclimate due to vegetation clearing) and the results from Project field studies and discussions with local resource users.

Although the biophysical assessment considered a wide range of environmental components, the assessment focused on the following VECs (Chapter 3): ecosystem diversity, intactness (fragmentation), priority plants, raptors, common nighthawk, olive-sided flycatcher, rusty blackbird, moose and caribou.

Detailed results for the technical component of the environmental assessment are provided in the supporting Technical Reports. This section interprets the results of the Aboriginal Traditional

Knowledge (ATK) and scientific studies. Effects of the Project are identified and assessed for each major biophysical component of the environment. Each environmental component is described and assessed on the basis of the following topics:

- Overview
- Project Activities
- Potential effects
- Valued Environmental Components
- Environmental effects assessment and mitigation
    - Organized by Project phase (Construction and Operation)
- Summary of residual effects and significances
    - A determination of significance is only provided for VECs.
- Follow-up

7.2.1 Terrain and Soils

Overview

The following section presents an assessment of the terrain and soil environment. As described in Chapter 4 (Environmental Setting), the topography of the region is generally flat with undulating loamy moraines that erode into drumlin crests and ridges. The region lies within the Canadian Shield, with overburden thickness estimated to be up to 30 m over the Precambrian bedrock. Organic soils are the most common soil group in the Project Study Area while mineral soils are concentrated on elevated areas which primarily occur along the Nelson River and the upper portions of eskers and moraines. Discontinuous surface permafrost is widespread in the area and generally occurs in all peatland types except for horizontal and aquatic peatlands.

Project Activities

The following Project-related activities have the potential to affect terrain and soils:

- The movement of vehicles and equipment, the temporary and long-term storage of materials, and the placement of tower structures during transmission line construction.
- Station Site and right-of-way clearing activities (e.g., stripping and grubbing).

- Construction of Construction Power Station and Keeyask Switching Station (e.g., ground grid installation and movement of vehicles).
- Herbicide use in vegetation management activities on rights-of-way and station sites.
- Creation of borrow pits for foundation materials.

Potential Effects

The Keeyask Transmission Project has the potential to affect the soil and terrain environment in the following key ways:

- Loss of soil structure and increase in soil bulk density due to compaction and rutting.
- Loss of topsoil due to erosion by wind or water.
- Loss of permafrost due to degradation from soil temperature increases related to clearing of the right-of-way or at Station Sites.
- Persistence of herbicide residue.
- Soil temperature increases.
- Surficial and bedrock removal.

Valued Environmental Components

For the Physical Environment assessment, VECs were not identified. The effects of changes in the physical environment are identified and described for consideration of their associated effects on valued environmental components in the aquatic, terrestrial and socio-economic environments. For example, the effects of loss of permafrost from soil temperature increases on terrestrial plants, and specifically priority plants, are discussed in Section 7.2.7 of this EA Report and ECOSTEM (2012, i.e., Terrestrial Habitat, Ecosystems and Plants Technical Report).

7.2.1.1 Effects Assessment and Mitigation

Soil Compaction

Construction and Operation

Soil compaction refers to the squeezing together of soil particles which results in reduced space available for air and water and a loss of soil structure. The movement of vehicles and equipment, the temporary and long-term storage of materials, and the placement of structures can result in soil compaction and rutting. Imperfectly to poorly drained mineral and organic soils

(i.e., moist drainage regime) that are medium to fine textured, such as loams and clays, are most susceptible to compaction and rutting.

The effects of soil compaction can be mitigated by targeting dry or frozen ground conditions for construction activities, using temporary ground cover or matting in problem areas, reducing the extent of traffic movements, and rehabilitating areas that have been compacted.

To minimize the effects of off-road travel on soils and terrain, access to work sites is typically restricted to existing roads, the right-of-way, and off right-of-way access trails where necessary (e.g., because of severe terrain conditions).

Erosion

Construction and Operation

Erosion is a natural process and refers to the detachment, movement and removal of soil from the land by wind or water. Repeated passes by heavy machinery can also disturb the ground surface, creating opportunities for erosion. As clearing and construction activities are planned to occur during the winter months, effects will be minimized. To minimize the effects of off-road travel on soils and terrain (e.g., through rutting, slumping and other forms of erosion), access to work sites will be limited to the rights-of-way, and existing winter roads and access trails where available. Where trails must be developed outside the right-of-way or existing access roads for construction or operations and maintenance, an investigation will be undertaken to avoid sensitive terrain (e.g., permafrost areas, steep or erodible slopes and stream banks).

Where temporary sensitive terrain cannot be avoided, environmental protection measures such as operating on frozen ground and maintaining snow cover. Further measures are outlined in the Draft EnvPP (Chapter 8, Appendix F).

Effects of water erosion can be mitigated by targeting frozen soils and reducing soil water contact, particularly on slopes; whereas, effects of wind erosion can be mitigated by targeting moist soils and reducing periods of bare soil exposure.

Permafrost Degradation

Construction and Operation

Permafrost degradation refers to decreases in the lateral/areal or vertical extent of permafrost soils. Clearing activities associated with the Project have the potential to affect sensitive terrain locations, such as permafrost layers. In northern Manitoba, repeated movement of construction equipment over frozen organic landforms can lead to the degradation of permafrost by compacting and destroying the insulating properties of the surface layer. Areas of continuous, discontinuous and isolated patches of permafrost are susceptible to degradation. Where

possible, structures will not be located on sites underlain by permafrost. Indirect effects of permafrost degradation and loss include adverse effects to infrastructure engineering, alteration to drainage patterns and increases in greenhouse gas releases to the atmosphere.

Strategies for reducing the degradation of permafrost include avoidance, construction under frozen conditions and minimizing compaction or removal of the insulating active layer cover.

By creating cleared areas in the forest, there is potential for soil temperature increase, both at the station site and in the immediately adjacent forest. The Keeyask Switching Station site is in an area of discontinuous permafrost, and depending on the extent of soil warming, there is a further potential for permafrost thawing.

Herbicide Residue

Operation

Herbicides are an issue for a number of other environmental components, including vegetation. Herbicide residue refers to herbicides which persist into periods beyond the application season due to slowed decay. The rate of breakdown for herbicides that are not bound to soil is influenced primarily by soil type, application rate, chemical and microbial degradation, photodecomposition, volatility and climatic factors (Horowitz *et al.* 1974). The climatic variables involved in herbicide degradation are moisture, temperature and sunlight (Hager and Nordby 2007). Under optimum climatic conditions, herbicides can have a soil residual life (persistence) of one month to more than 12 months, depending on the herbicide applied (Hager and Nordby 2007).

Herbicides will not be utilized during construction activities. Therefore, effects from accumulation of application of herbicides is expected to be related to operations only.

During operations, herbicides will be used at the station sites to control noxious weeds and other vegetation to maintain safe operation of the ground grid and cooling of equipment. Herbicides may be used as part of an integrated right-of-way vegetation management approach to maintain safe conductor clearances. Vegetation management plans involving the use of herbicides will be developed in consultation with local area stakeholders. Any herbicide application will be conducted in accordance with Manitoba Pesticide Use Permits (*The* [Manitoba] *Environment Act*) and follow Manitoba Hydro guidelines for vegetation management along transmission lines and at station sites (Manitoba Hydro 2003).

Since 1985, Manitoba Hydro has significantly reduced the use of soil residual herbicide products for management of vegetation (operation phase) along transmission line rights-of-way. Use of herbicide products is currently more selective than it has been in the past, resulting in minimal soil residue lingering into the next growing season. Manitoba Hydro does not currently use aircraft to apply herbicides to rights-of-way and large-scale herbicide use on northern

transmission lines was discontinued in 1990, in favour of practicing the winter shearing method instead. Manitoba Hydro completes annual reporting of the product and quantity of herbicides, as well as the locations of application to Manitoba Conservation and Water Stewardship in accordance with Pesticide Use Permits issued pursuant to the provisions of *The* (Manitoba) *Environment Act*.

Soil Temperature Increases

Construction and Operation

Soil temperature is influenced by soil cover and may be increased when soil cover, such as tree canopy cover, low vegetation and forest litter, is removed. Increases to the mean soil temperature can result in changes to moisture conditions causing dry or droughty soils where soil moisture is currently a limitation, loss of permafrost and potentially positive effects of increased productivity as a result of earlier spring thaw and an extended growing season.

Soil temperature increases can be mitigated by reducing the extent of clearing required by utilizing existing access routes and siting temporary work areas in natural openings, retaining ground cover and allowing for natural revegetation, where appropriate.

Surficial and Bedrock Removal

Construction and Operation

The removal of mineral, organic and surficial (unconsolidated), and bedrock (consolidated) aggregate materials for the backfill of excavations and construction of tower foundations will result in a loss of material at borrow sites. These materials may be removed by stripping, excavating or using explosives (blasting) at existing and new offsite borrow areas. Indirect effects include surface reconfiguration, including potential creation or destabilization of steep or unstable slopes, increased water erosion risk and risk of fish mortality and wildlife disruption due to the use of explosives. Wherever feasible, aggregate material will be obtained from established and approved sites and transported along the right-of-way access trail to the structure locations. In the event that borrow pits are required along the right-of-way, Manitoba Hydro's standard environmental protection practices for utilizing borrow pits will be applied to minimize potential effects. Activities to be undertaken to reduce the effect of the removal of surficial and bedrock materials include utilizing existing sources, where possible; conducting work in accordance with the Department of Fisheries and Oceans Guidelines for the Use of Explosives In or Near Canadian Fisheries (Wright and Hopky 1998); and preparing and implementing rehabilitation plans for borrow sites to be abandoned.

It is expected that the surficial and bedrock removal associated with the Keeyask Transmission Project will be almost entirely associated with the construction phase. Should any aggregate be

required for upkeep of station access roads, etc., it will be obtained from an operating borrow site used for North or South Access Road maintenance.

7.2.1.2 Summary of Residual Effects

The residual effects on terrain are included in Table 7-1. The table outlines the potential effects that are likely to occur and the phase (construction or operation) in which they may occur. As well, an assessment of the type and extent of the effect is made. The effect of the Project on soil and permafrost is expected to be moderate in magnitude and small in geographic extent (limited to the Project footprint) over a medium- to long-term period (Table 7-1). There are long-term effects associated with the removal of soil from borrow areas.

Table 7-1: Residual Effects of Keeyask Transmission Project on Terrain and Soils

Potential Effect	Project Phase	Residual Effect	Assessment Characteristics
Disturbance of soil and/or permafrost (permafrost degradation, soil temperature increases)	Construction	Minimal soil compaction and rutting in organic soil	Direction: Adverse Magnitude: Moderate Geographic Extent: Small Duration: Medium
		Minimal permafrost thaw following disturbance	Direction: Adverse Magnitude: Moderate Geographic Extent: Small Duration: Long-term
Removal of material from borrow areas and potential for slope failure	Construction	Borrow pit excavation	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term
		Borrow pit slope stability	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term
Accumulation of herbicide residue	Operation	Temporary impairment of soil quality	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short to Medium

7.2.1.3 Follow-up

In addition to environmental protection planning measures to be implemented, follow-up and monitoring activities will be undertaken to assess the success of proposed mitigation measures and verify the effects related to potential accidental releases to the soil environment. Additional monitoring may be required for on-site specific measures during construction, such as erosion and sediment control, as described below.

The condition of any erosion and sediment control environmental protection measures implemented should be monitored by the Contractor and/or Manitoba Hydro Inspector during construction of the Project. Any deficiencies in the condition of the control measures should be addressed as soon as possible, to prevent loss of soil material or potential deposition in waterways. Erosion and sediment control measures will remain in place until vegetation has re-established. More details on specific monitoring is outlined in the Biophysical Monitoring Framework in Appendix G.

7.2.2 Groundwater

Overview

The groundwater environment includes the groundwater regime (i.e., aquifer characteristics and recharge) and quality. The assessment focuses on the major hydrogeological features located in the vicinity of the proposed route of the transmission line due to the regional extent of the Project, and also considers the local groundwater environments near the station sites.

Project Activities

The following Project-related activities have potential to affect groundwater:

- Drilling/excavation for tower foundations.
- An unintended discharge of groundwater to the surface through a drill hole.
- Fuel spills entering the groundwater.
- Persistence of herbicides used for vegetation maintenance.

Potential Effects

The Keeyask Transmission Project has the potential to affect the groundwater environment in the following key ways:

- Groundwater quality

- Aquifer productivity
- Unintended discharges

Valued Environmental Components

As discussed under terrain and soils (Section 7.2.1), no VECs were selected for the Physical Environment components.

7.2.2.1 Effects Assessment and Mitigation

Groundwater Quality

Construction

The main potential issue with transmission line construction with regard to groundwater is related to drilling for tower foundations and accidental releases of hazardous substances. Normal pile foundation construction procedures (described in Chapter 2) are not expected to negatively affect groundwater resources in terms of either flow or quality. Tower foundations will not usually reach the groundwater aquifer as they extend to a maximum of 3 m and usually less, below existing surface grade (Section 2.5.4.2).

Standard environmental protection practices commit Manitoba Hydro to store fuel, lubricants and other potentially hazardous materials within dedicated storage areas at work camps and marshalling yards. Dedicated areas would provide appropriate spill containment measures and spill-response equipment, and would be located away from any sensitive features. Any products transferred from storage sites to work areas would not exceed the daily requirement. Manitoba Hydro also requires its contractors to have an emergency-response plan in place that is consistent with Manitoba Hydro's spill-response procedure.

Operation

Groundwater quality is not expected to be affected under normal operations of the proposed Keeyask Transmission Lines and associated infrastructure. The potential for environmental effects to groundwater quality through entry of contaminants, such as herbicides, into groundwater is expected to be very minor. Under normal application conditions, most of these chemicals should degrade within the unsaturated zone above the water table. Herbicides are applied under applicable permit and regulations and the Manitoba Hydro Transmission Line and Transmission Station – Vegetation Management Practices guidelines (Manitoba Hydro 2003).

Aquifer Productivity

Construction

During construction concrete will be required for some tower foundations and at station sites. Concrete may be supplied from the batch plant for the Keeyask Generation Station or from local sources; as such, the Project will not require a separate water source for concrete production.

Operation

Aquifer productivity is not expected to be affected by normal operations of the transmission lines or at station sites. A well may be required to supply domestic water and fire protection at the switching station. This will be determined at final design stage. If a well is required, under normal operations, the effect of this groundwater withdrawal will be minimal.

Unintended Discharges

Construction

Excavations for tower foundations are relatively shallow and artesian groundwater conditions do not exist, resulting in the potential for groundwater discharges to the surface to be small.

Potential effects on groundwater quality consist mainly from excavation of borrow materials and accidental spills and leaks from construction equipment and installation of station equipment.

Operation

No unintended discharges of groundwater to the surface are expected from normal operations of the transmission line or at station sites.

7.2.2.2 Summary of Residual Effects

The residual effects on groundwater are included in Table 7-2. The Project effects on groundwater are expected to be small, short-term and limited to the footprint (site) of the Project.

7.2.2.3 Follow-up

The Keeyask Transmission Study Area is not affected by artesian conditions where groundwater flows freely to the surface when a hole/pathway is opened. This can result in increased soil moisture and/or swamping at tower foundations. Since tower swamping is not expected, no specific monitoring will be done for groundwater effects.

Table 7-2: Residual Effects of Keeyask Transmission Project on Groundwater

Potential Effect	Project Phase	Residual Effect	Assessment Characteristics
Reduction in aquifer productivity	Operation	Groundwater withdrawal*	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short-term
Reduction in groundwater quality from herbicide accumulation	Operation	Impaired groundwater quality	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short-term

*Note: depends on whether a well is required for fire protection.

7.2.3 Climate, Air Quality and Noise

Overview

This section covers the effect of the Project on climate and potential climate change as well as the effects of climate and climate change on other biophysical components that will be affected by the Project. Climate-related issues include the potential for increased Greenhouse Gas emissions from vehicles during construction, operation and maintenance. As well, the potential for effects on Air Quality and Noise will be assessed. Some climate change effects (e.g., related to greenhouse gases) are similar to, but longer in duration, than air quality effects.

Project Activities

The following Project-related activities have the potential to affect climate, air quality and noise:

- Station Site and right-of-way clearing activities (e.g. removal of vegetation).
- Noise and emissions from construction equipment.
- Noise from operations at the Construction Power and Keeyask Switching stations.

Potential Effects

The Keeyask Transmission Project has the potential to affect climate, air quality and noise in the following key ways:

- Greenhouse gases
- Air quality
- Noise

Valued Environmental Components

As discussed in Section 7.2.1 (Terrain and Soils), no VECs were selected for the Physical Environment components of the Keeyask Transmission Project. The evaluation of effects on the physical environment are assessed and described for the potential to affect the aquatic, terrestrial and socio-economic VECs.

7.2.3.1 Effects Assessment and Mitigation

Climate

Construction and Operation

The Keeyask Transmission Project is a separate Project from the Keeyask Generation Station; however, the Generation Station used a Life Cycle Analysis of greenhouse gas emissions resulting from the construction and operation of the Generation Station and other infrastructure, including the Keeyask Transmission Project. The Life Cycle Analysis considered the greenhouse gas emissions involved in the construction of the Generation Station and transmission line components, including land-use changes such as clearing of transmission line rights-of-way. The Life Cycle Analysis considered these changes and compared them with displaced greenhouse gas emission resulting from the sale of surplus electricity to interconnected provinces and states and displacement of thermal-generating energy. The overall Life Cycle Analysis balance indicates a very positive benefit regarding greenhouse gas life cycle emissions.

Air Quality

Construction

The potential effects on air quality are generally very localized and temporary. The review of air quality is applicable anywhere in the vicinity of the Project footprint and is not assessed by project component. There will be a temporary increase in vehicular and equipment traffic during the clearing and construction activities associated with the Project. As a result, there will

potentially be higher vehicle (i.e., engine exhaust and hydrocarbon vapours) and dust emissions that affect local air quality. Winter clearing and construction will minimize potential dust impacts resulting from these activities. Clearing activities along the rights-of-way will also involve the cutting, piling and burning of slash, resulting in emissions that could potentially affect local air quality. Hazardous materials could potentially be released into the air as a result of an accidental spill of solvents, fuels, etc., during construction.

Operation

Hazardous materials could potentially be released into the air as a result of an accidental spill of solvents, fuels, etc., during maintenance and operations activities (Section 7.4). Ongoing operation and maintenance activities are unlikely to affect local air quality, as inspection and maintenance patrols of the rights-of-way, tower structures and hardware are typically undertaken two to three times per year by fixed-wing aircraft or helicopters. Ground patrols are typically conducted once per year. Non-scheduled patrols or maintenance may also be conducted by ground or air should unexpected repairs to the lines be required.

Noise

Construction

A number of construction activities have the potential to elevate noise levels and create disturbances to people and wildlife. Construction will involve use of heavy machinery such as bulldozers, excavators, drilling rigs, cranes and concrete trucks. Blasting may be required in certain areas to assist in removing rock to construct tower footings. Manitoba Hydro may use implosives for splicing conductors during construction activities Noise generated during construction activities will be temporary and intermittent, and will typically fall within acceptable provincial noise level guidelines.

Operation

Although noise levels associated with operation of the transmission lines are predicted to comply with provincial standards, specific calculations of station-related noise levels have not been made. Provincial guidelines in Manitoba specify maximum one-hour equivalent noise levels for residential and commercial areas of 55 dBA and 45 dBA for daytime and nighttime periods respectively (EDM, 1992). Operation of a transmission line involves the production of corona discharges which can result in audible noise. The level of these will vary with time, subject to operating mode and loading conditions of the line and, as well, to final line design, conductor condition, and to external considerations such as meteorological conditions. Although expected noise levels in close proximity (e.g., within 1 m or 3 ft) to certain equipment (e.g., power transformers) can be in the range of 45 to 83 dBA, noise levels will be substantially attenuated by the distance of the equipment from the boundaries of the sites, and/or by the

location of the sites in relation to sensitive activities or land use. Canadian Standards Association (CSA) standards respecting transformers, noise levels, measurements and hearing protection will be followed.

7.2.3.2 Summary of Residual Effects

The residual effects related to climate, air quality and noise are included in Table 7-3. The effects are expected to be small in magnitude, local to regional in extent and short to medium-term in duration.

Table 7-3: Residual Effects of Keeyask Transmission Project on Climate/Air Quality/Noise

Potential Effect	Project Phase	Residual Effect	Assessment Characteristics
Emissions from machinery during construction and operation affecting local air quality	Construction	Minor increase in emissions	Direction: Adverse Magnitude: Small Geographic Extent: Small to Medium Duration: Short-term
	Operation	Minor increase in emissions	Direction: Adverse Magnitude: Small Geographic Extent: Small to Medium Duration: Medium-term
Emissions from machinery during construction and operation affecting climate	Construction	Greenhouse gas emissions (materials manufacturing, change in land use, other factors	Direction: Negative Magnitude: Small Geographic Extent: Medium to Large Duration: Medium-term
	Operation	Greenhouse gas emissions (materials manufacturing, change in land use, other factors	Direction: Negative Magnitude: Small Geographic Extent: Small to Medium Duration: Medium-term

Note: Effects of noise on various wildlife VECs is discussed under the Terrestrial Environmental section.

7.2.3.3 Follow-up

Follow-up is not required for greenhouse gas emissions, other than to record project inputs and volumes to improve the accuracy of the greenhouse gas contribution calculation. Manitoba Hydro will monitor the performance of the transmission line structures in response to severe

climate events. Data from investigations may be used to modify and improve future designs to deal with climate change predictions.

Air quality monitoring will not be required, as the nature of any residual effects from construction will be localized and short-term in nature. The only follow-up will be to assure that mitigation is implemented correctly and that any unforeseen effects are responded to in a timely manner.

7.2.4 Aquatic Environment

Overview

The aquatic environment includes both the non-living (water, rocks, soil) and living (plants, invertebrates, fish) components of rivers, creeks, lakes and ponds. A detailed description of the aquatic environment within the overall Project Study Area and specific to project components is available in Chapter 4 and the Keeyask Transmission Aquatics Technical Report (North/South 2012).

Environmental effects to the aquatic environment were identified based on a review of Project components (Chapter 2) and the results of the biological assessment of the aquatic environment at the Project component locations. Overlap of Project activities with the aquatic component of the environment was the focus of review.

Project Activities

The following Project-related activities have the potential to affect the aquatic environment include:

- The movement of vehicles and equipment, the temporary and long-term storage of materials, and the placement of tower structures during transmission line construction.
- Station site and right-of-way clearing activities (e.g., stripping and grubbing).
- Creation of access to sensitive aquatic habitats.
- Herbicide use in vegetation management activities on right-of-way.

Potential Effects

The Keeyask Transmission Project has the potential to affect the aquatic environment in the following key ways:

- Loss of riparian vegetation
- Erosion and sediment entering water courses

The loss of riparian vegetation, erosion causing sedimentation of water courses and the introduction of deleterious substances to water sources are considered the greatest potential effects from the construction and operation of an overhead transmission line.

Valued Environmental Components

The assessment of potential environmental effects followed the approach outlined in Chapter 3 and primarily involved an evaluation of fish habitat, which represents the Valued Environmental Component (VECs) selected for the aquatic environment.

Potential environmental effects for aquatics were assessed for the VEC (fish habitat). The identification of potential effects was based on the project description for each component of the project, review of available literature, and habitat assessment results. Surface water quality is closely tied to fish habitat and is therefore included when assessing fish habitat. Therefore, the assessment and discussion of fish habitat includes consideration for surface water quality relative to Provincial guidelines for the protection of aquatic life (Manitoba Water Stewardship 2011).

Although the two potential effects noted above (loss of riparian vegetation and erosion and sedimentation) have not been selected as Valued Environmental Components for the Aquatic Environment, they are assessed at a similar level of detail to Fish Habitat which is the Aquatic Environment Valued Environmental Component.

7.2.4.1 Effects Assessment and Mitigation

Loss of Riparian Vegetation

Construction and Operation

Riparian vegetation plays an important role in the maintenance of water quality and fish habitat in water courses. It aids in bank stability and erosion protection, and contributes nutrients to streams and lakes through litter and terrestrial insect drop. The removal of riparian vegetation can result in the reduction of nutrient inputs into aquatic food webs as well as increased erosion and sedimentation of water courses. In many streams, terrestrial insects contribute a significant portion of fish diet and leaf litter and other organic matter are consumed by aquatic invertebrates, another important food source for many fish species, including salmonids (Allan *et al.* 2003).

Mitigation measures to be implemented to minimize the effect of riparian vegetation loss during construction are as follows:

- Removal of riparian vegetation will be limited to select plants within the right-of-way required to accommodate overhead lines and uprooting of plants will be minimized.

- Vegetation will be retained for as long as possible prior to construction.
- A machine free zone of 7 m will be established from the high water mark of all waterbodies where harvesting or clearing machinery will not enter, other than to cross the stream.
- A riparian buffer of 7, 15 or 30 m (depending on fish habitat quality) will be established at all waterbodies where ground disturbance is minimized, all shrub and herbaceous vegetation is retained.
- Clearing limits and sensitive areas will be clearly marked prior to vegetation removal.
- Clearing will be conducted under favorable weather conditions. Operations will be postponed under adverse weather (i.e., storm events) to minimize potential sediment introduction into the aquatic environment.
- Slash/debris piles will be adequately stabilized and stored well above the high water mark.
- Whenever possible, existing trails, roads, and cut lines will be used as access routes.

Fisheries and Oceans Canada has developed operational statements for both Overhead Line Construction and Maintenance of Riparian Vegetation within Existing Rights-of-Way (DFO 2007a and 2007e). Mitigation outlined in these two documents will serve to avoid any potential effects of riparian vegetation clearing and vegetation maintenance activities.

Erosion and Sedimentation

Construction and Operation

Vegetation removal and improper construction practices near watercourses can result in increased erosion leading to sedimentation of streams. Clearing streamside vegetation for transmission line crossings may result in decreased bank stability and exposure of bare soils that are prone to erosion. Machinery and equipment working in or near watercourses can cause rutting and erosion of floodplains, streambeds and channel banks. Increased levels of suspended sediment and deposited sediment can have multiple negative effects on the aquatic environment, including impacts to the primary producers, invertebrates, and fish.

Decreased light penetration due to higher turbidity (suspended sediment) can result in decreased photosynthesis by primary producers. Since primary producers form the base of the food chain, reductions in productivity can impact higher trophic levels, such as invertebrates and fish. Furthermore, large influxes of sediment can bury aquatic invertebrates, an important food item for many fish species, resulting in reductions in invertebrate species diversity and abundances. Deposition of fine streambed materials over larger substrates may create unsuitable habitat for invertebrate species that anchor to coarse substrates.

Short and long-term increases in turbidity from suspended sediments can decrease feeding success by visual feeders (Berg and Northcote 1985; Gardner 1981). Suspended sediment can also be harmful to fish by clogging their gills, decreasing oxygen exchange and reducing growth rates (Wood and Armitage 1997).

Since riparian vegetation plays an important role in reducing erosion and sedimentation of water courses, adhering to riparian vegetation mitigation, as described in Operational Statements (DFO 2007a and 2007e) will help reduce erosion and sedimentation at stream crossings.

The Project Environmental Protection Plan (Chapter 8, Appendix F) includes mitigation measures to be implemented for the prevention of erosion and sedimentation during construction; key measures are listed below:

- Disturbed areas will be revegetated following completion of works.
- Appropriate erosion and sediment control measures will be implemented to prevent sediment introduction into watercourses.
- Temporary stream crossings will be constructed only where existing crossings do not exist or are not practical for use.
- Temporary stream crossings consist of bridges, dry streambed fords, or a one-time ford (over and back) in flowing waters.
- One-time fording (over and back) of flowing streams and temporary bridge construction will only occur where the channel width is less than 5 m (from high water mark to high water mark).
- If fording will likely result in erosion and degradation of the streambed and banks, a temporary bridge will be constructed.

Fish Habitat

Construction

There are five stream crossings on the Preferred Construction Power Transmission Line route, two crossings on the Unit Transmission Line route and seven crossings on the Preferred Route for the Generation Outlet Transmission (GOT) Line route (Table 7-4). Fish and fish habitat sensitivity ratings for watercourses on the Construction Power Transmission Line route are primarily Low (three) with one Moderate (Butnau River – site 13), and one Moderate-High (Nelson River – site 19). Fish and fish habitat sensitivity in watercourses on the Preferred GOT Route (from an aquatic environment perspective) are also primarily Low (four), with one

Moderate (Butnau River – site 24), and two Moderate-High (Kettle River – site 26 and Kettle River – site 48).

Table 7-4: Summary of Keeyask Transmission Alternative Routes Stream Crossings and Sensitivity Ratings for Preferred Routes

Route	Total Stream Crossings	Low Sensitivity Stream Crossings	Low-Moderate Sensitivity Stream Crossings	Moderate Sensitivity Stream Crossings	Moderate-High Sensitivity Stream Crossings	High Sensitivity Stream Crossings
Construction Power	5	3	0	1	1	0
Generation Outlet	7	4	0	1	2	0
Unit Transmission	2	1	0	0	1	0

The loss of riparian vegetation, erosion causing sedimentation of watercourses, and the introduction of deleterious substances to watercourses are considered the greatest potential effects from the construction and operation of an overhead transmission line (BC EAO 2011, SaskPower 2009, DOE and DEQ 2008). These and other potential effects are discussed below. Moderate to Moderate-High sensitivity crossings are considered more sensitive to these effects; if needed, additional site-specific mitigation measures will be adopted for these sites.

Sedimentation may result in the loss of spawning habitats and/or decreased spawning success for some fish species. Fine sediment deposition may bury existing coarse or rocky substrates creating unsuitable spawning habitat. Deposited eggs can be smothered by sediments and larval emergence from spawning substrates may be inhibited by infilling of interstitial spaces (Kondolf 2000).

Riparian losses can result in increased water temperatures due to loss of shading by canopy species. Further, increases in plant growth can also occur due to increased light exposure. The loss of low, overhanging vegetation represents a loss of cover for fish.

Habitat loss and degradation due to structure foundations and installations may result in decreased productivity and fish population declines. Loss of migration routes may limit access to critical habitats, such as spawning areas. Effects on spawning and nursery areas may decrease fish abundances.

To minimize potential effects of the Project, aquatic resource and habitat information has been considered in project planning and the site selection process. Sensitive habitats have been avoided. To assure that Project-related effects are minimal, applicable legislation, regulations, and guidelines will be adhered to. Construction and maintenance of the Project will generally have the least effect on the aquatic environment when ground conditions are hard (frozen) and water levels are low (i.e., during winter, dry summer months, and early fall), especially in terrains such as bogs. Construction near waterbodies in undesirable conditions (i.e., unfrozen) will only be conducted if the environmental effects can be avoided or reduced through mitigation. Measures to mitigate or minimize the effects of project-related impacts have been discussed under removal of vegetation, erosion and sedimentation and other measures are outlined below.

There are no watercourses within the footprint or the area immediately adjacent to the Construction Power Station, Keeyask Switching Station or the Radisson Converter Station. As there are no watercourses near those stations, no effects on fish habitat are anticipated. The Construction Power Station does have one moderate-high rated site (Nelson River: Gull Rapids) (Construction Power Station Site 1) that is approximately 350 m south of its footprint, and therefore within the Study Area. Due to the large distance from the Construction Power Station site, no direct effects on the watercourse is expected to occur (erosion and sedimentation, loss of riparian vegetation, habitat loss, contamination from structure foundations and installation impacts to stream bank, blockage or alteration of flow, fish stranding).

The construction, operation, and maintenance of overhead transmission lines pose a low risk to negatively affect fish habitat at watercourse crossings. To this end, the Department of Fisheries and Oceans has developed an Operational Statement that describes mitigation measures to prevent impacts to fish and fish habitat during the construction of overhead lines (DFO 2007a; North/South 2012). Specific mitigation, as described in this document, will be implemented at watercourse crossings:

- Where possible, installation of lines over watercourses and poorly drained habitats such as bogs and fens will be conducted under frozen conditions or aerially.

- Where possible, transmission line approaches and crossings will be perpendicular to the watercourse and will avoid unstable features such as meander bends, braided streams, and active floodplains.

- All structures (temporary and permanent) will be placed above the high water mark.

Stream Crossings

Existing stream crossings will be used whenever possible during construction of the transmission line including access trails. Where a crossing does not exist and/or is not practical

for use, a temporary stream crossing may be used. The Department of Fisheries and Oceans Operational Statements for “Temporary Stream Crossings” (DFO 2007b) and, if appropriate conditions exist, for “Ice Bridges and Snow Fills” (DFO 2007c) should be adhered to including:

- Crossings will be constructed on a straight section of the watercourse, perpendicular to the channel.
- Clean materials will be used in the construction of temporary crossings. All materials will be removed upon Project completion or prior to freshet (whichever occurs first).
- Fording in flowing waters will occur within appropriate fisheries timing windows, as outlined in the Department of Fisheries and Ocean’s “Manitoba In-water Construction Timing Windows for the Protection of Fish and Fish Habitat” (DFO 2007d; North/South 2012).
- Fording will occur under low flow and favorable weather conditions and will avoid known fish spawning areas.
- Where necessary, measures to protect the streambed and banks will be in place prior to fording (e.g., pads, swamp mats). Protection measures will not impede fish passage or constrict flows.

Concrete Works

- Any uncured or partly cured concrete will be kept isolated from watercourses.
- Concrete wash water or water that has contacted uncured or partly cured concrete will be isolated from watercourses until it has reached a neutral pH.

The environmental protection measures outlined in Chapter 8 and Appendix F will also be followed.

Operation

Improper use of herbicides during right-of-way and station maintenance can also affect waterways. The main pathways of herbicide entry into streams are leaching, surface run-off, and drain flow (Carter 2000). Entry is dependent on soil and herbicide properties, hydrology, application practices, and climate conditions. Many herbicides are toxic and releases of these chemicals into streams may have lethal and/or sublethal effects on aquatic organisms, including fish. Herbicides may also reduce the abundance of aquatic plants.

Clearing of the right-of-way may provide improved access to sensitive habitats by both work crews and the public. This may lead to increased fishing pressure in lakes and streams along the alignment, and motorized vehicles (trucks, ATVs) used to access these areas may cause

physical disturbances (e.g., disturb riparian vegetation and stream banks, which could cause erosion and sedimentation).

There is also a risk of accidental spills and leaks of substances harmful to the aquatic environment, e.g., oil, fuel, gasoline. Hydrocarbons such as oil, fuel, gasoline, lubricants, or hydraulic fluids can enter surface waters from machinery used for construction, or from maintenance and fuelling activities that are conducted too close to a watercourse. Hydrocarbons are considered deleterious substances and may kill fish or other aquatic biota directly, or may result in impaired health, vigor, or productive capacity. Polycyclic aromatic hydrocarbons can persist in stream sediments resulting in chronic exposure through direct contact or indirectly through food chain interaction (Collier *et al.* 2002). Effects of polycyclic aromatic hydrocarbons to fish include fin erosion, liver abnormalities, cataracts, and compromised immune systems (Fabacher *et al.* 1991; Weeks and Warinner 1984, 1986; O'Conner and Huggett 1988). In benthic invertebrates, polycyclic aromatic hydrocarbons exposure can inhibit reproduction, delay emergence, and cause sediment avoidance and mortality. Mitigation measures are outlined in Section 7.4.2.

Vegetation removal near watercourses can result in increased erosion leading to sedimentation of streams, as described earlier with respect to construction effects. In addition to contributing to bank stability and erosion protection, riparian vegetation contributes nutrients to streams and lakes through litter and terrestrial insect drop. Vegetation management mitigation will help protect riparian areas and maintain their function.

Vegetation Management

During the operation of the Project, riparian vegetation management within the right-of-way will adhere to the Department of Fisheries and Oceans' Operational Statement for "Maintenance of Riparian Vegetation in Existing Rights-of-way" (DFO 2007e; North/South 2012) including the following measures:

- In riparian areas, vegetation will be maintained in a way that leaves root systems intact.
- Riparian vegetation maintenance within 30 m of the high water mark will affect a maximum of one third of woody vegetation (e.g., trees and shrubs) within the right-of-way.
- Riparian vegetation maintenance will be conducted by the method that minimizes stream bank disturbance. If rutting or erosion is likely, appropriate bank protection measures will be implemented prior to machinery use.
- All waste materials (slash) will be stabilized well above the high water mark to mitigate entry into the watercourse.

- Application of herbicides will adhere to Manitoba Hydro's Vegetation Management Practices for Transmission Line and Transformer Station (Manitoba Hydro 2003). All pesticide applications will be conducted by a licensed applicator.

Erosion and sediment control measures to be followed include:

- Disturbed areas will be stabilized through seeding, planting, mulching, or other appropriate materials to prevent erosion and sediment transport into the watercourse.

- Erosion and sedimentation control measures will be routinely inspected to ensure effectiveness.

Existing stream crossings will be used whenever possible during operations and maintenance. Where an existing crossing does not exist and/or is not practical for use, a temporary stream crossing may be used. The Department of Fisheries and Oceans' Operational Statement for "Temporary Stream Crossings" (DFO 2007b) and, if appropriate conditions exist, for "Ice Bridges and Snow Fills" (DFO 2007c) should be adhered to as described in Section 5.2.3.2 of the Aquatics Technical Report (North/South 2012).

7.2.4.2 Summary of Residual Effects

The effects assessment was applied to each Project component and specific activities that have the potential to affect the selected VECs as described in Chapter 3 of the Environmental Assessment Report.

The "Practitioners Guide to the Risk Management Framework for the Department of Fisheries and Oceans Habitat Management Staff" (DFO 2010) was considered in the effects assessment. Within this framework, the Department of Fisheries and Oceans has developed Operational Statements for certain lower risk projects/activities. The Department of Fisheries and Oceans Operational Statements outline specific conditions and mitigation measures that must be followed to avoid a Harmful Alteration, Disruption or Destruction of fish habitat.

Where an Operational Statement is in place for a specific activity (e.g., Overhead Line Construction), the Operational Statement's specific mitigation will be adhered to and is considered in compliance with the *Fisheries Act*.

The construction and operation of overhead transmission lines poses a low risk to fish habitat as indicated in the Department of Fisheries and Ocean's Operational Statement for "Overhead Line Construction" (DFO 2007a). The two main potential effects to fish habitat from construction and operation of overhead transmission lines are loss of riparian habitat and in-stream sedimentation. With appropriate mitigation measures implemented, the construction and operation of the Unit, Construction Power and Generation Outlet Transmission Lines is expected to result in an alteration of riparian vegetation, where low-growth plants remain, but tall

trees are removed and potential short-term localized increase in total suspended solids in watercourses. Table 7-5 illustrates that the overall residual effect on the aquatic environment is expected to be small, occur over the medium term and be not significant.

Table 7-5: Residual Effects of Keeyask Transmission Project on the Aquatic Environment

Potential Effect	Project Phase	Residual Effect	Assessment Characteristics
Project will cause erosion and sedimentation of streams from disturbed banks, loss of riparian vegetation along the extent of right-of-way at watercourses, and right-of-way runoff. This may result in increased levels of suspended sediments.	Construction and Operation	Loss of riparian vegetation, stream bank damage, increase in total suspended solids.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short to Medium-term **Overall: Not Significant**

7.2.4.3 Follow-up

All stream crossing sites will be inspected following construction to document compliance with prescribed mitigation and recommend additional remediation where deemed necessary.

Where disturbance to streambed and stream banks has occurred, all disturbed bed and bank sites will be restored comparable to pre-disturbance conditions. Restoration efforts will be monitored until restoration work is deemed acceptable and temporary erosion control structures removed. More details on specific monitoring can be found in the Biophysical Monitoring Framework in Appendix G.

7.2.5 Terrestrial Habitat

Overview

Potential direct Project effects on terrestrial habitat will include the loss, alteration and disturbance of habitat in the station sites, transmission line right-of-way, borrow areas, station sites and any associated access roads and trails. Direct Project effects will create indirect effects, both within the Project footprint (site) and in some surrounding areas. Since habitat is the key pathway for most Project effects on terrestrial ecosystems, an overview of anticipated Project effects on terrestrial habitat is provided.

Project Activities

The following Project-related activities have the potential to affect terrestrial habitat:

- The movement of vehicles and equipment, the temporary and long-term storage of materials, and the placement of tower structures during transmission line construction.
- Station site and right-of-way clearing activities (e.g. stripping and grubbing).
- Herbicide use in vegetation management activities on right-of-way and station sites.
- Creation of access trails and borrow pits for foundation materials.

Potential Effects

The Keeyask Transmission Project has the potential to affect terrestrial habitat in the following key ways:

- Transmission line rights-of-way and Project infrastructure will fragment habitat.
- The loss, alteration and disturbance of habitat in the station sites, transmission line rights-of-way, borrow areas used for tower construction, and any associated access roads and trails.
- Indirect effects on habitat composition within about 50 m of the transmission line rights-of-way and 150 m of the station sites.
- Habitat fragmentation associated with development of the transmission lines and rights-of-way and other Project infrastructure.
- Improved access in some locations, which increases the potential for access-related effects such as accidental fires or the spread of invasive plants.

Valued Environmental Components

The Valued Environmental Components (VECs) relate to terrestrial ecosystems and priority plants (Sections 7.2.6 and 7.2.7). Terrestrial habitat is evaluated within the context of the ecosystem diversity VEC.

7.2.5.1 Effects Assessment and Mitigation

Construction

Habitat can be altered as a result of construction activities. Habitat loss refers to the conversion of terrestrial habitat into a human feature or an aquatic area, either temporarily or permanently.

Habitat alteration refers to changes in one or more habitat attributes that are large enough to convert a habitat patch to a different habitat type. Lesser changes in one or more habitat attributes are classified as habitat disturbance. An example of habitat disturbance is a habitat patch adjacent to the right-of-way that has had trees or debris pushed into it.

An example of indirect effects related to the direct effect of tree clearing is where clearing trees occurs on permafrost soils and leads to higher soil temperatures, both within the cleared area and in adjacent areas. The geographic extent and nature of the indirect effect, also referred to as the zone of influence, will be determined by how the particular Project feature interacts with the ecosystem component of interest and local conditions. For example, tree clearing in dense, mature forest on permafrost soils will have a much larger zone of influence than clearing sparsely distributed trees on a bedrock outcrop.

Other types of indirect Project-related effects may also occur. Better access brings more equipment, material and/or people into an area, which could lead to increased resource harvesting, invasive plant spread and human-caused fires. In extreme cases, a single accidental fire that is severe could alter ecosystem diversity, either by extirpating a habitat type or substantially reducing its abundance (by degrading site conditions and/or decimating the seed bank). Invasive plants have the potential to crowd out native plant species and, in extreme cases, alter ecosystem diversity through changes to broad habitat composition.

A 50-m buffer of the transmission line rights-of-way was created to account for both the direct and indirect Project effects on terrestrial habitat (i.e., the terrestrial habitat zone of influence). This was a cautious overestimate of the anticipated total size of the terrestrial habitat zone of influence. Project effects on terrestrial habitat were expected to generally diminish below measurable levels within 10 m from the transmission line rights-of-way (ECOSTEM 2012, i.e., Terrestrial Habitat, Ecosystems and Plants Technical Report for the Keeyask Transmission Project). Indirect effects on habitat could extend further than 10 m from the transmission line rights-of-way in localized areas along the routes. These exceptions could occur in wetlands, areas physically disturbed by equipment, locations where by-pass trails are needed in difficult terrain and/or areas affected by a low probability event (e.g., a human caused fire). To the extent these effects occur, they were expected to alter only a small portion of the peripheral 40 m of the 50 m buffer so that the 50 m right-of-way buffer was likely a substantial overestimate of the total area of habitat indirectly affected by transmission line construction and operation.

A larger buffer of 150 m was used for station sites to account for the higher degree of impact associated with soil removal and permanent infrastructure as well as the higher potential for unplanned Project activities such as equipment moving or additional clearing.

Project construction is predicted to directly affect approximately 958 ha of terrestrial habitat (Table 7-6); note that the reported areas do not include surface water that is not a marsh

wetland), and assumes all of the borrow areas and construction camps are in pre-existing sites and/or within the transmission line rights-of-way.

The Project was predicted to indirectly affect an additional 628 ha of terrestrial habitat (Table 7-6) based on overestimates of the anticipated width of the terrestrial habitat zone of influence. The Construction Power Station and the Radisson Converter Station will not affect terrestrial habitat area because they are contained within areas where habitat has already been altered and/or cleared by previous projects.

Table 7-6: Estimated Maximum Potential Amount (ha) of Terrestrial Habitat Affected During Construction by Source by Project Component

Project Footprint Component	Area (ha)		
	Project Footprint	Habitat Zone of Influence	Total
Construction Power Station	0	0	0
Construction Power Line	111	173	285
Construction Power Temporary Line	23	17	39
Unit Transmission Lines	81	35	116
Keeyask Switching Station	35	30	64
Generation Outlet Transmission Lines	708	373	1,081
Radisson Converter Station	0	0	0
All	958	628	1,586

Notes: Reported areas do not include surface water that is not a marsh wetland and assumes borrow areas and construction camps are in pre-existing sites or within the transmission line right-of-way.

Needleleaf treed vegetation on mineral or thin peatland, and on other peatlands made up 85% of the native terrestrial habitat in the Project footprint (ECOSTEM 2012). Most of this land cover was comprised of the black spruce treed on thin peatland (43%) and black spruce treed on shallow peatland (28%) coarse habitat types. Most of the remaining habitat in the Project footprint was comprised of low vegetation on shallow peatland and low vegetation on mineral or thin peatland (7% combined). Broadleaf treed on all ecosites made up less than 2% of the total land cover in the Project footprint.

Mitigation measures that will benefit terrestrial plant habitat during the construction and operation phases include the following:

- Retention of vegetation buffers around wetlands, lakes and streams.
- Stockpiled organic material removed from temporarily cleared areas will be replaced to encourage re-growth of native vegetation.
- The EnvPPs will include measures to minimize the risk that accidental fires, accidental spills and invasive plants will affect terrestrial habitat.
- Right-of-way access trails will be decommissioned where not required for maintenance activities to minimize access-related effects such as soil rutting and compaction.

The construction and operation-related mitigation proposed for terrestrial ecosystems and priority plants would also benefit terrestrial habitat (Sections 7.2.6 and 7.2.7).

Operation

The Construction Power Transmission temporary line is the only temporary component of the Project footprint. The portion of the Construction Power Line right-of-way allocated for the temporary power line will be left to regenerate to a natural condition after removal of the temporary infrastructure. The extent of native habitat recovery in this right-of-way will vary depending on a number of factors such as degree of vegetation removal, degree of soil compaction, soil type and topography. Additionally, portions of the decommissioned right-of-way would become the terrestrial habitat zone of influence for the permanent backup power line. For the Project effects assessment it was cautiously assumed that approximately one half of the area would recover to the habitat types present before construction. On this basis, the amount of affected terrestrial habitat could decline by about 8 ha during operation.

Taking a cautious approach, the sizes of the terrestrial habitat zone of influence along the remainder of the Construction Power Transmission Line right-of-way and along the Generation Outlet Transmission Line right-of-way were assumed to remain unchanged during operation. On this basis, the assumed extent of edge effects during construction and operation were the same.

The mitigation measures implemented during the construction period with respect to terrestrial plant habitat will also assist in reducing the operation-related effects. The measures that reduce ecosystem diversity effects will also benefit terrestrial habitat.

7.2.5.2 Summary of Residual Effects

The residual effects of the Project on terrestrial habitat are considered and discussed in the ecosystem diversity evaluation (Section 7.2.7). Ecosystem diversity uses habitat component measures in the determination of potential effects.

7.2.5.3 Follow-up

Monitoring and follow-up related to terrestrial habitat is discussed in the section regarding ecosystem diversity. More details on specific monitoring can be found in the Biophysical Monitoring Framework in Appendix G.

7.2.6 Terrestrial Ecosystems

Overview

Fragmentation and ecosystem diversity are the VECs used to represent ecosystem level characteristics. Fragmentation refers to the breaking up of contiguous blocks of habitat into increasingly smaller blocks as a result of direct loss (e.g., clearing and construction) and/or sensory disturbance (e.g., effects of noise from construction vehicles on wildlife). Potential Project effects on fragmentation include increased adding linear features, reducing the total amount of core area, subdividing core areas and affecting large core areas. Newly constructed roads, transmission lines, trails and cutlines add to linear feature density. Core area is reduced by Project features that either remove existing core area or are near an existing core area. Total linear feature density (kilometer of linear features per square kilometer of regional land area), core area percentage (total core area as a percentage of regional land area) and effects on the largest core areas were the indicators used to measure changes in fragmentation.

An ecosystem is a functional unit including the living and the non-living things in an area, as well as the relationships between those living and non-living things. The potential pathways for Project effects on ecosystem diversity are the same as for terrestrial habitat because ecosystem diversity indicators were measured using the terrestrial habitat mapping. Potential Project effects on ecosystem diversity include extirpating and ecosystem type, substantially changing the distribution of area amongst the ecosystem types and reducing the area of ecosystem types that are particularly important in the regional context (e.g., types that are species rich, structurally complex or rare for the Regional Study Area). Since stand level habitat mapping is used to represent ecosystem types, the terms ecosystem type and habitat type are used interchangeably for the ecosystem diversity assessment. The number of native habitat types, the distribution of area amongst the habitat types, the total number of stands representing a habitat type and the total area of each priority habitat type were the indicators used to assess effects on ecosystem diversity. A priority habitat type is a stand level, native broad habitat type that is regionally rare or uncommon, highly diverse (*i.e.*, species rich and/or structurally

complex), highly sensitive to disturbance, has a high potential to support rare plants and/or is highly valued by people.

Project Activities

The following Project-related activities have the potential to affect fragmentation and ecosystem diversity:

- The movement of vehicles and equipment, the temporary and long-term storage of materials, and the placement of tower structures during transmission line construction.
- Station site and right-of-way clearing activities (e.g., stripping and grubbing).
- Herbicide use in vegetation management activities on right-of-way and station sites.
- Creation of access trails and borrow pits.

Potential Effects

Effects of the transmission lines and the stations are not separated since the stations only account for 3% of the habitat affected and make an even smaller contribution to fragmentation because they are within or near existing human features. Effects are discussed with regard to their effect on ecosystem diversity as well as fragmentation.

The key potential effects of the Project on fragmentation and ecosystem diversity include:

- Adding linear features and reducing the size and number of core areas increases fragmentation.
- Clearing and construction activities will remove, alter and disturb ecosystems, which will affect ecosystem diversity.
- Improved access in some locations, which increases the potential for access-related effects such as accidental fires or the spread of invasive plants.

Valued Environmental Components

As described in Chapter 3 and ECOSTEM (2012), fragmentation and ecosystem diversity were the VECs selected to represent effects on terrestrial ecosystems.

7.2.6.1 Effects Assessment and Mitigation

Fragmentation

Construction

The combined total length of the various Project linear features is approximately 68 km, which includes approximately 21 km for the Construction Power Transmission Line, 5 km for the KR1 Extension (temporary Construction Power Line), approximately 38 km for the three Generation Outlet Transmission Lines, and 14 km for the four Unit Transmission Lines.

The Project was predicted to increase total linear feature density from 0.45 km/km^2 to 0.47 km/km^2 for the entire region encompassing the Project Study Area (Map 4-1) and from 0.32 km/km^2 to 0.34 km/km^2 in the portion of the region that is outside of the Thompson area (ECOSTEM 2012). Total linear feature density for the region was expected to remain at the low end of the moderate magnitude effects range (between 0.40 km/km^2 and 0.60 km/km^2) and well within the small magnitude range for the region outside of the Thompson area.

Project construction would reduce total core area by approximately 1,835 ha (ECOSTEM 2012). Since the reduction was relatively small in the regional context, the percentage of the region in core areas larger than 1,000 ha would remain at approximately 82%, which was still well within the small magnitude range of 66% to 100%.

Project construction would affect five core areas. Three cores larger than 1,000 ha would be reduced in size and fragmented. The fifth largest core area in the region would become 1,194 ha smaller and be fragmented into four core areas. The two remaining affected core areas are all less than 2,400 in size. One 315 ha core area would be removed.

Some of the potential fragmentation effects of the Project were already mitigated through the site selection process for the transmission line routes. Locating the Generation Outlet Transmission Line route near existing human features minimized the risk that the right-of-way would provide hunters with better access to the area. Mitigation beyond that already incorporated through the preferred route selection process was not proposed.

Operation

Removal of the temporary Construction Power Transmission Line would reduce the total length of linear features in the region by approximately 5 km. Total linear feature density would remain at 0.47 km/km^2 for the entire region and at 0.34 km/km^2 in the portion of the region outside of the Thompson area.

To the extent that native habitat recovers in the temporary construction line right-of-way, total core area may increase very slightly over time. It was cautiously assumed that approximately

8 ha of native terrestrial habitat could recover and contribute to the core area during operation. On this basis, total core area percentage would remain at 82% for core areas larger than 1,000 ha and at 84% for all core areas.

Ecosystem Diversity

Construction

As described in Section 7.2.5.1, Project-related fires or invasive plant spread can alter habitat composition, which would alter ecosystem diversity. The risk that a Project-related fire would substantially affect native terrestrial habitat composition and priority habitat is anticipated to be low because transmission line right-of-way clearing, brush burning and infrastructure construction occurs in the winter. The Environmental Protection Plan (EnvPP) will include measures to minimize the risk that invasive plants, accidental fires and accidental spills will affect terrestrial habitat (Chapter 8, Appendix F).

The 1,586 ha of terrestrial habitat directly and indirectly affected by Project construction (Table 7-6) would affect priority habitat types and the other measures used to assess ecosystem diversity.

Project construction will not change the total number of native broad habitat types in the region (Map 4-1; ECOSTEM 2012). Project construction is not expected to substantially change the regional proportions of any of the regionally common or uncommon native habitat types by more than 0.01% (ECOSTEM 2012). Changes to the regionally rare habitat types are evaluated below.

Twelve native habitat types are represented by less than ten stands in the detailed habitat mapping area. Project construction is expected to reduce the total number of stands for four of these native habitat types. In all cases the removed stands are very small and represent far less than 1% of the total stand area. In addition, it is likely that there additional stands representing each of these habitat types in the portion of the region that is outside of the detailed habitat mapping area (Map 4-1; ECOSTEM 2012). A simple area-based extrapolation to estimate the total number of stands increases the number of stands by approximately 7.5 times for each of the habitat types.

Before considering additional mitigation measures, the Project is expected to affect 32 of the 46 priority habitat types. Depending on the habitat type, up to 0.8% of the area would be affected (ECOSTEM 2012). Past and current projects have already affected many priority habitat types to the extent that moderate magnitude effects already exist. After considering the effects of the Project in combination with these projects, the Project was not expected to increase effects to 10% of historical area for any of the priority habitat types. For all of the affected priority habitat types, estimated Project effects in combination with past and current projects accounted for less

than 6% of historical area, which was substantially lower than the 10% benchmark used to identify high magnitude effects.

In descending order, the priority habitat types that were most affected before mitigation were tamarack mixture on shallow peatland, tamarack mixture on mineral, tamarack mixture on thin peatland, black spruce mixedwood on mineral and tamarack dominant on mineral.

Since effects were already in the moderate magnitude range for all of the affected priority habitat types, all of these types will be avoided to the extent practicable during final routing of the transmission lines for the EnvPPs. Additionally, since this Project will not proceed without the Keeyask Generation Project, consideration was given to interactions with the Keeyask Generation Project. Those priority habitat types identified by the Keeyask Generation Project Environmental Impact Statement (Keeyask HydroPower Limited Partnership 2012b) as being of particular concern will be given special consideration for avoidance during the final transmission line routing.

Since ecosystem diversity effects from past and current projects and activities were already in the moderate magnitude range for all of the affected priority habitat types, all of these types will be avoided to the extent practicable during final routing of the transmission lines. The EnvPPs will include measures to minimize the risk that accidental fires and accidental spills will affect terrestrial habitat (Chapter 8, Appendix F). The EnvPPs will also include measures to minimize the risk that invasive plants will affect terrestrial habitat. Control and eradication measures will be implemented in the event that invasive plants become a problem.

Operation

As described in Section 7.2.5.1, the decline in habitat affected during operation when compared to construction was expected to be very small in regional terms. Since the ecosystem diversity indicators were measured using habitat composition, Project effects on ecosystem diversity were not expected to change substantially from construction to operation.

7.2.6.2 Summary of Residual Effects

Fragmentation

After considering mitigation and the effects of other past and existing human projects and activities, residual Project effects on fragmentation during construction and operation were expected to include a small increase to linear feature density and a very slight reduction to total core area percentage. Total linear feature density for the entire region was expected to remain at the low end of the moderate magnitude effects range (between 0.40 km/km^2 and 0.60 km/km^2) and well within the small magnitude range for the region outside of the Thompson area. The predicted total core area percentage during construction would be reduced from

82.5% to 82.4%, which was considerably above the 65% value for the transition from small to moderate magnitude effects.

Using the criteria established to determine the significance of Project effects for regulatory purposes (Chapter 3), the likely residual effects of Project construction on fragmentation were expected to be adverse, medium in geographic extent, long-term in duration and small in magnitude (Table 7-7).

Table 7-7: Residual Effects of Keeyask Transmission Project on Fragmentation and Ecosystem Diversity

Potential Effect	Phase	Residual Effects	Assessment
Fragmentation effects	Construction and Operations	Small increase to linear feature density.	Direction: Adverse Magnitude: Small Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**
Fragmentation effects on core areas	Construction and Operations	Very slight reduction to total percentage of Project Study Area in core areas.	Direction: Adverse Magnitude: Small Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**
Ecosystem Diversity: Potential loss of an ecosystem type or a substantial change in ecosystem composition	Construction and Operations	No loss of any ecosystem types and a very slight change to ecosystem composition.	Direction: Adverse Magnitude: Negligible or moderate Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**
Ecosystem Diversity: Potential reduction in the number of stands representing an ecosystem type	Construction and Operations	The stands that are lost are very small	Direction: Adverse Magnitude: Negligible or moderate Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**
Ecosystem Diversity: Potential reductions in priority habitat types	Construction and Operations	Remove or alter priority habitat.	Direction: Adverse Magnitude: Negligible or moderate Geographic Extent: Small to medium* Duration: Long-term **Overall – Not Significant**

* Varies with the priority habitat type.

Overall, the likely residual Project effects on regional fragmentation were expected to be adverse but regionally acceptable because the increase to total linear feature density was small, no very large core areas were lost and core area percentage was expected to remain over 80% – which was well within the small magnitude range. This occurred partly because the Project was located in a portion of the region where fragmentation already exists due to past and current human development.

Ecosystem Diversity

After considering mitigation and the effects of other past and existing human projects and activities, Project operation is not expected to create additional effects on 14 priority habitat types and is expected to affect between 0.1% and 0.8% of the estimated area for the 32 remaining priority habitat types. After considering these remaining Project effects in combination with other past and current projects and activities, the residual effects of the Project on ecosystem diversity are expected to include affecting between 5.0% and 5.8% of estimated historical area for 32 priority habitat types, which were moderate magnitude effects.

Using the criteria established to determine the significance of Project effects for regulatory purposes, the likely residual effects of the Project during operation on ecosystem diversity are expected to be adverse, medium in geographic extent, long term in duration and, depending on the ecosystem diversity indicator either nil or moderate in magnitude (Table 7-7). The moderate magnitude residual effects are expected to be irreversible, continuous in frequency, and low in ecological context.

Overall, the likely Project residual effects on ecosystem diversity were expected to be adverse but regionally acceptable because no stand level habitat types were lost, the distribution of area amongst the stand level habitat types was not expected to change substantially and the cumulative area losses for all of the priority habitat types remained well below 10%.

7.2.6.3 Follow-up

Monitoring to verify the short and long-term effects of the VECs is outlined in this section and detailed in Appendix G. The monitoring focuses on VECs. Monitoring for fragmentation will include measurements of Project linear features and footprints relative to core areas to verify Project effects on linear feature density and core area abundance. Direct and indirect habitat loss and disturbance by habitat type will be calculated for the Project footprint as part of ecosystem diversity monitoring.

The intent of this monitoring is to:

- Verify the predicted amounts and composition of direct and indirect habitat loss, alteration and disturbance during construction and operation.

- Verify that priority habitat patches marked for avoidance in the environmental protection plans are not disturbed.

More details on specific monitoring can be found in the Biophysical Monitoring Framework in Appendix G.

7.2.7 Priority Plants

Overview

Direct Project effects on terrestrial plants will include loss and disturbance of plants and plant populations as well as loss, alteration and disturbance of habitats in the cleared right-of-way, borrow areas used for tower construction and any associated access roads and trails. These direct effects will lead to indirect effects on terrestrial plants, both within and adjacent to the Project footprint, primarily through edge and access-related effects.

Project Activities

The following Project-related activities have the potential to affect priority plants and other terrestrial plants:

- The movement of vehicles and equipment, the temporary and long-term storage of materials, and the placement of tower structures during transmission line construction.
- Station site and right-of-way clearing activities (e.g., stripping and grubbing).
- Herbicide use in vegetation management activities on right-of-way and station sites.
- Creation of access trails and borrow pits for foundation materials.

Potential Effects

The key potential effects of the Project on priority plants include:

- The loss and disturbance of priority plants.
- The loss and disturbance of priority plant habitat.
- Indirect effects on priority plants and their habitat composition.
- Improved access in some locations, which increases the potential for access-related effects such as accidental fires or spread of invasive plants.

Valued Environmental Components

Priority plants was the VEC selected to represent terrestrial plants, as described in the following section. Priority plants were the native species that are particularly important for ecological or social reasons. Criteria used to identify the priority plants were as follows: highly sensitive to human features; thought to make high contributions to ecosystem function; and/or are of particular interest to local people. A plant species was considered to be highly sensitive to human features if it was globally, provincially or regionally rare, near a range limit, had low reproductive capacity, depended on rare environmental conditions and/or depended on the natural disturbance regime.

7.2.7.1 Effects Assessment and Mitigation

Project effects on plants were generally expected to decline with distance from the Project footprint. The spatial extent of the Project zone of influence on terrestrial plants, including priority plants, was expected to be the same as the terrestrial habitat zone of influence, which was generally less than 10 m adjacent to transmission line rights-of-way and less than 50 m around the stations. For the effects assessment, it was cautiously assumed that all plants within 50 m of the transmission line rights-of-way and within 150 m of the stations would be affected by the Project.

Improved access is another potentially important pathway for indirect Project effects on terrestrial plants since this will bring more equipment, material and/or people into an area. This could lead to increased resource harvesting, invasive plant spreading and/or human-caused fires. The Generation Outlet Transmission right-of-way is not expected to substantially increase plant harvesting since it will largely follow the South Access Road. Access along the Construction Power Transmission right-of-way will be difficult in the summer due to its remoteness and the number of waterways and very wet wetlands that are crossed by the route.

Herbicide use during transmission line right-of-way maintenance may affect some priority plant species.

Past and current projects and activities, as well as natural dispersal processes, have introduced and will continue to introduce and spread invasive plants into the Project Study Area. The Project is not expected to substantially increase the rate at which invasive plants are introduced and/or spread in the Project Study Area. Project environmental protection plans can include measures that minimize the risk that equipment transported to the area will spread seeds in the area. Additionally, weed control on the rights-of-way is required for regulatory (i.e., *The Noxious Weed Act*), operational and safety reasons.

Construction

Project effects on endangered or threatened plant species during construction are not expected since these species were not found during field surveys and are not expected to occur within the terrestrial plants zone of influence (ECOSTEM 2012). Project effects on provincially rare plant species were not expected since none were found during extensive field studies in the region and, to the extent that these species were associated with regionally rare habitat types, Project effects on their anticipated habitats were expected to be nil or low, depending on the species (ECOSTEM 2012).

Elegant hawk's-beard was the only species found during field studies with an uncertain rank of provincially very rare or rare. The likelihood that this species occurs in the terrestrial plants zone of influence is expected to be low because it was not found there during extensive field studies in the Project Study Area and its recorded local habitat was roadsides.

The three provincially rare to uncommon plant species recorded in the Study Area during field studies were swamp lousewort, rock willow and shrubby willow. Project effects on swamp lousewort are not expected. The only recorded location for this species in the Project Study Area was outside of and a short distance from the Construction Power Transmission right-of-way in a horizontal fen. Since this fen extends into the right-of-way, it is possible that additional swamp lousewort locations occur in the Project footprint at this location. The possibility that other swamp lousewort occur in this fen was considered. Right-of-way clearing was not expected to have overstorey removal or edge effects on swamp lousewort, except possibly along the access trail or the conductor stringing path, at this location because clearing is not required where the right-of-way crosses this fen the vegetation is already low. Once pre-construction rare plant surveys are completed, the access trail can be routed to avoid any potential effects on unobserved plants. Towers can be located outside of the 200 m wide area where the right-of-way crosses this fen. Indirect effects on hydrology were not expected since there is no vegetation clearing and construction occurs in the winter.

Project effects on rock willow were expected to be low. The estimated percentage of rock willow locations in the region falling within the Study Area was approximately 0.8 %.

Project effects on shrubby willow are expected to be low. Approximately 0.8% of the estimated number of shrubby willow locations in the region were within the Project Study Area. Shrubby willow was often recorded on veneer bogs on slopes, which was a common habitat type in the region.

An additional 50 species ranked as being of provincial conservation concern that were not found but could potentially occur in the Project Study Area. None of the 42 species ranked S1 to S2 were found in the Study Area despite extensive surveys in these areas. To the extent that the distribution of the provincially very rare to uncommon plant species are related to broad habitat

types, Project-related effects on all of the native broad habitat types is expected to be nil to moderate in magnitude.

Seven regionally rare and/or range limit plant species were observed within the Study Area. Of these, balsam poplar, goldthread, jack pine, northern Labrador-tea and hairy goldenrod were the species not already discussed above. The estimated percentage of known locations in the region falling within the Study Area was less than 1% for all five species except for goldthread. The Project could affect approximately 3% of goldthread locations before considering mitigation.

An additional 28 regionally rare and four range limit species were not encountered but could potentially occur in the Study Area. To the extent that the distributions of these species are related to the broad habitat types, the Project is predicted to affect less than 1% of their habitat.

Seven of the eleven species identified as being of particular interest to the local First Nation communities were recorded in the Study Area as follows: white birch (16 locations), northern Labrador-tea (1 location), red currant (1 location), cloudberry (12 locations), red raspberry (3 locations), bog bilberry (14 locations) and rock cranberry (26 locations). Substantial Project effects on the species of particular interest to the local First Nation communities were not expected. Most of these species were either generally widespread or widespread in their preferred habitat. For each of these species, the percentage of locations within the Study Area was less than 1%. Additionally, to the extent that the distribution of these species is related to broad habitat type, the Project is predicted to affect less than 1% of their habitat.

Since it is possible that existing locations of swamp lousewort and other provincially very rare to rare species were not found, mitigation for these species during construction will include:

- In the segment of the Construction Power Transmission line right-of-way that is near the swamp lousewort location, access trails will be located to avoid swamp lousewort locations and towers will be sited outside of the area where the right-of-way crosses this fen.
- Pre-construction rare plant surveys will be conducted in portions of the Project Study Area that were not previously surveyed and have the highest potential for supporting provincially very rare to rare species.
- In the unlikely event that a provincially very rare to rare species is discovered in the Project footprint, the plants will be transplanted outside of the Terrestrial Plants Project Study Area.

Mitigation measures to be implemented during construction to minimize the risk of introducing and spreading invasive plants will include:

- Equipment and machinery that was recently used more than 150 m from the Project Study Area will be washed prior to transport to the Project area.

- Personnel working on the Project will be educated about the importance of cleaning their vehicles, equipment and footwear before travelling to the area.

Many of the mitigation measures to be followed during construction will facilitate reducing the potential effects on terrestrial habitat and ecosystems during operation. For example, the risk of spreading invasive plants that will persist during the operational period will be reduced through the above-mentioned measures regarding equipment clearing and locations where they can be utilized. As well, the portion of the Construction Power Line allocated for the temporary power line will be left to regenerate to a natural condition after removal of the infrastructure.

Operation

The decline in habitat area affected during operation when compared to construction is expected to be small in regional terms (Section 7.2.6). Consequently, Project effects on priority plants during operation are expected to remain similar to those described for Project construction. The potential for maintenance activities to affect priority plant locations or further spread invasive plants is not expected to change substantially when compared with the construction phase — with the exception of herbicides that may be used to control the growth of trees in the right-of-way. Since these herbicides are formulated to target broad-leafed plants, they may affect species of conservation concern.

In addition to the mitigation measure outlined during construction, the following will occur during operation:

- Containment, eradication, and/or control programs will be implemented if monitoring identifies problems with invasive plants.

- The locations of any provincially very rare or rare species in the transmission line rights-of-way will be mapped out clearly and marked during herbicide application.

    - Herbicides will not be applied within 100 m of these locations.

7.2.7.2 Summary of Residual Effects

After considering mitigation and the effects of other past and existing projects and activities, substantial residual Project effects on priority plants during operation are not expected (Table 7-8). None of the species of highest conservation concern are expected to occur in the Study Area. For the remaining species, the Project is expected to affect low percentages of their known locations and/or available habitat.

Table 7-8: Residual Effects of Keeyask Transmission Project on Priority Plants

Potential Effect	Project Phase	Residual Effects	Assessment Characteristics
Potential loss of priority plants	Construction and Operations	Remove or alter priority plants.	Direction: Adverse Magnitude: Negligible or moderate* Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**
Potential loss of priority plant habitat	Construction and Operations	Remove or alter priority plant habitat.	Direction: Adverse Magnitude: Negligible or moderate Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**

* Varies with species.

Overall, the likely Project residual effects on priority plants are expected to be adverse but regionally acceptable.

Using the criteria established to determine the significance of Project effects for regulatory purposes, the likely residual effects of Project operation on priority plants are expected to be adverse, medium in geographic extent, long-term in duration and, depending on the species, nil to moderate in magnitude (Table 7-8).

Project effects on endangered or threatened plant species are not expected since none of these species are expected to occur in areas affected by the Project. Project effects on the species of particular interest to the local First Nation communities are expected to be low because most of these species are widespread in appropriate habitats and the percentages of known locations and/or available habitat affected by the Project are low. While the Project would affect the locations and/or habitat for some of the remaining priority plant species, the magnitude of these effects is anticipated to range from small to moderate, depending on the species, based on the percentage of known locations affected and/or the cumulative percentage area losses for the native habitat types. Regarding ecological context for species with moderate magnitude effects, there were no substantial ongoing adverse trends in the amounts of native habitat types. Additional pre-construction mitigation is included for the species of highest conservation concern to address the unlikely event that patches of these species exist but were not discovered to date due to the rarity of the species.

7.2.7.3 Follow-up

Monitoring and follow-up to verify the short and long-term effects of the VECs is outlined in this section. Monitoring to confirm avoidance of priority plants patches and spread of invasive plants will be conducted. This monitoring will verify that recommendations from pre-construction rare plant surveys are implemented, and that the environmental protection plan measures limit the further introduction and spreading of invasive non-native plants. More details on specific monitoring can be found in the Biophysical Monitoring Framework in Appendix G.

7.2.8 Terrestrial Invertebrates

Overview

Terrestrial and aquatic habitats present within the Project Study Area provide important habitat for terrestrial invertebrates. Many terrestrial invertebrates utilize the aquatic environment during one or more of the stages of their life cycle, e.g., larval stage. The diverse plant communities in the boreal forest zones, including the region surrounding the Project Study Area (Map 4-1), support equally diverse terrestrial invertebrate communities.

These invertebrate communities include species living in the soil (nematodes, earthworms), on the ground (beetles, spiders), in the air (butterflies, moths, flies), and within the vegetation canopy (spiders, aphids, beetles). Terrestrial invertebrates are ecologically important for their role as nutrient cyclers and decomposers (e.g., earthworms), as predators of pest species, as pollinators of flowering plants (e.g., bees) and as food for other animals (e.g., Birds).

Project Activities

The following Project-related activities have the potential to affect terrestrial invertebrates:

- The movement of vehicles and equipment, the temporary and long-term storage of materials, and the placement of tower structures during transmission line construction.
- Station site and right-of-way clearing activities (e.g., stripping and grubbing).
- Herbicide use in vegetation management activities on right-of-way and station sites.
- Creation of access trails and borrow pits for foundation materials.
- Increased vehicular traffic during the construction and operation phases of the Project.

Potential Effects

The key potential effects of the Project on terrestrial invertebrates include:

- Habitat loss or alteration:
    - Such as through fragmentation.
- Localized microclimate changes.
- Direct mortality:
    - Particularly from vehicles and equipment.

Several issues may contribute to declines of terrestrial invertebrate species. Habitat loss or alteration is one concern (COSEWIC 2003) which can result in fragmentation and changes in microclimate. Habitat fragmentation can have large effects on invertebrate communities from the creation of habitat barriers (i.e., edge effects; Haskell 2000; Stong *et al.* 2002), which inhibit movements and alter dispersal patterns (Mader *et al.* 1990; Holmquist 1998; Stong *et al.* 2002). On a smaller scale, habitat alteration also results in changes in microclimate, such as temperature and moisture levels, to which terrestrial invertebrates may be very sensitive (Klein 1989; Didham *et al.* 1996).

Valued Environmental Components

No VECs were selected from terrestrial invertebrates. Terrestrial invertebrates are widespread and plentiful at Keeyask and no species designated as “at risk” by COSEWIC, MESA or SARA are believed to occur in the Project Study Area.

7.2.8.1 Effects Assessment and Mitigation

Construction

Habitat alteration or the change in plant community and overall habitat type composition is likely the largest Project-related activity affecting terrestrial invertebrates (Meffe and Carroll 1997). Habitat alteration can occur during activities such as the clearing and maintenance of habitat along the transmission line rights-of-way, at the station sites and during installation of permanent transmission towers along the right-of-way (Stantec 2012a, i.e., Keeyask Transmission Project Amphibian Technical Report).

Alterations in overall habitat composition can result during right-of-way clearing. Fragmentation of forest habitat from clearing activities has been shown to affect foraging behaviour in some terrestrial invertebrates (Baur *et al.* 2012). The increased use of rights-of-way, and associated

vehicle-related effects can have direct and indirect effects on terrestrial invertebrates, ranging from direct mortality to sensory disturbances.

Maintaining an undisturbed buffer zone along wetlands and streams is important as these provide cover and breeding habitat for terrestrial invertebrates which may in turn provide forage for fish and amphibians (Wipfli 1997).

The mitigation measures that will be implemented and benefit terrestrial invertebrates include the following:

- Removal of all waste construction materials from construction sites to assure no substances detrimental to invertebrates enter the environment.
- Retention of buffers around wetlands and streams will benefit many wildlife species, including invertebrates. The buffers suggested in the Aquatics Technical Report (i.e., 7, 15 and 30 m; North/South 2012) would be suitable for protection of invertebrates as well. Tall trees, which may interfere with the transmission line, need not be retained in these buffers in order to protect invertebrates.
- Allowing low growing vegetation cleared along the rights-of-way to re-establish habitat for terrestrial invertebrates.

Operation

The general effects of all Project-related activities on terrestrial invertebrates during the operational period are:

- Alteration of habitat related to creation of ponds/wet areas along the right-of-way as a result of permafrost melting or alteration of drainage patterns.
- Effects of increased use of seasonal access trails and rights-of-way and other machinery-related effects.

Habitat alteration, defined as a change in plant community and overall habitat type composition, is perhaps the single predominant Project-related activity affecting terrestrial invertebrates.

Use of both seasonal access trails and the right-of-way will increase traffic-use effects in areas where access was previously limited. Effects on terrestrial invertebrates may range from direct mortality to sensory disturbances.

Vehicular traffic and machinery operation may crush and thereby cause mortality of a small number of invertebrates. This effect would be minimized through the implementation of winter construction and maintenance practices. Sensory disturbance effects are also associated with

vehicular traffic and machinery use and include such sources as exhaust emissions, noise, dust, headlight illumination, as well as spills and leaks.

7.2.8.2 Summary of Residual Effects

Residual effects on terrestrial invertebrates are associated with habitat alteration that will occur along the transmission right-of-way and at station sites (Table 7-9). The preservation of existing low-growth vegetation along the right-of-way and buffers around sensitive sites is expected to minimize potential effects associated with degradation in these habitats. Additionally, careful storage and removal of any hazardous materials and measures taken to limit access to the right-of-way post-construction will further alleviate potential effects of the Project on terrestrial invertebrates.

Residual effects are primarily associated with the long-term loss of habitat at tower footprints and station sites due to habitat loss or alteration. The footprint of the Keeyask Transmission Project is 958 hectares (Table 7-6). Of this area, about 35 hectares at the station sites and the tower footprints will be lost. The remaining area will experience habitat alteration, which can have negative or positive effects on terrestrial invertebrates.

Traffic-related operational activities (from workers accessing station sites or from maintenance activity) are expected to have long-term negative effects on terrestrial invertebrates. The overall adverse residual environmental effects on terrestrial invertebrates are expected to be small in magnitude and geographic extent and long-term (Table 7-9).

Table 7-9: Residual Effects of Keeyask Transmission Project on Terrestrial Invertebrates

Potential Effect	Project Phase	Residual Effect	Assessment Characteristics
Minor habitat loss will occur at station sites and transmission tower footprints	Construction and Operation	Some terrestrial habitat will be altered or lost.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term

7.2.8.3 Follow-up

No follow-up monitoring regarding terrestrial invertebrates is required or planned.

7.2.9 Amphibians and Reptiles

Overview

The findings of field studies conducted for the Keeyask Transmission Project (2009-2011) indicate that amphibians, particularly boreal chorus frogs and wood frogs, are widely dispersed and relatively abundant throughout the Project Study Area (Map 4-1). Frog populations in boreal regions are generally lower than those observed in southern Manitoba.

As the Project is outside of the northern range of reptiles and no reptiles were observed during field studies conducted in the Study Area and surrounding region since 2001, there is not expected to be Project effects on reptiles. Reptiles are therefore not any discussed further in this chapter.

Project Activities

The following Project-related activities have the potential to affect amphibians:

- The movement of vehicles and equipment, the temporary and long-term storage of materials, and the placement of tower structures during transmission line construction.
- Station site and right-of-way clearing activities (e.g., stripping and grubbing).
- Herbicide use in vegetation management activities on right-of-way and station sites.
- Creation of access trails and borrow pits for foundation materials.
- Increased vehicular traffic during the construction and operation phases of the Project.
- Construction of Construction Power Station and Keeyask Switching Station (e.g., ground grid installation and movement of vehicles).

Potential Effects

Effects of the Project on amphibians are generally considered to be related to:

- Alteration of habitat
- Direct mortality
- Sensory disturbance

Valued Environmental Components

No amphibian or reptile VEC was selected for further evaluation. When considering whether it was appropriate to select an amphibian VEC, the study team considered that the two frog species most prevalent in the Study Area, wood and boreal chorus frogs, are relatively widespread and present in low to moderate densities throughout the region. The potential for notable Project-related effects on these frogs was judged to be small. Reptiles do not appear to occur in the Study Area and therefore were not considered a VEC. Amphibians are also prey to other species (birds and mammals) and are considered in the pathway of effects for predators. Effects on amphibians are assessed as a group, similar to terrestrial invertebrates.

7.2.9.1 Effects Assessment and Mitigation

Construction

The most substantial habitat alteration that will occur during the Keeyask Transmission Project is from clearing of the transmission line rights-of-way and at the station sites. Clearing activities result in an opening of the forest canopy. Forest canopy is an important structural component of amphibian forest habitat, such as for adult wood frogs (Kanstra *et al.* 1995; Gillespie *et al.* 2005). Some positive potential effects may result from the clearing in association with the resulting habitat change, including the development of ponding and snags alongside the rights-of-way.

Alterations in overall amphibian habitat composition can result during right-of-way clearing. These alterations can affect amphibian movement patterns, distribution and abundance. Fragmentation of forest habitat from clearing activities has been shown to affect juvenile amphibian dispersal between populations (Rothermal and Semlitsch 2002; Cushman 2006). This has been identified as one of many potential reasons for amphibian declines.

Habitat can also be destroyed or altered during the construction of transmission line towers. Disturbance will occur at the tower site from construction vehicles, grubbing and/or excavation for foundations and from the erection of the tower itself. For much of this area, the disturbance will be short term, but the presence of the tower will continue for the long term.

Among the habitat alterations that can occur as a result of right-of-way clearing and other construction activities is the creation of ponds and wetted areas. Often ponds form in low areas along cleared rights-of-way since the vegetation which originally took up the available water has been removed. These ponds may provide some amphibian habitat, particularly if they are in close enough proximity to the forest edge to benefit from some shading from the adjacent forest. Even if these are ephemeral wetlands, they may provide additional suitable breeding habitat for frogs before drying up later in the summer.

An increase in vehicular traffic has been shown to have negative effects on amphibian populations. Vehicle noise can affect amphibian calling and decrease mating (Barrass 1985; Lengagne 2008). Also, the vehicles traveling along trails and rights-of-way can result in direct amphibian mortality (Fahrig 1995).

Construction at the station sites has potential to affect amphibians. Effects may include habitat loss or alteration from the clearing of the site and the development of the station infrastructure. Construction vehicles may cause some amphibian mortality along the station access routes.

Mitigation measures for amphibians include:

- Retention of buffers around streams and wetlands.
- Retention of some debris piles at the edge of the right-of-way as amphibian habitat in proximity to wetlands potentially used for amphibian courtship.
- Remove all waste construction materials from construction sites to assure no substances detrimental to amphibians enter the environment.
- Restrict right-of-way construction and station site clearing activities outside of the courtship period of April to July.
- Retaining a vegetated buffer around wetlands and streams will benefit many wildlife species, including amphibians. The buffers outlined in the Aquatics Section 7.2.4.1 (7, 15 and 30 m) would be suitable for the protection of amphibians as well.
- Retain some small slash piles along the right-of-way, preferably in relatively close proximity to water to provide amphibian habitat. During clearing activities, slash piles are created along right-of-way edges and station site margins. Amphibian abundance has been found to increase with the creation and retention of woody debris (Ross *et al.* 2000). Slash piles are often used by amphibians as cover during the summer and as overwintering habitat.
- To the extent practicable, transmission towers to be located away from wetlands identified as productive amphibian habitat during final siting activities as identified in the Draft EnvPP (Appendix F).
- Follow mitigation measures outlined in Section 7.4.2 with respect to avoiding or minimizing the effects associated with accidents and malfunctions.

Operation

Residual effects on amphibians related to transmission lines will occur as a result of ongoing right-of-way maintenance activities. Herbicide use on the right-of-way has potential to negatively

affect amphibians, especially if the herbicide enters the ponds or wetlands utilized by amphibians. If the right-of-way is used as a travel route by local resource users, there may be a minor potential for vehicle-related mortality of amphibians.

Operational effects on amphibians will also result from ongoing vegetation maintenance at the station sites. Herbicide use at the station sites has the potential to negatively affect amphibians, which are very sensitive to pollutants in their environment. If herbicides used at the station sites enter ponds or wetlands, the effect on amphibians could be larger ─ potentially posing an increased risk of reproductive failure and higher mortality in frogs utilizing wetlands and foraging in proximity to station sites. Proper application of herbicides and methods to reduce the accumulation of herbicide residue is discussed in Manitoba Hydro (2003).

There will also be potential for some vehicle-related mortality from station workers accessing the site.

7.2.9.2 Summary of Residual Effects

No amphibian or reptile VECs were selected for the Keeyask Transmission Project. Residual effects of the Project were evaluated with respect to amphibians only, as no reptiles were found in the Study Area. As with other environmental components that were not deemed as VECs, there is no determination of significance. Residual effects with regard to amphibians include minor habitat loss at station sites and tower locations.

The footprint of the Keeyask Transmission Project is 958 hectares (Table 7-6). Of this area, the 35 hectares at the Switching Station site and a few more hectares at the tower footprints will be lost. The remaining area will experience habitat alteration, which may affect amphibians.

Residual effects of the Project on amphibians will be minor, long-term and will not be measurable when considered over the entire Project Study Area (Table 7-10).

Table 7-10: Residual Effects of Keeyask Transmission Project on Amphibians

Potential Effect	Project Phase	Residual Effects	Assessment Characteristics
Minor habitat loss will occur at station sites and transmission tower footprints	Construction and Operation	Minor amounts of amphibian habitat will be lost and altered – it is not expected that this will be fully offset by habitat gains, e.g., ponding along transmission rights-of-way	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term

7.2.9.3 Follow-up

The construction-related activity that has the most potential for effects on amphibians is the clearing and grubbing of habitat in the Project footprint. While formal monitoring activities are not anticipated specifically for potential effects on amphibians, it is expected that while undertaking other monitoring programs (e.g., breeding-bird surveys) the Study Team will look for and record any amphibian effects that may be occurring. Also, the Environmental Inspector/Monitor will be advised to report any significant amphibian mortalities that may occur. If any amphibian-related effects are reported, an adaptive management approach will be taken with the Environmental Protection Plan to adapt mitigation measures to minimize the effect. More details on specific monitoring can be found in the Biophysical Monitoring Framework in Appendix G.

Since the potential for negative effects on amphibians from operation of the Keeyask Transmission Project is expected to be negligible, no monitoring is proposed for the operation period.

7.2.10 Birds

Overview

Approximately 178 bird species potentially breed within or migrate through the region encompassing the Keeyask Transmission Project Study Area (Map 4-1; Stantec 2012b, i.e., Keeyask Transmission Project Avian Technical Report). The diverse terrestrial habitats and abundant food sources support several landbird species (i.e., songbirds, woodpeckers, upland game birds, raptors, nighthawks), including resident species, e.g., gray jay, ruffed grouse, boreal owl that inhabit the region year-round (Stantec 2012b). Inland lakes, creeks and wetlands provide key breeding habitats for many waterbirds including ducks, shorebirds and sandhill cranes. Birds are a key food source for the Keeyask Cree Nations, with spring and fall hunts being important community events.

Project Activities

The following Project-related activities have the potential to affect birds:

- Station site and transmission right-of-way clearing activities (e.g., stripping and grubbing).
- Installation of tower structures.
- Increased vehicular traffic during the construction and operation phases of the Project.
- Construction of Construction Power Station and Keeyask Switching Station (e.g., ground grid installation and movement of vehicles).

Potential Effects

The Keeyask Transmission Project has the potential to affect the birds in the following key ways:

- Mortality:
    - Collisions of birds with vehicles, machinery or transmission wires.
    - Increased hunting of waterfowl, other waterbirds and upland game birds.
    - Nest loss associated with construction or maintenance during the spring nesting season.
    - Increased susceptibility to terrestrial predators.
- Habitat Loss or Alteration:
    - Disruption of movements for species unwilling to cross large openings in the forest cover and tend to not include such openings within their breeding territory, e.g., Swainson's thrush.
- Sensory Disturbance:
    - Habitat avoidance due to clearing or maintenance activities.
    - Disruption of daily movements due to the physical presence of humans, machinery, or Project structures.

Potential effects are expected when bird ranges overlap spatially and temporally with the Project. Most bird species are migratory in Manitoba, generally migrating northward in spring, nesting in suitable habitats in spring and summer, and migrating south in fall to over-winter in the southern United States and in Central and South America. In Manitoba, few bird species are year-round residents (Carey *et al.* 2003).

Mortality

Increases in bird mortality can occur in a variety of forms, including collisions with transmission wires and vehicles, electrocutions, increased predation and hunting, and brood parasitism. Bird-wire strikes are one of the most common causes of non-hunter related mortality for birds, particularly birds with short wings and large body masses (Avery *et al.* 1980; Malcolm 1982; Rusz *et al.* 1986; Faanes 1987; Morkill and Anderson 1991; Brown and Drewien 1995; Bevanger 1998; Training Unlimited Inc. 2000; Bevanger and Broseth 2004). Other factors that may influence a bird's likelihood of colliding with a transmission wire include visibility (e.g., weather conditions and time of day; Brown and Drewien 1995), age of the bird (i.e., younger

birds are more prone to collisions), location of the wire (e.g., wires crossing migration corridors can cause more collisions), and surrounding environment (Bevanger 1994; Brown and Drewien 1995; Bevanger 1998). While there is a possibility for any bird species to collide with a vehicle, the likelihood of such an event is considered to be remote while travelling on a transmission line right-of-way, as vehicle speeds are reduced.

Clearing and maintenance associated with the right-of-way and other Project components may result in the destruction of some nests, consequently decreasing nest success or increasing mortality rates of hatchlings. With the exception of a few irregular nesting species such as gray jay (*Perisorens canadensis*) that nest in late winter, the risk of nest disturbance from maintenance and clearing is reduced and nearly eliminated by limiting these activities to winter months.

The introduction of new transmission lines on the landscape could contribute to increased predation on some bird species located near the right-of-way. Artificial perching and roosting structures such as transmission towers are used by some raptors in habitats with few natural perches; these perches provide an elevated viewpoint to aid in locating prey (Boeker and Nickerson 1975; Knight and Kawashima 1993). Raptors often utilize transmission towers, even in habitats containing natural perch sites as the height provided by transmission towers typically offer the highest vantage point in a landscape (Lammers and Collopy 2007).

In addition, nests located near the forest edge are under greater predatory pressures from small mammals such as chipmunks and red squirrels that may not utilize the central portion of transmission line rights-of-way (Chasko and Gates 1982). In addition to increased predation as the right-of-way is cleared and access trails are created, opportunities for harvest of upland game birds and waterfowl may increase. In some cases, access could be limited by physical barriers (e.g., terrain and water). Provincial harvest management strategies and regulations are an important consideration in assuring sustainable upland game bird and waterfowl population goals are met.

Upland game birds, which are of importance to the resource users in the area, are among the other birds evaluated. The upland game birds which will be considered for the purpose of this assessment are spruce and ruffed grouse.

Habitat Alteration

The loss of individual birds and a decline in a species' population is strongly associated with habitat loss (Schmiegelow and Mönkkönen 2002). The vulnerability of bird species to habitat loss is dependent on their degree of habitat specialization; birds with broad-ranging habitat requirements are less likely to be affected (Hockey and Curtis 2008). Conversely, species that are highly specialized for small, rare habitat features are extremely vulnerable to any habitat

loss (Hockey and Curtis 2008). Generally, habitat types that occur in the Keeyask Transmission Project Study Area are common in the region (Section 7.2.6; ECOSTEM 2012).

Fragmentation of habitat involves the removal of existing habitat that results in smaller isolated patches of remaining habitat where there was previously continuous habitat (Bender *et al.* 1998; Section 7.2.6). Stable species abundance in fragmented landscapes may mask changes in bird communities due to replacement of locally extirpated species by immigration of species that favour fragmented habitats (Schmiegelow *et al.* 1997). Population declines observed in some birds may be attributed to their habitat requirements, as species that favour interior habitat will experience declines as the habitat becomes fragmented into smaller and smaller patches (Bender *et al.* 1998). This high degree of habitat specialization increases bird species' susceptibility to habitat loss and fragmentation. Increasing fragmentation of a landscape may not lead to declines in bird populations when remaining patches of habitat are large enough to provide suitable breeding habitat to allow for stable populations (Schmiegelow *et al.* 1997).

The effects of fragmentation on bird groups may be somewhat mitigated by allowing vegetation regrowth to occur; however vegetation management will generally maintain the right-of-way at an early stage of succession, which may be of limited use to species favouring interior forest habitat. The habitat on the right-of-way is expected to benefit edge-favouring species, and potentially shrubland birds.

The effects of habitat alteration due to clearing and maintenance activities, as well as construction activities, would be mitigated in part by limiting these activities to winter months. Year-round construction disturbances in the north are associated with point-source disturbances at the station sites and borrow areas.

Sensory Disturbance

Birds occurring along transmission lines that are affected by sensory disturbance may react by nest or territory abandonment, particularly those birds that rely on songs and calls for communication and territory establishment and defence (Bayne *et al.* 2008; Francis *et al.* 2009). Additionally, noise disturbance may result in increased and decreased predation rates, as noise interferes with the ability of some birds to pick up on audio cues to the presence of a predator (e.g., warning calls from other birds) while interfering with the ability of predators to pick up on audio cues regarding the presence of prey species (Slabbekoorn and Ripmeester 2007).

The physical presence of humans, towers, and machinery could affect seasonal and daily movements of some species or individuals as they alter their pathways to avoid disturbance. Limited movement can prevent individuals from accessing resources and can hamper their ability to avoid predators (AltaLink Management Ltd. 2006). Daily movements could be altered on a local scale. Most transmission line projects likely have little effect on seasonal movements such as the spring and fall migrations of larger bird species, as most fly considerably higher

than the height of transmission lines and any related construction activities on the ground (Gauthreaux 1972). The effects of disruption of movements due to clearing and maintenance activities, as well as construction activities, are mitigated for most birds by limiting these activities to winter months.

Valued Environmental Components

The bird VECs selected which were used to assess effects of the Project (Table 3-1) include:

- Raptors
- Common nighthawk
- Olive-sided flycatcher
- Rusty blackbird

7.2.10.1 Effects Assessment and Mitigation

Construction

Potential construction-related activities that would have the most notable effect on birds in general are primarily associated with:

- The clearing and grubbing of habitat in the Project footprint.
- The presence and noise associated with construction equipment and personnel, which is expected to have potential effects on bird use in habitat adjacent to the Project footprint.

Raptors

Mortality

Few direct causes of mortality of raptors (birds of prey) such as bald eagle are expected during the clearing and construction phase. Birds of prey are somewhat susceptible to collisions with vehicles (Harness and Wilson 2001; AltaLink Management Ltd. 2006; Stinson *et al.* 2007). Limited increases in local traffic to and from construction sites, and low vehicle speeds along the right-of-way are expected to result in very few accidental injuries or mortalities to raptors.

Any clearing within the nesting period (April to end of July) has the potential to destroy nests or kill young raptors. Short-eared owls (*Asio flammeus*) and northern harriers (*Circus cyaneus*) are ground nesters (Holt and Leasure 1993) and their nests and eggs can be destroyed by machinery (COSEWIC 2008a).

Habitat Alteration

Clearing of the right-of-way and at the station sites will result in the disruption, alteration, and improvement of some raptor nesting and foraging habitat. Loss of mature and dead standing trees from clearing will have an adverse effect on the local population of raptors that return each year to breed within the Project footprint (e.g., northern hawk owl [*Surnia ulula*], great gray owl [*Strix nebulosa*], osprey and red-tailed hawk [*Buteo jamaic ensis*]).

With the exception of short-eared owl and northern harrier, two ground-nesting species that use open habitats, the loss of tree cover will have a long-term adverse effect on all raptor species that utilize the Project Study Area (Holt and Leasure 1993; Marks *et al.* 1994; Houston *et al.* 1998). Species potentially affected by habitat alteration include merlin (*Falco columbarious*), northern hawk owl and long-eared owl (*Asio otus*).

The removal of forest cover would not only affect breeding and foraging habitat but would also lower the abundance of thermal cover required by raptor species that overwinter within the Project Study Area (e.g., northern hawk owl, great gray owl).

Some raptor species, including members of the hawk (*Accipteridae*), falcon (Falconidae), and owl (Strigidae) families, may benefit from the creation of edge habitats associated with forest clearing along the right-of-way and at station sites. For some raptors, foraging efficiency is often greater along forest edges due to the presence of perches (e.g., trees), visibility of prey and abundance of prey (Widen 1994). For other species, fragmentation of contiguous forest will have an adverse effect on their abundance and distribution. Great gray owls can be adversely affected by forest clearing activities through increased competition with great horned owls, which benefit from the creation of edge habitats (Bull and Duncan 1993).

Sensory Disturbance

During construction, noise from heavy equipment and human activity may cause short-term disturbance to some raptors breeding and/or overwintering in the Project Study Area. However, raptors are quite tolerant of disturbance and may acclimate to the noise quite readily (Becker 2002).

Common Nighthawk

Mortality

Common nighthawk range extends throughout the Project Study Area. No effects on this migratory species' mortality are anticipated during winter clearing. These birds lay eggs directly on the ground in open areas (Taylor 2003a), and eggs or hatchlings could be destroyed for projects where construction occurs in summer. Common nighthawks frequently roost on bare patches on the ground, and are susceptible to collisions with vehicles (COSEWIC 2007b). Local

increases in traffic associated with construction activities may temporarily increase the risk of common nighthawk collisions with vehicles. These collisions are generally infrequent. A common nighthawk was found dead on the roadside during 2010 bird surveys, indicating that collisions with vehicles are possible in the Project Study Area. Since all sources of mortality are important to species at risk as they can affect local and regional populations, mitigation measures are required to minimize these potential effects.

Habitat Alteration

COSEWIC (2007b) reports that habitat loss or alteration may contribute to the decline of common nighthawk populations in the Prairie Provinces. In some cases, common nighthawk nesting and foraging habitat may improve slightly where forest is converted to open habitats where nighthawks nest on the ground and often forage in open habitats. This may occur in association with the clearing of the transmission line right-of-way and at station sites.

Common nighthawks may be subject to sensory disturbance from construction noise. Also, lighting at the construction camp and work sites may attract insects which could be preyed upon by nighthawks.

Olive-sided Flycatcher

No effects on the olive-sided flycatcher's mortality are anticipated during the winter clearing period. Olive-sided flycatchers are unlikely to nest on the cleared rights-of-way if shrubs are not established, and collisions with vehicles are not reported in the literature reviewed. No Project-related effects are expected during the clearing and construction phase.

COSEWIC (2007d) states that habitat loss and alteration are believed to contribute to olive-sided flycatcher population declines. Minor habitat alterations and losses may affect a few individuals where suitable perch trees are removed, but are not expected to have a measurable effect on local populations or to breeding and nesting habitat availability.

Rusty Blackbird

Rusty blackbird range extends throughout Manitoba, including the Project Study Area. As this species is migratory, no effects on mortality are anticipated during the winter clearing period. Rusty blackbirds mainly nest in northern treed muskeg habitat (Nero and Taylor 2003), and are unlikely to nest on the cleared right-of-way if regenerating vegetation is not established. Collisions with vehicles are not reported in the literature reviewed. No Project-related effects are expected during the clearing and construction phase.

COSEWIC (2006a) states that alteration of wintering habitat is the most important threat to rusty blackbird populations, and loss of breeding habitat also contributes to this species' decline. Minor habitat alterations and any potential habitat losses may affect a few individuals at Project

footprints but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability.

The following mitigation measures are proposed to minimize and mitigate effects of the transmission lines during the clearing and construction phase on birds (particularly raptors, common nighthawk, olive-sided flycatcher and rusty blackbird VECs):

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance.
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods.
    - Pre-clearing nest surveys for areas where potential species at risk have potential to occur will occur within the April 1 to August 31 period, if required.
    - Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods for breeding (300 m for olive-sided flycatcher, 200 m for common nighthawk, and 100 m for rusty blackbirds), and 30 m for other species deemed by COSEWIC and MESA to not be species at risk.
- Night-time activities will be avoided during the nesting season in part to minimize disturbance to common nighthawk.
    - While the typical breeding season is April 1 to July 31, in most years, common nighthawk will nest as late as August 31 in the region.

Operation

Raptors

As a group, raptors include several species that may utilize transmission line corridors for hunting, perching or nesting (certain hawks, bald eagles [*Haliaeetus leucocephalus*] and osprey [*Pandion haliaetus*]). Consequently, they have the potential to be affected by the Project.

Effects on raptors can be mainly due to direct mortality or habitat alterations. Raptors can be susceptible to vehicle collisions (Harness and Wilson 2001). Many raptor species that frequent the Project Study Area are migratory species (eagles, hawks and some owls), which means they should not be negatively affected by winter clearing activities.

Electrocution can be a source of bird of prey mortality (Lehman *et al.* 2007). As large birds of prey such as bald eagle are susceptible to electrocution (Harness and Wilson 2001; Millsap *et al.* 2004), mortality could increase where they are attracted to the transmission line and

structures. Collisions with wires are a potential source of mortality, and species that fly at high speeds in pursuit of prey, such as northern goshawk (*Accipiter gentilis*), are most prone to collisions (Bevanger 1994). Potential collision occurrences can be minimized in areas of high incidents with the use of deflectors to increase the visibility of these wires. While individual birds may occasionally collide with transmission wires, otherwise healthy populations should not be affected by such incidents. Mortality of a few individuals would result in negligibly reduced local populations of birds of prey.

Common Nighthawks

As common nighthawks lay eggs on the ground in clearings (Taylor 2003b), eggs or hatchlings could potentially be damaged or destroyed during vegetation maintenance. As this species is migratory, no effects on mortality are anticipated during the winter. As well, there is potential for some bird-wire collisions by nighthawks foraging along the right-of-way. Permanent lighting at station sites may attract insets which could be preyed upon by common nighthawks.

Olive-sided Flycatcher

Minor Project-related effects on olive-sided flycatcher mortality are anticipated during the operation and maintenance phase. As olive-sided flycatchers are associated with semi-open forests, edges, and clear-cuts (Altman and Sallabanks 2000), nests could be destroyed during vegetation management on the right-of-way in spring. However, creation of forest edges in a previously contiguous forest will create some habitat for olive-sided flycatcher.

Although individuals of a population may collide with transmission lines, there is not expected to be a population level effect on olive-sided flycatcher; however, the use of deflectors on the lines could potentially reduce the collision risk if an area of high occurrence was found.

Rusty Blackbird

Minor effects on rusty blackbirds may occur as a result of right-of-way maintenance activities. However, the effects are not expected to be significant.

Mitigation measures for the bird VECs during operation include:

- Limiting vegetation management activities between April 1 and July 31 to reduce disturbance of nesting birds.
- Maintaining some low woody vegetation along the right-of-way as bird habitat.
- Use of bird diverters at stream crossings or near preselected waterbodies to reduce risk of bird collisions at sites deemed to have higher risk of bird collisions, e.g., Nelson River crossing.

- Maintaining treed margins around wetlands that are adjacent to the right-of-way will cause birds to fly over the trees, thereby reducing the rate of birds colliding with the transmission lines.

- Vegetation management activities will be limited from April 1 to August 31 in areas where common nighthawk and other rare bird species have potential to occur will be implemented to minimize the risk of nest destruction.

7.2.10.2 Summary of Residual Effects

Residual effects on raptors and the other bird VECs will include habitat alteration, habitat loss and habitat avoidance due to sensory disturbance (Table 7-11). During construction, habitat alteration will occur along the transmission line rights-of-way and at borrow sites. Habitat loss will occur at the tower footprints and at the station sites. Sensory disturbance from construction activities may discourage use of some habitat in the local area.

The footprint of the Keeyask Transmission Project is 958 hectares (Table 7-6). Of this area, the 35 hectares at the Keeyask Switching Station site and a few more hectares at the tower footprints will be lost. The remaining area will experience habitat alteration. As well, there will be an additional area outside the footprint where birds may experience additional effects related to the habitat alteration for the Project. This habitat "zone of influence" will vary in size depending on the bird species being considered.

Table 7-11: Residual Effects of Keeyask Transmission Project on Bird Valued Environmental Components

Potential Effect	Project Phase	Residual Effects	Assessment Characteristics
Raptors			
Minor habitat loss will occur at station sites and transmission tower footprints	Construction and Operation	Decreased local bird population due to loss of some bird habitat.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**

Table 7-11: Residual Effects of Keeyask Transmission Project on Bird Valued Environmental Components

Potential Effect	Project Phase	Residual Effects	Assessment Characteristics
Minor habitat alteration will occur along right-of-way	Construction and Operation	Change in local bird distribution and numbers associated with some bird habitat that will be altered. Some species will benefit from creation of edge habitat, while others will be adversely affected.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**
Sensory disturbance from construction activities	Construction	Avoidance and/or reduced usage of habitat near Project footprint due to disturbance from construction noise.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short-term **Overall: Not Significant**
Mortality due to collision of bird with vehicles, conductor or other transmission facilities	Construction and Operation	Reduced bird population.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**
Increase in foraging opportunities for species that frequent forest openings	Construction and Operation	Potential positive effect on some species.	Direction: Positive Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**
Common Nighthawk			
Minor habitat loss will occur at station sites and transmission tower footprints	Construction and Operation	Decreased local bird population due to loss of some bird habitat .	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**
Minor habitat alteration will occur along right-of-way	Construction and Operation	Some bird habitat will be altered; creation of openings and areas of bare ground will benefit common nighthawk.	Direction: Positive Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**

Table 7-11: Residual Effects of Keeyask Transmission Project on Bird Valued Environmental Components

Potential Effect	Project Phase	Residual Effects	Assessment Characteristics
Sensory disturbance from construction activities	Construction	Avoidance and/or reduced usage of habitat near Project footprint due to disturbance from construction noise.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short-term **Overall: Not Significant**
Mortality due to collision of bird with vehicles, conductor or other transmission facilities	Construction and Operation	Reduced bird population.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**
Increase in foraging opportunities for species that frequent forest openings	Construction and Operation	Potential positive effect on some species.	Direction: Positive Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**
Olive-sided Flycatcher			
Minor habitat loss will occur at station sites and transmission tower footprints	Construction and Operation	Decreased local bird population due to loss of some bird habitat.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**
Minor habitat alteration will occur along right-of-way	Construction and Operation	Some bird habitat will be altered; creation of edge habitat can benefit olive-sided flycatcher.	Direction: Positive Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**
Sensory disturbance from construction activities	Construction	Avoidance and/or reduced usage of habitat near Project footprint due to disturbance from construction noise.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short-term **Overall: Not Significant**
Mortality due to collision of bird with vehicles, conductor or other transmission facilities	Construction and Operation	Reduced bird population.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**

Table 7-11: Residual Effects of Keeyask Transmission Project on Bird Valued Environmental Components

Potential Effect	Project Phase	Residual Effects	Assessment Characteristics
Rusty Blackbird			
Minor habitat loss may occur at transmission tower footprints	Construction and Operation	Decreased local bird population due to loss of some bird habitat.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**
Sensory disturbance from construction activities	Construction	Avoidance and/or reduced usage of habitat near Project footprint due to disturbance from construction noise.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short-term **Overall: Not Significant**
Mortality due to collision of bird with vehicles, conductor or other transmission facilities	Construction and Operation	Reduced bird population.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**

During operations, habitat alteration will result from vegetation management along the transmission line rights-of-way. It is possible there will be short-term avoidance of the area as a result of sensory disturbance during maintenance activities. However, maintenance activities will only occur once per year or less. Habitat avoidance may occur at the station sites due to sensory disturbance from human or mechanical activities. As well, there is the potential for some bird-wire collisions along the transmission line.

After the mitigation measures are implemented, the potential long-term residual effects remaining may include:

- Minor alteration or loss of habitat and its use by birds along the transmission line rights-of-way, at the station sites and borrow sites.
- Sensory disturbances which may result in temporary movements into alternate habitats by local birds.
- Small increases in foraging and nesting opportunities for some birds, while other bird species may experience small decreases in foraging and nesting opportunities.

- Small increase in bird mortality from increased hunting pressure due to increased access along the transmission line rights-of-way.

These effects can be observed during the construction and operations phases of the Project. The effects are mainly reversible based on decommissioning of the Project. Residual effects are expected to only be of small magnitude after applying the Project mitigation measures.

7.2.10.3 Follow-up

In order to determine the effects of the Project on birds, a bird-monitoring program will be implemented during the construction and operation phases. Bird monitoring is designed to confirm predictions of effects and to determine whether unexpected effects are occurring and to verify the predicted effects of habitat alteration and disturbance during construction and operations. Surveys will also be conducted before clearing to identify the location of nests. Depending on the outcome of those surveys, it may be necessary to mark and avoid construction clearing of nests.

Recommended follow-up during the initial years of operation also includes monitoring of species at risk populations and assessment of bird-wire collisions. Monitoring for bird wire strikes during the operation of the Construction Power Transmission Line and backup Construction Power Transmission Line (future GOT Line) will occur in the period between the operation of those lines and the construction of the Generation Outlet Transmission Lines; this will help verify the predicted effects of mortality for all bird VECs during Project operations and allow for the identification of any unknown areas with high potential for bird wire collision.

More details on specific monitoring can be found in the Biophysical Monitoring Framework in Appendix G.

7.2.11 Mammals

Overview

A range of potential effects on mammal species can be associated with the development of infrastructure related to the Project. Change in species diversity and abundance are known to occur through the anthropogenic development of habitat areas such that these areas are no longer able to sustain some species. Changes in habitat composition can also lead to increases in the abundance of other species, which can lead to increased competition for resources between wildlife species, where none existed before. Construction of Project components can lead to sensory disturbance and discourage species' use of habitats. Operation of Project components can lead to increased opportunities for harvesting species through hunting and trapping. While these activities can occur in a sustainable manner with regulation or

enforcement, if done in excess they can lead to local and potentially regional declines in some mammal populations.

In this assessment, particular attention was given to the potential effects of the Project on VECs. However, a range of effects is also anticipated for non-VEC species of cultural and economic importance, including beaver, muskrat and other wildlife. Species could be affected by the construction and operation of Project components if riparian habitat is affected or if considerably improved access leads to an increase in trapping. Reducing access to previously undisturbed areas and minimizing effects on sensitive habitats will also likely reduce potential Project effects on mammal species, including the VECs considered in more detail in this section.

Project Activities

The following Project-related activities have the potential to affect mammals:

- The movement of vehicles and equipment, the temporary and long-term storage of materials, and the placement of tower structures during transmission line construction.
- Station site and right-of-way clearing activities (e.g., stripping and grubbing).
- Construction of Construction Power Station and Keeyask Switching Station (e.g., ground grid installation and movement of vehicles).

Potential Effects

The Keeyask Transmission Project has the potential to affect mammals in the following key ways:

- Mortality:
    - Collisions of mammals with vehicles, machinery
    - Increased hunting of mammals
    - Increased predator access
- Habitat Loss or Alteration
- Sensory Disturbance:
    - Habitat avoidance due to clearing or maintenance activities
    - Disruption of daily movements due to the physical presence of humans, machinery, or Project structures

- Habitat fragmentation

Mortality

Mammal mortality could occur as a result of improved access to the Project Study Area by hunters, trappers, and predators, and via accidents such as collisions with vehicles. Linear features including roads and transmission lines act as movement corridors for predators such as red fox and gray wolf, and improve access to formerly remote areas by resource users. Increased mortality of prey species and harvested animals could result from increased access to the Project Study Area. Improved hunting efficiency could benefit some predator species.

Habitat Alteration

Mammals are expected to experience a loss of habitat and change in habitat structure and composition through the clearing and construction of transmission lines and other infrastructure. The effects of habitat alteration could have more pronounced effects on some species, such as caribou, than others, such as large carnivores.

Sensory Disturbance

Sensory disturbance will likely affect mammals in the Project Study Area, and could result in disruption of movements. Sensory disturbance will likely be due to construction activities and traffic. Such disturbances could decrease the amount of effective habitat available for various species, as individuals disturbed by construction activities will avoid active construction zones. Sensory disturbance could also be due to transmission line maintenance during operation.

Habitat Fragmentation

Transmission line rights-of-way and access trails contribute to habitat fragmentation, which reduces core area size for mammals requiring large, undisturbed blocks of habitat. Fragmentation also influences ecosystem processes and species. Habitat fragmentation could result in avoidance of the Project Study Area by mammals, disrupting their movements. Such disruptions could occur temporarily during construction or over a longer term due to the presence of transmission line rights-of-way and Project infrastructure.

Valued Environmental Components

The mammal VECs selected which were used to assess effects of the Project were:

- Moose
- Caribou

Assessment of effects on mammals was done for the VECs as well as small mammals, aquatic furbearers, terrestrial furbearers and large carnivores. However, any assessment of significance of residual effects was made for the VECs only.

7.2.11.1 Effects Assessment and Mitigation

Following is an overview of the potential effects on mammals during the construction and operation period. A detailed evaluation of the potential effects and mitigation associated with mammal VECs (moose and caribou) is followed by a brief description of potential effects and mitigation associated with other mammals.

Construction

Moose

Potential Project effects on moose during construction of transmission lines include habitat loss or alteration. Based on the results of a habitat modelling exercise, the Construction Power Transmission Line footprint consists of 4.1% primary moose habitat and 83.2% secondary moose habitat. Since the footprint, plus some additional area related to loss of habitat effectiveness, only encompasses a total of 755 ha, the amount of moose habitat altered is expected to be small. No calving and rearing islands are intersected by the transmission line right-of-way.

The Unit Transmission Lines footprint consists of 0.1% primary moose habitat and 83.5% secondary moose habitat. Since the Unit Transmission Line footprint, plus some additional area related to loss of habitat effectiveness, only encompasses an area of 86 ha, the amount of moose habitat altered is expected to be small. No calving and rearing islands are intersected by the transmission line right-of-way.

The Generation Outlet Transmission Lines footprint consists of 14.1% primary moose habitat and 76.8% secondary moose habitat. Because the footprint, plus some additional area related to loss of habitat effectiveness, only encompasses an area of 1,583 ha, the amount of moose habitat altered is expected to be small. No calving and rearing islands are intersected by the transmission line right-of-way.

The Keeyask Construction Power Station overlaps pre-existing human infrastructure and clearing associated with the construction of the north access road, thus no additional moose habitat will be lost. The Keeyask Switching Station footprint consists of 0.1% of primary moose habitat and 99.4% secondary moose habitat. Because the footprint, plus some additional area related to loss of habitat effectiveness, only encompasses an area of 68 ha, the amount of moose habitat lost is expected to be small. The Radisson Converter Station upgrades overlap pre-existing human infrastructure and clearing associated with current Radisson Converter Station site and consequently no moose habitat will be lost during construction.

Sensory disturbances (e.g., traffic, machinery) associated with transmission line clearing and construction could result in a loss of effective habitat, temporary abandonment of calving habitat, and disruption of movements. Moose exhibit a high level of calving site fidelity and do not easily abandon suitable areas (RRCS 1994); they often return once the disturbance ends (Colescott and Gillingham 1998). Moose cows and calves were often reported by workers during the construction of the Wuskwatim Generating Station, and overall moose activity levels during construction remained high throughout the access road construction period, indicating that construction activity does not affect all moose (Wuskwatim Power Limited Partnership 2011). Individuals could be displaced from the construction zone, but will likely relocate to suitable areas elsewhere in their home ranges. Disruption of moose movements could occur through the avoidance of construction zones. Moose occasionally move across or along linear features, even during construction (Wuskwatim Power Limited Partnership 2011). Since moose do not easily abandon habitat due to sensory disturbance and are likely to return when the disturbance ends, the effects of sensory disturbance and disruption of movements on moose in the Project Study Area are expected to be negligible to small.

Other Project effects on moose could include increased mortality. The creation of cleared linear corridors will likely increase hunter and predator access to the Project Study Area along the transmission line rights-of-way. Species such as gray wolves use cleared linear corridors as transportation routes in order to hunt more efficiently (James and Stuart-Smith 2000). Similarly, hunters, including workers and local resource users, can use clearings to access areas that were previously inaccessible. Potential effects of predation and harvest will likely be reduced due to sensory disturbances by people, machinery, and traffic in the Project Study Area during construction. The effects of increased mortality are expected to be small during construction, and will be considered further under operation.

Potential Project effects on moose also include mortality due to wildlife-vehicle collisions. The number of collisions with vehicles could increase due to increased traffic levels during construction. While vehicles may occasionally collide with moose, due to increased local construction traffic, such events are uncommon and will likely have a negligible effect on the regional moose population.

Mitigation measures for moose during construction include:

- An Access Management Plan will be developed for the Keeyask Transmission Project to reduce the effects of moose mortality from increased access and harvest in the Project Study Area.
- Vegetation buffers will be established on the transmission line rights-of-way as practicable to reduce the line of sight between hunters and moose.
- Possession of firearms by Project workers will be prohibited in camps and at work sites to reduce moose mortality due to hunting during construction.

- Information about wildlife awareness will be provided for workers to reduce vehicle speeds and the risk of wildlife-vehicle collisions.

Caribou

Three types of caribou have been identified in the Project Study Area: barren-ground caribou, Pen Islands coastal caribou and summer resident caribou. Barren-ground caribou occur infrequently in winter. Pen Island coastal caribou occur mainly in winter, and individuals are also present in summer (Manitoba Hydro 2012).

Potential Project effects on caribou during construction of the transmission lines include habitat loss or alteration. The Construction Power Transmission Line footprint consists of 74% caribou winter habitat. As the footprint, plus some additional area related to loss of habitat effectiveness, only encompasses an area of 755 ha, the amount of winter habitat altered is expected to be small. No calving and rearing islands are intersected by the transmission line right-of-way.

The Unit Transmission lines footprint consists of 87% caribou winter habitat. As the footprint, plus some additional area related to loss of habitat effectiveness, only encompasses an area of 86 ha, the amount of winter habitat altered is expected to be small. No calving and rearing islands are intersected by the transmission line right-of-way.

The Generation Outlet Transmission Lines footprint consists of 68% caribou winter habitat. As the footprint, plus some additional area related to loss of habitat effectiveness, only encompasses an area of 1,583 ha, the amount of caribou habitat lost is expected to be small. No calving and rearing islands are intersected by the transmission line right-of-way.

The Keeyask Construction Power Station overlaps pre-existing human infrastructure and clearing associated with the construction of the north access road, thus no additional caribou habitat will be lost. The Keeyask Switching Station footprint consists of 98% caribou winter habitat. As the footprint, plus some additional area related to loss of habitat effectiveness, only encompasses an area of 68 ha, the amount of caribou habitat lost is expected to be small. No calving and rearing islands are in the Keeyask Switching Station footprint, while three islands occur within 2 km of it.

The Radisson Converter Station upgrades overlap pre-existing human infrastructure associated with the current Radisson Converter Station site and consequently no caribou habitat will be lost during construction. There are no calving and rearing islands within 2 km of the Radisson Converter Station.

Potential Project effects on caribou during construction also include sensory disturbance and disruption of movements. Sensory disturbances from traffic, machinery, and people will likely result in avoidance of some winter habitat within 2 km of construction zones by migratory caribou. Individuals that move away from affected winter habitat will most likely find suitable

habitat elsewhere in the region (as defined in WRCS 2012; Shideler *et al.* 1986; Dyer *et al.* 2001), which would include areas within their home ranges (see Manitoba Hydro 2012 for locations of collared summer residents and Pen Islands caribou). Caribou activity will also likely decline within 2 km of construction zones in late spring, summer, and fall (Wuskwatim Power Limited Partnership 2011), resulting in a loss of effective habitat. Construction during the spring calving season could result in temporary abandonment of calving and rearing areas. Because clearing and most construction activities for the transmission lines are expected to occur in winter, caribou calving will not be affected by sensory disturbance. As relatively little effective habitat will be affected compared with its availability beyond the Project Study Area, and because there is suitable calving and rearing habitat elsewhere in the region, the overall effect of sensory disturbance will likely be small.

Movements of migratory caribou through the area could be disrupted. Although the timing is generally known, the extent of these movements is unpredictable. The effects of the Project components are likely to be negligible because of the small affected area compared to the broad movements and large ranges that these caribou occupy in winter.

Access to calving and rearing islands in Stephens Lake could be impeded by the cleared rights-of-way. Pen Islands and summer resident caribou exhibit seasonal movements into and out of the Project Study Area (Manitoba Hydro 2012). In addition, the Wuskwatim Transmission Line has had minimal to no effect on caribou movements or their use of core areas (Manitoba Hydro 2012). A small loss of effective habitat in calving and rearing complexes near the Construction Power Transmission Line, Unit Transmission Lines, and the Generation Outlet Transmission Lines, including those in Stephens Lake, is expected during construction.

Caribou mortality can be caused by factors including hunting, predation, and collisions with vehicles. The creation of cleared linear corridors will likely increase hunter and predator access to the Project Study Area along the transmission line rights-of-way. Species such as gray wolves use linear features to travel and to hunt (James and Stuart-Smith 2000). Greater hunting efficiency and a potential influx of predators could increase caribou mortality. However, data from the Bipole III Transmission Project suggest that caribou mortality due to predation is more common in burned habitat than on transmission line rights-of-way, and that population growth rates in disturbed areas are similar to those in remote unfragmented areas (Manitoba Hydro 2012). As such, effects of increased mortality due to predation on caribou populations in the region will likely be negligible, and particularly for Qamanirjuaq barren-ground caribou, which are infrequently found in the Project Study Area.

Effects of improved access to the area could also include increased mortality due to hunting. Hunters could use the transmission line rights-of-way to access areas that were previously inaccessible. The cleared rights-of-way could also improve the line of sight between hunters and caribou. However, the Project Study Area overlaps only a small portion of Game Hunting Area 3, the area where licensed hunting of coastal and barren-ground caribou is permitted, and

the limited number of resident licences available for caribou harvest is managed by the Province. The potential increase in caribou mortality due to workers hunting will be managed and the overall effect will likely be neutral. Domestic harvest could occur during construction, although with disturbances in the area, these locations will not likely be used by either caribou or hunters.

Potential transmission-related Project effects on caribou also include mortality due to wildlife-vehicle collisions. Collisions with vehicles are not generally considered an important source of caribou mortality (Jalkotzy *et al.* 1997; Environment Canada 2012) and due to the existing terrain along the rights-of-way and cautionary speed limits, the risk of collisions is very low. Effects of mortality due to collisions with vehicles on the regional caribou population will likely be small and should be negligible with mitigation.

Mitigation measures for caribou during construction include:

- Winter construction on transmission line (outside calving period).
- Borrow areas will be sited to avoid calving and rearing complexes and reduce habitat loss.
- Access trails will be routed to avoid calving and rearing complexes and reduce loss of effective habitat.
- An Access Management Plan will be developed for the Keeyask Transmission Project to reduce the effects on caribou mortality from increased access and harvest in the Project Study Area.
- Possession of firearms by Project workers will be prohibited in camps and at work sites to reduce mortality due to hunting during construction.

Small Mammals

Small mammals such as red-backed vole are expected to experience limited habitat loss and sensory disturbance during construction, possibly including roosting habitat for little brown myotis. Some roosting habitat may be created in temporary buildings set up for construction. Small mammals are expected to find suitable habitat throughout the region (Map 4-1). Some small mammal mortality could occur during clearing of the rights-of-way, and if individuals are removed from camp buildings.

Mitigation measures for small mammals will include:

- Construction camps and marshalling yards will be kept clean and free of garbage to avoid attracting wildlife to the site.

Aquatic Furbearers

Aquatic furbearers are expected to experience minor habitat loss and sensory disturbance during construction, as relatively small streams will be crossed by the transmission line rights-of-way. Additionally, some beaver may be removed by local trappers from dammed stream crossings to facilitate clearing and construction.

Mitigation measures for aquatic furbearers include:

- A 100-m buffer will be retained, where practical, around lakes, wetland, and creeks to minimize habitat loss for aquatic furbearers. When a 100-m buffer is not practical, a smaller buffer may be applied.

Terrestrial Furbearers

Terrestrial furbearers are expected to experience some habitat loss and sensory disturbance during construction. Terrestrial furbearers are expected to find suitable habitat throughout the region. In addition, some terrestrial furbearers such as red fox could become habituated to people if food and garbage are not properly managed. These potential effects are likely manageable with mitigation. Given the large home range for a single wolverine, it is unlikely that construction will have a measureable effect on the wolverine population.

Mitigation measures for terrestrial furbearers include:

- Right-of-way access trails will be decommissioned, where not required for maintenance activities. to minimize access-related effects such as harvest.

- Construction camps and marshalling yards will be kept clean and free of garbage to avoid attracting wildlife to the site.

Large Carnivores

Large carnivores are expected to experience some habitat loss and sensory disturbance during construction, possibly at black bear and gray wolf dens. Large carnivores are expected to find suitable habitat throughout the region (Map 4-1). Other effects during construction include the potential for black bear to become habituated to people if food and garbage are not properly managed. Some harvest of large carnivores could occur.

Mitigation measures for large carnivores include:

- Possession of firearms by Project workers will be prohibited in camps and at work sites to reduce large carnivore mortality due to hunting during construction.

- Construction camps and marshalling yards will be kept clean and free of garbage to avoid attracting wildlife to the site.

- 100-m buffers will be established around active gray wolf and black bear dens within the Project footprint to minimize the disturbance of animals during sensitive periods.

Operation

Moose

Potential Project effects on moose during operation of transmission lines include habitat alteration. Periodic maintenance will be required to prevent vegetation from reaching heights that could interfere with the function of the transmission line, impede access for maintenance workers, or create a fire hazard (Manitoba Hydro 2007). Vegetation maintenance will likely disturb moose habitat on the Construction Power Transmission Line, Unit Transmission Lines, and Generation Outlet Transmission Lines rights-of-way; however, moose prefer younger vegetation to mature vegetation and regenerating shrub communities are important moose habitat (Richard and Doucet 1999; Peek 2007). Winter and summer thermal and snow interception cover may be reduced in areas where trees are removed (Coady 1974; Peek *et al.* 1976; Demarchi and Bunnell 1993; Osko and Hilz 2004). If herbicides are used for vegetation maintenance on the right-of-way, some winter browse species could be reduced. The overall quality of moose habitat in the Project Study Area is not anticipated to change during operation.

Potential Project effects on moose during operation of the transmission lines also include sensory disturbance, disruption of movements, and habitat fragmentation. Annual inspections of the transmission lines on the ground or by air could disturb moose; however, such events will be brief and infrequent. Maintenance activities follow well-established guidelines (see Chapter 2), and effects of sensory disturbance on the regional moose population are expected to be negligible. Moose movements in the area could be disrupted due to habitat fragmentation and the presence of the rights-of-way. Moose are resilient to development features on the landscape (Laurian *et al.* 2008) and often use edge habitat (Dussault *et al.* 2005). As such, effects of the disruption of moose movements by the transmission line rights-of-way and other Project infrastructure will likely be negligible.

Other Project effects on moose could include increased mortality. The cleared transmission line rights-of-way will likely increase predator access into the Project Study Area, which can result in increased moose mortality. Species such as gray wolves have been shown to use cleared linear corridors as transportation routes in order to hunt more efficiently (James and Stuart-Smith 2000). Increased access to the Project Study Area and greater hunting efficacy will affect moose near the rights-of-way, and is expected to have an effect on the local population. Collisions with vehicles could increase if moose are attracted to the Generation Outlet Transmission Lines right-of-way adjacent to the south access road. While vehicles may

occasionally collide with moose, such events are uncommon and will likely have a negligible effect on the local moose population.

Moose mortality will likely increase in the Project Study Area due to hunting. Hunters can use clearings to access areas that were previously inaccessible, and the cleared rights-of-way could improve the line of sight between hunters and moose. The effect of increased moose harvest in the Project Study Area is an important concern. Access and harvest is expected to have an effect on moose where individual home ranges overlap the transmission line rights-of-way. The effect is considered small compared to the regional moose population.

The measures for mitigating the effects of transmission lines on moose during operation could apply to other infrastructure. Mitigation measures for moose during operation include:

- Right-of-way access trails will be decommissioned, unless required for on-going maintenance, to minimize access-related effects of harvest and predation.
- Manitoba Hydro will work with Manitoba Conservation and Water Stewardship to develop access control and hunter related signage in order to prevent excessive hunting.
- If moose mortality is greater than anticipated, moose crossing signs will be placed along the south access road near high-quality moose habitats to reduce the potential of wildlife-vehicle collisions.
- The use of helicopters for maintenance activities on the transmission lines will be avoided near calving and rearing habitat from May 15 to June 30, to reduce effects of sensory disturbance on calving females and their young.

Caribou

Potential Project effects on caribou during operation include habitat alteration. Periodic maintenance will be required to prevent vegetation from reaching heights that could interfere with the function of the transmission line, impede access for maintenance workers, or create a fire hazard (Manitoba Hydro 2007). Vegetation maintenance will alter habitat on the rights-of-way. Where herbicides are used for vegetation maintenance, some broadleaf summer plant forage species for caribou could be marginally reduced on the rights-of-way. Typical summer foods such as horsetails, graminoids, and forbs (Rettie *et al.* 1997; Rettie and Messier 2000) and winter foods such as lichens could also be reduced on the rights-of-way.

Potential Project effects on caribou during operation also include sensory disturbance, habitat fragmentation, and disruption of movements. Line maintenance activities in spring could disturb females and their young during the calving period. Because line maintenance activities will be infrequent and short-term, effects of sensory disturbance on caribou will likely be negligible. Habitat fragmentation can affect the quality of caribou habitat and caribou movements

throughout their ranges (Environment Canada 2012), particularly for summer residents and Pen Islands coastal caribou, which are the two main types of caribou found in the Project Study Area. Human developments can create barriers to caribou movements (Smith *et al.* 2000; Dyer *et al.* 2001; Sorenson *et al.* 2008) and can affect movements to calving and rearing complexes. Pen Islands coastal caribou and summer residents move throughout the Project Study Area and cross existing rights-of-way including PR 280, transmission lines and a railway to access to calving islands on Stephens Lake. In addition, the Wuskwatim Transmission Line has had minimal to no effect on caribou movements or their use of core areas (Manitoba Hydro 2012). It is likely that caribou will continue to cross the rights-of-way in the long term, but a small loss of effective habitat in calving and rearing complexes near the Construction Power Transmission Line, Unit Transmission Lines, and the Generation Outlet Transmission Lines is expected as a result of Project operations. As caribou ranges and migration routes shift in response to changing conditions, and as the occurrence of some groups of caribou is erratic in the Project Study Area, a negligible to small effect on caribou movements is expected during operation.

The cleared linear corridor will likely increase hunter and predator access to the Project Study Area, which could result in increased caribou mortality. Species such as gray wolves use cleared linear corridors for more efficient travel and hunting (James and Stuart-Smith 2000). Similarly, hunters can use clearings to access areas that were previously inaccessible. Movements of Pen Islands coastal caribou and infrequent occurrences of Qamanirjuaq barren-ground caribou in the area would likely result in a negligible winter harvest of caribou compared to the large population. Caribou are not usually harvested during the spring and summer, and therefore the summer resident caribou are unlikely to be affected. With mitigation, including the continued regulation and monitoring of caribou harvest by Manitoba Conservation and Water Stewardship, the caribou harvest will not likely exceed sustainable levels and is expected to have a negligible effect on the regional caribou population.

Mitigation measures for caribou during operation include:

- Right-of-way access trails will be decommissioned, unless required for ongoing maintenance, to minimize access-related effects of harvest and predation.
- Manitoba Hydro will work with Manitoba Conservation and Water Stewardship to maintain previously developed access control and hunter related signage in order to prevent excessive hunting.
- The use of helicopters for maintenance activities on the transmission lines will be avoided near calving habitat from May 15 to June 30, to reduce effects of sensory disturbance on calving females and their young.

- A plan is being developed to coordinate caribou mitigation and monitoring activities among Manitoba Hydro's northern developments, as well as with government authorities and existing caribou committees and management boards.

Small Mammals

During operation, no additional habitat loss is expected. As vegetation regenerates along the rights-of-way, new habitats will be created and used by small mammals. New small mammal communities will develop on the rights-of-way and along edges. Habitats with low-growth vegetation will be dominated by species that do not require forest canopy cover (e.g., meadow vole). No additional roosting opportunities are expected to be created for little brown myotis; however, edge habitat along the rights-of-way may allow for increased feeding opportunities.

Mitigation measures for small mammals during operation include:

Organic material removed from temporarily cleared areas will be replaced to encourage re-growth of native vegetation and reduce habitat loss.

Aquatic Furbearers

During operation, no additional habitat loss is expected. As vegetation regenerates along the rights-of-way, new browse is likely to be created for beaver. While some new access may be created for trappers, trapping pressure is not expected to increase substantially. Local traplines that overlap the Project Study Area will have variations in harvest associated with fluctuating fur prices and domestic consumption. The effects of trapping on aquatic furbearers are expected to be small in magnitude.

Mitigation measures for aquatic furbearers during operation include:

- Right-of-way access trails will be decommissioned where practical to minimize access-related effects such as harvest.

Terrestrial Furbearers

During operation, no additional habitat loss is expected. As vegetation regenerates along the right-of-way, hunting opportunities could be created as small mammal populations begin to use habitat along the rights-of-way. Local traplines that overlap the Project Study Area will have variations in harvest associated with fluctuating fur prices and domestic consumption. The effects of trapping on terrestrial furbearers are expected to be small. Considering the large home range for a single wolverine, it is unlikely that operation of the Project will have a measureable effect on wolverine.

Mitigation measures for terrestrial furbearers during operation include:

- Right-of-way access trails will be decommissioned where practical to minimize access-related effects such as harvest.

Large Carnivores

During operation, no additional habitat loss is expected. The creation of new linear corridors could facilitate movement and increase hunting efficiency for gray wolves, although decommissioning access trails where feasible will reduce this effect. Predator movements could become more frequent if snowmobiles are used on the transmission line rights-of-way for travel. Because large carnivores occupy large home ranges, it is unlikely that operation of the Project will have a measureable effect on their populations.

Mitigation measures for large carnivores during operation include:

- Right-of-way access trails will be decommissioned where practical to minimize access-related effects.

7.2.11.2 Summary of Residual Effects

After mitigation, the Project is not expected to have significant adverse residual effects on mammal populations or their habitats (Table 7-12). Predicted long-term potential residual effects include the following:

- Small alteration of habitat for caribou and moose along the Generation Outlet, Construction Power and Unit Transmission Lines, and a small, long-term loss of habitat at the Construction Power Station and Keeyask Switching Station.

- Small avoidance of Project infrastructure by caribou resulting in a loss of effective habitat.

- Periodic sensory disturbance effects to caribou and moose during construction and operation, resulting in small behavioural changes.

- A small increase in regional access for predators and hunters resulting in a small increase in moose and caribou mortality.

These effects can be observed during the construction and operations phases of the Project. It is expected that Project activities will be reversible, as over time, biophysical disturbances due to the Project will be reversed by the natural succession of revegetation upon decommissioning. Residual effects are expected to be of small magnitude after applying mitigation measures.

Table 7-12: Residual Effects of the Keeyask Transmission Project on Mammals

Potential Effect	Project Phase	Residual Effect	Assessment Characteristics
Moose			
Habitat loss and alteration	Construction and Operation	Decreased moose population in the Project Study Area for two or more generations due to reduced habitat	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**
Sensory disturbance, disruption of movement, and habitat fragmentation	Construction and Operation	Altered movements in the Project Study Area due to sensory disturbance	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**
Mortality due to predation, hunting and wildlife-vehicle collisions	Construction and Operation	Decreased moose population in the Project Study Area for two or more generations due to increased mortality	Direction: Adverse Magnitude: Small to large Geographic Extent: Small Duration: Long-term **Overall – Not Significant**
Caribou			
Habitat loss and alteration	Construction and Operation	Decreased caribou population in the Project Study Area for two or more generations due to habitat alteration	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**
Sensory disturbance, disruption of movement, and habitat fragmentation	Construction and Operation	Altered movements and distributional shifts due to sensory disturbance	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**
Mortality due to predation, hunting and wildlife-vehicle collisions	Construction and Operation	Decreased caribou population in the Project Study Area for two or more generations due to increased mortality	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall: Not Significant**

7.2.11.3 Follow-up

In order to verify the short-term and long-term effects of the Project on moose and caribou, the effectiveness of mitigation measures, and where there is higher uncertainty in predicting Project effects, monitoring will be required These monitoring activities will:

- Measure habitat alteration and use of calving and rearing islands near the Project footprint.
    - This will assist in verifying the predicted effects of habitat alteration and disturbance on caribou during operation.
- Measure movements across the widest rights-of-way.
    - This will assist in verifying the predicted effects of habitat alteration and disturbance on caribou during operation.
- Monitor harvest and predation effects associated with access.
    - This will assist in verifying the predicted effects of mortality on caribou and moose during operation.

More details on specific monitoring can be found in the Biophysical Monitoring Framework in Appendix G.

7.3 SOCIO-ECONOMIC ENVIRONMENT EFFECTS AND MITIGATION

Overview

The socio-economic environment considers the people and communities in the Project Study Area and the way they interact with the physical and biophysical environment. The assessment of socio-economic environmental effects of the Project considers information summarized in three technical supporting volumes:

- Socio-economic Technical Report
- Heritage Resources Technical Report
- Forestry Technical Report

The Socio-economic Study Area Map 4-9; InterGroup 2012) includes the Project Study Area as well as:

- The community of Split Lake which is the reserve community for Tataskweyak Cree Nation (TCN) (formerly known as Split Lake Cree Nation). The proposed Project would be constructed in the Split Lake Resource Management Area (SLRMA) where TCN Members engage in resource harvesting and traditional activities.

- Fox Lake (Bird) is one of the reserve communities for Fox Lake Cree Nation (FLCN). Many FLCN members live in Gillam and on the adjacent A Kwis Ki Mahka reserve and engage in resource harvesting activities and traditional activities in the Project Study Area.

- The Town of Gillam.

Valued Environmental Components

Socio-economic valued environmental components (VECs) are aspects of the socio-economic environment that are valued by people. Socio-economic VECs identified for the project include:

- Land and Resource Use

- Economy

- Population, Infrastructure and Services

- Personal, Family and Community Life

- Heritage Resources

Potential Effects

Potential environmental effects were identified based on the project description, review of available literature, experience with other linear projects in Northern Manitoba and information provided by communities in the Socio-economic Study Area. Potential effects of the project are reviewed for each of the socio-economic environment VECs (Land and Resource Use; Economy; Population, Infrastructure and Services; Personal, Family and Community Life and Heritage Resources).

- Project effects are described, where possible, by Project phase. Project effects on the socio-economic environment include:

- Clearing, construction, operation and maintenance of the Unit, Construction Power and Generation Outlet Transmission lines will affect domestic resource use, recreation, commercial trapping and forest resources in the Socio-economic Study Area.

- Employment and business opportunities will be created during the Project construction phase. Employment opportunities during the operations phase are limited.
- During the construction phase, the Project is expected to increase traffic, increase demands on community health and emergency services and increase demand on Gillam recreation and leisure services.
- During the construction phase, the Project may increase the risk of workplace accidents.
- During the construction phase, there may be risks to public safety as a result of adverse interactions between local people and non-local construction workers.
- During the construction and operation phases, the Project may increase the risk of accidents or injuries to area residents or resource users at Project sites.
- During the construction and operation phases there will be effects related to the loss of cultural landscapes and effects to culturally important domestic and commercial resource use opportunities.
- During the operation phase, concerns related to effects to human health from electro-magnetic fields may arise.
- No known archaeological sites were identified in the areas proposed to be developed by the Project. However, there is the potential for heritage resources and human remains to be unearthed during construction activities.

7.3.1 Land and Resource Use

Land and resource use considers the way people in the area use the land and water for domestic purposes, commercial uses and outdoor travel and recreation. This section discusses potential effects of the Project on land and resource activities including:

- Domestic resource use
- Commercial resource use
- Outdoor travel and recreation

7.3.1.1 Effects Assessment and Mitigation

Construction

Domestic Resource Use

The Project will affect domestic resource use in the Socio-economic Study Area during construction. These effects will continue through the operation phase:

- Construction of the Generation Outlet Transmission Lines will typically require clearing an additional approximately 200 m wide corridor over the approximately 38 km length of the lines. However the width and configuration of the three lines in the corridor will vary, as described in Section 2.3.4.1.

- Construction of the Construction Power Transmission Line will require clearing an additional approximately 21 km corridor approximately 60 m wide between KN36 and the Construction Power Station for most of its length. Rights-of-way widths will vary at locations shared with the Generation Outlet Transmission lines as described in Section 2.3.4.1.

- Construction of four 138 kV Unit Transmission Lines will require a single 265 metre wide corridor of approximately 4 km.

The estimated total cleared area required for all Project transmission line rights-of-way is approximately 744 ha. The clearing of areas for Project infrastructure will affect habitat in the Socio-economic Study Area. This may lead to increased pressures on resource use activities in areas out of the project footprint area. As discussed in the biophysical effects assessment section, aquatic furbearers and terrestrial furbearers are expected to experience some habitat loss and sensory disturbance during construction. Moose and caribou are expected to experience habitat loss and sensory disturbance. Seven species identified as being of particular interest to local First Nations were recorded in the Study Area though substantial effects related to the Project are not anticipated as most of these species were either generally widespread or widespread in their preferred habitat. These effects on the biophysical environment are also anticipated to cause effects on domestic resource use including hunting and gathering.

TCN's evaluation report notes issues related to the Project include the loss of traditional plants and berries, adverse effects to subsistence activities such as trapping and hunting and diminished opportunities to pursue a traditional lifestyle (TCN 2011). During workshops with FLCN, similar concerns were noted with respect to potential effects on wildlife and domestic resource use.

The construction of the Construction Power Transmission Line and the Generation Outlet Transmission Lines may allow access by individuals who would not previously have used the area. This effect may be considered positive in some respects (by allowing increased access to

some areas by traditional resource users) and negative in other respects (by improving accessibility to other resource users or recreational users).

Mitigation measures for these effects include:

- The site selection process leading to the preferred route selection was designed to minimize the potential for effects on domestic resource use.
- Manitoba Hydro will work with directly affected communities to prepare an Access Management Plan prior to construction.

Commercial Resource Use

The Project will affect commercial trapping activities in the PSA. These effects will begin during the construction phase and persist through the operations phase:

- The Generation Outlet Transmission Lines will create an additional approximately 200 m wide corridor over the approximately 38 km length of the lines. This corridor will cross portions of traplines 65 and 9.
- The Construction Power Transmission Line will create an approximately 22 km corridor between KN-36 and the Construction Power Station. This corridor will cross portions of traplines 7, 8, 9 and 15.
- The Unit lines will be located in a portion of trapline 15.

Access created by the existence of the rights-of-way will have effects on the pursuit of commercial resource use. During construction and operation, the rights-of-way may allow access by individuals who would not previously have used the area. This effect may be considered positive in some respects (by allowing increased access to commercial trappers in some areas of their traplines) and negative in other respects (by improving accessibility to recreational users).

During construction, the Project will result in the loss of useable timber resources in the non-commercial forest zone. The maximum potential effect on the non-commercial forest zone was calculated at 0.35% of the land base within the non-commercial forest zone. The Project will result in loss of productive forestland in the commercial forest zone. This effect was calculated to represent approximately 0.06% of the total productive forestland within FMU 86. The Project will also result in a loss of standing timber. This effect was calculated at 0.023% of the total volume of productive timber within FMU 86. Some of this wood volume may be of sufficient size and concentration to make it practical to salvage. Refer to the Forestry Technical Report for more information.

Mitigation measures for these effects include:

- The site selection process leading to the preferred route selection was designed to minimize the potential for effects on commercial resource use.
- Manitoba Hydro will work with directly affected communities to prepare an Access Management Plan prior to construction.
- Registered trapline holders whose commercial trapping operations are affected by the Project will be compensated consistent with Manitoba Hydro's Trapper Notification and Compensation Policy for New Transmission Development. Compensation may include trap line improvements, employment opportunities, equipment replacement or monetary settlement.
- Limiting clearing to the Project footprint.
- Salvaging timber where demand exists and it is economically and logistically feasible.
- Clearing to be conducted on frozen ground to minimize effects on adjacent forest stands.
- Burn piles should be placed well clear of adjacent forest stands to avoid scorching them during burning.
- All fires must be fully extinguished prior to spring breakup.
- Compensate Manitoba Conservation and Water Stewardship consistent with the forest damage appraisal and valuation guidelines.

Travel and Outdoor Recreation

During construction, access to some trails and travel routes may be affected. These effects are expected to be small and localized.

Mitigation measures for these effects include:

- The site selection process leading to the preferred route selection was designed to minimize the potential for effects on travel and outdoor recreation.
- Manitoba Hydro will work with directly affected communities to prepare an Access Management Plan prior to construction.

Operation

Domestic Resource Use

As noted above, clearing and maintenance of areas for Project infrastructure will affect habitat in the Socio-economic Study Area beginning in the construction phase and continuing through the operations phase. Effects on domestic resource use that begin in the construction phase are anticipated to continue in the operations phase.

As discussed in the biophysical effects assessment section, aquatic furbearers and terrestrial furbearers are expected to experience some habitat loss during construction, but no additional habitat loss is expected during operations. As vegetation regenerates along the rights-of-way, some populations may begin to use habitat along the rights-of-way. As discussed in the biophysical effects assessment section, effects on priority plants during operation are expected to remain similar to those described during Project construction.

No additional loss of moose and caribou habitat is expected during operation, though sensory disturbance and disruption of movements may occur infrequently during maintenance activities. Moose and caribou may also experience caribou and moose mortality as a result of increased hunter and predation access. These effects on the biophysical environment are also anticipated to cause effects on domestic resource use including hunting and gathering.

Commercial Resource Use

Effects on commercial trapping that begin in the construction phase are anticipated to persist in the operations phase of the Project.

Travel and Outdoor Recreation

Project infrastructure will be located adjacent to existing or planned infrastructure to the extent feasible. Therefore adverse effects to travel and outdoor recreation are not anticipated during the operations phase.

7.3.1.2 Summary of Residual Effects

Clearing, construction, operation and maintenance of the Project will affect domestic resource use, commercial trapping and forest resources, and outdoor travel and recreation in the Socio-economic Study Area. An assessment of these residual effects, following mitigation, was completed consistent with the methods and definitions described in Chapter 3. Table 7-13 summarizes the residual effects of the Project on Land and Resource Use.

Table 7-13: Residual Effects of Keeyask Transmission Project on Land and Resource Use

Potential Effect	Project Phase	Residual Effect	Assessment Characteristics
Reduced habitat for furbearers, moose and caribou leads to potential reduction of local wildlife affecting hunting.	Construction and Operations	Potential reduction of local wildlife reduces hunting opportunity.	Direction: Adverse Magnitude: Small Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**
Reduced plant habitat leads to potential reduction of plant harvest opportunities.		Potential reduction of plant harvest opportunities.	
Rights of way create access for recreational hunters and other recreational resource users resulting in increased hunting pressure.	Construction and Operations	Rights-of-way create access for recreational hunters and other recreational resource users resulting in increased hunting pressure.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall – Not Significant**
Reduced habitat for furbearers, moose and caribou leads to potential reduction of local wildlife affecting trapping.	Construction and Operations	Potential reduction of local wildlife affecting trapping.	Direction: Adverse Magnitude: Small Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**
Loss of useable timber resources in the non-commercial forest zone.	Construction	Loss of useable timber resources in the non-commercial forest zone.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall – Not Significant**

Table 7-13: Residual Effects of Keeyask Transmission Project on Land and Resource Use

Potential Effect	Project Phase	Residual Effect	Assessment Characteristics
Loss of productive forestland in the commercial forest zone.	Construction	Loss of productive forestland in the commercial forest zone.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall – Not Significant**
Loss of standing timber.	Construction	Loss of standing timber.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall – Not Significant**
Access to some outdoor trails and travel routes may be disturbed during construction.	Construction	Access to some outdoor trails and travel routes may be disturbed during construction.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short-term **Overall – Not Significant**

Domestic Resource Use

Effects to domestic resource use occur during the construction and operation phases as a result of clearing, presence and maintenance of Project infrastructure. The project will create additional rights-of-way and affect habitat. These effects have been mitigated through the site selection process. The preferred route for the Generation Outlet Transmission lines has been selected to follow existing or planned infrastructure to the extent feasible, thereby minimizing the creation of new cleared areas. The biophysical effects assessment concluded that effects on caribou and moose from habitat loss and alteration would be small and not significant. Effects on priority plant species were determined to be negligible to moderate and not significant. Effects on habitat fragmentation were determined to be small and not significant. Effects on domestic resource use are anticipated to have similar characteristics to the effects on these biophysical components of the environment.

Following mitigation, the residual effects are anticipated to be adverse in direction, small in magnitude (as a result of preferred routes following existing or planned infrastructure to the extent feasible), medium in geographic extent and long-term in duration. Residual effects are therefore determined to be not significant.

Access created by the Project will also create effects on domestic resource use during the construction and operation phases. These effects have been mitigated through the site selection process by following existing or planned infrastructure to the extent feasible. Manitoba Hydro will also work with directly affected communities to prepare an Access Management Plan prior to construction. Following mitigation, the residual effects are anticipated to be adverse in direction, small in magnitude, small in geographic extent and long-term in duration. Residual effects are therefore determined to be not significant.

Commercial Resource Use

Construction, operation and maintenance of the Project will cause effects to commercial trapping. Portions of traplines 7, 8, 9, 15 and 65 will be affected by construction and operation of the Project. These effects have been mitigated through the site selection process by following existing or planned infrastructure to the extent feasible. In addition, registered trapline holders whose commercial trapping operations are affected by the Project will be compensated consistent with Manitoba Hydro's Trapper Notification and Compensation Policy for New Transmission Development. Following mitigation, the residual effects are anticipated to be adverse in direction, small in magnitude, medium in geographic extent and long-term in duration. Residual effects are therefore determined to be not significant.

During construction, the Project will result in the loss of useable timber resources in the non-commercial forest zone; loss of productive forestland in the commercial forest zone and loss of standing timber. These effects can be mitigated through a variety of methods including limiting clearing to the project footprint; salvaging timber where demand exists and it is economically and logistically feasible; and compensating Manitoba Conservation and Water Stewardship consistent with the forest damage appraisal and valuation guidelines. Following mitigation, these effects are anticipated to be adverse in direction, small in magnitude, small in geographic extent, and long-term in duration. Residual effects are therefore determined to be not significant.

Travel and Outdoor Recreation

During construction, access to some trails and travel routes may be affected. These effects are expected to be small and localized. The site selection process leading to the preferred route selection was designed to minimize the potential for these effects. In addition, Manitoba Hydro will work with directly affected communities to prepare an Access Management Plan prior to construction. Following mitigation, these effects are anticipated to be adverse in direction, small in magnitude, small in geographic extent and short-term in duration (effects are not anticipated

to persist in the operation phase of the project). Residual effects are therefore determined to be not significant.

7.3.1.3 Follow-up

The environmental assessment identified situations where mitigation measures are required. These include the application of Manitoba Hydro's Trapper Notification and Compensation Policy for New Transmission Development as appropriate and mitigation measures related to forestry resources. Follow-up is also required with respect to access consistent with the development of an Access Management Plan.

7.3.2 Economy

This section considers potential effects of the Project on the economy. Potential effects on employment and business opportunities and regional supplies and services are discussed.

7.3.2.1 Effects Assessment and Mitigation

Construction

Project Employment and Business Opportunities

Workforce requirements during construction are expected to be cyclical and seasonal in nature. Transmission line work is expected to be concentrated in the winter months and therefore employment opportunities are generally expected to be short-term in nature. Table 7-14 summarizes the preliminary peak workforce estimates by quarter for the Project. These estimates could change when the Project is implemented depending on how the contractors choose to perform the work.

Table 7-14: Preliminary Estimated Peak Workforce Estimates by Quarter

Calendar Year	Q1	Q2	Q3	Q4
2014	0	0	100	200
2015	200	100	0	0
2016	0	0	0	200
2017	200	25	25	200
2018	200	25	25	200
2019	200	0	0	0

*Estimated average workforce by quarter. These estimates could change when the Project is implemented depending on how the contractors choose to perform the work.

The major transmission activities involving potential local workforce opportunities relate to non-designated trades such as labourers and equipment operators required for rights-of-way clearing. There may be some local workforce employment opportunities associated with the site preparation of the temporary construction power station and Keeyask Generating Station switching station, though much of this work will involve specialized skilled labour requirements.

The Joint Keeyask Development Agreement (JKDA) designates the construction power sub-station clearing and the construction power right-of-way clearing as direct-negotiation contracts for the Cree Nation Partners (CNP)[10]. Local hiring preferences and Manitoba Hydro's northern purchasing policy are also expected to enhance the local employment benefits of the Project.

Regional Supplies and Services

The Project will increase demand for supplies and services during the construction phase in the regional service area, primarily Gillam and Thompson. Sectors most likely to experience effects include construction equipment and material suppliers; restaurant and hospitality; transportation; and recreation services. This effect may be perceived as positive by businesses with unused or under-utilized capacity or adverse by businesses or users or businesses that experience constraints on capacity. On balance, however, the net effect is expected to be positive.

The effect of demands on businesses and services, particularly in Gillam, can be mitigated by maintaining communication between Manitoba Hydro and the municipal leadership. Providing ongoing information about construction activities and timing can allow for planning related to business service levels and can help to identify and address constraints and concerns as they arise.

Operation Phase

Project Employment and Business Opportunities

Workforce requirements during the operations phase are expected to be small. On average, annual workforce requirements are expected to be approximately 11.5 persons. Two or three of these positions would be internal Manitoba Hydro staff with the remaining positions being contractors engaged on an as-required basis. Employment effects are therefore expected to be small during the operations period.

[10] IC-2 and IC-4 in Schedule 13-1 of the JKDA address the clearing contracts for the Construction Power right-of-way and the Construction Power sub-station. IC-4 notes this contract is subject to MH Transmission and Distribution review. The Cree Nation Partners include Tataskweyak Cree Nation and War Lake First Nation.

Regional Supplies and Services

During the operations phase, the Project is not anticipated to have a noticeable effect on the demand for regional supplies and services.

7.3.2.2 Summary of Residual Effects

Project employment and purchases will affect employment, business opportunities and regional supplies and services. An assessment of these residual effects, following mitigation, was completed consistent with the methods and definitions described in Chapter 3. Table 7-15 summarizes the residual effects of the Project on the Economy.

Table 7-15: Residual Effects of Keeyask Transmission Project on the Economy

Potential Effect	Project Phase	Residual Effect	Assessment Characteristics
Increased direct employment and business opportunities during construction.	Construction	Increased employment and business opportunities.	Direction: Positive Magnitude: Moderate Geographic Extent: Medium Duration: Short-term **Overall – Not Significant**
Increased direct employment and contracting opportunities during operations.	Operations	Increased employment and contracting opportunities.	Direction: Positive Magnitude: Small Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**
Increased demands for supplies and services including hospitality, recreation, transportation and construction equipment and materials.	Construction	Increased demand for supplies and services.	Direction: Positive Magnitude: Small Geographic Extent: Large Duration: Short-term **Overall – Not Significant**

Project Employment and Business Opportunities

Workforce requirements during the construction phase are expected to be cyclical and seasonal in nature. The JKDA designates the construction power sub-station clearing and the construction power right-of-way clearing as direct-negotiation contracts for the CNP. Local hiring preferences are also expected to enhance the local employment benefits of the Project. Following mitigation, the residual effects were determined to be positive in direction, moderate in magnitude (peak work forces of approximately 200), medium in geographic extent and short-term in duration (the effects are seasonal and occur only during the construction phase). Therefore the residual effects are determined to be not significant.

During the operations phase, workforce requirements are expected to be small with the majority of work being performed by contractors engaged on an as-required basis. Following mitigation, residual effects were determined to be positive in direction, small in magnitude, medium in geographic extent, long-term in duration and therefore not significant.

Regional Supplies and Services

During construction, the Project is expected to increase demand for supplies and services in the regional service area, primarily Gillam and Thompson. Sectors most likely to experience effects include construction equipment and material suppliers; restaurant and hospitality; transportation; and recreation services. The effect of demands on businesses and services, particularly in Gillam, can be mitigated by maintaining communication between Manitoba Hydro and the municipal leadership. Providing ongoing information about construction activities and timing can allow for planning related to business service levels and can help to identify and address constraints and concerns as they arise. While the perception of this effect may vary depending on the individual business or sector, on balance residual effects are considered to be positive, small in magnitude, large in geographic extent, short-term in duration and therefore not significant.

7.3.2.3 Follow-up

Manitoba Hydro typically conducts monitoring of employment and business outcomes associated with the development of new facilities. The objectives of the monitoring are to track effects of the Project on employment for local communities and the economic activity generated by the Project. A socio-economic monitoring plan for the Project will be developed and finalized based on Licence conditions issued for the Project.

7.3.3 Population, Infrastructure and Services

This section describes potential effects of the Project on Population, Infrastructure and Services in the Socio-economic Study Area. Components of the socio-economic environment addressed in this section include:

- Population and housing
- Traffic and transportation infrastructure
- Health and emergency services
- Other community services

7.3.3.1 Effects Assessment and Mitigation

Construction

Population and Housing

The Project is not expected to noticeably affect the population or housing requirements of communities in the Socio-economic Study Area during the construction period. Project construction employment opportunities are temporary and largely seasonal (concentrated in the winter months). Construction work camps will be developed to provide temporary accommodation for workers during the construction period. Therefore, Project construction employment does not provide a strong incentive for workers to relocate to the area.

Traffic and Transportation Infrastructure

The Project is expected to increase traffic volumes during the construction phase, particularly in the vicinity of Gillam and on PR 280 between Gillam and Thompson. Transportation requirements for the Project are expected to include the transportation of equipment (bulldozers, excavators, drum rollers/compactors, graders, cranes, scissor lifts and concrete trucks) and materials (granular material, rebar and concrete). Materials and equipment may be transported by low bed or flat bed. The Project will also result in some workforce related traffic, particularly in the area near Gillam for workers seeking recreation and leisure opportunities during their off-hours. Construction workforce requirements are temporary and highly seasonal (occurring primarily in the winter) and associated worker traffic is expected to be similarly seasonal and temporary.

Upgrades to PR 280 between Thompson and Gillam have been initiated by the Province of Manitoba as part of its 2012 infrastructure projects. The upgrades include widening and curve shaving. By the time Project construction begins, the upgrades are intended to meet a standard

that will improve safety and accommodate increased traffic (Keeyask Hydropower Limited Partnership 2012). Effects related to transportation and traffic can also be mitigated by having Project construction and transportation workers observe safe and responsible driving practices.

There may also be increased air and rail transportation as a result of the Project, though the railway running through Gillam has not experienced capacity issues in the past. Special trains have been put into service in the past for large freight requirements for northern hydro-electric development and it is anticipated similar services can be implemented for the Project if required.

Health and Emergency Services

The presence of a temporary workforce may increase demands on health care and emergency services during the construction phase. It is anticipated Gillam would be the primary community providing health and emergency services in the event these services are required. At present the Gillam Hospital adequately meets the needs of the population (Keeyask Hydropower Limited Partnership 2012). The relatively small, temporary nature of the construction workforce is not anticipated to result in material additional requirements for health and emergency services. Mitigation includes adherence to provincial workplace health and safety legislation, Manitoba Hydro's safe construction policies and ongoing communication between Manitoba Hydro and communities in the Socio-economic Study Area.

Other Community Services

Clearing and construction workers on transmission lines are expected to be housed in mobile construction camps. Construction workers for the Keeyask Switching Station and Radisson Converter Station Upgrades will make use of other Manitoba Hydro camps and infrastructure in the vicinity of the Project. Potable water will be transported by truck to the mobile camps. Subject to suitable soil conditions, drainage will be established with the approval of the Natural Resources Officer. Wastewater will typically use disposal pits constructed for the purpose and restored upon camp relocation. The construction workforce therefore is not anticipated to have noticeable effects on existing water and waste water facilities.

The majority of construction workers are anticipated to be accommodated in work camps near Gillam. These camps will not have substantial recreational amenities. As a result, it is likely that construction workers will seek recreation in nearby communities, particularly Gillam. Therefore the presence of a temporary workforce may increase demands on community services, particularly in Gillam, including recreation and leisure services during the construction phase.

The effect of demands on community services can be mitigated by maintaining communication between Manitoba Hydro, leadership and local service providers such as health authorities and the RCMP. Providing ongoing information about construction activities and timing can allow for planning related to community service levels and can help to identify and address constraints

and concerns as they arise. The Town's Mayor, Council and Chief Administrative Officer, along with Manitoba Hydro and leadership of FLCN will need to maintain strong communication on construction-related activities and mitigation measures. These groups are already involved in a community land use planning process as well as the Harmonized Gillam Development process (Keeyask Hydropower Limited Partnership 2012).

Operation

Population and Housing

On average during the operation phase, the Project is anticipated to provide employment for 11.5 persons annually. Of these, two or three positions are expected to be Manitoba Hydro internal staff with the remainder being contractor staff engaged on an as-required basis. Line inspections could involve concurrent inspections of several transmission lines in the area. Maintenance activities would take place on an as-required basis. Therefore the Project is not anticipated to create substantial permanent employment during the operations period and is not expected to result in noticeable effects on population or housing in the Socio-economic Study Area.

Traffic and Transportation Infrastructure

The Project is not anticipated to have discernible effects on traffic and transportation infrastructure during the operation phase. Workforce requirements are small. Maintenance activities will occur on an as-required basis and may be combined with similar activities for other transmission infrastructure in the area.

Health and Emergency Services

The Project is not anticipated to have discernible effects on health and emergency services during the operation phase. Workforce requirements are small. Maintenance activities will occur on an as-required basis and may be combined with similar activities for other transmission infrastructure in the area.

Other Community Services

The Project is not anticipated to have discernible effects on other community services during the operation phase. Workforce requirements are small. Maintenance activities will occur on an as-required basis and may be combined with similar activities for other transmission infrastructure in the area.

7.3.3.2 Summary of Residual Effects

Project employment and transportation requirements will result in effects to traffic and transportation infrastructure, health and emergency services and other community services during the construction phase of the Project. No discernible Project-related effects are anticipated during the operation phase. An assessment of residual effects, following mitigation, was completed consistent with the methods and definitions described in Chapter 3. Table 7-16 summarizes the residual effects of the Project on Population, Infrastructure and Services.

Table 7-16: Residual Effects of Keeyask Transmission Project on Population, Infrastructure and Services

Potential Effect	Project Phase	Residual Effect	Assessment Characteristics
Increased traffic in the vicinity of Gillam and on PR280 between Gillam and Thompson.	Construction	Increased traffic.	Direction: Adverse Magnitude: Small Geographic Extent: Medium Duration: Short-term **Overall – Not Significant**
Presence of construction workforce may increase demands on community health and emergency services.	Construction	Increased demands on community health and emergency services.	Direction: Adverse Magnitude: Small Geographic Extent: Medium Duration: Short-term **Overall – Not Significant**
Presence of construction workforce may increase demands on community recreation and leisure services.	Construction	Increased demands on community recreation and leisure services.	Direction: Adverse Magnitude: Small Geographic Extent: Medium Duration: Short-term **Overall – Not Significant**

Traffic and Transportation Infrastructure

The Project is expected to increase traffic volumes during the construction phase, particularly in the vicinity of Gillam and on PR 280 between Gillam and Thompson. Upgrades to PR 280 between Thompson and Gillam have been initiated by the Province of Manitoba. By the time Project construction begins, the upgrades are intended to meet a standard that will improve

safety and accommodate increased traffic. Additional mitigation measures include project construction and transportation workers implementing safe and responsible driving practices. The residual effect following mitigation is anticipated to be adverse in direction, small in magnitude, medium in geographic extent and short-term in duration. Residual effects are therefore determined to be not significant.

Health and Emergency Services

The presence of a temporary workforce is expected to increase demands on health care and emergency services during the construction phase. It is anticipated Gillam would be the primary community providing health and emergency services in the event these services are required. At present the Gillam Hospital adequately meets the needs of the population (Keeyask Hydropower Limited Partnership 2012). The relatively small, temporary and largely seasonal nature of the construction workforce combined with adherence to provincial workplace health and safety requirements and Manitoba Hydro's safe construction practices is not anticipated to result in material additional requirements for health and emergency services. Residual effects following mitigation are expected to be adverse in direction, small in magnitude, medium in geographic extent and short-term in duration. Residual effects are therefore determined to be not significant.

Other Community Services

The presence of a temporary workforce may increase demands on community services, particularly in Gillam, including recreation and leisure services during the construction phase. The effect of demands on community services can be mitigated by maintaining communication between Manitoba Hydro, community leadership and local service providers. Providing ongoing information about construction activities and timing can allow for planning related to community service levels and can help to identify and address constraints and concerns as they arise. Residual effects following mitigation are anticipated to be adverse, small in magnitude, medium in geographic extent and short-term in duration. Residual effects are therefore determined to be not significant.

7.3.3.3 Follow-up

The environmental assessment identified situations where mitigation measures are required. These include construction and transportation workers implementing safe and responsible driving practices, ongoing communication between Manitoba Hydro, community leadership and service providers, and adherence to provincial workplace health and safety legislation and Manitoba Hydro's safe construction policies.

7.3.4 Personal, Family and Community Life

Personal, family and community life play a central role in the quality of life experienced by people and communities. This section describes potential effects to the following aspects of personal, family and community life in the Socio-economic Study Area:

- Workplace health and safety
- Health and safety of area residents and resource users
- Electromagnetic fields
- Public safety and worker interactions
- Culture and spirituality
- Aesthetics (the way the landscape looks)

7.3.4.1 Effects Assessment and Mitigation

Construction

Workplace Health and Safety

During the construction phase, there may be effects to worker health and safety from accidents. It is anticipated there will be safety and accident prevention measures in place during the construction period. Exposure to drug and alcohol use at the construction camp and increased stress and anxiety for workers in new environments and away from families and home communities may also be experienced during the Project's construction phase.

Workers will be expected to adhere to provincial workplace health and safety legislation, Manitoba Hydro's safe construction policies. The Project environmental protection plan and camp rules can help to mitigate potential workplace health and safety effects.

Health and Safety of Area Residents and Resource Users

During the construction phase, there may be effects on the health and safety of area residents and resource users due to the presence of equipment and construction activities. A Construction Access Management Plan will also be developed to manage access to the Project site during construction and mitigate potential effects on safety related to construction activities.

Public Safety and Worker Interactions

The construction workforce is expected to be housed in temporary work camps close to Gillam. The limited recreation and leisure options that will be available at the construction work camp sites are likely to result in construction workers seeking out recreation and leisure options in Gillam. This leads to concerns about the potential for harmful interactions between workers and vulnerable community members. The potential for these interactions also leads to broad concerns about adverse effects on general public safety in the community. Adverse effects on public safety, both perceived and realized, can change how community members feel about the community, leading to impacts on community cohesion and well-being.

FLCN's and TCN's past experiences with hydroelectric projects indicate that an influx of non-local workers can result in a broad array of adverse effects on public safety for those residing in communities close to these developments. Effects noted during past projects include racism, increased alcohol and drug abuse, assaults and other violent crimes and inappropriate sexual behaviour between construction workers and community Members in the Socio-economic Study Area, including risks related to sexually transmitted infections (Keeyask Hydropower Limited Partnership 2012). FLCN and TCN are concerned about the potential for similar effects as a result of the Project. These concerns were noted during discussions with TCN, workshops conducted with FLCN and public open houses that were attended by TCN and FLCN Members.

Mitigation for potential adverse interactions between non-local construction workers and local residents includes preventative measures and monitoring to determine if further mitigation measures are required. Mitigation is geared not only to Members of FLCN and TCN, but also to construction workers on site and the broader community in Gillam.

As a part of orientation for all workers at the main site, workers will be required to participate in cultural awareness training. This will provide an opportunity to describe local expectations for respectful behaviour by construction workers both on site and when visiting communities. Camp rules and security measures can also assist in this regard.

Considerable uncertainty exists concerning the expected number of visits by non-local construction workers in Socio-economic Study Area communities (especially Gillam) and the expected number and type of adverse occurrences. Ongoing dialogue between Manitoba Hydro and the RCMP during the construction phase will assist in identifying whether worker interaction is an issue in Gillam or in other Socio-economic Study Area communities. Discussion will also begin prior to construction among Manitoba Hydro, the Town of Gillam, FLCN and TCN to determine the appropriate mechanism for tracking and addressing worker interaction issues and concerns across all of Manitoba Hydro's proposed projects in the vicinity of Gillam. It is anticipated that local justice and social agencies will be involved in these discussions, where appropriate, to gather data and to participate in the development of suitable mitigation measures.

Culture and Spirituality

Effects to domestic resource use are also expected to lead to effects to culture and spirituality. Both TCN and FLCN view the ability to engage in resource use activities as a fundamental means of cultural expression and transmission. Therefore adverse effects to domestic resource use are also expected to lead to adverse effects on culture and spirituality for TCN and FLCN. These effects are anticipated to begin during the construction phase and persist through the operation phase of the Project.

The preferred routes and sites for project infrastructure were chosen to minimize potential effects to domestic and commercial resource use. These activities are extremely culturally and spiritually important to TCN and FLCN. Manitoba Hydro will work with First Nations in the Socio-economic Study Area to organize a site ceremony for the Project to recognize the cultural and spiritual importance of the area.

Aesthetics (the Way the Landscape Looks)

The Project will create permanent changes to the landscape and aesthetics due to the presence of project infrastructure. These effects will begin during the construction phase and persist through the operations phase. Both TCN and FLCN noted preferences for routes for Project infrastructure that followed existing rights-of-way wherever possible. Some residents of communities in the Socio-economic Study Area also noted a preference during public open houses to locate project infrastructure in areas of existing disturbance wherever possible to minimize these effects. The preferred routes and sites for Project infrastructure were selected to minimize effects on the visual landscape.

Operation

Workplace Health and Safety

The average annual workforce requirement during the operations phase is expected to be small (approximately 11.5 persons on average) and provincial workplace health and safety standards will be observed. Therefore no discernible effects on workplace health and safety are anticipated during the Project's operations phase.

Health and Safety of Area Residents and Resource Users

During the operations phase, the presence of project infrastructure may lead to effects on the health and safety of area residents and resource users. Accidents related to collisions with project infrastructure are possible. During workshops, FLCN raised concerns related to snowmobile safety, particularly related to transmission infrastructure and guy wires.

Site security for the Construction Power Station, Keeyask Switching Station and Radisson Convertor Station will include perimeter fencing to limit access to the sites and reduce the potential for accidents involving area residents and resource users. Guy wire shields will be used to improve the visibility of guy wires for the Unit, Construction Power and the Generation Outlet Transmission lines and reduce the potential for accidents for snowmobilers and others travelling in the area.

Electromagnetic Fields

Adverse effects to health during the operating phase related to electromagnetic fields (EMFs) are not anticipated. Numerous studies have been conducted with respect to health effects and EMFs. National and international scientific agencies responsible for public health have convened multidisciplinary groups of scientists to evaluate the research and to determine if health effects are associated with exposure to EMFs. Such groups include the World Health Organization (WHO) in 2006, the National Radiological Protection Board of Great Britain in 2004 and the International Agency for Research on Cancer in 2002. These organizations have concluded that there are no known adverse health effects associated with ac EMFs or with low levels of static EMFs such as those associated with dc transmission lines. However, Manitoba Hydro is sensitive to public concerns regarding potential health effects and EMFs and continues to undertake the following actions regarding the issue:

- Monitoring of worldwide research programs on EMFs.
- Participation in and support of on-going health and safety research on local, national and international levels.
- Maintenance of active communications and provision of technical information to interested parties, including the public and agencies responsible for public and occupational health and the environment.

In addition, Manitoba Hydro continues to conduct measurements of magnetic fields levels for the public on request. Additional information on Manitoba Hydro's approach to addressing issues related to EMFs can be found in Section 8.3.5.3 of the Environmental Impact Statement for the Bipole III Transmission Project (Manitoba Hydro 2011).

Public Safety and Worker Interactions

The permanent Manitoba Hydro workforce during the operations phase is expected to be small (2-3 persons). Therefore no discernible effects related to public safety and worker interactions are anticipated during the operations phase of the Project.

Culture and Spirituality

TCN notes in their report that the area has already been affected by major projects including generating stations, transmission lines, roads, rail spurs and other facilities. TCN also states that the Project Study Area remains an important cultural and resource use area. TCN's report identifies that from their perspective the most concerning effects of the Project are those that affect their ability to practice their traditions, culture and beliefs (TCN 2011).

FLCN noted during workshops conducted for the Project that the area has been affected by numerous existing developments, including Manitoba Hydro projects and other projects. FLCN stated the PSA is used by their Members for a variety of domestic and commercial resource use activities including trapping, hunting and berry and plant harvesting. FLCN noted the cultural importance of these activities and of many parts of the Project Study Area.

Effects to domestic resource use are also expected to lead to effects to culture and spirituality. Both TCN and FLCN view the ability to engage in resource use activities as a fundamental means of cultural expression and transmission. Therefore adverse effects to domestic resource use are also expected to lead to adverse effects on culture and spirituality for TCN and FLCN. It is understood, however, that effects on culture and spirituality extend beyond effects to domestic resource use activities and that aspects of these effects may be intangible and difficult to predict with certainty. This does not diminish their importance.

The preferred routes and sites for project infrastructure were chosen to minimize potential effects to domestic and commercial resource use. These activities are extremely culturally and spiritually important to TCN and FLCN and therefore the route selection process was also designed to minimize effects to culture and spirituality. In addition to mitigation through the route selection process, Manitoba Hydro will work with First Nations in the Socio-economic Study Area to organize a site ceremony for the Project to recognize the cultural and spiritual importance of the area to First Nations. Manitoba Hydro will also continue to liaise with Aboriginal groups to review concerns that arise about the Project and opportunities for cultural preservation occasioned by the Project. Manitoba Hydro anticipates this ongoing liaison and communication will occur through existing forums and protocols, including the ongoing ATK studies being conducted with FLCN and the Manitoba Metis Federation.

Aesthetics (the Way the Landscape Looks)

The Project will create permanent changes to the landscape and aesthetics due to the presence of project infrastructure. TCN notes in their report that the area has already been affected by major projects including generating stations, transmission lines, roads, rail spurs and other facilities. TCN also states that the Project Study Area remains an important cultural and resource use area for their Members (TCN 2011).

FLCN noted during workshops conducted for the Project that the area has been affected by numerous existing developments, including Manitoba Hydro projects and other projects. FLCN stated the PSA is used by their Members for a variety of domestic and commercial resource use activities including trapping, hunting and berry and plant harvesting. FLCN noted the cultural importance of these activities and of many parts of the Project Study Area.

Both TCN and FLCN noted preferences for routes for Project infrastructure that followed existing rights-of-way wherever possible. Some residents of communities in the Socio-economic Study Area also noted a preference during public open houses to locate project infrastructure in areas of existing disturbance wherever possible to minimize these effects. The preferred routes and sites for Project infrastructure were selected to minimize effects on the visual landscape.

7.3.4.2 Summary of Residual Effects

Project employment and clearing requirements will result in effects to workplace health and safety, health and safety of area residents and resource users, public safety and worker interaction, culture and spirituality and aesthetics (the way the landscape looks). An assessment of residual effects, following mitigation, was completed consistent with the methods and definitions described in Chapter 3. Table 7-17 summarizes the residual effects of the Project on personal, family and community life.

Workplace Health and Safety

During the construction phase, there may be effects to worker health and safety from accidents. It is anticipated there will be safety and accident prevention measures in place during the construction period. Exposure to drug and alcohol use at the construction camp will be mitigated through camp rules prohibiting the use of illegal drugs. Increased stress and anxiety for workers in new environments and away from families and home communities may also be experienced during the Project's construction phase. Mitigation measures include adherence to provincial workplace health and safety legislation and Manitoba Hydro's safe construction policies. The average annual workforce requirement during the operations phase is expected to be small (approximately 11.5 persons on average). Therefore no discernible effects on workplace health and safety are anticipated during the Project's operation phase.

Table 7-17: Residual Effects of Keeyask Transmission Project on Personal, Family and Community Life

Potential Effect	Project Phase	Residual Effect	Assessment Characteristics
Possibility of workplace accidents or health effects related to alcohol, drug use or workplace stress during construction.	Construction	Increased risks of workplace accidents.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Short-term **Overall – Not Significant**
Risk of accidents or injuries to area residents or resource users at Project sites.	Construction and Operations	Increased risk of accidents or injuries to area residents or resource users at Project sites.	Direction: Adverse Magnitude: Small Geographic Extent: Small Duration: Long-term **Overall – Not Significant**
Effects to human health from electro-magnetic fields.	Operations	No residual effect.	Direction: Neutral
Risk to public safety related to influx of non-local construction workers.	Construction	Increased risk to public safety from worker interactions.	Direction: Adverse Magnitude: Moderate Geographic Extent: Medium Duration: Short-term **Overall – Not Significant**
Loss of cultural landscape and culturally important resource use opportunities.	Construction and Operations	Loss of cultural landscape and effects to culturally important resource use opportunities.	Direction: Adverse Magnitude: Small Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**
Physical changes to the landscape and aesthetics.	Construction and Operations	Physical changes to the landscape and aesthetics.	Direction: Adverse Magnitude: Small Geographic Extent: Medium Duration: Long-term **Overall – Not Significant**

Residual effects are expected to be adverse, small in magnitude, small in geographic extent and short-term in duration and therefore not significant.

Health and Safety of Area Residents and Resource Users

During the construction phase, there may be effects on health and safety of area residents and resource users due to the presence of equipment and construction activities. Where access is a concern to communities, Manitoba Hydro will work with directly affected communities to prepare Access Management Plans prior to construction. Appropriate signage and fencing will also be in place during construction.

During the operations phase, the presence of Project infrastructure may lead to effects on the health and safety of area residents and resource users. Accidents related to collisions with project infrastructure are possible. Site security for the Construction Power Station, Keeyask Switching Station and Radisson Convertor Station will include perimeter fencing to limit access to the sites and reduce the potential for accidents involving area residents and resource users. Guy wire shields will be used to improve the visibility of guy wires for resource users and others travelling in the Project area.

Residual effects are expected to be adverse, small in magnitude, small in geographic extent and long-term in duration and therefore not significant.

Electro-magnetic Fields

Magnetic fields and electric fields are expected to be below limits recommended by provincial, national and international agencies. No residual effects to health related to electro-magnetic fields are anticipated.

Public Safety and Worker Interactions

The construction workforce is expected to be housed in temporary work camps close to Gillam. The limited recreation and leisure options that will be available at the work camp sites are likely to result in construction workers seeking recreation and leisure options, particularly in Gillam. This leads to concerns about the potential for harmful interactions between workers and vulnerable community members. Effects noted during past projects include racism, increased alcohol and drug abuse, assaults and other violent crimes and inappropriate sexual behaviour between construction workers and community members in the Socio-economic Study Area, including risks related to sexually transmitted infections (Keeyask Hydropower Limited Partnership 2012). FLCN and TCN are concerned about the potential for similar effects as a result of the Project.

Mitigation measures include preventative measures focused on construction workers at the Project site (including cultural sensitivity training), coordinated discussion among Manitoba Hydro, the Town of Gillam, TCN and FLCN (where appropriate) to determine the best mechanism for tracking and addressing worker interaction issues and socio-economic monitoring and adaptive management. The permanent Manitoba Hydro workforce during the

operations phase is expected to be small (2-3 persons). No discernible effects are anticipated during the operations phase of the Project. Residual effects are expected to be adverse, moderate in magnitude, medium in geographic extent and short-term in duration and therefore not significant.

Culture and Spirituality

TCN and FLCN both view the ability to engage in domestic resource use activities as a fundamental means of cultural expression and transmission. Therefore adverse effects to domestic resource use and the landscape are also expected to lead to adverse effects on culture and spirituality for TCN and FLCN. It is understood, however, that effects on culture and spirituality extend beyond effects to domestic resource use activities and that aspects of these effects may be intangible and difficult to predict with certainty.

Mitigation includes the site selection process whereby preferred routes and sites for project infrastructure were chosen to minimize potential effects to domestic and commercial resource use. In addition to mitigation through the route selection process, Manitoba Hydro will work with First Nations in the Socio-economic Study Area to organize a site ceremony for the Project to recognize the cultural and spiritual importance of the area to First Nations. Manitoba Hydro will also continue to liaise with Aboriginal groups to review concerns that arise about the Project and opportunities for cultural preservation occasioned by the Project. Manitoba Hydro anticipates this ongoing liaison and communication will occur through existing forums and protocols, including the ongoing ATK studies being conducted with FLCN and the Manitoba Metis Federation.

Following mitigation, residual effects are expected to be adverse, small in magnitude, medium in geographic extent and long-term in duration and therefore not significant.

Physical Changes to the Landscape

The Project will create permanent changes to the landscape and aesthetics due to the presence of project infrastructure. Preferred routes and sites for Project infrastructure have been chosen adjacent to other existing or planned infrastructure developments wherever possible to minimize additional disturbance to the landscape caused. Residual effects are expected to be adverse, small in magnitude, medium in geographic extent and long-term in duration and therefore not significant.

7.3.4.3 Follow-up

The environmental assessment identified situations where mitigation measures are required. These include:

- Preventative measures focused on construction workers at the Project site including camp rules and cultural sensitivity training.
- Coordinated discussion among Manitoba Hydro, the Town of Gillam, TCN and FLCN to determine the best mechanism for tracking and addressing worker interaction issues.
- Socio-economic monitoring and adaptive management.
- Working with First Nations to conduct a site ceremony for the Project.

Follow-up is also required with respect to access consistent with the development of an Access Management Plan.

7.3.5 Heritage Resources

This section considers potential effects of the Project on heritage resources. Heritage resources are non-renewable resources that are the tangible remains of human endeavour which have survived through time and which indicate evidence of past human activities. All heritage resources are protected under Provincial legislation and as such have been categorized under a single VEC. There are no existing archaeological sites within the planned development areas of the Project study area; therefore there are no measurable concerns to the VEC heritage resources. However, there is the potential for heritage resources to be unearthed during construction activities.

7.3.5.1 Effects Assessment and Mitigation

Construction

An in-field assessment of the Project study area was undertaken prior to the selection of the Preferred Route for the Generation Outlet Transmission lines. Two water crossings were identified to be of heritage concern due the potential of heritage resources in proximity to water features. The first water crossing is the Kettle River, which is a major tributary to the Nelson River. The mouth of the Kettle River, while outside the Project study area, contains cultural site evidence of recent history Cree occupation and culturally modified trees. The second location is the Butnau River crossing. The river was once the outlet of the Butnau River into the Nelson River. The river was diverted into the Kettle River through a man-made channel. The river has high potential for heritage resources containing favourable environmental attributes associated

with predictive modeling; furthermore, the river was once a travel route into Cache Lake which is identified by FLCN as a traditional land use area.

The Preferred Route for the Generation Outlet Transmission lines crosses both water bodies. Both locations have the potential for heritage resources within 50 m of the embankment on either side of the river. Traditional knowledge indicates that the Project has the potential to disrupt the cultural and historical connection to the cultural landscape. However, without specific and locational information from the ATK, the development of mitigation measures are insufficient for this scope of concern. If specific information on a spiritual or heritage resource is identified, then mitigation in the form of avoidance. salvage or other measures will be recommended by the Project Archaeologist in consultation with the Provincial Archaeologist and the concerned First Nation. A Heritage Resource Protection Plan will address these concerns during the monitoring and follow-up components of the Project.

Supplementary to the *Heritage Resources Act* (1986) and Manitoba's Policy Respecting the Reporting, Exhumation and Reburial of Found Human Remains (1987) which provides guidelines for managing human remains, the Environmental Protection Plan and the Heritage Resource Protection Plan will provide a monitoring program for the Keeyask Transmission Project. Required monitoring will focus on the Generation Outlet Transmission line water crossings of the Kettle River and Butnau Diversion Channel. Monitoring will include on-site shovel testing of the Preferred GOT line route right-of-way within 50 metres of each water crossing to determine the presence of *in situ* heritage resources or features. Monitoring could occur immediately prior to or during tree clearing activities and before any ground disturbing activities, such as tower footing excavation, takes place, or at the time of footing excavation.

Following principles of best practice, the Heritage Resource Protection Plan (HRPP) will include implementation of Environmental Inspectors to protect discovered heritage resources during construction and operations of the Project. The role of the Environmental Inspectors is to be present for all on-site during construction activities and to be the initial contact if heritage resources are discovered during construction activities. The Environment Inspector will immediately contact the Project Archaeologist who will then work with the Construction Supervisor and Site Manager to ensure that all in-field workers are informed of and understand the process of implementing heritage protection measures.

Operation

No effects to heritage resources are anticipated during the Project's operation phase.

7.3.5.2 Summary of Residual Effects

At this time no residual effects are expected to known heritage resources. No archaeological sites were identified that fall within the Preferred Route or associated infrastructure. However,

there is potential for unknown heritage resources to be discovered or impacted through construction (Table 7-18). Monitoring of the Kettle River and Butnau Diversion Channel crossings and a Heritage Resource Protection Plan will address these potential concerns. Residual effects are anticipated to be neutral, small in magnitude, small in geographic extent and short-term in duration and therefore not significant.

Table 7-18: Residual Effects of Keeyask Transmission Project on Heritage Resources

Potential Effect	Project Phase	Residual Effect	Assessment Characteristics
Disturbance to unknown Heritage Resources	Construction	Project is not expected to displace or disturb heritage resources in the project study area.	Direction: Neutral Magnitude: Small Geographic Extent: Small Duration: Short-term **Overall – Not Significant**

7.3.5.3 Follow-up

The Environmental Protection Plan and the Heritage Resource Protection Plan will provide a monitoring program for the Keeyask Transmission Project. Required monitoring will focus on the Generation Outlet Transmission line water crossings of the Kettle River and Butnau Diversion Channel. Monitoring will include on-site shovel testing of the Preferred GOT line route right-of-way within 50 metres of each water crossing to determine the presence of *in situ* heritage resources or features. Monitoring could occur immediately prior to or during tree clearing activities and before any ground disturbing activities, such as tower footing excavation, takes place, or at the time of footing excavation.

The Heritage Resource Protection Plan (HRPP) will include implementation of Environmental Inspectors to protect discovered heritage resources during construction and operations of the Project. The role of the Environmental Inspectors is to be present for all on-site during construction activities and to be the initial contact if heritage resources are discovered during construction activities. The Environment Inspector will immediately contact the Project Archaeologist who will then work with the Construction Supervisor and Site Manager to ensure that all in-field workers are informed of and understand the process of implementing heritage protection measures.

7.4 ACCIDENTS AND MALFUNCTIONS

7.4.1 Effects Assessment

This section reviews the potential for accidents or malfunctions that could affect primarily the biophysical environment. Issues of public safety are discussed in Section 7.3. Accidents are discussed mainly in the context of hazardous materials and malfunctions in the context of fire response and emergency preparedness.

Manitoba Hydro designs its transmission lines to meet or exceed the current Canadian Standards Association standard for overhead transmission systems (Canadian Standards Association 2010). Structures, insulators and hardware are selected to minimize the risk of failure. Regular patrols of the transmission lines are undertaken to ensure potential problems are identified and rectified in advance of a failure or malfunction.

Hazardous materials are handled and generated in the course of construction and operational activities. Examples of some common types of hazardous materials to be handled or generated during the construction and operations of the Project include fuel, oil, lubricants, gasoline, solvents, herbicides, and pesticides. As with any project involving construction and operations, there is a risk of contingency events such as spills or fires. Accidental releases of hazardous materials may occur as a result of human induced error (e.g., during re-fuelling of equipment) or failure of station components. With respect to the Project, there are a number of components and stages where this risk exists and, depending on the nature and magnitude of the contingency event, there is a resulting potential for an effect on the biophysical environment including soil, groundwater, surface water, and the aquatic environment if materials such as fuel, lubricants, solvents or herbicides enter a water course. Other contingency events could include accidental fires which may affect air quality or result in wildlife and habitat loss. If any of these contingency events occurs, it may create a risk to public health and safety or may potentially affect wildlife, fish and terrestrial and aquatic habitat.

Project activities have the potential to result in accidental releases of hazardous materials. These accidents could occur during all Project phases and include, but are not limited to, the use of heavy equipment during construction, construction decommissioning and operations, the filling of station equipment with insulating oil during station commissioning and operations, and the storage, transportation and handling of hazardous materials. Releases of hazardous materials can be measured through analytical analysis of relevant parameters (e.g., Benzene, Toluene, Ethylbenzene, Xylenes [BTEX], Mineral Oil and Grease, and Herbicides). Relevant criteria within the Canadian Council of Ministers of the Environment (CCME) Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (CCME 1999) would form the threshold levels for restoration of environments from any spills or leaks.

Spills in and adjacent to wetlands, waterbodies and water courses are of the greatest concern to fish and wildlife. Hydrocarbon spills in this type of habitat are difficult to clean-up and if not contained quickly, could contaminate the aquatic environment damaging aquatic life and habitat. Mitigation for the potential effects of accidental spills includes effective spill response management that will be outlined in the Construction and Phase Environmental Protection Plans.

During construction and operation of transmission lines and stations, spills of hazardous materials could occur during refuelling of equipment, or due to failure of station components. Soil contamination affecting soil productivity or entry into a watercourse could potentially occur as a result of a spill or leak of a hazardous substance. Spills into watercourses, or contaminants which enter groundwater, may create a risk to public health and safety or may potentially impact wildlife populations and habitat. The magnitude and duration of the potential effects of accidental spills are dependent upon the nature of the material spilled, the quantity spilled, the location of the spill, and the time of year the incident occurs.

Construction during the winter, under frozen ground conditions, will facilitate the containment and recovery of any spilled material and reduce the potential effects on soils, watercourses and groundwater. Standard environmental protection practices commit Manitoba Hydro to store fuel, lubricants, and other potentially hazardous materials within dedicated storage areas at work camps and marshalling yards. Dedicated areas would provide spill containment, bermed storage areas where necessary, and spill response equipment, and would be located away from any sensitive features. Any products transferred from storage sites to work areas would not exceed the daily requirement. Manitoba Hydro also requires its contractors to have an emergency-response plan in place that is consistent with Manitoba Hydro's spill response procedure.

The proposed station sites will house a variety of electrical equipment, some of which (e.g., power transformers) will contain insulating oil, dielectric fluid or glycol. Much of the equipment is status and/or hermetically sealed, and essentially maintenance free. The probability of a leak or spill is extremely low. However, in some cases, there is a possibility of accidental spills during periodic fluid replacement (e.g., during transformer maintenance).

Chemicals present at the stations will be limited to those brought to the sites for the operation and maintenance of the facilities. There will be no permanent storage of chemicals or gasoline and no use of materials containing polychlorinated biphenyls (PCBs) at the proposed station sites. Additional information on the potential effects of accidental spills and leaks of substances harmful to the aquatic environment is outlined further in Section 7.2.4.1, and to the terrestrial environment in Sections 7.2.5 to 7.2.11. There is also a risk of contamination of aquatic and terrestrial environments through the improper application of herbicides.

7.4.2 Mitigation

Potential effects and contingencies will be avoided or mitigated by application of design standards and established environmental construction and operations protocols. Current fire protection, oil containment and materials handling/spill response standards will be applied through the design, construction and operations phases:

- Manitoba Hydro has developed practices and protocols, documented in the Spill Response Handbook (1995), to ensure that, if a spill occurs at a station site, it is contained and remediated. Manitoba Hydro further undertakes to have personnel trained in emergency spill response techniques available to respond in the event of an oil spill. Manitoba Hydro will also adhere to its Hazardous Waste Management Handbook (1994), pertaining to the transport and disposal of all hazardous products. Staff and contractors will also comply with all laws, bylaws and regulations respecting the transportation and handling of hazardous waste established by federal, provincial and municipal or local authorities.

- The storage, handling and disposal of chemicals will be carried out in accordance with Manitoba Hydro guidelines, and relevant federal and provincial statutes and regulations. Manitoba Hydro has developed a Chemical Control Program that provides its workers with the information necessary for the safe use and disposal of chemicals. Manitoba Hydro also complies with the federal Workplace Hazardous Materials Information System regulations and the provincial Workplace Health Hazard Regulations. An inventory of materials covered by Workplace Hazardous Materials Information System will be maintained on-site and Workplace Hazardous Materials Information System documentation will be displayed and available as required.

- The station sites will be designed and operated in accordance with Manitoba Hydro's Fire Manual, prepared by Manitoba Hydro's Fire Prevention Engineer. The manual provides corporate guidelines, rules and standards for fire prevention and protection.

Adherence to Manitoba Hydro's environmental protection practices and any additional specific mitigation measures identified as a condition of licence approval, or in development of the EnvPP, will further minimize the potential impact of accidents or malfunctions on soil, plants, wildlife or aquatic resources. Any potential adverse effects would likely be short term and reversible.

The approach to these potential accidents with hazardous materials involves good planning and prevention with the use of protocols, plans and mitigation measures. These are outlined in the Draft EnvPP in sections on hazardous material and petroleum products use, handling and storage, appropriate emergency preparedness and response (Appendix F). All spills and leaks will be reported to regulatory authorities in accordance with provincial requirements including regulations under the *Dangerous Goods Handling and Transportation Act*.

Some of the general mitigation measures to prevent and respond to accidental spills/releases of hazardous materials include:

- Construction crews will be adequately trained in spill prevention and cleanup procedures.
- Fuel, lubricants and other potentially hazardous materials will be stored and handled within dedicated areas at work sites and marshaling yards in full compliance with regulatory requirements.
- Harmful substances, such as fuels, chemicals and herbicides will be stored greater than 100 m from the ordinary high water mark of any waterbody.
- All storage sites will be located a minimum distance of 100 m from waterbodies.
- Marshaling yards will be located on low permeability soils and upland sites, where possible (i.e., areas of well drained soils, as identified soils maps and locally by Manitoba Hydro's Construction Supervisor or Site Manager).
- Transfer of fuel must be attended at all times.
- An Emergency Preparedness and Spill Response Plan will be developed and an emergency response spill kit will be kept on-site at all times in case of fluid leaks or spills from machinery.
- Only clean construction materials and equipment will be used.
- Vehicles, machinery and construction materials will arrive on-site clean and free of leaks.
- Equipment refueling and maintenance will be conducted greater than 100 m from the stream's ordinary high water mark and away from wetlands.
- When servicing equipment, waste products such as oil and antifreeze will be drained into appropriate containers and removed to an approved disposal ground.
- Machinery will remain above the high water mark, unless fording is required to transport equipment across the watercourse and only in accordance with the Department of Fisheries and Oceans Operational Statements.
- Temporary crossings will be constructed to ensure that construction vehicles and machinery remain out of watercourses and will be done in accordance with the Department of Fisheries and Oceans Operational Statements.

- All fuel spills or leaks will be reported to the Manitoba Hydro Construction Supervisor or Site Manager or delegate immediately upon discovery.

- Any spills of hazardous substances will be cleaned up immediately and reported to the local Natural Resources Officer. All measures outlined in the Environmental Accident Reporting Regulation 439/87 will be followed.

- General clean-up in storage areas, and sites where incidental spillage occurs, will be in accordance with regulatory standards.

- All soil is to be remediated or disposed of in a manner approved by regulatory authorities and Manitoba Hydro.

- Hazardous materials, fuel containers and other materials will be removed from the site and disposed of according to Manitoba Hydro's Hazardous Materials Management Handbook and in accordance with regulatory requirements.

- The Canadian Wildlife Service will be informed of all incidents where the spill of toxic pollutants will harm or potentially harm wildlife species and/or species at risk. In accordance with the National Policy on Oiled Birds and Oiled Species at Risk (Environment Canada 2011).

The operation of oil containing electrical equipment, the burning of trees and brush for disposal, and other potential sources of ignition creates a risk for accidental fires to start. Strict adherence to proper protocols to minimize the risk of accidental fires makes its occurrence highly unlikely. Mitigation for the potential effects of accidental fires, as outlined in the EnvPP (Chapter 8, Appendix F), includes effective fire response management as part of emergency preparedness and response plans to be developed for the Project. There is substantial design mitigation to be prepared for potential station fires and to collect and separate oil contaminated water from such an event. The stations are also designed with oil containment and drainage systems that will collect any oil and water from leaks, spills or fires and treat and separate the oil in oil/water separators prior to release to the environment. In the event of a station or other construction site fire, follow-up monitoring would be required.

Worker safety is highly regulated under provincial legislation and all activities during construction and operations of the Project components will be undertaken in compliance with current Workplace, Safety and Health requirements, to prevent accidents and injury. Manitoba Hydro is committed to safe workplaces and injury prevention through its corporate goals.

7.5 RESIDUAL EFFECTS

Through the SSEA process, Manitoba Hydro and local First Nations sought to avoid adverse effects and enhance positive benefits wherever possible and practical. As outlined in the preceding sections, the Project is not expected to cause significant adverse environmental effects given the proposed mitigation measures outlined in the proceeding sections and the development and implementation of an EnvPP (Tables 7-1, 7-2, 7-4, 7-5; Section 8; Appendix F).

Residual Project effects on the aquatic and terrestrial environments are expected to be insignificant considering implementation of the proposed mitigation measures. Similarly, the Project is not expected to cause significant adverse residual effects on people or the environment. The nature and extent of adverse residual effects associated with the Project are described generally in this subsection, with more detail provided in Sections 7.2 and 7.3 with respect to each of the biophysical and socio-economic parameters assessed for this Project.

The following key residual effects on the biophysical and Socio-Economic environments are among the potential effects assessed as Cumulative Effects in Section 7.6:

Physical Presence of the New Facilities: The presence and appearance of the transmission lines and stations will alter the landscape for as long as the facilities are in operation. Preferred routes for Project infrastructure have been developed to follow rights-of-way for existing infrastructure wherever possible to minimize the creation of new areas of visual effects.

Access: The cleared rights-of-way will create some additional opportunities for access in a region containing existing and proposed roads and several cut lines. The access management plan to be prepared prior to clearing and construction activities will assist in avoiding or minimizing the issues associated with increased access. The plan will identify access management objectives, the approach during Project construction and operation, means of communicating the plan to all parties, and a monitoring program.

Traffic: The Project will interact with other construction projects and concerns have been noted with respect to additional wear and tear on transportation infrastructure and traffic levels, in particular on PR280.

Public Safety and Worker Interactions: Potential residual adverse effects of the Keeyask Transmission Project on public safety related to interactions between non-local construction workers and local residents may interact with adverse effects of other projects and activities planned during the construction phase.

The Draft Environmental Protection Program, outlined in Chapter 8 and Appendix F, will serve to identify any residual effects that are not predicted or foreseen.

7.6 CUMULATIVE EFFECTS ASSESSMENTS

7.6.1 Overview

The cumulative effects assessment describes the incremental adverse environmental effects likely to result from the Keeyask Transmission Project, when taken in combination with the effects of other past, present and future projects or human activities, that overlap spatially and temporally. The cumulative effects assessment focuses on Valued Environmental Components (VECs) that will be adversely affected by the Project, based on the effects assessment summarized in Chapter 7 of this EA Report. The approach to the cumulative effects assessment is described in detail in Chapter 3 (Section 3.5.2).

The proposed Project primarily consists of the following components: transmission lines, Keeyask Switching Station, Construction Power Station and Radisson Converter Station upgrade. These Project components may have environmental effects that act cumulatively with the effects of other components as well as the effects of future projects or activities in the area. This section summarizes the approach and results of the cumulative effects assessment for the Keeyask Transmission Project.

7.6.1.1 Projects Considered in the Cumulative Effects Assessment

Past and Current Projects

Past and current projects and activities considered as influencing the existing environment (as required for assessment of each specific environmental component) include the following:

- Keeyask Infrastructure Project.
- Churchill River Diversion, Lake Winnipeg regulation and development of the Lower Nelson River generating stations, and other existing Manitoba Hydro facilities (e.g., other generating stations, transmission facilities).
- Existing transmission lines in the region, e.g., Bipole I and II, KN36, etc.
- Provincial Road (PR) 280 and other existing public or forestry roads and exploration trails/cut lines; it is assumed that the new trails will be balanced by vegetation regeneration of old ones, though regeneration may not be identical to the original vegetation in the region.
- Population growth as it normally affects communities in areas in the Project region (e.g., Gillam, Split Lake, Ilford, York Landing and Bird).

- Other various community-driven initiatives, projects and activities in the Project Study Area, including: resource-use activities (e.g., domestic harvest, commercial trapping and ecotourism).

Past and current projects are also described further in Appendix E.

Future Projects

This section provides a summary of potentially foreseeable future projects that are considered in this cumulative effects assessment. Descriptions of these future projects are also provided in Appendix E.

Future projects considered in evaluating the effects of the Keeyask Transmission Project include:

- The Keeyask Generation Project, with potential construction from 2014 to 2021.
- The Bipole III Transmission Project, with potential construction from 2013 to 2017.
- The Conawapa Generation Project, with potential construction from 2017 to 2027.
- Gillam Redevelopment (including the potential for development of new housing within the Town of Gillam) between 2013 and 2019.

The Keeyask Generation Project will be developed concurrently with this Transmission Project. In at least some areas, the environmental effects of the Keeyask Transmission Project will temporarily overlap in time and space with the environmental effects of the Generation Project during the construction and operation phases. The spatial overlap between the Keeyask Generation and Transmission projects is primarily associated with the close proximity of the South Access Road and the Generation Outlet Transmission Lines.

7.6.1.2 Assessment of Cumulative Effects

The effects of past projects and activities have shaped the existing environment. Accordingly, the interactions between these past and current projects and the Keeyask Transmission Project are addressed in the description of the existing environment (Chapter 4) and the discussion of residual Project effects (Sections 7.2 and 7.3).

The potential interaction of residual adverse effects of the Keeyask Transmission Project with future projects in the Keeyask Transmission Project Study Area is evaluated in this assessment. This cumulative effects assessment emphasizes the use of the same environmental indicators and measurable parameters as the Keeyask Transmission Project environmental effects assessment. The assessment of cumulative effects requires that adverse residual effects

resulting from the Keeyask Transmission Project are evaluated for interactions with reasonably foreseeable future projects and human activities (further discussion of the approach is provided in Section 3.5.2).

Valued Environmental Components (VECs) identified in Chapter 3 are evaluated for potential interactions with future projects in determining if there is:

- A residual adverse effect of the Project on that VEC, as identified in Sections 7.2 and 7.3 (VECs with no residual effect, a positive or neutral residual effect are not included in the cumulative effects assessment).
- A spatial and temporal overlap of the residual effects of the Project on that VEC with the effects of the other projects and human activities.

Table 7-19 summarizes the residual effects of the Keeyask Transmission Project on each VEC, and identifies which VECs are evaluated for potential interactions with future projects. The evaluation of potential cumulative effects on these VECs with future projects is described in the following sections.

Table 7-19: Application of Cumulative Effects Assessment with Future Projects to VECs

VEC	Notes Regarding Predicted (or anticipated) Keeyask Transmission Project Residual Effects	Overlap with Future Projects	Included in CEA for Future Projects or Activities
Fish Habitat	Residual adverse effects during construction and operation related to increased levels of suspended sediments in streams.	• Keeyask Generation Project • Bipole III	Yes
Fragmentation	Residual adverse effects on plant habitats and core areas during construction and operation related to fragmentation.	• Keeyask Generation Project • Bipole III • Gillam Redevelopment	Yes
Ecosystem Diversity	Residual adverse effects during construction and operation related to loss of tree stands (reduced ecosystem diversity).	• Keeyask Generation Project • Bipole III • Gillam Redevelopment	Yes

Table 7-19: Application of Cumulative Effects Assessment with Future Projects to VECs

VEC	Notes Regarding Predicted (or anticipated) Keeyask Transmission Project Residual Effects	Overlap with Future Projects	Included in CEA for Future Projects or Activities
Priority Plant Species	Residual adverse effects during construction and operation related to potential loss of priority plants and habitats.	• Keeyask Generation Project • Bipole III • Conawapa Generation Project • Gillam Redevelopment	Yes
Raptors	Residual adverse effects are associated with noise effects during construction, alteration and loss of habitat during both construction and operation, and bird-collision mortality during operation.	• Keeyask Generation Project • Bipole III • Conawapa Generation Project • Gillam Redevelopment	Yes
Common Nighthawk	Residual adverse effects are associated with noise effects during construction, alteration and loss of habitat during both construction and operation, and bird-collision mortality during operation.	• Keeyask Generation Project • Bipole III • Gillam Redevelopment	Yes
Olive-sided Flycatcher	Residual adverse effects are associated with noise effects during construction, alteration and loss of habitat during both construction and operation, and bird-collision mortality during operation.	• Keeyask Generation Project • Gillam Redevelopment	Yes
Rusty Blackbird	Residual adverse effects are associated with noise effects during construction, alteration and loss of habitat during both construction and operation, and bird-collision mortality during operation.	• Keeyask Generation Project • Gillam Redevelopment	Yes

Table 7-19: Application of Cumulative Effects Assessment with Future Projects to VECs

VEC	Notes Regarding Predicted (or anticipated) Keeyask Transmission Project Residual Effects	Overlap with Future Projects	Included in CEA for Future Projects or Activities
Moose	Residual adverse effects during construction and operation are related to loss and alteration of habitat, sensory disturbance and fragmentation, and mortality.	• Keeyask Generation Project • Bipole III • Conawapa Generation Project • Gillam Redevelopment	Yes
Caribou	Residual adverse effects during construction and operation are related to loss and alteration of habitat, sensory disturbance and fragmentation, and mortality.	• Keeyask Generation Project • Bipole III • Conawapa Generation Project • Gillam Redevelopment	Yes
Land and Resource Use	Residual adverse effects during construction and operation on domestic and commercial resource use and access.	• Keeyask Generation Project • Bipole III • Conawapa Generation Project	Yes
Economy	Positive residual effects related to employment and business opportunities.	• Keeyask Generation Project. • Bipole III • Conawapa • Gillam Redevelopment	No. Residual effects of KTP are positive.
Population, Infrastructure and Services	Residual adverse effects during construction on traffic and community services.	• Keeyask Generation Project. • Bipole III • Conawapa • Gillam Redevelopment	Yes
Personal, Family and Community Life	Residual adverse effects to health and safety, public safety, culture and spirituality and aesthetics during construction and operation.	• Keeyask Generation Project. • Bipole III • Conawapa • Gillam Redevelopment	Yes
Heritage Resources	Neutral residual effects following mitigation.	• Keeyask Generation Project	No. Residual effects of Keeyask Transmission Project are neutral.

7.6.2 Physical Environment

There is no separate consideration of the Physical Environment in either the Project effects assessment or the cumulative effects assessment because changes to the physical environment are considered pathways to change in the Valued Environmental Components assessed with respect to the Aquatic, Terrestrial and Socio-economic environments.

7.6.3 Aquatic Environment

The main effects to fish habitat in the Project Study Area from other future projects include:

- The direct loss of fish habitat from project infrastructure (e.g., Keeyask South Access Road).
- Changes to flow regimes and water quality in the Nelson River resulting from generating stations and changes to flow regimes of the lower reaches of tributaries.
- The loss of riparian habitat and potential erosion and sedimentation from other transmission lines and roads.

The proposed Keeyask Generation Project will overlap both spatially and temporally with the Keeyask Transmission Project. The Keeyask Generation Project will affect the Nelson River through development and operation of the hydro-electric generating station. The Keeyask Generation Project South Access Road will require the enhancement of existing stream crossing sites on the Butnau Road and the development of new stream crossings west of the Butnau Weir. This will result in effects to riparian vegetation and direct effects to fish habitat where in-stream crossing structures are required. Where the Generation Outlet Lines for the Keeyask Transmission Project parallel the South Access Road stream crossings, interaction between the two projects may occur.

The Bipole III Transmission Project and the Conawapa Generation Project do not directly overlap with the Keeyask Transmission Project spatially.

As discussed in Section 7.2.4.1, overhead transmission lines pose a small risk to fish habitat. As noted, there is little spatial overlap between components of the projects considered except for the South Access Road component of the Keeyask Generation Station. Effects to fish habitat occur primarily through erosion and sedimentation of streams and the loss of riparian vegetation and associated function. These potential effects on fish habitat will be mitigated through such measures as revegetating sites and using appropriate erosion and sediment control measures (Section 7.2.4.1). The residual effects of construction and operation of individual overhead transmission lines are considered negligible. Where a number of transmission lines or other linear rights-of-way occur in close proximity or the right-of-way becomes larger, the potential for increased residual effects from the loss of riparian vegetation increases. Such would be the

case where the Keeyask Transmission Lines parallel the proposed Keeyask South Access Road; however, the overall effects on fish habitat are not considered significant.

Considering the mitigation measures outlined above and in Section 7.2.4.1, the residual effects characteristics of the Keeyask Transmission Project are not changed by consideration of interactions with future projects.

7.6.4 Terrestrial Environment

The following sections outline the potential cumulative Project effects on terrestrial plant, ecosystem and wildlife VECs. The overall conclusion is that the cumulative effects on the terrestrial environment are not significant.

7.6.4.1 Terrestrial Habitat, Ecosystems and Plants

The primary potential effects of the Project on terrestrial habitat, ecosystem and plants are associated with the: fragmentation of terrestrial habitat and ecosystems, changes in ecosystem diversity, and effects on priority (plants of concern) plants and habitats.

The terrestrial environment in the area that would be affected by the Project has been substantially altered by past hydroelectric developments, linear developments (including transmission lines, highways and rail lines), forestry and mining exploration, and other agents of change ─ and continues to experience those effects today. Project effects will interact cumulatively with these past and existing projects and activities as well as the future projects considered in this assessment.

Fragmentation

It is anticipated that the Keeyask Transmission Project will fragment terrestrial habitat and ecosystems in the Project Study Area by adding linear features and affecting core areas. These residual Project effects are cumulative with other past and current projects in the region, such as the North Access Road associated with the Keeyask Infrastructure Project. Past and existing linear features (*e.g.,* roads, railways, transmission lines) and other permanent infrastructure have fragmented the regional terrestrial ecosystem. It is estimated that total core area in the region has already been reduced to approximately 83% of land area. Potential fragmentation effects were largely mitigated through the careful siting of the transmission lines and stations, and minimizing the footprint of the Project infrastructure. Residual Project effects on fragmentation will overlap spatially and temporally with the potential effects of Gillam Redevelopment, Bipole III Transmission Project and the proposed Keeyask Generation Project. Based on the anticipated locations of these reasonably foreseeable overlapping future projects, total linear feature density could increase substantially. However, using the methods outlined in

Chapter 3, the conclusion that the predicted residual effects of the Project would not be significant does not change.

Ecosystem Diversity

The Project has potential to affect local ecosystem diversity through loss of an ecosystem type, change in the ecosystem composition of the region, and a predicted reduction in the number of stands representing an ecosystem type and/or substantially reducing the area of a priority habitat type. Key mitigation measures to reduce these potential effects on plant habitat and ecosystems are:

- Avoid priority habitats during final routing of transmission lines to the extent practicable.
- Leave vegetation buffers around shoreline wetlands, lakes and streams.
- Construction practices that reduce the risk of fires, spills and invasive plants affecting plant habitats.

The physical footprints of past and current projects and activities have removed approximately 5% of historical land area in the region, which has altered ecosystem diversity and reduced the total area of most, if not all, priority habitat types. Additional area was indirectly affected by these projects and activities. Effects from these past and current effects would overlap with residual Project effects on ecosystem diversity. The combined effects are not expected to be significant because they are well below the benchmarks used to identify potentially significant effects.

Although the anticipated location of the Keeyask Generation, Gillam Redevelopment and Bipole III Transmission projects could affect more habitat in the region, there is not expected to be a substantial cumulative effect. A detailed assessment of the combined effects of all projects on ecosystem diversity is provided in Keeyask Hydropower Limited Partnership (2012b). Based on these predictions and the anticipated locations of the future projects, the residual effects of the Project in combination with the reasonably foreseeable future projects should remain at the low end of the moderate range for total habitat area affected and the common habitat types and within the small to moderate range for all of the priority habitat types.

Based on the assessment methods described in Chapter 3, this does not change the conclusion that the residual effects of the Keeyask Transmission Project would not be significant.

Priority Plants

The Project can primarily affect priority plants through the:

- Loss and disturbance of priority plants and their habitat.

- Indirect effects on priority plants and their habitat.

- Increased potential for fires and spread of invasive plants.

Past and current projects and activities have affected priority plants, primarily through the same ways that they have affected ecosystem diversity. Effects from these past and current effects would overlap with residual Project effects on priority plants. The mitigation measures outlined for priority plants and ecosystem diversity would effectively reduce the effects on priority plants so that residual effects are within the range identified as being not significant.

The future projects that have some potential to overlap spatially and temporally with residual Project effects on priority plants include Bipole III, Keeyask and Conawapa Generation projects and Gillam Redevelopment. All of these future projects, except for the Conawapa Generation Project, are expected to remove individual plants and their habitat and alter plant populations. Transportation and increased activity along PR 280 for the Conawapa Generation Project could spread invasive plants and increase the risk of access-related effects. However, the residual effects of the Project in combination with the other projects are not expected to increase effects on priority plants to the high magnitude degree. Based on the assessment methods described in Chapter 3, this does not change the conclusion that the residual effects of the Keeyask Transmission Project would not be significant.The overall cumulative effect is not significant.

7.6.4.2 Wildlife

The assessment of potential cumulative effects regarding wildlife considers adverse residual effects of the Keeyask Transmission Project that interact with reasonably foreseeable projects and activities. Terrestrial invertebrates and amphibians are not discussed as no VECs were selected for these components and there is not expected to be a significant cumulative effect.

7.6.4.2.1 Birds

The main potential effects of the Project on birds are:

- Mortality associated with collisions with transmission wires, towers and associated facilities.

- Habitat loss or alteration which can be positive for some species but negative for others ─ such as creating a barrier to movements and habitat use for bird species that are interior-forest specialists, e.g., yellow-rumped warbler and Swainson's thrush.

Raptors

The clearing of the Project transmission rights-of-way and station sites may disrupt and alter raptor nesting sites; however, the rights-of-way clearings and transmission structures will also provide perching and enhanced foraging opportunities for hawks, owls and falcons. The

potential for raptor mortality resulting from collisions with transmission lines and towers is expected to be small. The application of treed buffers or mitigation measures such as bird diverters at environmentally sensitive sites such as wetlands will help reduce the residual effects of the Project.

Specific developments that could affect the presence of bald eagle and other raptors include forest clearing practices (e.g., clearing of severance lines) and other development that reduces the quantity of usable forest stands. The residual effects of the Keeyask Transmission Project on bald eagles and other raptors include habitat alteration, habitat loss and potentially habitat avoidance due to sensory disturbance. There is minor potential for transmission conductor wire strikes by this species (Buehler 2000); bald eagles are generally considered agile flyers, and wire strikes will likely not affect overall population numbers.

The projects that have potential to interact with raptors include the Keeyask Generation Project, Bipole III and the Conawapa Generation Project. Due to its proximity to the Project Study Area, the Keeyask Generation Project has the most spatial and temporal overlap. There is generally little spatial overlap with other projects such as the Bipole III Transmission Project and Conawapa Generation Project during the bird breeding season. Raptors are wide ranging, particularly outside of the breeding season (e.g., pre-migration aggregations and movements of bald eagles along waterways such as the Nelson River) and can potentially move between the Keeyask Transmission Project Study Area and the Conawapa and Bipole III areas.

Residual effects of the Keeyask Transmission Project could affect short-eared owl, bald eagles and other raptors through mortality associated with a few individual bird-wire collisions. The transmission lines and rights-of-way may also benefit raptors by providing ideal perching sites as well as enhanced foraging opportunities within the openings created by the rights-of-way. The residual long-term effects of the Keeyask Transmission Project on raptors are expected to be small and not significant.

The cumulative loss and alteration of avian habitat in the Keeyask Transmission Project Study Area is not expected to have a substantial spatial overlap with regional habitat loss associated with Bipole III and the Conawapa Generation Project. As a result of the limited spatial overlap of the Project with other foreseeable projects and activities, the small magnitude of these potential effects and the wide-ranging movements of raptors, the prediction of no significant effect remains for this VEC and no additional mitigation is recommended.

Species at Risk

The Project has potential to affect species at risk through mortality and habitat alteration. Common nighthawk, olive-sided flycatcher and rusty blackbird are small, more maneuverable birds that have a lower potential to collide with the ground wire on transmission lines than some other bird species. The application of treed buffers and mitigation measures such as bird

diverters at environmentally sensitive sites such as wetlands will help reduce the residual effects of the Project. There will remain some small residual potential for these birds to collide with transmission lines and station facilities that cannot be completely avoided with mitigation.

The different species at risk will react differently to effects of the Project-related habitat alteration. Negligible residual effects associated with habitat alteration are expected for rusty blackbird, which prefer to nest in association with wetlands and have no potential to nest at station sites and limited potential to nest along the transmission rights-of-way. The application of treed buffers near wetlands and keeping towers set back from streams should effectively reduce the potential effects on this species. There will be a direct long-term loss of habitat for common nighthawk and olive-sided flycatcher associated with the development of switching stations and transmission towers. The alteration of habitat for the transmission rights-of-way would have some benefit to both common nighthawk, which prefers nesting in openings, and olive-sided flycatcher, which is often associated with edge habitat.

Much of the potential effects on species at risk will be avoided through winter clearing. The negative aspects of habitat alteration will be minimized through careful selection of routes to avoid their habitat, careful siting of towers and retention/encouragement of woody vegetation along rights-of-way.

The long-term effect of the Keeyask Transmission Project on bird species at risk was determined to be small and not significant. The Keeyask Generation Project and Gillam Redevelopment are the two projects that may have spatial and/or temporal overlap with the Keeyask Transmission Project and therefore have the potential to cumulatively affect bird species at risk.

The common nighthawk habitat is widely dispersed within the region, including along the preferred Construction Power and Generation Outlet Transmission routes and station sites. The breeding range of the common nighthawk extends over much of Manitoba, though it is seldom present above the treeline (Taylor 2003a). Threats to common nighthawk are mainly related to habitat loss and alteration and reductions in insect populations that serve as a primary food source (Behrstock 2001; Savignac 2007). Other species at risk (including olive-sided flycatcher and rusty blackbird) experience similar effects associated with habitat loss or alteration.

Foraging by common nighthawks generally takes place in areas with water (i.e. lakes, rivers and swamps) as well as forested clearings. The creation of gravel roads, borrow areas and clearings can serve to attract nighthawks for nesting purposes and can result in increased mortalities through vehicle-related strikes (Taylor 2003a). The Project may also create some usable habitat through the maintenance of cleared rights-of-way. This would represent a positive effect of both the Keeyask Transmission and Generation projects on common nighthawks in the region. However, it is anticipated that there would be somewhat more loss of habitat (e.g., transmission tower foundations and new stations) than creation of suitable nesting and foreign habitat. This

predicted net habitat loss in the Keeyask Transmission Project Study Area would act cumulatively with the loss of other common nighthawk habitat in the region.

The largest amount of olive-sided flycatcher habitat was identified in a few locations east of Gilrat Lake and along a few stream crossings. Olive-sided flycatchers commonly occur throughout the region and are typically associated within mature forest stands, particularly riparian habitat. While there is some limited potential for spatial and temporal overlap of habitat-related effects between the Keeyask Transmission Project and Gillam Redevelopment, the potential for overlap is greater with the Keeyask Generation Project ─ particularly with respect to the South Access Road.

There are a few wetland locations, such as at/near Cache and Gilrat lakes, where rusty blackbird habitat occurs (Map 4-6). Rusty blackbird habitat is generally dispersed throughout the region. The only other Project likely to overlap with that habitat is the Keeyask Generation Project, and in particular the South Access Road.

Residual effects of the Keeyask Transmission Project on common nighthawks, olive-sided flycatchers and rusty blackbirds are expected to include habitat loss and alteration and a small potential for mortality associated with bird-wire and bird-vehicle collisions. While there is some potential for overlap with the Keeyask Generation Project, there is little spatial overlap with other projects such as Bipole III.

The Project is not expected to cause a significant cumulative effect on bird species at risk when considered in combination with other projects or activities, and therefore no additional mitigation measures are recommended. Based on the assessment methods described in Chapter 3, the conclusion that residual effects of the Keeyask Transmission Project would not be significant does not change.

7.6.4.2.2 Mammals

Moose

Effects of past and current projects on moose include habitat alteration and increased mortality from resource harvesting and predator access along existing linear features including roads, railway lines, and trails. Prior to hydroelectric development, moose occurred between Split Lake and what is now Stephens Lake. Shoreline habitat loss and fluctuating water levels resulted in a decrease in the number of moose present, resulting in resource users tending to travel further to harvest. Today, some harvest occurs along the shorelines of Stephens Lake. At present, moose appear to be common, widely distributed, and clustered in the Project Study Area, and the regional population appears stable. Concerns have been expressed about the sustainability of local and regional moose populations.

The main residual effects of the Project on moose in combination with past and current projects are a decreased population and altered movements. Moose abundance, distribution, and movements are likely to change during construction, primarily as a result of sensory disturbance from construction. It is highly likely that Project effects on moose will be negligible to small in the Project Study Area. Small changes in habitat are expected given the small footprint of the Project and that moose will use the right-of-way to move from place to place and to forage. A small amount of thermal cover will be reduced. Reduced habitat and increased mortality from increased hunter and predator access, albeit limited, are expected to result in decrease of animals near linear features, and a small decrease in the moose population in the Project Study Area for two or more generations. Finally, a small change in habitat intactness and fragmentation is expected as a result of the Project.

Residual Project effects on moose are expected to overlap with the effects of reasonably foreseeable future projects including Conawapa Generation Project, Bipole III Transmission Project, the Keeyask Generation Project, and Gillam Redevelopment. Although total linear feature density will increase and core areas will decrease substantially, these changes are considered regionally acceptable given the limited magnitude and geographic extent. Although the Split Lake Resource Management Area moose population appears to be stable, recent declines in the abundance of moose in western and eastern Manitoba have occurred ─ and access, harvesting and increased predation are believed to be the main contributors to the decline.

Although changes including habitat alteration are likely to occur with each project, access issues and sustainable moose harvest are of particular concern near Gillam. For the Keeyask Generation Project, Tataskweyak Cree Nation (TCN) is preparing a Moose Harvest Sustainability Plan to guide the management of their Adverse Effects Agreement Access Program to ensure the sustainability of the moose population in the Split Lake Resource Management Area. The Province is responsible for managing the licensed harvest while recognizing the priority of Aboriginal harvesting rights.

The Project is expected to cause a small cumulative effect on moose when considered in combination with other projects or activities. Considering the mitigation measures described above and in Section 7.2.11.1, the conclusion that the residual effects of the Keeyask Transmission Project would not be significant does not change.

Caribou

Effects of past and current projects on caribou include habitat alteration and increased mortality from resource harvesting and predator access along linear features. Habitat alteration and access effects from past and current developments (e.g., hydroelectric development, linear developments) can further depress populations that experience periodic decline from increased predation and harvest over the entire migratory caribou range. Concerns have been expressed

about the disappearance of large caribou herds in the region since the 1950s, the limited return of caribou beginning in about the early 1990s (Thompson and Abraham 1994; Abraham and Thompson 1998) and continuing today (FLCN 2010 Draft). Potential declines in some migratory caribou and the sustainability of their populations are of further scientific concern (Beverly and Qamanirjuaq Caribou Management Board 2011).

Local First Nations are concerned about past and current habitat loss, fragmentation, predation, harvest, changes in movement patterns, and accidental mortality of summer resident caribou attributed to development. Caribou have recently returned to the area and occasionally mix in the Study Area. Local First Nations distinguish a small group of woodland caribou from migratory barren-ground and coastal caribou herds. This group of caribou has been described as migratory woodland caribou (Fox Lake Aski Keskentamowin Keeyask Powistik 2012) and Pen Islands coastal caribou (Keeyask Hydropower Limited Partnership 2012; Manitoba Hydro 2012).

Recent estimates of the Pen Islands coastal caribou population indicates that it has stable to potentially increasing trends. The Qamanirjuaq barren-ground caribou population may have declined since the 1980s (e.g., Beverly and Qamanirjuaq Caribou Management Board 2002; Campbell *et al*. 2010), or are redistributed across the landscape. Recent reports indicate that Qamanirjuaq caribou are still plentiful and the declines are not significant (Beverly and Qamanirjuaq Management Board 2011). Cape Churchill coastal caribou, which range into the Caribou Regional Study Area but are not present in the Project Study Area, have increased in number since 2007 (e.g., Abraham *et al*. 2012b; Manitoba Hydro 2012).

Past and current project effects have resulted in regional habitat loss and alteration but most of these changes are limited to habitat affected by flooding along the Nelson River. The main residual effects of the Project on Pen Islands and Qamanirjuaq caribou in combination with past and current projects are localized altered movements due to habitat fragmentation and sensory disturbance, and decreased populations due to increased mortality. Given the large ranges of migratory caribou, the effects of altered movements and mortality on these animals will be negligible to small and affect two or more generations.

Summer resident caribou abundance, distribution, and movements are likely to be altered by the Project during construction and operation, primarily because of sensory disturbance near calving and rearing complexes. Expected changes in habitat are small when compared to regional habitat availability and use by caribou. Predator hunting efficacy is predicted to marginally improve as predators move along new linear features. As the traditional caribou harvest primarily occurs in winter, summer resident caribou that are mixed with other caribou during this time, are unlikely to be harvested. Existing access trails in the Project Study Area, and the transmission lines are not expected to contribute substantially to access and caribou harvest effects. Therefore, only a negligible to small effect for local caribou populations is anticipated from the Project in combination with past and current projects.

Residual Project effects on caribou are expected to overlap with the effects of reasonably foreseeable future projects including the Conawapa Generation Project, Bipole III Transmission Project, the Keeyask Generation Project, and Gillam Redevelopment.

Incremental habitat fragmentation effects for summer resident caribou from the Project in combination with future projects are a concern within the Project Study Area because of the scientific uncertainty associated with abundance and range use of these animals. For summer residents, the effect of cumulative habitat fragmentation will be small and is highly unlikely to result in a measurable change to the population.

Human and fire disturbance in the Region is already large, and existing habitat may not support a summer resident caribou population over the long term. The density of predators, however, is not expected to increase with a small increase in fragmentation because there is likely not enough caribou and moose biomass in the Project Study Area to support a dense predator population (Keeyask Hydropower Limited Partnership 2012). Although total linear feature density will increase and core areas will decrease, the incremental fragmentation effects from future projects are considered regionally acceptable given the limited magnitude and geographic extent of these changes.

Management of access and harvest of migratory caribou in the lower Nelson River area is of high scientific and social concern. Infrequent but potentially high harvest events, coupled with incremental habitat effects over a broad region, could result in a decrease of Pen Islands Coastal caribou. The Province is responsible for managing the licensed harvest while recognizing the priority of Aboriginal harvesting rights. All Project-related caribou mortality in association with other effects will be monitored to better understand and respond to potential cumulative effects. A plan is being developed to coordinate caribou monitoring activities among northern hydroelectric developments, as well as with government authorities and existing caribou committees and management boards.

Considering the mitigation measures outlined in Section 7.2.11.1, the Project is not expected to cause a significant cumulative effect on caribou when considered in combination with other projects or activities.

7.6.5 Socio-economic Environment

Potential interactions of the Project with future projects were based on a consideration of the residual adverse effects described in Section 7.3. Residual effects on the economy are anticipated to be positive and residual effects on heritage resources are anticipated to be neutral. Therefore residual effects on the economy and heritage resources VECs are not discussed in this section.

Potential interactions of the Project with future projects may occur as a result of spatial or temporal overlaps (e.g., construction workforce overlaps). Spatial overlaps occur primarily with the Keeyask Generation Project. Construction workforces overlap with several planned Manitoba Hydro projects, particularly in 2017 and 2018. Figure 7-1 shows the estimated cumulative quarterly average workforces of Manitoba Hydro Projects in the vicinity of Gillam.

7.6.5.1 Land and Resource Use

7.6.5.1.1 Domestic and Commercial Resource Use

Residual effects to domestic resource use, commercial trapping and forestry use related to the Keeyask Transmission Project were determined to be small in magnitude and not significant. The effects of past and current projects in the Project Study Area were included in this assessment. These conclusions considered the site selection process which resulted in preferred routes that follow existing or planned infrastructure to the extent feasible and minimize the creation of entirely new rights-of-way, as well as other mitigation measures. Of the future projects considered in the cumulative effects assessment:

- The preferred route for Bipole III Project extends to the proposed Keewatinoow Converter Station northeast of the existing Limestone Generating Station and outside the Project Study Area for the Keeyask Transmission Project.

- The Conawapa Generation Project would be located downstream of the Limestone Generation Station and outside the Project Study Area for the Keeyask Transmission Project.

Therefore effects on domestic and commercial resource use of the Keeyask Transmission Project are anticipated to overlap in geographic extent primarily with the proposed Keeyask Generation Project.

The environmental impact statement for the Keeyask Generation Project concluded that overall there would be neutral effects for that Project on domestic hunting and gathering and commercial trapping following mitigation that included Offsetting Programs established under the Adverse Effects Agreements with the Keeyask Cree Nations. Effects on commercial forestry related to the Keeyask Generation Project were determined to be negligible. More information on these conclusions is available in Section 6.7 of the Keeyask Generation Project Environmental Impact Statement (Keeyask Hydropower Limited Partnership 2012).

As a result, a consideration of potential cumulative effects with future projects is not expected to alter the consideration of residual effects characteristics of the Keeyask Transmission Project, and no additional mitigation is recommended.

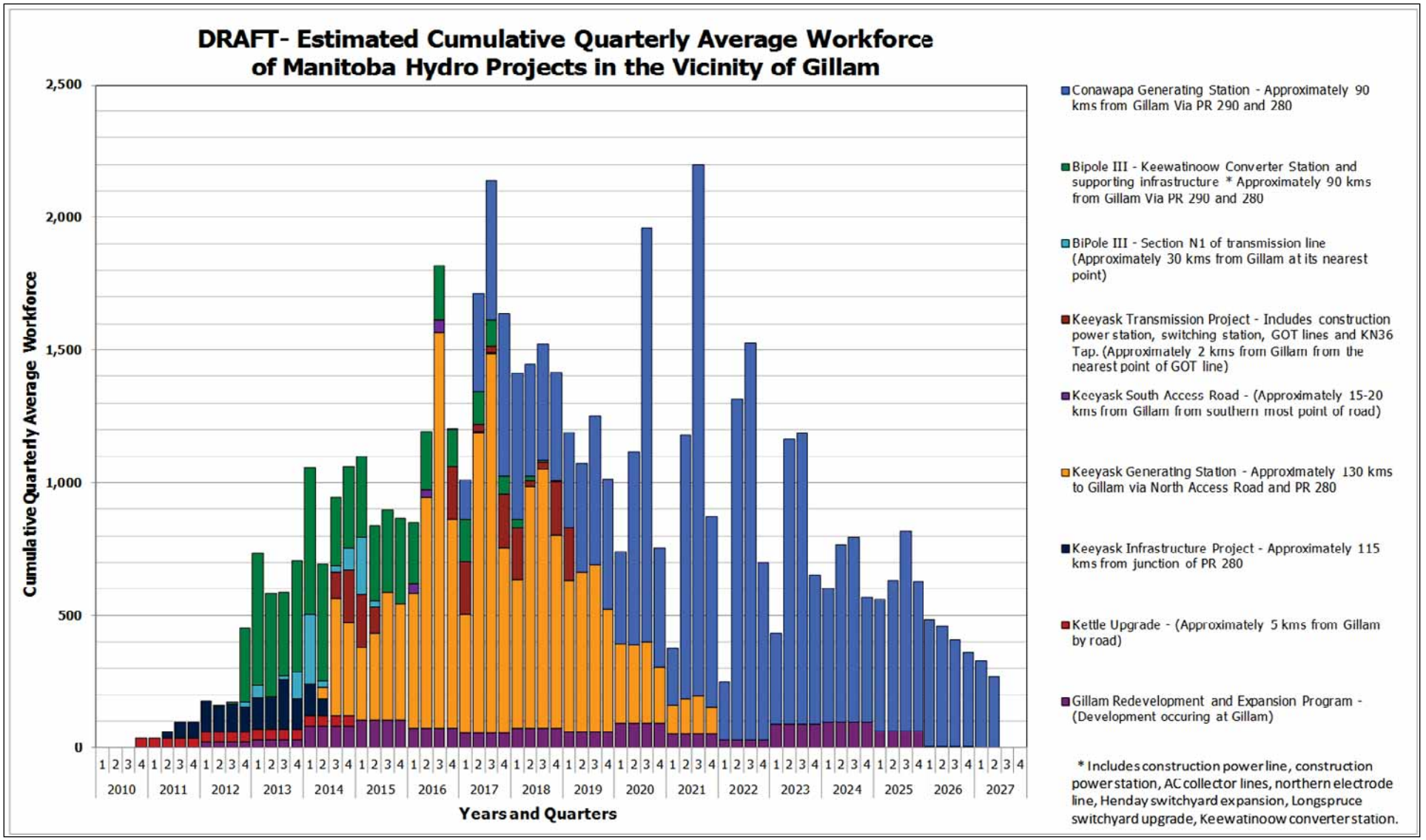

Figure 7-1: Major Construction Activity in the Gillam Area During Construction of the Keeyask Transmission Project

Notes:

1. The estimates are quarterly average workforce requirements (averages within each quarter based on monthly information) based on information available at the time of compilation and are subject to change. In some instances the level of detail for the estimates vary and the footnotes below provide further details where necessary. Unless otherwise noted: the above information represents a forecast only, based on current regulations, present project plans, and experience with similar projects; contractors will determine specific job requirements when the project is being built; actual employment requirements will vary from the forecast presented. Unless otherwise noted, the above information indicates contractor site personnel (including supervisory and management positions); it also includes Manitoba Hydro site staff. The above forecasts do not include Manitoba Hydro Winnipeg office staff, or workforce for the construction of Substations and Transmission Lines.

2. Gillam Redevelopment and Expansion Program

- Estimated number of workers required per year. Assumes quarterly peak workforce is equal to number of workers required per year.

3. Kettle Upgrade

- Assumes peak quarterly workforce of 40 workers.

4. Keeyask Infrastructure Project

- The above forecasts are based on Manitoba Hydro's forecast of workforce and a construction schedule of November 2019 first unit in-service date.
- The Keeyask Infrastructure Project is expected to be completed by May 2014.

5. Keeyask Generating Station

- The above forecasts are based on KGS Acres and Manitoba Hydro's forecast of workforce and a construction schedule of November 2019 first unit in-service date.
- The Keeyask Generating Station project is expected to start in June 2014.
- The above forecast does not include the workforce for the South Access Road (SAR); SAR estimates are provided separately in the figure.

6. Keeyask South Access Road

- The above forecasts are based on KGS Acres and Manitoba Hydro's forecast of workforce and a construction schedule of November 2019 first unit in-service date.
- The Keeyask Generating Station project is expected to commence in June 2014.

7. Keeyask Transmission Project - Construction Power Station

8. Keeyask Transmission Project - Switching Station and GOT lines.

9. Bipole III

i. The following notes apply to N1 clearing and construction, Keewatinoow construction power line, Keewatinoow AC collector lines and the northern electrode line
   - Projections are extrapolated from Wuskwatim Transmission Line figures.
   - Projections based on a December 2012 construction start date.
   - Projections are assumptions only; each contractor will staff and schedule his/her section of the work as per their own preferences.
   - Breakdown is derived from Wuskwatim-Herblet actuals and then applied as a percentage to Bipole III projected figures
   - Estimate includes contractor workers and contractor supervisory positions and Manitoba Hydro workers and Manitoba Hydro supervisory positions.

ii. The following notes apply to Henday switchyard expansion, Long Spruce switchyard upgrades, and the Keewatinoow construction power station
   - Estimate includes contractor workers and contractor supervisory positions and Manitoba Hydro workers and Manitoba Hydro supervisory positions.

iii. Keewatinoow Converter Station
   - The above forecasts are based on Manitoba Hydro's forecast of workforce and a construction schedule based on an October 2017 BP III in-service date.

10. Conawapa Generating Station

- The above forecasts are based on KGS Acres and Manitoba Hydro's forecast of workforce and a construction schedule of May 2023 first unit in-service date, and was shifted to the current first unit in-service date of May 2025.
- The above information The above forecasts do not include Manitoba Hydro Winnipeg office staff, or workforce for the construction of Substations, Converter Station or Transmission Lines.

7.6.5.1.2 Outdoor Travel and Recreation

Overlaps of construction workforce requirements with the Keeyask Generation Station, Keewatinoow Converter Station and potentially the Conawapa Generation Station could increase effects on outdoor recreation access and opportunities, particularly in the 2017-2018 period. The magnitude of residual effects when considering potential interactions with future projects may change from small to moderate in the short-term. However, based on the assessment methods described in Chapter 3, this does not change the conclusion that the residual effects of the Keeyask Transmission Project would be not significant.

7.6.5.2 Population, Infrastructure and Services

7.6.5.2.1 Traffic and Transportation Infrastructure

Key concerns of interactions with future projects relates to additional wear and tear and traffic levels, in particular on PR 280. For example, during 2017 and 2018 there is expected to be substantial traffic as a result of the Keeyask Generation Station, Keewatinoow Converter Station and potentially the Conawapa Generation Station. These higher traffic levels could accelerate the schedule for road refurbishment, maintenance and/or upgrades. Manitoba Hydro and Manitoba Infrastructure and Services will need to keep each other informed on a regular basis prior to and during periods of overlapping construction traffic to identify requirements for road improvements and traffic management.

In light of expected traffic related to future projects, in particular on PR 280, the magnitude of residual effects when considering potential interactions with future projects may change from small to moderate in the short-term. However, based on the assessment methods described in Chapter 3, this does not change the conclusion that the residual effects of the Keeyask Transmission Project would be not significant.

7.6.5.2.2 Health and Emergency Services

Overlaps of construction workforce requirements with the proposed Keeyask Generation Project, Keewatinoow Converter Station and potentially the Conawapa Generation Project could increase demands on health and emergency services, particularly in the 2017-2018 period. The magnitude of residual effects when considering potential interactions with future projects may change from small to moderate in the short-term. Ongoing communication between Manitoba Hydro and the communities in the Socio-economic Study Area, as well as adherence to provincial workplace health and safety legislation and Manitoba Hydro's safe construction practices can help to mitigate the potential combined effects of these Projects. In Gillam, the Gillam Land Use Planning process currently underway is a forum for addressing demands on infrastructure and services.

Given the mitigation noted above, including the Gillam Land Use Planning process already in place to address the effects of increased demands on infrastructure and services, and based on the assessment methods described in Chapter 3, the conclusion that the residual effects of the Keeyask Transmission Project would be not significant does not change when taken into consideration with the effects of future projects.

7.6.5.2.3 Other Community Services

Overlaps of construction workforce requirements with the proposed Keeyask Generation Project, Keewatinoow Converter Station and potentially the Conawapa Generation Project could increase demands on community recreation and leisure services, particularly in the 2017-2018 period. This is expected to be mitigated to some degree by the presence of recreation and leisure opportunities at the main Keeyask Generation Project construction camp. The magnitude of residual effects when considering potential interactions with future projects may change from small to moderate in the short-term. Ongoing communication between Manitoba Hydro and the communities in the Socio-economic Study Area, can help to mitigate the potential combined effects of these Projects. In Gillam, the Gillam Land Use Planning process currently underway is a forum for addressing demands on infrastructure and services.

Although the magnitude of the predicted residual effects increases slightly when the effects of the Project are considered with the potential effects of future projects, given the mitigation outlined above and based on the assessment methods described in Chapter 3, this does not change the conclusion that the residual cumulative effects would be not significant.

7.6.5.3 Personal, Family and Community Life

7.6.5.3.1 Workplace Health and Safety

Overlaps of construction workforce requirements with the Keeyask Generation Station, Keewatinoow Converter Station and potentially the Conawapa Generation Station could increase effects on workplace health and safety, particularly in the 2017-2018 period. The magnitude of residual effects when considering potential interactions with future projects may change from small to moderate in the short-term. Adherence to workplace health and safety legislation and Manitoba Hydro's safe construction policies can help to mitigate the potential combined effects of these Projects. Based on the assessment methods described in Chapter 3, this does not change the conclusion that the residual effects of the Keeyask Transmission Project would be not significant.

7.6.5.3.2 Health and Safety of Area Residents and Resource Users

Overlaps of construction workforce requirements with the Keeyask Generation Station, Keewatinoow Converter Station and potentially the Conawapa Generation Station could

increase effects on health and safety of area residents and resource users, particularly in the 2017-2018 period. The magnitude of residual effects when considering potential interactions with future projects may change from small to moderate in the short-term. Where access is a concern to communities, Manitoba Hydro will work with directly affected communities to prepare Access Management Plans prior to construction. Appropriate signage and fencing for the construction site can also help mitigate these effects. Based on the assessment methods described in Chapter 3, this does not change the conclusion that the residual effects of the Keeyask Transmission Project would be not significant.

Effects during the operations phase are not anticipated to combine with other potential future projects.

7.6.5.3.3 Public Safety and Worker Interactions

The residual adverse effects of the Keeyask Transmission Project have the potential to interact with adverse effects of other projects and activities planned during the construction phase. Potential public safety and worker interaction effects related to the Bipole III Project are described in Section 8.3.5 of the Bipole III Project environmental impact statement. Potential public safety and worker interaction effects related to the Keeyask Generation Project are described in Section 6.6.5.4 in the Keeyask Generation Project environmental impact statement.

Mitigation measures have been designed to address these potential interactions including:

- Mitigation measures to reduce the number of worker visits, as well as an overall coordinated approach to address worker interaction have been incorporated into the assessment of the Keeyask Generation Project and the Bipole III Transmission Project EIS, particularly in relation to the Keewatinoow Converter Station.

- Additional mitigation in the form of ongoing coordination with Manitoba Hydro, contractors, monitoring advisory committees, the RCMP and social groups will be necessary to reduce the risk of adverse effects.

- Ongoing monitoring will be a necessary component of all Manitoba Hydro projects and activities in the vicinity of Gillam in particular. Further discussion with the RCMP is recommended to facilitate appropriate level of staffing and to determine how best to track incidents related to separate projects.

Given the sizeable increase in the number of potential visits to Gillam by non-local construction workers and added adverse interaction opportunities, the planning for each of the future projects discussed in this section will need to address incremental mitigation and

monitoring as required and reviewed above. Coordinated planning in this regard will be facilitated to the extent that Manitoba Hydro is responsible for these future projects.

Assuming the above mitigation and monitoring occurs, residual effects characteristics of the Keeyask Transmission Project are not changed by the consideration of interactions with future projects.

7.6.5.3.4 Culture and Spirituality

Future projects and activities will add to the physical alteration of the land and water in the area. These changes will result in additional effects on culture and spirituality for TCN, FLCN and others. Manitoba Hydro will work with TCN, FLCN and others so that these future projects are planned, constructed and developed in a way that minimizes adverse effects as much as possible. Other mitigation measures, including agreements where appropriate, may be developed to address known and foreseeable potential adverse effects. Based on a consideration of these measures, the assessment of significance on culture and spirituality in section 7.3, which considered cumulative effects of past and current projects, is not changed by the consideration of potential interactions with other future projects.

7.6.5.3.5 Aesthetics (the Way the Landscape Looks)

There is spatial and temporal overlap between the Project and the Keeyask Generation Project for both the construction and operation phases. The preferred routes and sites for Project infrastructure have been selected to minimize the creation of new disturbance areas, including future infrastructure related to the Keeyask Generation Project. Given an already disturbed visual landscape and the site selection process designed to follow existing or planned infrastructure to the extent feasible, the determination of significance related to visual effects of the Project is not changed after considering the cumulative effects of other future projects.

7.6.6 Residual Cumulative Effects Summary

This section described potential interactions of adverse residual Project effects with other reasonably foreseeable future projects. The cumulative effects assessment has noted instances where assessment characteristics of adverse residual Project effects may change when considering future projects. For example, in some instances a small magnitude residual adverse Project effect may become a moderate magnitude residual adverse effect through interaction with other future Projects. However, no significant residual adverse effects were identified through the cumulative effects assessment. Table 7-20 summarizes the results of the consideration of the cumulative effects assessment with future projects.

Table 7-20: Summary of Results of the Cumulative Effects Assessment with Future Projects

VEC	Summary of Residual Effects of the Keeyask Transmission Project and Mitigation	Conclusions of CEA on Potential Interaction with Future Projects
Fish Habitat	**Residual Adverse Effects:** • Direct loss of fish habitat from Project infrastructure; effects to riparian vegetation and direct effects to fish habitat where in-stream crossing structures are required. **Mitigation Overview:** • Site selection process. • Construct lines over watercourses and wetlands under frozen conditions. • Structures will be above high water mark. • Transmission line approaches and crossings will be perpendicular to watercourses. • Disturbed areas will be stabilized. • Other mitigation described in Section 7.2.4.1.	• The effect of the Keeyask Transmission Project on aquatic habitat in combination with Keeyask GS Project is small in magnitude and geographic extent and medium-term in duration. No change to conclusion that residual adverse effects are not significant. • There is no spatial but some temporal overlap between the Keeyask Transmission and Bipole III projects with respect to fish habitat. • No change to conclusion that residual adverse effects are not significant.
Fragmentation	**Residual Adverse Effects:** • Small increase to linear feature density. • Very slight reduction to total percentage of core area in Project Study Area. **Mitigation Overview:** • Site selection process.	• The effect of the Keeyask Transmission Project in combination with other projects is expected to be regionally acceptable. • No change to conclusion that residual adverse effects are not significant.
Ecosystem Diversity	**Residual Adverse Effects:** • Affecting 32 priority habitat types. **Mitigation Overview:** • Site selection process. • Environmental Protection Plan measures to avoid habitats of concern as well as to minimize opportunity for invasive species. • Other mitigation described in Section 7.2.6.1.	• The effect of the Keeyask Transmission Project in combination with other project is expected to be small to medium in magnitude and geographic extent, long-term. • No change to conclusion that residual adverse effects are not significant.

Table 7-20: Summary of Results of the Cumulative Effects Assessment with Future Projects

VEC	Summary of Residual Effects of the Keeyask Transmission Project and Mitigation	Conclusions of CEA on Potential Interaction with Future Projects
Priority Plant Species	**Residual Adverse Effects:** • Potential loss of priority plants and habitat. **Mitigation Overview:** • Site selection process, e.g., site access trails to avoid swamp lousewort. • Equipment and machinery cleaning. • Monitoring to locate rare species and invasive plants and follow-up where required, e.g., containment/control programs for invasive plants. • Other mitigation described in Section 7.2.7.1.	• The effect of the Keeyask Transmission Project in combination with other projects is expected to be regionally acceptable. • No change to conclusion that residual adverse effects are not significant.
Raptors	**Residual Adverse Effects:** • Localized change in raptor distribution and decreased population in Project Study Area related to alteration and loss of habitat during construction and operation. • Avoidance and/or reduced use of areas by raptors near Project Footprint due to noise effects during construction. • Reduced raptor population in Study Area due to potential collisions with vehicles and transmission-related infrastructure, e.g., towers and conductors. • Enhancement of foraging for forest-dwelling raptors – potentially altering local distribution. **Mitigation Overview:** • Clearing and vegetation management (operation) on the right-of-way, to occur outside the April 1 to July 31 breeding season. • Selectively use bird diverters on transmission conductors. • Other mitigation described in Section 7.2.10.1.	• The long-term adverse effect of the Keeyask Transmission Project in combination with other projects is expected to be small in magnitude and geographic extent. • No change to conclusion that residual adverse effects are not significant.

Table 7-20: Summary of Results of the Cumulative Effects Assessment with Future Projects

VEC	Summary of Residual Effects of the Keeyask Transmission Project and Mitigation	Conclusions of CEA on Potential Interaction with Future Projects
Common Nighthawk	**Residual Adverse Effects:** • Localized change in nighthawk distribution and population in Project Study Area related to alteration and loss of habitat during construction and operation. • Avoidance and/or reduced use of areas near Project Footprint due to noise effects during construction. • Reduced common nighthawk population in Study Area due to potential collisions with vehicles and transmission-related infrastructure, e.g., towers and conductors. • Change in nesting locations and potential local increase in breeding associated with enhancement of foraging and nesting opportunities, e.g., creating new clearings. **Mitigation Overview:** • Clearing and vegetation management (operation) on the right-of-way, to occur outside the April 1 to July 31 breeding season. - Pre-clearing nesting surveys required between April 1 and August 31. - 200 m avoidance buffer around nests. • Selectively use bird diverters on transmission conductors. • Other mitigation described in Section 7.2.10.1.	• The long-term effect of the Keeyask Transmission Project in combination with other projects is expected to be small in magnitude and geographic extent. • Overall net effect is adverse, but some associated positive effects • No change to conclusion that residual adverse effects are not significant.
Olive-sided flycatcher	**Residual Adverse Effects:** • Localized change in olive-sided flycatcher distribution and decreased population in Project Study Area related to alteration and loss of habitat during construction and operation. • Avoidance and/or reduced use of areas by olive-sided flycatchers near Project Footprint due to noise effects during construction. • Reduced olive-sided flycatcher population in Study Area due to potential collisions with vehicles and transmission-related infrastructure, e.g., towers and conductors.	• The long-term adverse effect of the Keeyask Transmission Project in combination with other projects is expected to be small in magnitude and geographic extent. • No change to conclusion that residual adverse effects are not significant.

Table 7-20: Summary of Results of the Cumulative Effects Assessment with Future Projects

VEC	Summary of Residual Effects of the Keeyask Transmission Project and Mitigation	Conclusions of CEA on Potential Interaction with Future Projects

	Mitigation Overview:
	• Clearing and vegetation management (operation) on the right-of-way, to occur outside the April 1 to July 31 breeding season.
	  - Pre-clearing nesting surveys required between April 1 and August 31.
	  - 300 m avoidance buffer around nests.
	• Selectively use bird diverters on transmission conductors.
	• Other mitigation described in Section 7.2.10.1.	

Rusty blackbird	**Residual Adverse Effects:**
	• Very small localized change in rusty blackbird distribution and decreased population in Project Study Area related to alteration and loss of habitat during construction and operation.
	• Minor avoidance and/or reduced use of areas by rusty blackbirds near Project Footprint due to noise effects during construction.
	• Reduced rusty blackbird population in Study Area due to potential collisions with vehicles and transmission-related infrastructure, e.g., towers and conductors.
	
	Mitigation Overview:
	• Clearing and vegetation management (operation) on the right-of-way, to occur outside the April 1 to July 31 breeding season.
	  - Pre-clearing nesting surveys required between April 1 and August 31.
	  - 300 m avoidance buffer around nests.
	• Selectively use bird diverters on transmission conductors.
	• Other mitigation described in Section 7.2.10.1.
		• The long-term adverse effect of the Keeyask Transmission Project in combination with other projects is expected to be small in magnitude and geographic extent.
		• No change to conclusion that residual adverse effects are not significant.

Table 7-20: Summary of Results of the Cumulative Effects Assessment with Future Projects

VEC	Summary of Residual Effects of the Keeyask Transmission Project and Mitigation	Conclusions of CEA on Potential Interaction with Future Projects
Moose	**Residual Adverse Effects:** Effects during construction and operation: • Decreased moose population in Project Study Area for two or more generations due to reduced habitat. • Altered movements in the Study Area due to sensory disturbance. • Decreased moose population in Project Study Area for two or more generations due to increased mortality. **Mitigation Overview:** • Site selection process. • Access Management Plan. • Vegetation buffers on transmission lines. • Prohibition of hunting in camps and worksites during construction. • Decommission right-of-way access trails where not required for operations. • Other mitigation described in Section 7.2.11.1.	• The long-term adverse effect of the Keeyask Transmission Project in combination with other projects is expected to be small in magnitude and geographic extent. • No change to conclusion that residual adverse effects are not significant.
Caribou	**Residual Adverse Effects:** Effects during construction and operation: • Decreased caribou population in Project Study Area for two or more generations due to reduced habitat. • Altered movements and distributional shifts of caribou in the Study Area due to sensory disturbance. • Decreased caribou population in Project Study Area for two or more generations due to increased mortality. **Mitigation Overview:** • Site selection process, e.g., avoiding calving and rearing complexes. • Access Management Plan. • Prohibition of hunting in camps and worksites during construction. • Decommission right-of-way access trails where not required for operations. • Other mitigation described in Section 7.2.11.1.	• The long-term adverse effect of the Keeyask Transmission Project in combination with other projects is expected to be small in magnitude and geographic extent. • No change to conclusion that residual adverse effects are not significant.

Table 7-20: Summary of Results of the Cumulative Effects Assessment with Future Projects

VEC	Summary of Residual Effects of the Keeyask Transmission Project and Mitigation	Conclusions of CEA on Potential Interaction with Future Projects
Land and Resource Use	**Residual Adverse Effects:** • Reduced habitat for plants and animals leads to potential reduction in hunting, trapping and gathering opportunities. • Rights-of-way create access for recreational hunters and other recreational resource users resulting in increased hunting pressure. • Loss of timber resources. **Mitigation Overview:** • Site selection process • Trapper compensation • Access Management Plan • Other mitigation described in Section 7.3.1.1.	• Keeyask GS EIS concluded effects following mitigation to domestic and commercial resource use were negligible. Therefore consideration of Keeyask Generation Project does not change conclusions with respect to effects of the KTP. • Magnitude of effects on access and outdoor travel and recreation may change from small to moderate in the short-term. No change to conclusion that residual adverse effects are not significant.
Economy	**Residual Adverse Effects:** • Residual effects are positive. No residual adverse effects. **Mitigation Overview:** • Local hiring preference and Northern purchase policy. • Ongoing communication between Manitoba Hydro and Aboriginal and municipal leadership. • Other mitigation described in Section 7.3.2.1.	• Residual effects of KTP are positive. Therefore not considered as part of potential interactions with future projects.
Population, Infrastructure and Services	**Residual Adverse Effects:** • Increased traffic in the vicinity of Gillam and on PR 280 between Gillam and Thompson. • Increased demands on community health, emergency services and recreation and leisure services. **Mitigation Overview:** • Ongoing communication between Manitoba Hydro and Aboriginal and municipal leadership. • Adherence to health and safety legislation and policies. • Other mitigation described in Section 7.3.3.1.	• Overlaps of construction workforce and traffic may lead to an increase in magnitude of effects in the short-term from small to moderate. No change to conclusion that residual adverse effects are not significant.

Table 7-20: Summary of Results of the Cumulative Effects Assessment with Future Projects

VEC	Summary of Residual Effects of the Keeyask Transmission Project and Mitigation	Conclusions of CEA on Potential Interaction with Future Projects
Personal, Family and Community Life	**Residual Adverse Effects:** • Workplace health and safety and risk of accidents or injuries to area residents or resource users. • Risks to public safety related to influx of non-local construction workers. • Loss of cultural landscape and culturally important resource use opportunities. **Mitigation Overview:** • Site selection process. • Preventative measures and monitoring and ongoing dialogue between Manitoba Hydro, FLCN, the Town of Gillam and TCN to determine appropriate mechanism for tracking and addressing worker interaction issues. • Ceremony to recognize cultural and spiritual importance of the area. • Other mitigation described in Section 7.3.4.1.	• Mitigation measures for public safety and worker interaction have been designed to address potential interactions across projects. Therefore assessment conclusions with respect to KTP do not change. • Considering the mitigation associated with KTP and other future projects, a consideration of potential effects of future projects to culture and spirituality does not change the conclusions with respect to the residual effects of the KTP. • Magnitude of effects to workplace health and safety and health and safety of area residents and resource users may change from small to moderate in the short-term. However, conclusion remains that residual adverse effects are not significant.
Heritage Resources	**Residual Adverse Effects:** • Residual effects are neutral. No residual adverse effects. **Mitigation Overview:** • Heritage Resources Protection Plan. • Other mitigation described in Section 7.3.5.1.	• Residual effects of KTP are neutral. Therefore not considered as part of potential interactions with future projects.