Keeyask Generation Project

PRELIMINARY DRAFT

Terrestrial Effects Monitoring Plan

Hydropower Limited Partnership

April 2013

KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS

MONITORING PLAN

DRAFT

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PREFACE

KEEYASK ENVIRONMENTAL PROTECTION PROGRAM

An Environmental Protection Program (the Program) has been developed to mitigate, manage and monitor potential environmental effects described in the *Keeyask Generation Project: Response to EIS Guidelines* during the construction and operation phases of the Keeyask Generation Project (the Project) shown on Map 1-1. The Program includes a collection of plans grouped in the following categories: Environmental Protection Plans, Environmental Management Plans, and Environmental Monitoring Plans.

Figure 1 lists all of the plans included in the Program. It also demonstrates how the Program will be managed. The Keeyask Hydropower Limited Partnership (the Partnership) has delegated authority to Manitoba Hydro to manage construction and operation of the Project including implementation of the Program. The organizational structure of the Partnership for this aspect of the Project includes a Monitoring Advisory Committee (MAC), which includes participants from each of the Keeyask Cree Nations (KCNs) and Manitoba Hydro. Manitoba Hydro will be guided on the implementation of the Program by the MAC, the Partnership Board of Directors and ongoing discussion with Regulators.

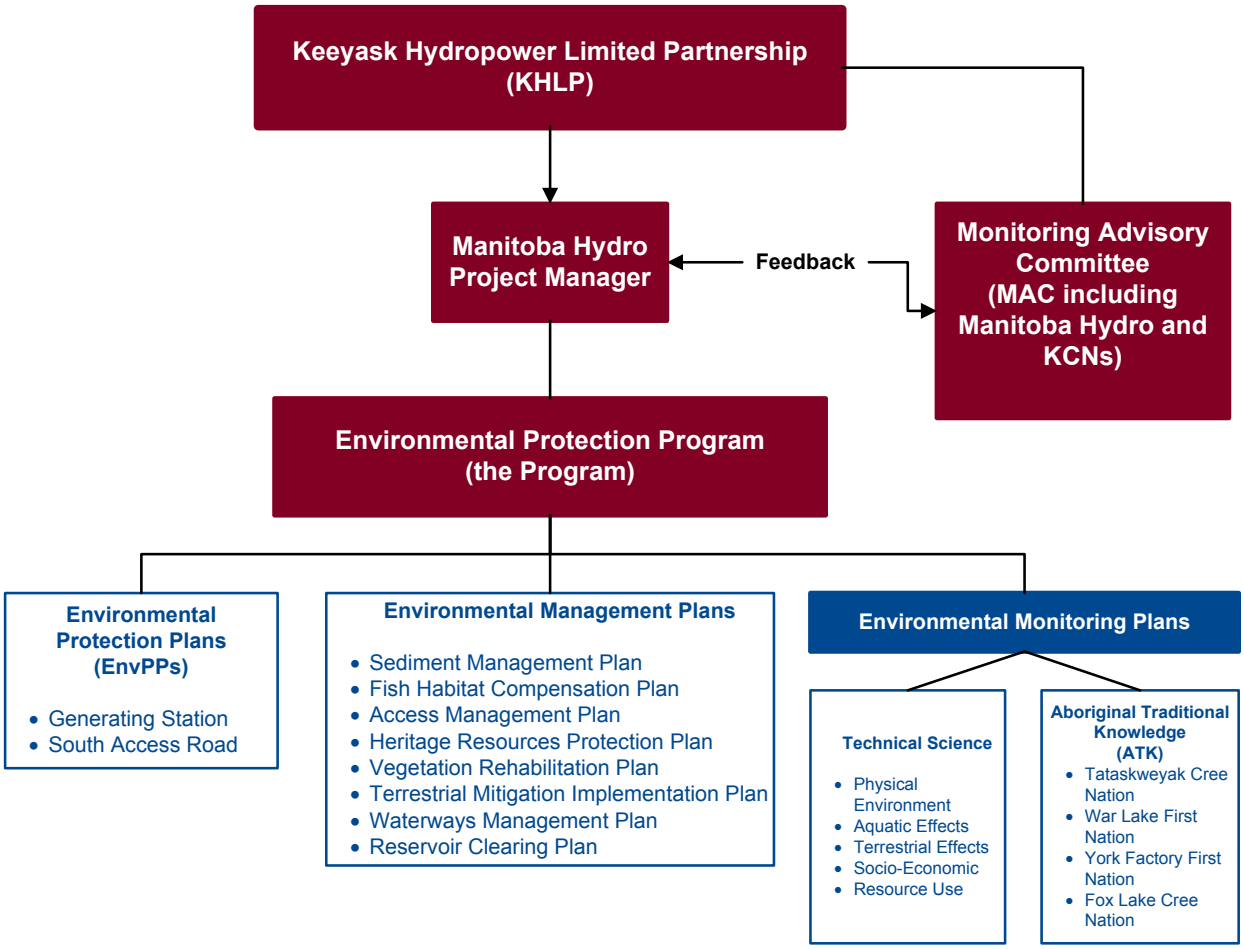

Figure 1: Environmental Protection Program

The Environmental Protection Plans (EnvPPs) provide detailed, site-specific environmental protection measures to be implemented by the contractors and construction staff to minimize environmental effects from construction of the generating station and south access road. They are designed for use as reference documents providing the best management practices to meet or exceed regulatory requirements. EnvPPs are organized by construction activity, highlighting measures to reduce the impact of a specific work activity (e.g., tree clearing or material placement in water). Contractors' compliance with the EnvPPs is a contractual obligation. Under Manitoba Hydro's construction site management, a Site Environmental Officer will be responsible for monitoring compliance and determining when corrective actions are required.

The Environmental Management Plans focus on minimizing effects on specific environmental parameters. They outline specific actions that must be taken during construction and in some cases into the operational phase to mitigate Project effects. The management plans include monitoring to determine success of the actions taken and to determine other actions that need to be undertaken (adaptive management). Implementation of these plans will involve Manitoba Hydro's staff, the KCNs, specialized consultants and contractors under the direction of the Project Manager.

The Environmental Monitoring Plans are designed to measure the actual effects of the Project, test predictions or identify unanticipated effects. During the course of the environmental assessment, numerous requirements for monitoring were identified. There will be both technical science monitoring and Aboriginal Traditional Knowledge (ATK) monitoring undertaken. The technical science monitoring will be conducted by Manitoba Hydro and specialized consultants contracted by Manitoba Hydro, who will in turn hire members of the KCNs to work with them to fulfil the monitoring activities. Manitoba Hydro will also have contracts with each of the KCNs to undertake ATK monitoring of the project.

The activities that occur and the results generated from the Environmental Protection Program will be discussed at MAC meetings. The MAC is an advisory committee to the Partnership Board of Directors and will review outcomes of the programs and, if appropriate provide advice and recommendations to the Partnership on additional monitoring or alternative mitigation measures that may be required. The MAC will provide a forum for collaboration among all partners. On behalf of the Partnership, the MAC will also ensure that the outcomes of the Environmental Protection Program are communicated more broadly on an annual basis to Members of the KCNs, regulators and the general public.

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1.0 INTRODUCTION

This document describes the Terrestrial Effects Monitoring Plan (TEMP) for the Keeyask Generation Project (the Project), a 695-megawatt (MW) hydroelectric generating station at Gull (Keeyask) Rapids on the lower Nelson River, immediately upstream of Stephens Lake (Map 1-1). The *Keeyask Generation Project: Response to EIS Guidelines* (EIS), submitted in July 2012, provides a description of the existing environment, a summary of predicted effects, and planned mitigation for construction and operation of the Project. Technical supporting information for the terrestrial environment, including a description of the environmental setting, effects and mitigation, and a description of proposed monitoring and follow-up programs is provided in the *Keeyask Generation Project Environmental Impact Statement: Terrestrial Environment Supporting Volume* (TE SV).

An ecosystem-based approach to assessment of potential project effects was used that recognizes the inter-connected webs of relationships among the organisms within this landscape and how these organisms interact with their environment to operate as a functional unit which performs a wide range of ecosystem functions. At the same time, some components of Keeyask terrestrial ecosystems have been recognized as being of particular social or ecological interest as a result of, for example, being highly valued by communities, their rarity, their role in ecosystem function, or due to their protection under legislation. Key issues were identified during the assessments and in consultation with communities, resulting in the identification of Valued Environmental Components (VECs). Follow-up monitoring focuses on these VECs as particularly valuable indicators of the effectiveness of Project mitigation measures, and also tracks the effects on a number of other supporting topics of interest.

Terrestrial VECs identified in the EIS include: ecosystem diversity, priority habitat types, wetland function, fragmentation, priority plant species, Canada geese, mallards, bald eagle, at-risk bird species, caribou, moose, and beaver.

1.1 OVERALL OBJECTIVES, APPROACH, AND IMPLEMENTATION

1.1.1 Overall Objectives

Monitoring is required to verify the short- and long-term effects of the Project's construction and operation on the terrestrial environment, including ecosystems, habitat, plants, amphibians birds, and wildlife. In particular, the objectives of terrestrial monitoring will be to:

- determine if the key effects assessment predictions in the TE SV are correct;
- identify unexpected effects related to the Project;
- determine the effectiveness of mitigation measures;
- assess the need for additional mitigation or remedial actions if initial measures are not adequate;
- determine the effectiveness of any additional/adapted mitigation measure(s); and

- confirm compliance with any regulatory requirements, including Project approvals and environmental regulations.

1.1.2 Approach to Terrestrial Monitoring

Monitoring and follow-up during the construction and operation phases will focus on VECs as well as a number of other topics. For example, monitoring will be carried out in situations where Aboriginal Traditional Knowledge (ATK) and technical assessments differ substantially, where a prediction has substantial uncertainty, or where a difference between predicted and actual residual effects could substantially alter the effects assessment.

Keeyask Cree Nations (KCNs) have expressed concern about mammal populations and how the Project will affect them, and have suggested that effects may be greater than predicted in the EIS, particularly the effects of the harvest of caribou and moose. They have noted that increased access may increase harvest, including that by non-KCN individuals, and that continuing harvest needs to be undertaken in a sustainable manner. Given the importance of these species to KCNs culture and country foods supply, and some level of uncertainty regarding the level of effects, long-term monitoring will be carried out for these species.

The approach to monitoring in the TEMP is adaptive with provisions to review results and modify monitoring programs and mitigation measures, if and as required. For example, during the operation period, whether or not little brown myotis (bats) are found to be using Project infrastructure for roosting will determine the frequency of the follow-up monitoring required. During the construction phase, results will be reviewed to determine the need for adjustments to either the temporal and/or spatial scope of sampling, and to provide feedback to Project personnel if alterations to mitigation measures are required. During the operation phase, monitoring results will provide the basis for modifications to sampling plans (*e.g.*, reduction if effects are not observed, design changes if effects are not adequately recorded by existing plan), and the modification or implementation of additional mitigation measures, if required. In general, monitoring will take place in the study zone appropriate to the subject of study (see TE SV 1.3.5 for details and Map 1-2 in this TEMP). While operation monitoring may continue for thirty years post-impoundment of the reservoir, the monitoring timeframe for particular components may be reduced if there are no unexpected observed effects or if results indicate a more rapid stabilization.

1.1.3 Implementation

Manitoba Hydro will oversee monitoring activity to confirm that work is in accordance with the finalized plans approved by regulators. The Keeyask Hydropower Limited Partnership (KHLP), through its Monitoring Advisory Committee, will also where possible promote coherence and complementarity between monitoring undertaken for regulatory purposes (such as under the TEMP) and ATK monitoring undertaken by KCNs.

1.1.4 Reporting

Reports detailing results of monitoring activities will be submitted to the regulatory authorities on a timely and regular basis to facilitate appropriate management of construction activities and facilitate modifications to the monitoring programs in accordance with monitoring results, as required. Reports

will initially be generated annually for KHLP, and provided to Manitoba Conservation and Water Stewardship, as well as uploaded to the KHLP website. Notifications of new reports on the website will be communicated to relevant federal and provincial regulatory agencies.

After approximately six years of operation, a synthesis report will be prepared, providing analysis of data collected to date for terrestrial habitat, birds and mammals studies, relating the results to pre-Project or reference site conditions. This report will describe:

- the effects of the Project on the terrestrial environment during the operating phase;
- effects that were not anticipated in the EIS;
- effects that are occurring that may need to be addressed through a modification of mitigation measures; and
- proposed monitoring program for those components of the operations monitoring program that will be ongoing.

1.2 OVERVIEW OF PROJECT AND TERRESTRIAL EFFECTS

The Project will be built immediately upstream of Stephens Lake at Gull (Keeyask) Rapids. It will involve the development of a number of permanent structures, including a powerhouse, spillway, dams, dykes, and a reservoir. The initial reservoir area will be 93km^2, including 45 km^2 of newly-flooded lands. Once established, the reservoir will operate within a one-metre range. Other features to support construction of these major elements include access roads, borrow areas, excavated-material placement areas, boat launches, and a portage. Temporary support infrastructure includes camps, landfill, water- and sewage-treatment facilities, cofferdams, rock groins, and an ice boom. Collectively, the zone where clearing, flooding and physical disturbances due to construction activities and operation of the Project occur is referred to as the Project Footprint.

In general, potential terrestrial effects from the proposed Project would include habitat loss, habitat change, fragmentation, noise and disturbance, and access-related effects (including mortality from harvest, accidents, and increased predation). A condensed summary of some anticipated effects on the terrestrial environment and some proposed mitigation measures follows (for more detail see the Keeyask EIS Section 6.5.10 and the TE SV):

- **Ecosystem Diversity:** Clearing, flooding, edge effects and reservoir-related groundwater changes will reduce the amount of and alter the nature of some priority habitat types. Mitigation measures will include: rehabilitation of the most affected priority habitat types; revegetation to minimize habitat disturbance, invasive plant spread and total habitat loss; and closure of trails and cutlines that are not existing resource-use trails where they intersect the Project Footprint.
- **Intactness:** Clearing, flooding, and reservoir expansion will reduce core area, while increased access may produce more access-related effects such as accidental fires and increased disturbance. Mitigation measures will include the development of rehabilitation plans and blocking of Project-related cutlines and trails that are not existing resource-use trails.

- **Wetland Function:** Clearing, flooding, reservoir expansion, and groundwater changes will result in a temporary loss of most Nelson River shoreline wetlands in Study Zone 2 (Map 1-2) and would result in the permanent loss of some important off-system wetlands without mitigation. As a mitigation measure, 12 ha of off-system marsh will be developed within or near the Study Zone 2, and will be described in the Terrestrial Mitigation Implementation Plan.
- **Priority Plants:** Key effects will be the loss, alteration, and disturbance of plants and their habitats due to clearing, flooding, access-related effects, reservoir expansion, and groundwater changes. If pre-clearing surveys identify provincially rare to very rare plant species that are not well represented in known locations outside the Project's zone of influence, discovered locations will be avoided or the individual plants removed and transplanted.
- **Invasive Plants:** The main potential effect could be the introduction and further spread of invasive plant species. Mitigation measures will include revegetating cleared areas as soon as practicable with a non-invasive ground cover, using seed mixtures of native and non-invasive introduced plant species, and establishing containment and eradication programs quickly where problems with invasive plants are identified.
- **Amphibians**: Key potential effects include habitat alteration, fragmentation, and loss, as well as frog mortality related to road traffic and winter clearing activities. Mitigation measures will include sediment control to prevent sediment flow into wetlands from construction, the development of wetlands, and enhancement of some of the decommissioned borrow areas to promote suitable amphibian habitat.
- **Canada Goose:** Anticipated effects include avoidance of aquatic habitats due to construction noise and activity disturbance, decrease in the quality of staging habitat due to reservoir creation, and potential increased harvest due to increased access from new roads, trails, and dykes. Mitigation will include retention of 100-m vegetated buffers around inland lakes near construction, enhancement of shoreline wetlands to improve staging habitat, and decommissioning of trails following construction.
- **Mallard:** Effects are associated with habitat loss and alteration as land is cleared for reservoir and infrastructure, avoidance due to noise and activity, and potential increased harvest due to increased access from new roads, trails, and dykes. Mitigation will include avoiding the sensitive breeding period for land clearing, enhancement of wetland shorelines, retention of vegetated buffers, and installation of mallard nesting platforms in suitable wetlands to offset losses in upland nesting cover.
- **Bald Eagle:** Land clearing for the reservoir and for infrastructure will result in the loss of some trees used for nesting and perching, while shoreline erosion and peatland disintegration will continue the loss of shoreline trees over the longer term. Mitigation will include land clearing outside the sensitive breeding period, buffers around nests that remain, and replacement of nests removed as a result of reservoir clearing with artificial nest platforms in suitable areas.
- **Olive-Sided Flycatcher:** The principal anticipated effect will be loss of breeding habitat due to land clearing, reservoir creation, and shoreline erosion. Mitigation will include land clearing outside the sensitive breeding period, and retention of some areas of standing-dead trees within reservoir back bays to offset lost habitat.

- **Rusty Blackbird:** The principal anticipated effect will be loss of breeding habitat due to land clearing, reservoir creation, and shoreline erosion. Mitigation will include land clearing outside the sensitive breeding period. The development of wetlands will also create some foraging habitat.
- **Common Nighthawk:** Land clearing will result in a net gain in breeding habitat, while construction noise and activity may cause some individuals to avoid nesting areas during construction. Mitigation will include leaving portions of decommissioned borrow sites as bare ground, which is suitable nesting habitat.
- **Colonial Waterbirds:** Some gull and tern breeding and foraging habitat will be affected by Project construction and flooded by creation of the reservoir. Mitigation will include the development of measures such as nesting platforms, enhanced nesting structures and development of an artificial island to offset the loss of colonial breeding sites.
- **Caribou:** Potential effects during construction include habitat loss, increased linear development, sensory disturbance, increased mortality due to collisions with vehicles and access effects such as predation and hunting. Mitigation measures will include leaving calving islands in the reservoir greater than 0.5 ha undisturbed, limiting blasting near calving areas during the calving period, a Construction Access Management Plan, gates at north and south dykes, and a prohibition of firearms at camps and work sites. Potential effects during operation include loss of calving islands and altered movements from disturbance, as well as decreased population in Study Zone 4 (Map 1-2). Mitigation measures will include decommissioning of trails used during construction, rehabilitation of temporary cleared areas, and signage for drivers along access roads.
- **Moose:** Habitat loss and alteration, including change in calving habitat, as well as sensory disturbance and mortality through predation, hunting, and collisions with vehicles may result in a decreased population in Study Zone 5 (Map 1-2). Offset programs to improve KCNs member access to harvest moose outside the immediately affected zone will affect populations beyond Study Zone 5. Mitigation measures will include rehabilitation of roadside ditches, prohibition of firearms in camps and at work sites, mitigation for improved wetlands, and implementation of the Cree Nation Partners' Moose Harvest Sustainability Plan.
- **Beaver:** Clearing and reservoir creation will result in habitat loss, disturbance, and mortality due to flooding, conflicts with humans, and predation. A decreased beaver population in Study Zone 3 (Map 1-2) is anticipated due to reduced habitat and increased mortality. Mitigation measures will include 100-m buffers at creeks, streams, ponds, and lakes as well as installation of beaver bafflers to protect culverts.
- **Regionally Rare Mammals:** There may be effects on wolverine (a COSEWIC species of special concern) and little brown myotis (bats; under consideration by COSEWIC as an endangered species) due to habitat loss, alteration of cover, and Project-related sensory disturbance. Increased access created through Project development could increase wolverine mortality. Mitigation measures will include blocking of Project-related cutlines and trails and their revegetation within 100 m of the Project Footprint, as well as the rehabilitation of temporarily cleared areas to native habitat types and plant species.

- **Large Carnivores:** Wolves and black bears may be affected by the Project by habitat loss, alteration of cover, attraction to human activities, movement of prey such as moose by sensory disturbances, and by access effects from harvest by resource users. Mitigation measures will include 100-m buffers around active gray wolf and black bear dens within Study Zone 1 (Map 1-2) where possible; prohibition of firearms in camps and at work sites, and the rehabilitation of roadside ditches with native plants with low food value for black bears.
- **Wildlife and Mercury:** During operation, wildlife that consume fish from the reservoir are expected to accumulate increased levels of mercury, with concentrations in fish expected to peak within seven years post-flooding, and then slowly decline to pre-flooding levels by year 30. Bird and most mammal species are not expected to show measurable effects at a local population level, but a small decline in the abundance of river otter found in Study Zone 4 (Map 1-2) is forecast.

1.3 MONITORING SCHEDULE

As some terrestrial environment components experience wide ranges of seasonal and year-to-year variation, and as some effects of the Project may only be detectable after a period of several years, the TEMP has been designed to be long-term. Some monitoring activities have been scheduled on an ongoing basis over the long term (20–30 years post-impoundment), while others will be conducted on an 'as required' basis (*e.g.*, focused monitoring for specific construction activities with short-term impacts).

Baseline data were collected as part of the Keeyask environmental studies. The majority of work for most study components was conducted between 2001 and 2011. In 2013, sampling will be repeated for several study components to update databases prior to construction, as well as some new survey work on topics requiring more information (*e.g.*, for the design of appropriate mitigation measures).

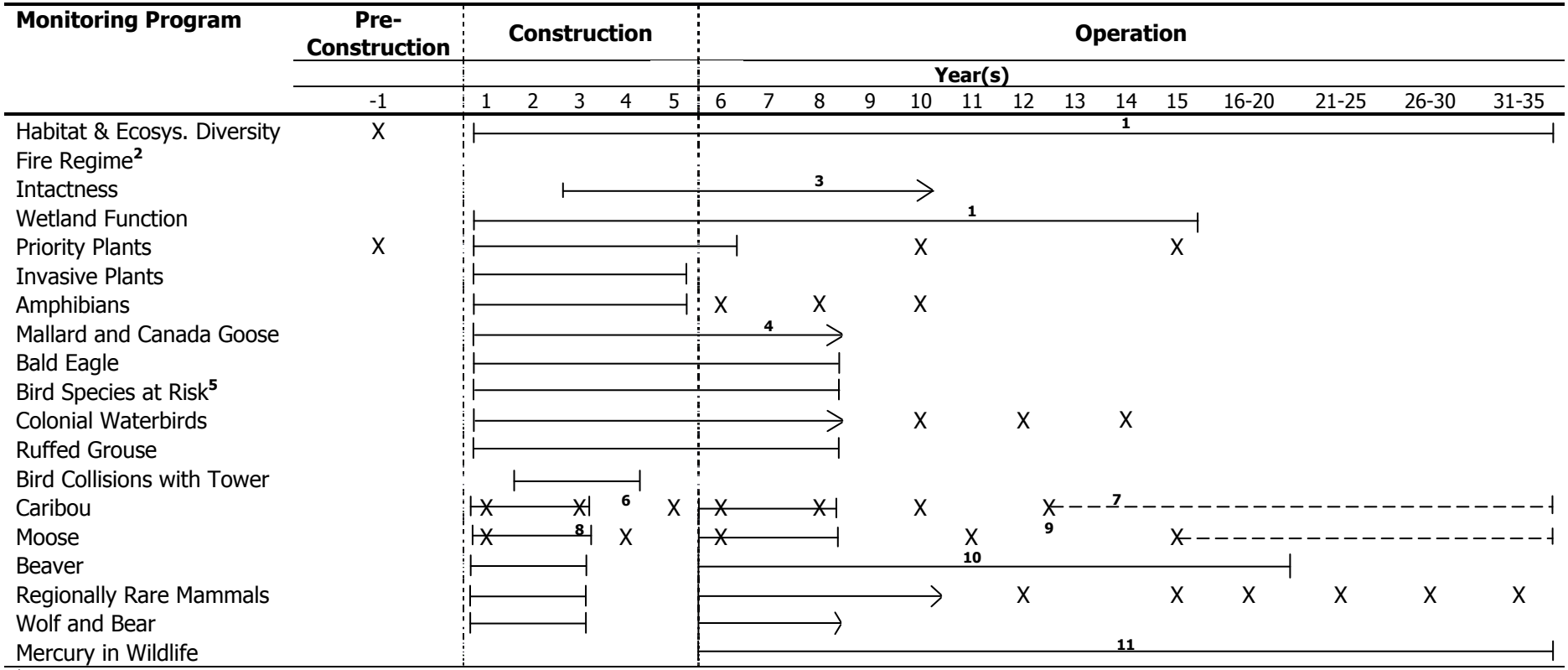
The monitoring schedule is generally as follows (see also Table 1-1 and details in individual sections):

- Pre-Construction – For the purposes of this document the pre-construction phase is defined as the period between Project approval and the start of clearing activities for construction. Monitoring in this period is specifically timed to occur prior to the commencement of clearing in order to identify and protect significant habitats or species during the subsequent construction phase.
- Construction – For the purposes of this document the construction phase is defined as the beginning of clearing and construction activities until the reservoir water level is raised to the full supply level (FSL), projected to be a period of five to six years. Most monitoring during construction is closely linked to specific activities, but some broader-based monitoring is planned to provide continuity among databases established prior to construction and components that will be monitored during the operation phase.
- Operation – For the purpose of this document the operation phase will begin when the reservoir is impounded to the FSL. For many components, intensive monitoring will be conducted annually during the first three to five years post-impoundment, when many of the operation-related effects will first occur and will be at the highest magnitude (*e.g.*, rates of peatland disintegration and organic sediment input into the aquatic system are considerably higher in the first few years compared with

the rest of the operation phase). The frequency of subsequent monitoring may be adjusted depending on initial results.

Table 1-1: Summary of program planned for the Keeyask Terrestrial Effects Monitoring Plan

Note: This table provides condensed information for purposes of general illustration. Details of the monitoring program are found in Sections 2 through 7 following.



[1] Periodic, frequency decreasing over time.
[2] Contingent on any Project-related fire events.
[3] Periodically until revegetation is successfully established.
[4] Annually during first 3 years of operation and years 5, 10, and 15 or until shoreline wetland habitat re-establishes.
[5] No monitoring anticipated in operation phase for yellow rail or horned grebe.
[6] During construction: calving and rearing studies three times yearly for first 3 years; population surveys every 2 years.
[7] During operation: calving and rearing studies three times yearly for 3 years; population studies every 2 years for 6 years; future to be evaluated depending on results.
[8] During construction: calving and rearing studies three times yearly for 3 years; population studies every 3 years.
[9] During operation: calving and rearing studies three times yearly for 3 years; population studies every 5 years for up to 30 years, depending on results.
[10] Regularly during operation and continuing for up to 15 years, depending on results.
[11] Annually during operation until maximum levels are reached, then every 3 years until reaching pre-impoundment concentrations.

1.4 TEMP COMPONENTS AND RELATED PROGRAMS

The main components of the TEMP are summarized in Section 1.4.1. In addition to the TEMP, results from components of the Physical Effects Monitoring Program, the Resource Use Monitoring Plan, and KCNs' ATK monitoring will be used as inputs to an understanding of changes to terrestrial habitats and ecosystems.

1.4.1 Summary of TEMP Components

The following is a brief summary of the major components of the TEMP. Detailed descriptions of planned monitoring are provided in sections 2.0 to 7.0. Although plans are discussed for each component separately, results will be interpreted in an integrated manner in order to better understand observed environmental effects in an ecosystem context. In addition, if unanticipated effects are recorded in one component, results from another component may assist in interpreting and identifying whether modifications to mitigation are required.

1.4.1.1 Terrestrial Habitat and Ecosystems

During the construction phase, direct habitat loss and disturbance will be measured in the Project Footprint, as well as success in terrestrial habitat recovery in those areas designated for rehabilitation treatment at that time. Priority habitat patches marked for avoidance will be monitored regularly during clearing activities to promote the protection of key components of ecosystem diversity. Ground surveys will be used to confirm that trails slated to be blocked have been closed and initial revegetation efforts are adequate, and to confirm the effectiveness of construction measures to protect off-system marshes from Project-related erosion, siltation and hydrological changes. In the event of Project-related wildfire effects (*e.g.*, influences on fires stemming from Project roads or activities), monitoring of fires in the Project area will assess potential changes in the fire regime. Information collected from these studies will be used to produce a terrestrial footprint map for Keeyask construction and to verify predicted Project effects on ecosystem diversity, intactness and wetland function, which are the VECs for terrestrial habitat and ecosystems.

During the operation phase, direct and indirect habitat loss and change will also be measured periodically where ongoing effects are predicted. The terrestrial ecologist will produce a terrestrial footprint map for Keeyask operation, which can be compared to pre-operation baseline conditions. Habitat rehabilitation will be measured to ascertain success in meeting rehabilitation targets. Monitoring of wetlands during the operation phase will verify the creation of off-system marsh, document shoreline wetland development along the reservoir, and confirm Project effects on wetland composition. Information collected by studies will be used to verify predicted Project effects on ecosystem diversity, intactness and wetland function.

1.4.1.2 Terrestrial Plants

Rare plant surveys will be conducted prior to clearing areas within the Project Footprint (such as borrow sites) to determine the presence or absence of provincially rare to very rare species (which have not been found to date). If such species are found, avoidance or transplanting measures would be undertaken.

During construction, monitoring of the introduction and spread of invasive plants will be undertaken to verify implementation of mitigation measures, and evaluate the need for further control. Information collected by studies will be used to verify predicted Project effects on the priority plants, which is the only plant VEC.

During the operation phase, known priority plant locations will be visited during the summer after construction is complete to confirm the amount of their habitat directly and indirectly affected. Sampling for invasive plants will be conducted during the initial years of operation to document potential spread of these species and determine the need for additional control and eradication programs. Information collected by studies will be used to verify predicted Project effects on the priority plants

1.4.1.3 Amphibians

During the construction phase, wetland surveys and point-count transects will be undertaken to determine if there are any unexpected effects on local amphibian population abundance and distribution.

During the operation phase, similar monitoring is anticipated annually for the initial years, and then continued bi-annually until shoreline wetland habitat has re-established.

1.4.1.4 Birds

Breeding bird studies during the construction period will focus on areas where bird habitat will be most affected by construction-related activities, ensuring that preferred habitats of species at risk are included. Helicopter surveys will also be undertaken to evaluate construction effects on bald eagle, waterfowl, and colonial waterbird nesting and foraging.

Bird monitoring surveys during Project operation will be conducted at sites previously sampled during baseline monitoring field studies, at sites adjacent to principal structures and supporting infrastructure, and at additional sites in order verify predicted effects of the operation activities on species at risk, bald eagle populations, and ruffed grouse. For comparative purposes, reference sites comprised of habitats similar to those located in Study Zones 3 and 4 (Map 1-2) will also be sampled within and adjacent to the Project Footprint.

1.4.1.5 Mammals

Monitoring of caribou during the construction phase will aim to track vital measures of caribou populations (such as distribution, relative abundance, and movement), as well as provide information on effects to summer resident caribou calving and rearing habitat. Moose monitoring during construction will track changes to habitat in areas with predicted Project effects, sample vital measures

of the moose population (*e.g.*, abundance, sex ratio), and collect activity, movement, and mortality data in areas with predicted Project effects. The removal of beaver and muskrat in the future reservoir will be tracked during the construction phase, as well as beaver populations in Study Zones 2 to 4 (Map 1-2). Abundance of little brown myotis and wolverine in the Gull and Stephens lakes area will be evaluated annually during construction. Gray wolf and black bear distribution and abundance will be monitored regularly in the vicinity of construction camps and worksites.

Monitoring of caribou during the operation phase will also aim to track vital measures of caribou populations, as well as provide information on effects on summer resident caribou calving and rearing habitat. Moose monitoring during operation will continue to track changes to habitat in areas with predicted Project effects, sample vital measures of moose population, and collect activity, movement, and mortality data in areas with predicted Project effects. Monitoring of beaver populations will be undertaken at locations within Study Zones 1 to 4 and compared to abundance prior to construction. Presence/abundance of little brown myotis and wolverine in the Gull and Stephens lakes area will be evaluated annually during the initial years of operation. Gray wolf and black bear distribution and abundance will be monitored annually during the early years of operation and then every five years until caribou and moose monitoring is concluded.

1.4.1.6 Mercury in Wildlife

During the operation phase, mercury levels will be monitored in beaver, muskrat, otter, and mink, as well as other game samples voluntarily supplied by trappers from on- and off-system locations. This will continue on an annual basis until maximum mercury levels are reached and then periodically until concentrations return to pre-impoundment levels.

1.4.2 Other Monitoring Relevant to the TEMP

A Physical Effects Monitoring Program (PEMP) will also be established by Manitoba Hydro to monitor immediate physical effects resulting from construction and operation of the Project. The PEMP will establish monitoring programs related to greenhouse gases, to surface water and ice regimes, and to shoreline erosion and peatland disintegration.

Physical environment monitoring data that would be useful for the terrestrial habitat, ecosystems and plant monitoring would include water and ice regime data, air photos or remote sensing, and information on areas where organic and mineral sediment deposition are occurring. Information on the operating water regime will also be required to understand the effects on species using islands in the Nelson River as breeding habitat, such as caribou and colonial waterbirds.

In addition, a Resource Use Monitoring Plan (RUMP) was developed to address uncertainties around potential effects of the Project on local communities' resource use. The RUMP will monitor changing patterns of licensed moose and caribou harvest, to the extent possible, in cooperation with Manitoba Conservation and Water Stewardship, which will be of direct interest to this TEMP.

Aboriginal Traditional Knowledge monitoring will also be undertaken, though at this time details have yet to be determined. The KHLP's Monitoring Advisory Committee will facilitate the sharing of information so that the monitoring programs inform and complement one another, wherever possible.

2.0 TERRESTRIAL HABITAT AND ECOSYSTEMS MONITORING

2.1 CONSTRUCTION MONITORING

2.1.1 Terrestrial Habitat Clearing and Disturbance

2.1.1.1 Rationale

Terrestrial habitat is a keystone for Project effects on terrestrial ecosystems. Terrestrial habitat effects are also of interest in their own right. Mapped habitat attributes represent most of the major stand level ecosystem components (*e.g.*, vegetation, soils in a mapped habitat patch), biomass and controlling factors. Plants and animals use habitat for survival and reproduction. Most terrestrial environment effects predictions incorporate terrestrial habitat predictions in some fashion. The KCNs indicate that all terrestrial habitats are important (WLFN 2002, CNP Keeyask Environmental Evaluation Report 2011). For these reasons, terrestrial habitat monitoring provides an effective means for identifying anticipated and unexpected effects on the terrestrial environment.

2.1.1.2 Objectives

The overall objectives of this monitoring program are to:

- document the actual amounts and composition of terrestrial habitat loss and disturbance during construction; and
- confirm actual Project effects on habitat composition during construction.

2.1.1.3 Design

A combination of remote sensing, aerial surveys, and ground surveys will be used to map Project-related clearing, disturbance, roads and trails. Helicopter-based aerial surveys and photography will identify the extent of habitat loss and overstorey alteration. Foot- and vehicle-based ground surveys will identify understorey disturbance that is not visible from above. A geographic information system (GIS) will spatially reference and store the information collected during field surveys. This information will be used to produce the *Keeyask Generation Project Terrestrial Footprint Map for Construction* and to notify Manitoba Hydro of any deviations from predicted effects during construction. This clearing and disturbance map will be a critical input into planning the locations and nature of terrestrial habitat rehabilitation. The road and trail mapping will also be used to confirm the predictions regarding Project effects on intactness (see Section 2.1.4).

2.1.1.4 Parameters of Concern

Parameters being measured are:

- area cleared or disturbed by habitat type and by Project component; and
- length and width of roads and trails by type.

2.1.1.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2). It will be expanded if additional or unintended Project activities occur outside of this area.

2.1.1.6 Sample Locations

Field studies will be confined to Study Zone 2 because all of the Project clearing and disturbance are expected to occur inside this area.

2.1.1.7 Sampling Frequency and Schedule

Sampling will be conducted once each year that there is construction clearing and once during the summer following the end of the construction phase. Sampling will generally occur in late summer but this may vary depending on the timing and nature of construction activities that year.

2.1.1.8 Methods and Reporting

Manitoba Hydro will:

- provide stereo photography acquired at a scale no smaller than 1:10,000 after the majority of Project-related clearing has been completed and shortly before reservoir impoundment;
- provide digital ortho-rectified imagery developed from the stereo photography identified in the previous bullet; and
- provide construction activity progress reports as needed to plan field studies.

The terrestrial ecologist will:

- conduct one aerial and ground survey each summer and during the summer following the end of the construction phase. Information collected during the aerial survey will be reviewed and used to plan the subsequent ground survey;
- record Project-related clearing and disturbance in the field with geo-referenced photographs, marked-up maps and notes;
- map the clearing and disturbance observed in the stereo photography and field data in a GIS and review these data;
- use the digital ortho-rectified 1:10,000 imagery provided by Manitoba Hydro as the base map for GIS mapping of the data;
- report any unanticipated clearing or disturbance to the Site Environmental Officer;

- within one year of construction phase completion, integrate all of the data collected into the *Keeyask Generation Project Terrestrial Footprint Map for Construction*, which illustrates the actual amounts of terrestrial habitat clearing and disturbance; and
- prepare a final construction phase report that synthesizes all of the clearing and disturbance information collected during the construction phase and compares actual with predicted Project effects. The construction phase report will include the *Keeyask Generation Project Terrestrial Footprint Map for Construction*, analysis of the field data collected, a comparison of actual clearing and disturbance data with assumptions made in the *Keeyask Generation Project: Response to EIS Guidelines* (EIS), and an assessment of whether there are deviations between actual and expected clearing and disturbance. If the terrestrial ecologist finds deviations from predictions that are of sufficient magnitude, or if unforeseen conditions arise, the report will also make recommendations for alterations or enhancements to monitoring programs, to mitigation measures and/or to the Environmental Protection Program.

2.1.2 Terrestrial Habitat Rehabilitation

2.1.2.1 Rationale

Terrestrial habitat rehabilitation mitigates adverse Project effects, controls erosion, controls invasive plant spread, restores wildlife habitat and improves aesthetics, among other things. Terrestrial habitat will be rehabilitated in areas not required for Project operation and some areas that are required for Project operation (*e.g.*, ditches). Some of the planned rehabilitation addresses potential adverse Project effects on intactness by blocking or hindering access from Project areas to surrounding areas, reducing some of the impacts that can result from linear development. Monitoring is needed to verify the implementation and effectiveness of rehabilitation measures, the locations and nature of which will be set out in the *Keeyask Generating Station Vegetation Rehabilitation Plan* by Manitoba Hydro as part of the overall Environmental Management Program.

2.1.2.2 Objectives

The overall objectives of this monitoring program are to:

- verify the implementation and effectiveness of rehabilitation efforts set out in the *Keeyask Generating Station Vegetation Rehabilitation Plan*;
- confirm that trails intersecting the Project Footprint (except for existing resource-use trails identified in the Construction Access Management Plan) are blocked and initial revegetation efforts are adequate; and
- confirm that the revegetated portions of the blocked trails are regenerating successfully.

2.1.2.3 Design

Ground surveys will be used to map the degree of implementation and the effectiveness of rehabilitation efforts at the locations identified in the *Keeyask Generating Station Vegetation Rehabilitation Plan*. The *Keeyask Generation Project Terrestrial Footprint Map for Construction* will be used as the base map for mapping rehabilitation success.

2.1.2.4 Parameters of Concern

Parameters being measured are:

- percentage of area meeting rehabilitation targets by rehabilitation location; and
- habitat composition and site conditions of locations meeting and not meeting rehabilitation targets.

2.1.2.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2).

2.1.2.6 Sample Locations

Sampling will be conducted in the rehabilitation locations identified in the *Keeyask Generating Station Vegetation Rehabilitation Plan*.

2.1.2.7 Sampling Frequency and Schedule

In general, the rehabilitation locations will be sampled the summer following each year when rehabilitation efforts occur. The number of surveys conducted each year will depend on the actual timing of construction and rehabilitation efforts. Since planned rehabilitation at a given location may include several different prescriptions and occur over several years, the timing of monitoring surveys will be set out in the *Keeyask Generating Station Vegetation Rehabilitation Plan*.

2.1.2.8 Methods and Reporting

Manitoba Hydro will:

- provide the *Keeyask Generating Station Vegetation Rehabilitation Plan* when it becomes available; and
- provide construction activity and rehabilitation implementation progress reports as needed to plan field surveys.

The terrestrial ecologist will:

- use the *Keeyask Generating Station Vegetation Rehabilitation Plan* and reports on construction and rehabilitation progress to plan the locations and timing of the rehabilitation surveys;
- conduct ground surveys each summer following each year when rehabilitation efforts occur and at subsequent times as described in the *Keeyask Generating Station Vegetation Rehabilitation Plan*;

- record rehabilitation success with stem density surveys, vegetation cover evaluations, soil development evaluations, geo-referenced photographs, marked-up maps and notes;
- use the *Keeyask Generation Project Terrestrial Footprint Map for Construction* as the base map for GIS mapping of field data;
- map the field data in a GIS and review them;
- report any areas not meeting rehabilitation targets to the Site Environmental Officer;
- within one year of construction phase completion, integrate all of the field data into a map which illustrates the actual amounts and types of terrestrial habitat rehabilitation; and
- prepare a final construction phase report that synthesizes all of the information collected during the construction phase and compares actual with prescribed rehabilitation. The construction phase report will include the actual rehabilitation map, analysis of the field data collected, a comparison of actual rehabilitation with assumptions made in the EIS, and an assessment of whether there are deviations between actual and expected rehabilitation. If the terrestrial ecologist finds deviations from predictions that are of sufficient magnitude, or if unforeseen conditions arise, the report will also make recommendations for alterations or enhancements to the rehabilitation plan, monitoring programs, to mitigation measures and/or to the EnvPP.

2.1.3 Ecosystem Diversity

2.1.3.1 Rationale

Ecosystem diversity refers to the number of different ecosystem types and their areal distribution at various ecosystem levels. Maintaining native ecosystem diversity is fundamental to maintaining terrestrial ecosystem functions and overall ecosystem health. Of special concern are those ecosystem types that are particularly important in the regional context (*e.g.*, types that are species rich, structurally complex or regionally rare), which are referred to as priority ecosystem or priority habitat types.

Habitat mapping is often used as a proxy for ecosystem mapping. Through the EnvPP, as a component of mitigation, priority habitat patches will be identified that are to be avoided to the extent practicable, such as a priority habitat patch adjacent to a specific borrow area that will be avoided. Mitigation also includes giving preference to rehabilitating the most affected priority habitat types.

2.1.3.2 Objectives

The overall objectives of this monitoring program are to:

- determine the degree to which the priority habitat patches identified for avoidance where practicable are not disturbed; and
- confirm actual Project effects on ecosystem diversity during construction.

2.1.3.3 Design

Ground surveys will be conducted to verify the extent to which priority habitat patches marked for avoidance are not disturbed.

Actual Project effects on ecosystem diversity during construction will be documented using the mapping completed for the terrestrial habitat clearing and disturbance monitoring study (Section 2.1.1). The extent of priority habitat rehabilitation will be evaluated during the operation phase to allow adequate time for regeneration.

2.1.3.4 Parameters of Concern

Parameters being measured are:

- areas and locations of cleared or disturbed terrestrial habitat by habitat type; and
- whether priority habitat patches to avoid where practicable are disturbed and, if they are disturbed, the extent and nature of the disturbance.

2.1.3.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2). The study area will be expanded if monitoring information identifies Project activities outside of this area.

2.1.3.6 Sample Locations

Sampling will be confined to the study area because all of the Project clearing and disturbance are expected to occur inside this area.

2.1.3.7 Sampling Frequency and Schedule

The priority habitat patches to avoid will be sampled each year when construction activities occur. The information collected and developed for the terrestrial habitat clearing and disturbance monitoring study (see Section 2.1.1) will provide the remaining data needed for this study.

2.1.3.8 Methods and Reporting

Manitoba Hydro will provide information as in Section 2.1.1.8:

The terrestrial ecologist will:

- visit the priority habitat patches designated for avoidance prior to the start of clearing activities to confirm that the patch boundaries are correctly and adequately marked;
- conduct ground surveys each summer when construction occurs and during the summer following the end of the construction phase to confirm that the priority habitat to avoid have not been disturbed;
- record conditions in the priority habitat patches designated for avoidance using reconnaissance surveys, geo-referenced photographs, marked-up maps and notes;

- use the digital ortho-rectified 1:10,000 imagery and *Keeyask Generation Project Terrestrial Footprint Map for Construction* as the base map for GIS mapping of field data; and
- map the field data in a GIS and review them;
- within one year of construction phase completion, prepare a final construction phase report that synthesizes all of the information collected during the construction phase and compares actual with predicted Project effects. The construction phase report will include a map that illustrates the actual amounts and types of changes to ecosystem diversity during construction, analysis of the field data collected, a comparison of actual ecosystem diversity changes with assumptions made in the EIS, and an assessment of whether there are deviations between actual and predicted ecosystem diversity effects. If any deviations from predictions are of sufficient magnitude, or if unforeseen conditions arise, the report will also make recommendations for alterations or enhancements to monitoring programs, to mitigation measures and/or to the EnvPP.

2.1.4 Intactness

2.1.4.1 Rationale

Intactness is the degree to which an ecosystem remains unaltered by human development and activities that remove habitat and increase fragmentation. Fragmentation is a landscape-level process in which human features (such as cutlines and roads) progressively subdivide habitat blocks into smaller and more isolated fragments. Fragmentation affects ecosystem processes as well as species. Among other things, fragmentation reduces the size of large unaltered areas (*i.e.*, core areas). Some wildlife species that are sensitive to human disturbance require large core areas. There is concern among the KCNs that the construction of roads, camps and transmission lines will disrupt habitat and migratory paths of wildlife (Split Lake Cree – Manitoba Hydro Joint Study Group 1996, FLCN Traditional Knowledge Report 2010 Draft).

The EIS predicted that the main Project effects on intactness would include a slight reduction in total linear feature density (a positive effect) due to existing cutlines being replaced by Project features (*e.g.*, reservoir flooding covering cutlines), and slight reductions in total core area, average core area size and the sizes of some of the largest core areas. A mitigation to reduce adverse effects is blocking Project-related cutlines and trails (except for existing resource-use trails identified in the Construction Access Management Plan) where they intersect the Project Footprint, and revegetating the portions of these trails that are within 100 m of the Project Footprint.

2.1.4.2 Objectives

The overall objectives of this monitoring program are to:

- confirm that trails intersecting the Project Footprint (except for existing resource-use trails identified in the Construction Access Management Plan) are blocked and initial revegetation efforts are adequate; and
- confirm actual Project effects on intactness during construction.

2.1.4.3 Design

Information developed for the terrestrial habitat clearing and disturbance (Section 2.1.1) and terrestrial habitat rehabilitation success (Section 2.1.2) monitoring studies will be used to confirm that trails are blocked and to document actual Project changes to linear feature density and core areas during construction. The extent of linear feature and habitat rehabilitation will be evaluated during the operation phase to allow adequate time for regeneration.

2.1.4.4 Parameters of Concern

Parameters being measured are:

- degree to which identified cutlines and trails are blocked and revegetated;
- Project-related changes to linear feature density; and
- Project-related changes to the number, size and locations of core areas.

2.1.4.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2). The study area will be expanded if monitoring information identifies Project activities outside of this area.

2.1.4.6 Sample Locations

The information used for this study will be from the study area because all of the Project-related changes to intactness are expected to occur inside this area.

2.1.4.7 Sampling Frequency and Schedule

Sampling to verify the degree to which cutlines and trails are blocked will occur in the fall of each year that expansion of the Project Footprint intersects additional cutlines and trails.

The information needed for the remainder this study will be provided by the terrestrial habitat clearing and disturbance (Section 2.1.1) and terrestrial habitat rehabilitation (Section 2.1.2) monitoring studies.

2.1.4.8 Methods and Reporting

Manitoba Hydro will:

- provide construction activity progress reports as needed to plan field surveys.

The terrestrial ecologist will:

- conduct ground surveys each year that expansion of the Project Footprint intersects additional cutlines and trails and during the summer following the end of the construction phase to confirm that the cutlines and trails have been adequately blocked and revegetated;
- map the field data in a GIS and review them;
- report any inadequately blocked cutlines or trails to the Site Environmental Officer; and

- within one year of construction phase completion, prepare a final construction phase report for KHLP that analyzes and synthesizes all of the information collected by other studies during the construction phase and compares actual with predicted Project effects on intactness and assesses whether there are deviations between actual and expected effects on intactness. If the terrestrial ecologist finds deviations from predictions that are of sufficient magnitude, or if unforeseen conditions arise, the report will also make recommendations for alterations or enhancements to monitoring programs, to mitigation measures and/or to the EnvPPs.

2.1.5 Wetland Function

2.1.5.1 Rationale

Wetlands perform many ecosystem functions and contribute to overall ecosystem health. Several medicinal and country food plant species used by members of the KCNs are either exclusively or most commonly found in wetlands (*e.g.*, sweet flag, tamarack).

The EIS predicted that the Project would not have significant adverse effects on wetlands – from a scientific and regulatory perspective – after considering wetland mitigation. Mitigation includes creating 12 ha of the off-system marsh wetland type to replace marsh that would be removed by the Project, as well as implementing measures to protect against erosion, siltation and hydrological alteration in the existing off-system marshes that are near the Project Footprint.

2.1.5.2 Objectives

The overall objectives of this monitoring program are to:

- verify the implementation and effectiveness of off-system marsh creation measures;
- verify the implementation and effectiveness of off-system marsh protection measures; and
- confirm actual Project effects on wetlands during construction.

2.1.5.3 Design

Ground surveys will be conducted to verify the implementation and effectiveness of wetland protection measures and the off-system marsh wetland creation measures that will be provided in the *Terrestrial Mitigation Implementation Plan* by Manitoba Hydro as part of the overall Environmental Management Program.

Since wetlands are a type of terrestrial habitat, the habitat mapping completed for the terrestrial habitat clearing and disturbance monitoring study (Section 2.1.1) will be the primary data source for confirming actual Project effects on wetlands. Supplemental ground surveys will identify wetland changes that would not be captured by the habitat mapping.

2.1.5.4 Parameters of Concern

Parameters being measured are:

- amount of off-system marsh being successfully created;

- amounts and types of Project-related erosion, siltation, and surface hydrological alteration in off-system marshes near the Project Footprint; and
- areas and locations of wetlands affected by the Project by wetland type.

2.1.5.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2). The study area will be expanded if monitoring information identifies potential Project effects outside of this area.

2.1.5.6 Sample Locations

Field studies will be confined to the study area because all of the Project effects on wetlands are expected to occur inside this area. Aerial surveys and limited ground surveys will be conducted outside of Study Zone 2 to confirm this.

2.1.5.7 Sampling Frequency and Schedule

Sampling to monitor efforts to develop the off-system marsh wetland type will be conducted once each year when wetland creation occurs, and once during each of the following two summers. Sampling will generally occur in mid- to late summer but this may vary depending on the timing and nature of construction and mitigation activities that year.

Habitat mapping to document wetland changes will be provided by the habitat clearing and disturbance monitoring study (see Section 2.1.1). Sampling to identify wetland changes not discernible from habitat mapping and to monitor wetland protection measures will occur once each year of construction and once during the summer following the end of the construction phase.

2.1.5.8 Methods and Reporting

Manitoba Hydro will:

- provide stereo photography that is acquired at a scale no smaller than 1:10,000 after the majority of Project-related clearing has been completed and shortly before reservoir impoundment;
- provide digital ortho-rectified imagery developed from the stereo photography identified in the previous bullet; and
- provide construction activity and wetland creation progress reports as needed to plan field surveys.

The terrestrial ecologist will:

- conduct ground surveys each summer when construction or wetland creation occurs, the two summers following wetland creation measures and during the summer following the end of the construction phase;
- use the digital ortho-rectified 1:10,000 imagery provided by Manitoba Hydro as the base map for GIS mapping of wetland creation and unanticipated wetland disturbance;

- report any issues with wetland creation or unanticipated wetland disturbance to the Site Environmental Officer; and
- prepare a final construction phase report for KHLP that synthesizes all of the information collected during the construction phase and compares actual with predicted Project effects. The construction phase report will include a wetland effects map, analysis of the field data collected, a comparison of actual wetland loss and alteration data with assumptions made in the EIS, and an assessment of whether there are deviations between actual and expected wetland effects. If the terrestrial ecologist finds deviations from predictions that are of sufficient magnitude, or if unforeseen conditions arise, the report will also make recommendations for alterations or enhancements to monitoring programs, to mitigation measures and/or to the EnvPP.

2.1.6 Fire Regime Changes

2.1.6.1 Rationale

Wildfire is the keystone terrestrial process in the boreal biome. Changes to the frequency and/or severity of fires could adversely affect a number of ecosystem components. The Project effects predictions and significance assessments could be substantially altered if the Project causes fires that would not otherwise occur, or if the Project alters the behavior of fires started by other sources (*e.g.*, slash produced from clearing could affect fire behavior by allowing a naturally occurring fire to spread through areas that might otherwise serve as a fire break).

2.1.6.2 Objectives

The overall objectives of this monitoring program are to:

- confirm the Project does not create moderate- to large-sized fires; and
- confirm that the Project does not alter the behavior, frequency and/or severity of fires started by other sources.

2.1.6.3 Design

Since substantial Project-related fire effects are not anticipated, this monitoring study would only include fieldwork and reporting if the Project creates an accidental wildfire or peat fire or if a non-Project fire spreads into the Project Footprint area. Consequently, this monitoring study consists of two basic steps. Step 1 will determine whether there have been any Project-related fires or fire behavior effects during the previous year. If the Project has caused any fires or altered the behavior of natural fires that are larger than 30 ha, Step 2 would include a ground inspection of the burned areas and reporting of the nature and magnitude of ecosystem effects.

2.1.6.4 Parameters of Concern

Parameters being measured in the unanticipated event that there are Project-related fire effects:

- number, type and extent of fires caused or influenced by the Project; and

- the area and types of habitat affected, and the nature of effects on vegetation, soils and permafrost.

2.1.6.5 Study Area

If the Project causes any fires or alters the behavior of natural fires, then the fire boundaries will determine the study area boundaries.

2.1.6.6 Sample Locations

Sample locations will be determined by the boundaries of the Project-related fire effect, if they occur.

2.1.6.7 Sampling Frequency and Schedule

The terrestrial ecologist will map new burns using information from Manitoba Hydro and aerial surveys conducted during the summer of each construction year and during the year following Project completion. The aerial surveys for fire effects will be completed during the aerial surveys conducted to develop the *Keeyask Generation Project Terrestrial Footprint Map for Construction* (Section 2.1.1).

Ground surveys of the burns, if any, will be conducted during the summer following the fire.

2.1.6.8 Methods and Reporting

Manitoba Hydro will:

- provide fire incident reports that document the timing and extent of any fires that start as a result of Project features or activities.

The terrestrial ecologist will:

- determine whether the Project has caused any fires or altered the behavior of natural fires by:
- review Manitoba Hydro fire incident reports;
- search for new burns during the aerial surveys conducted for the terrestrial habitat clearing and disturbance monitoring study (Section 2.1.1). If any new burns are mapped during the aerial surveys, then Manitoba Hydro and/or Manitoba Conservation will be contacted to determine the date and the cause of the fire; and
- in the event that the Project causes or affects any fires that are larger than 30 ha, conduct a ground inspection of the burned areas. If these ground inspections indicate that the aerial extent of the habitats affected are large enough to substantially alter any Project effects predictions, then a fire effects report will be completed. The report to KHLP will provide implications for the Project effects predictions and, where appropriate, provide recommendations for modification of EnvPP measures that should reduce the risk of future fires.

2.2 OPERATION MONITORING

2.2.1 Terrestrial Habitat Loss, Disturbance and Alteration

2.2.1.1 Rationale

This study is a continuation of the terrestrial habitat clearing and disturbance study (Section 2.1.1). While the construction monitoring focuses primarily on direct Project effects, operation phase monitoring concentrates on indirect effects such as reservoir-related groundwater effects or edge and soil warming effects produced by vegetation clearing. The EIS predicted that the reservoir will be 7 to 8 km^2 in area by 30 year of operation, which includes 6 to 7 km^2 of terrestrial habitat. The indirect effects of reservoir expansion and construction clearing and disturbance on terrestrial habitat are not expected to become observable to a substantial degree until the operation phase. Additionally, natural vegetation regeneration and habitat rehabilitation during operation are expected to restore some of the native terrestrial habitat that was lost or disturbed during construction.

2.2.1.2 Objectives

The overall objectives of this monitoring program are to:

- document the actual amounts and composition of terrestrial habitat loss, disturbance and alteration during operation; and
- confirm actual Project effects on habitat composition during operation.

2.2.1.3 Design

A combination of remote sensing, aerial surveys and ground surveys will be used to map evolving reservoir shoreline attributes (*e.g.*, shoreline location and bank material types), direct and indirect Project effects on terrestrial habitat and terrestrial habitat recovery. To provide a base map for initial pre-flooding conditions, large-scale stereo photography will be acquired after the majority of Project-related clearing has been completed and shortly before reservoir impoundment (see Section 2.1.1). Initial post-flooding conditions will be established from large-scale stereo photography acquired at the first reasonable opportunity in the open-water season following reservoir impoundment. Subsequent shoreline and terrestrial habitat changes will be documented primarily through a combination of helicopter-based video, still photography and/or high resolution multi-spectral satellite imagery. Ground surveys will be conducted in locations of particular interest to identify changes that may not be visible from remote sensing and aerial surveys. Information collected during field surveys will be transferred into a GIS and used to produce a *Keeyask Generation Project Terrestrial Footprint Map for Operation* at years 1, 3, 5 and 10. Ongoing analysis of field data will be used to adjust the frequency and locations of subsequent surveys and to notify KHLP of any deviations from predicted Project effects during operation. Information developed for this study will be the sole data source for the ecosystem diversity (Section 2.2.3) and intactness (Section 2.2.4) monitoring studies during operation.

2.2.1.4 Parameters of Concern

Parameters being measured are:

- reservoir shoreline attributes such as shoreline location, bank material, bank height and bank slope;
- area lost, disturbed or altered by habitat type and by Project component; and
- area recovering to native habitat types by habitat type.

2.2.1.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2). Study Zone 2 represents a substantial overestimate of the expected spatial extent of Project-related terrestrial habitat change. Aerial surveys and limited ground surveys will be conducted outside of Study Zone 2 to confirm this. The study area will be expanded if aerial surveys or other monitoring information identifies potential Project-related terrestrial habitat effects outside of this area.

2.2.1.6 Sample Locations

Field studies will generally be confined to the study area because all of the Project effects are expected to occur inside this area. Aerial surveys and limited ground surveys will be conducted outside of Study Zone 2 to determine if there are any unanticipated changes outside of this zone (see Section 2.1.1).

2.2.1.7 Sampling Frequency and Schedule

Information collected during construction monitoring will establish pre-operation baseline conditions.

Reservoir shoreline sampling will be most frequent during the first ten years of operation, which is when the majority of reservoir expansion is expected to occur. Shoreline location, bank attributes and shoreline ecosite update sampling will occur in years 1, 3 and 5, with subsequent frequency being determined by how closely reservoir expansion follows the EIS predictions.

Since indirect terrestrial habitat effects and habitat recovery are expected to occur over many years, sampling in the rest of the study area will occur in year 1 and every fifth year during the first 30 years of operation. The frequency of sampling will be reviewed after each sample year. The terrestrial habitat rehabilitation monitoring study (Section 2.2.2) will provide information on native habitat recovery resulting from rehabilitation efforts.

Sampling will generally occur in mid- to late summer but this may vary.

2.2.1.8 Methods and Reporting

Manitoba Hydro will:

- provide stereo photography that is acquired at a scale no smaller than 1:10,000 immediately after reservoir impoundment; and
- provide digital ortho-rectified imagery developed from the stereo photography identified in the previous bullet.

The terrestrial ecologist will:

- conduct periodic aerial and ground surveys (see Section 2.1.1) during the operation phase. Information collected during the aerial survey will be reviewed and used to select locations for subsequent ground surveys;
- record Project-related terrestrial habitat loss, alteration, disturbance and recovery in the field with geo-referenced photographs, marked up maps and notes;
- use the digital ortho-rectified 1:10,000 imagery provided by Manitoba Hydro as the base map for GIS mapping of field data;
- map the aerial and ground survey data in a GIS and review them;
- acquire and classify any high resolution multi-spectral satellite imagery needed to supplement the other available information;
- create the *Keeyask Generation Project Terrestrial Footprint Map for Operation* at years 1, 3, 5 and 10;
- report any unanticipated terrestrial habitat changes to Manitoba Hydro; and
- prepare a report to KHLP in years 1, 3, 5 and 10 that analyzes and summarizes the information collected to date and evaluates any deviations between actual and predicted terrestrial habitat change. If the terrestrial ecologist finds deviations from predictions that are of sufficient magnitude, or if unforeseen conditions arise, the report will also make recommendations for alterations or enhancements to monitoring programs, to mitigation measures and/or to the EnvPP. The year 10 report to KHLP will evaluate trends in terrestrial habitat composition change and make recommendations on the degree and timing of subsequent monitoring.

2.2.2 Terrestrial Habitat Rehabilitation

2.2.2.1 Rationale

While the construction phase terrestrial habitat rehabilitation monitoring (Section 2.1.2) focuses primarily on verifying adequate implementation of rehabilitation efforts, the operation phase of this monitoring study concentrates on verifying the effectiveness and ultimate success of the rehabilitation efforts.

2.2.2.2 Objectives

The overall objectives of this monitoring program are to:

- verify the implementation of rehabilitation efforts that occur during operation; and
- verify the effectiveness of rehabilitation efforts set out in the *Keeyask Generating Station Terrestrial Habitat Rehabilitation Plan*.

2.2.2.3 Design

Ground surveys will be used to verify the effectiveness of rehabilitation efforts in the blocked trails and at the rehabilitation locations identified in the *Keeyask Generation Project Terrestrial Habitat Rehabilitation Plan*. The *Keeyask Generation Project Terrestrial Footprint Map for Operation* will be used as the base map for mapping rehabilitation success.

2.2.2.4 Parameters of Concern

Parameters being measured are:

- percentage of area meeting rehabilitation targets; and
- habitat composition of locations meeting and not meeting rehabilitation targets.

2.2.2.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2).

2.2.2.6 Sample Locations

Field studies will be conducted in the rehabilitation locations identified in the *Keeyask Generation Station Vegetation Rehabilitation Plan* and at the blocked trails.

2.2.2.7 Sampling Frequency and Schedule

The rehabilitation locations will be sampled periodically during the operation phase until vegetation and soils achieve the rehabilitation targets set out in the *Keeyask Generation Station Vegetation Rehabilitation Plan*. Annual surveys will likely be required during the first few years of operation to verify adequate vegetation and soil establishment while the frequency and timing of subsequent surveys will be scheduled based on observed success at meeting the rehabilitation targets. Sampling will typically occur in late summer.

2.2.2.8 Methods and Reporting

The methods and reporting are the same as for the construction phase with the following exceptions:

The terrestrial ecologist will:

- conduct ground surveys each summer following each year when rehabilitation efforts occur and periodically until vegetation and soil recovery meet the targets set out in the *Keeyask Generation Station Vegetation Rehabilitation Plan*;
- use the digital ortho-rectified 1:10,000 imagery and *Keeyask Generation Project Terrestrial Footprint Map for Operation* as the base map for GIS mapping of field data; and
- prepare a report to KHLP in years 1, 3, 5, and 10 of operation that analyzes and synthesizes all of the information collected to date and compares actual with prescribed rehabilitation. The year 10

report to KHLP will recommend if and when additional terrestrial rehabilitation monitoring should be performed.

2.2.3 Ecosystem Diversity

2.2.3.1 Rationale

This study is a continuation of the construction phase ecosystem diversity monitoring study (Section 2.1.3). Reservoir expansion, indirect Project effects on terrestrial habitat and habitat rehabilitation all contribute to ongoing changes to ecosystem diversity during operation.

2.2.3.2 Objectives

The overall objectives of this monitoring program are to:

- document the extent to which native habitat recovery is occurring in priority habitat patches that were lost or altered in the temporary construction Footprint; and
- confirm actual Project effects on ecosystem diversity during operation.

2.2.3.3 Design

The mapping completed for the terrestrial habitat loss, disturbance and alteration (Section 2.2.1) and terrestrial habitat rehabilitation (Section 2.2.2) monitoring studies will be used to document actual Project effects on ecosystem diversity during operation.

2.2.3.4 Parameters of Concern

Parameters being measured are:

- areas and locations of cleared, disturbed or altered terrestrial habitat by habitat type; and
- areas and locations of rehabilitated native terrestrial habitat by habitat type.

2.2.3.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2). The study area will be expanded if field information (*e.g.*, Section 2.2.1) identifies ecosystem diversity effects outside of this area.

2.2.3.6 Sample Locations

Information used for this study will be from the study area because all of the Project effects are expected to occur inside this area.

2.2.3.7 Sampling Frequency and Schedule

There is no fieldwork for this study because all of the required information is provided by the terrestrial habitat loss, disturbance and alteration (Section 2.2.1) and terrestrial habitat rehabilitation (Section 2.2.2) monitoring studies.

2.2.3.8 Methods and Reporting

The terrestrial ecologist will:

- prepare a report to KHLP in years 3, 5, and 10 that analyzes and synthesizes all of the information collected to date and compares actual with predicted Project effects on ecosystem diversity. Each report will include an updated actual ecosystem diversity effects map, analysis of the field data collected, a comparison of actual ecosystem diversity effects with assumptions made in the Keeyask Generation Project EIS, and an assessment of whether there are deviations between actual and expected effects. The year 10 report will recommend if and when additional ecosystem diversity reviews should be performed.

2.2.4 Intactness

2.2.4.1 Rationale

This study is a continuation of the construction phase intactness monitoring study (Section 2.1.4). Continued monitoring of intactness is required to determine the effects, over time, of two opposite trends resulting from reservoir expansion. The expanding reservoir will reducethe size of some core areas, while at the same time, vegetation regeneration in some portions of existing and Project-related linear features could increase intactness by converting these linear features back into native habitat.

2.2.4.2 Objectives

The overall objectives of this monitoring program are to:

- confirm that trails intersecting the Project Footprint (except for existing resource-use trails identified in the Construction Access Management Plan) remain blocked and revegetation efforts are adequate;
- confirm that the revegetated portions of the blocked trails are regenerating successfully; and
- confirm actual Project effects on intactness during operation.

2.2.4.3 Design

The mapping completed for the terrestrial habitat loss, disturbance and alteration (Section 2.2.1) and terrestrial habitat Rehabilitation (Section 2.2.2) monitoring studies will be used to document actual Project effects on intactness during operation.

2.2.4.4 Parameters of Concern

Parameters being measured are:

- Project-related changes to linear feature density; and
- Project-related changes to the number, size and locations of core areas.

2.2.4.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2). The study area will be expanded if monitoring information (*e.g.*, Section 2.1.1) identifies Project activities outside of this area.

2.2.4.6 Sample Locations

The information used for this study will be from the study area because all of the Project-related changes to intactness are expected to occur inside this area.

2.2.4.7 Sampling Frequency and Schedule

There is no fieldwork for this study because all of the required information is provided by the terrestrial habitat loss, disturbance and alteration (Section 2.2.1) and habitat rehabilitation (Section 2.2.2) monitoring studies.

2.2.4.8 Methods and Reporting

The terrestrial ecologist will:

- prepare a report to KHLP in years 3, 5, and 10 that analyzes and synthesizes all of the information collected to date and compares actual with predicted Project effects on intactness. Each report will include an updated actual intactness effects map, analysis of the field data collected, a comparison of actual intactness effects with assumptions made in the EIS, and an assessment of whether there are deviations between actual and expected effects. The year 10 report will recommend if and when additional intactness reviews should be performed.

2.2.5 Wetland Function

2.2.5.1 Rationale

This study is a continuation of the construction phase wetland function monitoring study (Section 2.1.5). While the wetland function construction monitoring focused primarily on implementation of wetland mitigation and direct Project effects, operation phase monitoring concentrates on wetland creation success and indirect Project effects on wetland composition. Of particular interest are Project-related groundwater effects and wetland development along the evolving reservoir shoreline.

2.2.5.2 Objectives

The overall objectives of this monitoring program are to:

- verify that 12 ha of off-system marsh are successfully created;
- document the degree and nature of shoreline wetland development along the reservoir; and
- confirm actual Project effects on wetland composition during operation.

2.2.5.3 Design

Ground surveys will be conducted to verify that 12 ha of off-system marsh have been successfully created. Monitoring to document bird and mammal use of this off-system marsh will also be conducted (see Sections 5.3.1 and 6.3.3).

Aerial (helicopter-based) and ground (foot- and boat-based) surveys will map the degree of wetland development along the reservoir shoreline. Since wetlands are a type of terrestrial habitat, coarse information for this wetland mapping will come from the terrestrial habitat loss, disturbance and alteration study (Section 2.2.1). Additional ground surveys will be conducted to provide the higher resolution and more penetrating data needed to map some shoreline wetland attributes such as plant composition and substrate type.

Mapping completed for the terrestrial habitat loss, disturbance and alteration study (Section 2.2.1) will provide much of the information required to confirm actual Project effects on wetland composition. Additional ground surveys will check for potential effects that would not be manifested in vegetation for a long period of time. Project-related reductions in depth to groundwater could alter vegetation and soils, in some case to the extent that uplands are converted to wetlands. Such effects are expected along the reservoir shoreline. Areas further inland could also be affected if there are hydrological connections with the reservoir. Soil profile sampling will occur at the inland locations, including areas outside of Study Zone 2, that are most likely to experience groundwater effects based on factors such as elevation relative to the reservoir or subtle changes in vegetation that suggest groundwater effects.

2.2.5.4 Parameters of Concern

Parameters being measured are:

- areas, locations and composition of off-system marsh that is successfully created;
- areas and locations of Nelson River shoreline wetlands by wetland type; and
- areas and locations of wetlands affected by the Project by wetland type.

2.2.5.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2). The study area will be expanded if monitoring information (*e.g.*, Section 2.2.1) suggests that indirect effects may be occurring outside of this area.

2.2.5.6 Sample Locations

Field studies will be confined to the study area because all of the Project effects on wetlands are expected to occur inside this area.

2.2.5.7 Sampling Frequency and Schedule

Sampling to verify off-system marsh creation will be conducted once in the first and third years after completion of mitigation measures. The frequency of subsequent sampling will be determined based on conditions observed in the year three survey.

Ground surveys to supplement those completed for the terrestrial habitat loss, disturbance and alteration study (Section 2.2.1) will be conducted in the first summer after reservoir impoundment and then every third year until the tenth year of operation. The timing of subsequent sampling will be determined by factors such as how closely reservoir expansion follows the EIS predictions and the extent to which inland groundwater effects are detected. Sampling will generally occur in mid to late summer.

2.2.5.8 Methods and Reporting

The methods and reporting are the same as for the construction phase with the following exceptions:

Manitoba Hydro will:

- provide stereo photography that is acquired at a scale no smaller than 1:10,000 immediately after reservoir impoundment; and
- provide digital ortho-rectified imagery developed from the stereo photography identified in the previous bullet.

The terrestrial ecologist will:

- use relevant information developed by other terrestrial habitat and ecosystem monitoring studies;
- conduct ground surveys periodically during operation;
- use the digital ortho-rectified 1:10,000 imagery provided by Manitoba Hydro as the base map for GIS mapping of field data;
- report any unanticipated wetland effects to Manitoba Hydro; and
- prepare a report to KHLP in years 4, 7, and 11 that analyzes and synthesizes all of the information collected to date and compares actual with predicted Project effects on wetland composition. Each report will include an updated actual wetland composition effects map, analysis of the field data collected, a comparison of actual wetland composition effects with assumptions made in the EIS, and an assessment of whether there are deviations between actual and expected effects. The year 11 report will recommend the timing for subsequent ground surveys and reports.

3.0 TERRESTRIAL PLANT MONITORING

3.1 CONSTRUCTION MONITORING

3.1.1 Pre-clearing Rare Plant Surveys

3.1.1.1 Rationale

Because it is possible that existing locations of provincially very rare to rare plant species were not found during EIS studies (see Terrestrial Environment Supporting Volume Table 3E-2 for a list of the potential species), mitigation for these species includes pre-clearing rare plant surveys. In the unlikely event that a provincially very rare to rare species is discovered, mitigation also includes avoidance or transplanting of rare plant patches under certain conditions.

3.1.1.2 Objectives

The overall objectives of this monitoring program are to:

- determine if any provincially very rare or rare plants occur within the Project Footprint and immediately adjacent areas; and
- in the unlikely event that provincially very rare or rare plants are discovered:
    - confirm that any identified locations are well marked for avoidance where avoidance is practicable; and
    - develop a transplanting plan for provincially very rare plant locations where avoidance is not practicable.

3.1.1.3 Design

Ground surveys will be conducted in the flexible portions of the Project Footprint and in nearby areas that were not previously surveyed and have the highest potential for supporting provincially very rare to rare plant species. In the unlikely event that a provincially very rare to rare species is discovered in the terrestrial plants zone of influence, and there are not at least 20 known healthy patches outside of Study Zone 2 (Map 1-2), then the discovered locations will be avoided where practicable and where avoidance is not practicable the plants will be transplanted outside of the terrestrial plants zone of influence.

3.1.1.4 Parameters of Concern

Parameters being measured are:

- locations and sizes of provincially very rare and rare plant patches that are located in the Project Footprint;
- disturbance in plant patches marked for avoidance, if any; and

- survival and health of transplanted plants, if any.

3.1.1.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2). The study area will be expanded if Project clearing or disturbance outside of this area.

3.1.1.6 Sample Locations

Field studies will be confined to the study area because all of the Project effects on terrestrial plants are expected to be confined to this area.

3.1.1.7 Sampling Frequency and Schedule

Sampling will be conducted prior to the start of clearing occurring in each portion of the flexible Project Footprint that was not previously surveyed. Sampling will generally occur in the spring or early summer, or as needed if very rare or rare species are found and as the exact timing of construction activities is determined.

3.1.1.8 Methods and Reporting

Manitoba Hydro will:

- provide construction activity progress reports as needed to plan field surveys.

The botanist will:

- conduct pre-clearing rare plant surveys in the flexible portions of the Project Footprint where construction activities are planned that have not been previously surveyed and have the highest potential for supporting provincially very rare to rare plant species;
- record findings in the field by taking geo-referenced photos, marking up maps and making notes;
- flag patches of provincially very rare and rare species to make them visible for additional marking by Manitoba Hydro;
- create maps and review field data;
- report the occurrence and location of any provincially very rare or rare species to the Site Environmental Officer identified in the Environmental Protection Plans (EnvPP). Manitoba Hydro would subsequently inform the KHLP and the appropriate regulatory authority in keeping with the EnvPP.; and
- submit a final report to KHLP within one year of completing all fieldwork. The final report will include a map of any provincially very rare and rare plant locations, a map of any transplant locations and review of activities conducted.

3.1.2 Introduction and Spread of Invasive Plants

3.1.2.1 Rationale

Invasive plants are defined as those plants that are growing outside of their country or region of origin and are out-competing or even replacing native plants (Invasive Species Council of Manitoba 2012). Invasive plants are of concern because they can crowd out other plant species and, in extreme cases, change vegetation composition or other ecosystem attributes. Introduced plant species that are not generally invasive species may outcompete native species under some conditions or may do so in the future with changing climate.

In the Project area, 19 invasive terrestrial plant species such as reed-canary grass, smooth brome grass, and Canada thistle have been detected to some degree (see TE SV 6.2.3.4.3). The EIS predicted that the Project is not expected to substantially increase the risk that invasive plants would crowd out native species or convert habitat. There is a need to document the degree to which construction introduces and/or spreads invasive plants, as well as the actions are taken to control or eradicate invasive plants.

3.1.2.2 Objectives

The overall objectives of this monitoring program are to:

- verify the implementation of mitigation measures such as appropriate seed mixtures;
- document the degree of invasive plant introduction and spread; and
- if there is introduction and/or spread, recommend appropriate control and eradication programs.

3.1.2.3 Design

Invasive plant distribution and abundance changes will be monitored using vehicle and pedestrian surveys in areas where Project activities or features could introduce or spread invasive plants. Incidental observations will also be recorded during other terrestrial habitat, ecosystem and plant field studies. The locations and sizes of invasive plant patches will be mapped in a GIS.

3.1.2.4 Parameters of Concern

Parameters being measured are:

- locations and sizes of invasive plant patches by species.

3.1.2.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2). The study area will be expanded if monitoring information (*e.g.*, Section 2.1.1) identifies Project-related invasive plant spread outside of this area.

3.1.2.6 Sample Locations

Field studies will be confined to Study Zone 2 because most of the Project activities that could introduce or spread invasive plants are expected to occur inside this area.

3.1.2.7 Sampling Frequency and Schedule

Sampling will be conducted the summer prior to construction start to establish baseline conditions, every summer during construction and during the first summer after construction completion. If there is evidence that invasive plants are spreading, then additional fieldwork may need to be conducted after construction completion to verify the effectiveness of control and eradication measures.

3.1.2.8 Methods and Reporting

The botanist will:

- conduct ground surveys every summer during construction and the summer after Project completion;
- record findings in the field by taking geo-referenced photos, marking up maps, and making notes;
- create maps and review field data;
- report unanticipated effects as they occur to the responsible the Site Environmental Officer identified in the Environmental Protection Plans (EnvPP);
- analyze all of the available data and determine whether more fieldwork is needed within one year of construction completion;
- submit annual reports to KHLP documenting the distribution of invasive plants within the Project Footprint and immediately adjacent areas (Study Zone 2, Map 1-2);
- as needed and in conjunction with Manitoba Hydro develop and implement control and eradication procedures for invasive species; and
- submit a final report to KHLP within one year of construction completion. The final report will include invasive plant distribution maps in Study Zone 2, and an assessment of whether there are changes to the EIS predictions. If any deviations from predictions are of sufficient magnitude, or if unforeseen conditions arise, the report will also make recommendations for alterations or enhancements to monitoring programs, to mitigation measures and/or to the EnvPP.

3.2 OPERATION MONITORING

3.2.1 Priority Plants

3.2.1.1 Rationale

Priority plants are defined as those plants that are particularly important for ecological and/or social reasons. Priority plants are the native plant species that are highly sensitive to Project features, make high contributions to ecosystem function and/or are of particular interest to the KCNs. For example,

KCNs have noted a variety of plants of traditional importance, such as *wihkis* (sweet flag), cranberries, Labrador tea, and white birch (for more detail see TE SV 6.2.3.4.3). The species of highest conservation concern in the Project area include boreal buttercup, elegant hawk's-beard, mountain sagewort, slender-leaved sundew, northern twayblade and swamp lousewort.

From a scientific standpoint of significance, the EIS predicted that effects on priority plants would be low because the Project is expected to affect low percentages of their known locations or available habitat. From the Cree worldview, KCNs have noted the value they place on non-priority plant species as well as those priority plants traditionally used, and the value of the places associated with those plants that will be affected by the Project.

3.2.1.2 Objectives

The overall objectives of this monitoring program are to:

- confirm actual Project effects on the number of known priority plant locations and priority plant habitat during operation.

3.2.1.3 Design

Ground surveys will determine which of the known priority plant locations are affected by the Project. terrestrial habitat clearing and disturbance (Section 2.1.1), terrestrial habitat loss, disturbance and alteration (Section 2.2.1), and wetland function (Section 2.2.5) monitoring studies will provide all of the information required to determine the proportions of priority plant habitat affected by Project during construction and operation.

3.2.1.4 Parameters of Concern

Parameters being measured are:

- for each priority plant species, the number of known locations directly and indirectly affected by the Project effects and the nature of effects on these priority plant patches; and
- for each priority plant species, amount of habitat directly and indirectly affected by the Project.

3.2.1.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2). The study area will be expanded if monitoring information (*e.g.*, Section 2.1.1) identifies terrestrial habitat effects outside of this area.

3.2.1.6 Sample Locations

Sampling of known priority plant locations will occur at the locations identified by EIS studies.

3.2.1.7 Sampling Frequency and Schedule

Known priority plant locations will be visited once during the summer following construction completion to document construction phase effects. Ground surveys will also be conducted during

years 5 and 10 of operation. The timing of subsequent surveys will be determined by how closely actual direct and indirect Project effects areas coincide with EIS predictions. Sampling will generally occur in mid to late summer.

No additional fieldwork is planned for the remaining components of this study because all of the required information is provided by the terrestrial habitat clearing and disturbance (Section 2.1.1), terrestrial habitat loss, disturbance and alteration (Section 2.2.1), and wetland function (Section 2.2.5) monitoring studies.

3.2.1.8 Methods and Reporting

To document operations phase effects, the ecologist will:

- conduct ground surveys at the known priority plant locations within the *Keeyask Generation Project Construction Footprint* (Section 2.1.1) during the summer after construction completion to document the degree of plant loss and disturbance;
- use information from the terrestrial habitat clearing and disturbance (Section 2.1.1) monitoring study to map affected priority plant habitat by plant species; and
- submit a report to KHLP within one year after construction completion that compares predicted and actual effects on priority plant locations and habitats during construction.

To document operation phase effects, the botanist will:

- conduct ground surveys at the known priority plant locations not already affected by Project construction to document the degree of plant loss and disturbance; and
- in years 6 and 11 of operation, submit a report to KHLP that compares predicted and actual effects on priority plant locations and habitats. Recommendations from the year 11 report will determine the need for and timing of subsequent ground surveys and reports.

3.2.2 Introduction and Spread of Invasive Plants

3.2.2.1 Rationale

This study is a continuation of the construction phase introduction and spread of invasive plant monitoring study (Section 3.1.2). The potential for the Project to promote invasive plants will decline dramatically during operation because Project-related activities will be much reduced. However, better access to Study Zone 2 will increase the potential for people passing through or using the area to introduce and/or further spread invasive plants. Also of interest is the extent to which invasive plants attractive to wildlife (*e.g.*, bears attracted to dandelions in ditches) are controlled.

3.2.2.2 Objectives

The overall objectives of this monitoring program are to:

- document the degree of invasive plant introduction and spread during operation; and

- if there is introduction and/or spread related to Project features or activities, recommend appropriate control and eradication programs.

3.2.2.3 Design

The design is the same as for the construction phase (see Section 3.1.2.3).

3.2.2.4 Parameters of Concern

Parameters being measured are:

- locations and sizes of invasive plant patches by species.

3.2.2.5 Study Area

The study area is Study Zone 2 (*i.e.*, within the Project Footprint and immediately adjacent areas; Map 1-2). The study area will be expanded if monitoring information (*e.g.*, Section 2.2.1) identifies Project-related invasive plant spread outside of this area.

3.2.2.6 Sample Locations

Field studies will be confined to the study area because all of the Project effects on invasive plants are expected to occur inside this area.

3.2.2.7 Sampling Frequency and Schedule

Sampling will be conducted every summer during the first five years of operation. If there is evidence of Project-related spreading of invasive plants, then additional fieldwork may need to be conducted in subsequent years.

3.2.2.8 Methods and Reporting

The methods and reporting are the same as for the construction phase (see Section 3.1.1.8) with the exception of:

The botanist will:

- during the first five years of operation, submit annual reports to KHLP documenting the distribution of invasive plants in Study Zone 2 and, if warranted, making recommendations for control and/or eradication; and
- after the first five years of operation, submit a report to KHLP that includes invasive plant distribution maps for Study Zone 2, analyze all of the available data, determine whether more fieldwork is needed and assess whether there are changes to the EIS predictions. Recommendations from this report will determine the need for and timing of subsequent ground surveys and reports.

4.0 AMPHIBIAN MONITORING

4.1 CONSTRUCTION MONITORING

4.1.1 Rationale

Frogs and their populations are considered suitable environmental indicators due to their two-phase life cycle and semi-permeable skin. Their need for both aquatic and terrestrial environments makes them suitable indicators of whole system ecosystem health. Because amphibian populations remain relatively localized, they can respond to environmental change quickly.

As indicators of healthy wetland habitats, amphibian population monitoring is anticipated to identify Project-related effects such as the long-term loss or degradation of breeding habitat are affecting the abundance and/or distribution of amphibians in areas within and adjacent to construction sites.

4.1.2 Objectives

The primary objectives of amphibian monitoring surveys are to:

- verify predictions regarding the effects of construction-related activities on local amphibian population abundance and distribution;
- determine if any unexpected effects on amphibian abundance and distribution are occurring as a result of construction-related activities; and
- if appropriate, propose revisions or develop new mitigation options should unexpected effects to amphibian populations occur as a result of construction-related activities.

4.1.3 Design

During the construction phase, data gathered from wetland amphibian surveys will be used to assess amphibians inhabiting Study Zone 3 (Map 1-2). Monitoring will occur at amphibian breeding ponds located adjacent to construction sites, as well as at reference sites not affected by construction activities. Data collected from sites affected by construction activity will be compared to reference and baseline data to assess changes in the relative abundance and distribution of amphibians during the breeding season.

4.1.4 Parameters of Concern

Parameters measured during amphibian monitoring surveys will include:

- changes in utilization of breeding ponds by frogs;
- changes in species abundance and distribution resulting from construction activities; and
- habitat characteristics where amphibians are expected to be observed.

4.1.5 Study Area

Amphibian surveys will primarily occur in Study Zone 3 (Map 1-2) during Project construction as well as at reference sites within Study Zone 4.

4.1.6 Sample Site Locations

Sample site locations will be based primarily on previously sampled locations from previous years' field studies reported in the EIS — locations where amphibian breeding habitat (*e.g.*, small lakes and ponds) occur within and/or adjacent to the areas where construction activities are occurring. Reference sites, which are utilized for purposes of comparison with sites affected by the Project, will consist of new and previously identified amphibian breeding habitat sites where no construction activities are occurring.

4.1.7 Sample Frequency and Schedule

Amphibian-monitoring will occur at least bi-annually during the construction phase of the Project. Amphibian surveys will be conducted within the peak amphibian breeding period that extends from early May through early June.

4.1.8 Methods and Reporting

Amphibian breeding pond survey methods will follow standard protocols that have been used during amphibian baseline studies (USGS 2012). In addition to surveys outlined in this section, observations (visual or auditory) of amphibians will be recorded on an opportunistic basis in order to expand the existing knowledge base of where amphibians are occurring in the Project area.

Breeding pond surveys will be used to identify courting frogs in late afternoon and early evening (between 1600h and 0000h) in May to June. Auditory evidence of amphibians will be recorded using a digital recorder deployed at wetlands of interest. Breeding pond peripheries will be visually inspected for signs of amphibians (*i.e.*, swimming adults, juveniles, or egg masses) in order to collect more comprehensive data on breeding activity. The location of frog calls (*i.e.*, pond, peripheral vegetation, upland forest edges) will be recorded at the various sampling sites that occur within and adjacent to sites potentially affected by the Project as well as in reference sites.

An annual report outlining the results of monitoring activities during the construction period will be provided to KHLP. The report produced in the last year of construction-related amphibian monitoring will consider, compile and analyze all years of monitoring conducted during the construction period.

4.2 OPERATION MONITORING

4.2.1 Rationale

Refer to Section 4.1.1.

4.2.2 Objectives

The primary objectives of amphibian monitoring surveys are to:

- verify predictions regarding the effects of operation-related activities on local amphibian population abundance and distribution;
- determine if any unexpected effects on amphibian abundance and distribution are occurring as a result of operation-related activities;
- document the utilization of the created off-system marsh habitat (Section 2.2.5); and
- determine the effectiveness of mitigation measures (*e.g.*, newly developed wetlands and other wetlands that form alongside the Project roads and dykes) and, if appropriate, propose revisions or develop new mitigation options should unexpected effects to amphibian populations occur as a result of operation-related activities.

4.2.3 Design

During the operation phase, data gathered from wetland amphibian surveys will be used to assess amphibians inhabiting Study Zone 3 (Map 1-2). Monitoring will occur at previously surveyed amphibian breeding ponds that had been located adjacent to construction sites, amphibian breeding habitat effected by operation activities, and previously identified reference sites not affected by operation activities, and along access roads and dykes where newly created amphibian breeding habitat may form over time, including road and dyke ditches and wetted areas of decommissioned borrow pits.

Data collected from sites affected by operation activity will be compared to reference and baseline data to assess changes in the relative abundance and distribution of amphibians during the breeding season.

4.2.4 Parameters of Concern

Parameters measured during amphibian monitoring surveys will include:

- presence/absence of amphibians in wetted areas that form along dykes, roads and decommissioned borrow pits;
- changes in utilization of breeding ponds located along roads and other areas potentially affected by the Project;
- changes in frog species distribution and abundance at known breeding areas; and
- changes in habitat characteristics where amphibians are expected to be observed.

4.2.5 Study Area

Amphibian surveys will primarily occur in Study Zone 3 (Map 1-2) during Project operation.

4.2.6 Sample Site Locations

Sample sites will be located in areas along new infrastructure (*e.g.*, roads, dykes), within wetted areas of decommissioned borrow pits, and at a selection of previously sampled locations (as reference sites) from the construction and baseline monitoring phases.

4.2.7 Sampling Frequency and Schedule

The amphibian-monitoring field studies will be repeated at least bi-annually in years 1, 3 and 5 of Project operation. Amphibian surveys will be conducted during the amphibian breeding period, between May and early June.

The need for continued biannual amphibian monitoring will be assessed on the basis of the results obtained from the first three years of study.

4.2.8 Methods and Reporting

Amphibian monitoring will involve the use of both breeding pond and road call count survey methods. Both breeding pond and road call count survey methods will follow standard protocols that have been used during amphibian baseline and construction phase studies (USGS 2012). Breeding pond surveys will be used to identify courting frogs in late afternoon and early evening (between 1600h and 0000h) in May to June. In areas where access is limited, auditory evidence of amphibians will be recorded using a digital recorder deployed at wetlands and/or wetted areas of interest. Breeding pond peripheries will be visually inspected for signs of amphibians (*i.e.*, swimming adults, juveniles, or egg masses) in order to collect more comprehensive data on breeding activity. The location of frog calls (*i.e.*, pond, peripheral vegetation, upland forest edges) will be recorded.

In areas along roads and dykes, road call counts will be used to detect the presence of frog breeding activity. Species present will be identified and calling activity will be coded (index of abundance) in keeping with methods described by USGS (2012). Information on habitat, including changes in habitat will be recorded.

An annual report outlining the results of monitoring activities during the operation period will be provided to KHLP. A summary report, produced after three years of operational monitoring for amphibians, will consider, compile, and analyze all years of monitoring conducted during the operation period.

5.0 BIRD MONITORING

5.1 CONSTRUCTION MONITORING

Construction-related monitoring will be employed to verify effects of the Project on birds, especially where scientific uncertainty exists (see Keeyask GS EIS, TE Volume 6, Section 6.4.5). Recommended monitoring and follow-up relates primarily to VECs (*i.e.,* Canada goose, mallard, bald eagle, olive-sided flycatcher, rusty blackbird and common nighthawk) and other priority birds including colonial waterbirds, ruffed grouse and other species listed under the *Manitoba Endangered Species Act* (MESA), federal *Species at Risk Act* (SARA), and/or the Committee on the Status of Endangered Species in Canada (COSEWIC).

This section outlines these monitoring programs that are typically intended to validate and test key predictions and effectiveness of mitigation proposed in the EIS.

5.1.1 Canada Goose

5.1.1.1 Rationale

Canada goose is a VEC identified by KCNs to be an important source of food. As such, monitoring of Canada goose abundance and distribution will occur. Potential construction-related Project effects are considered to be temporary avoidance of foraging habitat during migration due to sensory disturbances (*e.g.*, construction-related noise and blasting). Monitoring Canada goose will identify any changes attributable to construction activities.

5.1.1.2 Objectives

The objectives of Canada goose monitoring during construction activities are to:

- verify predictions regarding the effects of construction activities on bird abundance and distribution; and
- determine if any unexpected effects on bird abundance and distribution are occurring as a result of construction activities.

5.1.1.3 Design

Aerial surveys will be conducted by helicopter to determine abundance, distribution, and habitat use by waterfowl (including Canada goose) along inland lakes and portions of the Nelson River system potentially affected by construction activities and in suitable reference areas. Aerial surveys will follow standard methods used by the United States Fish and Wildlife Service, US Geological Survey, Missouri Department of Conservation (2006), and Manitoba Conservation and Water Stewardship (Raedeke*pers. comm*. 2007), and will be conducted between the hours of 0800h and 1700h.

5.1.1.4 Parameters of Concern

Parameters of concern regarding Canada goose include changes in Canada goose abundance and distribution resulting from construction activities.

5.1.1.5 Study Area

Surveys will be conducted along predetermined flight paths within Study Zones 3 and 4 (Map 1-2).

5.1.1.6 Sample Site Locations

Sampling for Canada goose will encompass previously sampled site locations, reference and affected areas (*i.e.,* sections of the Nelson River and selected off-system waterbodies) and are defined as follows:

- Split Lake
- Clark Lake
- Nelson River West of Birthday Rapids
- Nelson River East of Birthday Rapids
- Gull Lake
- Gull Rapids
- Stephens Lake - south shore of the reservoir
- Stephens Lake - north arm of the reservoir
- Nelson River E of Kettle GS
- Assean River
- Assean Lake
- Inland Lakes North
- Inland Lakes South

5.1.1.7 Sample Frequency and Schedule

Helicopter surveys for assessing predicted effects of construction activities of the Project on Canada goose will occur annually in May, July, August, and September during the construction period.

5.1.1.8 Methods and Reporting

Standard helicopter-based bird survey procedures follow those used during baseline studies, which employ methods adapted from United States Fish and Wildlife Service, US Geological Survey, Missouri Department of Conservation (2006), and Manitoba Conservation (Raedeke*pers. comm.* 2007) as follows:

- Flights will occur when wind speeds were less than 25 kph.
- Flights will be conducted at approximately 100 kph at an altitude of approximately 40m.
- Two primary observers will be positioned on opposite sides of the helicopter to record all wildlife within 200 m of each side of the helicopter.
- The helicopter will fly between 100 m and 200 m from waterbody shorelines such that when surveying the waterbody, one primary observer will have a clear view of the shoreline while the second primary observer will be able to view the central portion of the waterbody.

A time-stamped GPS track will be recorded for the duration of each flight that will provide positional data for all observations. Number and species of birds, along with other observed wildlife will be recorded, as well as pertinent observations regarding habitat features (*e.g.,* landforms, woody debris) along the survey route.

Since information for species other than Canada goose will be collected during helicopter surveys, avian species will be separated into two categories for analysis: Waterbirds[1] and Land Birds[2]. Data collected will be utilized to determine bird abundance and distribution of VECs and priority birds, primarily throughout Study Zone 4, and to determine landform and habitat availability and use by bird species. GPS data recorded during survey flights will be used to calculate the area of existing reservoir, river, and inland lakes and creeks over which helicopter surveys were flown.

Canada goose abundance (birds/km^2) will be calculated using number of birds observed divided by survey distance (determined utilizing GPS tracks recorded during surveys) multiplied by the estimated search image (*i.e.,* 200 m on either side of the helicopter, or 400 m in total). Comparisons of these calculated bird abundances between each waterbody surveyed and between landform types will allow for standardized comparisons of results between survey years as well as between existing and proposed reservoir areas.

Annual reports outlining the results of monitoring activities during the construction period will be provided to KHLP. The report produced in the last year of construction-related bird monitoring will consider, compile and analyze all years of monitoring conducted during the construction period.

5.1.2 Mallard

5.1.2.1 Rationale

Mallard is a VEC that has been identified by KCNs to be an important food source. As such, monitoring of mallard abundance and distribution will occur. Potential construction-related effects to mallard populations are considered to be temporary reduction of effective nesting and foraging habitat near wetlands, creeks and lakes due to sensory disturbances (*e.g.*, construction-related noise and blasting), and long-term loss and degradation of some upland nesting habitat due to land clearing

[1]Consisting of loons, grebes, bitterns, herons, swans, geese, ducks, gulls, terns, rails, cranes, shorebirds, pelicans, cormorants, and shorebirds.
[2]Consisting of woodpeckers, kingfishers, grouse, ptarmigan, nighthawks, passerines, and raptors (including eagles, hawks, owls, falcons, and osprey).

activities. In order to enhance some of the mallard nesting habitat located in areas unaffected by the Project, mallard nest boxes or tunnels will be installed and monitored during the construction period. Mallard abundance and distribution will also be monitored to identify whether construction activities are having an effect on mallard habitat use within the local area.

5.1.2.2 Objectives

The objectives of mallard monitoring during construction activities are to:

- evaluate the success of mallard nesting structures;
- verify predictions regarding the effects of construction activities on bird abundance and distribution; and
- determine if any unexpected effects on abundance and distribution are occurring as a result of construction activities.

5.1.2.3 Design

Aerial surveys for monitoring mallard abundance and distribution will occur in conjunction with Canada goose aerial surveys (Section 5.1.2.3). Artificial mallard nesting structures will be deployed in early May of the first year following Project approval (as soon as the ice is off wetlands) within suitable habitats located outside of affected areas, and will be re-visited to determine use by mallards.

5.1.2.4 Parameters of Concern

Parameters of concern regarding mallard include:

- changes in mallard abundance and distribution resulting from construction activities; and
- success of mallard nesting structures as a means to enhance nesting habitat.

5.1.2.5 Study Area

As mallard monitoring will occur in conjunction with Canada goose monitoring, the study area will be the same as for Canada goose (Section 5.1.1.5). Mallard nest structures will be deployed within suitable habitats located throughout Study Zone 4.

5.1.2.6 Sample Site Locations

Sampling sites identified for monitoring Canada goose will also be investigated for mallard (Section 5.1.1.6). Mallard nest structures will be deployed and monitored in areas that support suitable brood-rearing habitat (*e.g.*, areas with emergent aquatic vegetation), including creeks, inland lakes and wetlands within Study Zone 4.

5.1.2.7 Sample Frequency and Schedule

The frequency and schedule of monitoring mallard abundance and distribution will be the same as for Canada goose monitoring (Section 5.1.1.7). During the first year of construction following installation,

nest structures will be visited in July and again in late winter for maintenance. During the next two construction years, the effectiveness of nest structures will be determined through an August site investigation; maintenance will occur during a mid-winter visit. After the third yearof monitoring, the continued monitoring and maintenance of structures will be assessed based on results of structure use.

5.1.2.8 Methods and Reporting

As mallard monitoring will be conducted in conjunction with Canada goose monitoring, methods and reporting outlined in Section 5.1.1.8 will also be utilized to monitor and report on mallard.

Equipment and methods used to implement and monitor mallard nest structures will be determined in consultation with Ducks Unlimited Canada. Artificial nest structures will be deployed in areas identified as providing suitable mallard habitat. Structures will be placed along creek/wetland/lake margins, on the water edge of the emergent vegetation zone (Eskowich *et al.* 1998). Mallard nest structures will remain in place over winter, with annual maintenance occurring in the late-winter prior to the breeding season. During the August visit, evidence of nests and eggs/egg fragments from the breeding season will be recorded. Feathers, down and/or egg shell fragments will be used to determine which species nested within the structure. Nests, eggs and/or egg fragments found within structures will then be removed.

5.1.3 Bald Eagle

5.1.3.1 Rationale

Local First Nations have indicated that the bald eagle, a VEC identified in the EIS, is an important bird and has sacred relevance. Potential construction-related effects on bald eagle include habitat loss and alteration due to construction activities (*e.g.*, land clearing near shore) and the temporary disruption of foraging activities at Gull Rapids due to sensory disturbances (*e.g.,* noise from construction equipment and blasting). In order to off-set bald eagle nests lost through land clearing activities, artificial nest platforms will be constructed and deployed in suitable bald eagle habitat. The success of these structures will need to be assessed by monitoring eagle activity during the construction period. In addition to artificial nest monitoring, bald eagle abundance and distribution will be monitored at sites adjacent to Project construction sites and at sites located away from Project construction sites to verify predicted effects of the Project on bald eagles.

5.1.3.2 Objectives

The objectives of bald eagle monitoring during construction activities are to:

- evaluate the success of any artificial nesting platforms constructed for bald eagle;
- evaluate the suitability of buffer size retained around active bald eagle nests located within or adjacent to construction areas;
- verify predictions regarding the effects of construction activities on bald eagle abundance and distribution; and

- determine if any unexpected effects on bird abundance and distribution are occurring as a result of construction activities.

5.1.3.3 Design

Aerial surveys for monitoring bald eagles will occur in conjunction with Canada goose and mallard aerial surveys (Section 5.1.1.3). Artificial bald eagle nesting structures will be deployed outside of the breeding season – if and where required – *i.e.*, where proposed clearing and construction activities will remove any tree that contained an active nest in the prior year. These sites will be re-visited during the breeding season to determine nesting platform use by bald eagles.

5.1.3.4 Parameters of Concern

Parameters of concern regarding bald eagles include:

- effectiveness of implemented mitigation measures (*i.e.*, artificial nest platforms, buffer sizes); and
- changes in local bird abundance and distribution resulting from construction activities.

5.1.3.5 Study Area

As bald eagle monitoring will occur in conjunction with both Canada goose and mallard monitoring, the study design and sampling areas will be the same as for Canada goose (Section 5.1.1.5).

5.1.3.6 Sample Site Locations

Sampling sites identified for monitoring Canada goose and mallard will also be sampled for bald eagle (Section 5.1.1.6).

5.1.3.7 Sample Frequency and Schedule

The frequency and schedule of monitoring bald eagle will be the same as for Canada goose and mallard monitoring (Section 5.1.1.7).

5.1.3.8 Methods and Reporting

As bald eagle monitoring will be conducted in conjunction with Canada goose and mallard monitoring, methods and reporting outlined in Section 5.1.1.8 will also be utilized to monitor and report on bald eagle.

5.1.4 Olive-sided Flycatcher

5.1.4.1 Rationale

Species at risk have regulatory protection and are often indicators for change in an ecosystem, as they are often either in low numbers and/or at the edge of their range. Construction-related effects on olive-sided flycatcher are expected to be limited to the temporary disturbance within preferred habitats accompanying construction-related noise.

5.1.4.2 Objectives

The objectives for monitoring olive-sided flycatcher during construction activities are to:

- verify predictions regarding the effects of construction activities on abundance and distribution; and
- determine if any unexpected effects on abundance and distribution are occurring resulting from construction activities.

5.1.4.3 Design

Construction-related olive-sided flycatcher monitoring surveys will be conducted utilizing standard breeding bird surveys (*i.e.*, those used in the collection of baseline data including breeding-bird surveys). These surveys will occur at reference sites previously sampled during baseline monitoring field studies and at sites within construction areas. Additional sites in the vicinity of the principal structures and supporting infrastructure will also be sampled in order to expand the existing dataset and verify predicted effects of the construction activities on olive-sided flycatcher. For comparative purposes, control sites comprised of habitats similar to those located in areas scheduled to be cleared will also be sampled adjacent to the Project Footprint.

Breeding-bird surveys will provide data regarding olive-sided flycatcher abundance and distribution and enable the evaluation of predicted effects and mitigation strategies employed during the construction phase of the Project.

5.1.4.4 Parameters of Concern

Parameters that will be measured during olive-sided flycatcher monitoring include:

- changes in abundance and distribution resulting from construction activities;
- changes in habitat characteristics over time; and
- changes in bird community structure, evaluated in relation to preferred habitats of olive-sided flycatcher.

5.1.4.5 Study Area

Monitoring studies for olive-sided flycatcher during the construction period will take place within Study Zone 4 (Map 1-2).

5.1.4.6 Sample Site Locations

Breeding-bird monitoring sites for rare species during the Project construction phase will be located in areas of preferred habitat. Sampling will occur in sites within and adjacent to areas affected by the Project, as well as in reference sites to enable comparisons of abundance, distribution and community structure between the condition of pre-construction abundance and distribution and the conditions that exist during construction activities.

5.1.4.7 Sample Frequency and Schedule

During the construction phase of the Project, olive sided flycatcher monitoring (conducted utilizing breeding-bird surveys) will take place annually. Breeding-bird surveys will be conducted during an approximate three-week period during spring (late May to early June) when most birds are singing and will commence the first spring following the start of construction.

5.1.4.8 Methods and Reporting

Methods for conducting breeding-bird monitoring surveys for species at risk will be consistent with standard procedures for conducting surveys using the Point Count Method (Ralph *et al.* 1993; Welsh 1993). Surveys will not be conducted when rain or winds greater than ~20 kph may interfere with the intensity or audibility of bird songs, or when fog or rain may interfere with visibility. Pre-selected survey points sampled during baseline surveys will be resampled during the construction period as follows:

- point counts will be surveyed within the preferred habitat of each diurnal species at risk; surveys will occur in the early morning hours (*e.g.,* olive-sided flycatcher and rusty blackbird);
- locations surveyed during baseline studies will be resurveyed during the construction period;
- two biologists, utilizing waypoint information for each survey site uploaded into a GPS unit, will identify and record birds and other wildlife (*e.g.,* amphibians) by sound and/or sight within a 75-m radius at each point-count stop;
- surveys will be conducted during peak singing times, between sunrise and 1000h for diurnal species; and
- other data such as habitat type, time, and weather will be recorded along with photographs of representative habitat types.

Data collected will be utilized to determine changes in bird abundance, distribution and community structure throughout Study Zone 4 (Map 1-2) in comparison to earlier baseline surveys as reference. Abundance (birds/hectare) will be calculated utilizing the number of birds observed at each stop divided by the area (hectares) of each stop (*i.e.,* the area of a 75-m radius stop). Standardized comparisons will be made utilizing these calculated bird abundances between reference survey stops and those survey stops potentially affected by construction activities. Community structure information will be calculated utilizing average number of birds found in each habitat/cover type.

An annual report outlining the results of monitoring activities during the construction period will be provided to KHLP. The report produced in the last year of construction-related bird monitoring will consider, compile and analyze all years of monitoring conducted during the construction period.

5.1.5 Rusty Blackbird

5.1.5.1 Rationale

Species at risk have regulatory protection and are often indicators for change in an ecosystem, as they are often either in low numbers and/or at the edge of their range. Construction-related effects on rusty blackbird are expected to be limited to the temporary disturbance within preferred habitats accompanying construction-related noise.

5.1.5.2 Objectives

The objectives for monitoring rusty blackbird are the same as for olive-sided flycatcher, outlined in Section 5.1.4.2.

5.1.5.3 Design

Rusty blackbird monitoring will occur in conjunction with that for olive-sided flycatcher, utilizing the same design (Section 5.1.4.3).

5.1.5.4 Parameters of Concern

Parameters that will be measured during rusty blackbird monitoring include:

- changes in abundance and distribution resulting from construction activities;
- changes in habitat characteristics over time; and
- changes in bird community structure, evaluated in relation to preferred habitats of rusty blackbird.

5.1.5.5 Study Area

Rusty blackbird monitoring will occur in the same study area as olive-sided flycatcher (Section 5.1.4.5).

5.1.5.6 Sample Site Locations

As rusty blackbird monitoring will occur in conjunction with olive-sided flycatcher monitoring, the sampling areas will be the same (Section 5.1.4.6)

5.1.5.7 Sample Frequency and Schedule

The frequency and schedule of monitoring rusty blackbirds will be the same as olive-sided flycatcher monitoring (Section 5.1.1.7).

5.1.5.8 Methods and Reporting

As rusty blackbird monitoring will be conducted in conjunction with olive-sided flycatcher monitoring, methods and reporting outlined in Section 5.1.1.8 will also be utilized to monitor and report on rusty blackbirds.

5.1.6 Common Nighthawk

5.1.6.1 Rationale

Species at risk have regulatory protection and are often indicators for change in an ecosystem, as they are often either in low numbers and/or at the edge of their range. Potential construction-related effects on common nighthawk include habitat avoidance and limited displacement due to construction-related noise and human activities.

5.1.6.2 Objectives

The objectives for monitoring abundance and distribution of common nighthawk are similar to the olive-sided flycatcher, as outlined in Section 5.1.4.2.

5.1.6.3 Design

Monitoring common nighthawk will be conducted through the deployment of automated recording devices at sites previously sampled during baseline monitoring field studies and at sites within construction areas. Additional sites in the vicinity of the principal structures and supporting infrastructure will also be sampled in order to expand the existing dataset and verify predicted effects of the construction activities on common nighthawk. For comparative purposes, reference sites comprised of habitats similar to those located in areas scheduled to be cleared will also be sampled. This will permit the determination of the adverse effects associated with equipment and noise presence, as well as any positive effects of clearing (*e.g.*, at borrow sites) on common nighthawk.

5.1.6.4 Parameters of Concern

Parameters of concern regarding common nighthawk include:

- changes in abundance and distribution resulting from construction activities; and
- changes over time in habitat characteristics where common nighthawk are observed.

5.1.6.5 Study Area

Monitoring studies for common nighthawk during the construction period will occur within Study Zone 4 (Map 1-2).

5.1.6.6 Sample Site Locations

Common nighthawk monitoring sites during the Project construction phase will be located in previously identified preferred habitat. Sites within and adjacent to areas affected by the Project, including reference sites, will also be sampled to enable comparisons of abundance and distribution between the condition that exist prior to and during construction.

5.1.6.7 Sample Frequency and Schedule

Common nighthawk monitoring is presently anticipated to be conducted annually during the construction phase of the Project. Recording units will be deployed for 7 days monthly during May, June, July and August in order to capture all potentially nesting common nighthawk, commencing in the first spring following the start of construction.

5.1.6.8 Methods and Reporting

Common nighthawk surveys will be conducted using automated recorders deployed in pre-selected preferred common nighthawk habitat. Recorders will be calibrated to record at 10-minute intervals once an hour during peak calling time (dusk to dawn).

Data collected will be utilized to determine changes in common nighthawk abundance and distribution throughout Study Zone 4 (Map 1-2) in comparison to earlier baseline surveys.

An annual report outlining the results of monitoring activities during the construction period will be provided to KHLP. The report produced in the last year of construction-related bird monitoring will consider, compile and analyze all years of monitoring conducted during the construction period.

5.1.7 Yellow Rail

5.1.7.1 Rationale

Although yellow rail were not detected over the course of baseline field studies (2001-2012), they have the potential to breed within Study Zone 3 and be subjected to Project effects. Potential construction-related effects on yellow rail include short-term habitat avoidance due to construction-related noise and human activities. Short-term improvements to habitat may occur within the reservoir footprint as woody vegetation is removed from open fens and peatlands during the process of reservoir clearing.

5.1.7.2 Objectives

The objective for monitoring yellow rails is to verify the prediction that yellow rails are not being affected by the Project.

5.1.7.3 Design

Yellow rail, considered a 'secretive marsh bird', are difficult to detect visually and not often detected during breeding bird surveys. Since males tend to call primarily at night (Bookhout 1995), the use of standardized night surveys with call broadcast methods is the preferred approach to detect this species (Bazin and Baldwin 2007). Sites in the vicinity of the principal structures and supporting infrastructure will be sampled to identify the potential presence of yellow rail. For comparative purposes, reference sites comprised of habitats similar to those located in areas scheduled to be cleared will also be sampled adjacent to the Project Footprint.

5.1.7.4 Parameters of Concern

Parameters of concern regarding yellow rail include:

- presence and number of yellow rail at any sites potentially affected by construction; and
- if detected, changes in abundance and distribution resulting from construction activities as habitat characteristics change over time.

5.1.7.5 Study Area

Monitoring studies on yellow rail during the construction period will occur within Study Zone 4 (Map 1-2).

5.1.7.6 Sample Site Locations

Yellow rail monitoring sites will be located in areas of their preferred habitat that may potentially be affected by the Project. Sampling will occur at sites both within and adjacent to areas affected by the Project, but also in reference sites located outside of Study Zone 3.

5.1.7.7 Sample Frequency and Schedule

Yellow rail monitoring will be conducted during years 1, 2, and 3 of construction. If yellow rail still have not been detected at that point, no further dedicated monitoring will take place. Automated recording units will be deployed for three days monthly during June and July to provide representative seasonal information commencing in the first spring following the start of construction.

5.1.7.8 Methods and Reporting

Yellow rail surveys will be conducted utilizing automated recorders deployed in pre-selected wetlands that support potential yellow rail habitat. Recorders will be set to capture a five-minute listening period, followed by a three-minute call-out broadcast period and a final two-minute listening period (Bazin and Baldwin 2007). Recorders will be set up at locations spaced approximately 400 m apart, up to a maximum of 8 listening stops per wetland depending on its size.

An annual report outlining the results of monitoring activities during the construction period will be provided to KHLP. The report produced in the last year of construction-related bird monitoring will consider, compile and analyze all years of monitoring conducted during the construction period.

5.1.8 Horned Grebe

5.1.8.1 Rationale

Horned grebe, identified as a priority bird, has been named a species of Special Concern by COSEWIC. As such, Project-related construction effects on horned grebe will be monitored. While project-related construction effects are considered to be loss and/or reduction and degradation of nesting and foraging habitat, monitoring the abundance and distribution of horned grebe will occur and identify any changes attributable to construction activities.

5.1.8.2 Objectives

The objectives for monitoring horned grebes are the same as for mallard (Section 5.1.2.2).

5.1.8.3 Design

Aerial surveys for monitoring horned grebes will occur in conjunction with Canada goose and mallard aerial surveys (Section 5.1.2.3).

5.1.8.4 Parameters of Concern

Parameters regarding horned grebes are the same as Canada goose (Section 5.1.1.4).

5.1.8.5 Study Area

As horned grebe monitoring will occur in conjunction with mallard and Canada goose monitoring, the study area will be the same as for Canada goose (Section 5.1.1.5).

5.1.8.6 Sample Site Locations

Sampling site identified for monitoring Canada goose and mallards will also be sampled for horned grebes (Section 5.1.1.6).

5.1.8.7 Sample Frequency and Schedule

The frequency and schedule of monitoring horned grebes will be the same as for Canada goose and mallard monitoring (Section 5.1.1.7).

5.1.8.8 Methods and Reporting

As horned grebe monitoring will be conducted in conjunction with Canada goose and mallard monitoring, methods and reporting outlined in Section 5.1.1.8 will also be utilized to monitor and report on horned grebe abundance and distribution.

5.1.9 Ruffed Grouse

5.1.9.1 Rationale

Ruffed grouse, considered a species at the edge of their range and therefore classified as a priority bird, are a year-round resident with a limited distribution in Study Zone 4 (Map 1-2). Grouse have also been identified as important birds that are hunted by KCNs. Anticipated Project construction-related effects are considered to be loss and alteration of some foraging and/or breeding habitat and possible increased mortality due to access road traffic and increase harvest pressure due to increased access.

5.1.9.2 Objectives

The objectives of ruffed grouse monitoring during construction activities are to:

- verify predictions regarding the effects of construction activities on bird abundance and distribution; and
- determine if any unexpected effects on bird abundance and distribution are occurring as a result of construction activities.

5.1.9.3 Design

Utilizing standard methods outlined by Larson (2011), ruffed grouse drumming surveys will be conducted to monitor changes in abundance and distribution in areas affected by construction activities and areas where hunter access may have improved (*e.g.*, north access and south access roads).

5.1.9.4 Parameters of Concern

Parameters of concern with respect to ruffed grouse population include:

- abundance and distribution of ruffed grouse; and
- habitat characteristic changes to preferred ruffed grouse habitat.

5.1.9.5 Study Area

Monitoring studies of ruffed grouse during the construction period will occur within Study Zone 3 (Map 1-2).

5.1.9.6 Sample Site Locations

Ruffed grouse drumming surveys during construction-related activities will focus on areas where ruffed grouse habitat will be affected the most by construction-related activities (*i.e.,* along the north and south access roads and other suitable habitat located within the Regional Study Area) and compared with the results from reference sites.

5.1.9.7 Sample Frequency and Schedule

Ruffed grouse drumming surveys will occur during the ruffed grouse breeding period in May, and be repeated annually during the construction phase.

5.1.9.8 Methods and Reporting

Surveys will involve listening for drumming males at stops located within primary breeding habitat. Surveys will be conducted from approximately one hour before until two hours after sunrise. For comparative purposes, surveys will be conducted in areas identified as affected by the Project and in reference areas.

An annual report outlining the results of monitoring activities during the construction period will be provided to KHLP. The report produced in the last year of construction-related bird monitoring will consider, compile and analyze all years of monitoring conducted during the construction period.

5.1.10 Colonial Waterbirds

5.1.10.1 Rationale

Colonial waterbirds such as gulls and terns were identified in the EIS as priority birds since the Project has potential to have considerable local effects on the species through the development of a powerhouse near productive and large gull breeding colonies. Anticipated construction-related effects

on colonial waterbirds (consisting of ring-billed gull, herring gull, and common tern) include the loss and alteration of foraging and breeding habitat, and habitat avoidance due to Project disturbances (noise) at Gull Rapids.

Constructed mitigation measures will be implemented to offset the loss of colonial waterbird nesting habitat at Gull Rapids. Some of these measures will be implemented during the construction period and will thus require monitoring to determine their effectiveness. Monitoring of colonial waterbirds at Gull Rapids and areas outside of construction areas will also occur in order to identify if and how nesting abundance and distribution changes during the construction period.

5.1.10.2 Objectives

The objectives of monitoring colonial waterbirds are to:

- verify prediction regarding the effects of construction activities on gull and tern abundance and distribution;
- determine if any unintended effects on abundance and distribution are occurring as a result of construction activities; and
- verify effectiveness of constructed mitigation measures.

5.1.10.3 Design

Aerial surveys for monitoring colonial waterbird abundance and distribution will occur in conjunction with Canada goose aerial surveys (Section 5.1.1.3). In addition to aerial surveys, monitoring of gull foraging and/or nesting activity in the Gull Rapids area will also occur through ground-based investigations. Monitoring of constructed mitigation measures will occur in Gull Lake, Stephens Lake and/or inland lakes where measures are implemented and, depending upon location, will employ the use of ground-, boat-, or helicopter-based observations.

5.1.10.4 Parameters of Concern

Parameters of concern regarding colonial waterbirds include:

- changes in bird abundance and distribution resulting from construction activities;
- characteristics of the habitat where colonial waterbirds are nesting; and
- use of constructed mitigation measures as breeding sites for colonial waterbirds.

5.1.10.5 Study Area

Aerial surveys will be conducted along predetermined flight paths within Study Zone 4 (Map1-2). Ground-, boat-, or helicopter-based surveys will occur in areas where alternate/enhanced habitat has been made available to colonial waterbirds (Study Zone 3).

5.1.10.6 Sample Site Locations

Sampling sites identified for monitoring Canada goose and mallard will also be sampled for colonial waterbirds (Section 5.1.1.6) with emphasis on areas that have previously been identified as supporting nesting colonies. Monitoring of constructed mitigation measures will occur where there measure are implemented, likely within Gull Lake, Stephens Lake and/or inland lakes located near Gull Rapids.

5.1.10.7 Sample Frequency and Schedule

Aerial surveys for assessing predicted effects of construction activities of the Project on colonial waterbirds will occur annually in May, July, August, and September during the construction period. Monitoring of constructed mitigation measures will occur in May through to August or until chicks fledge. It is anticipated that weekly visits will be required beginning in May through August during the first two years of mitigation measures being implemented. The final determination of the frequency of site visits will depend upon mitigation measures employed.

5.1.10.8 Methods and Reporting

Methods for monitoring colonial waterbirds will be conducted in conjunction with Canada goose, mallard, horned grebe and bald eagle surveys utilizing methods outlined in Section 5.1.1.8. Additionally, information regarding bird use of existing colonial reef nesting sites will be collected (*e.g.*, photographs, waypoints and bird nesting-pair enumeration) during June and July overflights.

Methods used to monitor the effectiveness of mitigation measures will follow protocols used by others that have had success in implementing artificial and/or enhance nesting habitat for colonial waterbirds (*e.g.*, Chapman 1986, Dunlop *et al.* 1991, Quinn *et al.* 1996, Jarvie *et al.* 1996, Lampman *et al.* 1996, Pekarik *et al.* 1997; Collis et al. 2002, Ross 2007). It is anticipated that information on the use of these structures by birds will be gathered using a combination of methods including ground-based observations, boat/canoe and helicopter-based observations. Success of artificial and/or enhanced nesting habitat will be assessed.

An annual report outlining the results of monitoring activities during the construction period will be provided to KHLP. The report produced in the last year of construction-related bird monitoring will consider, compile and analyze all years of monitoring conducted during the construction period.

5.2 OPERATION MONITORING

5.2.1 Canada Goose

5.2.1.1 Rationale

Canada geese are most abundant along the Nelson River and Gull Lake during the spring and fall migration periods. During years with low water levels, the bays, inlets and creek mouths associated with these reaches can provide suitable forage, shelter and cover for flocks of migrant geese. Canada goose is a VEC identified by KCNs to be an important source of food. As such, monitoring of

Canada goose abundance and distribution will occur and seek to identify any changes attributable to operation activities. Inundation of shallow areas (*e.g.*, back bays, inlets, and creek mouths of Gull Lake) is anticipated to affect Canada goose use of the area until new shorelines and suitable habitats re-establish.

5.2.1.2 Objectives

The objectives of Canada goose monitoring during Project operation are to:

- verify predictions regarding the effects of Project operation on bird abundance and distribution;
- document the use of the created off-system marsh habitat (Section 2.2.5); and
- determine if any unexpected effects on bird abundance and distribution are occurring as a result of Project operation.

5.2.1.3 Design

Aerial surveys for monitoring Canada goose will be the same as aerial surveys conducted during the construction phase of the Project, as outlined in Section 5.1.1.3. Land surveys will be conducted in the created off-system marsh habitat in keeping with approaches in the scientific literature and in consultation with experts in evaluating the use of enhanced wetland habitat.

5.2.1.4 Parameters of Concern

Parameters for Canada goose during the operation phase of the Project are the same as those identified for the construction phase (Section 5.1.1.4). In addition, use of the created off-system marsh habitat by Canada goose for staging and foraging will also be assessed.

5.2.1.5 Study Area

The study area for monitoring Canada goose abundance and distribution during Project operations will be the same as that identified for the construction phase (Section 5.1.1.5).

5.2.1.6 Sample Site Locations

Sampling sites identified for monitoring Canada goose during Project operation will be the same as that identified for the construction phase (Section 5.1.1.6).

5.2.1.7 Sample Frequency and Schedule

Aerial surveys for assessing predicted effects of Project operation on Canada goose will occur at least annually for at least the first three years of Project operation in May, July, August, and September. Sampling would continue at year 5, 10, 15 or until the shoreline wetland habitat and/or aquatic vegetation beds re-establish within the reservoir. Monitoring of the created off-system marsh habitat will take place for at least three years from the inception of Project operation and will be conducted concurrent with other avian migration monitoring timed to coincide with staging observed for Canada goose.

5.2.1.8 Methods and Reporting

Canada goose monitoring will be conducted utilizing methods outlined in Section 5.1.1.8. Additionally, use of the created off-system marsh habitat by Canada goose will be surveyed by land-based observations utilizing standard methods.

Reporting will be the same as conducted during the construction phase of the Project and is outlined in Section 5.1.1.8.

5.2.2 Mallard

5.2.2.1 Rationale

Mallard is a VEC, identified by KCNs to be an important food source that typically nest in upland areas located within 200 m of water which include areas adjacent to some wetlands and creeks in the study area. Therefore, inundation of inland lake and wetland areas during Project operation will result in the long-term loss of some sluggish, sedge-filled creeks and wetlands that provide brood-rearing habitat preferred by mallards in the study area. As such, monitoring mallard abundance and distribution will occur.

5.2.2.2 Objectives

Objectives for monitoring mallards during Project operation are the same as those identified during the construction phase, as outlined in Section 5.2.1.2. Additionally, verification will be undertaken that constructed mitigation measures are providing appropriate habitat for mallards to nest and brood-rear successfully.

5.2.2.3 Design

Aerial and land-based surveys for monitoring mallards will occur in conjunction with Canada goose aerial and land-based surveys (Section 5.2.1.3).

5.2.2.4 Parameters of Concern

Parameters of concern for mallard are the same as those outlined for Canada goose (Section 5.2.1.4), as well as the utilization of locations where alternate/enhanced habitat has been made available to mallard (*e.g.*, wetland enhancement, mallard platforms/boxes).

5.2.2.5 Study Area

As mallard monitoring will occur in conjunction with Canada goose monitoring, the study area will be the same as for Canada goose (Section 5.2.1.5).

5.2.2.6 Sample Site Locations

Sampling sites identified for monitoring Canada goose will also be sampled for mallard (Section 5.2.1.6).

5.2.2.7 Sample Frequency and Schedule

As mallard monitoring will be conducted in conjunction with Canada goose monitoring, methods and reporting outlined in Section 5.2.1.7 will also be utilized to monitor and report on mallards.

5.2.2.8 Methods and Reporting

As mallard monitoring will be conducted in conjunction with Canada goose monitoring, methods and reporting outlined in Section 5.2.1.8 will also be utilized to monitor and report on mallards.

5.2.3 Bald Eagle

5.2.3.1 Rationale

The rationale for monitoring bald eagles during Project operation is the same as that identified during the construction phase (Section 5.1.3.1).

5.2.3.2 Objectives

The objectives for monitoring bald eagles during Project operation are the same as those identified for the construction phase (Section 5.1.3.2).

5.2.3.3 Design

Aerial surveys for monitoring bald eagle abundance and distribution will occur in conjunction with Canada goose and mallard aerial surveys (Section 5.1.1.3).

5.2.3.4 Parameters of Concern

Parameters of concern regarding bald eagle populations during Project operation are the same as those identified during the construction phase (Section 5.1.3.4).

5.2.3.5 Study Area

As bald eagle monitoring will occur in conjunction with both Canada goose and mallard monitoring, the study design and sampling areas will be the same as for Canada goose (Section 5.1.1.5).

5.2.3.6 Sample Site Locations

Sampling sites identified for monitoring Canada goose and mallard will also be sampled for bald eagles (Section 5.1.1.6).

5.2.3.7 Sample Frequency and Schedule

The frequency and schedule of monitoring bald eagles will be the same as for Canada goose and mallard monitoring (Section 5.1.1.7).

5.2.3.8 Methods and Reporting

As bald eagle monitoring will be conducted in conjunction with Canada goose and mallard monitoring, methods and reporting outlined in Section 5.1.1.8 will also be utilized to monitor and report on bald eagle abundance and distribution.

5.2.4 Olive-sided Flycatcher

5.2.4.1 Rationale

Species at risk have regulatory protection and are often indicators for change in an ecosystem, as they are often either in low numbers and/or at the edge of their range. Potential operation-related effects on olive-sided flycatcher include additional loss of some habitat associated with the filling of the reservoir, shoreline erosion, and peatland disintegration. In some areas of the reservoir, trees may be retained near shore in order to improve habitat quality for olive-sided flycatcher as perching structures located in open areas are necessary for this species. Success of artificial perching structures erected in decommissioned borrow sites will also require monitoring.

5.2.4.2 Objectives

The main objectives for operations monitoring of olive-sided flycatcher are to:

- verify predictions regarding the effects of Project operation on their abundance and distribution; and
- determine the use of areas where mitigation measure have been implemented.

5.2.4.3 Design

Design of olive-sided flycatcher monitoring during Project operation will be the same as that utilized during the construction phase (Section 5.1.4.3).

5.2.4.4 Parameters of Concern

Parameters that will be measured during olive-sided flycatcher monitoring include:

- changes in abundance and distribution during operation;
- changes in habitat characteristics over time; and
- effectiveness of mitigation measures implemented for olive-sided flycatcher.

5.2.4.5 Study Area

Monitoring studies for olive-sided flycatcher during Project operation will take place within Study Zone 4 (Map 1-2).

5.2.4.6 Sample Site Locations

Breeding-bird monitoring sites for rare species during Project operation will be located in areas of their preferred habitat. Sampling will occur at sites both within and adjacent to areas affected by Project operations to enable comparisons of abundance, distribution and community structure between pre-construction conditions and the abundance and distribution that exist during Project operation. Additionally, olive-sided flycatcher use of sites where perching structures were installed or retained within reservoir back bays will be monitored.

5.2.4.7 Sample Frequency and Schedule

For at least the first three years of Project operation, olive-sided flycatcher monitoring (conducted utilizing breeding-bird surveys) will occur annually. Breeding-bird surveys will be conducted during an approximate three-week period during spring (late May to early June) when most birds are singing and will commence the first spring following the start of operation.

5.2.4.8 Methods and Reporting

Olive-sided flycatcher monitoring methods during Project operation will be conducted in the same manner as those conducted during the construction phase (Section 5.1.4.8).

An annual report outlining the results of monitoring activities and success of constructed mitigation measures during the operation period will be provided to KHLP. The report produced in the last year of operation-related olive-sided flycatcher monitoring will consider, compile and analyze all years of monitoring conducted during the operation period.

5.2.5 Rusty Blackbird

5.2.5.1 Rationale

Species at risk have regulatory protection and are often indicators for change in an ecosystem, as they are often either in low numbers and/or at the edge of their range. Operation-related effects on rusty blackbird are expected to be associated with disturbance of preferred habitats that either occurred during construction and continued into operation or are specifically associated with Project operation.

5.2.5.2 Objectives

The objectives for monitoring rusty blackbird are the same as those for olive-sided flycatcher, as outlined in section 5.2.4.2, as well as determining the utilization of the created off-system marsh habitat by rusty blackbirds.

5.2.5.3 Design

Rusty blackbird monitoring during Project operation will be the same as that utilized during the construction phase (Section 5.1.4.3).

5.2.5.4 Parameters of Concern

Parameters that will be measured during rusty blackbird monitoring include:

- changes in abundance and distribution resulting from construction activities;
- changes in habitat characteristics over time; and
- utilization of the created off-system marsh habitat and adjacent habitats by rusty blackbird.

5.2.5.5 Study Area

Rusty blackbird monitoring will occur in the same study area as olive-sided flycatcher (Section 5.2.4.5).

5.2.5.6 Sample Site Locations

Rusty blackbird monitoring will occur within their preferred habitats in Study Zone 4, typically associated with wetlands and creeks located along the newly created reservoir as well as reference sites (Section 5.2.4.6).

5.2.5.7 Sample Frequency and Schedule

The frequency and schedule of monitoring rusty blackbird abundance and distribution will occur in conjunction with olive-sided flycatcher monitoring (Section 5.2.1.7).

5.2.5.8 Methods and Reporting

Methods for monitoring rusty blackbirds during the operation phase of the Project will be conducted in a similar fashion as that utilized during the construction phase, outlined in Section 5.1.5.8.

An annual report outlining the results of monitoring during the operation period will be provided to KHLP. The report produced in the last year of operation-related rusty blackbird monitoring will consider, compile and analyze all years of monitoring conducted during the operation period.

5.2.6 Common Nighthawk

5.2.6.1 Rationale

Species at risk have regulatory protection and are often indicators for change in an ecosystem, as they are often either in low numbers and/or at the edge of their range. Potential operation-related effects on common nighthawk include long-term loss of habitat and potential creation of suitable habitat at decommissioned borrow areas.

5.2.6.2 Objectives

The objectives for operations monitoring of common nighthawk are to:

- assess changes in abundance and distribution resulting from Project operation; and
- determine the use of decommissioned borrow areas.

5.2.6.3 Design

Monitoring of common nighthawk during Project operation will be an extension of monitoring conducted during the construction phase. Additional sites in the vicinity of the principal structures and supporting infrastructure will also be sampled in order to expand the existing dataset and verify predicted effects of the operation activities on common nighthawk. For comparative purposes, reference sites comprised of habitats similar to those located in areas affected by Project operations will be sampled within unaffected areas. This will permit the determination of the adverse effects associated with Project operation activities and creation of the reservoir, along with any positive effects of decommissioned borrow sites on common nighthawk.

5.2.6.4 Parameters of Concern

Parameters of concern regarding common nighthawk include:

- changes in abundance and distribution resulting from Project operation; and
- habitat characteristic changes over time where common nighthawk are observed.

5.2.6.5 Study Area

Monitoring studies on this species at risk during Project operation will occur within Study Zone 3 (Map 1-2).

5.2.6.6 Sample Site Locations

Common nighthawk monitoring sites during Project operation will be located in previously identified preferred habitat. Sites within and adjacent to areas affected by the Project, including reference sites, will also be sampled to enable comparisons of abundance, distribution of common nighthawk and community structure between pre-construction conditions and the conditions that exist during Project operation.

5.2.6.7 Sample Frequency and Schedule

Common nighthawk monitoring will be conducted annually for at least the first three years of Project operation. Scheduling of monitoring will be the same as that identified during construction monitoring (Section 5.1.6.7) and will commence the first spring following the start of operation.

5.2.6.8 Methods and Reporting

Methods for monitoring common nighthawk abundance and distribution during the operation phase of the Project will be conducted in a similar fashion as those utilized during the construction phase, outlined in Section 5.1.6.8.

An annual report outlining the results of monitoring activities during the operation period will be provided to KHLP. The report produced in the last year of operation-related bird monitoring will consider, compile and analyze all years of monitoring conducted during the operation period.

5.2.7 Yellow Rail

No Project-related effects are anticipated during the operation period; as such, no specific operational monitoring is currently planned for yellow rail.

5.2.8 Horned Grebe

No Project-related effects are anticipated during the operation period; as such, no specific operational monitoring is currently planned for horned grebe.

5.2.9 Ruffed Grouse

5.2.9.1 Rationale

Ruffed grouse, considered a species at the edge of their range and therefore classified as a priority bird, are a year round resident with a limited distribution in Study Zone 4 (Map 1-2). Grouse have also been identified as important birds that are hunted by KCNs. Anticipated Project operations effects are considered to be loss and alteration of some foraging and breeding habitat, possible increased mortality due to access road traffic, and increased harvest pressure due to increased access.

5.2.9.2 Objectives

The objectives of ruffed grouse monitoring during Project operation are to:

- verify predictions regarding the effects of Project operation on bird abundance and distribution; and
- determine suitability of decommissioned and rehabilitated borrow areas for ruffed grouse.

5.2.9.3 Design

Utilizing methods adapted from Larson (2011) and Department of Environmental Conservation (2013), ruffed grouse drumming surveys will be conducted to monitor changes in abundance and distribution in areas affected by operation activities and areas where hunter access may have been improved (*e.g.*, north access road). Monitoring of ruffed grouse at decommissioned and rehabilitated borrow areas will also occur through site investigations to assess vegetation suitability and through the use of drumming surveys.

5.2.9.4 Parameters of Concern

Parameters of concern with respect to ruffed grouse include:

- changes in abundance and distribution of ruffed grouse within preferred habitats; and
- re-establishment of suitable ruffed grouse habitat in rehabilitated upland areas (*e.g.*, borrow areas).

5.2.9.5 Study Area

During the operation phase, ruffed grouse will be monitored in preferred habitats, and in any new habitat that develops within Study Zone 4 (Map 1-2).

5.2.9.6 Sample Site Locations

Ruffed grouse drumming surveys during Project operations will focus on areas where ruffed grouse habitat will be affected by operation-related activities (*e.g.,* along the north access road) as well as at reference sites located in suitable habitat. Additionally, ruffed grouse monitoring will occur at decommissioned and rehabilitated borrow sites.

5.2.9.7 Sample Frequency and Schedule

During the first three years of operation, ruffed grouse drumming surveys will occur during the ruffed grouse breeding period in May. For decommissioned and rehabilitated sites, drumming surveys will occur every two years until regrowth is determined to be suitable for ruffed grouse.

5.2.9.8 Methods and Reporting

Surveys will involve listening for drumming males at stops located within primary breeding habitat. Surveys will be conducted from approximately one hour before until two hours after sunrise. In addition to recording the physical presence of ruffed grouse, other evidence of upland gamebirds (*e.g.,* scat, tracks) will also be recorded.

An annual report outlining the results of monitoring activities during Project operation will be provided to KHLP. The report produced in the last year of ruffed grouse operation monitoring will consider, compile and analyze all years of monitoring conducted during the period of study.

5.2.10 Colonial Waterbirds

5.2.10.1 Rationale

Colonial waterbirds such as gulls and terns were identified in the EIS as priority birds since the Project has potential to have considerable local effects on the species through the development of a powerhouse near productive and large gull breeding colonies. Anticipated construction-related effects on colonial waterbirds (consisting of ring-billed gull, herring gull, and common tern) include the loss and alteration of foraging and breeding habitat, and habitat avoidance due to Project disturbances (noise) at Gull Rapids. While the focus of the studies on waterbirds is to determine potential Project effects on the various species, it is important to have an adequate comparative description of regional nesting populations of colonial waterbirds and to identify whether and how abundance and distribution may change during Project operations. Anticipated operation-related effects on colonial waterbirds include the long-term alteration of foraging and breeding habitat.

5.2.10.2 Objectives

The objectives of Project operation monitoring are the same as those identified for Project construction (Section 5.1.10.2).

5.2.10.3 Design

Colonial waterbird monitoring during Project operation will be an extension of the monitoring conducted during Project construction (Section 5.1.10.3).

5.2.10.4 Parameters of Concern

Parameters of concern are the same as those identified for construction monitoring (Section 5.1.10.4).

5.2.10.5 Study Area

The study area for monitoring colonial waterbirds during Project operation is the same as that identified for construction phase monitoring (Section 5.1.10.5).

5.2.10.6 Sample Site Locations

Sample site locations for monitoring colonial waterbirds during Project operation are the same as those identified for the construction phase (Section 5.1.10.6).

5.2.10.7 Sample Frequency and Schedule

Colonial waterbird monitoring will occur annually during the first three years of operations and every second year thereafter until year 10 of operations at which time the need for additional monitoring will be reassessed. The scheduling for monitoring is the same as that identified for construction monitoring (Section 5.1.10.7).

5.2.10.8 Methods and Reporting

Methods for monitoring colonial waterbird abundance and distribution during Project operation are similar to those utilized during the construction phase (Section 5.1.10.8).

An annual report outlining the results of monitoring activities will be provided to KHLP. The report produced in the last year of operation-related colonial waterbird monitoring will consider, compile and analyze all years of monitoring conducted during the operation period.

5.3 BIRD COLLISIONS WITH LIGHTED TOWERS

5.3.1.1 Rationale

Concerns regarding bird collisions related to tower illumination stem from the recognition that birds can be attracted to lighting on tall towers. Once attracted to the lighting, birds may collide with the tower or become "trapped" in the illuminated area, hesitant to fly into the darkness and end up

circling the area until collapsing of exhaustion. This plan will focus on monitoring bird fatalities at the communications tower, and will take effect when the permanent communications tower has been constructed and is lighted.

5.3.1.2 Objectives

The objectives of potential bird collision monitoring are to:

- determine the number of bird fatalities associated with the lit communications tower; and
- consider mitigation measures (*e.g.*, alternative lighting options) should the lighted communications tower prove to be an attractant for birds.

5.3.1.3 Design

Bird fatalities at the Keeyask communications tower will be monitored through regular ground-based carcass searches. Information gathered will be compared to data obtained from relavent, published studies that assessed bird mortality at communication towers of comparable heights.

5.3.1.4 Parameters of Concern

The parameter of concern will be the number of bird fatalities associated with the Keeyask communications tower.

5.3.1.5 Study Area

This monitoring will take place at the Keeyask construction power station site (Study Zone 1; Map 1-2), where the communications tower will be located during the construction phase. Monitoring of bird collisions will take place around the base of the communications tower (within 35 m, or larger if required) during the spring, summer and fall seasons.

5.3.1.6 Sample Site Locations

Bird mortality monitoring will occur below the lit communications tower located at the construction power station site.

5.3.1.7 Sampling Frequency and Schedule

It is expected that bird fatality monitoring at the communications tower will take place for three years once the communications tower has been constructed and is lighted. Monitoring will occur for four weeks during the spring migration season (April through May), two weeks during the breeding period (June-July) and four weeks during the fall migration period (September-October). Depending on the timing of tower construction, it is recognized that the period of monitoring may extend into the Project operation phase. If this is the case, the monitoring described in this section (5.3) will continue until three years of monitoring have occurred.

5.3.1.8 Methods and Reporting

The methods to monitor bird collisions at the communiciation tower involve carcass searches and are adapted from methods proposed by the Canadian Wildlife Service for monitoring bird mortality at wind turbines (CWS 2007):

- A few months prior to carcass searches, applications will be submitted for federal and/or provincial permits required to handle and collect dead birds or parts thereof;
- Carcass searches will be conducted every three days at the site, to minimize loss of carcasses due to scavenging, and to estimate more reliably the actual date/weather conditions when mortality took place. If scavenger efficiency trials (see below) reveal the persistence of carcasses for a week or more, then less frequent searches will occur;
- The accuracy of bird mortality estimates (extrapolated from carcass search results) can be affected by the removal of carcasses by scavengers (*e.g.*, fox). In order to account for carcasses lost to scavengers, scavenger efficiency trials are required during each season and each year of monitoring. Scavenger efficiency trials will be conducted early in the monitoring period (See CWS 2007 for details on conducting scavenger efficiency trials). Results from scavenger trails will be used to determine the frequency of carcass searches (more or less often than the proposed frequency of every 3 days);
- Carcass searches will occur shortly after sunrise in order to minimize carcass loss from early morning scavengers;
- During each visit, the searcher(s) will focus searches to bare, open ground within a 35m radius below the communication tower (Gehring *et al.* 2009). The searcher(s) will walk a survey grid with adjacent survey lines close enough together to assure that complete coverage of the ground occurs;
- Since the tower will be located on a gravel pad, the lack of vegetation will enhance searcher efficiency. It is expected that with high searcher efficiency, trials to determine the number of carcasses that go undetected by the searcher(s) will not be required. However, if part of the search area is covered in vegetation, searcher efficiency trials may be deemed necessary (See CWS 2007 for searcher efficiency trial methods);
- For every carcass found, date, time, state of decomposition, and species will be recorded. Photographs and GPS coordinates would also be taken for reference; and
- Weather conditions will be recorded for each night during search periods (spring, summer, fall search periods).

It will be necessary to interpret the results of the bird mortality monitoring activities immediately to determine whether negative effects are occurring, the magnitude of the effect and whether any adaptive management measures (Gehring *et al.* 2009) can be undertaken to lessen these effects. In the situation where bird mortality warrants adaptive measures, a report will be made to the project manager.

An annual report outlining the results of monitoring activities once the permanent communications tower is constructed and lighted will be provided to KHLP. The report produced following the third year of monitoring will consider, compile and analyze all years of monitoring conducted. This report will include any efforts/modifications that are made to reduce observed collision impacts and the success of these measures will be documented.

6.0 MAMMALS MONITORING

6.1 CONSTRUCTION MONITORING

6.1.1 Caribou

6.1.1.1 Rationale

Caribou, a VEC, is an important species in the region, having ecological, cultural, and economic value. As such, direct and indirect Project effects will be considered.

Three groupings of caribou are described for the Keeyask region: barren-ground caribou (*Rangifer tarandus groenlandicus*); coastal caribou (*R. t. caribou*), which is a forest-tundra migratory woodland caribou ecotype; and summer resident caribou (summer residents), a type of woodland caribou whose exact range and herd association is uncertain. Barren-ground caribou from the Beverly-Qamanirjuaq herd migrate from Nunavut in autumn to overwinter in Manitoba's northern forests and then leave in spring to calve. On occasion, a small fraction of the Qamanirjuaq herd may reach Study Zone 6 (Map 1-2) – about 10,000 animals migrated this far south once in the last 10 years, of the total population of 348,000 estimated in 2008.

Coastal caribou from the Cape Churchill and Pen Islands herds migrate from northern Manitoba and northern Ontario into parts of Study Zone 6 in winter and typically leave the area in spring to calve. The number of Pen Islands coastal caribou in Study Zone 6 is highly variable from year to year, typically ranging from none to hundreds of animals. On occasion, larger numbers occur in the area. For example, in the winter of 2012/13 approximately 7,500 animals were observed near the north access road, after having crossed the Nelson River.

Summer resident caribou likely move within and beyond Study Zone 6, but the extent of their core range is unknown. These caribou remain in Study Zone 6 to calve, but it is unclear whether the same individuals calve in the area year after year. Summer residents are conservatively estimated to number 20 to 50 individuals.

As indicated by aerial surveys conducted in select township blocks in Study Zone 6 from 2002 to 2006, the abundance and distribution of caribou in the Keeyask region varies from year to year (Section 7.3.6.3 of the TE SV). Because of this annual variability, it will be difficult to attribute changes in abundance to a particular cause, such as construction activity in a portion of widespread caribou ranges. In order to monitor Project effects on caribou in the Keeyask region, caribou abundance and distribution (or absence) near the construction area have been documented before construction and will be compared with conditions during the construction period. Aerial surveys for caribou covering the eastern portion of Study Zone 5 were conducted in winter 2011/12 and 2012/13 for this purpose.

Sensory disturbance from construction activity will likely result in a temporary loss of effective calving and rearing habitat; some summer resident caribou activity near the south access road and the generating station will likely also decline (Section 6.5.8.1 of the EIS). In order to monitor Project effects on caribou in the Keeyask region, caribou abundance, distribution, use of calving and rearing

habitat, and recruitment near and beyond the construction zone must be determined during construction. Potential Project effects on caribou during construction could also include mortality, for example due to collisions with vehicles and harvest by the workforce, which will be monitored.

6.1.1.2 Objectives

The objectives of the caribou monitoring program for Project construction are to:

- quantify the winter distribution and abundance of caribou in the Study Zone 5 (Map 1-2) during construction activities;
- determine whether there are Project effects on caribou or caribou behaviour by quantifying distribution, relative abundance, and movement, and assessing the loss of effective habitat resulting from construction activity;
- monitor the use of calving and rearing habitat by summer resident caribou in Study Zones 4 through 6 (Map 1-2);
- quantify and assess caribou mortality related to the access roads, particularly through wildlife-vehicle collisions and harvest;
- monitor the effectiveness of mitigation measures such as signage, and identify other mitigation or remedial actions that may be required;
- identify unexpected effects;
- address uncertainties with respect to cumulative effects and the viability of caribou populations in the Keeyask region by sharing and contributing knowledge with other caribou monitoring initiatives; and
- confirm effects predictions in the EIS, and if there are substantial deviations from the EIS assumptions:
    - modify monitoring programs, if needed; and
    - make recommendations for modifications to mitigation measures.

6.1.1.3 Design

Caribou Populations

Aerial surveys conducted prior to construction will be repeated during construction to monitor changes in abundance and distribution of caribou in Study Zone 5 during construction (Appendix 7A of the TE SV). Monitoring within and beyond Study Zone 6 and will be coordinated with other Manitoba Hydro projects and Manitoba Conservation and Water Stewardship monitoring initiatives.

Calving and Rearing Habitat Use

Spring and summer tracking surveys will be used to evaluate summer resident caribou use of calving and rearing habitat within 2 km of the access road construction zone and within 4 km of the

generating station construction zone. In order to detect deviations in use of traditional calving areas, information gathered will also be collected in control areas extending beyond 2 and 4 km from future infrastructure. Control areas will be in Study Zones 4 through 6, in habitats similar in size, function, and composition.

Mortality

Caribou mortality associated with the access roads will be documented. Wildlife-vehicle collisions will be recorded. Harvest along the access road will be monitored where possible using Manitoba Conservation and Water Stewardship harvest records, harvest data collected from socio-economic resource use studies where possible, and resource harvest by the Project construction workforce documented through the Resource Use Monitoring Plan.

6.1.1.4 Parameters of Concern

Parameters to be measured include:

- distribution and abundance of caribou in Study Zone 5;
- distribution and abundance of caribou near the construction zone;
- use of calving and rearing complexes by summer resident caribou in Study Zones 1 through 6 during construction;
- distance of summer resident caribou calving activity from the construction zone;
- continued use of calving and rearing complexes more than 2 km from road construction and 4 km from generating station construction activities; and
- caribou mortality attributable to accidents (including drowning), harvest, and other reported sources such as gray wolf kills.

6.1.1.5 Study Area

Caribou Populations

Barren-ground and coastal caribou will be monitored in the Study Zone 5 during the winter period.

Calving and Rearing Habitat Use

Summer resident caribou will be monitored in Study Zone 4 and control areas in Study Zones 4 through 6 (Map 1-2).

Mortality

Caribou mortality will be documented throughout Study Zone 5.

6.1.1.6 Sample Site Locations

Caribou Populations

Aerial surveys conducted in winter 2011/12 and 2012/13 will be replicated to locate caribou. Aerial surveys will focus on the eastern portion of Study Zone 5 between Split Lake and Long Spruce GS.

Calving and Rearing Habitat Use

Monitoring activities will be completed in calving and rearing habitat within 2 km of the access road construction zone, within 4 km of the generating station construction zone, and in comparable calving and rearing habitat in Study Zones 4 through 6 unaffected by Project activity (control area). Sample sites surveyed to produce existing baseline data will be replicated during construction. Primary calving and rearing habitat will be surveyed.

6.1.1.7 Sample Frequency and Schedule

Caribou Populations

Aerial surveys for caribou will occur at least every two years in winter during construction.

Calving and Rearing Habitat Use

Summer resident caribou monitoring in calving and rearing habitat will occur in the spring and summer calving and rearing period during the first three years of construction. Each site will be sampled three times annually, in spring, mid-summer, and fall. Spring study set-up will occur prior to the arrival of caribou on calving islands.

6.1.1.8 Methods and Reporting

Caribou Populations

Aerial surveys for caribou will be conducted in winter through systematic aerial survey transects that cover Study Zone 5. Monitoring within and beyond Study Zone 6 will be coordinated with other Manitoba Hydro projects and Manitoba Conservation and Water Stewardship monitoring initiatives and protocols. The 2011/12 and 2012/13 winter aerial surveys will be replicated (Appendix 7A of the TE SV). Three observers, including those from KCNs, and a pilot will fly in a fixed wing aircraft at approximately 80 m above ground level. Flights will consist of linear transects north-south, 2 km apart, ranging from Split Lake to Long Spruce GS. All observations of caribou and their signs will be recorded. The northern and southern limits will be the boundary of Study Zone 5. When caribou are observed, age and sex will be determined where possible based on morphological characteristics, and the number of individuals will be counted or estimated if groups are large. Where tracks are observed, these will also be recorded. The location of all observations will be marked with a GPS unit. Other data that will be collected to validate effects predictions may include wolf and wolverine tracks and observations (see Sections 6.2.4, 6.2.5, 6.3.4 and 6.3.5). Survey data will be documented, analyzed, and reported to KHLP by the wildlife biologist.

Reports detailing results and comparisons with baseline surveys will be provided after construction monitoring surveys have been completed. The wildlife biologist will prepare a report to KHLP for each year surveyed. 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.

Calving and Rearing Habitat Use

The use of existing calving and rearing habitat will be assessed using tracking transect methods, where the layout and general principles of the survey design follow Schemnitz (1980) and Elzinga *et al.* (2001). Trail camera photos will supplement tracking data. Calving and rearing habitat monitoring studies conducted during construction will be replicated from existing baseline data surveys. Tracking transects will be re-established and trail cameras will be re-deployed on the same calving and rearing islands to monitor caribou distribution and activity. Calving and rearing habitat was selected using data from the environmental assessment, orthophotographs, maps, GIS, and other data obtained from existing field studies. Tracking transects will be established using hip-chain thread to monitor caribou distribution and activity. These transects will be re-established annually, and thread will be repaired after each site visit. All animal sign visible up to 1 m on either side of the thread will be recorded during the first site visit. Sign will include tracks, trails, droppings, shelters, browse or feeding sites, and visual observations. The specific locations of all caribou sign will be recorded with GPS.

During subsequent site visits, caribou distribution and activity will be monitored by thread breaks observed along the transects. The specific locations of all breaks will be recorded with GPS. Sign such as tracks and droppings will indicate what species was responsible for each thread break. These sites will be visited up to three times annually during the construction period.

Trail cameras will be deployed on heavy-use game trails on a subset of the calving and rearing islands being monitored. The number of trail cameras deployed per complex (peatland complex or waterbody) will depend on the size of the complex and the number of islands within the complex. Trail cameras will be used to gather data on the timing of caribou movements, individual occurrences, and to identify the age and sex of animals.

The number, size, and quality of calving and rearing islands will be described using maps and thread-break activity counts. Caribou activity in calving and rearing habitat will be described using the number of occurrences, number of individuals, and the timing of movements, where feasible. The wildlife biologist will prepare reports to KHLP on an annual basis.

Mortality

Project-related caribou mortality will be monitored. Caribou drowning reports will be investigated and reported, including the location, timing, and ice conditions. These data are required to establish a pre-operation baseline. Radio-collaring data from other studies in the region will be used to confirm caribou movements and predator kills in Study Zone 4 if available.

Harvest along the access road will be monitored using Manitoba Conservation and Water Stewardship harvest records, harvest data collected from socio-economic resource use studies where possible, and

resource harvest by the Project construction workforce documented through the Resource Use Monitoring Plan. The wildlife biologist will co-ordinate reports to KHLP as scheduled with the socio-economic resource use studies.

6.1.2 Moose

6.1.2.1 Rationale

Moose, a VEC, is an important species in the region, having ecological, cultural, and economic value. As such, direct and indirect Project effects will be considered. In order to monitor Project effects (Section 6.5.8.2 of the EIS) on the moose population in the Keeyask region, moose abundance, distribution, and population characteristics including age and sex have been documented near the construction zone before construction and will be compared with conditions during the construction period. Sensory disturbance from construction activity will likely result in a temporary loss of effective calving and rearing habitat; some moose activity near the south access road and the generating station will also likely decline (Section 6.5.8.1 of the EIS). In order to monitor Project effects on moose in the Keeyask region, abundance, distribution, use of calving and rearing habitat near and beyond the construction zone will be determined during construction. Potential Project effects on moose during construction could also include mortality, for example due to collisions with vehicles and harvest.

6.1.2.2 Objectives

The objectives of the moose monitoring program for Project construction are to:

- determine whether predicted effects on moose habitat and its use occur and to evaluate the performance of mitigation measures;
- address uncertainties associated with productivity, distribution, and accidental moose mortality; and
- determine whether the redistribution of harvest effort affects the moose population in the Split Lake Resource Management Area (SLRMA).

6.1.2.3 Design

Moose Population

Aerial surveys for moose in Study Zone 4 and possibly Study Zone 5 (Map 1-2) will be conducted in winter when moose are easiest to observe. This monitoring is required to document the distribution, abundance, and population characteristics (including age and sex of moose in Study Zone 4) during construction in order to compare with baseline information on moose activity in the same area.

Calving and Rearing Habitat Use

Moose calving and rearing habitat monitoring via tracking transects and trail cameras will be conducted in tandem with summer resident caribou monitoring (see Section 6.1.1.3).

Mortality

Moose mortality associated with the access roads will be documented. Wildlife-vehicle collisions will be recorded. Harvest along the access road will be monitored using Manitoba Conservation and Water Stewardship harvest records and harvest data collected from socio-economic resource use studies where possible.

6.1.2.4 Parameters of Concern

Parameters of concern include:

- the distance of moose activity from the construction zone;
- continued use of habitat more than 2 km from construction activities; and
- moose mortality attributable to accidents, harvest, and other reported sources such as gray wolf kills.

6.1.2.5 Study Area

Construction monitoring for moose will focus on Study Zone 4 but could extend to Study Zone 6 as required.

6.1.2.6 Sample Site Locations

Moose Population

Aerial surveys will focus on Study Zone 4 and could extend into Study Zone 5.

Calving and Rearing Habitat Use

Habitat monitoring activities will occur simultaneously with caribou monitoring. Sites in calving and rearing habitat within 2 km of the road construction zone, within 4 km of the generating station construction zone, and in comparable calving and rearing habitat in Study Zones 4 through 6 unaffected by Project activity (control area) will be surveyed. Locations of sample sites selected from existing baseline data will be replicated during construction.

6.1.2.7 Sample Frequency and Schedule

Moose Population

An aerial survey will be conducted every three years during construction to monitor changes in abundance, distribution and the population characteristics of moose in Study Zone 4.

Calving and Rearing Habitat Use

Habitat monitoring will occur using the same sampling frequency as described for caribou (see Section 6.1.1.7).

Other Habitat Use

Moose use of habitats (*e.g.*, burns and forest cover) adjacent to the north and south access roads and the generating station will occur during the first three years of construction. Each site will be sampled three times annually, in spring, mid-summer, and fall.

6.1.2.8 Methods and Reporting

Moose Population

Stratified random sampling will be employed to survey moose in Study Zone 4. Basic methods described by Siniff and Skoog (1964) and Gasaway *et al.* (1986) will be employed. A Gasaway-style aerial survey will be conducted. Study Zone 4 will be divided into sampling units by applying a three-minute grid to a map of the area. Initially, a fixed wing aircraft will fly stratification flights over the entire study area to search for signs of moose activity, which will indicate the relative distribution and abundance of moose. Flight lines oriented north-south and 1.5 km apart will be flown at approximately 100 m above the ground. A minimum of two sample lines will be required for each sample cell. In addition to the pilot, three observers (including those from KCNs) will search the ground for moose or their tracks, whose positions will be marked with a GPS.

Sample units will be stratified into extra low, low, medium, and high moose densities based on existing data, local knowledge, and stratification survey data. Sample units from each stratum will be surveyed for moose by helicopter. Flight lines oriented north-south will be 500 m apart and the helicopter will fly approximately 60 m above the ground, effectively providing 100% survey coverage of each sample unit. The number, age and sex of moose observed will be recorded, and these data will be used to produce an estimate for KHLP of the abundance and composition of the moose population in Study Zone 4.

The wildlife biologist will prepare a report for the KHLP for each year surveyed.

Calving and Rearing Habitat Use

Calving and rearing habitat monitoring via tracking transects will be completed in tandem with summer resident caribou monitoring (see section 6.1.1.8).). Moose activity will be identified by signs such as tracks and droppings. The wildlife biologist will prepare a report for the KHLP for each year surveyed.

Other Habitat Use

Paired transects measuring 5 km in length will be established perpendicular to the access road, and at varying distances from the generating station beyond the expected zone of influence.. Moose activity will be identified by signs such as tracks and droppings. See Section 6.1.1.8 for details concerning transect establishment.

The wildlife biologist will prepare a report for the KHLP for each year surveyed.

Mortality

Data from aerial surveys are required to measure vital population parameters (*e.g.*, recruitment). Harvest along the access road will be monitored using Manitoba Conservation and Water Stewardship harvest records, the results of CNP Moose Harvest Sustainability Plan monitoring, and harvest data collected from socio-economic resource use studies from the KCNs where possible. Mortality due to collisions with vehicles will be monitored via reports from workers through the Resource Use Monitoring Plan. The wildlife biologist will co-ordinate reports as scheduled with the socio-economic resource use studies.

6.1.3 Beaver and Muskrat

6.1.3.1 Rationale

Beaver, a VEC, and muskrat are important species in the region, having cultural, economic, and ecological value. As the future reservoir impoundment (Study Zone 1; Map 1-2) will flood beaver lodges and muskrat burrows and dens, beaver and muskrat will be humanely trapped out of affected areas to prevent the exposure and displacement deaths of these animals.

6.1.3.2 Objectives

The objective of the beaver and muskrat monitoring program for Project construction is to:

- quantify and evaluate the removal of individual beaver and muskrat trapped.

6.1.3.3 Design

This program is designed to minimize the distress of animals by removing individuals prior to reservoir impoundment. The removal of beaver and muskrat during reservoir clearing by the trapline holder will be monitored and quantified. The protocol will be adjusted as needed to meet the reservoir clearing and impoundment schedules.

6.1.3.4 Parameters of Concern

Parameters to be measured include:

- the number of beaver and muskrat removed Study Zone 1; and
- the effectiveness of the removal program.

6.1.3.5 Study Area

Beaver monitoring during construction will occur in riparian habitat in Study Zone 1, where clearing is to occur.

6.1.3.6 Sample Site Locations

Beaver and muskrat monitoring activities will be conducted in waterbodies and watercourses in Study Zone 1 and will focus on beaver lodges and muskrat bank burrows, dens, and push-ups.

6.1.3.7 Sample Frequency and Schedule

Monitoring will occur regularly during reservoir clearing and prior to impoundment. Because it will likely take a few years to trap out all beaver and muskrat, the program should begin a minimum of three years prior to reservoir impoundment, and it should occur on a yearly basis until all vegetation is cleared from riparian areas or the reservoir is impounded.

6.1.3.8 Methods and Reporting

Beaver and muskrat monitoring will include an annual helicopter survey to locate lodges and push-ups in Study Zone 1. Helicopter flights will be flown at low-level using two observers. Beaver lodge locations and muskrat push-ups will be recorded using GPS units. Beaver lodge and muskrat push-up data will be provided to KHLP.

Registered trappers, ideally holders of the affected traplines, will search for and trap animals in Study Zone 1. Data from the aerial survey will be provided to trappers to locate known lodges; however, intensive ground searches of waterbodies and watercourses throughout Study Zone 1 will also be required. Trappers will set traps for beaver and muskrat at lodges, burrows, and near push-ups. Traps will be checked and re-set regularly during the trapping season to ensure that all animals in a colony are trapped out completely. Trapping will follow humane trapping standards set in the Provincial guidelines. The disposition of beaver and muskrat meat and fur will follow all regulations and standards established by the Provincial authority. Samples of beaver and muskrat muscle and liver tissue will also be collected and used for baseline mercury monitoring (see Section 7.0).

Trapping standards, locations, and success will be reviewed on a yearly basis. The location and number of individuals trapped will be recorded and reported to the wildlife biologist. Other animal species that are trapped inadvertently during this program will be recorded and reported. The disposition of the meat and fur will also be reported. The wildlife biologist will prepare a report of all activities for the KHLP annually during the survey and collection period.

6.1.4 Rare or Regionally Rare Species

6.1.4.1 Rationale

Little brown myotis [bats] (Endangered) and wolverine (Special Concern) are regionally rare species listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and as such will be monitored for direct and indirect Project effects. Potential effects on wolverine and little brown myotis during construction include physical habitat loss, loss of effective habitat due to sensory disturbance, and disruption of movements due to construction activity. Effects on wolverine could also include mortality due to increased harvest.

6.1.4.2 Objectives

The objective of the rare or regionally rare mammal monitoring program for Project construction is to:

- address uncertainties with respect to the presence and response of little brown myotis and wolverine associated with Project disturbances and habitat use during construction.

6.1.4.3 Design

As construction activities can affect habitat used by little brown myotis, potential hibernacula, roosting sites, and species abundance will be monitored in the Gull and Stephens lakes area within Study Zone 4 (Map 1-2) using searches, sample counts and marking measures (if required).

The abundance of, and habitat use by, wolverine will be monitored near the road construction zone and the generating station construction zone, and in comparable habitat in areas unaffected by Project activity (control area).

6.1.4.4 Parameters of Concern

Parameters of concern include:

- potential loss or alternation of little brown myotis habitat such as hibernacula and maternity roosts; and
- abundance, spatial distribution, and habitat use of little brown myotis and wolverine resulting from disturbance due to construction activity.

6.1.4.5 Study Area

Monitoring activities will be conducted in Study Zones 1 through 6 (Map 1-2).

6.1.4.6 Sample Site Locations

Monitoring activities for little brown myotis will be completed near roads, trails, and other access corridors in the construction zone.

Because wolverine range extensively, broader areas will be monitored opportunistically during summer resident caribou and moose calving and rearing habitat use surveys, and during winter aerial surveys for caribou. Sites within 2 km of the road construction zone, within 4 km of the generating station construction zone, and in comparable habitat in areas in Study Zones 4 through 6 unaffected by Project activity (control areas) will be surveyed for wolverine. Locations of sample sites selected from existing baseline data will be replicated during construction.

6.1.4.7 Sample Frequency and Schedule

Monitoring for bats will be completed at least once in summer during construction. If no bats are found, future surveys will not be required. If bats are detected, then monitoring will be completed periodically during construction until such time as sensitive habitats are identified.

Monitoring for wolverine will be conducted at the same frequency as for caribou and moose habitat use surveys (see Sections 6.1.1.7 and 6.1.2.7).

6.1.4.8 Methods and Reporting

Bat surveys will be conducted using bat detectors in the Gull and Stephens lakes area within Study Zone 1. Pedestrian surveys and point counts will be conducted at night, beginning a half-hour after sunset. Monitoring sites will include access roads, trails, shorelines, and wetlands. Although this species is unlikely to occur in large numbers, if little brown myotis are detected, a radio-tracking program will be established to monitor bat activities. Bats will be captured in high-use movement areas by using harp nets and a few individuals will be fitted with radio-transmitters. Radio-tracking techniques will be used to follow bats to sensitive habitats such as hibernacula and maternity roosts. Bat ranges and sensitive habitats will be mapped.

Wolverine data will be collected opportunistically during caribou and moose calving and rearing habitat use surveys using track counts observations, trail camera photos, winter aerial surveys (see Sections 6.1.1 and 6.1.2), by reviewing wolverine trapping records, and from socio-economic resource use studies where possible. Presence/absence records and spatial locations will be mapped. The wildlife biologist will compile data, map locations, and submit a report to KHLP once at the end of the construction phase.

6.1.5 Gray Wolf, Black Bear and Other Wildlife

6.1.5.1 Rationale

Many terrestrial mammals are found throughout the Keeyask region. Two important large mammals include gray wolf and American black bear. Both species require dens for the birthing and rearing of young, and in the case of bears, for hibernation. Dens are considered important and possibly critical to the life requisites for these species.

Animals are often attracted to human infrastructure such as camps and work areas that will be associated with the Project. For instance, encounters with species such as red fox, gray wolf, caribou, and moose were reported at camps and on the access road during construction of the Wuskwatim Generating Station. Displacement and/or mortality of animals could result if species such as black bear, gray wolf, red fox, arctic fox, or beaver conflict with humans. These human-wildlife encounters will require monitoring.

As gray wolves and black bears prey on moose and caribou, potential Project effects include easier access to, and more efficient hunting of, ungulates in the region. Wolves and bears are also susceptible to accidental mortality.

6.1.5.2 Objectives

The objectives of the monitoring program for gray wolf, black bear, and other wildlife prior to clearing and during construction are to:

- systematically search for gray wolf and black bear den locations in advance of specific construction activities, determine the level of denning activity, and report locations;
- record mammal mortality from accidents, harvest, and other sources;
- document the frequency and trends of human-wildlife encounters; and
- determine the extent of gray wolf and black bear use of habitats adjacent to the road, trails, and in caribou calving and rearing complexes and islands during construction.

6.1.5.3 Design

Den Survey

In the spring, fall, and winter months, gray wolf and black bear are dependent on dens either for giving birth to young or for hibernation in the case of bears. If clearing activities coincide with these sensitive time periods, an intensive survey in designated areas within the Project Footprint (Study Zone 1, Map 1-2) will be conducted. Because the reservoir clearing area is very large but unlikely to contain dens in low-lying habitats such as sparsely treed peatlands, only high probability denning habitat will be surveyed. Once located, the den will be flagged and its location reported to the Site Environmental Officer identified in the Environmental Protection Plans (EnvPP), for action as appropriate. Mitigation options will be discussed with Manitoba Conservation and Water Stewardship.

Distribution and Abundance

As construction and clearing will create movement corridors areas for wolves and other large carnivores, monitoring of gray wolf and black bear distribution and abundance will be completed via tracking in tandem with caribou and moose habitat use surveys (se Sections 6.1.1.3 and 6.1.2.3). Large carnivore activity will be identified by signs such as tracks and droppings.

Interactions with Humans

As construction camps and human activities can attract wildlife, it is important to monitor all wildlife relocations and the mortality of black bear, gray wolf, red fox, arctic fox, and beaver. Site record forms will be used to document these occurrences.

6.1.5.4 Parameters of Concern

Parameters of concern include:

- the location of gray wolf and black bear dens near construction activities;
- human-wildlife encounters, wildlife displacement, and animal mortality; and
- large carnivore abundance and habitat use adjacent to linear features and in important ungulate habitats.

6.1.5.5 Study Area

Monitoring will occur in Study Zones 1 through 6.

6.1.5.6 Sample Site Locations

Den Survey

Monitoring will be undertaken in Study Zone 1 at infrastructure such as camps, and near roads and other linear features in the construction zone.

Distribution and Abundance

Monitoring the distribution and abundance of gray wolves and black bears will occur opportunistically in Study Zones 1 through 6 during caribou and moose habitat use monitoring (see Sections 6.2.1.6 and 6.1.2.6).

6.1.5.7 Sampling Frequency and Schedule

Den search surveys will be conducted in March/April when gray wolves are actively seeking and using dens for birthing and rearing young. Den surveys will also be conducted in October/November to overlap the period when black bears are seeking, excavating and/or entering dens prior to and during winter snowfall. Survey timing will be dependent on the clearing and construction schedules.

Monitoring data for gray wolf and black bear activity will be collected at the same frequency as for caribou and moose habitat use surveys (see Section 6.1.1.7 and 6.1.2.7). Monitoring for human-wildlife encounters will be done on a quarterly basis.

6.1.5.8 Methods and Reporting

A systematic ground-search method will be used to sample Study Zone 1 for wolf and bear dens. Groups of personnel, including KCNs members, will intensively search infrastructure sites, including the road right-of-way, camp sites, and borrow areas. In the reservoir clearing area (Study Zone 1), only high-probability denning habitat will be surveyed. Individuals will walk parallel to each other searching for den cues at distances of about 10 m. Distances between searchers may vary depending on ground conditions, vegetation density, visibility, and the number of personnel available for searches. Surveyors will be trained to key in on structures that may appear to be dens or denning areas around hill sides, woody debris, root masses, and other sites that could be easily dug out or are close to food and water sources. All dens will be flagged, and their locations geo-referenced. Location and activity data will be provided as soon as practicable to the Site Environmental Officer identified in the Environmental Protection Plans (EnvPP), for action as appropriate.

Large carnivore data will be collected opportunistically during caribou and moose surveys using track counts and observations, collected opportunistically during trail camera studies, and through trapping and harvest records, and socio-economic resource use studies where possible. Available data and reports from ATK monitoring will be used to corroborate the findings of this study. The wildlife biologist will also prepare and submit forms to Manitoba Hydro including a large carnivore

observation form, and a wildlife-vehicle accident form to monitor large carnivore mortality. All reports will be submitted on a scheduled basis.

Large carnivore monitoring that may occur within and beyond Study Zone 6 will be coordinated with other Manitoba Hydro projects and Manitoba Conservation and Water Stewardship monitoring initiatives. These data would be used to supplement the findings of Project-related large carnivore effects if available.

The wildlife biologist will prepare and submit forms to Manitoba Hydro including wildlife encounter and actions taken forms. Wildlife management actions to be taken will be discussed with Manitoba Hydro and documented.

6.2 OPERATION MONITORING

6.2.1 Caribou

6.2.1.1 Rationale

Rationale is discussed in Section 6.1.1.1. Additionally, there is some uncertainty concerning the long-term residual effects of the Project on caribou and habitat in Study Zone 4 during operation (EIS Section 6.5.8.1). Uncertainties are associated with habitat use, distribution, movements, timing, and mortality. Continued monitoring of caribou populations as well as reviewing associated records from other Manitoba Hydro developments and Manitoba Conservation and Water Stewardship monitoring initiatives within and outside Study Zone 6 will be required.

6.2.1.2 Objectives

The objectives of the caribou monitoring program for Project operation are to:

- address uncertainties with respect to long-term Project effects on caribou populations in the lower Nelson River region;
- verify the long-term direct and indirect predicted effects on summer resident caribou and habitat;
- evaluate performance of mitigation measures; and
- address uncertainties associated with habitat use, distribution, timing, movements, and mortality due to predation and accidents.

6.2.1.3 Design

Monitoring during operation will include sampling replication from the construction period (see Section 6.1.1.3). Site records, mapping of summer resident caribou calving and rearing habitat effects in areas associated with Project effects, and the on-going collection of caribou activity, movement, and mortality data in areas where effects are predicted to occur will be maintained.

6.2.1.4 Parameters of Concern

Parameters of concern include:

- caribou movements in and through Study Zones 1 through 5;
- use of caribou calving and rearing habitats in Study Zones 1 through 5; and
- caribou mortality attributable to accidents (including drowning), harvest, and other reported sources such as gray wolf kills.

6.2.1.5 Study Area

Monitoring will be completed in Study Zones 1 through 6 (Map 1-2) as in the construction phase (see Section 6.1.1.5).

6.2.1.6 Sample Site Locations

Caribou Populations

Aerial surveys conducted in the winters of 2011/12 and 2012/13 and during construction monitoring will be replicated (see Section 6.1.1.5). Aerial surveys will focus on the eastern portion of Study Zone 5 (Map 1-2) from Split Lake to Long Spruce GS.

Calving and Rearing Habitat Use

Monitoring activities will also be undertaken in summer resident caribou calving and rearing habitats on any new islands formed within the reservoir. Locations of sample sites surveyed during construction will be replicated (see Section 6.1.1.6).

Mortality

Accidental caribou drowning will be monitored in the reservoir and downstream of the Keeyask GS.

Vehicle collisions will be monitored in the Gillam area.

6.2.1.7 Sample Frequency and Schedule

Caribou Populations

Aerial surveys for caribou will occur every two years in winter for an initial period of six years. After six years the need for and frequency of continued monitoring will be evaluated.

Calving and Rearing Habitat Use

Summer resident caribou monitoring in calving and rearing habitat will occur in the spring and summer calving and rearing season during operation for an initial period of three years. Each site will be sampled three times annually: spring, mid-summer, and fall. After three years the need for and frequency of continued monitoring will be evaluated.

6.2.1.8 Methods and Reporting

Caribou Populations

Winter aerial surveys will be conducted in Study Zone 5 to map caribou movements (See Section 6.1.1.8). River crossing attempts will be recorded from these surveys. 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.

Calving and Rearing Habitat Use

In addition to monitoring new calving islands formed in the reservoir, calving and rearing habitat monitoring studies will be replicated from construction surveys (see Section 6.1.1.8).

Mortality

Project-related caribou mortality will be monitored. Caribou drowning reports will be investigated and reported, including the location, timing, and ice conditions. Radio-collaring data from other studies in the Region will be used to confirm predator kills in Study Zone 4 if available.

Harvest along the access roads will be monitored using Manitoba Conservation and Water Stewardship harvest records, and harvest data collected from socio-economic resource use studies where possible. The results of ATK monitoring will be reviewed and used to corroborate long-term scientific monitoring initiatives. The wildlife biologist will analyze all data collected and report annually to KHLP on long-term caribou population trends and habitat use.

Vehicle collisions will be monitored using Manitoba Public Insurance Corporation statistics and Manitoba Conservation and Water Stewardship wildlife reports. Data will be compiled on an annual basis and trends will be reported to KHLP every five years.

6.2.2 Moose

6.2.2.1 Rationale

Rationale is discussed in Section 6.1.2.1. Additionally, there is some uncertainty concerning the long-term residual effects of the Project on moose populations and habitat in Study Zone 4 (Section 6.5.8.2 of the EIS). Uncertainties are associated with population size, population characteristics including age and sex, distribution, and mortality. As such, monitoring of the moose population is required during operation.

6.2.2.2 Objectives

The objectives of the moose monitoring program for Project operation are to:

- address uncertainties associated with how population characteristics may change over time, distribution, and moose mortality; and

- address uncertainties with respect to the redistribution of harvest effort affecting the moose population in the SLRMA.

6.2.2.3 Design

See Section 6.1.2.3. Additionally, site records, mapping of moose habitat in areas associated with Project effects, and the on-going collection of moose activity, movement, and mortality data in areas where effects are predicted to occur will be maintained. Broader area records from the SLRMA Moose Harvest Sustainability Plan will be reviewed, including the use of moose management units, harvests strategies, and the models used to project future populations and harvest.

6.2.2.4 Parameters of Concern

Parameters of concern include:

- amount of use of calving and rearing habitats in Study Zones1 through 6; and
- moose mortality attributable to harvest, predation, and accidents.

6.2.2.5 Study Area

Moose monitoring will be completed in Study Zones 1 through 6, and in the SLRMA.

6.2.2.6 Sample Site Locations

Moose Population

See Section 6.1.2.6.

Aerial surveys will focus on Study Zone 4 and could extend into Study Zone 5. Surveys will be replicated from construction surveys (see Sections 6.1.2.6).

Calving and Rearing Habitat Use

Monitoring activities will be undertaken in calving habitat in and near access roads. Locations of sample sites selected during construction activities will be replicated (see Section 6.1.2), and will occur simultaneously with caribou monitoring during operation.

Other Habitat Use

Monitoring activities will be completed in moose habitats within 5 km of the access road construction zone (*i.e.*, within Study Zone 4).

6.2.2.7 Sample Frequency and Schedule

Moose Population

Aerial surveys for moose will occur approximately every five years for up to 30 years of operation, depending on results.

Calving and Rearing Habitat Use

Moose monitoring in calving and rearing habitats will occur in the spring and summer calving and rearing period during Project operation for an initial period of three years. Each site will be sampled three times annually: spring, mid-summer, and fall. After three years the need and frequency for continued monitoring will be evaluated.

Other Habitat Use

Moose monitoring will occur during Project operation for an initial period of three years. Each site will be sampled three times annually: spring, mid-summer, and fall. After three years the need and frequency for continued monitoring will be evaluated.

6.2.2.8 Methods and Reporting

Moose Population

The aerial survey conducted during construction will be replicated (see Section 6.1.2.8). The wildlife biologist will report upon the completion of each aerial survey.

Calving and Rearing Habitat Use

Calving and rearing habitat monitoring studies will be replicated from construction surveys (see Section 6.1.1.8). The wildlife biologist will report annually.

Other Habitat Use

See Section 6.1.2.8. The wildlife biologist will report annually.

Moose Harvest

Harvest along the access roads will be monitored using Manitoba Conservation and Water Stewardship harvest records, and harvest data collected from socio-economic resource use studies where possible. The results of CNP Moose Harvest Sustainability Plan monitoring and other ATK monitoring will be reviewed and used to corroborate long-term scientific monitoring initiatives. The wildlife biologist will analyze all data collected and report to KHLP every five years on long-term moose population trends.

6.2.3 Beaver

6.2.3.1 Rationale

Beaver is an important species in the region, having cultural, economic, and ecological value. Beaver habitat will be lost to clearing, flooding, and future peatland disintegration. However, the formation of anchored floating peat islands in the reservoir could attract beaver to these habitats (*e.g.*, as has occurred in Wuskwatim Lake) and temporarily increase the abundance of beaver in the reservoir. The creation of an off-system marsh could displace the existing local beaver population. Finally, the quality

of habitat in creeks near the reservoir, which will be important for maintaining the local beaver population, could also be affected by water level fluctuations. Therefore, it will be important to monitor alterations of beaver habitat quality in and near the reservoir during operation.

As a wetland mitigation measure, 12 ha of off-system marsh will be created (see Section 2.2.5). An element of the success of its creation as a functioning marsh will be its use and colonization by wildlife such as muskrat and beaver.

6.2.3.2 Objectives

The objectives of the beaver monitoring program for Project operation are to:

- verify whether predicted effects on the local and regional beaver population (Section 6.5.8.3 of the EIS) occur;
- document the utilization of the created off-system marsh habitat (see Section 2.2.5); and
- address uncertainties regarding habitat quality in the reservoir, wetland mitigation areas, and adjacent creeks.

6.2.3.3 Design

Habitat changes and the spatial distribution of beaver lodges will be monitored during operation using aerial surveys, ground surveys, and the mapping of habitat quality in and near the reservoir. Additional information will be collected in Study Zone 4 through aerial and ground surveys. These data will be used for baseline and comparison purposes.

6.2.3.4 Parameters of Concern

Parameters of concern include:

- the number of beaver in Study Zone 1 and Study Zone 4 (Map 1-2) during operation compared with the number before construction;
- the availability and quality of beaver habitat in and near Study Zone 1; and
- the use and colonization of the created off-system marsh habitat by muskrat and beaver.

6.2.3.5 Study Area

Monitoring will be undertaken in the reservoir, wetland mitigation areas, and adjacent creeks and, for comparative purposes, throughout Study Zone 4).

6.2.3.6 Sample Site Locations

Monitoring will occur on floating peat islands, along the reservoir perimeter, at waterbodies and watercourses in Study Zone 1, and at waterbodies and watercourses near the reservoir beyond Study Zone 1 (*i.e.*, in Study Zone 4). Monitoring will also occur in the wetland mitigation area.

6.2.3.7 Sample Frequency and Schedule

Monitoring for beaver populations will be undertaken regularly for up to 15 years of operation, depending on results, such as the longevity of peat islands. Habitat quality will be mapped periodically during operation, for up to 15 years, depending on the results of the habitat use surveys.

6.2.3.8 Methods and Reporting

Monitoring activities will be completed through aerial surveys, ground surveys, and habitat mapping. Helicopter surveys will be used to locate and record lodges using those reported for the construction period (Section 6.1.3). Ground and/or boat-based surveys will be used to monitor measurable parameters of beaver lodges and habitat, including but not limited to water depth, lodge volume and food cache size and composition. The terrestrial ecologist will provide copies of Project habitat effects to the wildlife biologist, including peatland disintegration maps and vegetation changes as they become available. Population estimates, changes in the spatial distribution of beaver, and changes to beaver habitat over time will be reported annually to KHLP.

6.2.4 Rare or Regionally Rare Species

6.2.4.1 Rationale

Rationale is discussed in Section 6.1.4.1. Additionally, potential effects on these species during operation include physical habitat loss, loss of effective habitat due to sensory disturbance, and, for wolverine, mortality due to increased harvest.

6.2.4.2 Objectives

The objective of the rare or regionally rare monitoring program for Project operation is to:

- address uncertainties with respect to the presence and response of little brown myotis and wolverine associated with Project disturbances and habitat use during operation.

6.2.4.3 Design

As operation activities can affect habitat used by little brown myotis and wolverine, potential hibernacula, roosting sites, and species abundance will be monitored for little brown myotis if they are found during construction monitoring, and species abundance will be monitored for wolverine in the in the Gull and Stephens lakes area using searches, and sample counts. Wolverine monitoring via tracking transects and trail cameras will be conducted in tandem with caribou and moose calving and rearing habitat monitoring and aerial surveys during operation (see Sections 6.2.1 and 6.2.2).

6.2.4.4 Parameters of Concern

Parameters of concern include:

- potential loss or alternation of little brown myotis habitat such as hibernacula and maternity roosts; and

- abundance and spatial distribution of little brown myotis and wolverine resulting from disturbance due to operation activity.

6.2.4.5 Study Area

Monitoring will take place in Study Zones 1 through 6 (Map 1-2).

6.2.4.6 Sample Site Locations

Monitoring for the little brown myotis will occur near the Keeyask GS (which could provide maternity roost and other roosting habitats), roads, and other decommissioned access trails. Because wolverine range extensively, broader areas will be monitored opportunistically during caribou and moose calving and rearing habitat surveys. Tracking transects surveyed during construction will be replicated (see Section 6.1.1.6).

6.2.4.7 Sample Frequency and Schedule

Monitoring for little brown myotis will occur at least once summer during the first five years of operation. If bats are found using Project infrastructure, monitoring will occur annually for a period of three years, and thereafter every three to five years for up to 30 years of operation, depending on the results. If no bats are found, monitoring will occur once every five years for up to 30 years of operation, depending on results.

6.2.4.8 Methods and Reporting

Bat surveys will be conducted using bat detectors in areas where they were observed during construction. If no bats are observed during construction monitoring, surveys during operation will focus on Project infrastructure. Ground surveys and point counts will be conducted at night, beginning a half-hour after sunset. Monitoring sites will include Project infrastructure, access roads, trails, shorelines, and wetlands. Although this species is unlikely to occur in large numbers, if little brown myotis are detected, a radio-tracking program will be established to monitor bat activities. Bats will be captured with harp nets in high-use movement areas and a few individuals will be fitted with radio-transmitters. Radio-tracking techniques will be used to follow bats to critical habitats such as hibernacula and maternity roosts. Bat ranges and sensitive habitats will be mapped.

Wolverine data will be collected opportunistically during caribou and moose surveys using track counts and observations, trail camera monitoring activities (see Section 6.2.1.8) and reviewing wolverine trapping records. Presence/absence records and spatial locations will be mapped. The wildlife biologist will compile data, map locations, and submit a report to KHLP.

6.2.5 Gray Wolf and Black Bear

6.2.5.1 Rationale

As gray wolves and black bears prey on moose and caribou, potential Project effects during operation include easier access to, and more efficient hunting of, ungulates in the region due to the creation of linear features. Wolves and bears are also susceptible to accidental mortality. Changes in predator-prey

dynamics could result in reduced ungulate populations. These interactions will be monitored during operation.

6.2.5.2 Objectives

The objective of the gray wolf and black bear monitoring program for Project operation is to:

- determine the extent of gray wolf and black bear use of habitats adjacent to the road, trails, and in caribou and moose calving and rearing habitat during operation.

6.2.5.3 Design

As some linear features that can be used by wolves and bears will persist during operation, monitoring for large carnivore distribution and abundance will be required. Data will be collected opportunistically during caribou and moose monitoring studies.

6.2.5.4 Parameters of Concern

Parameters of concern include:

- large carnivore abundance and habitat use adjacent to linear features and in important ungulate habitats.

6.2.5.5 Study Area

Monitoring will occur in Study Zones 1 through 6 (Map 1-2).

6.2.5.6 Sample Site Locations

Monitoring will be completed near roads and other linear features, and opportunistically in broader areas during caribou and moose calving and rearing habitat use monitoring (see Section 6.2.1.6).

6.2.5.7 Sampling Frequency and Schedule

Monitoring for gray wolf and black bear activity will be conducted at the same frequency as for caribou and moose calving and rearing habitat use surveys (see Section 6.2.1.7).

6.2.5.8 Methods and Reporting

Large carnivore data will be collected opportunistically during caribou and moose calving and rearing habitat use surveys (Section 6.2.1.8) and through trapping and harvest records, where possible. Other data and reports from ATK monitoring and the Resource Use Monitoring Plan will be used to corroborate the findings of this study. All reports will be submitted to KHLP on a scheduled basis at the same frequency as caribou and moose studies.

Available data from other Manitoba Hydro developments and Manitoba Conservation and Water Stewardship monitoring initiatives within and outside Study Zone 6 will be used to supplement the findings of Project-related large carnivore effects if available.

7.0 MERCURY IN WILDLIFE

7.1 CONSTRUCTION MONITORING

7.1.1 Introduction

Monitoring for increases in mercury concentrations in terrestrial ecosystems will focus on those pathways where effects may be anticipated to occur. Therefore, no mercury monitoring of terrestrial plants will be done under this TEMP, since the primary pathway of concern for exposure is through the aquatic food web. However, under the Socio-Economic Monitoring Plan (SEMP), collection of wild plants will be undertaken on a voluntary basis by local community members to confirm that mercury concentrations remain acceptable for domestic consumption (see EIS, Section 8.2.4). Similarly, mercury monitoring of waterfowl will be done under the SEMP through voluntary collection by community members to confirm the expectation that mercury levels remain within an acceptable level. Given expected exposure pathways, as well as the importance of aquatic furbearers, caribou, and moose to KCNs, mercury monitoring under the TEMP will focus on these species.

7.1.2 Mercury Monitoring in Aquatic Furbearers

7.1.2.1 Rationale

Flooding will increase mercury levels in the Keeyask reservoir. Potential effects on wildlife are linked to increases in fish mercury concentrations in the Keeyask reservoir and Stephens Lake and have importance to domestic resource use. Mercury levels in wildlife will increase over baseline conditions and peak approximately seven years after the reservoir is impounded. Mercury levels are expected to begin declining after that point and reach pre-Project levels approximately 20 to 30 years post-impoundment. Mercury levels in herbivorous species such as beaver are not expected to change due to the minute quantities of mercury taken up by plants. Small increases in mercury concentrations will likely occur in muskrat, which forage on plants and lower trophic level invertebrates such as molluscs.

7.1.2.2 Objectives

The objective of mercury monitoring in beaver and muskrat during construction is to:

- enhance baseline data of the existing mercury content in beaver and especially muskrat in the future reservoir area.

7.1.2.3 Design

Samples of beaver and muskrat muscle and liver tissue from individuals removed from within the Project Footprint during construction will be collected and analyzed for baseline mercury monitoring. Samples provided by Project trappers will be frozen and submitted to an accredited laboratory for analysis. Results will be related to the species, sex, and age of the individual, and the location where it

was trapped. These data will be added to the existing (pre-impoundment) database for comparison with samples collected during operation.

7.1.2.4 Parameters of Concern

Parameters of concern are:

- mercury levels in muscle and liver tissue of beaver and muskrat.

7.1.2.5 Study Area

Collection of beaver and muskrat tissue samples during construction will occur within the Project Footprint (Study Zone 1, Map 1-2), where clearing is to occur.

7.1.2.6 Sample Site Locations

The collection area will be riparian zones inhabited by beaver and muskrat in the reservoir area (see Section 6.2.3).

7.1.2.7 Sample Frequency and Schedule

Samples will be collected as beaver and muskrat are trapped (see Section 6.2.3).

7.1.2.8 Methods and Reporting

Methods for tissue extraction and storage will be in accordance with previously established protocols described here. A sample of muscle and liver tissue each approximately the size of two fingers will be removed from the carcass and placed in a re-sealable plastic bag. The bag will be labelled with the trapper's name, the date the samples were collected, the animal species, and the location where it was trapped. Samples will be submitted to a designated KCNs member appointed by the KHLP who will store them in a freezer. The pelts from animals from which samples are submitted will be required for inspection to verify that there is the same number of pelts for each species as there are tissue samples. Pelts will be left in the possession of the trapper. Trappers will be provided with collection materials such as freezer bags, tags, and maps. Samples will be frozen and submitted to an accredited laboratory for analysis. The wildlife biologist will facilitate quality control for the methods and collection of any data related to the tissue samples, will submit the samples for analysis, and will submit annual reports to KHLP of mercury levels in beaver and muskrat.

7.1.3 Mercury Monitoring in Caribou and Moose

KCN Members are concerned about mercury levels in caribou and moose. Mercury levels in these species will be monitored via tissue samples voluntarily submitted by resource users. Baseline mercury levels in these species should be established if comparisons are to be made with post-Project mercury levels.

7.1.3.1 Objectives

The objective of mercury monitoring in caribou and moose during construction is to:

- provide additional baseline and comparative data of the mercury content in caribou and moose in the Keeyask region.

7.1.3.2 Design

Samples of caribou and moose muscle, liver and kidney tissue from individuals removed from within Study Zone 6 during construction will be collected and analyzed for baseline mercury monitoring. Samples submitted by resource users will be frozen and submitted to an accredited laboratory for analysis. Results will be related to the species, sex, and age of the individual, and the location where it was harvested where possible. A database will be created for comparison with samples collected during operation.

7.1.3.3 Parameters of Concern

Parameters of concern are:

- mercury levels in muscle, liver and kidney tissue of caribou and moose.

7.1.3.4 Study Area

Collection of tissue samples from caribou and moose during construction will occur throughout Study Zone 6 where these species are harvested and samples are submitted.

7.1.3.5 Sample Site Locations

As samples will be voluntarily submitted by resource users, sample sites will not be determined in advance.

7.1.3.6 Sample Frequency and Schedule

As samples will be voluntarily submitted by resource users, there will be no sample schedule.

7.1.3.7 Methods and Reporting

Methods for tissue extraction and storage in accordance with previously established protocols will be provided to resource users. A sample of muscle and liver tissue each approximately the size of two fingers will be removed from the carcass and placed in a re-sealable plastic bag. The bag will be labelled with the harvesters name, the date the samples were collected, the animal species, and the location where it was harvested. Samples will be submitted to a designated KCNs member who will store them in a freezer. Samples will be frozen and submitted to an accredited laboratory for analysis. The wildlife biologist will periodically submit tissue samples for analysis and will submit annual reports to KHLP of mercury levels in caribou and moose.

7.2 OPERATION MONITORING

7.2.1 Mercury Monitoring in Aquatic Furbearers

7.2.1.1 Rationale

See Section 7.1.2.1 discussing mercury in muskrat and beaver. Larger increases in mercury concentrations are expected for mink and river otter, which eat fish.

7.2.1.2 Objectives

The objectives of mercury monitoring in aquatic furbearers during construction are to:

- monitor the changes in mercury levels, if any, in aquatic furbearers during operation of the generating station;
- confirm effects predicted in the EIS; and
- provide information to the KCNs about mercury levels in aquatic furbearers.

7.2.1.3 Design

Samples of aquatic furbearer muscle and liver tissue submitted by trappers will be collected and analyzed for baseline mercury monitoring. Samples will be frozen and submitted to an accredited laboratory for analysis. Results will be related to the species, sex, and age of the individual, and the location where it was trapped. These data will be added to the existing (pre-impoundment) database for comparison with samples collected before construction. If voluntary sample submissions are insufficient, additional trapping under a scientific collection permit will be required.

7.2.1.4 Study Area

Beaver, muskrat, mink, and river otter tissue samples will be collected adjacent to the reservoir (on-system) and in areas unaffected by the Project (off-system).

7.2.1.5 Sample Site Locations

Samples will be submitted by trappers from sites on their registered traplines. Samples collected on-system will be compared with those collected off-system to identify the natural variability of mercury levels in aquatic furbearers trapped on-system and off-system. Samples collected near the Keeyask reservoir will be compared with those collected near the reservoir before construction to quantify the increased mercury concentration in aquatic furbearer tissue.

7.2.1.6 Parameters of Concern

Parameters of concern are:

- mercury levels in muscle and liver tissue of beaver, muskrat, mink, and river otter.

7.2.1.7 Sample Frequency and Schedule

Tissue samples will be collected annually during the winter and spring fur harvest for a period of up to 30 years of operation.

7.2.1.8 Methods and Reporting

Tissue will be removed and stored according to established protocols. Trappers will be provided with collection materials such as freezer bags, tags, and maps. Tissue samples will be analyzed by an accredited laboratory. The wildlife biologist will ensure quality control for methods and data collection, and submit an annual progress report to KHLP. Information will be disseminated to the communities yearly.

7.2.2 Mercury Monitoring in Caribou and Moose

KCN Members are concerned about mercury levels in caribou and moose. Mercury levels in these species will be monitored via tissue samples voluntarily submitted by resource users. If baseline mercury levels in these species are established prior to reservoir impoundment, comparisons can be made with post-Project mercury levels.

7.2.2.1 Objectives

The objective of mercury monitoring in caribou and moose during construction is to:

- monitor the changes in mercury levels, if any, in caribou and moose during operation of the generating station.

7.2.2.2 Design

Samples of caribou and moose muscle, liver and kidney tissue from individuals removed from the Keeyask region during operation will be collected and analyzed for mercury monitoring. Results will be related to the species, sex, and age of the individual, and the location where it was harvested where possible.

7.2.2.3 Parameters of Concern

Parameters of concern are:

- mercury levels in muscle and liver tissue of caribou and moose.

7.2.2.4 Study Area

Collection of tissue samples from caribou and moose during construction will occur throughout Study Zone 6 where these species are harvested and samples are submitted.

7.2.2.5 Sample Site Locations

As samples will be voluntarily submitted by resource users, sample sites will not be determined in advance.

7.2.2.6 Sample Frequency and Schedule

As samples will be voluntarily submitted by resource users, there will be no sample schedule.

7.2.2.7 Methods and Reporting

Methods for tissue extraction and storage in accordance with previously established protocols will be provided to resource users (see Section 7.1.3.8). Samples will be frozen and submitted to an accredited laboratory for mercury analysis. In addition, as requested by the KCNs, other heavy metal content (*e.g.*, cadmium) will be measured. The wildlife biologist will periodically submit tissue samples for analysis and will submit annual reports to KHLP of mercury and other heavy metal levels in caribou and moose.

8.0 STUDY AREA MAPS

N

PR 280

North Access Road

Proposed Keeyask G.S.

Proposed South Access Road

STEPHENS LAKE

GULL LAKE

NELSON RIVER

Birthday Rapids

CLARK LAKE

Tataskweyak Cree Nation
Tataskweyak (Split Lake)

TL KS37

BURNTWOOD RIVER

Kelsey G.S.

York Factory First Nation
York Landing (Kawechiwasik)

TL KN36

War Lake First Nation
Ilford

HUDSON BAY RAILWAY

York Factory RMA

Split Lake RMA

Bipoles 1 & 2

TL KH38

NELSON RIVER

TL RG60

Kettle G.S.

Gillam

Radisson C.S.

Fox Lake Cree Nation
A Kwis Ki Mahka Reserve

Long Spruce G.S.

Fox Lake Cree Nation
Fox Lake (Bird)

Henday C.S.

Limestone G.S.

Split Lake RMA

Fox Lake RMA

KEEYASK
Hydropower Limited Partnership

DATA SOURCE:
Manitoba Hydro; Government of Manitoba; Government of Canada

CREATED BY:
Manitoba Hydro - Hydro Power Planning - GIS & Special Studies

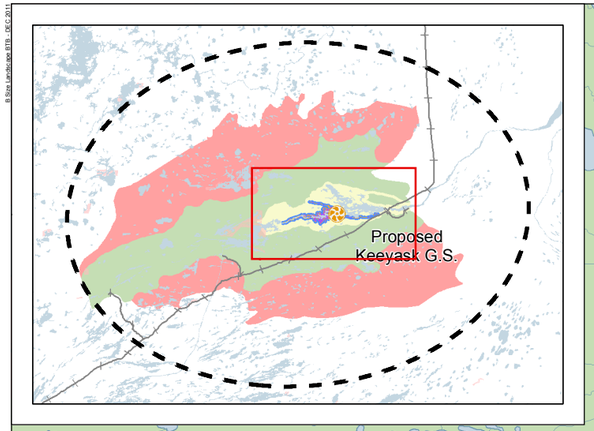
COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	03-AUG-11	31-MAY-13
0 5 10 Kilometres / 0 4 8 Miles	VERSION NO: 2.0	QA/QC: JCL/YYY/ZZZ

Legend

- Generating Station (Existing)
- Generating Station (Planned)
- Converter Station
- Keeyask Principal Structures
- Highway
- Access Road
- Proposed Access Road
- Rail
- Transmission Line
- Proposed Road Corridor
- First Nation Reserve
- Resource Management Area

General Project Location

Map 1.1



N

LIMESTONE RIVER

NORTH MOSWAKOT RIVER

MOSWAKOT SOUTH RIVER

Ferris Bay

STEPHENS LAKE

PR 280

Kettle G.S.

Long Spruce G.S.

Proposed
Keeyask G.S.

Gillam

Fox Lake Cree Nation
A Kwis Ki Mahka Reserve

NELSON RIVER

GULL LAKE

CLARK LAKE

SPLIT LAKE

Tataskweyak Cree Nation
Tataskweyak (Split Lake)

RIVER

BUTNAU RIVER

KETTLE RIVER

ANGLING RIVER NORTH

KETTLE LAKE

York Factory First Nation
York Landing (Kawechiwasik)

AIKEN RIVER

MOOSE NOSE LAKE

War Lake First Nation
Ilford

KEEYASK
Hydropower Limited Partnership

DATA SOURCE:
Study areas - ECOSTEM Ltd.; Water - NTS; Roads and rail - Manitoba Conservation.

CREATED BY:
ECOSTEM Ltd.

COORDINATE SYSTEM:	DATE CREATED:	REVISION DATE:
UTM NAD 1983 Z15N	13-MAR-12	18-MAY-12
0 2.5 5 Kilometres / 0 3 6 Miles	VERSION NO: 1.0	QA/QC: JWE/RDB/MWZ

Legend

Geographic Zones

- Study Zone 1 (Project Footprint for Both Phases)
- Study Zone 2
- Study Zone 3
- Study Zone 4
- Study Zone 5
- Study Zone 6

Project Areas

- Keeyask Generation Project Area

Note: Each zone includes all of the smaller zones within its perimeter

Geographic Zones Used for Terrestrial Study Areas

Map 1-2

File Location: Z:\Workspace\Keeyask GIS\EIS\Figure\Terrestrial\1 Introduction\Map 1-1 Terrestrial Study Areas_Zone Names v2.mxd

9.0 ACRONYMS AND GLOSSARY

9.1 GLOSSARY

Aboriginal traditional knowledge (ATK): Aboriginal traditional knowledge is knowledge that is held by, and unique to, Aboriginal peoples. It is living knowledge that is cumulative, dynamic, and adapted over time to reflect changes in the social, economic, environmental, spiritual and political spheres of the Aboriginal knowledge holders. It often includes knowledge about the land and its resources, spiritual beliefs, language, mythology, culture, laws, customs and medicines (Canadian Environmental Assessment Agency).

Adaptive management: Involves the implementation of new or modified mitigation measures over the life of a project to address its unanticipated environmental effects (*Canadian Environmental Assessment Act*).

Amphibians: Cold-blooded animal of the Class Amphibia that typically lives on land but breeds in water (*e.g.*, frogs, toads, salamanders).

Aquatic environment: All organic and inorganic matter and living organisms and their habitats that are related to or are located in or on the water, beds, or shores of a water body.

Attribute: A readily definable and inherent characteristic of a plant, animal, or habitat.

Biomass: Total mass of living matter, within a given unit of area or volume.

Boreal: Of or relating to the cold, northern, circumpolar area just south of the tundra, dominated by coniferous trees such as spruce, fir, or pine. Also called taiga.

Borrow area: An area where earth material (clay, gravel or sand) is excavated for use at another location (also referred to as 'borrow sites' or 'borrow pits').

Broad habitat type: The third coarsest level in the hierarchical habitat classification used for the terrestrial assessment. From coarsest to finest, the levels in the habitat classification system are land cover, coarse habitat type, broad habitat type and fine habitat type.

Browse: Refers to animals eating the tender current growth (and occasionally older growth) or bark of woody plants as a food source; can also be the generic term for the food source, especially as it refers to ungulates.

Buffer: An area surrounding a defined geographic area, usually created by locating a line a fixed distance around the area of interest.

Cache: A hiding place for concealing and preserving provisions.

Caribou calving and rearing (habitat) complex: a habitat mosaic that includes a cluster of islands in lakes or a cluster of islands in peatlands that are comprised mainly of raised peatland areas with black spruce trees surrounded by expansive wetlands or treeless areas. These complexes are suitable

habitats for summer resident caribou to calve, and/or to raise calves, between May and August. Water or wet habitats provide caribou with increased security and isolation from predators.

Cause-effect linkage: The relationship between an event (the cause) and a second event (the effect) or subsequent event (an indirect effect), where the second event or subsequent event is a consequence of the first.

Cofferdam: A temporary dam, usually made of rockfill and earth, constructed around a work site in the river, so the work site can be dewatered or the water level controlled during construction.

Concentration: The density or amount of a material suspended or dissolved in a fluid (aqueous) or amount of material in a solid (*e.g.*, sediments, tissue).

Construction: Includes activities anticipated to occur during Project development.

Core area: A natural area that meets a minimum size criterion after applying an edge buffer on human features. Two minimum sizes (200 ha, 1,000 ha) after applying a 500 m buffer on human features were used in the intactness effects assessment.

Cumulative effect: The effect on the environment, which results when the effects of a project combine with those of the past, existing, and future projects and; the incremental effects of an action on the environment when the effects are combined with those from other past, existing and future actions.

Diurnal: Active in the daytime.

Dyke: An earth embankment constructed to contain the water in the reservoir and limit the extent of flooding.

Ecosystem: A dynamic complex of plant, animal and micro-organism communities and their non-living components of the environment interacting as a functional unit (Canadian Environmental Assessment Agency).

Ecosystem diversity: The number of different ecosystem types and the distribution of area amongst them, at various ecosystem levels.

Ecosystem function: The outcomes of ecosystem patterns and processes viewed in terms of ecosystem services or benefits. Examples include producing oxygen to breathe, habitat for animals, purifying water and storing carbon.

Edge effect: The effect of an abrupt transition between two different adjoining ecological communities on the numbers and kinds of organisms in the transition between communities as well as the effects on organisms and environmental conditions adjacent to the abrupt transition.

Effect: Any change that the Project may cause in the environment. More specifically, a direct or indirect consequence of a particular Project impact. The impact-effect terminology is a statement of a cause-effect relationship (see **Cause-effect linkage**). A terrestrial habitat example would be 10 ha of vegetation clearing (*i.e.*, the impact) leads to habitat loss, permafrost melting, soil conversion, edge effects*, etc.* (*i.e.*, the direct and indirect effects).

Effective habitat: An estimate of the percentage of habitat available to support individuals within a wildlife population after subtracting habitat alienated by human influences (*e.g.*, sensory disturbances). Human influences do not include physical habitat losses.

Environmental assessment: Process for identifying project and environment interactions, predicting environmental effects, identifying mitigation measures, evaluating significance, reporting and following-up to verify accuracy and effectiveness leading to the production of an Environmental Assessment report. EA is used as a planning tool to help guide decision-making, as well as project design and implementation (Canadian Environmental Assessment Agency).

Environmental protection plan (EnvPP): A practical tool that describes the actions required to minimize environmental effects before, during and after project implementation. The plan may include details about the implementation of the mitigation measures identified in the environmental assessment, such as who is responsible for implementation, where the measures are intended to be implemented, and within what timeframe (Canadian Environmental Assessment Agency); description of what will be done to minimize the effects before, during and after project construction and operation. This includes protection of the environment and mitigation of effects from project activities.

Existing environment: The present condition of a particular area; generally included in the assessment of a project or activity prior to the construction of a proposed project or activity.

Fire regime: The frequency, size, intensity, severity, patchiness, seasonality and type (*e.g.*, ground versus canopy) of fires in the Fire Regime Area.

Flooding: The rising of a body of water so that it overflows its natural or artificial boundaries and covers adjoining land that is not usually underwater.

Fragmentation: Refers to the extent to which an area is broken up into smaller areas by human features and how easy it is for animals, plant propagules and other ecological flows such as surface water to move from one area to another. Fragmentation can isolate habitat and create edges, which reduces habitat for interior species and may reduce habitat effectiveness for other species. *OR* The breaking up of contiguous blocks of habitat into increasingly smaller blocks as a result of direct loss and/or sensory disturbance (*i.e.*, habitat alienation). Eventually, remaining blocks may be too small to provide usable or effective habitat for a species.

Generating station: A complex of structures used in the production of electricity, including a powerhouse, spillway, dam(s), transition structures and dykes.

Groundwater: The portion of sub-surface water that is below the water table, in the zone of saturation.

Habitat: The place where a plant or animal lives; often related to a function such as breeding, spawning, feeding, etc.

Habitat attribute: A readily definable and inherent characteristic of a habitat patch.

Habitat effect: Regarding terrestrial habitat, any change in a habitat attribute that results from the Project.

Habitat loss: Conversion of terrestrial habitat into human features or aquatic areas.

Habitat recovery: Regarding terrestrial habitat in a temporarily affected area, the return to the habitat type that was there prior to the Project or to a similar habitat type through natural regeneration processes or rehabilitation measures.

Hydroelectric: Electricity produced by converting the energy of falling water into electrical energy (*i.e.*, at a hydro generating station).

Ice regime: A description of ice on a water body (*i.e.*, lake or river) with respect to formation, movement, scouring, melting, daily fluctuations, seasonal variations, *etc.*

Impact: Essentially, a statement of what the Project is in terms of the ecosystem component of interest while a project effect is a direct or indirect consequence of that impact (*i.e.*, a statement of the cause-effect relationship). A terrestrial habitat example would be 10 ha of vegetation clearing (*i.e.*, the impact) leads to habitat loss, permafrost melting, soil conversion, edge effects, etc. (*i.e.*, the direct and indirect effects). Note that while *Canadian Environmental Assessment Act* requires the proponent to assess project effects, Manitoba legislation uses the terms impact and effect interchangeably. See also Effect.

Impoundment: The containment of a body of water by a dam, dyke, powerhouse, spillway or other artificial barrier.

Infrastructure: Permanent or temporary structures or features required for the construction of the principal structures, including access roads, construction camps, construction power, batch plant and cofferdams.

Invasive plant: A plant species that is growing outside of its country or region of origin and is out-competing or even replacing native organisms.

Keeyask Cree Nations: As a convenience to readers, all four communities are referred to in this document as the Keeyask Cree Nations (KCNs).

Key topic: A topic selected to focus the terrestrial effects assessment. Includes valued environmental components and key supporting topics.

Lacustrine: Of or having to do with lakes, and also used in reference to soils deposited as sediments in a lake.

Landscape: The ecological landscape as consisting of a mosaic of natural communities; associations of plants and animals and their related processes and interactions.

Local study area: The spatial area within which potential Project effects on individual organisms, or individual elements in the case of ecosystem attributes, may occur. Effects on the populations to which the individual organisms belong to, or the broader entity in the case of ecosystem attributes, were assessed using a larger regional study area; the spatial area in which local effects are assessed (*i.e.*, within close proximity to the action where direct effects are anticipated.

Magnitude: A measure of the size of an effect. *Alternatively,* a measure of how adverse or beneficial an effect may be.

Marsh: A class in the Canadian Wetland Classification System which includes non-peat wetlands having at least 25% emergent vegetation cover in the water fluctuation zone.

Mitigation: A means of reducing adverse Project effects. Under the *Canadian Environmental Assessment Act*, and in relation to a project, mitigation is "the elimination, reduction or control of the adverse environmental effects of the project, and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means."

Model: A description or analogy used to help visualize something that cannot be directly observed. Model types range from a simple set of linkage statements or a conceptual diagram to complex mathematical and/or computer model.

Mollusc: Animals in the phylum Mollusca, including snails (gastropods), clams and mussels (bivalves) and squids and octopuses (cephalopods).

Monitoring: Measurement or collection of data to determine whether change is occurring in something of interest. The primary goal of long term monitoring of lakes and rivers is to understand how aquatic communities and habitats respond to natural processes and to be able to distinguish differences between human-induced disturbance effects to aquatic ecosystems and those caused by natural processes; a continuing assessment of conditions at and surrounding the action. This determines if effects occur as predicted or if operations remain within acceptable limits, and if mitigation measures are as effective as predicted.

Nocturnal: Active at night.

Off-system: Water body or waterway outside of the Nelson River hydraulic zone of influence.

On-system: Waterbody or waterway inside the Nelson River hydraulic zone of influence.

Organic: The compounds formed by living organisms.

Parameter: Characteristics or factor; aspect; element; a variable given a specific value.

Peatland: A type of wetland where organic material has accumulated at the surface.

Population: A group of interbreeding organisms of the same species that occupy a particular area or space.

Post-project: The actual or anticipated environmental conditions that exist once the construction of a project has commenced.

Priority habitat: A native broad habitat type that is regionally rare or uncommon, highly diverse (*i.e.*, species rich and/or structurally complex), highly sensitive to disturbance, highly valued by people and/or has high potential to support rare plant species.

Priority plant: A native plant species that is rare, plays a highly disproportionate role in ecosystem function, is highly sensitive to Project features, or is highly valued by people.

Priority mammal: see **Priority species**.

Priority species: A species or group of species that is particularly important for ecological/social reasons.

Project feature: Any Project physical impact or activity that changes the environment. Synonymous with "action" in the *Canadian Environmental Assessment Act*.

Project Footprint: The maximum potential spatial extent of clearing, flooding and physical disturbances due to construction activities and operation of the Project, including areas unlikely to be used.

Push-up: A dome-shaped resting and feeding station built by muskrats by pushing vegetation and mud above holes in ice.

Raptor: Any of the group known as "birds of prey", including eagles, hawks, owls, vultures and falcons.

Regional study area: The regional comparison area used for a particular key topic. Alternatively, the spatial area within which cumulative effects are assessed (*i.e.* extending a distance from the Project Footprint in which both direct and indirect effects are anticipated to occur).

Relative abundance: The number of individuals of one species compared to the number of individuals of another species. The number of individuals at one location or time compared to the number of individuals at another location or time. Generally reported as an index of abundance.

Reptile: Cold-blooded animal of the Class Reptilia that includes tortoises, turtles, snakes, lizards, alligators and crocodiles.

Reservoir: A body of water impounded by a dam and in which water can be stored for later use. The reservoir includes the forebay.

Resident: With respect to wildlife, resident refers to a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating (Canadian Environmental Assessment Agency).

Residual effect: An actual or anticipated Project effect that remains after considering mitigation and the combined effects of other past and existing developments and activities.

Riparian: Along the banks of rivers and streams.

Sensory disturbance: To upset the natural and especially ecological balance or relations of[2] due to auditory, olfactory or visual stimuli.

Shoreline wetland: A wetland where surface water level fluctuations, water flows and ice scouring are the dominant driving factors.

Staging: The tendency of migratory organisms to stop temporarily (**stage**) at a site during migration; **staging areas** are stop-over sites where, for example, migratory birds will rest, forage, and/or moult along the course of a migration route.

Study area: The geographic limits within which effects on a VEC (valued environmental component) or supporting topic is assessed.

Substrate: the material forming the streambed; also solid material upon which an organism lives or to which it is attached. See also bed material.

Supporting topic: A Project assessment topic of concern that is of lesser interest than a VEC.

Terrestrial: Belonging to, or inhabiting the land or ground.

Terrestrial habitat: Terrestrial habitats include forests and grasslands (among others). They are typically defined by factors such as plant structure (trees and grasses), leaf types (*e.g.*. broadleaf and needleleaf), plant spacing (forest, woodland, savannah) and climate.

Terrestrial plant: Any plant adapted to grow on the land or areas with water that is typically shallower than 2 m.

Transect: A line located between points and then used to investigate changes in attributes along that line.

Trophic level: one of the hierarchical strata of a food web characterized by organisms that are the same number of steps removed from the primary producers.

Uncertainty: For the purpose of the EIS, the lack of certainty or a state of having limited knowledge where it is difficult or impossible to exactly describe an existing state or a future outcome, or there is more than one possible outcome. In environmental assessment, uncertainty is not knowing, with high confidence, the nature and magnitude of environmental effects or the degree to which mitigation measures would prevent or reduce adverse effects.

Upland: A land ecosystem where water saturation at or near the soil surface is not sufficiently prolonged to promote the development of wetland soils and vegetation.

Valued environmental component: Any part of the environment that is considered important by the proponent, public, scientists and government involved in the assessment process. Importance may be determined on the basis of cultural values or scientific concern.

Waterbody: An area with permanent surface water

Wetland: A land ecosystem where periodic or prolonged water saturation at or near the soil surface is the dominant driving factor shaping soil attributes and vegetation composition and distribution. **Peatland**s are a type of wetland.

Zone of Influence: The spatial areas outside of the Project Footprint where direct and indirect effects occur. The location and size of the zone of influence varies for each ecosystem component of interest.

9.2 ACRONYMS

Acronym/Abbreviation	
ATK	Aboriginal Traditional Knowledge
CNP	Cree Nation Partners
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
E	East
e.g.	example
EIS	Environmental impact statement
EL&P	Manitoba Hydro Environmental Licensing and Protection Department
EnvPP	Environmental protection plan
et al.	and others
etc.	and so forth
FRI	Forest Resource Inventory
FSL	Full supply level
GIS	Geographical Information System
GPS	Global positioning system
GS	Generating Station
i.e.	in other words
KCNs	Keeyask Cree Nations communities including Tataskweyak Cree Nation (TCN), War Lake First Nation (WLFN), York Factory First Nation (YFFN), and Fox Lake Cree Nation (FLCN)
MESA	Manitoba Endangered Species Act
PEMP	Physical Effects Monitoring Program
RMA	Resource Management Area
SARA	Species at Risk Act
SLRMA	Split Lake Resource Management Area
TEMP	Terrestrial Environment Monitoring Plan
TE SV	Terrestrial Environment Supporting Volume
VEC	Valued Environmental Component
W	West
Unit	
hectare	ha

hour	h
kilometer	km
kilometer per hour	kph
meter	m
megawatt	MW
square kilometer	km^2

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