Keeyask Generation Project

Environmental Impact Statement

Response to EIS Guidelines

KEEYASK

Hydropower Limited Partnership

June 2012

CHAPTER 8

MONITORING AND FOLLOW-UP

KEEYASK
Hydropower Limited Partnership

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8.0 MONITORING AND FOLLOW-UP

The Keeyask Hydropower Limited Partnership (the Partnership) is committed to constructing and operating the Keeyask Generation Project (the Project) in a manner that facilitates the long-term integrity and productivity of the economy, environment, and natural resources, and that safeguards human health. Manitoba Hydro's continual improvement of environmental performance is demonstrated through the company's Environmental Management System, which is ISO 14001 certified. The Keeyask Cree Nations (KCNs) share a worldview that includes a responsibility to care for and protect *Askiy* - the word used by the *Ininewak* for the whole of the land, water, animals and plants, including medicines, people, all other creatures and the interconnections between all things. The KCNs' shared worldview and the Manitoba Hydro environmental commitments are described in Chapter 2: Partners' Context, Worldviews and Evaluation Process.

An Environmental Protection Program (the Program), comprised of three different types of plans (Environmental Protection Plans, Environmental Management Plans and Environmental Monitoring Plans), is being developed to mitigate, manage and monitor potential environmental effects during the construction and operation phases of the Project. While the description of the existing environment is based on measurement and observation, the description of effects and the mitigation designed to address adverse effects are predictions based on technical scientific studies and analysis, professional experience and Aboriginal traditional knowledge (ATK). Monitoring is required to determine if the predictions are correct and if the mitigation packages are working as anticipated. The Program will be used to test predictions made in this Environmental Impact Statement (EIS). If unexpected effects are detected through monitoring, the Program will outline the process for determining what actions, including adaptive management where possible, will be taken.

The Program facilitates the ability of the Partnership (and its contractors) to meet the environmental commitments set out in this EIS and the regulatory requirements.

8.1 INTRODUCTION AND APPROACH

The EIS guidelines require a description of a follow-up program to be undertaken to test and respond, if necessary, to predictions and the effectiveness of mitigation in reducing environmental and social effects of the Project. The purpose of this Chapter is to outline such a program and describe how it will be implemented and how information resulting from the program will be applied.

This chapter provides the reader with information of the planned Environmental Protection Program and its associated plans that describe extensive monitoring and follow-up activities associated with the construction and operation of the Project.

8.1.1 OVERVIEW OF THE PROGRAM

The Project is a large, complex development that has been the subject of over a decade of study and planning, including both its engineering design and its potential effects on the environment. The planning phase also includes ways to prevent, mitigate or compensate for adverse effects the Project might bring forth. Predictions of effects have been made based on technical science and ATK, and mitigation plans have been developed to address potential adverse effects of the development. These predicted potential effects and planned mitigation measures have been set out in Chapters 6 and 7. The environmental assessment has been comprehensive and has utilized the best scientific practice and ATK, comprised of generations of knowledge and experience. However, due

> to factors such as the complexities of ecosystems and difficulties predicting details of future development, all environmental assessments (EA) involve some level of uncertainty regarding the identification of environmental effects, the assessment of their significance and the effectiveness of mitigation measures. The Act implicitly recognizes uncertainty by requiring a follow-up program for all projects that undergo an assessment by comprehensive study or a review panel[1].

The monitoring and follow-up process addresses areas where uncertainty exists in the predictions, including those areas where there are differences between the predictions based on technical analysis and ATK. Variations in predicted and actual results identified through monitoring will be assessed by the Partnership and regulatory authorities for follow-up actions such as mitigation adjustments and adaptive management.

The development of the Program is an incremental process culminating with incorporation of terms and conditions of the environmental licence and other regulatory approvals into the appropriate plans. As a result, details associated with the Program components will be provided subsequent to the submission of this EIS. This chapter provides an outline of the Program. The form of the Program is illustrated below in Figure 8-1.

[1] CEAA Operational Policy Statement: Adaptive management Measures under the *Canadian Environmental Assessment Act*.

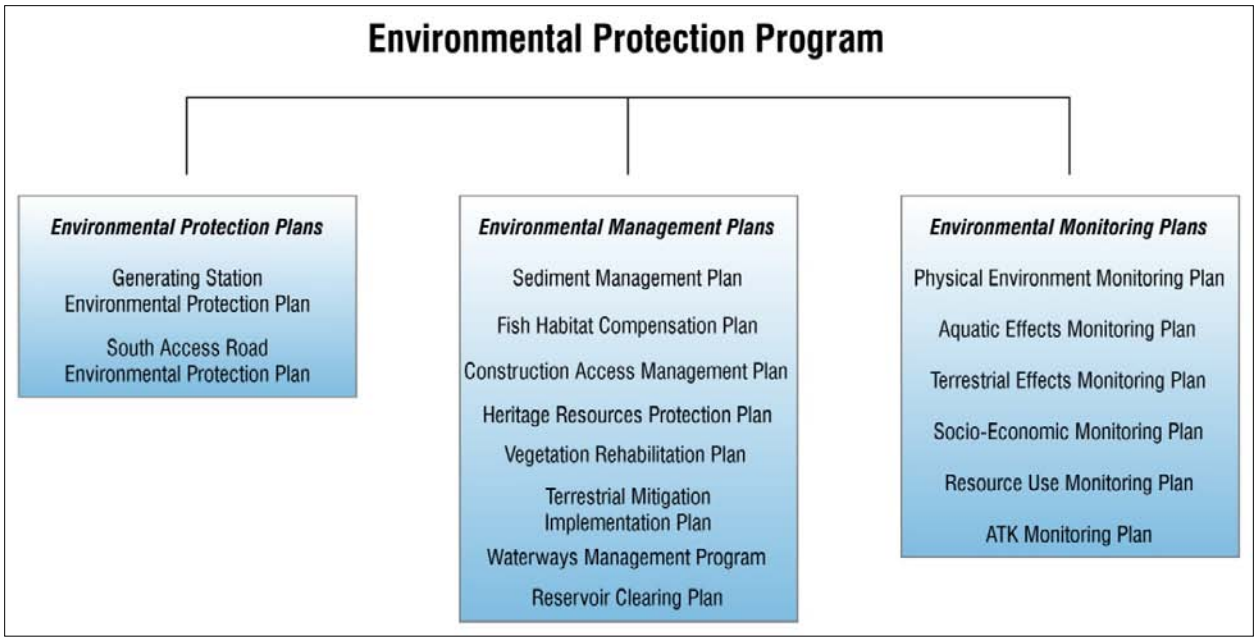

Figure 8-1: Environmental Protection Program

8.1.2 APPROACH OF ENVIRONMENTAL PROTECTION PROGRAM

The Program described in this chapter is based on the assessment information provided in Chapters 6 and 7 and associated supporting volumes, construction and operational activities and regulatory requirements. The preliminary plans developed as part of the Program will undergo regulatory review. Input received during the regulatory review process will be incorporated into the documents prior to their being finalized.

The Program includes the "who, what, when, where and how" aspects of protecting and monitoring the environment within the area affected by the Project. Responsibility for implementation of the Program is a delegated responsibility from the Partnership to Manitoba Hydro.

The Program will contain three different types of plans:

- Environmental Protection Plans (EnvPPs), which 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 the south access road;
- Environmental Management Plans, which are focused on specific environmental issues, such as sediment management, access management, fish habitat and heritage resources. The plans often include both mitigation and monitoring to determine if the mitigation implemented is successful; and

- Environmental Monitoring Plans, which describe the activities to be undertaken for monitoring the effects of construction and operational activities on the biophysical, physical and socio-economic environments.

Each plan includes an implementation strategy. Depending upon the plan, the implementation strategy may include contractual arrangements, training, compliance inspections and communication of results.

8.1.2.1 ENVIRONMENTAL PROTECTION PLANS

An EnvPP provides detailed site-specific environmental protection procedures to be implemented by the construction team or operational personnel during various phases of the Project. They are designed for use as reference documents providing the best management practices to meet or exceed regulatory requirements. The purpose of EnvPPs is to guide construction and operational activities to have the least adverse effect on the environment and to remain within limits set by various environmental guidelines, regulations and approvals. EnvPPs are organized by construction component, highlighting measures to reduce the impact of a specific work activity (*e.g.*, tree clearing or cofferdam construction). Environmental Protection Plans will be in place for construction of the generating station and the south access road.

The Partnership requires all contractors and site staff to work in compliance with the EnvPP. The contents of the EnvPP include, but are not necessarily limited to the following:

- Mitigation measures – includes those measures outlined in Chapters 6 and 7, licence requirements and other sources that apply to construction;
- Erosion and sediment control measures – engineering drawings and/or specifications for materials and methods to be applied to prevent erosion and sediment input from land into water;
- Timing restrictions – restrictions on construction activities (*e.g.,* blasting) for wildlife nesting, calving and spawning;
- Environmental sensitivity maps – detailed maps of the construction area that show setback distances from environmental features that are particularly sensitive (*e.g.,* caribou calving areas and rare habitat features). They provide a visual tool for the contractors that assist them in applying appropriate mitigation to reduce negative effects;
- Emergency response plan – spill containment equipment, clean up and communication protocols;
- Regulatory guidance documents – pertinent federal and provincial guidelines for work being undertaken;
- Permits, licences, and authorizations received; and

- Inspection sheets – an environmental officer will monitor contractors' compliance with the mitigation measures.

8.1.2.2 ENVIRONMENTAL MANAGEMENT PLANS

Environmental management plans focus on minimizing effects of a specific environmental parameter. They outline specific actions that must be taken during construction and in some cases following construction to mitigate Project effects. Many of the management plans include monitoring to determine success of the actions taken and to determine other actions that need to be undertaken (adaptive management).

The following eight environmental management plans will be developed for the Project:

- Sediment Management Plan – Describes procedures to measure the concentration of suspended sediments in the Nelson River due to construction of the Project during in-stream construction and Project commissioning, as well as prescribing actions to be taken if total suspended solids (TSS) due to the Project exceed target levels.
- Fish Habitat Compensation Plan – Describes works to be installed that compensate for the loss of fish habitat due to the Project and monitoring and follow up activities to determine the success of the structures and modifications if required.
- Construction Access Management Plan – Describes specific measures that will be undertaken to ensure the safe, coordinated access for authorized users during construction to protect the area's natural resources, including limiting worker impact on the surrounding area, heritage resources, local communities, fisheries, and wildlife resources.
- Heritage Resource Protection Plan – Describes procedures for responding to heritage resources or human remains found during construction and operation of the Project.
- Vegetation Rehabilitation Plan – Describes where Project areas not needed for operation will be decommissioned and rehabilitated.
- Terrestrial Mitigation Implementation Plan – Describes how the mitigation measures outlined particularly in the terrestrial section of Chapter 6 will be implemented, including wetland restoration or creation plans and bird nesting structures, *etc.*
- Waterways Management Program – A Program created as part of the JKDA committing the Keeyask Hydropower Limited Partnership to activities during both pre and post-flooding to have a multi-purpose boat patrol to monitor shoreline and waterway activities, provide for safe travel and plan and implement protective measures for historic resources.

- Reservoir Clearing Plan – A Program created as part of the JKDA that describes in detail the areas that will be flooded in the reservoir that must be cleared of trees prior to impoundment and the methods to be undertaken to do so.

8.1.2.3 ENVIRONMENTAL MONITORING PLANS

Environmental monitoring plans are designed to measure the actual effects of the Project, test predictions or identify unanticipated effects. They will also include monitoring commitments made to regulatory authorities. During the course of the environmental assessment, various requirements for monitoring were identified. The Project-specific monitoring plans are developed and presented in the context of the environmental components: physical, aquatic, terrestrial and socio-economic environments and resource use. The monitoring plans will cover the construction phase and continue into the operation phase as appropriate.

The following environmental monitoring plans will be developed (more specific details are provided in Section 8.2):

- Physical Environment Monitoring Plan – Describes monitoring for the effects on physical environmental components such as water regime, erosion and sedimentation.
- Aquatic Effects Monitoring Plan – Describes monitoring for the effects on aquatic environmental components such as water quality, aquatic habitat, lower trophic levels, and fish community.
- Terrestrial Effects Monitoring Plan – Describes monitoring for the effects on terrestrial environmental components such as birds, amphibians, wildlife, plants and terrestrial habitat.
- Socio-Economic Monitoring Plan – Describes monitoring for the effects on components such as employment, business opportunities, traffic, and safety.
- Resource Use Monitoring Plan – Describes monitoring of effects to resource use (this plan will consist largely of a compilation of monitoring activities done as other parts of the program, *e.g.*, reporting on ice conditions (Physical Environment Monitoring Plan and how it affects resource users).
- ATK Monitoring Plans – Describes monitoring by and for the KCNs communities related to the effects on their relationship with *Askiy*.

8.1.2.4 MONITORING PRINCIPLES

In order to achieve a level of consistency and appropriate focus, the development and implementation of monitoring plans will be guided by the following principles:

- KCNs involvement and ATK will be utilized along with technical science and recognized as an integral component of the monitoring (see Section 8.2.7);
- Monitoring design will include, where applicable, the nature of potential adaptive management measures;
- Monitoring activities will make use of both qualitative and quantitative methodologies as appropriate; and
- Where monitoring reveals that a prediction is incorrect or that mitigation measures are not working as designed, appropriate follow-up action will be initiated and continued until the situation is deemed to be stable/satisfactory by the Partnership and the regulators.

Although monitoring activities will be developed related to needs identified for specific Valued Environmental Components (VECs) or supporting topics, efforts will be made to facilitate efficient implementation by:

- Setting practical temporal and spatial scope for the monitoring based on the effects of the Project; and
- Building strategic and logistical efficiencies into fieldwork and data collection activities to serve multiple monitoring programs.

8.1.3 ADAPTIVE MANAGEMENT

In the context of the Project, adaptive management is a planned process for responding to uncertainty or to an unanticipated or underestimated Project effect. It is the application of information learned from monitoring actual Project effects and comparing them with predicted effects. If there is a variance between the actual and the predicted effects, a determination will be made as to whether modifications are required in existing mitigation measures, other actions are necessary to address the variance or, in cases where there may be no mitigating options available, the appropriate information is disseminated in a timely manner.

Where appropriate, potential adaptive management activities are included in the monitoring and management plans that are being developed as a part of the Environmental Protection Program or through an on-going process during monitoring in consultation with regulators.

The EA undertaken for the Project has utilized technical science and ATK, most prominently from the four KCNs whose current and traditional homelands are in the Keeyask area. Mitigation measures have been carefully planned and designed to prevent or reduce, to the extent practical, adverse effects from the Project. As noted previously, however, there are uncertainties associated with predicted effects and the effectiveness of planned mitigation measures. To address these uncertainties many of the predictions and

mitigation measures are supported by monitoring to enable verification of the predictions and timely response when actual results differ from the predictions.

Where there is a reasonable understanding of an area of uncertainty such that a choice was made between two or more potential outcomes, it is reasonable to have prepared, in advance, a conceptually appropriate response should one of the optional outcomes occur. However, in other cases, the effects will be unforeseen and the response will be designed upon receipt and analysis of the data/information resulting from the monitoring. In a few cases, especially in areas of greater certainty, the monitoring is for information and communication purposes and there may be no potential adaptive management opportunities available.

Examples of each of these situations are set out below:

1. The following are examples of predetermined adaptive measures:
    - Terrestrial habitat – For rehabilitated areas that are not regenerating as anticipated, additional and/or different rehabilitation prescriptions will be applied.
    - Suspended sediment – Construction activities will be modified or temporarily suspended if suspended sediment concentrations increase above specified limits.
    - Lake sturgeon spawning structure – If the structure is not as effective as anticipated, alternative measures such as redesigning or providing additional spawning areas would be implemented.
    - Lake sturgeon stocking program – The number and/or age of fish released and the location where they are released could be modified, if required.
    - Colonial waterbirds – The use of tern nesting structures and any new/enhanced nesting islands by waterbirds will be monitored and, if required, the number and location of nesting structures will be adjusted and the enhancement of other existing islands/reefs will be considered.
2. The following are examples of adaptive management to be designed based on monitoring:
    - Fish passage – Fish will be moved upstream past the generating station as part of the planned trap/catch and transport program and their movements monitored. Modifications to this program cannot be determined until information on fish movements both downstream and upstream of the generating is obtained, including the response of the fish that are transported as part of the trap/catch and transport program.
    - Employment – Concerns respecting employment will be reviewed by the Advisory Group on Employment, which may make recommendations to the Project Manager and, if deemed necessary by the Partnership, to determine if any new measures are appropriate.

- Worker interaction – Should interaction between the construction workforce and local population be identified as a problem, the Partnership will work with the appropriate local authorities to evaluate the situation and develop strategies to reduce the likelihood of future occurrences.

3. The following are examples of monitoring with no probable adaptive measures available:

   - Methylmercury in fish in the reservoir and Stephens Lake – Concentrations of methylmercury will be measured so that increases and eventual decreases can be recorded, but there is no means by which elevated levels can be changed. Results will be communicated to resource users and health service providers, so that consumption of fish from these areas can be modified appropriately.
   - Water quality effects in the flooded areas during operation – There is uncertainty in the magnitude of predicted increases in sediments, nutrients, and metals, and decreases in dissolved oxygen in the terrestrial flooded area. Water quality will be monitored to improve predictive ability for future projects and assist in interpreting effects to the biological community; however, these effects to water quality cannot be mitigated.
   - Dissolved oxygen and temperature – If dissolved oxygen concentrations are lower and temperatures are higher than predicted in back bays of the reservoir, no practical means are available to improve conditions.

8.2 OVERVIEW OF MONITORING ACTIVITIES

8.2.1 PHYSICAL ENVIRONMENT MONITORING

The expected changes in the physical environment resulting from the construction and operation of the Project are described in Section 6.3. There are uncertainties in the predictive models and the effectiveness of planned mitigation measures. KCNs are also uncertain about the effectiveness of the planned mitigation measures and ATK anticipates a larger spatial extent of effects, extending upstream to Split Lake and downstream to the Nelson River estuary. For these reasons, a comprehensive Physical Environment Monitoring Plan as outlined in Table 8-1 and Table 8-2 will be implemented during construction, the initial operating period (considered to be the first five to ten years) and beyond if necessary to verify predicted results and the effectiveness of planned mitigation measures. Specific monitoring requirements and the need to continue or discontinue any monitoring during construction and the initial operating period, or over a longer period, will be routinely assessed based on monitoring results and programs adjusted accordingly.

Table 8-1: Monitoring and Follow-Up Plans for the Physical Environment

Supporting Topic or VEC	Issue/Rationale	Monitoring	Timelines
Climate (supporting topic)	• To verify GHG emissions from the Project.	• CO2 and CH4 GHG emissions from the reservoir will be monitored once the reservoir is fully impounded.	During the initial operating period.
Water regime (supporting topic)	• To verify results of water level predictions.	• Monitoring of water levels at various locations upstream and downstream of Keeyask.	During construction and operation.
	• To verify predictions on depth and velocity.	• Monitoring of water depth and velocity under a variety of flow conditions during open water upstream and downstream of Keeyask	During the initial operating period.
Ice regime (supporting topic)	• To verify results of ice regime predictions.	• Annual observation of ice formation and breakup upstream and downstream.	During construction and initial operating period.
Shoreline erosion (peat and mineral) (supporting topic)	• To verify results of erosion modeling, rates and locations of peat resurfacing, shoreline peat land breakdown, and shoreline recession.	• Monitoring of shoreline erosion and peat breakdown.	During construction and the initial operating period.
Sedimentation (supporting topic)	• To verify sedimentation predictions.	• Monitoring of sediment parameters (*e.g.*, suspended sediment, turbidity, bedload) upstream and downstream of Keeyask. • Monitoring of sediment deposition upstream and downstream of Keeyask.	During construction and the initial operating period.

Table 8-2: Monitoring and Follow-Up Plans for Physical Environment Parameters Conducted to Support Other Monitoring Programs*

Supporting Topic or VEC	Issue/Rationale	Monitoring	Timelines
Woody debris (supporting topic)	• Debris may pose a potential risk to the safety of river travel and other activities.	• Monitoring of debris in the waterways to record the amount of debris being removed and the locations from which it was removed by the Waterways Management Program (WMP).	During construction and operation.
Dissolved oxygen and water temperature (supporting topic)	• To verify predictions of dissolved oxygen and water temperature in backbays.	• Monitoring of DO and water temperature in the reservoir mainstem and flooded backbays and downstream of Keeyask.	During the initial operating period.
Total dissolved gas pressure (supporting topic)	• To verify the predicted effect of the Project on total dissolved gas pressure.	• Monitoring of total dissolved gas pressure upstream and downstream of Keeyask under a variety of flow conditions.	During the initial operating period.

*Note: These physical environment parameters are being collected solely to support other monitoring programs and will not be reported in physical environment reports.

8.2.2 AQUATIC ENVIRONMENT MONITORING

Predicted changes and planned mitigation for the aquatic environment are described in Section 6.4. In general, predicted changes in the technical assessment are based on models and observed changes in other reservoirs. Adverse effects are expected primarily within the reservoir, with fewer changes predicted downstream in Stephens Lake. Based on planned mitigation, it is expected that, in the long term, the aquatic environment will be productive and support VEC fish species upstream and downstream of the GS. However, given uncertainties in the predictive models and planned mitigation measures, conditions during construction and operation need to be monitored, and mitigation measures modified if required. ATK anticipates a much larger spatial extent of effects, extending upstream to Split Lake and downstream in the Nelson River past the Kettle GS. In addition, the KCNs are not confident that the reservoir will evolve to be a productive environment, and have expressed uncertainty as to the effectiveness of planned mitigation measures. For these reasons, monitoring for certain components of the aquatic environment will be extended beyond the area where effects are predicted in the technical assessment.

As described in the AE SV, the Aquatic Effects Monitoring Plan provides a detailed description of the rationale, schedule, sampling locations and sampling methodology for the technical monitoring that is proposed for the Project. This plan will be implemented in consultation with regulators, in particular DFO and MCWS, and it is expected that it will change based on regulatory review and on-going review of monitoring results. A description of the ATK-based monitoring is provided in Section 8.2.7. A brief summary of the AEMP is provided in Table 8-3.

Table 8-3: Monitoring and Follow-Up Plans for the Aquatic Environment

Supporting Topic or VEC	Issue / Rationale	Monitoring	Timelines
Water quality (VEC)	• To address the effectiveness of management measures (*e.g.*, sediment management plan) during construction. • To verify that predicted effects in the reservoir are not greater than anticipated and that effects do not extend upstream of the reservoir or downstream of the GS (apart from reduced suspended sediment concentrations).	• Sampling at sites along the Nelson River from immediately downstream of the Kelsey GS to downstream of the Kettle GS. • In addition, targeted sampling programs in relation to specific activities (instream construction) and site-specific effects (*e.g.*, inputs from flooded terrain).	Multiple times each year during construction and during the initial 10 years after full supply level is reached; less frequently for the following 20–30 years, depending on results.
Aquatic habitat (Supporting Topic)	• To verify modeled predictions for post-Project habitat, in particular in relation to sensitive or highly altered habitats (*e.g.*, lake sturgeon spawning and young-of-the year habitat, terrestrial flooded areas). • To confirm that conditions on constructed habitat areas are suitable and do not deteriorate over time (*e.g.*, potential for sedimentation).	• Sampling in flooded terrestrial and aquatic habitat for changes in substrate type and the development of rooted aquatic plant beds. • Monitoring in the main channel and on constructed habitats for changes in substrate type.	Annually for the first three years after full supply level is reached, and then at least every five years for the following 20- 30 years, depending on results.

Table 8-3: Monitoring and Follow-Up Plans for the Aquatic Environment

Supporting Topic or VEC	Issue / Rationale	Monitoring	Timelines
Aquatic vegetation, phytoplankton, zooplankton and macro-invertebrates (Supporting Topic)	• To confirm predicted response of biota to construction activities (*e.g.*, sediment inputs). • To determine whether plants and invertebrates colonize the flooded areas as predicted. Productivity may be limited by habitat conditions in the initial years after full supply level is reached.	• Sampling downstream of in-stream construction activities. • Sampling at all habitat types in the reservoir after full supply level is reached, in particular in flooded areas.	Annually of selected components during instream construction and the first three years after full supply level is reached and then at least every five years for the following 20-30 years, depending on results.
Fish community (Supporting Topic) (additional monitoring for VEC species listed below)	• To provide information on responses to specific construction activities (*e.g.*, sediment inputs, blasting). • To provide information on the fish community within the reservoir, and in Split and Stephens lakes. • Determine effectiveness of mitigation and compensation measures. • To address concerns of the KCNs, all fish species (as well as general fish health) in the reservoir will be monitored.	• Sampling in relation to specific environmental changes during construction (*e.g.*, fish would be sampled upstream and downstream of the construction site for analysis of gill histology if peak sediment inputs exceed target levels). • Monitoring the relative abundance and composition of the fish community, as well as indicators of fish health after full supply level is reached.	During construction, in relation to specific activities that may affect fish distribution and health. Annually during the first three years after full supply level is reached and then at least every five years for the following 20-30 years, depending on results.

Table 8-3: Monitoring and Follow-Up Plans for the Aquatic Environment

Supporting Topic or VEC	Issue / Rationale	Monitoring	Timelines
Lake sturgeon (VEC)	• To address uncertainties with respect to the behavioural response of sturgeon to disturbances during construction and the initial period of reservoir creation. • To assess the need for further mitigation with respect to fish passage. • To determine whether predicted effects to spawning activity and young-of-the-year survival occur during construction and after full supply level is reached and record performance of constructed habitat. • To determine whether the reservoir and Stephens Lake provide suitable habitat for sub-adult and adult lake sturgeon, as predicted in the EIS. • To determine the survival of stocked fish. • To determine whether predicted positive effects to the regional sturgeon population occur.	• Monitoring movement of adult lake sturgeon using long-term telemetry tags, including individuals transported from Stephens Lake to the reservoir. • Monitoring of fish behaviour immediately downstream and upstream of the GS to provide information for the modification of upstream and downstream fish passage methods, if required. • Monitoring of the frequency and survival of fish passing the station via the turbines or spillway. • Sampling for spawning and young-of-the-year sturgeon in predicted locations after full supply level is reach, including constructed habitats. Continue year-class strength monitoring in Gull and Stephens lakes. • Sampling of sub-adult and adult lake sturgeon and measurement of relative abundance, condition and other indicators of fish health, and population size. • Marking and sampling of stocked fish. • Sampling to estimate population size in the region (Kelsey GS to Kettle GS).	Varying frequency depending on the program. Annually of selected components during in-stream construction and the first three years after full supply level is reached and then at least every five years for the following 20-30 years, or longer, depending on the program and results. Monitoring of lake sturgeon populations will continue in conjunction with mitigation programs such as stocking until stocking/habitat mitigation create self-sustaining populations.

Table 8-3: Monitoring and Follow-Up Plans for the Aquatic Environment

Supporting Topic or VEC	Issue / Rationale	Monitoring	Timelines
Lake whitefish, walleye (pickerel), and northern pike (jackfish) (VEC) Note that these species are also addressed in the fish community, above).	• To verify that habitat to support spawning is available in the reservoir and downstream, and that constructed habitat is functioning as intended. • To assess the need for further mitigation with respect to fish passage.	• Monitoring for spawning activity/larval fish, at locations where these would be expected to occur post-Project, including on constructed habitats. • Monitoring of fish movements, including individuals transported from Stephens Lake to the reservoir. • Monitoring of fish behaviour immediately downstream and upstream of the GS to provide information for the modification of upstream and downstream fish passage methods, if required. • Monitoring of the frequency and survival of fish passing the station via the turbines or spillway.	Sampling for spawning and larval fish would occur at a minimum every two years during construction and annually during the first three years after full supply level is reached and then at a minimum every five years for the following 20-30 years, depending on results. Fish movement studies would occur for the first five years after full supply level is reached; further monitoring would depend on results and subsequent development of fish passage.

Table 8-3: Monitoring and Follow-Up Plans for the Aquatic Environment

Supporting Topic or VEC	Issue / Rationale	Monitoring	Timelines
Mercury in fish flesh (Supporting Topic)	• To verify predicted increases in mercury levels in fish in the Keeyask reservoir and Stephens Lake and address uncertainties regarding the duration and magnitude of increases. • Results will be used in health communications undertaken in mercury-in-food programs outlined in the Socio-Economic and Resource Use mitigation sections in Chapter 6.	• Monitoring of mercury levels in selected fish species in the Keeyask reservoir and Stephens Lake. • To address concerns of the KCNs, sampling will also be conducted in Split Lake and tributaries such as the Aiken River where no increase is predicted.	Annually after full supply levels are reached until maximum levels are recorded and then every three years thereafter until concentrations reach stable levels.

8.2.3 TERRESTRIAL ENVIRONMENT MONITORING

Monitoring will be required to verify the long-term effects of the Project on the terrestrial environment. As outlined in Table 8-4, the recommended monitoring and follow-up includes both VECs and some supporting topics during the construction and operation phases. While this table provides a preliminary summary of the topics requiring monitoring, information on the methods and procedures are outlined in the Terrestrial Environment Supporting Volume and will be provided in further detail in a Terrestrial Effects Monitoring Plan.

Monitoring is planned for situations where ATK and technical assessments differ, where a prediction has substantial uncertainty, or where a difference between predicted and actual residual effects could substantially alter the effects assessment.

Table 8-4: Monitoring and Follow-Up Plans for the Terrestrial Environment

Supporting Topic / VEC	Issue / Rationale	Monitoring	Timelines
Terrestrial Habitat and Ecosystems			
Terrestrial habitat (Supporting Topic)	• To verify the predicted amounts and composition of direct and indirect habitat loss, alteration and disturbance during construction and operation.	• Measure direct habitat loss and disturbance, by habitat type, in the Project Footprint.	Once at the end of construction.
		• Measure indirect habitat loss and change, by habitat type, in areas where indirect effects are predicted to occur.	Periodically during first 30 years of operation, with frequency decreasing over time.
		• Monitor under storey vegetation and soil effects in areas where indirect effects are predicted to occur.	Periodically during first 30 years of operation, with frequency decreasing over time.
	• To verify the effectiveness of rehabilitation efforts in temporarily cleared or modified areas.	• Collect vegetation and soils data in the rehabilitated areas to assess degree of habitat recovery.	Periodically after regeneration is implemented, until vegetation is successfully established.
Ecosystem Diversity (VEC)	• To verify that the priority habitat patches that are to be avoided are not disturbed.	• Monitor to confirm avoidance of priority habitat patches.	Regularly during clearing activities.
Fire regime (Supporting Topic)	• To confirm the Project does not create large accidental fires.	• In the event that any accidental Project-related fires occur, document the amount and composition of affected habitat and subsequent regeneration.	Contingent upon the nature of the event, if it occurs.

Table 8-4: Monitoring and Follow-Up Plans for the Terrestrial Environment

Supporting Topic / VEC	Issue / Rationale	Monitoring	Timelines
Intactness (VEC)	• To confirm that portions of trails that are blocked and revegetated are successfully regenerating.	• Collect vegetation data in the rehabilitated portions of linear features to assess degree of vegetation regeneration.	Periodically after regeneration is implemented.
	• To verify Project effects on linear feature density and core area abundance.	• Measure linear features associated with Project development.	Once at end of construction.
		• Monitor the contribution of habitat recovery to increased core area using terrestrial habitat monitoring data.	Once after revegetation is successfully established.
Wetland function (VEC)	• To verify predicted Project effects on wetlands.	• Monitor the amount and composition of inland wetland loss and alteration.	See Terrestrial Habitat Monitoring Section.
		• Sample shoreline wetlands in areas that may be indirectly affected by groundwater changes and edge effects.	Periodically during first 30 years of operation, with frequency declining as reservoir expansion slows.
	• To verify effectiveness of wetland mitigation measures.	• Collect vegetation, soils and other environmental data in the wetland mitigation areas to assess degree of wetland development.	Periodically after measures are implemented, as needed to assess success of wetland establishment.

Table 8-4: Monitoring and Follow-Up Plans for the Terrestrial Environment

Supporting Topic / VEC	Issue / Rationale	Monitoring	Timelines
TERRESTRIAL PLANTS			
Priority plants (VEC)	• To verify that the priority plant patches that are to be avoided are not disturbed. • To verify predicted effects on priority plant species.	• Monitor to confirm avoidance of priority plant patches. • Monitor effects on priority plants and their habitat using terrestrial habitat monitoring data.	Regularly during clearing activities. See Terrestrial Habitat Monitoring Section.
Invasive plants (Supporting Topic)	• To verify that mitigation measures limit the further introduction and spreading of invasive non-native plants.	• Conduct invasive plant surveys within and near to the Project Footprint.	Periodically during construction and first five years of operation.
AMPHIBIANS			
Priority amphibians (Supporting Topic)	• To verify predicted effects of the Project on amphibians.	• Monitor changes in the distribution of amphibians within the Regional Study Area.	Annually during the first three years of operation and periodically until shoreline wetland habitat re-establishes.
BIRDS			
Mallard and Canada Goose (VECs)	• To verify predicted effects of the Project on waterfowl.	• Monitor to assess abundance and distribution of waterfowl within the Regional Study Area.	Annually during the first three years of operation, and periodically until shoreline wetland habitat re-establishes.
	• To verify success of nesting platforms/boxes to enhance mallard breeding habitat in suitable wetlands.	• Monitor success of nesting platforms/boxes.	Annually during the first two years of deployment.

Table 8-4: Monitoring and Follow-Up Plans for the Terrestrial Environment

Supporting Topic / VEC	Issue / Rationale	Monitoring	Timelines
Bald Eagle (VEC)	• To verify predicted effects of the Project on bald eagle.	• Monitor to assess the distribution and abundance of bald eagles along the Nelson River.	Annually during the first three years of operation.
	• To verify success of any nesting platforms established to replace nests disturbed by the Project.	• Monitor to assess the effectiveness of any installed nesting platforms.	Annually for the first three years following platform installation.
Olive-sided Flycatcher (VEC), Rusty Blackbird (VEC), Common Nighthawk (VEC), and Other Species at Risk (Supporting Topic).	• To verify the predicted effects of the Project on bird species at risk.	• Monitor listed species' abundance and distribution within the Regional Study Area.	Annually during construction and for the first three years of operation.
Colonial waterbirds (Supporting Topic)	• To verify the predicted effects of the Project on colonial waterbirds.	• Monitor abundance and distribution of colonial waterbirds within the Regional Study Area.	Annually during the first three years of operation.
	• To verify the effectiveness of mitigation measures to offset losses in colonial waterbird breeding habitat.	• Monitor the effectiveness of mitigation measures implemented for colonial waterbirds.	Annually during the first three years of operation or until mitigation measures are deemed to be successful.

Table 8-4: Monitoring and Follow-Up Plans for the Terrestrial Environment

Supporting Topic / VEC	Issue / Rationale	Monitoring	Timelines
Ruffed grouse (Supporting Topic)	• To verify the predicted effects of the Project on ruffed grouse.	• Monitor ruffed grouse abundance and distribution along north and south access roads and in other suitable ruffed grouse habitat located within the Regional Study Area.	Annually during construction. Annually during the first three years of operation, and periodically until disturbed habitat re-establishes.
MAMMALS			
Caribou (VEC)	• To address uncertainties with respect to cumulative effects and the viability of caribou populations in the lower Nelson River region.	• Monitoring vital measures of caribou populations including productivity, mortality and recruitment using sample counts and records from the lower Nelson River Area.	Regularly during construction and continuing for up to 30 years of operation, depending on results.
	• To verify direct and indirect predicted effects to summer resident caribou and habitat and evaluate performance of mitigation measures.	• Sampling, site records and mapping for summer resident caribou calving and rearing habitat effects in areas associated with Project effects.	Regularly during construction and continuing for up to 30 years of operation, depending on results.
	• To address uncertainties associated with productivity, distribution, movements and accidental caribou mortality.	• Collect caribou activity, movements, and mortality data in areas where effects are predicted to occur.	Regularly during construction and continuing for up to 30 years of operation, depending on results.

Table 8-4: Monitoring and Follow-Up Plans for the Terrestrial Environment

Supporting Topic / VEC	Issue / Rationale	Monitoring	Timelines
Moose (VEC)	• To determine whether predicted effects to moose habitat occur and to evaluate performance of mitigation measures.	• Sampling, site records and mapping for moose habitat effects in predicted locations.	Regularly during construction and continuing for up to 30 years of operation, depending on results.
	• To address uncertainties associated with productivity, distribution and accidental moose mortality.	• Collect moose activity, movements, and mortality data in areas where effects may occur.	Regularly during construction and continuing for up to 30 years of operation, depending on results.
	• To address uncertainties with respect to the redistribution of harvest effort affecting the viability of moose in Split Lake Resource Management Area.	• Monitor vital measures of moose population including productivity, mortality and recruitment using sample counts and records from the Split Lake Resource Management Area. • Use special moose management units, harvest strategies and models to project the future population and adjust protocols as needed.	Regularly during construction and continuing for up to 30 years of operation, depending on results.

Table 8-4: Monitoring and Follow-Up Plans for the Terrestrial Environment

Supporting Topic / VEC	Issue / Rationale	Monitoring	Timelines
Beaver (VEC)	• To verify whether predicted effects to regional beaver population occur.	• Monitor beaver population in locations within the Project Footprint and the Regional Study Area post-impoundment using counts.	Regularly during construction and continuing for up to 15 years of operation, depending on results.
		• Monitor the removal of beaver (and muskrat) during reservoir clearing and adjusting protocol as needed.	Regularly during reservoir clearing activities.
	• To address uncertainties of future habitat quality in the reservoir, wetland mitigation areas, and adjacent creeks.	• Monitor habitat changes during operation using mapping.	Periodically during operation, for up to 15 years.
Rare or Regionally Rare Species (Supporting Topic)	• To address uncertainties with respect to the behavioural response of little brown myotis and wolverine associated with Project disturbances.	• Monitor little brown myotis and wolverine abundance in the Gull and Stephens lakes area using sample counts and marking measures.	Annually during construction, annually during the first five years of operation, and then every five years for up to 30 years of operation, depending on results.

Table 8-4: Monitoring and Follow-Up Plans for the Terrestrial Environment

Supporting Topic / VEC	Issue / Rationale	Monitoring	Timelines
Gray Wolf and Other Predators (Supporting Topic)	• To address uncertainties with respect to the behavioural response of predators associated with disturbances and habitat effects.	• Monitoring gray wolf and black bear distribution and abundance using sample counts and marking measures.	Annually during construction, annually during the first five years of operation, and then every five years until caribou and moose monitoring is concluded.
Other Mammals (Supporting Topic)	• To confirm effects predictions where problem wildlife control measures are implemented in construction camps and worksites.	• Monitor relocation and mortality of black bear, gray wolf, red fox, arctic fox and beaver using site records.	Regularly during construction.
Mercury in Wildlife (Supporting Topic)	• To verify predicted increases and address uncertainties regarding duration of mercury levels in country foods and top-level predators during operation.	• Monitor mercury levels in beaver, muskrat, river otter and mink, and in other wild game samples voluntarily supplied in the Keeyask and Stephens Lake areas, and in nearby off-system areas where no increase in mercury levels is predicted.	Annually during operation until maximum levels are reached and then every three years until concentrations reach pre-impoundment levels (up to 30 years).

8.2.4 SOCIO-ECONOMIC ENVIRONMENT MONITORING

Monitoring of socio-economic effects will be organized into a coordinated Socio-Economic Monitoring Plan (SEMP), the details of which will be developed after the Project has been filed. It will be adjusted upon receipt of the Project's approvals and licence to incorporate any required terms of the license. The program will define in detail the process, scope, methods, documentation and application of the socio-economic monitoring for the Project. It will be part of a larger strategy to identify where the proposed approaches to conducting the Project and mitigating its effects may have to be adjusted in order to address observed Projects effects that do not align with what had been predicted. This adaptive management approach will be inherent in the design and implementation of the SEMP.

The plan will be designed to satisfy licence conditions and to address monitoring proposals set out in the EIS.

The SEMP will be developed by the Partnership with representatives of the KCNs expected to play a central role in its development and implementation.

Table 8-5 summarizes the monitoring and follow-up programs for the socio-economic environment; more information is provided in the Socio-Economic Supporting Volume under each VEC.

Table 8-5: Monitoring and Follow-Up Plans for the Socio-Economic Environment

Supporting Topic or VEC	Issue/Rationale	Monitoring	Timelines
Economy[1]			
Employment and Training Opportunities (VEC)	• To determine overall employment outcomes of Project construction, with particular emphasis on Aboriginal and northern resident employment outcomes. • To determine extent to which recipients of pre-Project training (HNTEI) participated in Keeyask construction jobs, and received on the job training.	• Track total opportunity available including the amount (*e.g.*, total person years) and type (*e.g.*, job classification) of work available, and the total number of hires and total number of employees. Breakdown by Aboriginal, non-Aboriginal, northern, Manitoban and CBN region. • Collect trainee status by on-site contractors and Manitoba Hydro, including information on trainee participation in HNTEI pre-Project training, trainee designation and apprenticeship level at the point of hire, at the point of separation and at any point during employment when reclassification occurs.	During the construction period.
Business Opportunities (VEC)	• To track construction business outcomes of Project construction, with particular focus on the KCNs, Aboriginal and northern business participation, and to understand any indirect business opportunities generated as a result of Project-related expenditures in Gillam, Thompson and the KCNs communities.	• Track direct purchases made by the Partnership. At the peak of the General Civil Contract, undertake a Key Person Interview program in Thompson, Gillam and each of the KCNs communities to ascertain any indirect business opportunities generated as a result of the Project. • Conduct KPIs of key participants involved in managing the DNCs.	Annually during construction. Business Survey: Yr 3 or 4: mid-way through the general civil contract, coinciding with peak construction activity.

[1] Socio-economic monitoring is not required for Economy VECs Cost of Living and Resource Economy during the Construction phase. Monitoring for Economy VECs is not required during the operation phase.

Table 8-5: Monitoring and Follow-Up Plans for the Socio-Economic Environment

Supporting Topic or VEC	Issue/Rationale	Monitoring	Timelines
Income (VEC)	• To determine the levels of employment income generated by Project construction, particularly for KCNs and CBN region employees.	• Estimate total labour income generated by the Project based on total person-years of employment generated by the Project and applicable wage rates from the BNA. Break down of labour income by the KCNs, CBN region, Aboriginal, non-Aboriginal, northern, Manitoban.	During the construction period.
Population, Infrastructure and Services[1]			
Population (Supporting Topic)	• Confirm extent of Project-induced in-migration in the KCNs communities and Gillam. • Confirm EA prediction that there is minimal Project-induced in-migration in the KCNs communities and Gillam. • Population growth in Gillam in response to operation employment will increase the demand for housing, infrastructure and services.	• Track overall trends in the population of Gillam and the KCNs communities, including in- and out-migration. If construction related in-migration is greater than anticipated, undertake KPIs to understand the influence of the Project on population. • Monitor population change in Gillam to enable service providers and community planning process to plan and respond to anticipated change.	During the construction period. During the operation period (first five years).
Housing (VEC)	• To confirm EA prediction of minimal demand on housing in KCNs communities and Gillam due to the Project. • To determine any Project effects on infrastructure and provision of services.	• Gillam: Demand for housing is considered in the Gillam Land Use Planning process. Monitor population changes in Gillam. See above. • KCNs: Conduct a one-time set of KPI's with representatives of the Housing Authorities in the KCNs. Monitor population changes. See above.	During the construction period.

[1] Monitoring is not required for Population, Infrastructure and Services VECs of Land and Transportation Infrastructure during the construction phase; and for Land during the operation phase.

Table 8-5: Monitoring and Follow-Up Plans for the Socio-Economic Environment

Supporting Topic or VEC	Issue/Rationale	Monitoring	Timelines
Housing – Gillam (VEC)	• Increases in population in Gillam re: operation employment; part of planning process.	• Demand for housing is considered in the Gillam Land Use Planning process. Monitor population changes in Gillam. See above.	During the operation period (first five years).
Infrastructure and Services - KCNs (VEC)	• To confirm EA prediction of minimal effect on KCNs infrastructure and services due to the Project.	• Conduct a one-time set of KPIs with contractors and service providers in the KCNs communities.	2nd or 3rd year of construction period.
Infrastructure and Services – Gillam (VEC)	• To understand the effects from an influx of non-local construction workers on demand for infrastructure and services.	• Work with Manitoba Hydro, Town of Gillam and Fox lake Cree Nation to assess related effects from an influx of workers.	During the construction period.
	• Increases in population in Gillam re: operation employment; part of planning process.	• Assess demand on infrastructure and services in Gillam to feed into ongoing community planning process.	During the operation period (first five years).
Transportation Infrastructure (VEC)	• Concerns about the predicted effects on open water levels at Split Lake that could affect ferry service, landing sites and the winter road.	• Monitor water levels at Split Lake and inform TCN and YFFN of the results.	During the operation period– annually.

Table 8-5: Monitoring and Follow-Up Plans for the Socio-Economic Environment

Supporting Topic or VEC	Issue/Rationale	Monitoring	Timelines
Personal, Family and Community Life – Construction Phase[1] [2]			
Public Safety and Worker Interaction (VEC)	• There is potential for adverse interactions between non-local construction workers and TCN and FLCN Members and Gillam residents. • Mechanism to help identify incidents and enable process to address problems with construction workforce.	• Manitoba Hydro, working with FLCN and TCN (where appropriate) will determine the best mechanism to track the number and type of adverse incidents on a regular basis, including possible discussion with local justice and social agencies in the gathering of data. • Work closely with RCMP in Thompson, Gillam and other KCNs communities.	During the construction period.
Travel, Access and Safety (VEC)	• Community concern regarding increased traffic on PR 280. • Community concern regarding ice and open water travel. • To monitor the safety of open water, ice crossing and ice trails. • Travel, access and safety are concerns for KCNs Members who use Split and Gull lakes for traditional activities. • To monitor the safety of open water, ice crossing and ice trails	• **Road travel** – Track statistics collected by MIT on traffic-related incidents and complaints on PR280. • **Ice and Open water travel** – Monitoring from Split Lake to Stephens Lake is contained under the Waterways Management Program Phase I (Sch. 11-2 of the JKDA). • Monitoring from Split Lake to Stephens Lake is contained under the Waterways Management Program Phase II (Sch. 11-2 of the JKDA).	During the construction period. During the operation period.

[1] Socio-economic monitoring for the Personal Family and Community Life VECs Community Health, Mercury and Human Health and the Way the Landscape Looks (Aesthetics) is not required during the construction phase. The Way the Landscape Looks is expected to be addressed in the ATK monitoring program.
[2] Monitoring for the Personal Family and Community Life VECs Governance, Goals and Plans, Community Health, Public Safety/Worker Interaction and The Way the Landscape Looks (Aesthetics) is not required during the Operation Phase. Governance, Goals and Plans and the Way the Landscape Looks are expected to be addressed through the ATK monitoring program.

Table 8-5: Monitoring and Follow-Up Plans for the Socio-Economic Environment

Supporting Topic or VEC	Issue/Rationale	Monitoring	Timelines
Culture and Spirituality (VEC)	• Uncertain how much the construction phase of the Project will affect culture of KCNs. • Uncertain about how employment experience during Project construction will affect the culture of workers and their families.	• Adverse Effects Agreements have been negotiated with each of the KCNs based on each community's assessment of the Project's potential effects, including any interference with its traditional customs and practices. On an annual basis, each community undertakes its own internal evaluation of the AEA offsetting programs and determines whether they continue to address the adverse effects of the Project. If required, these agreements provide flexibility for the AEA offsetting programs to be modified to more adequately address Project effects as they are experienced.	KCNs community Review and Evaluation: During the construction period.
		• Conduct a worker and family survey of a sample of KCNs workers employed on Project construction and their families to assess employment experience such as cross-cultural awareness training, work and camp life, counselling, ceremonies, effects on family, community life and traditional life.	Worker family survey in the third year of construction.
	• Uncertain how much operation of the Project will affect the culture of KCNs.	• As noted above under construction, the AEAs have been negotiated with each of the KCNs and include an annual evaluation; as well as flexibility to modify the AEA offsetting programs to more adequately address Keeyask Generation Project effects as they are experienced.	Operation period.

Table 8-5: Monitoring and Follow-Up Plans for the Socio-Economic Environment

Supporting Topic or VEC	Issue/Rationale	Monitoring	Timelines
Mercury and Human Health (VEC)	• Increase in mercury levels in country foods used by local communities; mitigation component.	• Mercury monitoring undertaken under the Aquatic and Terrestrial Monitoring Programs re: country foods. • Collection on voluntary basis of samples of wild game, waterfowl and plants for mercury testing to confirm mercury concentrations remain acceptable for domestic consumption. • Conduct periodic survey of consumption of country food in KCNs communities.	Post-impoundment: on annual basis or until mercury levels return to baseline conditions. For food consumption survey, every five years starting in 2022.

8.2.5 RESOURCE USE MONITORING

Many of the monitoring needs for resource use overlap with monitoring for other environmental components due to resource user reliance on fish (Section 8.2.2), plants (Section 8.2.3), birds (Section 8.2.3) and mammals (Section 8.2.3) for domestic and commercial pursuits and the ability to safely access resource harvest areas (Section 8.2.6).

Though all KCNs Members have been provided substitute opportunities to participate in AEA offsetting programs in unaffected locations, it is expected that domestic resource use will continue to be practiced in the resource use Local Study Area by authorized KCNs resource users. The Keeyask Generation Project Construction Access Management Plan (Construction AMP) is expected to limit workforce fishing and prohibit harvest of wildlife by not allowing recreational vehicles (*i.e.,* ATVs and boats) and firearms on the Project site (as per Keeyask Camp Rules). The Construction AMP will also prevent unauthorized use of the area by the public. Despite these measures, KCNs concerns remain with respect to workforce harvest competing for domestic resources. Hunting of wildlife resources will be prohibited on site by the construction workforce, therefore only workforce harvest of fish will be monitored.

Harvesting activities conducted by domestic resource users authorized to harvest within the Project site will be monitored at the north and south access gates. Annual interviews will also be conducted with the Environmental Officer (see Section 8.3.2 for definition) to investigate and monitor any fish harvest by construction workers.

In the resource use Regional Study Area, where increasing domestic resource use is expected from AEA offsetting program participation, monitoring traditionally practiced by KCNs resource users is expected to result in sustainable use of resources. The CNP have also developed moose and fish harvest sustainability plans to address the long-term sustainability of these species in the Split Lake RMA in cooperation with the Split Lake Resource Management Board.

Increasing populations in Gillam in the operations phase may increase recreational resource use, which is expected by the KCNs to compete for domestic resources. Monitoring of non-Aboriginal recreational harvest undertaken by Gillam residents is not proposed, as this is a provincial management responsibility. Local resource management boards (Split Lake, York Factory and Fox Lake), which are comprised of representatives from First Nations, Provincial Government and Manitoba Hydro, are expected to provide the venue for communication on resource harvesting conflicts and allow for appropriate responses to potential increases in recreational resource use during construction and operation. It should be noted that after conservation, domestic resource by Aboriginal people is given priority by provincial management agencies when allocating resources for harvest.

Resource use observations and ATK may be communicated through the ATK monitoring site visits as part of ATK monitoring programs (Section 8.2.7).

Table 8-6 provides a summary of monitoring and follow-up program timelines for issues that may affect resource use and associated environmental components.

Table 8-6: Monitoring and Follow-Up Program for Resource Use

Supporting Topic or VEC	Issue/Rationale	Monitoring	Timelines
Domestic Fishing (VEC)	• To determine if the construction workforce is increasing competition for fish resources that, in turn, would affect domestic fishing success.	• As part of the resource use monitoring plan, ongoing access gate monitoring will document harvest within the Project site. • Annual interviews with the Environmental Officer will investigate and monitor workforce harvest.	During the construction period.
Domestic Fishing (VEC)	• To understand changes to the quality and availability of fish resources for domestic use.	• See aquatic environment monitoring plan for fish abundance (fish community and lake sturgeon) and quality monitoring (mercury in fish flesh). • See socio-economic monitoring plans (mercury and human health).	During the operation period.
Domestic Fishing (VEC); Domestic Hunting and Gathering (VEC)	• To address resource user safety and access to domestic harvest locations as potentially affected by changing water and ice conditions in the local study area.	• Waterways Management Program will monitor issues relating to travel, access and safety.	During the construction and operation periods.
Domestic Hunting and Gathering (VEC)	• To understand if construction and operation disturbances will reduce local study area wildlife abundance, in turn, potentially affecting hunting success.	• See terrestrial monitoring plans (moose, caribou, beaver, mallard and Canada goose) population monitoring.	During the construction and operation periods.

8.2.6 HERITAGE RESOURCES MONITORING

As outlined in Chapter 6, heritage resources are at risk during construction and operation phases of the Project. Mitigation measures, as outlined in the Heritage Resources Protection Plan and periodic shoreline surveys implemented with the Waterways Management Program, will assist in protecting or removing existing heritage resources when avoidance or buffering of these sites may not be possible. Environmental Officers will be trained to identify heritage resources and offer proper courses of action, which will include contacting the Project Archaeologist and appropriate government authorities. When required, the Project Archaeologist will implement prescribed archaeological protection measures. However, uncertainty exists as to the effect on undiscovered heritage resources over the duration of the Project's lifespan. The KCNs communities have provided information on the presence of burial locations within the Gull Lake area, which have not yet been physically located. On-going monitoring as a mitigation measure is a viable solution for unknown heritage resources and/or burial locations.

Table 8-7: Monitoring and Follow-Up Program for Heritage Resources

Supporting Topic or VEC	Issue/Rationale	Monitoring	Timelines
Heritage Resources (VEC)	• Loss of heritage resources, unknown heritage resources and/or burials; mitigation component. • Reclamation of disturbed sites along shorelines. • Protection and preservation of heritage resources.	• As part of the Waterways Management Program (JKDA, Schedule 11-2), monitor shoreline, plan and implement the remaining protection and preservation measures at high priority, spiritually and culturally significant, historical or heritage sites. • Implement Heritage Resources Protection Plan upon potential discovery of heritage resources or human remains.	• During the construction period Continual involvement of Environmental Officers. • Periodic shorelines surveyed, as required. • During the operation Phase: Periodic shorelines surveyed, as required.

8.2.7 ABORIGINAL TRADITIONAL KNOWLEDGE MONITORING PROGRAMS

Each of the KCNs is working with Manitoba Hydro (on behalf of the Partnership) to develop community-specific ATK monitoring programs for the Keeyask Generation Project. These ATK monitoring programs will be based on Cree perspectives and understandings about the potential effects of the Project, and related activities will take place at key milestones during the Project's construction and operation phases. KCNs involvement in Project monitoring will facilitate capacity building by providing employment and training opportunities for KCNs Members in environmental and socioeconomic monitoring over the life of the Project and into the future.

It is expected that ATK monitoring will involve the development and implementation of annual monitoring programs based on construction and/or operational activities and related community concerns about potential effects. As part of these programs, the following types of activities are anticipated:

- Site visits by Elders, resources users and others to observe and communicate conditions on lands and waters before, during and following key Project milestones. The results of these site visits will ensure that ATK is an integral part of assessing the accuracy of predictions in the Project EIS, and the efficacy of mitigation measures. The involvement of youth will also ensure that the ATK held by Elders and resources users is passed on to the next generation, and that there is long-term continuity in the monitoring programs.
- Community-based activities to monitor socio-economic Project effects on the personal, family and community lives of Members, and the effectiveness of related mitigation measures. This could include working directly with community agencies to ensure a coordinated response to Project effects at the community level and activities such as conducting workshops and key-person interviews.
- The involvement of community Members in scientific-based monitoring programs. The KCNs will continue to be actively involved in the development of scientific monitoring programs through their participation in the Partnership through the Monitoring Advisory Committee (MAC) and the Board of Directors. Community Members will also continue to work on field programs with the scientific monitoring team.
- Facilitating communication among Hydro and its Partner communities through various forums, such as open houses, for the purpose of keeping community Members updated on Project activities, adverse effects, and proposed mitigation strategies.

8.3 ENVIRONMENTAL PROTECTION PROGRAM IMPLEMENTATION

As noted previously, the Environmental Protection Program is multi-faceted and includes implementation of an Environmental Protection Plan, management plans, additional Project mitigation activities outlined in the EIS and ongoing Project monitoring. Various aspects of these activities will take place prior to and during Project construction and many will continue into Project operation.

Manitoba Hydro, acting on behalf of the Partnership, is responsible for overall implementation of the Environmental Protection Program. In this capacity, Manitoba Hydro will be guided both by discussions with the KCNs through the Project's MAC and the Partership Board of Directors, and ongoing communication with Regulators.

The following sections describe implementation of the various activities to be undertaken as part of the Environmental Protection Program, starting with a focus on the communication mechanisms in place to ensure ongoing involvement of regulators and the KCNs.

8.3.1 PARTNERSHIP AND REGULATORY COMMUNICATION

8.3.1.1 WORKING AS PARTNERS

The Partnership is committed to environmental stewardship and have agreed that long-term success of the Environmental Protection Program requires equal consideration of both ATK and technical science. Although Manitoba Hydro is responsible for construction and operation of the Keeyask Generation Project, the Partnership has put mechanisms in place to ensure that all partners are involved in implementing the Program and reviewing Program outcomes. There are two key mechanisms in place to accomplish this goal: 1) the Keeyask MAC and the Partnership Board of Directors; and 2) ATK monitoring to be undertaken by each of the KCNs. Together, it is anticipated that these two activities will improve understanding and respect among the partners, foster an environment of sharing and collaboration in undertaking environmental stewardship activities and lead to the implementation of a more robust environmental protection program.

The MAC is an advisory committee to the Partnership Board of Directors and will review the outcomes of programs outlined in the Environmental Protection Program and, if appropriate, may provide advice and recommendations to the Partnership on additional or alternative mitigation measures that may be required. The committee will be comprised of Manitoba Hydro representatives involved in the Environmental Protection Program and participants from each of the KCNs. It is anticipated that the outcomes of both the technical science and ATK monitoring programs, as well as those of other aspects of the

Environmental Protection Program, will be reviewed and discussed at the MAC. In this way, the MAC will provide a forum for ensuring collaboration among all partners on these activities and an opportunity to review and discuss outcomes from both a western science and ATK perspective. 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 communities, regulators and the general public.

8.3.1.2 WORKING WITH REGULATORS

Licences and regulatory approvals for the proposed Project require environmental and compliance monitoring and production of monitoring reports. Regulatory authorities will be notified by the Project Manager or by a delegate about situations where the environment is affected that were not previously predicted. Full cooperation will be given to environmental regulators conducting inspections and a Project staff member will be available to escort the regulator around the construction site and answer questions and discuss concerns as required.

8.3.1.3 REPORTING

In fulfillment of the Project *Environment Act* licence and *Fisheries Act* authorization requirements, reports will be submitted by Manitoba Hydro (on behalf of the Partnership) to Manitoba Conservation and Water Stewardship and Fisheries and Oceans Canada in accordance with the schedule outlined in these approvals. Reports that will be prepared include:

- A compliance monitoring report in connection with the EnvPP;
- Technical reports of the activities and results of the monitoring plans including the outcomes of both ATK and western scientific monitoring; and
- In addition to the reports prepared for the regulator a summary document of all monitoring activities will be prepared annually by the Partnership for the KCNs and the general public.

8.3.2 ENVIRONMENTAL PROTECTION PLAN IMPLEMENTATION

For the Keeyask Generation Project two EnvPPs are being prepared to assist in reducing the impact of construction activities. One plan will cover the work associated with the generating station and the other is for the South Access Road. Manitoba Hydro's Construction Manager is ultimately responsible for ensuring that the Project is compliant with the EnvPPs and all regulatory requirements. An Environmental Officer will monitor and report on contractors' compliance with the EnvPPs.

8.3.2.1 TENDERS AND CONTRACTS

All environmental requirements, including the EnvPP, will be included in the tender packages and the binding construction contracts for the Project work. This will require contractors to budget and base their work on meeting the environmental requirements and conducting activities in an environmentally acceptable manner. The selected contractors will be required to comply with and implement the plans.

8.3.2.2 TRAINING AND ORIENTATION

Prior to construction, an environmental orientation program will be developed and delivered to contractors and Manitoba Hydro Project personnel so they are aware of the environmental requirements and sensitivities associated with the Project. They will be familiar with components of the Environmental Protection Program, particularly the EnvPP, as it has direct implications on day-to-day work. Periodic update sessions will occur during construction on specific environmental issues.

The Environmental Officer will receive specific training to fulfill the position including use of the EnvPP, how to perform inspections, reporting incidents and routine reporting, the protocol for emergency response, as well as what resources are available if an environmental issue arises.

8.3.2.3 INSPECTION AND COMPLIANCE

Environmental inspection is an essential function in environmental protection and implementation of mitigation measures. The Environmental Officer will be responsible for undertaking compliance monitoring of the work site to confirm that activities are not in contravention with regulatory requirements or the EnvPP. The inspector will visit work sites daily and record all inspection activities. Any incidents of concern or non-compliance will be recorded and reported so that appropriate action to rectify the problem is implemented.

8.3.2.4 WORKING WITH CONTRACTORS

Meetings will be held regularly with the Project Manager, Resident Engineer, Environmental Officer and contractors to discuss environmental issues and what needs to be done to protect the environment as construction progresses. Compliance with the EnvPP and regulatory requirements will also be included in these meetings.

8.3.2.5 WORK STOPPAGES

Construction activities may be stopped in the event unexpected effects are occurring to the environment or when mitigation measures are proving to be insufficient to prevent a

potential effect. For example, if a heritage resource is discovered, work in the immediate area must be stopped and the find reported.

The Project Manager, Resident Engineer, and Environmental Officer will all have authority to issue stop work orders. The contractor can also voluntarily stop work where circumstances indicate that some environmental damage or harm to heritage resources could result from continuation of a particular activity. Work will not resume until the situation has been assessed and resolved.

8.3.3 IMPLEMENTATION OF MANAGEMENT PLANS

All of the various management plans will be the responsibility of Manitoba Hydro to implement. Various environmental staff both at the construction site and in the Winnipeg office, under the direction of the Project Manager, will be assigned to oversee the implementation of the plans and make the necessary arrangements to have the required processes, procedures, equipment and human resources in place to have them fulfilled.

The plans will each have their own schedule for implementation based on how they are linked to construction activities; the Construction Access Management Plan will be implemented from the first day of construction until it is complete, *i.e.*, the Sediment Management Plan will be operational in advance of any in-stream construction activities in the Nelson River; the Reservoir Clearing Plan will be implemented in the three years prior to impoundment of the reservoir; and the Vegetation Rehabilitation Plan will be activated when areas that have been cleared for construction activities are no longer required.

8.3.4 MONITORING IMPLEMENTATION

The Partnership is proposing to undertake comprehensive monitoring for construction and into operations. Monitoring is outlined in Section 8.2 above and includes both technical, western-science based monitoring and ATK-based monitoring.

The KCNs will be involved in implementation of these monitoring programs in two ways: leading the ATK monitoring program, and working side-by-side with scientists as part of technical science based monitoring. Manitoba Hydro will be responsible for making the arrangements to have the scientific expertise required to carry out the monitoring in place, primarily through contractual arrangements with consulting companies. Manitoba Hydro will oversee the monitoring activities to ensure that the work is being conducted in accordance with the finalized, regulator approved plans.

CHAPTER 9

SUSTAINABLE DEVELOPMENT

KEEYASK
Hydropower Limited Partnership

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9.0 SUSTAINABLE DEVELOPMENT

9.1 INTRODUCTION AND PURPOSE

This chapter considers the Keeyask Generation Project (the Project) in the context of sustainable development. It considers the Project relative to the Keeyask Cree Nations' (KCNs) involvement and to federal, provincial and Manitoba Hydro's goals, principles and guidelines for sustainable development.

9.2 CONTEXT FOR SUSTAINABLE DEVELOPMENT

"*Our Common Future*," the 1987 report of the World Commission on Environment and Development, more commonly known as the Bruntland Commission, popularized "sustainable development" as both a phrase and a concept. The definition coined by that commission has remained as the most common definition among the many that have been framed since:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- "The concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and
- "The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs."

As a concept, sustainable development has relevance to most major developmental and planning decisions in that it integrates social, environmental and economic considerations into decision making. Since 1987, much thought and debate has been focused on how to implement this concept in diverse circumstances and geographic regions.

Both the federal and provincial governments have instituted sustainable development as policy goals for future development in Canada and Manitoba, respectively. To this end the Government of Canada has embedded the goal of achieving sustainable development into the "Preamble" and "Purposes" sections of the *Canadian Environmental Assessment Act* (CEAA; s.c. 1992, c.37) and has enacted a *Federal Sustainable Development Act (FSDA)*. The Government of Manitoba has enacted the *Sustainable Development Act* for the same purpose within the province. Each of these acts sets out principles and guidelines or goals to guide the implementation of sustainable development. Manitoba Hydro has also adopted a sustainable development policy and a set of principles and guidelines that guide its activities.

9.2.1 KEEYASK CREE NATIONS PRINCIPLES AND INVOLVEMENT

The World Commission on Environment and Development put forward the proposition that the empowerment of vulnerable indigenous people is a touchstone of a sustainable development policy (United Nations World Commission on Environment and Development 1987)[1]. The Commission was concerned that the gradual advance of development into remote regions would increase the vulnerability of indigenous people as they were often left out of the processes of economic development. The Keeyask Cree Nations (KCNs), in each of their respective Environmental Evaluation Reports, have shared their perspectives about how past hydroelectric projects have affected their communities.

In contrast to the past, the Project puts into practice the proposition of greater empowerment of local indigenous people. The KCNs Partners have been directly involved in planning the Project and the environmental impact assessment, emphasizing the importance of respecting Mother Earth in a manner consistent with their Cree worldview. As expressed in their philosophy of *mino pimatisiwin* (or "living the good and honourable life"), everything is interrelated and must be respected. Each KCN received funding to undertake its own evaluation of the Project and to involve its community in the decision as to whether or not to become a partner in the initiative. The KCNs' Environmental Evaluation Reports speak to a desire to restore harmony and balance with Mother Earth, to protect the environment, which is broadly defined to include people's wellbeing, to maintain and enhance their culture and traditions, and to provide greater hope and opportunities for future generations. The decision to support the Project was difficult, requiring much study, discussion and soul searching. Ultimately, the decision to proceed was based on evaluations of social, economic and environmental considerations, and a focus on both present and future generations to whom the benefits of the Project would accrue. In deciding to proceed with the Project, the KCNs saw an opportunity for current and future generations to benefit economically and to build their communities' capacity and self-sufficiency, while respecting and maintaining their Cree values, teachings, identity, culture and traditional knowledge.

As partners, the KCNs have been influential in identifying and advocating for measures to lessen the adverse environmental effects of the Project, and they will undertake appropriate activities, including rituals and ceremonies to show respect and give thanks to *Askiy* at major Project milestones. The Adverse Effects Agreements (AEAs) will provide continued access to healthy country foods and programs to maintain and strengthen their traditions and culture. The KCNs will also have a hands-on role in monitoring and follow-up activities, opportunities for training and employment on the Project and in the operation of existing hydroelectric projects, and a continuing role as board members of the Partnership, and they will receive long-term income from their investment in the Project. All of this is consistent with the World Commission's view of the role of indigenous people in sustainable development.

[1] Our Common Future; United Nations World Commission on Environment and Development, 1987, page 116 (Chapter 4, paragraph 78).

Consistent with their Cree worldview, the KCNs established the following Principles for Respect for the Land, to be followed in the construction and operation of the Project, and had these principles embedded into the Joint Keeyask Development Agreement (JKDA):

Principles Regarding Respect for the Land

- Adopting measures that increase, to the extent ecologically reasonable, the abundance of species and/or growing conditions for species that have special social or economic importance for the Keeyask Cree Nations.
- Employing strategies that "go with" rather than "go against" nature, as they have a much higher probability of success.
- Planting species and promoting site conditions that are widespread in the sub-region in which the Keeyask Project is located, rather than planting species and promoting site conditions that may be popular in more southern areas.
- Being respectful of the Keeyask Cree Nations' traditional relationships with the land.

For a more in-depth description of the KCNs worldview, Project evaluation and decision-making, see Chapter 2, the KCNs' Environmental Evaluation Reports, and the video, *Keeyask – Our Story*.

9.2.2 THE KEEYASK GENERATION PROJECT AND THE FEDERAL SUSTAINABLE DEVELOPMENT STRATEGY – GOALS

The Federal Sustainable Development Strategy (FSDS) is mandated by the *Federal Sustainable Development Act*, which received Royal Assent on June 26, 2008. The FSDA responds to a number of international commitments Canada has made to produce such a strategy, including at the Earth Summit in Rio de Janeiro, Brazil, in 1992 and at the 2002 World Summit on Sustainable Development in Johannesburg, South Africa.

The purpose of the FSDA is "to provide the legal framework for developing and implementing a Federal Sustainable Development Strategy that will make environmental decision-making more transparent and accountable to Parliament." The basic principle is that the Government of Canada accepts that sustainable development is based on an ecologically efficient use of natural, social and economic resources and acknowledges the need to integrate environmental, economic and social factors in the making of all decisions by government. In October 2010, the report titled "Planning for a Sustainable Future: A Federal Sustainable Development Strategy for Canada" was published. The Federal Sustainable Development Goals are set out below, followed by a description of how the Project addresses each goal.

Goal 1 – Climate Change: *Reduce greenhouse gas emission levels to mitigate the severity and unavoidable impacts of climate change.*

The Project will contribute to substantial reductions in greenhouse gases (GHG) by displacing fossil fuel electricity generation.

A detailed Life Cycle Assessment was conducted by the Pembina Institute in order to estimate the GHG emissions resulting from the construction, land use change, operation, and decommissioning of the Project. The resulting emissions are extremely low relative to other forms of generation. An equivalent amount of electricity, produced by a combined cycle natural gas generating station during one year of operation would result in more than double the entire life cycle emissions estimated to be associated with the Keeyask Project over a 100 year period. Since the Project will displace gas and coal generation, primarily in the U.S. Midwest, it will contribute to substantial GHG reductions. The Project is estimated to displace 30 million tonnes carbon dioxide equivalent during the first 10 years of operation.

Goal 2 – Air Pollution: *Minimize the threats to air quality so that the air Canadians breathe is clean and supports healthy ecosystems.*

There are very few air emissions from a hydroelectric generating station; compared to coal and gas fired generating stations, emissions from Keeyask would be considered minimal.

Goal 3 – Water Quality: *Protect and enhance the quality of water so that it is clean, safe and secure for all Canadians and supports healthy ecosystems.*

While the creation of the reservoir will result in some long-term effects to water quality, the area will generally remain suitable for aquatic life. As well, a series of good construction methods – *e.g.,* the use of double-sided cofferdams that will reduce the release of fine sediments into the water – will help maintain water quality and avoid /minimize adverse effects to aquatic life.

Goal 4 – Water Availability: *Enhance information to ensure that Canadians can manage and use water resources in a manner consistent with the sustainability of the resource.*

Manitoba Hydro has been studying northern rivers and streams for over four decades and, in conjunction with KCNs, has undertaken Project specific studies for more than a decade. This has added numerous data to pre-existing information.

Goal 5 – Wildlife Conservation: *Maintain or restore populations of wildlife to healthy levels.*

Maintaining and restoring wildlife populations in the area have been major components of the planning and environmental assessment of the Project. Through a combination of mitigation measures that includes habitat replacement, a hatchery and stocking programs, the existing stocks of lake sturgeon should not only be maintained but improved. As well, mammal resources are not likely to be significantly affected by the Project, and Cree Nation Partners (CNP) are developing moose and fish harvest sustainability plans to address long term sustainability of those resources in the Split Lake Resource Management Area. Caribou

will be monitored to guide programs to maintain the sustainability of the regional populations.

Goal 6 – Ecosystem / Habitat Conservation and Protection: *Maintain productive and resilient ecosystems with the capacity to recover and adapt; and protect areas in ways that leave them unimpaired for present and future generations.*

Special efforts have been undertaken to avoid or minimize Project effects to habitat and ecosystem intactness and to replace the loss of important habitat types; for example, sensitive terrestrial habitat sites were avoided to the extent feasible when routing roads and locating borrow and excavated material placement areas.

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

Goal 7 – Biological Resources: *Sustainable production and consumption of biological resources are within ecosystem limits.*

The Project is being planned consistent with the need for sustainable production and consumption of biological resources. For example, sustainable harvest plans for moose and fish are being developed by CNP for the Split Lake Resource Management Area, which is consistent with the TCN Access and Healthy Food Fish programs under the TCN AEA and the Improved Access Program and the Community Fish Program under the WLFN AEA.

Goal 8 – Greening Government Operations: *Minimize the environmental footprint of government operations.*

Although not a government operation, a number of measures have been taken to minimize the Project footprint. The best example of this approach was the decision to reduce the size of the Project. At one time, a high-head project with over 180 km^2 of initial flooding was under consideration; in contrast, the Project now being proposed by the Partnership will produce 45 km^2 of initial flooding.

9.2.3 KEEYASK AND MANITOBA SUSTAINABLE DEVELOPMENT PRINCIPLES AND GUIDELINES

In 1998, the Province of Manitoba enacted the *Sustainable Development Act* to "create a framework through which sustainable development will be implemented in the provincial public sector and promoted in private industry and in society generally" (Government of Manitoba 1998). Attached as schedules to the Act was a set of Principles and Guidelines of Sustainable Development to guide the behaviour and decision making of all government departments, agencies and Crown corporations.

9.2.3.1 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

The following sets out these Principles, and how the Project has been planned and designed and will be constructed and operated in conformity with the province's directive.

Integration of Environmental and Economic Decisions*: Economic decisions should adequately reflect environmental, human health and social effects. Environmental and health initiatives should adequately take into account economic, human health and social consequences.*

The Project has been designed to provide long term electricity benefits to Manitoba and export customers and to enhance quality of life through the provision of clean affordable energy. Hydroelectric energy is a much cleaner, healthier option than coal and gas, the main alternatives for generating electricity in the mid-continent market area.

The Project is being designed and will be constructed using methods to minimize effects on the environment and the local KCNs communities, and to maximize economic and social benefits for the communities, northern Manitoba, and the whole province. Job training, increased employment, and the associated improvement in the standard of living are positive, long lasting social outcomes. As an example of the attention given to human and social consequences, programs under the AEAs provide the KCNs with programs to address cultural objectives and access to a healthy food supply consistent with their traditional lifestyle.

Stewardship: *The economy, the environment, human health and social well-being should be managed for the equal benefit of present and future generations. Manitobans are caretakers of the economy, the environment, human health and social well-being for the benefit of present and future generations. Today's decisions are to be balanced with tomorrow's effects.*

The Project, by design, will provide hydroelectric energy benefits, including reduced greenhouse gas emission benefits, for many generations into the future. From a regional perspective, the KCNs have been very involved in planning the Project and in the environmental assessment and they will continue to have a direct role in the monitoring and follow-up programs. Intergenerational benefits are a mainstay of the KCNs' decision to participate in the Partnership. At the same time, the KCNs are equally attentive to applying their worldview to avoid and reduce environmental effects and demonstrate respect to Askiy. Partnership income will be beneficial to generations of KCNs community Members, and will provide sustained revenues to the broader Manitoba economy. Stewardship of the environment will continue through ongoing monitoring and follow-up programs involving KCNs communities and Manitoba Hydro, and AEA programs will enhance the cultural identity and connection to the land of present and future generations which in turn will contribute to social well being.

Shared Responsibility and Understanding: *Manitobans should acknowledge responsibility for sustaining the economy, the environment, human health and social well-being, with each being accountable for decisions and actions in a spirit of partnership and open cooperation. Manitobans share a common economic, physical and social environment. Manitobans should understand and respect differing economic and social*

views, values, traditions and aspirations. Manitobans should consider the aspirations, needs and views of the people of the various geographical regions and ethnic groups in Manitoba, including Aboriginal peoples, to facilitate equitable management of Manitoba's common resources.

The processes for developing the Project have included the development of a partnership that is intended, in part, to meet the societal, cultural, economic and employment aspirations of the local KCNs communities, which include the continuation of traditional and cultural practices, as well as a deeper integration into the regional and provincial economy. Discussions leading to the formation of the Partnership and the planning and environmental assessment activities have led to a growing understanding and respect for the different values, and worldviews of Manitoba Hydro and the KCNs.

Prevention: *Manitobans should anticipate, and prevent or mitigate, significant adverse economic, environmental, human health and social effects of decisions and actions, having particular careful regard to decisions whose impacts are not entirely certain but which, on reasonable and well-informed grounds, appear to pose serious threats to the economy, the environment, human health and social well-being.*

Early discussions with TCN, followed by discussion with all KCNs, resulted in Project design parameters aimed at minimizing environmental disruption. Adverse effects agreements entered into with each of the KCNs established mechanisms to avoid, offset and mitigate Project effects on the communities. As a result, each community endorsed its agreement. The AEA offsetting programs, direct costs and residual compensation in each agreement addresses and resolves all past, present and known or anticipated Project effects on the collective rights and interests of the respective Cree Nation and its Members and on the exercise of Aboriginal and Treaty rights by the Cree Nation and its Members.

As well, extensive technical and ATK studies have been undertaken to predict potential environmental effects of the Project and to develop plans to mitigate those effects. Monitoring and other follow-up programs will continue as required to test predictions and make adjustments as necessary.

Conservation and Enhancement: *Manitobans should: Maintain the ecological processes, biological diversity and life-support systems of the environment; harvest renewable resources on a sustainable yield basis; make wise and efficient use of renewable and non-renewable resources; and enhance the long-term productive capability, quality and capacity of natural ecosystems.*

These concepts have been a primary focus of the Project planning and design. Implementation measures have emerged through the environmental assessment and the Partnership's consultation processes. Examples for maintaining biological diversity and life-support systems include wetland development, rehabilitation of important habitat types, and avoiding effects on fire regimes. As well, CNP is developing sustainable harvesting plans for fish and moose in the Split Lake Resource Management Area, where the Project is located. The Project uses water, a renewable resource, in a sustainable manner, while providing the province and others with electricity that minimizes environmental effects and is cost effective relative to other options.

Rehabilitation and Reclamation: *Manitobans should: Endeavour to repair damage to or degradation of the environment; and consider the need for rehabilitation and reclamation in future decisions and actions.*

Once the Project is constructed, areas no longer required for operations will be decommissioned and rehabilitated. A hydroelectric generating station may operate almost in perpetuity. If decommissioning is required at some future date, it will be undertaken according to the legislative requirements existing agreements and industry standards prevalent at the time. KCNs Principles Regarding Respect for the Land, set out in Section 9.2.1., also speak to rehabilitation and reclamation.

Global Responsibility: *Manitobans should think globally when acting locally, recognizing that there is economic, ecological and social interdependence among provinces and nations, and working cooperatively, within Canada and internationally, to integrate economic, environmental, human health and social factors in decision-making while developing comprehensive and equitable solutions to problems.*

The Project will contribute to substantial reductions in greenhouse gases (GHG) by displacing fossil fuel electricity generation.

A detailed Life Cycle Assessment was conducted by the Pembina Institute in order to estimate the GHG emissions resulting from the construction, land use change, operation, and decommissioning of the Project. The resulting emissions are extremely low relative to other forms of generation. An equivalent amount of electricity, produced by a combined cycle natural gas generating station during one year of operation would result in more than double the entire life cycle emissions estimated associated with the Keeyask Project over a 100 year period. Since the Project will displace gas and coal generation, primarily in the U.S. Midwest, it will contribute to substantial GHG reductions. The Project is estimated to displace 30 million tonnes carbon dioxide equivalent during the first 10 years of operation.

9.2.3.1.1 GUIDELINES OF SUSTAINABLE DEVELOPMENT

The following are the Manitoba Guidelines of Sustainable Development (Manitoba Conservation n.d.) and a description of how the Project has been planned and designed and will be constructed and operated in conformity with the province's directive.

Efficient Use of Resources: *Encouraging and facilitating development and application of systems for proper resource pricing, demand management and resource allocation together with incentives to encourage efficient use of resources; and employing full-cost accounting to provide better information for decision makers.*

The Project is an efficient use of a renewable resource to produce electricity, and it compares favourably to gas and coal which are the main sources of electricity in the mid-continent market area. The Project has been planned and designed with mitigation, compensation and enhancement measures to reduce adverse environmental and social impacts and maximize benefits. By incorporating these measures into the Project's capital and operating budgets, the Project costs closely reflect the full societal cost of the Project. Compared to earlier approaches to hydroelectric development, this approach increases the per unit cost of

Project power, but it also results in a more sustainable project. The integration of environmental and social costs of the Project is also a critical element in full-cost accounting.

The Project will also pay water power rentals charged by the Province as part of its resource pricing policies.

The Project will be operated as part of Manitoba Hydro's integrated generation and northern collector system, allowing for peak efficiency and optimum water usage for all plants.

Public Participation: *(a) Establishing forums which encourage and provide opportunity for consultation and meaningful participation in decision-making processes by Manitobans; (b) Endeavouring to provide due process, prior notification and appropriate and timely redress for those adversely affected by decisions and actions; and (c) Striving to achieve consensus amongst citizens with regard to decisions affecting them.*

Discussions that began between TCN and Manitoba Hydro in the 1990s, and were later expanded to the other KCNs, resulted in the establishment of the Partnership. In addition to the discussions that led to the development of the Partnership, the communities have been closely involved with Manitoba Hydro in the environmental impact statement. These discussions and consultations have helped to shape the final design for the Project and monitoring of its effects. A Public Involvement Program (see Chapter 3) has been developed and implemented to reach interested Manitobans representing other communities and organizations.

Access to Information: *(a) Encouraging and facilitating the improvement and refinement of economic, environmental, human health and social information; and (b) Promoting the opportunity for equal and timely access to information by all Manitobans.*

In addition to the ongoing communication among the KCNs and Manitoba Hydro, each of the KCNs undertakes on-going communication with its Members. The Partnership is undertaking a Public Involvement Program for other communities and interested Manitobans, and relevant information is also made available to the public through the regulatory review process.

Integrated Decision Making and Planning: *Encouraging and facilitating decision making and planning processes that are efficient, timely, accountable and cross-sectoral and which incorporate an inter-generational perspective of future needs and consequences.*

The Partnership has established a governance structure that includes KCNs representation. As part of this structure, the communities have had direct involvement in the environmental assessment and will continue to have a strong role with their Aboriginal traditional knowledge (ATK) in the monitoring and follow-up programs.

Each partner concerns itself with the short and long-term benefits and costs of the Project. Multi-generational benefits are key to the commitment of the KCNs' participation in the Project.

Waste Minimization and Substitution: *(a) Encouraging and promoting the development and use of substitutes for scarce resources where such substitutes are both environmentally sound and economically viable; and (b) Reducing, reusing, recycling and recovering the products of society.*

While opportunities to recycle wastes in remoter northern areas are limited, waste generated by the Project will be minimized and waste materials will be recycled to the extent practical, and the remaining waste will be disposed of in accordance with license and regulatory requirements.

Research and Innovation: *Encouraging and assisting the researching, development, application and sharing of knowledge and technologies which further our economic, environmental, human health and social well-being.*

A great deal of research, study and sharing of knowledge has contributed to the current plans for the Project. Associated with the environmental assessment processes, there have been many technical and ATK studies related to wildlife (including caribou), fish populations (including sturgeon), social and economic conditions, heritage resources, history and culture that will be part of the record of the Project and will be of ongoing benefit far beyond their use in the EIS for the Project. For example, thousands of cultural artifacts, some as old as 4000 to 5000 years, have been recovered and preserved during the Project planning phase and will be accessible to the KCNs (and the public), enhancing cultural memory and identity. Through the Project, the communities have undertaken many of their own studies and reports that have resulted in a clear enunciation of their Cree worldview. Monitoring activities, involving ATK and technical science will continue through the construction and operation phases.

9.2.3.2 THE KEEYASK GENERATION PROJECT AND MANITOBA SUSTAINABILITY INDICATORS

The "2009 Provincial Sustainability Report for Manitoba" established categories of indicators within each of the three sustainable development "dimensions" (natural environment, economic and social well being) and indicators within each category. For each indicator, the province, after application of the appropriate criteria, determined and reported a province-wide trend for the indicator with respect to its sustainability; *e.g.*, stable, inconclusive, changing, variable, negative, positive, and other determinations as appropriate (Manitoba Conservation 2009).

Table 9A-1 in Appendix 9A utilizes the information and conclusions in the EIS to determine whether the Project will affect the Manitoba Government's reported sustainability trends.

9.2.4 THE KEEYASK GENERATION PROJECT AND MANITOBA HYDRO'S SUSTAINABLE DEVELOPMENT PRINCIPLES

In 1993, the Corporation adopted 13 sustainable development principles based on the principles and guidelines of sustainable development adopted by the Manitoba Round Table on Environment and Economy.

The policy and the 13 principles represent a guiding influence for Manitoba Hydro's decisions, actions and day-to-day operations. The general partner of the Partnership will operate within the Manitoba Hydro principles and guidelines of sustainable development.

The following illustrates how the Project is consistent with these 13 principles.

Stewardship of the Economy and the Environment: *Recognize its responsibility as a caretaker of the economy and the environment for the benefit of present and future generations of Manitobans. Meet the electricity needs of present and future Manitobans in a manner that ensures the long-term integrity and productivity of our economy, our environment and our natural resources, and safeguards our human health.*

Consistent with the KCNs' commitment to caring for *Askiy* and Manitoba Hydro's commitment to sustainable development, the Project has been designed to minimize adverse effects and maximize benefits to local and regional residents. Manitoba Hydro and the KCNs have planned the Project together and completed more than a decade of both ATK and technical studies to predict and mitigate adverse effects and enhance Project benefits.

These efforts have improved the Project in a number of ways. Bio-physical effects have been substantially reduced by: choosing a "low head" rather than a "high head" design, thereby reducing the amount of flooding required; siting and arranging the infrastructure utilizing environmental as well as engineering criteria; clearing the reservoir before impoundment to decrease floating debris and other environmental impacts; setting strict operating regimes to minimize reservoir elevation variation; and undertaking extensive mitigation measures to protect fish and terrestrial species. Activities such as the development of a partnership, extensive preconstruction consultations and studies, joint planning within the partnership, designing social and cultural mitigation measures, extensive use of ATK, and the use of AEAs and offset measures combine to reduce socioeconomic and cultural impacts from the Project. Through job training programs, preferential hiring, directly negotiated contracts, and equity participation with the KCNs, benefits to local and regional communities have been enhanced.

These mitigation, compensation and enhancement measures have been incorporated into the Project's capital and operating budgets, resulting in Project costs that reflect closely the full societal cost of the Project.

Compared to earlier approaches to hydroelectric development, this approach increases the per unit cost of Project power, but it also results in a more sustainable project. The integration of environmental and social costs of the Project is also a critical element in full-cost accounting.

Shared Responsibility: *Ensure that Manitoba Hydro's employees, contractors, and agents are aware of our sustainable development policies and guiding principles and encourage them to act accordingly. Encourage the Corporation's employees to share their knowledge of the concepts and practical application of sustainable development.*

All contractors and workers on the site will be provided with Project-relevant information that incorporates the application of the principles. Partnership oversight of the Project will include compliance measures associated with regulatory and policy standards for Project construction and operation as well as in the associated monitoring and follow-up programs.

Integration of Environmental and Economic Decisions: *Treat technical, economic and environmental factors on the same basis in all corporate decisions, from initial planning to construction to operations to decommissioning and disposal. To the extent practical, include environmental costs in economic and financial analysis.*

A major example of this integration is the Project design. The Project incorporates mitigation, compensation and enhancement measures to reduce adverse environmental and social impacts and maximize benefits. By incorporating these measures into the Project's capital and operating budgets, the Project costs closely reflect the full societal cost of the Project.

Economic Enhancement: *Enhance the productive capability and quality of Manitoba's economy and the well-being of Manitobans by providing reliable electrical services at competitive rates.*

Hydroelectric development is a principal contributor to Manitoba's economy. The Project will generate revenues through power sales locally and to the US. Earnings will flow to the Partner communities as well as to the province through Manitoba Hydro. External power sales allow for sustainable low rates within the province, providing affordable electricity to the citizens of Manitoba and competitive advantage to the business community.

Efficient Use of Resources: *Encourage the development and application of programs and pricing mechanisms for efficient and economic use of electricity by our customers. As well, efficient and economic use of energy and materials will be encouraged throughout all our operations.*

Although Manitoba Hydro has exceptionally low domestic electricity rates which tends to encourage consumption, Manitoba Hydro also has an exceptionally strong program to explicitly encourage customers to be efficient in the use of electricity. In fact, the Manitoba Hydro Power Smart Program is recognized as a national leader for transforming the market through its ongoing commitment to promote energy efficient products and practices.

Prevention and Remedy: *To the extent practical, anticipate and prevent adverse environmental and economic effects that may be caused by Corporate policies, programs, projects and decisions rather than reacting to and remedying such effects after they have occurred. Purchase, where practical, environmentally sound products taking into account the life cycle of the products.*

Address adverse environmental effects of Corporate activities that cannot be prevented by:

- *First, endeavouring, wherever feasible, to restore the environment to pre-development conditions or developing other beneficial uses through rehabilitation and reclamation;*
- *Second, striving to replace the loss with substitutes that would enhance the environment and/or associated resource uses while offsetting the type of damage experienced; and*
- *Third, making monetary payments for compensable damages on a fair, equitable and timely basis.*

A number of measures have been taken to prevent and minimize adverse effects, the most substantial being to reduce the size of the Project. At one time, a high head project with 180 km^2 of initial flooding was under consideration; in contrast, the current Project that will result in 45 km^2 of initial flooding. As another example, a combination of habitat enhancement measures and a fish stocking program that includes a fish hatchery will enhance the population of lake sturgeon in the Project area. As another example of anticipating and remedying effects before they occur, AEAs with the KCNs were negotiated as proactive measures in advance of the development, and programs under those agreements will address effects on resource users.

Efforts have been made to avoid many effects, and once construction is completed, temporary facilities and structures not required for the operations phase will be decommissioned.

Conservation: *To the extent practical, plan, design, build, operate, maintain and decommission Corporate facilities in a manner that protects essential ecological processes and biological diversity. Give preference, where practical, to projects and operating decisions that use renewable resources or that extend the life of supplies of non-renewable resources.*

Both ATK and over a decade of technical studies have contributed to the design of the Project in a manner that will avoid or reduce adverse effects and protect essential ecological processes and biological diversity. Hydropower utilizes a renewable resource, thus assisting in the conservation of non-renewable resources such as gas or coal that otherwise would be used to generate the electricity being produced at the Project.

Waste Minimization: *Manage all wastes arising from Corporate activities by:*

- First, endeavouring to eliminate or reduce the amount generated;
- Second, striving to fully utilise reuse and recycling opportunities; and
- Third, disposing of remaining waste in an environmentally sound manner.

While opportunities for recycling are limited in remote northern areas, waste generated by the Project will be minimized and waste materials will be recycled to the extent practical. All other waste will be disposed of in an environmentally sound manner and in accordance with regulatory requirements.

Access to Adequate Information: *Share relevant information on a timely basis with employees, interested people and governments to promote a greater understanding of Manitoba Hydro's current and planned business activities and to identify impacts associated with the Corporation's plans and operations.*

Project information has been and will continue to be shared with interested parties dedicated websites, meetings, open houses and newsletters. Project information is also available at government registries.

Participation of the partners on the board of the general partner and in three ongoing committees (Construction Advisory Committee, Monitoring Advisory Committee and the Advisory Group on Employment) will be mechanisms for current and accurate information to the KCNs.

Public Participation: *Provide opportunities for input by potentially affected and interested parties when evaluating development and program alternatives and before deciding on a final course of action.*

KCNs undertook their own evaluations of the Project and their representatives were included in Partnership decisions. Discussion with the local communities began in the early 1990s and has resulted in a partnership with four First Nations and Manitoba Hydro participating in the Project. Ongoing communications have been undertaken within the communities. A Public Involvement Program has also been developed and has been implemented to reach the interested public in Manitoba. Information gleaned from these discussions and proponent consultations have improved the design and will be reflected in the construction of the Project.

This information was also used in determining and assessing environmental effects as part of the environmental assessment and in the design of mitigation and monitoring measures.

Understanding and Respect: *Strive to understand and respect differing social and economic views, values, traditions and aspirations when deciding upon or taking action. Give preference to those alternatives which best fulfil Corporate objectives while minimizing infringement on the ability, rights, and interests of others to pursue their aspirations.*

The Project proponent is a partnership comprising Manitoba Hydro and the KCNs. Considerable effort has been made in forging constructive relationships between Manitoba Hydro and the KCNs, including facilitating community studies aimed at understanding history, community history, and more importantly the Cree worldview and ATK. This growing understanding has had a major impact on Project design, construction and operation. It has also led to specific arrangements through community-specific AEAs.

Scientific and Technological Innovation: *Research, develop, test and implement technologies, practices and institutions that will make electrical supply and services more efficient, economic and environmentally sound.*

Due to the potential for injury and mortality of fish as they pass downstream through turbines, a number of variables were considered in the selection and development of turbines for the Project to reduce the risk of injury and mortality. These variables include the number, alignment, and shape of stay vanes and wicket gates, clearance at the wicket gates

and runners, wicket gate overhang, number of blades, blade leading edge thickness, blade trailing edge (related to turbulence), rotation rate, runner diameter, blade speed, and absolute lowest pressure.

The use of a fixed blade vertical shaft turbine design for the Project results in several advantages for fish passage survivability compared to other turbine styles. The fixed blade pitch of the vertical shaft units allows for the gap between the runner blades and the discharge ring to be minimized, reducing the likelihood of fish impingement and injury. The low rotational speeds associated with large diameter vertical shaft turbines also result in greater fish survivability. To reduce the risk of striking or impingement injuries, runner blades incorporate a thicker rounder leading edge, the gaps between wicket gates and both the bottom ring and head cover were minimized, and the wicket gate overhang was also minimized. To reduce turbulence levels experienced by fish passing through the turbines, the runner blades incorporate a thinner trailing edge, units will operate at best gate whenever possible, and the shape of the draft tubes incorporate large sweeping radii. These are all known to improve the probability of a fish passing through a turbine without incurring significant injury or mortality.

This is the first time that Manitoba Hydro has included these variables relevant for fish survival as part of the evaluation in the initial turbine design selection process, and as a priority for further turbine design development. Although there are many variables to consider beyond those relevant for fish survival (particularly efficiency and cost), the objective for the Project turbines is to achieve a minimum survival rate of 90%. Based on the Franke formula (Aquatic Environment Support Volume, Appendix 1A) for estimating the probability of survival of fish passed through turbines, fish up to 500 mm passing through the turbines will have a survival rate of over 90%.

Global Responsibility: *Recognize there are no political and jurisdictional boundaries to our environment, and that there is ecological interdependence among provinces and nations. Consider environmental effects that occur outside of Manitoba when planning and deciding on new developments and major modifications to facilities and to methods of operation.*

The Project will contribute to substantial reductions in greenhouse gases (GHG) by displacing fossil fuel electricity generation.

A detailed Life Cycle Assessment was conducted by the Pembina Institute in order to estimate the GHG emissions resulting from the construction, land use change, operation, and decommissioning of the Project. The resulting emissions are extremely low relative to other forms of generation. An equivalent amount of electricity, produced by a combined cycle natural gas generating station during one year of operation would result in more than double the entire life cycle emissions estimated associated with the Keeyask Project over a 100 year period. Since the Project will displace gas and coal generation, primarily in the U.S. Midwest, it will contribute to substantial GHG reductions. The Project is estimated to displace 30 million tonnes carbon dioxide equivalent during the first 10 years of operation.

9.3 CONCLUSIONS RE: THE KEEYASK GENERATION PROJECT AND SUSTAINABILITY

This analysis demonstrates that the Project is consistent with the KCNs, federal, provincial, and Manitoba Hydro approaches to sustainable development.

In addition to the specific analysis related to the goals, principles and guidelines of sustainable development, several general conclusions about the Project emerge, from the perspective of the three pillars of sustainable development:

ECONOMY

- National
  - Increased tax revenue will accrue to the federal government from employment and business opportunities resulting from the Project; and
  - The Project is a model of First Nation and corporate partnership in new renewable resource development.
- Provincial
  - Increased employment opportunities and resultant employment income associated with the Project will stimulate the provincial economy during construction and operation;
  - Increased revenues from power sales will generate income into Manitoba Hydro, a provincial Crown corporation, and benefit Manitoba ratepayers over the long life of the Project;
  - Increased revenue from water power rights associated with the Project will generate ongoing revenue for the province over the life of the Project;
  - Employment income and business development associated with the Project will generate revenue for the province;
  - Over 4000 person-years of employment income and substantial business opportunities will decrease welfare/social assistance reliance, especially in northern Manitoba; and
  - Employment training has already benefitted hundreds of workers, the results of which will be long lasting skilled labour, transferrable to other projects in the future.
- Regional
  - Local indigenous (KCNs) people will have an opportunity to benefit economically through their ownership position in the Project and through training, employment and business opportunities;

- Local indigenous people (KCNs) are also participating in the governance of a major hydroelectric project being developed in their ancestral homelands;
- The costs of the many measures to avoid or mitigate adverse effects and to enhance social benefits have been integrated into the design of the Project. As a result, these costs have been internalized into the Project (moving an otherwise external social cost into a corporate internal cost);
- Employment opportunities and associated training and economic benefits have increased for workers throughout northern Manitoba;
- Economic activity associated with the Project will increase opportunities for regional commercial and industrial businesses; and
- There will be long-term population growth with well paid operational positions at the generating station.

SOCIAL

- The Partnership is an example of consistency with the World Commission proposition that empowerment of vulnerable indigenous people is a touchstone of sustainable development policy.
- Funds were provided to each KCN to undertake its own evaluation of the Project and conduct referendums on whether to support the Project. The KCNs' Environmental Evaluation Reports speak to a desire to restore harmony and balance with *Askiy*, to protect the environment which is broadly defined to include people's wellbeing, to maintain and enhance their culture and traditions, and to provide greater hope and opportunities for present and future generations.
- As partners the KCNs have been influential in identifying and advocating for measures to lessen the adverse environmental effects of the Project, and they will undertake appropriate ceremonies to show respect and give thanks to *Askiy* at major Project milestones.
- The AEAs will provide the KCNs with access to healthy country foods and programs to maintain and strengthen their traditions and culture.
- Benefits associated with their partnership in a major development will contribute to independence of northern remote FN communities.

ENVIRONMENT

- As the first step in environmental stewardship, the Project has been planned to avoid or reduce long-term environmental effects. For example, through the planning process, the Project was reduced from a 1150 MW generating station that would have flooded 183 km^2, to a smaller 695 MW station that will flood 45 km^2.

- Special attention has been given to sensitive species and habitats. One example is lake sturgeon, a species designated as endangered by COSEWIC and being considered for designation under the Species at Risk Act. Through a combination of mitigation measures that include habitat enhancement, a fish hatchery and stocking program, the objective is not only to maintain existing stocks but to improve the species' population.
- Attention has been given to sustainable resource use in the planning and design of the Project. Maintaining and restoring wildlife populations in the area have been major components of the planning and environmental assessment. Through a combination of mitigation measures the existing stocks of lake sturgeon should not only be maintained but improved. Fish and moose harvest sustainability plans are being developed by CNP to guide the sustainable harvest of fish and moose in the Split Lake Resource Management Area (SLRMA). Moose and caribou monitoring will be conducted to promote future sustainability of the regional populations.
- Consistent with federal and provincial government efforts to reduce GHG emissions, the Project will contribute to a substantial reduction in greenhouse gases by displacing electricity generated from coal or gas, which could produce more than 200 x's more GHGs than Keeyask over its productive lifetime.

APPENDIX 9A

EFFECT ON MANITOBA GOVERNMENT SUSTAINABILITY INDICATOR TRENDS

KEEYASK
Hydropower Limited Partnership

EFFECT ON MANITOBA GOVERNMENT SUSTAINABILITY INDICATOR TRENDS

The "2009 Provincial Sustainability Report for Manitoba"[1] established categories of indicators within each of the three sustainable development "dimensions" (natural environment, economic and social well being) and indicators within each category. For each indicator, the province, after application of the appropriate criteria, determined and reported a province-wide trend for the indicator with respect to its sustainability; *e.g.*, stable, inconclusive, changing, variable, negative, positive, and other determinations as appropriate.

The two left hand columns in the following table comprise information directly from the 2009 Sustainability Report. The right hand column is the proponent's comments respecting the Project's impact on the provincial trend. Although the sustainability trends were established and reported on a provincial basis, the table provides regional information as required.

[1] http://www.gov.mb.ca/conservation/pdf/sustainabilty_report_2009.pdf

Table 9A - 1: Keeyask Generation Project Effect on Manitoba Government Sustainability Indicator Trends

Category	Indicator From MB 2009 Sustainability Report	Province-wide Trend from MB 2009 Sustainability Report	Predicted Effect of Keeyask Generation Project on Manitoba Trend
NATURAL ENVIRONMENT FRAMEWORK			
Biodiversity	Natural lands and protected areas	Stable	No predicted effect
	Wildlife species and ecosystems at risk	Inconclusive	No predicted effect on mammal resources
Fish	Fish species biodiversity and population	Changing	Minimal effect Positive effect on lake sturgeon in the lower Nelson River, when regional mitigation and enhancement measures are considered.
	Commercial fish harvest	Variable, depending on fishery	Minimal effect
Forests	Forest type and age class	Stable	Minimal effect
	Forest renewal	Stable	No predicted effect
Air	Air quality	Stable- Winnipeg, Brandon and Flin Flon	Short term local adverse effect, no effect on local or regional air quality in long term.
Water	Water quality	Stable	Negative effect on some back bays on the reservoir for 10-20 years after impoundment. No marked adverse effect on region.
	Water allocation and consumption	Stable	No predicted effect
Climate Change	Average annual and seasonal temperature	Negative	No predicted effect

Table 9A - 1: Keeyask Generation Project Effect on Manitoba Government Sustainability Indicator Trends

Category	Indicator From MB 2009 Sustainability Report	Province-wide Trend from MB 2009 Sustainability Report	Predicted Effect of Keeyask Generation Project on Manitoba Trend
	Total annual and seasonal precipitation	Inconclusive	No predicted effect
	Greenhouse gas emissions	Stable	Positive – The Project will contribute towards global reductions in GHG emissions.
ECONOMIC FRAMEWORK			
Economic performance	Real gross domestic product per capita	Positive	Positive
	Gross domestic product by sector	Positive	Positive
Agricultural sustainability	Total net farm income	Variable	No predicted effect
	Farm structure	Increasing consolidation	No predicted effect
	Adoption of sustainable agricultural management practices	Positive	No predicted effect
Mining	Mineral exploration	Positive	No predicted effect
	Mineral reserves	Stable	No predicted effect
	Mineral production	Positive	No predicted effect
Energy efficiency and conservation	Energy intensity	Positive	No predicted effect
	Renewable energy consumed versus total energy consumed	Positive	Positive

Table 9A - 1: Keeyask Generation Project Effect on Manitoba Government Sustainability Indicator Trends

Category	Indicator From MB 2009 Sustainability Report	Province-wide Trend from MB 2009 Sustainability Report	Predicted Effect of Keeyask Generation Project on Manitoba Trend
Consumption and waste management	Waste disposal	Negative	No predicted effect
	Waste recycled or used	Negative	NTD – Needs answer
Employment	Labour force trends	Positive	Positive – Substantial local and regional employment opportunities during 8.5-year construction phase. - Enhanced skilled workforce.
	Labour force opportunities	Positive	Positive – 4,218 person-years of employment during 8.5-year construction phase. Substantial proportion of total Project employment is expected to be northern Aboriginal employment (34-51%). 46 long-term jobs are associated with operation of the Keeyask Generation Station, and 182 KCNs jobs for 20 years are also provided for in the JKDA.

Table 9A - 1: Keeyask Generation Project Effect on Manitoba Government Sustainability Indicator Trends

Category	Indicator From MB 2009 Sustainability Report	Province-wide Trend from MB 2009 Sustainability Report	Predicted Effect of Keeyask Generation Project on Manitoba Trend
	Building and maintaining vibrant communities	Stable/positive	Positive for KCNs during construction phase due to employment and Direct Negotiation Contract benefits. Positive for the KCNs during the operation phase as a result of partnership income, which can contribute to increased self-sufficiency and provisions for Hydro jobs. AEA programming/initiatives reflect and respond to the KCNs' concerns, goals, and interests; for example, access programs contribute to strengthening traditional uses of lands within the Split Lake RMA that are away from the Nelson River. Participation in the Partnership contributes toward the sense of involvement by the KCNs in development within their vicinity. Positive for Gillam during operation phase as the community is planning for growth.
Education	Readiness for school	Positive	No predicted effect
	Literacy and numeracy – youth, adult	Stable	Positive effect. Community based pre-Project training included educational upgrading programs.

Table 9A - 1: Keeyask Generation Project Effect on Manitoba Government Sustainability Indicator Trends

Category	Indicator From MB 2009 Sustainability Report	Province-wide Trend from MB 2009 Sustainability Report	Predicted Effect of Keeyask Generation Project on Manitoba Trend
	High school and post-secondary education completion	Increasing – high school Stable -- post secondary	Positive - Community based pre-Project training included trades and business management training programs. To encourage continuing education, a Manitoba Hydro Keeyask Leadership Scholarship has been established to be awarded to one grade 12 graduating student from each community who is pursuing post secondary education and has shown exemplary leadership. This annual scholarship will be continued for seven generations.
	Academic achievement and socio-economic status	Variable	Positive – Project has the opportunity to increase socio-economic status through employment income for construction workers (including Aboriginal workers who are the subject of preferential hiring provisions in the collective agreement governing the construction project). The Project is expected to contribute to long-term partnership income earned by the KCNs.
SOCIAL WELL BEING FRAMEWORK			
Demographic	Population growth	Positive	No predicted effect on Manitoba trend; localized population growth associated with 46 long term positions to be located in Gillam.
	Migration to Manitoba from other jurisdictions	Positive	No predicted effect.

Table 9A - 1: Keeyask Generation Project Effect on Manitoba Government Sustainability Indicator Trends

Category	Indicator From MB 2009 Sustainability Report	Province-wide Trend from MB 2009 Sustainability Report	Predicted Effect of Keeyask Generation Project on Manitoba Trend
Equity and rights	Low income	Positive	Positive – well-paying opportunities in construction and operation phases; substantial local and regional employment opportunities during 8.5 year construction phase. Forty-six long-term jobs are associated with operation of the Keeyask Generation Station.
	Income inequality	Positive	Positive – northern Aboriginal employment in well-paying operations jobs. KCNs partnership income could raise overall standard of living and degree of self-sufficiency in KCNs communities.
	Income dependency	Positive	Positive – northern Aboriginal employment in well-paying operations jobs will contribute to reduced income dependency on government transfers for those employed. KCNs partnership income is likely to raise overall standard of living and degree of self-sufficiency in KCNs communities.
	Community supported living	Positive	No predicted effects.
Community and culture	Community engagement	Positive	Positive – KCNs communities engaged as partners in Project planning, decision-making and economic expansion.
	Heritage conservation	Positive	Variable – loss of heritage resources in Project footprint; increased knowledge, identification and protection of heritage resources through fieldwork associated with the Project (that counterbalances the loss of heritage resources through construction).

Table 9A - 1: Keeyask Generation Project Effect on Manitoba Government Sustainability Indicator Trends

Category	Indicator From MB 2009 Sustainability Report	Province-wide Trend from MB 2009 Sustainability Report	Predicted Effect of Keeyask Generation Project on Manitoba Trend
	Language diversity	Positive	Positive – for KCNs communities, Cree language programs are part of adverse effects agreements that are intended to strengthen Cree culture and language.
Governance	Voting rates	Positive	No predicted effect.
	Progress toward debt repayment	Positive	Positive – substantial water rental and capital tax payments to provincial government.
Health	Health status	Stable	Stable – KCNs AEAs and partnership income as well as overall employment opportunities for Manitobans provide the favourable conditions to improve overall health status. Medium-term elevated mercury levels to be offset by other sources of domestic fish via programs in most AEAs. In addition, consumption guidelines and measures to encourage domestic consumption of low-mercury fish are intended to mitigate mercury changes in fish.
	Access and quality of care	Stable	No predicted effect
Justice	Crime rate	Inconclusive	Inconclusive

CHAPTER 10

CONCLUSIONS

KEEYASK
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10.0 CONCLUSIONS

10.1 INTRODUCTION

The Keeyask Hydropower Limited Partnership (the Partnership) has put forward the Keeyask Generation Project (the Project) for authorization in accordance with the *Canadian Environmental Assessment Act* (S.C. 1992, C. 37) and *The Environment Act* (Manitoba). The Partnership is comprised of four limited partners (Cree Nation Partners, representing Tataskweyak Cree Nation and War Lake First Nation; York Factory First Nation; Fox Lake Cree Nation; and Manitoba Hydro) and one general partner (5900345 Manitoba Ltd., a company owned by Manitoba Hydro).

Each of the Keeyask Cree Nations (KCNs) has previously undertaken its own evaluation of the Project. The Partnership has now produced a comprehensive environmental impact statement (EIS) in accordance with the requirements of the federal and provincial regulatory processes. The EIS includes an executive summary, this Response to EIS Guidelines, the KCNs' Environmental Evaluation Reports and a video, *Keeyask: Our Story*. The evidence presented in the Keeyask EIS demonstrates that the Project meets and exceeds the criteria by which the federal and provincial governments are to determine whether the Project will be approved.

10.2 FEDERAL CRITERIA

A primary purpose of the federal Act is "to ensure that projects are considered in a careful and precautionary manner before federal authorities take action in connection with them, in order to ensure that such projects do not cause significant adverse environmental effects." Consistent with the act, the Canadian Environmental Assessment Agency issued guidelines that directed the Partnership:

- To focus its assessment on valued environmental components (VECs); and
- To determine if the Project will cause a "significant" adverse effect, based on the effect's magnitude; geographic extent; timing, duration and frequency; reversibility; ecological and social context; level of confidence and probability; and existing environmental standards, guidelines or objectives.

Thirty-eight VECs were selected for the assessment and, following mitigation, none of the residual adverse effects exceeded the regulatory test for significance. That same conclusion held when the cumulative effects of the Project were considered in combination with the effects of past, current and future projects that overlap temporally and spatially with the Project.

One of the VECs – lake sturgeon – deserves special mention. Lake sturgeon are culturally and spiritually important to the Cree people and have special status as a heritage species in Manitoba. They have been designated as endangered by the Committee on the Status of Endangered Wildlife in Canada and are being considered for listing under the federal *Species at Risk Act*. They are also vulnerable to the effects of hydroelectric development. As a result, the Partnership has given the species special attention. New spawning habitat will be created to replace habitat being lost because of the Project, and a stocking program will be implemented. Stocking programs have been successful in re-establishing sturgeon populations in many other locations, and early results from the upper Nelson River appear positive. As a result, the Partnership is confident that similar results can be attained in the Keeyask area and is committed to utilizing an adaptive management approach to sturgeon stewardship with the objective of enhancing the sturgeon population in the lower Nelson River.

10.3 PROVINCIAL CRITERIA

The intent of the provincial Act is "to develop and maintain an environmental protection and management system in Manitoba which will ensure that the environment is protected and maintained in such a manner as to sustain a high quality of life, including social and economic development, recreation and leisure for this and future generations."

The evidence presented in the EIS demonstrates that the Project will certainly contribute to social and economic development while maintaining a system of environmental protection and management. The following is a summary of this evidence:

- Many potential environmental effects were avoided with the selection of a Project that minimizes the amount of flooding, which is a primary pathway to other environmental effects:
    - For example, the Project has been downsized from a 1150 MW high-head concept that would have initially flooded over 180 km^2 to a 695 MW low-head project that will initially flood 45 km^2.
- A decade-long environmental assessment process has been undertaken to identify potential adverse effects and develop appropriate mitigation measures;
- An extensive monitoring program will be applied to compare actual effects against the predictions that were based on technical scientific studies, professional judgement, and Aboriginal traditional knowledge; and
- Many adaptive management strategies have been identified, should the monitoring program indicate such strategies are required.

In addition to managing adverse effects, the Project will provide a number of environmental benefits. For example, the Project's hydroelectricity will produce fewer greenhouse gases in a

century of operation than an equivalent coal thermal station would produce in 100 days and a gas thermal station in half a year. The Project will also contribute to the Manitoba economy as a preferred source of low-emitting, renewable energy, as well as a source of over 4,000 person-years of construction employment during the eight year construction period; and more broadly to the Canadian economy.

The Project will also contribute to the social and economic development of local communities and the northern region. For example:

- The four local Cree Nations (*i.e.,* the KCNs) are partners in the Project, sharing in its governance and future returns on investment;
- A number of contracts will be directly negotiated with businesses controlled by the KCNs;
- Qualified Aboriginal and other northern workers will be given preference for jobs to construct the Project; and
- Agreements negotiated with the four local Cree Nations address adverse effects on each Nation's collective rights and interests and the exercise of Treaty and Aboriginal rights by their Members:
    - The core of each agreement is a set of Offsetting Programs, the overall purpose of which is to provide appropriate replacements, substitutions or opportunities to offset unavoidable adverse effects on the practices, customs and traditions integral to their distinctive cultural identity.

10.4 THE PRECAUTIONARY APPROACH

The concept of using a precautionary approach has been an implicit foundation in the planning and design of the Project, using both technical science and Aboriginal traditional knowledge (ATK). Alternative reservoir levels and general arrangements were evaluated during the initial stages of project planning. Some alternatives would avoid or reduce potential effects, while others would have cost less per unit of power but would have had more adverse effects. Taking the precautionary approach, the alternatives that would avoid or lessen adverse effects were selected. Once the fundamentals of the Project were defined, the Partnership continued to take a precautionary approach in designing the Project.

One example was the decision to clear the entire reservoir area before impoundment. Another example was the decision to minimize the operational range of the reservoir to one meter, which is very small for a hydroelectric station of this magnitude.

A third example of the use of the precautionary principle was an output from discussions with the Department of Fisheries and Oceans (DFO) regarding fish passage. Approximately 10 years of study on fish movements indicated that fish did not need to move up over the

dam to fulfill any of their life cycle requirements (e.g., spawning) and considerable effort was therefore placed on developing sufficient habitat in upstream and downstream areas to support local fish populations. However, through discussions with DFO a decision was made to commit to implementing fish passage at the Project using trap and transport and also to design the Project so it could be retrofitted to accommodate other fish passage options in the future, if follow-up monitoring indicates it is required.

While the precautionary approach has been used in many Project-related decisions to avoid adverse effects in the absence of scientific knowledge, it is important to stress that the Project has benefitted from more than 10 years of both scientific study and discussions and input from the local Cree Nations in sharing their ATK. In addition, potential effects have been avoided and mitigation measures identified and incorporated in the Project's plans, and a program of monitoring and adaptive management will be implemented.

10.5 KEEYASK CREE NATIONS' EVALUATIONS OF THE PROJECT

As noted in the EIS, the Project is actually the subject of two evaluation processes. In addition to the government regulatory environmental assessment process, each of the KCNs has also undertaken its own environmental evaluation process. In the KCNs' process, each of the KCNs, financially assisted by Manitoba Hydro, evaluated the impact of the Project on its communities and Members in terms of its own worldview, values and experience with past hydroelectric development. This assisted each Cree Nation when deciding to participate in the Partnership; in becoming partners, they also committed their support to the Partnership's application for regulatory approval of the Project. In voting to approve the Joint Keeyask Development Agreement, the KCNs expressed the hope – a realistic hope based on careful evaluation – that the Project will help to improve their home ecosystem's ability to sustain them physically and culturally and to restore harmony and balance to relationships and their lives; and that the Project will provide opportunities for current and future generations while respecting and caring for *Askiy*.

10.6 CONCLUDING STATEMENT

The Keeyask Generation Project will cause numerous and widespread environmental and social effects, some of which would have had the potential to be significant. However, using past experience, Aboriginal traditional knowledge and leading scientific and engineering techniques, the Keeyask Hydropower Limited Partnership has mitigated, remediated and/or compensated for these effects, such that the Partnership is confident the Project should proceed. The Project will also produce substantial environmental, social and economic

benefits, all of which are consistent with the principles of sustainability established by the Governments of Canada and Manitoba. The Project will contribute to reductions in greenhouse gases and increases in lake sturgeon populations; it will provide training and employment for hundreds of Aboriginal and northern workers; it will enable the Keeyask Cree Nations Partners to build capacity and profit from construction contracts and their investment as equity partners; and it will produce clean renewable energy for Manitobans and export markets. As such, the Partnership believes the Project should be granted regulatory approval to proceed.

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GLOSSARY

KEEYASK
Hydropower Limited Partnership

GLOSSARY

Abiotic: A nonliving physical or chemical attribute of a system, *e.g.,* light, temperature, wind patterns, rocks, soil, pH, pressure, *etc.*

Aboriginal traditional knowledge (ATK): Knowledge that is held by, and unique to, Aboriginal peoples. It is a living bit of knowledge that is cumulative and 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).

Above sea level (ASL) elevation: Elevations are referenced to Geodetic Survey of Canada, Canadian Geodetic Vertical Datum 1928, GSofC, CGVD28, 1929 Adjustment.

Acoustic-transmitter: A transmitter that emits signals detected by stationary or mobile acoustic receivers; used to track movements of fish when surgically implanted in the abdomen.

Acute toxicity: The ability of a substance to cause severe biological harm or death soon after a single exposure or dose. Also, any poisonous effect resulting from a single short-term exposure to a toxic substance.

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*).

Adult sturgeon: Lake sturgeon 834 mm long or greater (fork length) were assumed to be adults where sexually maturity was not evident at the time of sampling. This benchmark was based on sexual maturity data collected during the spawning season from a well-studied lake sturgeon population on the Lower Nelson River.

Advect: A horizontal movement of a mass of fluid, such as ocean or air currents; can also refer to the horizontal transport of something such as sediment.

Agreement-in-Principle (AIP): The agreement in principle made between Manitoba Hydro and TCN dated October 17, 2000. WLFN signed the AIP in July 2003.

Algae (a; al): A group of simple plant-like aquatic organisms possessing chlorophyll and capable of photosynthesis; they may be attached to surfaces or free-floating; most freshwater species are very small.

Allocation: For the purposes of the EIS, a parcel of land assigned to an outfitter or lodge operator to carry out their guiding services.

Alluvial: Pertaining to of composed of alluvium; clay, silt, sand, gravel, or similar detrital material deposited by running water.

Alpha diversity: The diversity within a particular area or ecosystem, and is usually expressed by the number of species (*i.e.*, species richness) in that ecosystem.

Alternating current (AC): An electric current that reverses its direction (positive/negative values) at regular intervals. See direct current.

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

Amphipod: A shrimp-like crustacean most often found in marine or fresh water environments, but also represented by terrestrial species (sand fleas).

Analytical detection limit: The lowest concentration of a substance that can be confidently measured using a particular analytical procedure.

Anchor ice: Ice that forms below the surface of a body of water that attaches either to a submerged object or to the bed of the waterbody.

Annelid: Segmented worms, such as earthworms and leeches, found in most wet environments.

Anoxic: Absence of oxygen.

Apprentice: A person who is learning a trade from a skilled employer, having agreed to work for a fixed period at low wages.

Apprenticeship: A system of training and certification in established trades — a way for people to obtain the credentials required for work in many important skilled trades. Apprenticeship is also a training model that combines on-the-job learning with the learning of theory.

Aquatic: Living or found in or near water.

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.

Aquatic peatland: Peatland that borders a water body or waterway. The portion adjacent to the water is usually floating.

Aquifer: An underground bed or layer of earth, gravel or porous stone that yields water.

Arboreal: Of or relating to trees.

Archaeology: The science and/or methods concerned with the recovery, description, analysis and explanation of the physical remains of past human cultures.

Area of special interest: An official designation of the Province of Manitoba that identifies "candidate sites" which have not been protected in any formal manner but have a high potential to protect groupings of enduring features and associated natural and cultural values.

Arthropod: The largest group within the animal kingdom, containing several million species; characterised by a rigid external skeleton and paired jointed legs.

Assimilation: The process of absorbing nutrients into the body after digestion.

Autotroph: An organism capable of synthesizing its own nutritional organic substances from inorganic compounds, such as CO_2, green plants, algae, and certain bacteria..

Availability (economic context): For those who are interested in work on the construction site, there are factors which may limit their availability to take advantage of these opportunities. These could include the extent to which a candidate maintains their status in the job referral system (there is a need to renew status every 6 months or the profile is considered dormant), the ability of the contractor to contact a referred candidate, a candidate's interest in the specific job opportunity once contacted, and the ability of the candidate to make arrangements to get to the job site.

Backbay: Area in a river or stream isolated from the main flow where water velocities are typically low or nonexistent.

Backflooding: Intentionally flooding the work area behind a cofferdam to minimize erosion during cofferdam removal.

Backwater effect: In hydrologic terms, the effect that a dam or other obstruction has in raising the surface of the water upstream from it.

Bank recession: Rate at which the bank erodes inland.

Bankfull: Water surface elevation at which a stream first overflows its natural banks.

Base-loaded mode: A generating station mode of operation based on a constant forebay elevation and gradual flow changes in response to changing inflows.

Base metal: A metal that is common and not considered precious (*e.g.*, iron, nickel, lead, zinc).

Basin: A distinct section of a lake, separated from the remainder of the lake by a constriction.

Batch plant: A plant used to manufacture concrete by mixing cement, sand, aggregate and water. The aggregate may be either crushed rock or gravel.

Bathymetry: Measurements of water depth of a lake or river.

Bayline: Refers to communities along the Hudson Bay railroad from Thompson to Churchill.

Bed load: Sediment or other material that slides, rolls, or bounces along the streambed or channel bed of flowing water.

Bed material: Soil material that makes up the bed of the river or lake.

Bed material transport: Sediment particles transported on or near the streambed by rolling, sliding or bouncing.

Bedrock: A general term for any solid rock, not exhibiting soil-like properties, that underlies soil or other surficial materials.

Bench Mark (BM): A point of known or assumed elevation used as a reference in determining other elevations.

Benthic: Relating to the bottom of a waterbody (*e.g.*, lake).

Benthic invertebrate: An animal lacking a backbone that lives on or in the bottom sediments of a waterbody (*e.g.*, mayfly, clam, aquatic earthworm, crayfish).

Benthivore: An animal that feeds on organisms that live on the lake or river bottom (*e.g.*, aquatic insects, molluscs, crustaceans and worms).

Berm: A flat strip of land, raised bank, or terrace bordering a river or canal.

- a path or grass strip beside a road.
- an artificial ridge or embankment, such as one built as a defense against tanks: *berms of shovelled earth*
- a narrow space between a ditch and the base of a parapet.

Best gate: The wicket gate setting at which a hydraulic turbine operates most efficiently. The wicket gates are the main flow control to the turbine.

Bioaccumulate: The accumulation of substances, such as methylmercury, in an organism or part of an organism. Bioaccumulation occurs when a substance is absorbed by an organism at a greater rate than it is lost.

Bioavailability: The availability of substances to be accumulated by biota.

Biodiversity: The variability among living organisms from all sources, including, without limiting the generality of the foregoing, terrestrial and marine and other aquatic ecosystems and the ecological complexes of which they form a part and includes the diversity within and between species and of ecosystems (Canadian Environmental Assessment Agency).

Biological (biochemical) oxygen demand (BOD): A test used to measure the level of pollution in water by determining how much dissolved oxygen is consumed by microorganisms (*e.g.*, bacteria) as they break down organic matter (*e.g.*, plants).

Biomagnification: The increasing concentration of a substance, such as a toxic chemical, in the tissues of organisms at successively higher levels in a food chain.

Biomass: For the purposes of this EIS, the total mass of all living material in a specific area, habitat or region.

Biophysical land classification: A delineation of distinct areas on a map based on soil, surficial deposits, landforms, permafrost and water.

Biota: The animal (fauna) and plant (flora) life of a region.

Black-start: Is the process of restoring electricity to the generation and transmission system during a system wide blackout or outage where transmission lines are not energized and generating stations are not operating. Some generating stations require a source of power to restore it to operation without relying on an off-site source of power. A stand-by diesel generator is normally used to provide power to start up the stations generating units. The generating station then provides power to key transmission lines to provide power to start up other hydroelectric generating stations that do not have their own on-site source of back-up power.

Blanket peatland: Bog, fen or mixtures of these types with peat of intermediate thickness (*i.e.*, up to approximately 2 m thick) and a featureless surface that cover gentle slopes.

Bog: A type of peatland that receives nutrient inputs from precipitation and dryfall (particles deposited from the atmosphere) only. Sphagnum mosses are the dominant peat forming plants. Commonly acidic and nutrient poor.

Border ice: Ice that forms along the bank or shoreline where velocities are low (also referred to as shore ice).

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').

Boulder: The largest of rock particles, having a diameter greater than 256 mm.

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.

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

Bulkhead gate: A fabricated steel unit that performs the same function as a number of stop logs when it is lowered into guides and seals against a frame to close a water passage in a dam or spillway.

Burntwood Nelson Agreement (BNA): The Burntwood Nelson Agreement (BNA) is the collective agreement between the Hydro Project Management Association (HPMA), representing Manitoba Hydro management, and the unions of the Allied Hydro Council (AHC), representing workers, that will be in effect during the construction of the Project. (See below for definition of collective agreement.)

Cache: A hiding place for concealing and preserving provisions.

Capacity factor: The ratio of average load of a plant or machine, to its maximum capacity rating.

Caribou calving and rearing habitat complex: A habitat mosaic that includes a cluster of islands on 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 mosaics or 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.

Cascade: A small waterfall or series of small waterfalls

Catch-per-unit-effort (CPUE): The number or weight of fish caught in a given time period with a specific equipment.

Chironomid: Non-biting midges that, in their larval form, are members of the benthic macroinvertebrate community.

Churchill River Diversion (CRD): The diversion of water from the Churchill River to the Nelson River via the Rat River and the impoundment of water in Southern Indian Lake as authorized by the CRD Licence.

Cladocerans: Small crustaceans that are members of the zooplankton community; commonly known as water fleas.

Clear-span bridge: Small-scale bridge structure that completely spans a watercourse without altering the stream bed or bank, and that are a maximum of two lanes wide. The bridge structure (including bridge approaches, abutments, footings, and armouring) is built entirely above the ordinary high water mark.

Climate scenario: A plausible and often simplified representation of the future climate, based on an internally consistent set of climatological relationships, that has been constructed for explicit use in investigating the potential consequences of anthropogenic climate change, often serving as input to impact models. Climate projections often serve as the raw material for constructing climate scenarios, but climate scenarios usually require additional information such as the observed current climate. A "climate change scenario" is the difference between a climate scenario and the current climate.

Climax: The culminating, self-replacing seral stage in plant succession that is relatively stable and persists for long periods relative to other **seral** stages.

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

Coarse habitat mosaic: Combination of habitat types for the purpose of analysis of data collected on mammal tracking transects.

Coarse habitat type: The second 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 used for the terrestrial assessment.

Cobble: Rocks larger than gravel but smaller than boulders, having a particle diameter between 64 and 256 mm.

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.

Commercial fishing: A fishery where the catch is sold.

Commercial trapping: The capture of furbearers for the sale of furs.

Community: In ecology, a community is an ecological unit composed of a group of organisms or a population of different species occupying a particular area, usually interacting with each other and their environment. For people, a community is a social group of any size, whose members reside in a specific locality.

Compensation agreement: An agreement between a resource developer and a party affected by their development to provide compensation for damages caused by the development.

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).

Concrete aggregate: Crushed rock or gravel of varying size used in the production of concrete. Aggregate is mixed with sand, cement, and water and other additives to produce concrete.

Conductivity: A measure of the ability of a solution to conduct electrical flow; units are microSiemens per centimetre.

Construction power: The electrical requirements during the construction of the project, required for the camp, batch plants, cranes, heaters and other equipment.

Converter station: A facility, which converts electricity, either from direct current (DC) to alternating current (AC) or from AC to DC.

Copepods: Small crustaceans that are members of the zooplankton community.

Country food: Traditional diet of Aboriginal people, particularly those living in northern regions, includes various forms of meat, fish, waterfowl and berries that can be hunted, fished and gathered from the land.

Crest: The top surface of a dam or roadway, or the high point of the spillway overflow section, or the highpoint of a landform.

Cryosol: A soil order in the Canadian System of Soil Classification that includes soils having permafrost within 1 m of the surface or within 2 m if the pedon (the smallest unit or volume of soil that contains all the soil horizons of a particular soil type) has been strongly cryoturbated (disturbed as a result of freeze–thaw processes) laterally within the active layer, as indicated by disrupted, mixed, or broken horizons. Cryosols have a mean annual temperature <0°C.

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

Dabbling duck: Various species of ducks that feed in shallow water, such as mallards, teals and northern shovelers.

Debris: Any material, including floating or submerged items (*e.g.*, driftwood, plants), suspended sediment or bed load, moved by flowing water.

Decommissioning: Planned shutdown, dismantling and removal of a building, equipment, plant and/or other facilities from operation or usage and may include site cleanup and restoration.

Deleterious: Harmful.

Dependable energy: The energy that can be generated by a generating station during the lowest flow conditions on record for a given length of time (*i.e.*, week, month, and year).

Deposition: Deposition is the process of settling of sediment particles from a state of suspension in water column as a result of reduction in flow velocity or increase in sediment concentration without corresponding increase to the discharge.

Designated trade: Occupations that have formal apprenticeship programs that provide supervised training leading to certification as a fully-qualified journeyperson in the trade. Apprenticeships in the designated trades typically entail four or more years of in-class technical training and on-the-job work experience. Carpenters and electricians are examples of occupations in the designated trades.

Detritivore: An organism that feeds upon decomposing organic matter.

Dewater: Removing the water from or draining an area behind a cofferdam so that construction activities can be undertaken.

Direct negotiated contract (DNC): A type of contract that is non-tendered and directly negotiated between parties.

Dispersal: The spread of animals, plants, or seeds to new areas.

Dissolved oxygen (DO): Oxygen molecules (O2) dissolved in water.

Domestic fishing (harvest): The harvest of natural resources for personal use or consumption (*i.e.*, not sold).

Draft tube: The part of the water passage immediately downstream of a turbine runner, through which the water is directed into the tailrace.

Driver: Any natural or human-induced factor that directly or indirectly causes a change in the environment.

Driving factor: Any natural or human-induced factor that directly or indirectly causes a change in the environment.

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

Ecological reserves: Established under the *Ecological Reserve Act* of Manitoba, ecological reserves are areas created to preserve unique and rare examples of plants, animals and geological features.

Ecosite type: A classification of site conditions that have important influences on ecosystem patterns and processes. Site attributes that were directly or indirectly used for habitat classification included moisture regime, drainage regime, nutrient regime, surface organic layer thickness, organic deposit type, mineral soil conditions and permafrost conditions.

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).

Eco–tourism: Viewing or studying fish, wildlife or a natural area; recreational or adventure activities such as canoeing, hiking and horseback riding that take place in a natural area.

Ecozone: A classification system that defines different parts of the environment with similar land features (geology and geography), climate (precipitation, temperature, and latitude), and organisms.

Edge effect: The effect that an abrupt transition between two different adjoining ecological communities has on organisms and environmental conditions 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 [ref]. The impact-effect terminology is a statement of a 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).

Effective habitat: Habitat that is 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.

Emigration: Movements of an organism away from their natural environment into another geographical area.

Empirical: Pertaining to, or founded upon, experiment or experience; depending upon the observation of phenomena.

Employment rate: The percentage of the total population 15 years of age and over that was employed in the week (Sunday to Saturday) prior to Census Day (June 4, 1991; May 15, 2001; May 16, 2006).

Endangered: A species facing imminent extirpation or extinction (COSEWIC).

Entrainment: 1) A process by which sediment from a surface is incorporated into a fluid flow (such as water) as part of the operation of erosion; and 2) Fish (larval or adult) that are drawn into a current and cannot escape.

Environment: The components of the Earth, including a) land, water and air, including all layers of the atmosphere, b) all organic and inorganic matter and living organisms, and c) the interacting natural systems that include components referred to in a) and b) (Canadian Environmental Assessment Agency).

Environmental assessment (EA): 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 component: Fundamental element of the physical, biological or socio-economic environment, including the air, water, soil, terrain, vegetation, wildlife, fish, birds and land use "that may be affected by a proposed project, and may be individually assessed in the environmental assessment (Canadian Environmental Assessment Agency)."

Environmental impact assessment (EIA): See *Environmental Assessment*.

Environmental officer: The person doing environmental inspections of the Keeyask site on behalf of the KHLP, pursuant to the EnvPPs.

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.

Erodibility coefficients: A numerical parameter that represents the susceptibility of mineral soils to wave erosion. It is usually determined empirically as the gradient of the linear relationship between effective wave energy and volumetric erosion rate at sites where historical erosion has been monitored.

Erosion: A natural process, which is either naturally occurring or anthropogenic in origin, by which the Earth's surface is worn away by the actions of water and wind.

Esker: A narrow ridge of sand or gravel, usually deposited by a stream flowing in or under glacial ice.

Eutrophic: Having waters or soils rich in phosphates, nitrates and organic nutrients that promote a proliferation of plant life, including algae.

Evapotranspiration: The process by which water is transferred to the atmosphere through evaporation, such as plants emitting water vapour from their leaves.

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.

Fecal coliform bacteria: Include genera such as *Escherichia* and *Klebsiella*, are indicators of organisms from the intestinal tracts of humans and other animals, used to represent the potential presence of pathogens.

Fen: Peatland in which the plants receive nutrients from mineral enriched ground and/or surface water. Water chemistry is neutral to alkaline. Sedges, brown mosses and/or Sphagnum mosses are usually the dominant peat forming vegetation.

Fetch: Length of water surface exposed to wind during generation of waves.

Fine habitat: The most detailed 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.

Fingerlings: A young fish that has finished absorbing its yolk sac and is approximately three to four months old.

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

Footprint: The surface area occupied by a structure or activity; the land or water area covered by a project. This includes direct physical coverage (*i.e.*, the area on which the project physically stands) and direct effects (*i.e.*, the disturbances that may directly emanate from the project, such as noise).

Forage fish: Small, schooling fish that are typically eaten by larger fish. Typically less than 150 mm as adults (*e.g.*, minnows, darters, sculpins, stickleback).

Forage(ing): To locate, capture, and eat food.

Forebay: Impoundment area immediately upstream from a dam or hydroelectric plant intake structure that forms the downstream portion of the reservoir.

Fragmentation: 1) 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. 2) 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. (Cumulative Effects Assessment).

Frazil ice: Fine, small, needle-like structures of thin, flat circular plates of ice formed in super-cooled, turbulent water.

Freshet: The flood of a river from heavy rain or melted snow.

Full supply level (FSL): The normal maximum controlled level of the forebay (reservoir).

Furbearer: Refers to those mammal species that are trapped (*e.g.*, marten, fox, *etc.*) for the useful or economic value of their fur.

Gathering: Collecting plants for medicinal and dietary purposes and other natural products such as firewood, driftwood or feathers for cultural purposes.

Generator: Machine that coverts mechanical energy into electrical energy.

Geological overburden: Material overlying a useful mineral deposit or desired bedrock anchor.

Glacial till: An unsorted, unstratified mixture of fine and coarse rock debris deposited by a glacier.

Glaciofluvial: Pertaining to streams fed by melting glaciers, or to the deposits and landforms produced by such streams.

Glaciolacustrine: Pertaining to lakes fed by melting glaciers, or to the deposits forming therein

Gradient: The rate at which a water level increases or decreases over a specific distance.

Granular: Composed of granules or grains of sand or gravel.

Granular fill: Fill material including sand and gravel.

Greenhouse gas (GHG): Gases emitted from a variety of sources and processes, said to contribute to global warming by trapping heat between the earth and the atmosphere;
(a) carbon dioxide, (b) methane,(c) nitrous oxide, (d) hydrofluorocarbons,
(e) perfluorocarbons, (f) sulphur hexafluoride, (g) any other gas prescribed by regulation.

Groin: A rock fill structure extending out into a river or lake from the bank or shore. Used to protect the bank from erosion.

Gross Domestic Product: The gross national product excluding the value of net income earned abroad.

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

Grouting: Filling cracks and crevices with a slurry composed of a cement and sand mixture or other material to prevent or reduce flow through them.

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

Habitat alteration: Changes in one or more terrestrial habitat attributes that are large enough to convert a habitat patch to a different fine habitat type.

Habitat disturbance: Changes in one or more terrestrial habitat attributes that are too small to convert a habitat patch to a different fine habitat type (*e.g.*, a machine trail through a habitat patch).

Habitat loss: Conversion of terrestrial habitat into a human feature or an aquatic area.

Habitat suitability index (HSI): A numerical index ranging from zero to 1.0 representing the capacity of a given habitat to support a selected species. A value of 1.0 represents optimal conditions for that species while a value of zero represents unsuitable conditions. HSI models are based on hypothesized species-habitat relationships rather than statements of proven cause and effect relationships. Such models serve as a basis for improved decision making and increased understanding of species-habitat relationships.

Hanging ice dam: A deposit of ice, typically at the downstream end of rapids that builds up through the winter by accumulating frazil ice, which then partially blocks the flow of water and causes water levels upstream to rise.

Hard water: Water that contains calcium carbonate at a concentration of 121 mg/L or higher. Water with a calcium carbonate concentration of 61-120 mg/L is considered moderately hard/soft.

Head: Refers to the hydraulic elevation head at a generating station which is calculated as the difference between the water level upstream of the station (forebay level) and the water level downstream (tailrace level) measured in meters. The amount of hydraulic head results in a specific amount of pressure that would be applied to the turbines to generate power due to the weight of the water.

Herbivore: An animal that feeds predominantly on plants.

Hibernaculum (plural hibernacula): For the purposes of the EIS, shelter occupied in the winter by a dormant animal.

Host animal / host plant: An animal or plant that nourishes and supports a parasite; the host does not benefit and is often harmed by the association.

Hydraulic: 1) of or relating to liquid in motion; and, 2) of or relating to the pressure created by forcing a liquid through a relatively small orifice, pipe, or other small channel.

Hydraulic model: Refers to the use of mathematical or physical techniques to simulate existing hydraulic systems and make projections related to hydraulic variables (*i.e.,* water levels, flows and velocities).

Hydraulic zone of influence (HZI): Reach of river over which water levels and water level fluctuations caused by the operation of a particular project are measurable within the accuracy required for operation and license compliance.

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

Hypoxic: A deficiency of oxygen.

Ice boom: A floating structure, anchored at opposite shorelines and/or the river bottom, designed to help form and hold an ice cover in place.

Ice pans: Free-floating sheets of ice.

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.*

Impermeable: Relating to a material through which substances, such as liquids or gases, cannot pass.

Impervious core: A zone of low permeability material (usually glacial till) in an earth dam, used to reduce leakage through the dam.

Impingement: Trapping of fish against the trash racks at the water intakes.

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

In situ: In place; undisturbed. An *in situ* environmental measurement is one that is taken in the field, without removal of a sample to the laboratory.

Incidental take: The accidental harming or destruction of a wildlife species or its habitat by humans (*e.g.*, the inadvertent destruction of a nest).

Inflow: The water flowing into a water body (lake, reservoir, *etc.*)

Inland peatland: A peatland that is beyond the direct influence of a water body's water regime and ice regime.

Intermediate head: A generating station design that has an intermediate forebay elevation compared to other options (usually low or high head).

Intermittently-exposed zone (IEZ): The zone that is routinely dewatered downstream of a generating station (*i.e.*, within the 5th and 95th percentile flows).

Invertebrates: Organisms lacking a backbone or vertebral column.

Invertivore: A species that feeds on invertebrates.

Joint Keeyask Development Agreement (JKDA): An agreement between Tataskweyak Cree Nation and War Lake First Nation operating as Cree Nation Partners, and York Factory First Nation, and Fox Lake Cree Nation, and the Manitoba Hydro-Electric Board regarding the partnership, ownership, development and operation of the Keeyask Project.

Journeyperson: Someone who has completed an apprenticeship and is fully certified in a trade or craft, but not yet a master.

Keeyask Environmental and Regulatory Protocol (the Protocol): The environmental and regulatory protocol for the finalization of the Environmental Impact Assessment and the EIS and the submission of the EIS to Regulatory Authorities, substantially in the form attached as Schedule 3-1 to the JKDA**.**

Key person interview (KPI): Interview with an individual whose knowledge, creativity, inspiration, reputation, and/or skills are critical to the credibility of a study.

Labour force: The employed are persons having a job or business, whereas the unemployed are without work, are available for work, and are actively seeking work. Together the unemployed and the employed constitute the labour force. Persons not in the labour force are those who, during the reference week, were unwilling or unable to offer or supply labour services under conditions existing in their labour markets (this includes persons who were full-time students currently attending school).

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

Lake Winnipeg Regulation (LWR): The LWR project was constructed by Manitoba Hydro in the 1970s to regulate the outflow from Lake Winnipeg to the Nelson River and store water in the lake as authorized by the LWR Licence. The project includes three excavated channels, the Jenpeg generating station and control structure and a dam at Kiskitto Lake. Lake Winnipeg is regulated for hydropower generation and flood control.

Land cover: The most general 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.

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

Larva (ae; al): The young, immature form of an insect or animal.

Lentic: Pertaining to very slow moving or standing water, as in lakes or ponds.

Life history stages: For the purposes of the EIS, the different developmental phases in a fish's life including: egg, larva, young-of-the-year, sub-adult and adult.

Life stage (of animals): One of the stages of life beginning with birth and progressing through larval or juvenile phases to sub-adult and adult phases.

Littoral zone: Area on or near the shore of a body of water.

Lodge: An accommodation facility of a permanent or semi-permanent nature that accommodates nine or more persons. In general ecological usage, this term can refer to the den of certain animals, such as the dome-shaped structure built by beavers.

Lotic: Pertaining to rapidly moving fresh water.

Macroinvertebrate: Small animals without backbones living on or in the substrata of lakes and rivers that are retained by a 500 µm mesh size. Macroinvertebrates retained on 500 µm sieves are important food items to vertebrates (particularly fish) and useful bioindicators of environmental change.

Macrophyte(s): Multi-celled aquatic and terrestrial plants.

Mainstem: The unimpeded, main channel of a river.

Mark-recapture studies: Fish are captured, marked a Floy® tag, and then subsequent rounds of fishing are conducted to recapture the marked fish. Data are used to determine species population size and movements.

Mass wasting: A general term of the dislodgement and downslope transport of soil and rock material under the direct application of gravitational body stresses. Includes slow displacements, such as creep and rotational slump failures, and rapid movements, such as rock and soil falls, rock slides, and debris flows.

Member: For the purposes of the EIS**,** means a person who is a "member of a band" as defined in subsection 2(1) of the *Indian Act* (Canada).

Mesoeutrophic: Moderately eutrophic (see eutrophic).

Mesotrophic: Description of a waterbody, typically a lake, characterized by moderate concentrations of nutrients (*i.e.*, nitrogen and phosphorus) and resulting significant productivity.

Metalloids: An element with the properties of metals and non-metals.

Methylmercury: An organic form of mercury that is able to concentrate in animal tissue.

Migration: The movement of an individual or group of individuals from one area to another.

Mineral erosion: Wearing away of minerals due to wind and water processes.

Mineral soil: Naturally occurring, unconsolidated material that has undergone some form of soil development as evidenced by the presence of one or more horizons and is at least 10 cm thick. If a surface organic layer (*i.e.*, contains more than 30% organic material or 17% organic carbon by weight) is present, it is less than 20 cm thick.

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."

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; 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.

Movement: For the purposes of the EIS, the act of individual or populations of animals moving from one habitat to another for spawning, foraging, overwintering, escape from predation, *etc.*

Nearshore: Aquatic habitat occurring at the interface between a lake or stream and adjacent terrestrial habitat; usually includes aquatic habitat up to 3 m in depth; shallow underwater slope near to shore.

Non-designated trade: Jobs that are directly involved with the construction of the Project, but do not have formal apprenticeship programs leading to a Journeyperson certification. Examples of non-designated trades are labourers, heavy equipment operators, vehicle drivers (teamsters), rebar workers and cement masons. Training and work experience requirements can range from basic on-the-job training for entry level positions to more than 3 years of formal training and professional experience to be fully qualified for the most highly-skilled positions.

Northern Aboriginal residents: Is a defined term in the Burntwood Nelson Agreement (BNA) generally referring to status Indians, Métis, non-status Indians and Inuit who qualify as **Northern Residents**. Northern Residents are defined as a person who has resided in northern Manitoba (north of the boundary set out in Schedule 12-5 to the BNA for (a) a period of five years accumulatively or more; and (b) a period of six consecutive months or more, immediately prior to being referred to employment or re-employment.

Northern Flood Agreement (NFA): An agreement signed in 1977 by Manitoba Hydro, the governments of Canada and Manitoba, and the Northern Flood Committee on behalf of five affected Cree Nations regarding the effects of the Churchill River Diversion and Lake Winnipeg Regulation.

Offshore: Aquatic habitat not adjacent to terrestrial habitat; usually includes aquatic habitat greater than 3 m in depth.

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

Oligotrophic: Description of a waterbody, typically a lake, or terrestrial site characterized by extremely low concentrations of nutrients (*i.e.*, nitrogen and phosphorus) which typically leads to low primary productivity.

Organic: The compounds formed by living organisms.

Organism: An individual living thing.

Outflow: The water flowing out of a water body (lake, reservoir, *etc.*).

Overburden: Soil (including organic material) or loose material overlaying bedrock.

Overtopping: When the water level rises above the top of a barrier (*e.g.*, a cofferdam) allowing water to flow over the barrier.

Overwinter(ing): The survival of fish through the winter beneath ice cover.

Palatability: A substance (*e.g.*, water or fish flesh) that is agreeable to the palate or taste.

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

Park reserve: A temporary designation under the *Manitoba Provincial Parks Act* to ensure that the lands under consideration for Provincial Park status are not otherwise allocated or used while planning and consultation is taking place.

Participation rate: For the purposes of the EIS, the percentage of the potential labour force that was in the labour force in the week (Sunday to Saturday) prior to Census Day (June 4, 1991; May 15, 2001; May 16, 2006).

Parturition: The process of giving birth.

Pathway diagram: A simple diagrammatic representation of a potential cause-effect relationship between two related states or actions that illustrates an impact model. Pathway diagrams take network diagrams one-step further by evaluating each linkage and assessing the cause-effect relationship in the context of a scientific hypothesis.

Peaking: For the purposes of the EIS, the mode of operation that begins with reducing the flow through the generating station during off-peak periods, thereby storing some water in the reservoir, and then increasing the flow and using the stored water to generate extra energy during on-peak periods.

Peat: Material consisting of non-decomposed and/or partially decomposed organic matter, originating predominantly from plants.

Peat plateau bog: Ice-cored bog with a relatively flat surface that is elevated from the surroundings and has distinct banks.

Peat resurfacing: Process whereby all or portions of a peat mat that was submerged by flooding detaches and floats to the water surface.

Peatland: Wetland where organic material has accumulated because dead plant material production exceeds decomposition.

Peatland disintegration: Processes related to flooded peat resurfacing; breakdown of non-flooded and resurfaced peatlands and peat mats; and peat formation on peatlands and peat mats that have hydrological connections to a regulated area.

Percentage point: The unit for the arithmetic difference of two percentages (*i.e.*, there is a 5 percentage point difference between 5% and 10%).

Percentile: Part of the "ile" family that signposts positions on a scale of numbers. The top percentile on, say, the distribution of income, is the richest 1% of the population.

Periphyton: Assemblage of microorganisms, including algae, that grow on submerged surfaces.

Permafrost: Ground where the temperature remains below 0°C for two or more consecutive years.

Permeability: The degree to which fluids or gases can pass through a barrier or material.

Person-years: A measure of the amount of work that could be available during a specific time period or for a specific type of work. One person-year approximates the amount of work that one worker could complete during twelve months of full-time employment.

pH: Method of expressing acidity or basicity of a solution. pH is the logarithm of the reciprocal of the hydrogen ion concentration, with a pH of 7.0 indicating neutral conditions. Ph values of less than seven are acidic.

Phyla: Taxonomic rank below the group known as a "Kingdom" and above that of a "Class"; a group of organisms with a certain degree of morphological or developmental similarity and/or with a certain degree of evolutionary relatedness.

Physiography: Physical geography, *i.e.*, the study of physical features of the surface of the Earth.

Phytoplankton: Algae suspended in the water column.

Piscivorous: An organism that feeds predominantly upon fish, including many species of birds, mammals and other fish.

Pollution: 1) Any human alteration of the natural environment producing a condition that is harmful to living organisms. 2) Any solid, liquid, gas, smoke, waste, odour, heat, sound, vibration, radiation, or a combination of any of them that is foreign to or in excess of the natural constituents of the environment, and (a) affects the natural, physical, chemical, or biological quality of the environment, or (b) is or is likely to be injurious to the health or safety of persons, or injurious or damaging to property or to plant or animal life, or (c) interferes with or is likely to interfere with the comfort, well being, livelihood or enjoyment of life by a person.

Population: For the purposes of the EIS, 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.

Potential labour force: In general, the number of individuals in a population 15 years of age and older.

Power: The instantaneous amount of electrical energy generated at a hydroelectric generating station, usually expressed in megawatts.

Powerhouse: Structure that houses turbines, generators, and associated control equipment, including the intake, scroll case and draft tube.

Precambrian shield: Bedrock formed in the Precambrian Era, which began with the consolidation of the earth's crust and ended approximately 4 billion years ago.

Primary habitat: For purposes of the EIS, the preferred habitat of a particular species.

Primary producers: A group of organisms that possess chlorophyll and conduct photosynthesis to meet their energy requirements for survival, growth and reproduction. They form the base of the food chain.

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

Probable maximum flood: The flood that would result from the most severe combination of hydrologic and meteorological conditions that could reasonably occur. It is based on analyses of precipitation, snowmelt and other factors conducive to producing maximum flows.

Productivity: Rate of formation of organic matter over a defined period; this can include the production of offspring.

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.

Protected area: As defined by the World Conservation Union, a protected area is an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.

Provincial park: Crown lands designated under the *Manitoba Provincial Parks Act.*

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

Quarry: An open pit where rock is mined for use as a building material at the construction site.

Quarterly employment: employment occurring during a quarterly time period within a year (*e.g.*, first quarter from January through March; second quarter from April through June; third quarter from July through September; fourthquarter from October through December).

Rapids: A section of shallow, fast moving water in a stream made turbulent by totally or partially submerged rocks.

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

Reach: A section, portion or length of stream or river.

Rearing: The raising of young.

Recreational fishing: Fishing activity where the primary intent is enjoyment; angling

Recruitment: The number of new juvenile fish reaching a size/age where they represent a viable target for the commercial, subsistence or sport fishery for a given species.

Regime: The frequency, size, intensity, severity, patchiness, seasonality and sub-type of a periodic event or continual fluctuation.

Rehabilitation: To restore a disturbed structure, site or land area to good condition, useful operation or productive capacity.

Relief: Variation in elevation on the surface of the earth.

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: For the purposes of the EIS, 1) Person living in Manitoba for the last consecutive six months; 2) 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.

Resource use: Subsistence and economic activities that make use of the resources derived from the natural environment.

Riparian: Along the banks of rivers and streams.

Riverine: Relating to, formed by, or resembling a river including tributaries, streams, brooks, *etc.*

Rockfill: Fill material typically consisting of excavated and crushed rock or blast rock that is used to provide mass to a structure while protecting it from erosion.

Rollway: The concrete portion of the spillway that water flows over when the spillway is in operation.

Scroll case: A reinforced concrete semi-spiral part of the turbine water passage, located between the intake and the turbine runner, with a gradually contracting cross-section (much like a snail shell), designed to distribute the water evenly over the turbine runner.

Secondary habitat: Useable or alternative habitat for a given species, typically lower in quality than primary habitat.

Sediment(s): Material, usually soil or organic detritus, which is deposited in the bottom of a waterbody.

Sedimentation: A combination of processes, including erosion, entrainment, transportation, deposition and the compaction of sediment.

Sediment budget: An accounting of the erosion, storage and transport processes of soil and sediment in drainage basins or smaller landscape units.

Sediment oxygen demand (SOD): The dissolved oxygen demand from the sediments or substrate of lakes and rivers.

Seral: Referring to the series of plant communities that succeed one another before a stable, or climax, plant community, is reached.

Service bay: An open area of the powerhouse where turbines and generator equipment are assembled during construction, and later, where maintenance and repairs are done to major generating components.

Service gate: Gates that are used to dewater a unit to allow inspections, maintenance and repairs to occur within the water passage.

Severance line: Under the *Water Power Act*, severance line describes the land and the works within it that are associated with a project licensed under this Act. This means that everything within these boundaries may be taken over by the Province of Manitoba in the event that the license should be terminated. The Crown also has an obligation to ensure that any additional rights granted on these lands do not prejudicially interfere with Manitoba Hydro's ability to operate and maintain its license.

Shear stress: Stress caused by forces operating parallel to one another but in opposite directions.

Shore zone: Areas along the shoreline of a waterbody including the shallow water, beach, bank and immediately adjacent inland area that is affected by the water body.

Significance: For the purposes of the assessment for regulators in the EIS of residual effects of the Project on VECs, a measure of how adverse or beneficial a residual effect is expected to be; significant adverse environmental effects are those residual effects that are predicted to cause significant adverse environmental effects as defined under the *Canadian Environmental Assessment Act*; significant positive effects are those residual effects that would cause a beneficial change that is measureable or obvious.

Silt: A very small rock fragment or mineral particle, smaller than a very fine grain of sand and larger than coarse clay; usually having a diameter of 0.002 to 0.06 mm; the smallest soil material that can be seen with the naked eye.

Socio-economic impact assessment (SEIA): Provides detailed information about effects, both positive and negative, that a proposed project may have on people, their lifestyles and their communities. In particular, effects that flow from biophysical effects are included. Often, effects that flow from other aspects of a project (*e.g.*, employment and business opportunities) are also discussed. An SEIA also provides ways to address effects that are likely to be adverse, from the point of view of an affected population, and to enhance those effects perceived to be positive. Residual effects, cumulative effects and monitoring are also included. A SEIA is often part of the environmental impact assessment (EIA) for a proposed project.

Soft water: Water that contains calcium carbonate at a concentration of 60 mg/L or less. Water with a calcium carbonate concentration of 61-120 mg/L is considered moderately hard/soft.

Specific conductance: Conductivity expressed at a standard temperature of 25°C.

Spillway: A concrete structure that is used to pass excess flow so that the dam, dykes, and the powerhouse are protected from overtopping and failure when inflows exceed the discharge capacity of the powerhouse.

Sporadic (ally): For the purposes of the EIS, the occurrence of isolated patches, 10–35% of a geographic region.

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

Stand level habitat type: A relatively uniform area in terms of vegetation, vegetation age, soils and topography that ranges from approximately one to one hundred hectares in size.

Steady-state: A stable condition that does not change over time or in which change in one direction is continually balanced by change in another.

Stewardship: Refers to general environmental care and protection.

Stocking program: Fish that are raised in captivity (generally from eggs and sperm collected from wild fish [brood stock]) are released into a designated water body to meet one or more specific management objectives. These management objectives can include population restoration, population enhancement, and/or establishment of a fishery.

Stratification: Arrangement of a body of water into two or more horizontal layers of differing characteristics (*e.g.*, temperature, pH, dissolved oxygen).

Stratigraphy: Scientific study of rock strata, especially the distribution, deposition, correlation and age of sedimentary rocks. Also can refer to the layering of materials or soil horizons at a location.

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

Sub-adult: For purposes of the EIS, a fish that is older than one year but has not reached sexual maturity. Lake sturgeon sub-adults measured between 200 and 833 mm long (fork length) based on sexual maturity data collected during the spawning season from a well-studied lake sturgeon population on the lower Nelson River.

Substrate(s)/Substrata: 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 key topic that has a lower degree of concern than the Valued Environmental Components and improves the reliability of the assessment.

Surcharge: A condition in a forebay or reservoir in which the water level rises above the full supply level.

Surface permafrost: Permafrost that occurs within the top 2 m of the surface materials.

Suspended sediment concentration: Measure of the amount of sediment in a unit of water usually expressed in terms of milligrams of dry sediment measured down to approximately 1micron (0.001 mm) in a litre of water.

Switching station: An area that typically contains electrical equipment that is used in the transmission of electricity.

Tailrace: A channel immediately downstream from a powerhouse that directs the water away from the turbine and into the river channel.

Tailwater: The water in the tailrace, or the level of the water in the tailrace.

Taxa: Plural of taxon.

Taxon: A group of organisms that are treated as a classification unit. Usually a taxon is given a name and a rank, although neither is a requirement.

Taxonomy: The classification of organisms in a hierarchical system or in taxonomic ranks (*e.g.*, order, family, genus, species) based on shared characteristics or relationships inferred from the fossil record or established by genetic analysis.

Telemetry: Automatic transmission and measurement of data from remote sources by wire or radio or other means.

Terrestrial habitat: The land areas where plants and animals live. The terrestrial habitat section classifies and maps habitat based on plants, standing and fallen dead trees, soils, ground ice, groundwater, surface water, topography and disturbance (*e.g.*, fire) conditions.

Thalweg: The deepest part of the channel of a river or stream.

Thermal ice cover: An ice cover that forms where velocities are low.

Topography: General configuration of a land surface, including its relief and the position of its natural and manmade features.

Total dissolved solids (TDS): Measure of the amount of material dissolved in water (primarily inorganic salts).

Total Kjeldahl nitrogen (TKN): Total concentration of nitrogen in the form of ammonia and organic nitrogen. As determined by the Kjeldahl test.

Total sediment load: Measure of the total sediment being transported in suspension and on the bed.

Total suspended solids (TSS): Solids present in water that can be removed by filtration consisting of suspended sediments, phytoplankton and zooplankton.

Transition structure: A concrete structure that connects an earth structure such as a dyke or dam to a concrete structure such as the powerhouse or spillway.

Transmission: The electrical system used to transmit power from the generating station to customers.

Transmission line: A conductor or series of conductors used to transmit electricity from the generating station to a substation or between substations.

Trap-nights: The number of traps in a small mammal trapping block or trap set multiplied by the number of nights the traps were set at that location; *e.g.*, 100 traps x 3 nights = 300 trap nights.

Trash rack: A grid of metal bars placed in front of the intake to prevent larger objects from entering the turbine and damaging the units.

Trophic: In ecology, **trophic level** describes an organism's position in the food chain.

Tundra: Treeless plain characteristic of arctic and subarctic regions, with permanently frozen subsoil and dominant vegetation of mosses, lichens, herbs, and dwarf shrubs.

Turbine: A machine for converting the power of flowing water to rotary mechanical power that is then transferred by a large metal shaft to the generator for conversion to electric power.

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.

Unconsolidated: Not compact or dense in structure or arrangement; *i.e.*, "loose gravel."

Unemployment rate: The percentage of the labour force in the week (Sunday to Saturday) prior to Census Day (June 4, 1991; May 15, 2001; May 16, 2006) that was unemployed.

Upland: Any area that does not qualify as a wetland because the associated water regime is not wet enough to be associated with wetlands. For the purposes of this document, upland is ground elevation at a distance from a waterbody or watercourse.

Valued Environmental Component (VEC): Is an element of the environment identified as having scientific, social, cultural, economic, historical, archaeological or aesthetic importance. The value may be determined on the basis of cultural ideals or scientific concern (adapted from CEAA).

Velocity: A measurement of speed of flow.

Veneer bog: Bog with thin surface peat (*i.e.*, less than 1.5 thick) that generally occurs on gentle slopes and contain discontinuous permafrost.

Wage economy: Portion of the economy dominated by the monetary flows and the exchange of money for labour and good and services.

Water quality: Measures of substances in the water such as nitrogen, phosphorus, oxygen and carbon.

Water regime: A description of water body (*i.e.*, lake or river) with respect to water levels, flow rate, velocity, daily fluctuations, seasonal variations, *etc.*

Water surface profile: A two-dimensional section view of a reach of the river that shows the elevation of the water surface along that reach.

Water table: The level below the surface where the soil is saturated by groundwater.

Watershed: A geographic region bounded by ridges, crest lines and other high points of land in which all surface water drains into a river, river system or other body of water.

Wetland: Land that is wet for all or part of the year, including areas where the water is up to 2 m deep. Water saturation is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. Marshes and peatlands are types of wetlands.

Wildlife management area (WMA): Crown lands set aside for the better management, conservation and enhancement of the wildlife resources of the province.

Yearlings: In regards to fish that are one year old and less than two years old.

Young-of-the-year (YOY): Fish less than one year of age.

Zooplankton: Floating or swimming invertebrates that live in the water column.