WUSKWATIM GENERATION PROJECT

CANADIAN ENVIRONMENTAL ASSESSMENT ACT
COMPREHENSIVE STUDY REPORT

PREPARED BY

FISHERIES AND OCEANS CANADA

CENTRAL AND ARCTIC REGION

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Executive Summary

Manitoba Hydro and the Nisichawayasihk Cree Nation (NCN) plan to build a new 200-megawatt (MW) generating station at Taskinigup Falls on the Burntwood River, downstream of the outlet of Wuskwatim Lake. The Wuskwatim Generation Project (the Project) will be constructed across the Burntwood River to harness the Churchill River Diversion's flow currently passing over the approximately 22 m combined elevation drop between Wuskwatim Falls and Taskinigup Falls. The stated rationale for this hydroelectric power project is to meet projected energy needs within the next two decades for Manitoba, as identified in Manitoba Hydro's 2002/03 Power Resource Plan, and to allow Manitoba Hydro and NCN to obtain additional export revenues and profits by advancing the in-service date of the Project from 2020 to 2009. Among the various options reviewed for development of the Project, a low head, modified run-of-river station with a three-unit fixed-blade vertical shaft propeller turbine design was selected by the Proponent based on a balance between the economics of capacity and the energy production requirements, environmental concerns, and the cost of the Project. The project provides for the construction of a powerhouse, a main dam 22 m high, and a spillway. The dam would raise water levels in the proposed forebay to 234 m ASL, which would flood out Wuskwatim Falls, flood 37 ha of land, and stabilize water levels in Wuskwatim Lake near the upper range of water levels currently experienced by the lake. The generating station takes advantage of seasonal flow regulation provided by the Notigi control structure for the Churchill River Diversion, and would be operated in a modified run-of-river mode in which water entering Wuskwatim Lake daily would be discharged within 24 hours. The project's main impacts would arise from the construction of the reservoir, the encroachment caused by the various facilities as well as changes in hydrological conditions.

Fisheries and Oceans Canada (DFO) has determined that the Project would cause fish habitat losses requiring an authorization under subsection 35(2) of the *Fisheries Act* (FA), which triggers the *Canadian Environmental Assessment Act* (CEAA). Several of the structures to be built in navigable waters would also require the issuing of formal approval under the *Navigable Waters Protection Act* (NWPA), which is also a trigger of the CEAA. Thus, DFO has prepared this report in consultation with Transport Canada (TC) and the federal authorities concerned (Environment Canada, Natural Resources Canada, Health Canada, Indian and Northern Affairs Canada and Parks Canada Agency).

This report fulfills Fisheries and Oceans Canada's and Transport Canada's obligations as responsible authorities established under the CEAA, to conduct an assessment of the project's environmental effects in consultation with other federal authorities who have the appropriate expertise. The report presents the assessment of the project's effects on the Valued Environmental Components: fish and fish habitat; birds, species at risk, human health (local air quality, quality of drinking water and consumption of fishery products), navigation, use of renewable resources, and current use of lands and resources for traditional purposes by Aboriginal persons (hunting, trapping, gathering, subsistence fishing; and heritage sites). The environmental assessment also includes the study of effects caused by potential accidents or malfunctions and the cumulative effects that the

project, combined with the existence of other structures or other projects or activities, is likely to have on the environment.

Following analysis of the nature of the project, the description of work, the infrastructures and the proposed changes to the hydraulic regime, Fisheries and Oceans Canada and Transport Canada have assessed the potential impacts that the Wuskwatim Generation Project is likely to have on the environment. This review was completed on the basis of the information provided by the Proponent in their Environmental Impact Study and Supplemental Filings, expert advice provided by federal authorities, results of discussions with provincial regulatory agencies and advice from provincial experts provided through the cooperative review process, and comments provided by Aboriginal groups and other public stakeholders through various consultation exercises.

Taking into account the implementation of any mitigation that was considered to be appropriate, including the proposed habitat compensation measures, as well as the follow-up programs and the Proponent's commitments, Fisheries and Oceans Canada and Transport Canada have determined that the proposed Project, as defined by the scope of the study, is not likely to cause significant adverse environmental effects.

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1.0 Introduction

Fisheries and Oceans Canada (DFO) prepared this comprehensive study report (CSR) for the construction and operation of the Wuskwatim Generation Project by Manitoba Hydro and the Nisichawayasihk Cree Nation (NCN), hereafter referred to as the Proponent. This report fulfills DFO's and TC's obligations as responsible authorities, established under the *Canadian Environmental Assessment Act* (CEAA), to conduct an environmental assessment of the Project, in consultation with other federal authorities who have the appropriate expertise.

This comprehensive study report includes a summary of the Wuskwatim Generation Project and the environment in which it will be built and operated. The results of public consultations are discussed and include consultations conducted by the Proponent, government Aboriginal consultations conducted jointly by the DFO and the Province of Manitoba, written input received during review of the Environmental Impact Statement, and consultation conducted through public hearing by Manitoba's Clean Environment Commission (CEC). This document includes a summary of the environmental effects of the Project, the cumulative effects and the effects caused by accidents or malfunctions that might occur, an outline of the associated mitigation and follow-up measures, the determination of the significance of the effects, approval conditions and a preliminary conclusion on the environmental acceptability of the Project.

The documents listed below were used extensively in the writing of this report. They contain more detailed information pertaining to the above-mentioned elements, as well as the Proponent's answers to questions raised during the analysis of environmental effects, and additional elements used to fulfill the requirements of an environmental assessment under the CEAA.

- Manitoba Hydro and Nisichawayasihk Cree Nation. April 2003. Wuskwatim Generation Project Environmental Impact Statement. Volumes 1 to 10.
- Manitoba Hydro and Nisichawayasihk Cree Nation, August, 2003. Supplemental EIS Filing: Wuskwatim Generation and Transmission Projects.
- Manitoba Hydro and Nisichawayasihk Cree Nation, October, 2003. Supplemental Filing #2, Need for and Alternatives to the Wuskwatim Project and Responses to Technical Advisory Committee
- Manitoba Hydro and Nisichawayasihk Cree Nation, 2003. Biological and environmental data from small mesh gillnetting conducted between the Rat River downstream of Wapisu Lake and Opegano Lake.
- Manitoba Hydro and Nisichawayasihk Cree Nation, January, 2004.Wuskwatim Generation Project, Public Involvement Program: Summary of Community Questions, Comments and Concerns.
- North/South Consultants Inc. 2004 Wuskwatim Generation Project Fish Habitat Compensation Plan, draft dated January 2004.

- Manitoba Hydro and Nisichawayasihk Cree Nation, February, 2004. Wuskwatim Generation Project Application for Authorization for Works or Undertakings Affecting Fish Habitat.
- Manitoba Hydro and Nisichawayasihk Cree Nation, February, 2004. Manitoba Hydro and Nisichawayasihk Cree Nation's Wuskwatim Generating Station Navigable Waters Protection Information.
- North/South Consultants Inc., February, 2004. Draft Aquatic Effects Monitoring Program.
- Acres Manitoba Limited, February, 2004.Wuskwatim Generation Project: Draft Sediment Management Plan, Rev A..
- Access Management Committee, February, 2004. Wuskwatim Generation Project Road Access Management Plan. Draft submitted to NCN Chief and Council and Manitoba Hydro.
- Manitoba Hydro and Nisichawayasihk Cree Nation, July, 2004 Follow-up information respecting bedrock geology. Submitted by request of Natural Resources Canada.
- Manitoba Hydro and Nisichawayasihk Cree Nation, July, 2004 Response to DFO review comments on Construction Sediment Management Plan, Habitat Loss Quantification and Monitoring.
- Manitoba Hydro and Nisichawayasihk Cree Nation, September, 2004 Follow-up information on construction sediment management, shoreline stabilization and fish habitat compensation works.

2.0 Project Description

2.1 Project Overview

The Wuskwatim Generation Project (the Project) involves the development of a 200-megawatt (MW) generating station (GS) at Taskinigup Falls on the Burntwood River, near the outlet of Wuskwatim Lake (Figure 1). The Project is located at Latitude 55° 32' 29" and Longitude 98° 30' 14" in the Nelson House Resource Management Area (RMA), 48 kilometres southwest of Thompson and 37 kilometres southeast of Nelson House.

The Wuskwatim Generating Station (GS) will be constructed across the Burntwood River to harness the Churchill River Diversion's flow currently passing over the approximately 22 m combined elevation drop between Wuskwatim Falls and Taskinigup Falls. The rated plant discharge has been selected by the Proponent to be 1,100 cubic metres per second (m^3/s). The Wuskwatim GS will therefore be capable of producing as much as 200 MW of power at any time. Over a year, the Wuskwatim GS will be able to typically produce approximately 1,550 gigawatts of energy.

The Project is jointly proposed by Manitoba Hydro and the Nisichawayasihk Cree Nation (NCN). Manitoba Hydro is a Crown Corporation located in Manitoba, Canada and owned by the Province of Manitoba. The Nisichawayasihk Cree Nation, whose members live

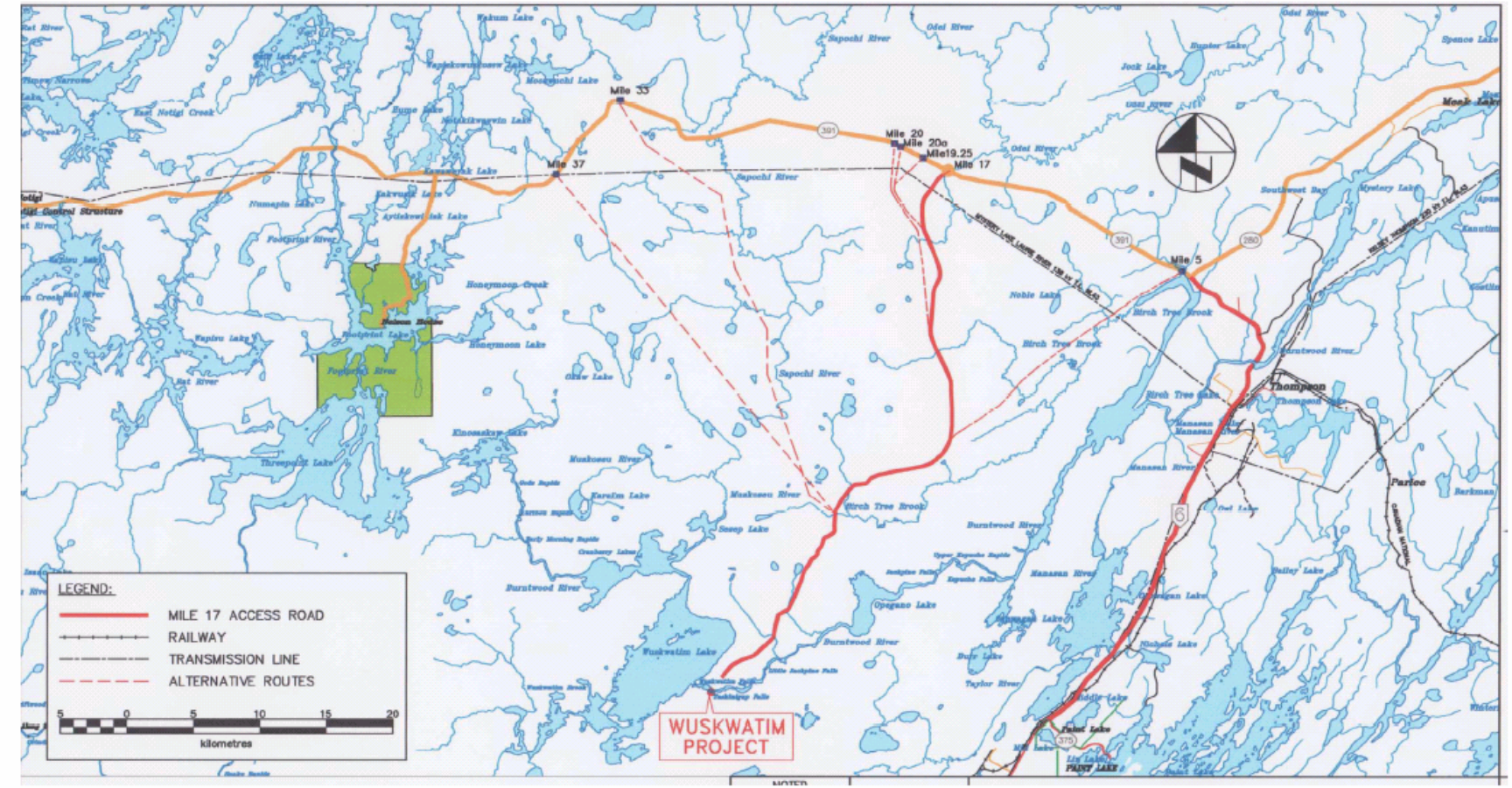

Figure 1: Location of Wuskwatim Generation Project, Access Road and Alternatives (Manitoba Hydro and NCN, 2003; Vol. 3, p. 3-13).

primarily in Nelson House (the closest community to the Project) and South Indian Lake, is a prospective partner with Manitoba Hydro in the Wuskwatim Project.

2.2 The Churchill River Diversion (CRD) – History and Water Regime Effects

The Wuskwatim Generation Project is the latest hydroelectric project proposed in a long history of such development in Northern Manitoba. Extensive hydroelectric development has dramatically altered the water regimes of the Churchill, Nelson, Rat, and Burntwood rivers. The potential impacts of the Wuskwatim Project are linked with the ongoing impacts and existing operating constraints of the CRD.

The Kelsey generating station, constructed on the Nelson River in 1961, was the first hydroelectric development on the system and provided 320 MW of power to the International Nickel Company of Canada (INCO) mine and refinery at Thompson, Manitoba. With the development of a 927 km high-voltage direct current transmission line it was considered economical to generate Nelson River power for sale to markets in southern Canada and the northern United States. By 1970 when a second generating station, with 1220 MW capacity, had been completed at Kettle Rapids, it was decided to divert the Churchill River to supplement flows along the lower Nelson River.

In 1971 Canada and Manitoba initiated the Lake Winnipeg, Churchill and Nelson Rivers Study (LWCNRS) to investigate the sociological, economic and environmental aspects of the proposed developments associated with Lake Winnipeg Regulation (LWR) and Churchill River Diversion (CRD). The primary purpose of LWR is to regulate Lake Winnipeg to provide increased winter outflows for power generation into the Nelson River. A secondary result of the LWR is the ability to regulate Lake Winnipeg for flood control. The primary purpose of the CRD is to divert water from the Churchill River to the Nelson River to supply additional water to the generating stations on the lower Nelson River.

In May 1973, the Water Resources Branch of the Manitoba Department of Mines, Resources and Environmental Management issued a license to proceed with CRD. The diversion was started at about one-third of licensed capacity in June 1976 and expanded to full operating discharge in 1977.

The CRD Project included construction of the following three main components to divert the Churchill River into the Burntwood River (see Figure 2 below):

- A control dam at Missi Falls, the natural outlet of Southern Indian Lake, that controls the outflow of the Churchill River. This dam reduced the mean outflow at Missi Falls (1979-1988) from 925 m^3/s to 135 m^3/s and raised the South Indian Lake level an average of three metres;
- An excavated channel from South Bay of Southern Indian Lake into Issett Lake that enables Churchill River waters to flow into the Rat-Burntwood River system, - a tributary of the Nelson River system; and

- A control dam at Notigi Lake on the Rat River that regulates the flow into the Burntwood-Nelson system. Discharge is currently limited by annual operating permits to 991 m^3/s under open water conditions and 963 m^3/s under ice cover conditions, and is further constrained by licensed limits for water levels in Footprint Lake and for the Churchill River Diversion at Thompson.

The CRD resulted in substantial flooding in Southern Indian Lake and throughout the Rat-Burntwood system, including Wuskwatim Lake. In June 1975, the final 13-volume LWCNRS report was released, containing technical findings and recommending mitigation measures. The five directly affected First Nation Communities (Nelson House, Split Lake, York Landing, Cross Lake and Norway House) formed the Northern Flood Committee, to facilitate joint discussions with Manitoba Hydro and the two levels of government on the Project and in 1977 of the Northern Flood Agreement with Manitoba Hydro, the Federal and Provincial governments was signed

Regulated flows for the post-development period are an estimated 8 times greater than what would have been the natural flow of the Burntwood River for this period. At Thompson, further downstream along the CRD, mean flows for the period 1979 to 1988 were 888 m^3/s compared to an estimated natural flow for that period of 93 m^3/s. Prior to diversion, about one-quarter of the annual runoff at both Notigi and Thompson occurred in May and over half in the three months of May, June, and July. Although the annual range at the Notigi Control Structure is now typically between 200 and 500 m^3/s, the pre-diversion spring runoff peak no longer occurs.

2.3 Manitoba Hydro's Electricity System – An Overview

The following description was summarized from the Wuskwatim Generation Project Environmental Impact Statement (Manitoba Hydro and NCN, 2003) Volume 1, Section 1.

Manitoba Hydro operates 14 hydroelectric generating stations located on the Winnipeg, Saskatchewan, Nelson, and Laurie Rivers, which generate over 95 % of the utility's electricity. Approximately 80% of Manitoba Hydro's generation capability is from hydroelectric generation facilities on the Nelson River, most notably Kettle, Long Spruce, and Limestone. The locations of the Manitoba Hydro's generating stations and associated transmission system in northern Manitoba are shown relative to the Wuskwatim Project in Figure 2. Approximately 40% of the electricity currently generated is sold in the export market. The proposed 200-megawatt (MW) Wuskwatim Generating Station would increase Manitoba Hydro's total installed generating capacity of 5,406 megawatts (MW) by approximately 3.7%.

2.4 Project Rationale and Alternatives

The information in the following sections was summarized from the Wuskwatim Generation Project Environmental Impact Statement (Manitoba Hydro and NCN, 2003) Volume 1, Sections 1 and 4, and Volume 3, Sections 2 and 3.

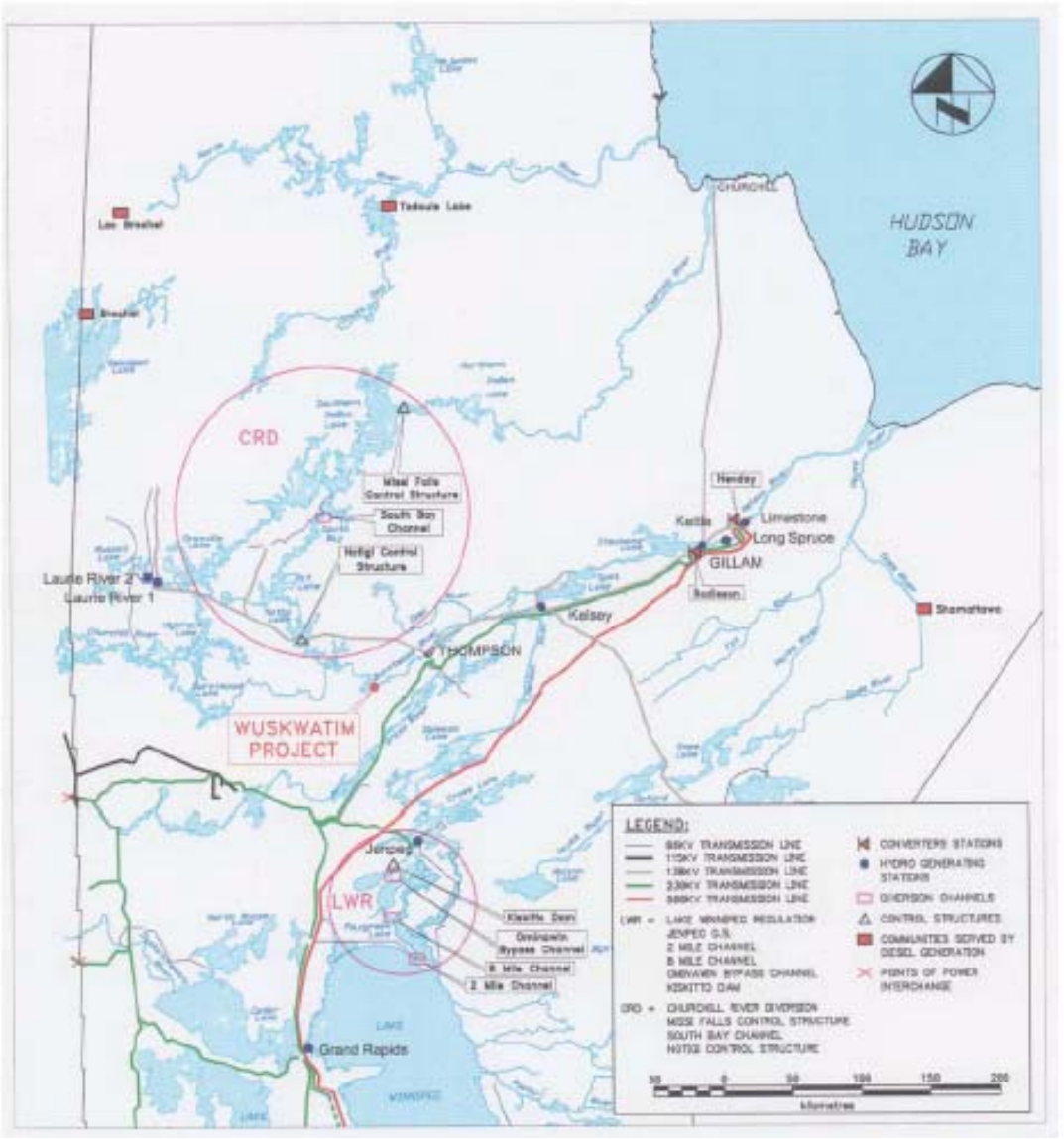

Figure 2: Manitoba Hydro's system in Northern Manitoba
(Manitoba Hydro and Nisichawaysihk Cree Nation, 2003, Vol. 3, p. 1-8)

2.4.1 Project Rationale

The Proponent has stated that the purpose of the Project is to construct and operate a hydroelectric generating station at the Wuskwatim site (Taskinigup Falls) on the Burntwood River to provide electricity into the Manitoba Hydro system. Analysis by Manitoba Hydro indicates that growing domestic energy demands require Manitoba Hydro to consider means of providing additional energy in its system to meet projected needs within the next two decades. Manitoba Hydro's 2002/03 Power Resource Plan indicates a need for new generation to meet the current forecast of firm requirements in

the year 2020, and identifies Wuskwatim as the next generating project to satisfy this demand.

The reason stated for advancing the in-service date of the Project from 2020 to 2009 would be primarily to allow Manitoba Hydro and NCN to obtain additional export revenues and profits. Manitoba Hydro states that the additional power from Wuskwatim would also assist in offsetting the decline in exports as the Manitoba load continues to grow, contribute to domestic customer supply reliability, and provide a source of additional power in the event of higher than expected load growth.

2.4.2 Alternative Means of Carrying out the Project

The following sections are based on material Volume 1, Sections 1 & 4, and Volume 3 Sections 2 & 3 of the EIS, as well as supplemental information supplied during the EIS review.

Several alternative means of carrying out the Project were considered that are technically and economically feasible. The following discussion provides a brief background of the alternatives studied by the Proponent and the rationale that led to site selection, design, and mode of operation for the Wuskwatim Generating Station, including:

- arrangement of primary structures;
- forebay elevation;
- mode of operation;
- access road;
- construction camp location; and
- construction materials source.

In planning its hydroelectric developments, Manitoba Hydro employs a staged approach in which the Project is at what is referred to as Stage 4, the pre-investment stage. This is the last stage that is completed before entering into the final design/construction stage. Project information developed during Stage 4 is used as the input into the public consultation and Environmental Review, Licensing, and approval processes.

2.4.2.2 General Arrangement of Primary Structures

Six alternative engineering layouts were developed by the Proponent and evaluated in the Stage 4 studies, with the most desirable alternative to the Proponent being the one presented in Volume 1, Section 4 of the Project EIS. Evaluations of all of these options were based on considerations of scheduling and constructability aspects, cost and technical issues, as well as in consideration of environmental issues and concerns.

Each of the options were assessed to determine which option would minimize the environmental impact of the construction, considering the amount of land that would be disturbed, the amount of land required to dispose of the excavated materials and the amount of work that would be done “in the wet” (i.e., within the flowing river).

Opportunities were identified to reduce the volumes of rock and overburden excavation by interchanging the locations of the Powerhouse and Spillway. Opportunities were also identified to reduce excavation quantities further by moving the Powerhouse and Spillway southwest along the original Principal Structure's axis until the right side of the Powerhouse coincided, approximately, with the right side of the chute, which forms the left extremity of Taskinigup Falls.

The optimum arrangement selected resulted in a minimization of excavation quantities, which reduced costs and also had the environmental benefit of minimizing the amount of land disturbed and minimizing the amount of material to be disposed. The arrangement selected also made it possible to construct a rockfill cofferdam across the river upstream of the discharge point of the Spillway Channel. Thus, all the Powerhouse tailwater channel excavation can be completed in the dry, thereby minimizing the amount of in-stream work that will be undertaken. The selected alternative minimizes in-stream construction activities and riparian land disturbance.

2.4.2.3 Forebay Elevation

The Proponent notes that the selection of the reservoir level determines the amount of energy the generating station can produce, as well as the extent of flooding and, therefore, the magnitude of environmental impact. Four forebay elevation options were investigated at the Stage 2 (feasibility stage) level, ranging from 235 m (which is about 1.4 m above the post-CRD (existing) average water level of 233.6 m) up to elevation 246.9 m (13.3 m higher than post-CRD levels), which would require additional easements and re-negotiation of the water level constraints contained within the NFA). Two forebay options were advanced from Stage 2 to Stage 3, a "low-head" option of 235 m and a reduced "high-head" option of 243.2 m. (Figure 3).

The Proponent reports that in late 1998/early 1999, Manitoba Hydro and NCN discussed the merits of the low-head and high-head options. The Full Supply Level (FSL) forebay elevation of 234.0 m above sea level (ASL) 234 m low-head option was considered more favorable as it would minimize environmental impacts while remaining technically and economically feasible. Manitoba Hydro notes that as a result of selecting the low-head option, a significant amount of the station's potential energy production has been foregone, which could be regained, in part, if a generating station were to be constructed sometime in the future at Early Morning Rapids.

The Proponent noted the following advantages of the low head (235m) option over the high head (243.2m):

- Development will be within the existing post-CRD water regime on Wuskwatim Lake;
- minimal flooding (0.5 km^2 vs 140 km^2 with the high head option);
- significant increases in methyl mercury levels are not predicted;
- fewer impacts on land and shoreline;
- less erosion;
- smaller resulting volumes of debris;

- lower impact on fish;
- decreased loss of terrestrial wildlife habitat;
- decreased risk of archeological and cultural sites damage; and
- lower levels of social and socio-economic concern.

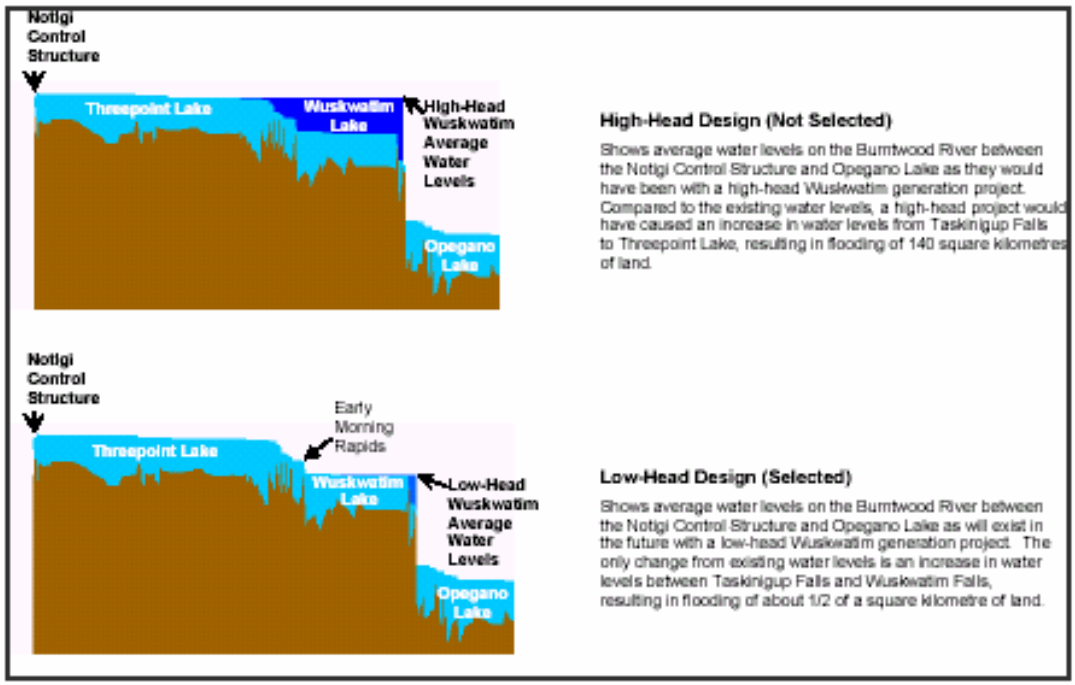

Figure 3: Potential high and low head options for Wuskwatim Lake (Manitoba Hydro and NCN, 2003; Vol. 1, p. 4-6)

The FSL selected would result in Wuskwatim Lake water levels being normally near the top end of the existing water regime, and the water levels would not normally exceed the maximum water level experienced to date on Wuskwatim Lake. The water levels on Wuskwatim Lake would no longer follow the seasonal and monthly trends that result from the operation of the CRD but would be relatively stable at or just below the FSL of 234.0 m. The Project requires excavations in the outflow channel from the lake to reduce the hydraulic losses that result from existing constrictions. These modifications are viewed as necessary by the Proponent to maximize the hydraulic head at the plant, given the relatively low forebay level proposed for development.

The Proponent predicts that flooding will be limited to the short reach of river located between the dam's axis and Wuskwatim Falls (Figure 4). This limited amount of flooding is viewed as necessary to allow the 22 metres of hydraulic head to be developed. The development of the permanent facilities will raise the water levels approximately 7 m in this area, which will cause inundation of approximately 37 ha (0.37 km^2) of land. This is

in contrast to the "high head" option that was not selected, which could have produced as much as 350 MW but would have resulted in 140 km^2 of flooding.

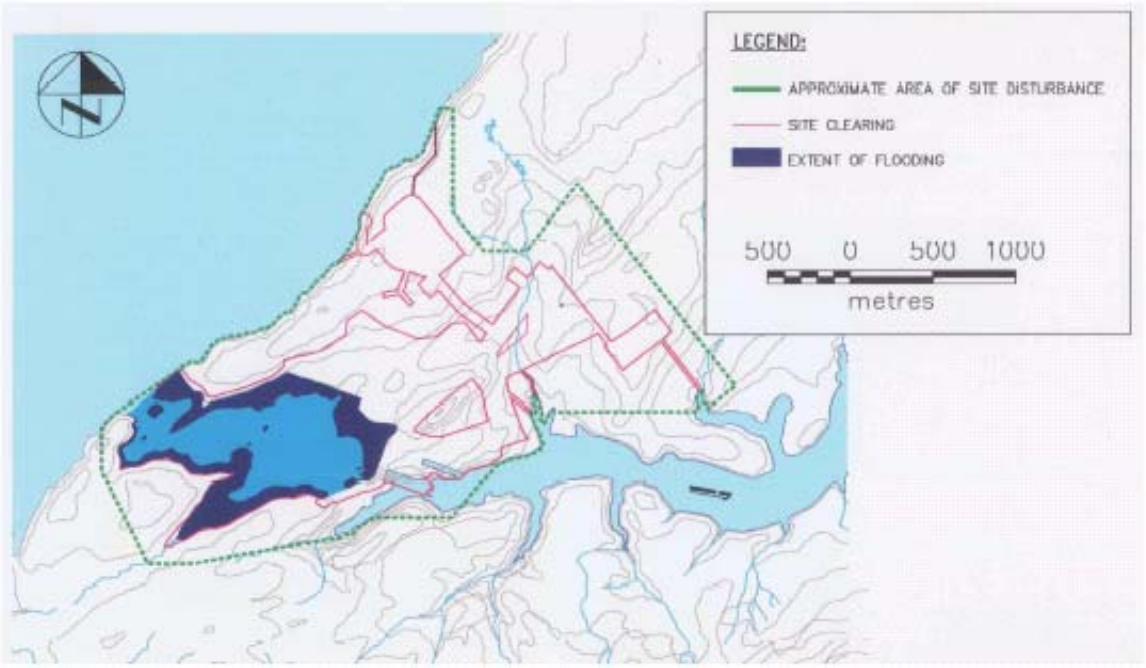

Figure 4: Extent of flooding, area of disturbance and location of lands required for impervious borrow areas, site infrastructure and permanent works
(Manitoba Hydro and NCN, 2003; Vol. 2, p. 2-7)

DFO and TC agree with the Proponent that the lower head design option would result in fewer impacts to the aquatic environment.

2.4.2.4 Mode of Operation

According to the Proponent, the mode of operation for a generating station defines the outflow pattern of how the river flows will be regulated within any given day to produce electricity. The Proponent identified three possible options for the site: peaking, run-of-river, and modified run-of-river (shaping).

The peaking mode of operation closely matches power generation with demand, with the higher loads occurring in the peak period when customers require more electricity, usually between the hours of 6 am and 10 pm. Peaking could maximize energy output at the selected forebay elevation but would result in frequent and severe forebay drawdowns as well as cause more significant and irregular fluctuations in outflows and associated dewatering and rewatering of the downstream river channel. This mode of operation does not restrict turbine selection and therefore costs are minimized.

The run-of-river mode of operation does not cause any fluctuations of the outflow, but does not match generation to demand, thereby reducing benefits to the Proponent. The

Proponent notes that to run effectively in this mode requires a special type of turbine (i.e., adjustable blade turbines or Kaplan turbines), which would have increased capital and operating costs.

The Proponent evaluated a third "modified run-of-river" (shaping) operating option that incorporates a modest cycling pattern, with generally smaller water level fluctuations than what would result from a peaking mode of operation and more water level fluctuations than what would be possible under a run-of-river mode of operation. The CRD flows that arrive from the Notigi Control Structure would enter Wuskwatim Lake and be regulated through the Powerhouse in such a way that the lake's outflow over the day would equal the lake's inflow over the day. This balancing of the outflows to the inflows means that the resulting mode of operation is essentially a daily balance cycle, very similar to a run-of-river mode of operation, but with the minute-by-minute outflows adjusted so that the plant's units are operated at or near the point of peak efficiency. Under the modified run-of-river operating mode, the station's typical operation would follow the requirement of shutting down or starting up only one unit during flow changes, to minimize the impacts on downstream water levels. The forebay elevation will typically vary slightly over the day, as the outflows are shaped. This mode of operation would create a flow pattern that would result in moderate water level changes.

The modified run-of-river mode of operation was selected by the Proponent as the option that best suited the Wuskwatim site, based on a balance between the economics of capacity and the energy production requirements, environmental concerns, and the cost of the Project. Flow changes associated with this mode would not be as dramatic as the peaking mode. The mode is less disruptive to the environment than a peaking mode and provides more useable energy when it is required than a run-of-river mode, capturing some of the peaking benefits.

2.4.2.5 Turbine Selection

Integrated with the mode of operation decision is the selection of the type, number and flow capacity of the turbines. The Proponent reports that in the turbine evaluation, over 20 different combinations were considered, including the mode of operation (run of river, modified run of river [shaping], peaking); the type of turbines (vertical-shaft propeller - adjustable [Kaplan] or fixed blade); the number of units (2, 3 or 4); and the rated plant discharge (1050, 1100, 1200 and 1400 m^3/s). A three-unit fixed-blade vertical shaft propeller turbine design with a total rated discharge capacity of 1,100 m^3/s was chosen by the Proponent, because it was felt that this choice provided the best balance between generation benefits, reliability and minimization of environmental effects for this site. These are also the same type of turbine that exists at many of Manitoba Hydro's generating stations.

In their EIS, and supplemental information, the Proponent notes that this configuration of turbine, the turbine's rotating speed and the highly efficient design of the turbine passage-way are conditions which are known to be conducive to the successful passage of various species of fish through the turbine assembly.

2.4.2.7 Access Road

An access road to the site is required for both construction and operation of the Project. Manitoba Hydro and NCN worked collaboratively to select the best access route to the generating station site. Following some preliminary work to develop appropriate criteria for evaluating alternative road corridors, an Alternatives Committee with representatives and advisors from Manitoba Hydro and NCN was formed on August 15, 2000. This committee developed and evaluated options and then selected a preferred route for the proposed Wuskwatim access road. The overall objective was to choose a route that best met the environmental, economic and community goals of NCN and Manitoba Hydro.

The Alternatives Committee evaluated a number of alternative road corridors, one that connected the site to Provincial Trunk Highway No. 6 crossing the Taylor River and the Burntwood River, a number of options which connected the site to Provincial Road 391, referred to by the distance in miles from downtown Thompson, as well as a number of options that connected the site to the Nelson House area:

- Taylor River;
- Mile 5;
- Mile 20;
- Mile 33;
- Mile 37; and
- Nelson House (3 Alternatives).

The alternative road corridors were evaluated using agreed upon criteria focusing on three main issues including: the benefits and drawbacks for NCN; impact on the environment; and impact on the Project, in terms of how the routes compared in terms of cost and schedule.

The alternatives selection process included input from technical specialists (including overflights and ground-based environmental investigations of potential routes), in-depth meetings and workshops, consultation with NCN members through two open house events and development of new information. From NCN's perspective, impacts on important cultural sites, particularly Eagle Hill and a nearby artesian water source, were considered most important. From an environmental perspective impacts on woodland caribou and moose were considered the most important. From a Project perspective safety and the affect of terrain type on construction and maintenance of the road were found to be the most important.

Following initial analyses, the potential corridors were screened down to routes between Mile 5 and Mile 33 along PR 391. From this initial screening, six possible centerline right-of-way alternatives were developed as shown in Figure 1 . The Alternatives Committee assessed these right-of-way alternatives using the criteria previously described. The process concluded the "Mile 17 route" located 32 kilometres west of Thompson, on PR 391 to be the preferred option. Mile 17 appeared to offer the most benefits to NCN, the least adverse impacts to the environment, was among the lowest

cost options, had good technical potential for a safe route design and provided fewer risks to the construction schedule as compared to other options.

2.4.2.8 Construction Camp Location

The Alternatives Committee also collaboratively formulated, considered, evaluated, and selected a preferred location for the proposed Wuskwatim construction camp. The alternatives were narrowed to the following construction camp location options:

- full camp at the Wuskwatim Generating Station site;
- split camp – with main camp at the Wuskwatim Generating Station and sleeping accommodations, second kitchen, and other facilities located remotely from the work area:
    - near Nelson House; and
    - near the junction of PR 280 and PT 391, approximately eight kilometres northwest of Thompson.

Using the same criteria and issues as were used in the selection process for the access road (impact on NCN, impact on the environment, and impact on the Project) the Alternatives Committee determined that a construction camp at the Wuskwatim site was the best alternative. This selection avoids costs and environmental impacts associated with the duplication of some facilities, avoids increased commuting time for workers, and avoids potentially adverse social effects associated with having a camp near the community of Nelson House. As a second camp could increase the potential impacts to stream habitat near the second site, and a larger camp near the project site would not appreciably increase potential effects to fish habitat, DFO and TC agree with the Proponent's conclusion with respect to the selected alternative.

2.4.2.9 Construction Materials Source

The construction of the Wuskwatim generating station and supporting infrastructure will require impervious fill, granular fill, rock fill, riprap, and concrete aggregates. On-site excavations will provide rock material for rock fill, riprap and concrete aggregate. A temporary local rock quarry may also be required.

Unlimited quantities of impervious materials are available close to the site. Consequently, most of the off-site borrow sources will be required to supply only granular materials. Granular fill material will be taken from amongst six nearby granular borrow areas identified by the Proponent, with the two closest to the proposed access road being the most likely sources for the construction of supporting infrastructure.

2.5 Project Components

Physical works associated with the proposed generating station would include: a main dam across Taskinigup Falls; a powerhouse/service bay complex (housing three turbines); and a three-bay spillway that would be built into the north bank of Taskinigup

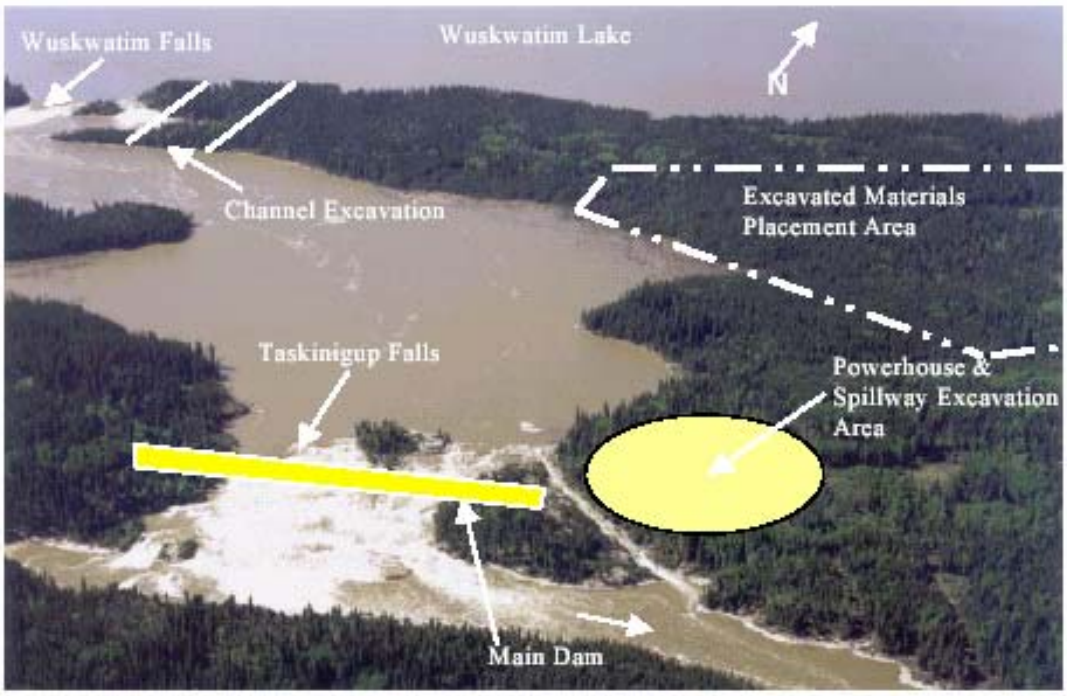

Figure 5: General location of the Wuskwatim Generating Station Components (Manitoba Hydro and NCN, 2003; Vol. 1, p. 4-4).

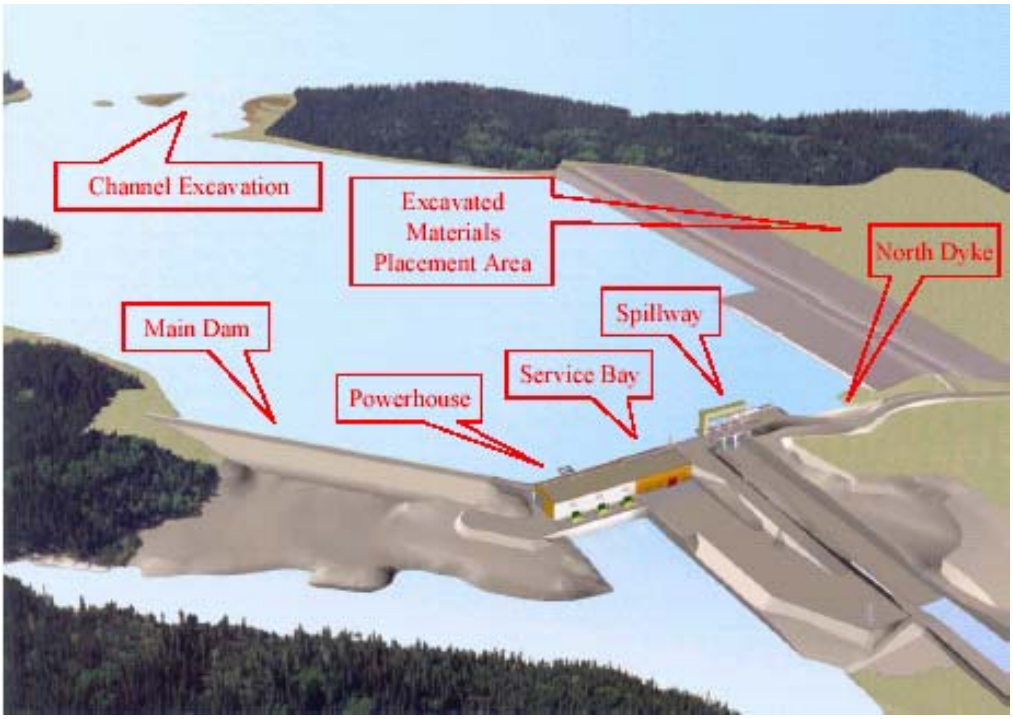

Figure 6: Computer Rendering of the General Arrangement of the Primary and Secondary Structures for the Wuskwatim Generating Station (Manitoba Hydro and NCN, 2003; Vol. 3, p. 2-12).

Falls (Figure 5). The generating station would increase water levels in the immediate forebay between Wuskwatim Falls (the natural outlet of Wuskwatim Lake) and the proposed structures located at the current site of Taskinigup Falls. A new channel would be excavated on the north side of the river at Wuskwatim Falls to improve the outflow from the lake into this immediate forebay area. In addition to the physical works noted above, the Project involves an associated access road, a construction camp and other related infrastructure (Figure 1).

The main Wuskwatim Generation Station components are referred to as Primary and Secondary Structures. These structures are shown completed in computer rendered form in Figure 6. The Main Dam, Powerhouse, Service Bay, Spillway and North Dyke are referred to as the Primary Structures. The Channel Excavation Area and the Excavated Materials Placement Area are considered to be Secondary Structures.

2.5.1 Primary Structures

The primary structures composing the Wuskwatim GS are the Spillway, Powerhouse/Service Bay Complex, Non-overflow Gravity Dam, Main Dam and Transition Structures. The general arrangement of these major components is shown below in Figure 7.

Spillway and Non-Overflow Dam

The Proponent indicates that the purpose of the spillway is to provide a diversion channel during the construction period and to provide an overflow for the reservoir during the operation period, thereby protecting the dam and dikes from flooding. The spillway will be a three bay concrete structure constructed along the axis of the primary structures, 43 m in length, 27.5 m wide and 43 m high, equipped with vertical-lift fixed-wheel steel gates. The spillway will be built within a channel, which will be approximately 500 m long and 34 m wide. The flow of water in the channel is expected to be largely contained within the bedrock except for two locations where concrete walls will be required to contain other fills and/or to reinforce areas of potentially poorer rock quality, to prevent erosion.

The Spillway will be located to the north of the Powerhouse and linked to it by a fixed concrete Non-Overflow Dam. The Spillway has been designed to protect the plant from flows up to the Inflow Design Flood (IDF), which is equal to the Probable Maximum Flood (PMF) event of 2650 m^3/s. Under the PMF scenario, the upstream water level is predicted to rise to 235.5 m which is the basis for selecting the elevation for the crest of the concrete structures. The Spillway will contain various mechanical and electrical systems needed to operate and control the Spillway, including safety, security and monitoring systems.

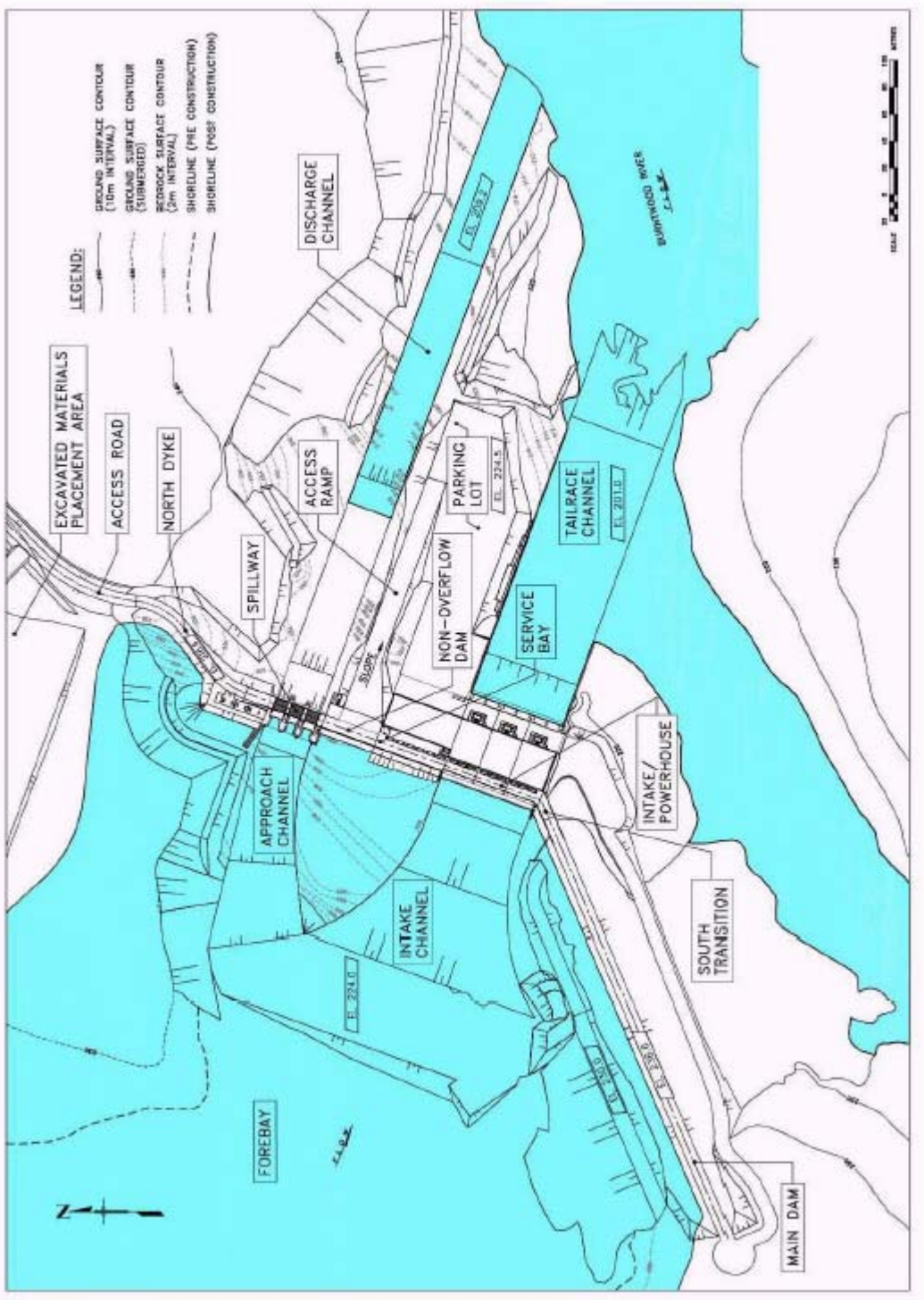

Figure 7: General arrangement of primary structures (Manitoba Hydro and NCN, 2003; Vol. 3, p. 4-67).

Intake/Powerhouse/Service Bay Complex

The Intake/Powerhouse Complex will be 72.4 m in length along the axis of the primary structures, 62.7 m wide and 56.0 m high. The structures will be located on bedrock, close to the north bank of the original river channel. A Service Bay (turbine and generator assembly and equipment erection area) will be provided at the north side of the Powerhouse. The road to the main Service Bay entrance door will be reached from the North Dyke, the Spillway Bridge, the crest of the Non-Overflow Dam and a descending ramp to a large parking area at Service Bay floor level. The concrete Non-Overflow Dam will link the Powerhouse and the Spillway and provide continuous access from the North Dyke to the crest of the Main Dam. To keep the intake openings free of debris, trashracks (a grid of steel bars and support beams, with a clear space of 165 mm between each bar and a clear space of over 500 mm between each horizontal support beam) will be placed across all the water passages to the upstream of the bulkhead gate slots.

Main Dam and North Dyke

The Main Dam is a zoned earth and rock-fill structure, approximately 14 m high and 300 m long and will reach from the south bank of the river above Taskinigup Falls to the South Transition Structure and the Intake/Powerhouse Complex. The North Dyke will be approximately 7 m high and 100 m long and will reach from the north bank of the river to walls on the north end of the Spillway. The Main Dam and the North Dyke will be constructed primarily on prepared and grouted bedrock to complete the containment of the immediate forebay.

The crest elevations of the dam and dyke have been set to accommodate the more severe of the following conditions, the FSL of 234.0 m, or the forebay level, which would occur during passage of the IDF (PMF), which corresponds to a level of 235.5 m. According to the Proponent, the required crest elevations take into account the appropriate combined affects of the wind-generated waves and post-construction embankment settlements, which are associated with each of these two design conditions.

2.5.2 Secondary Structures

The Secondary Structures include the channels for the Spillway, Powerhouse and the Upstream Channel Excavations. The channels will be cut through overburden and bedrock under dry conditions. The schedule for the construction of the Spillway and the Approach and Discharge Channels will be tightly interrelated with the schedule for the management of the river and the diversion sequencing. The construction of the Spillway and its associated Approach and Discharge Channels will require the excavation of approximately 365,000 m^3 of overburden and 215,000 m^3 of rock and the placement 8,000 m^3 of granular and rock fills. The72 m wide Tailrace Channel has been designed to conduct flow back to the river with minimal head loss and to maximize the efficiency of the plant. The floor of the channel will first slope upwards at the draft tube exit and then remain horizontal to a location approximately 240 m downstream where it will be feathered in to match the natural riverbed levels.

Upstream Channel Excavation Area

The immediate forebay will be physically separated from the main reservoir (Wuskwatim Lake) by Wuskwatim Falls, located at the outlet of Wuskwatim Lake, approximately 1.5 km upstream of the proposed site of the Wuskwatim GS (see Figure 6).

To regulate the lake within the prescribed limits of 234.0 m to 233.0 m and to minimize the loss of head in the flow towards the Powerhouse through the area, the Proponent plans to construct a channel through the bedrock peninsula on the east side of the falls. The dimensions of this channel were determined to be 125 m wide with a floor level elevation of 229.0 m. This configuration, to be confirmed during detailed design, will require the excavation of approximately 60,000 m^3 of overburden and 95,000 m^3 of rock, to be undertaken in the dry. A construction access road will be built to allow access to the channel improvement area

Most of the excavation will be carried out behind the protection of an upstream rock plug. The removal of this plug will be carried out after the balance of the channel excavation has been completed and the forebay has been impounded to the level of Wuskwatim Lake. This will provide water on both sides of the rock plug, minimizing the head differential through the channel and hence facilitating the rock plug removal, and will minimize potential drawdown of Wuskwatim Lake on removal of the rock plug.

2.6 Development Schedule

The Proponent expects to commence construction of the access road, assuming regulatory approval is obtained, immediately following receipt of Project approvals. Commissioning of the last turbine is scheduled to occur six years after the commencement of construction. The Proponent has identified the following sequence of construction:

- Year one: clearing and construction of access road; construction of starter and main camp; provision of sewer and water services and construction power.
- Year two: Installation of Stage 1 cofferdam; commencement of earthworks for north dike; commencement of excavations for structures and channels.
- Year three: Commencement of construction of spillway and powerhouse.
- Year four: Completion of spillway.
- Year five: Stage II river diversion through spillway; removal of Stage I cofferdam and spillway plug; installation of Stage II cofferdam and construction of main dam; excavation of Wuskwatim Falls channel improvement area; removal of Stage II cofferdam; impoundment of forebay.
- Year six: Completion of powerhouse; first power; construction cleanup and camp decommissioning.

3.0 Environmental Assessment and Applicable Regulations

3.1 Federal Legislation and Policy

On October 21, 2001, DFO was referred the Wuskwatim Generation Project by the Canadian Environmental Assessment Agency (the Agency). In a letter to the Agency dated November 28, 2001, DFO declared that a *Fisheries Act* authorization would be required for the Wuskwatim Generation Project and that, pursuant to section 5 of the *Canadian Environmental Assessment Act (CEAA*), an environmental assessment would be conducted. DFO was identified as the lead responsible authority for the review of the Wuskwatim Generation Project, which, with an estimated 200 MW of hydroelectric generating capacity requires a comprehensive study under section 4 (b) of the *Comprehensive Study List Regulations*. Pursuant to S. 55 of the *CEAA*, a federal public registry was established by DFO for the Wuskwatim Generation Project.

The project also requires formal approvals under section 5(1) of the *Navigable Waters Protection Act* (*NWPA*), which also initiates an environmental assessment under the *CEAA*. On March 29, 2004, an Order in Council of the Federal Government was signed transferring responsibility for the *NWPA* from DFO to Transport Canada, making TC a responsible authority under the *CEAA*. TC indicates that applications pursuant to the *NWPA* have been made by the Proponent for 4 stream crossings along the route of the access road (designated R2, R5, R6, and R8, see EIS Volume 5, Section 6, Manitoba Hydro and NCN, 2003) that cross navigable waters . The remaining stream crossing locations, including the crossing in the main camp, have been deemed "not navigable" and are therefore not subject to review under the *NWPA*. Applications have also been made under the *NWPA* for the construction and operation of the generating station and associated works including a water intake and boat launch. Applications for approval under the *NWPA* are still pending for the concrete batch intake, the downstream boat launch, and any proposed in-water habitat compensation works.

Natural Resources Canada reviewed the proponent's requirements for explosives and determined that no permit would be required under the *Explosives Act* that could trigger the *CEAA*.

Before an Authorization under S. 35(2) of the *Fisheries Act* is issued, the Proponent has to propose a compensation plan in compliance with the principle of no net loss in fish habitat productive capacity, as set out in the DFO's Policy for the Management of Fish Habitat (1986).

The *Species at Risk Act (SARA*) came into force in June 2003 and the *SARA* prohibitions came into force in June 2004. The purposes of *SARA* are to: prevent Canadian indigenous species, subspecies and distinct populations of wildlife from being extirpated or becoming extinct; to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity; and to manage species of special concern to prevent them from becoming endangered or threatened. The Minister of Fisheries and Oceans is the competent minister for listed aquatic species including fish

(as defined in section 2 of the *Fisheries Act*) and marine plants (as defined in section 47 of the *Fisheries Act*); the Minister of the Environment is the competent minister for all remaining species. On August 7, 2004, pursuant to subsection 79(1) of the *SARA* DFO notified the Minister of the Environment that the Wuskwatim Generation Project was likely to affect woodland caribou, which is a listed species under the *SARA*.

A comprehensive study under the *CEAA* is conducted based upon a self-assessment approach in which the responsible federal authorities consider a project's environmental effects before making any irrevocable decisions allowing the project to proceed. DFO and TC have ensured that the environmental assessment process and the comprehensive study report are in compliance with the requirements of the *CEAA*.

3.2 Canada-Manitoba Agreement on Environmental Assessment Cooperation

The Wuskwatim Generation Project fits the description of a Class 3 development defined in the *Classes of Development Regulation 164/88,* under *The Environment Act (Manitoba)*. Accordingly, the Project is also subject to environmental review and licensing under provincial legislation. Under the provisions of the *Canada-Manitoba Agreement on Environmental Assessment Cooperation* (the Agreement), Canada and Manitoba agreed to undertake a cooperative environmental assessment of the Project. Manitoba assumed the Lead Party role for the process. DFO, TC, and the Agency, along with two members from Manitoba Conservation's Environmental Approvals Branch, have representation on the Project Administration Team (PAT) established under the Agreement to manage the environmental assessment. The PAT is chaired by the Director of the Environmental Approvals Branch, Manitoba Conservation. A Technical Advisory Committee, which includes representation from federal authorities identified as having existing knowledge/expertise relevant to the review of the Project, as well as representation from provincial departments with an interest, was also established pursuant to the Agreement. Other licensing requirements for the Project include a license under the provincial *Water Power Act* and other specific land use permits.

In mid-December 2001, the PAT released for public comment draft "*Guidelines For The Preparation of an Environmental Impact Statement for the Wuskwatim Generation Project*" (the Guidelines). Within the same time frame, the PAT released *Draft Guidelines for the Preparation of an Environmental Impact Statement for the Wuskwatim Transmission Project*. The public release of these documents was in accordance with the provisions of "*The Canada-Manitoba Agreement on Environmental Assessment Cooperation*". Following a 90-day public review period and further public consultation conducted by the Clean Environment Commission, the guideline documents were issued by the Chair of the PAT on April 26, 2002. The Environmental Impact Statements for the Wuskwatim Generation Project and the Wuskwatim Transmission Project, as well as a submission on Project Need and Alternatives, were submitted to the Chair of the PAT by the Proponent on April 25, 2003.

3.3 The Wuskwatim Transmission Project

On November 1, 2001, the Agency referred the Wuskwatim Transmission Project to DFO and other federal government departments. The Proponent had made a separate application for licensing under Manitoba's Environment Act for the transmission project. For environmental review and licensing purposes, provincial regulators had chosen to review the transmission project separately but concurrently with the Wuskwatim Generation Project.

In a letter dated April 16, 2002, DFO indicated to the Agency that information on the Wuskwatim Transmission Project was insufficient for DFO to make a determination on its regulatory role in relation to the *CEAA*, and that until DFO determined its status pursuant to the *CEAA*, and in the absence of any other federal triggers for the project, it would continue to act as a responsible authority for the Wuskwatim Transmission Project. Following review of the Environmental Impact Statement and supplemental information for the Wuskwatim Transmission Project, DFO determined that it did not have any regulatory triggers pursuant to section 5 of the *CEAA*. In a letter dated October 31, 2003, DFO indicated to the Agency that it was not likely a responsible authority under the *CEAA* for the Wuskwatim Transmission Project. This determination was conveyed to the chair of the PAT by the Agency in a letter dated November 14, 2003. The Wuskwatim Transmission Project was considered when conducting the cumulative effects assessment of the Wuskwatim Generation Project.

3.4 Expert Federal Authorities

Federal authorities are those federal departments identified through the Federal Coordination Regulations process as having existing knowledge or expertise relevant to the environmental assessment of the project. Federal authorities are consulted during the scoping process; during review of environmental assessment information submitted by the Proponent and any other material relating to the CSR. Each federal authority is consulted prior to the submission of the CSR to the Minister of the Environment. Federal authorities do not, however, unless identified as responsible authorities, have decision-making responsibilities in relation to the comprehensive study.

The federal departments that have also been consulted to determine whether they have interests with regard to the Project or to obtain comments on their respective requirements concerning the environmental assessment under the *CEAA*, are the Department of Indian and Northern Affairs Canada (INAC), Environment Canada (EC), Natural Resources Canada (NRCan), Health Canada (HC), and Parks Canada Agency. The Canadian Environmental Assessment Agency has also worked on the environmental assessment of the Project regarding matters of interpretation of the *CEAA* and assessment methodology.

3.5 Other Federal Agencies and Provincial/Regional/Municipal Governments Consulted

In addition to the formal input received as part of the cooperative environmental assessment described above, the provincial Fisheries Branch, Wildlife and Ecosystem Protection Branch, Water Sciences Management Branch and the Regional Fisheries Manager for the Northeast Region, were consulted during the comprehensive study of the Project. DFO also consulted with First Nation and Northern Affairs Community Governments and their delegates through a joint federal-provincial aboriginal consultation process.

4.0 Scope of the Environmental Assessment and Impact Assessment Methodology

4.1 Scope of the Project

On May 03, 2004, prior to DFO and TC making their determination on the scope of project and scope of assessment, DFO undertook consultation with federal authorities identified as having an interest in the project pursuant to section 8 of the *Regulations Respecting the Coordination by Federal Authorities of Environmental Assessment Procedures and Requirements.* The determination of the scope of the project has been based upon the powers, duties and/or functions that would need to exercised by the responsible authorities with respect to the Project (*Fisheries Act Ss.35(2)* and *S.32*, and *Navigable Waters Protection Act Ss.5(1)*). As well, the determination was informed by the recommendations received from federal authorities participating in the comprehensive study. The scope of the project includes the construction and operation of the Wuskwatim hydroelectric generating station on the Burntwood River and its area of influence, as well as eight culvert crossings along the proposed access road and one culvert crossing in the proposed camp. The scope of the project also includes the construction, operation, and where relevant, the decommissioning, of all related physical works and physical activities required to carry out the principal project, including the associated cofferdams, access road, construction site distribution line, water intakes, construction camp, boat launches, and dumping sites.

In their environmental assessment of the Project, the Proponent has not included a timetable for decommissioning the principal facilities, noting that if the generating station were to be decommissioned, the earliest timeframe would be in 50 to 100 years. The Proponent submits that this is so far into the future that it is not feasible at present to provide meaningful assessment of likely plans or their environmental effects, based on available information and agreements. Therefore, the Proponent's EIS does not provide any further assessment of Project decommissioning and final disposition. If at a later date it is decided that the Wuskwatim Generating Station would no longer be utilized for power generation, the Proponent has indicated that it would develop a decommissioning plan that would include details on proposed site rehabilitation, and would submit this plan for regulatory review and approval prior to its implementation. After considering the

Proponent's submission, DFO and TC concluded that the inclusion of these undertakings would not be warranted.

4.2 Scope of the Assessment

The scope of the environmental assessment includes the environmental effects of the Project as defined in subsection 2(1) of the *CEAA*, including study of project's environmental effects and their significance, specifically, but not restricted to, those affecting fish and fish habitat, navigation, avian fauna, and species at risk. The comprehensive study includes the effects of any changes to the Project that might be caused by the environment and the direct effects of any changes caused by the project to the biophysical environment on human health, socio-economic conditions, natural and cultural heritage (historical, archaeological, paleontological and architectural), and the current use of lands and natural resources for traditional purposes by Aboriginal persons.

The factors considered in the environmental assessment of the Wuskwatim Generation Project, as stipulated by sections 16(1) and 16 (2) of the *CEAA*, for this comprehensive study report are as follows:

- the purpose of the project;
- the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the projects, and the significance of those effects identified during the assessment;
- the cumulative effects that the project, combined with the existence of other structures or other projects or activities, is likely to have on the environment and the significance of those effects identified during the assessment;
- measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects;
- alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such means;
- comments received from the public;
- comments received during consultation with Aboriginal communities;
- specialist advice received from other federal departments;
- the need for a follow-up program and its requirements; and
- the capacity of renewable resources that may be significantly affected by the project to meet the needs of present and future generations.

4.3 Spatial Scale

The spatial extent of the assessment of environmental effects on aquatic resources consists of a corridor of variable width, according to the specific needs of each assessed component, which extends from Early Morning Rapids approximately 22 km upstream of the proposed Project to the confluence of the Burntwood River with the Nelson River approximately 150 km downstream. In addition, the study area for effects of construction

and operation of stream crossings on the access road extends from 50m upstream of the proposed crossings to the confluence of that stream with the nearest downstream lake, river or wetland. For assessing impacts on other environmental components, study area boundaries are identified separately for each environmental component based on the predicted link between the Project and that environmental component.

DFO and TC are of the opinion that the study area considered by the Proponent allows an assessment of the environmental effects arising from the Wuskwatim Generating Station and the related components included in the Project scope.

4.4 Temporal Scale

The temporal scale of the assessment corresponds to the anticipated lifespan of the Wuskwatim Generation Project, which is estimated at 50 to 100 years from the time of construction. The temporal scale related to the effects of the construction of the Project are limited to the period during and immediately following construction of the station. According to the proponent's schedule, commissioning of the last turbine is expected to follow a six-year construction period.

4.5 Cumulative Effects

The assessment of cumulative effects includes consideration of all environmental effects of the project in combination with the environmental effects of other projects or activities that have been or will be carried out and that have the potential to act cumulatively with the project effects. Projects that "will be carried out" are defined as those projects for which an environmental assessment has been undertaken and where approval has already been provided.

4.6 Environmental Assessment Methodology

The assessment method used by DFO, TC and federal authorities consisted of identifying the project's impacts on the different Valued Environmental Components (VECs) as set out below, and determining their significance. The identification of the Project's environmental effects and the determination of their significance is based on information provided by the Proponent and the expert advice of the various federal authorities, as well as input from provincial reviewers that participated in the Technical Advisory Committee for the Project. The environmental assessment methodology takes into account the application of mitigation measures proposed by the Proponent or recommended by the responsible or federal authorities as well as the implementation of a follow-up program.

4.6.1 Valued Environmental Components

The selection of the Valued Environmental Components (VECs) takes into account the mandates and the areas of expertise of the various federal experts, scientific and

traditional knowledge, and the concerns expressed by the public either directly to the Proponent, to the province or to the federal government.

The following VECs have been selected as part of the present project:

- fish and fish habitat;
- birds;
- SARA listed species (woodland caribou);
- human health (drinking water quality, fish consumption and air quality);
- navigation; and
- current use of lands and resources for traditional purposes by Aboriginal persons (subsistence hunting, fishing, trapping and gathering; and heritage sites).

DFO and TC consider that assessment of the effects to the VECs will ensure incorporation of all of the project's environmental effects. Detailed information on the Proponent's environmental assessment approach can be found in Section 2, Volume 1 of the EIS (Manitoba Hydro and NCN, 2003).

4.6.2 Significance of Effects

The Proponent's assessment for the proposed Wuskwatim Project was structured to address the categories and types of environmental effects set out in the EIS Guidelines, i.e., effects at distinct phases of the Project (site preparation and construction, operation and maintenance) and effects on distinct biophysical (e.g., physical, aquatic and terrestrial), socio-economic (e.g., resource use and other socio-economic) and heritage resource components of the environment. The Project's environmental effects were identified by the Proponent using the information gathered on the project's technical aspects, basic data for the receiving environment, experience and lessons learned from similar projects, traditional knowledge, and the scientific literature. The analysis of this information allows for the identification of the Project's environmental effects by specifying the interconnections among the various physical, biological and human components of the environment into which the Project would be inserted. This analysis takes into account all of the physical works set up and the various phases of the Project, from construction through operation. The impact assessment takes into account the systematic application of proposed mitigation measures, as well as a number of mitigation measures that have been incorporated into the project's design.

The Proponent's approach to determining significance of effects is detailed in Section 2.4, Volume 1 of the EIS (Manitoba Hydro and NCN, 2003). The Proponent determined the significance of potential impacts on VEC's on the basis of the following criteria:

- nature of the effect (positive, neutral, or negative/adverse);
- magnitude of the effect;
- duration of the effect;
- frequency and timing of the effect;
- spatial boundaries or geographical extent of the effect (would the effect be limited to a small area or a large area);

- reversibility of the effect/resilience of the VEC (could the VEC readily recover from the impact); and
- ecological context (is the VEC particularly sensitive to the disturbance).

The assessment of significance for socio-economic VECs also considered:

- differing perspectives and values among different groups of people about their community and region, as well as their individual and family circumstances; and
- the problems inherent in assessing separately effects on different aspects or components of people's lives that each contribute to an overall "effect" on any group of people, i.e., effects may be either positive or negative, depending on the group affected, and may be both positive and negative when different groups are differentially affected.

The Proponent notes that, under the *CEAA*, environmental effects include socio-economic effects caused by a change in the biophysical environment which in turn is caused by the project, e.g., resource use or job losses due to a loss of fish habitat. However, if a socio-economic change is not caused by a change in the environment, but by something else related to the project (e.g., effects caused by employment or purchasing related to the project), the socio-economic effect is not an environmental effect within the meaning of the *CEAA.*

DFO and TC also note that, under the *CEAA*, the responsible authority is not bound by the Proponent's conclusions concerning the significance of the effects and, ultimately, must draw its own conclusions. In coming to their conclusions on the significance of the potential environmental effects, DFO and TC considered the Proponent's analysis and opinion, but also their own expertise, the expertise of other federal authorities and provincial technical advisory committee reviewers, views provided by the public and Aboriginal groups, and any other information at their disposal that was relevant to those conclusions.

4.6.3 Cumulative Effects

The method used by the Proponent to assess cumulative effects is very broadly drawn from the cumulative effects guidance document prepared for the Canadian Environmental Assessment Agency (Hegmann, G.C. et. al., 1999). Step 1 consists of determining the importance of the problems and the priorities by identifying the issues and the related Valued Environmental Components (VECs), by establishing the spatial and temporal bounds and by determining the other projects or activities whose adverse effects might add to those of the project.

The second step consists of analyzing the effects by describing the reference state and by assessing the cumulative effects. The third step consists of determining the mitigation measures while the fourth step permits the assessment of the significance of the residual impacts. Lastly, the fifth step identifies the follow-up required.

The VECs represent elements of the natural and human environment with a special value in the project region for the cumulative effects study. The VECs selected for the analysis of cumulative effects may constitute a subset of VECs retained for the analysis of the project's direct effects. A VEC is selected for the analysis of cumulative effects when the project is likely to cause residual effects on it, and when there is a strong possibility that these effects may combine with the effects of other past, present or future projects or activities.

It should be noted that although the Proponent's assessment approach recognizes that Wuskwatim Lake and adjoining waters, as well as the entire Churchill River Diversion (CRD) route, is a disrupted environment, as a result of both the initial diversion of water from the Churchill River in the 1970s and ongoing regulation, the CRD was not included in the Proponent's cumulative effects assessment. However, DFO and TC are of the view that where ongoing effects of the CRD have the potential to act cumulatively with identified effects of the Project, it is appropriate to consider the CRD in that context.

In addition to the CRD, DFO and TC considered the following list of current and future activities in the context of the cumulative effects assessment component of the comprehensive study:

- Wuskwatim Transmission Project: This project will be developed concurrently with the Project. For some VECs, its environmental effects may overlap with the environmental effects of the Project.
- Tolko present and future forest harvest plans
- Nisichawayasihk Cree Nation – increased number of cabins in Biophysical sub-region (particularly the waterway during the Transition Period (2009-2034)):
- NCN Treaty Land Entitlement (TLE) in Wuskwatim Lake and adjoining area: Although specific TLE plans are not developed, biophysical and resource use assessment considers how the Project could affect potential future uses.
- INCO Limited – integrated mining, milling, smelting and refinery complex located in Thompson, Manitoba.

4.6.4 Traditional Knowledge

The Proponent took the view in its environmental assessment that Traditional Knowledge (TK) is vital when considering assessment of development projects. From the outset of the study program TK has been incorporated by the Proponent into the design and implementation of the environmental and planning studies for the Project.

NCN has defined Traditional Knowledge from their perspective as:

- the observation and experience of the land;
- Aboriginal law regarding how the environment works;
- the understanding of NCN's place in the world – how things are connected, including spirituality, and the relationship to the land;
- the goals and aspirations of NCN;

- the outlook on the proposed Projects – concerns, acceptability;
- NCN's identity and culture;
- the stewardship of the land; and,
- a base for natural resource management.

NCN has indicated that TK comes from Elders and other people with both traditional and modern perspectives. DFO and TC acknowledge the incorporation of TK by the Proponent in the preparation of the EIS.

5.0 Description of Existing Environmental Conditions

The following section summarizes the current state of natural and human environments in the study area. The information in the following sections was summarized from the Wuskwatim Generation Project Environmental Impact Statement (Manitoba Hydro and NCN, 2003; Vol. 1), where more detailed information is available.

5.1 Physical Environment

5.1.1 Climate and Air Quality

The Wuskwatim site is located in a subdivision of the High Boreal Eco-Climatic Region in Manitoba. While this subdivision is warmer and more humid that the Region as a whole, it is generally characterized by short cool summers and cold long winters. The nearest climate station that maintains a comprehensive long-term record is located at the Thompson Airport, approximately 50 km NE of Wuskwatim Lake. The climate data from this station for the period of 1971-2000 (inclusive) indicates that the Thompson area exhibits the broad annual temperature range characteristic of a northern temperate, mid-continental climate. The annual mean temperature during the period of record was –3.2 °C. Daily mean temperatures range from an average high of 15.8 °C in the month of July to an average low of –24.9 °C in January (an annual range of 40.7 °C).

Rainfall accounts for about 67% of the total annual precipitation in the Thompson area, with the majority occurring between June and September (approximately 86% of the annual rainfall total; dataset 1971-2000 inclusive). Snowfall has been recorded in measurable amounts throughout nearly the entire year, with the only exception being the month of July. The five-month winter period (November through March) accounts for about 68% of the total average yearly snowfall.

An analysis of wind-rose data and climate-norm data indicate that prevailing winds are:

- westerly (W) for the 9 months from July through to March;
- shifting to north-easterly (NE) for 2 months from April through to May; and
- then shifting to easterly (E) during June.

Wind speeds are quite consistent throughout the year, fluctuating from an average high of 14 km/hr during April and May to an average low of 10 km/hr in December. The turbulence created by water flowing over Taskinigup and Wuskwatim Falls creates a mist

at these sites that turns into an ice fog, which is clearly visible from the air 20 km away from the site during the winter. When the fog comes in contact with the cooler surrounding land and vegetation, the surfaces become coated with layers of ice that gradually build up over the winter.

According to the Proponent, the existing air quality at the Project site is considered to be good to excellent, based on limited data from industrial emission monitoring (primarily sulphur dioxide emissions) of smelting operations in Thompson (the nearest industrial center), and the BOREAS (BOReal Ecosystem–Atmosphere Study) project. Based on the prevailing wind data recorded at the Thompson climate station, the Proponent does not expect that the study area would be subject to deposition from industrial facilities operating in Thompson. They noted, however, that Opegano Lake is considered to be within the secondary deposition zone of emissions from the INCO smelter.

5.1.2 Geology and Soils

The Wuskwatim Lake area is part of the Threepoint Lake Ecodistrict. The area is underlain by Precambrian bedrock (complex of gneisses and younger intrusive material), which controls the physiography. The bedrock has good interlocking crystalline texture, resulting in excellent rock-strength characteristics, and is generally considered to be competent throughout the area.

The bedrock is generally masked by fine textured glaciolacustrine sediments, and consequently extensive bedrock outcrops are uncommon. Clayey and fine silty, varved, calcareous glaciolacustrine sediments, “impervious materials”, in the form of deep blankets and shallow veneers characterize the uplands. Course textured non-calcareous to weakly calcareous surficial materials are limited. The district contains some sandy and gravelly glaciofluvial deposits and associated sandy glaciolacustrine sediments “granular materials”, and very limited areas of non-calcareous, sandy and cobbly till in the form of veneers and pockets. The access road to the Project site is located on the eastern side of the southern end of a long, roughly north-south to north-northeast trending interlobate ridge (glacial feature).

The general land cover in the Wuskwatim Study Area consists predominantly of closed forest with open treed areas, beaver flood and treeless wetlands and water. Shallow and deep peatlands are found in large and small basins and depressions and on lower slopes of uplands. These peatlands invariably overlie clayey, glaciolacustrine sediments and are derived from sedges and brown mosses as well as from Sphagnum and feather mosses and forest debris. High ice-content permafrost is associated with the moderately deep and deep bogs (peat-plateau and palsa bogs), with the lower slopes of shallow bogs, and in shallow depressions (veneer bogs). Discontinuous permafrost may also occur under mature, closed forest cover, but ice content is generally low.

5.1.3 Vegetation

The Wuskwatim Generation Project study area is located in the Boreal Shield Ecozone of northern Manitoba. The Proponent adopted five superimposed Study Areas for the

terrestrial environment disciplines using the habitat and life activity requirements (e.g., migration ranges, reproductive areas) of the VECs selected by the Proponent and the extent of Project effects. These areas are shown in Figure 8 and described as follows.

- Region (i.e., an ecological region encompassing the southern three-quarters of the Nelson House Resource Management Area and all of the proposed development site);
- Sub-Region (i.e., a block of approximately 340,000 ha centering on the proposed development site);
- Affected Aquatic Area (i.e., encompasses all the shoreline, peat island and mineral island habitat in the affected waterway from Early Morning Rapids to the Opegano Lake outlet);
- Aquatic Buffer (i.e., a 1 km band around the Affected Aquatic Area encompassing all anticipated mainland habitats to be directly and indirectly affected by the generating station features and Project related erosion); and
- Upland Buffer (i.e., a 1 km band around the access road and borrow pits encompassing all anticipated mainland habitats to be directly and indirectly affected by these Project features).

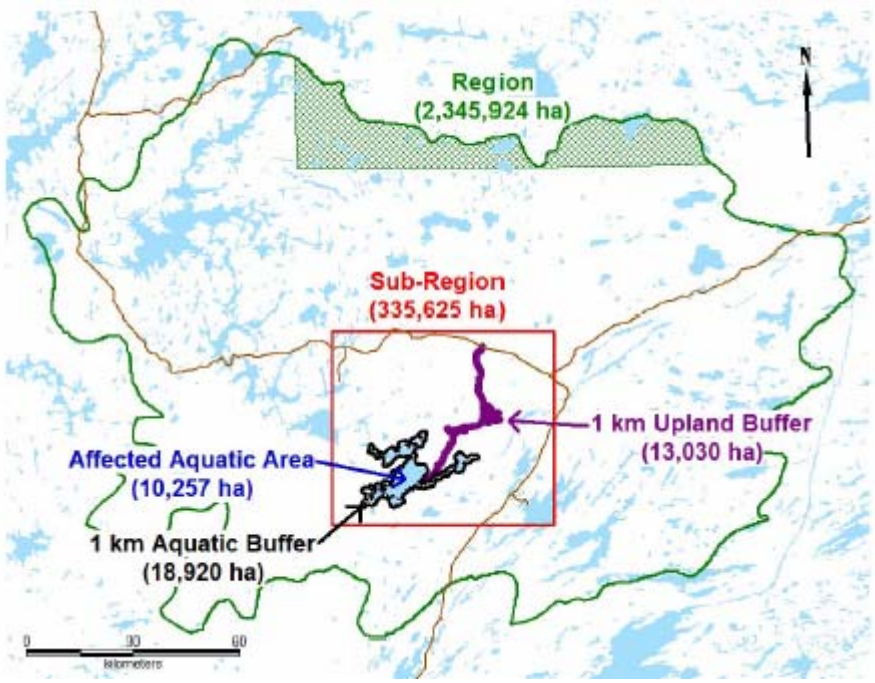

Figure 8: Terrestrial habitat assessment study areas. The crosshatched area shows the portion of the Region that has inconsistent habitat information
(Manitoba Hydro and NCN, 2003; Vol. 1, p. 7-4)

The Proponent defined habitat types (Figure 9) as areas with a particular combination of key attributes, including soils, hydrology, permafrost, vegetation/plants, vegetation age and disturbance regime that collectively determine the presence, survival and abundance

of plants and animals at any site. Aquatic, upland/mainland, shore zone, lake peatland, and mineral island are the major habitat types found in the region.

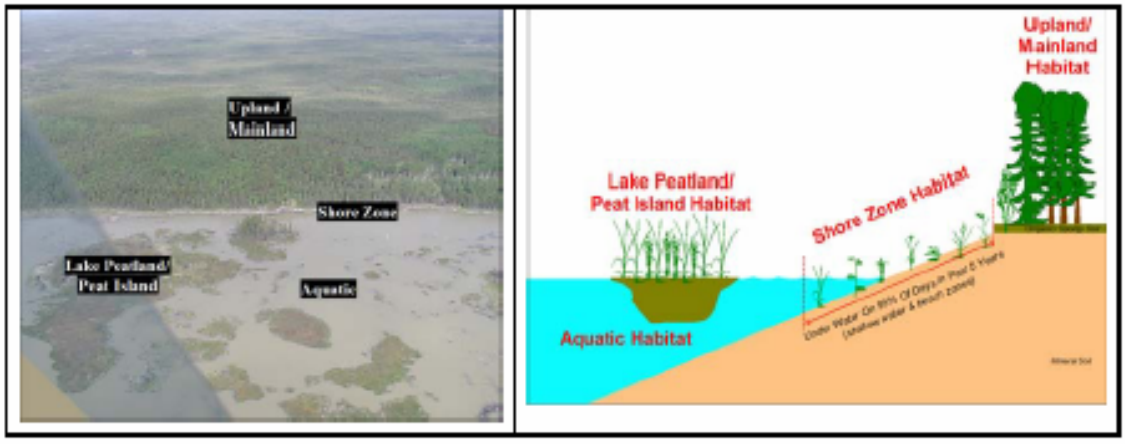

Figure 9: Major habitat types
(Manitoba Hydro and NCN, 2003; Vol. 1, p. 7-15)

Upland/Mainland Habitat

Terrestrial land cover in the Region and Sub-Region is dominated by conifer (black spruce, jack pine and other conifers) forest on various types of soils and very open vegetation on peatlands (48% and 29% of land area, respectively). Water covers about 10% of the Sub-Region and Region. It is estimated that over 80% of the forests are between 20 and 90 years old. Large disturbances, particularly wildfire, play an important role in creating the patchwork of upland/mainland habitat types in the Study Area and fire history maps indicate that approximately 25% of the Sub-Region area has been affected by large wildfires in the past 30 years.

The land type and habitat composition of the 1 km Upland and Aquatic Buffers are similar to that of the Sub-Region with a few exceptions. Peatlands and dry mineral soils are much less abundant in the 1 km Aquatic Buffer than elsewhere in the Sub-Region while mineral and peaty mineral soils are somewhat more abundant. Peat plateau bogs are virtually absent next to the CRD-affected shoreline. A small amount of white spruce forest and scattered balsam fir saplings and trees, rare in the Region, occur along the shoreline of Wuskwatim Lake.

Riparian, Peat Island and Mineral Island Habitat

Shore zone, lake peatland/peat island and mineral island are the major terrestrial habitat types found in what the Proponent refers to as the Affected Aquatic Area. Fluctuating water levels is the dominant disturbance in the Affected Aquatic Area. Most wetlands occur in the sheltered bays peripheral to the main body of Wuskwatim Lake and are a mixture of marsh, shoreline bog, shoreline fen and peat islands. The Proponent notes that wetland types have changed as a result of the CRD, after which an estimated 84% of the

lake peatlands disappeared and the remainder has become peat islands that are separated from the adjacent uplands by an organic or clayey beach.

Most of the shoreline vegetation is in the sheltered bays peripheral to the main body of Wuskwatim Lake where the low slope organic or clayey beaches occur. The vast majority of the organic and clayey beach vegetation is dominated by sedges, grasses and herbs that grow well on newly exposed wet organic or mineral soil. Transects from the upland edge across the beach and into the shallow water show a gradual transition from shore zone plants that die when their roots are submerged under water for a long time to plants that cannot survive out of the water for more than a few days. These shore zone bands of different vegetation types are created by the day-to-day water level fluctuations.

Peat islands with cattails or sedges, 8,700 concentrated outside of the main body of Wuskwatim Lake, provide a large amount of the habitat in the Affected Aquatic Area. The Affected Aquatic Area also has 119 Mineral Islands with black spruce forest, with the largest islands in the main body of Wuskwatim Lake. The largest island, located in the north part of Wuskwatim Lake, supports the largest balsam fir forest community in the Sub-Region (25 ha), accounting for 30% of Regional balsam fir forest.

For more detailed information on vegetation and terrestrial habitat in the study area the reader is referred to the Wuskwatim Generation Project Environmental Impact Statement (EIS) (Manitoba Hydro and NCN, 2003) Volume 1 Section 7, and Volume 6.

5.1.4 Hydrology and Hydrodynamics

The degree of physical change anticipated from the proposed Project (e.g., change in water levels and flows) differs substantially from one portion of the study area to another. The Proponent provides detailed information on hydrology and hydrodynamics in the Wuskwatim Generation Project Environmental Impact Statement (EIS) (Manitoba Hydro and NCN, 2003) Volume 1 Section 5, Volume 4 and Volume 5 . To facilitate their discussions, the Proponent divided the Burntwood River into six distinct reaches as follows:

- Reach 1 - Wuskwatim: The 22 km reach from Early Morning Rapids to the crest of Wuskwatim Falls, including an 8 km reach of the Burntwood River, and Wuskwatim Lake and adjacent waterbodies (Cranberry Lakes, Sesep Lake, and Wuskwatim Brook). This reach will comprise the reservoir for the proposed GS. The full-supply level will be 234 m ASL;

- Reach 2 - Falls: The 1 km reach between the crest of Wuskwatim Falls and the tailwater of Taskinigup Falls. This reach corresponds to the immediate forebay of the proposed GS; it will have an increased water level up to the 234 m ASL (reservoir operating elevation);

- Reach 3 - Burntwood: The 14 km reach, including the Burntwood River mainstem and several small backwater inlets, between the tail-water of Taskinigup Falls and Opegano Lake. This reach will be subjected to daily water level and discharge

fluctuations from operation of the GS superimposed on the existing fluctuations due to CRD operation and seasonal events;

- Reach 4 - Opegano: The 8 km reach from the inlet of Opegano Lake to the crest of Jackpine Falls, immediately downstream of Opegano Lake. This reach will be subjected to detectable daily water level fluctuations, although the magnitude of the fluctuations will be much less than those experienced in the upstream river reach;

- Reach 5 - Downstream of Opegano: The 25 km reach of the Burntwood River from Jackpine Falls, through Birch Tree Lake, to the City of Thompson; and

- Reach 6 - Downstream of Thompson: The approximately 100 km reach of the Burntwood River downstream of the City of Thompson to the inlet at Split Lake.

A seventh area was identified to include the streams crossed by the access road. In the Proponent's EIS, descriptions of the aquatic environment are focused on Reaches one through four and the stream crossing areas, where Projects impacts are more likely to occur.

According to the Proponent, the Rat and Burntwood Rivers drop approximately 90 m along the course between the Notigi Control Structure and the downstream confluence with the Nelson River at Split Lake (Figure 1). The river system is characterized by a series of lakes, separated by river reaches that are hydraulically controlled by narrow constrictions and rapids. Following the 22m combined drop at Wuskwatim Falls and Taskinigup Falls, the 13 km stretch of river to Opegano Lake is characterized by a series of relatively flat river reaches and three sets of small rapids. Water levels in the last 4 km of this river channel are controlled by Opegano Lake. As discussed in Section 2.2 above, the Rat/Burntwood River system forms part of the Churchill River Diversion (CRD), a regulated waterway since 1977. Implementation of the CRD resulted in the rise of Wuskwatim Lake water levels by approximately 3 m.

Ice Processes

The Proponent states that the nature of the ice cover will vary with location and water velocity, but generally can be described as either a smooth "lake ice" or a rougher more dynamic "river ice". Along the Burntwood River, Manitoba Hydro has studied ice processes in detail for the past 30 years, and has developed computer models to simulate the complex ice conditions along the river. River ice conditions currently experienced both upstream and downstream of the proposed Wuskwatim Generation Project site are variable, and depend on factors such as the magnitude of CRD flow and the type of winter (i.e., colder or warmer than normal).

The major ice processes observed along the river, from the Notigi Control Structure (upstream of the Project site) to Manasan Falls (downstream of the Project site), are summarized from the Proponent's EIS as follows: On the major lakes in this reach (i.e., Wapisu Lake, Threepoint Lake, Wuskwatim Lake, Opegano Lake, and Birch Tree Lake),

a competent ice cover forms quickly. The river sections (both upstream and downstream of the Project site) typically remain open and produce large volumes of frazil ice, ice crystals that start out small and then agglomerate to create floating ice pans. These ice pans either accumulate on the leading edge of the ice cover on downstream lakes, resulting in advancement of the cover upstream, or, if velocities are too high, deposit under the cover forming a hanging ice dam. An ice dam typically forms at the base of Early Morning Rapids at the entrance to Wuskwatim Lake, which can cause a localized rise (or staging) of water levels in the immediate upstream area . A similar ice dam forms at the inlet to Opegano Lake, and also immediately downstream of Kepuche Falls. Also in the river sections, there is a growth of anchor ice at many of the rapids, which can cause upstream staging of water levels in the river sections and lakes due to a reduction in the cross-sectional flow area of the river.

5.1.5 Water Quality

Water quality has been described by the Proponent with respect to Reaches one through five in the study area. In general:

Wuskwatim, Opegano, and Birch Tree lakes can be described as:

- meso-eutrophic to eutrophic (total phosphorus ranged from 0.018 to 0.048 mg/L);
- highly oxygenated (in ice-free and ice-cover seasons dissolved oxygen (DO) typically in excess of 9 mg/L);
- soft-water (water hardness ranged from 47 to 59 mg/L as CaCO3);
- slightly alkaline (lab pH ranged from 7.4 to 8.1);
- low transparency (Secchi disk depths ranged from 0.2 to 1.2 m); and
- total suspended solids (TSS) typically ranging from < 2 mg/L to 24 mg/L.

The lower Burntwood River in the study area can be described as:

- highly turbid (turbidity ranged from 18 to 63 NTU);
- total suspended solids typically ranging from < 5 mg/L to 24 mg/L;
- soft (water hardness ranged from 51 – 63 mg/L as $CaCO_3$);
- slightly alkaline (lab pH ranged from 7.4 to 7.9); and
- highly oxygenated (the majority of measurements of dissolved oxygen in excess of 9 mg/L and all were above 6 mg/L).

Nitrogen and phosphorus concentrations are moderately high in the study area and the area is characterized by moderate levels of organic carbon. While nitrogen may be a limiting nutrient, the Proponent suggests that due to the hydraulic conditions (i.e., high turbulence, high velocities, high flushing rates and low river travel times) and the low water transparency at most sites along the mainstem of the study area, phytoplankton growth is likely limited (or co-limited) by light and/or physical characteristics of the aquatic environment.

Concentrations of some metals were elevated in the study area, most notably aluminum and iron which are typically at least an order of magnitude above MWQSOGs for the protection of aquatic life, and have been elevated in this system for decades (Ramsey 1991). Iron also exceeds the aesthetic objective for drinking water quality throughout the study area. Canadian Water Quality Index (CWQI) (CCME 200b) as applied to water quality data collected in the study area during the open-water season 2001 ranked the overall water quality in the area as "marginal" for Birch Tree Lake, and "fair" for Wuskwatim Lake, the lower Burntwood River downstream of Taskinigup Falls, and the lower Burntwood River downstream of Early Morning Rapids. These rankings reflect water quality conditions that are consistently in non-compliance with objectives for iron, and aluminum, and non-compliant for phosphorus in the lakes and occasionally non-compliant in Birch Tree lake for lead.

For more detailed information on water quality in the study area the reader is referred to the Wuskwatim Generation Project Environmental Impact Statement (EIS) (Manitoba Hydro and NCN, 2003) Volume 1 Section 6, and Volume 5.

5.1.6 Erosion and Sedimentation

Wuskwatim Lake Erosion

The Proponent remarks that lakeshore erosion is a complex natural process involving many interrelated factors that may act alone or in combination. Bank-recession rates are influenced by variable wind and wave energy conditions, fluctuating lake levels, shoreline geometry, variable bedrock exposure around the shoreline, the presence of shoreline debris and other obstructions to incoming wave energy, and episodic bank failures. Erosion measurements by Manitoba Hydro at 45 sites (15 sites with 3 profiles for each site on Wuskwatim Lake) for the past 10 to 12 years show that there is both temporal and spatial variation in erosion rates.

According to the Proponent, about 30% of shorelines on Wuskwatim Lake and adjoining waters are currently eroding, primarily where the shorelines have silty-clay banks and silty-clay banks overlying low bedrock. With the commissioning of the CRD in 1977, and the resulting rise in average Wuskwatim Lake water levels of approximately 3 m, erosion rates on Wuskwatim Lake rose from a pre-CRD average shoreline recession rate of 0.7 m/yr to a post-CRD average rate of 2.0 m/yr. The Proponent states that over the past 25 years, shoreline-erosion rates have been declining through the development of nearshore beaches and a related increase in the prevalence of nearshore downcutting, however, current erosion rates in Wuskwatim Lake have not yet reached the long-term pre-CRD values. The majority of eroding shorelines are concentrated in the main part of Wuskwatim Lake and represent about 75% of that shoreline. The erosion-monitoring data from the past 10 years, in the main part of Wuskwatim Lake, indicate that 2.9 ha of shoreline area is lost each year to shoreline erosion.

Riverine Erosion

The Proponent observed that riverbank erosion accompanying channel migration, widening or downcutting is often initiated by scour and undermining of the toe of the bank, rather than by direct erosion of the slope by wind-generated wave action (i.e., the toe of the riverbank is undercut and the upper portion of the riverbank [cohesive-silt/clay material] collapses downwards). Where banks are underlain by permafrost, thawing may also play a role, resulting in large bank failures. Factors such as loss of vegetation, thawing of permafrost, or surface waves affect mainly the upper levels of the bank. Commissioning of the CRD in 1977 increased mean flows in the Burntwood River by about 8 times, increased yearly maximum channel-forming flows by about 3 times, and greatly reduced the variability of flows through the year. The Proponent believes that over the last 25 years, the river has adapted to these higher channel-forming flows.

From air photo analysis (1985 to 1998) and recent video footage (2000), the Proponent observed that in the stretch of river between Taskinigup Falls and Opegano Lake approximately 45% of the total length of banks were eroding to some degree, and the rest they described as “water-washed”; over substantial lengths, even in wider reaches, some shoreline recession is occurring on both banks simultaneously; riverbank recession varies locally from 0 to <1.0 m/yr, with a spatial average of approximately 0.2 m/yr.

The Proponent noted that in some areas, bank recession is occurring in reaches where bank velocities are very low, and they thought this may represent a surficial response to wave action and/or the thawing of permafrost, if present. The Proponent also observed that in certain areas, localized riverbank erosion may be exacerbated due to the formation of large hanging ice dams during the winter period, and noted that this is particularly evident at the inlet to Opegano Lake.

Sedimentation

In describing existing sedimentation conditions on the Burntwood system, the Proponent notes that sedimentation and Total Suspended Sediments (TSS) in the water column are the end results of several processes, including: erosion, sediment production, deposition and/or transport, and in-stream morphological processes. As in other lakes, inflowing rivers with sediment loads and localized erosional processes within Wuskwatim Lake are predominantly responsible for existing sedimentation processes and rates.

The Proponent reports that long-term TSS data has been collected on the Burntwood River near Thompson for pre-and post-CRD conditions. According to the Proponent, the data indicates that during and just after the commissioning of the CRD, TSS levels rose to 20 mg/L and then returned back to pre-CRD levels of 13 mg/L in the 1987 to 1992 reporting period. Additional data collected by Manitoba Conservation from 1992 through to 2002 shows average TSS levels continue to be approximately 13 mg/L. While TSS concentrations appear to have returned to pre-CRD conditions, total sediment loads have increased by about 8 times due to the increased volume of water flowing down the CRD.

In their preliminary sediment budget for post-CRD conditions for the main part of Wuskwatim Lake, the Proponent observed, based on three years of data (1999-2001) that the TSS levels entering into the Wuskwatim Lake are approximately 12 mg/L and the TSS levels leaving Wuskwatim Lake are about 10 mg/L (based on 2 recording stations in the lake as a surrogate of outflows), indicating sediment deposition is currently occurring within Wuskwatim Lake. TSS data for the surrounding lakes (i.e., Cranberry and Sesep lakes) are lower than the main CRD river/lake flow area. Using a post-CRD average annual flow of 845 m^3/s, the Proponent calculated that approximately 57,000 tonnes/year of sediment are currently being deposited within the main part of Wuskwatim Lake based on an inflow-outflow sediment balance, and an additional 45,600 tonnes/yr of soil is currently being added to the lake due to shoreline erosion.

Based on results from a more extensive study of erosion and deposition on Southern Indian Lake, the Proponent estimates that 22,800 tonnes/yr of eroded material are currently being deposited in the nearshore area around the shorelines of Wuskwatim Lake and the other 50% or 22,800 tonnes/yr are being transported out into the deepwater section of the Lake, where it joins with the other material coming into the lake via the river and is deposited in the water for a total net deposition rate of 79,800 tonnes/yr. In terms of deposition rates, potential nearshore deposition has been estimated by the Proponent to be approximately 0.29 g/cm^2 /yr (based on 52.6 km of eroding mainland shoreline and a conservatively low deposition width of 150 m). Deepwater deposition has been estimated to be approximately 0.21 g/cm^2 /yr (based on an effective lake area of the main part of Wuskwatim Lake of 38 km^2.

For more detailed information on erosion and sedimentation in the study area the reader is referred to the Wuskwatim Generation Project Environmental Impact Statement (EIS) (Manitoba Hydro and NCN, 2003) Volume 1 Section 4, and Volume 4.

5.1.7 Woody Debris

Debris, in the context of Manitoba Hydro's hydroelectric developments, is defined as "*woody or other organic material that impedes desired uses of a waterway*". Debris can be either fixed (trees or tree parts that remain rooted) or loose (either floating freely or deposited on a shoreline). The Proponent indicates that while naturally occurring phenomena such as floods and eroding banks will add woody debris to almost all waterways over time, the current debris environment in the study area is also the result of pre-CRD clearing programs; the post-CRD water-regime which, in addition to flooding, accelerated bank-erosion processes; and ice-clearing processes loosening/removing standing trees in open areas.

Debris types described by the Proponent and mapped according to density in the post-CRD study area include beached, standing dead, submerged, floating and rafted woody debris. It was noted that the predominant debris type in the main part of Wuskwatim Lake was beached debris and that debris concentrations are highest in the southern portions of Wuskwatim Lake and are correlated with the location of erodible soils. Downstream of Wuskwatim Falls, along the Burntwood River, beached debris is located along the edges of the channel, either on the banks or in shallow water. In the small embayments off the

river, there are a variety of woody debris types including beached, floating and standing dead.

5.2 Fish and Fish Habitat

Information on existing fish biology, quality and habitat was summarized from the EIS and supplemental information submitted by the Proponent (Manitoba Hydro and NCN, 2003). For more detailed information the reader is referred to Volume 1 Section 6, and Volume 5.

5.2.1 Fish Habitat

This section describes the fish habitat in each of Reaches one through four of the Burntwood River. The Proponent provides a quantitative classification of habitat in Volume 1, Section 6.6 of the EIS (Manitoba Hydro and NCN, 2003) using the following categories: water level (defined by elevation); substrata type; presence/absence of rooted submergent aquatic plants; and water velocity. The reader is referred to Volume 1, Section 6.6 of the EIS for images illustrating representative habitat within the reaches.

According to the Proponent, the study area encompasses a diverse range of aquatic habitats, from relatively large rivers to small streams, a variety of sizes of lakes and flooded terrestrial areas. From a biodiversity and conservation perspective, the Proponent notes that the aquatic environment of the study area is similar to the aquatic environment in much of the northern boreal forest of Manitoba, Ontario, and western Quebec.

The Proponent observes that the area harbours many lower trophic groups. The Proponent collected and identified 24 aquatic plant and two macroalgae species, and between 19 and 25 different kinds of zooplankton (Cladocera and Copepoda) in reaches 1 and 4. The Proponent did not collect zooplankton data in the riverine reaches 2 and 3 as it was believed that zooplankton would not grow well in swiftly flowing water. The Proponent notes that with a few exceptions, the majority of habitat types investigated could be considered representative of relatively healthy and diverse aquatic habitat, as there is an extensive list of invertebrate taxa identified. The Proponent observed that invertebrate taxa expected to be observed in intermittently exposed, nearshore, and offshore zones were present, and the relative proportions are as occur in other waterbodies.

Reach 1: Wuskwatim

The Proponent described aquatic habitat in Reach 1 at the 95th percentile water level (shoreline elevation 234.09 m). Within this reach, the intermittently exposed, nearshore, and offshore zones each occupy approximately 2022 ha (23 %), 2579 ha (29 %), and 4372 ha (49 %), respectively. The post-CRD flooded terrestrial area in Reach 1 is approximately 2913 ha, primarily in the area covered by Cranberry Lakes, Sesep Lake, Wuskwatim Brook, and Wuskwatim Lake south. Since the flooded terrestrial areas are shallow and typically sheltered, they support the majority of rooted aquatic plant growth for this reach. Rooted submergent aquatic plant distribution, however, is variable and

growth is patchy. The Proponent notes that as a result of CRD regulation, poorly established littoral zones occur because the frequency and extent of water level fluctuations preclude the development of extensive aquatic plant beds. Lake regulation may also affect plant density and distribution, as altering lake levels can influence both light regime and substrata availability or stability.

The majority of nearshore and offshore areas in Wuskwatim Lake main are predominantly soft silt/clay-based substrata, with a narrow band of boulder/cobble visible along a portion of some shorelines when water levels are relatively low. Shoals are typically hard substrata (i.e., bedrock, boulder/cobble). In the lower bank elevation area of Wuskwatim Lake south, the flooded terrestrial area occupies a proportionately larger area and is characterized by peat islands, flooded forest, patchy rooted aquatic plant beds, and soft silt/clay-based substrata rich in detritus.

Rooted submergent aquatic plants occupy approximately 744 ha (9 %) of the area of Reach 1. The majority of submergent aquatic plants are found within the what the Proponent referes to as the intermittently exposed zone (IEZ, 77 %), with the remainder found in the nearshore zone.

The Proponent reports the mean total abundance of benthic invertebrates (small animals without backbones living on or in the bottom substrata) in Reach 1 ranged from a low of 1276 individuals/m^2 in the IEZ to a high of 12551 individuals/m^2 in the nearshore zone. Chironomidae (midges) is the most common taxa in all habitat types, with the exception of the offshore zone where Amphipoda (scuds) and Sphaeriidae (fingernail clams) are most common. The insect group Ephemeroptera (mayflies) was a relatively important component of the benthos in the nearshore habitat zone, particularly where there was flooded terrestrial substrata with rooted submergent aquatic plants.

The two small sections of the Burntwood River in Reach 1, upstream of Cranberry Lakes to Early Morning Rapids; and between Cranberry Lakes and Wuskwatim Lake main, have high exposed clay banks and lower bedrock controlled banks, respectively, and both can have depths on the order of 15-17 m.

Reach 2: Falls

The Proponent reports that safety concerns limited that amount of data that could be collected from this reach between the base of Wuskwatim Falls and immediately upstream of Taskinigup Falls. Thus the area representative of data collection is smaller in size (43.6 ha) than the actual area of the reach (53.3 ha). Aquatic habitat in this section is described at the 95th percentile flow event (discharge at 1066 m^3/s). Reach 2 has a surface area of 43.6 ha, a maximum water depth of 19.0 m, a mean water depth of 6.4 m, and a water volume of about 3 million m^3. Aquatic habitat is predominantly found within the wetted zone (90.4 %), with relatively little in the intermittently exposed area.

The Proponent reports that the substrata of Reach 2 generally reflect the distribution of water velocities. Off-current areas along the riverbanks and in bays have soft silt/clay-based substrata (22.6 %). In on-current areas within the upstream half of the reach (where

water velocities are greatest) the centre of the river is bedrock (20.3 %), and the lower half, including the pools and scour channels, is hard silt/clay-based (29.6 %). The majority of boulder/cobble (13.0 %) is located between the substrata types found in the on-and-off current areas. There is substantial current through the majority of this reach. Maximum water velocities occur closest to Wuskwatim Falls and dampen out towards Taskinigup Falls. There are two larger bays midway through the reach, one on the north-side and one on the south that were low relief terrestrial areas inundated as a result of CRD. The flooded terrestrial area in Reach 2 occupies approximately 6.4 ha, with the majority (98.0 %) in these two bays. Local runoff enters into each of these bays via small ephemeral streams that have minimal discharge after the spring freshet. Associated with these sheltered bay areas is sparse aquatic plant growth. Relatively high water velocities preclude aquatic macrophyte growth in the remainder of the reach. Rooted submergent aquatic plants occupy an area of 2.2 ha in Reach 2.

The Proponent's baseline sampling indicates that the mean total abundance of benthos in Reach 2 ranged from a low of 2071 individuals/m^2 in the wetted mainstem with hard silt/clay-based substrata, low water velocity habitat type to a high of 4793 individuals/m^2 in the wetted mainstem with boulder/cobble substrata, medium water velocity. Large, stable bottom substrata, such as boulders and cobble, tend to support relatively more productive benthic invertebrate populations. Fingernail clams were the most common taxa in the majority of habitat types sampled, with the exception of the intermittently exposed mainstem where amphipods were most common. Within the insect groups, mayflies and midges were most common in the habitat types characterized as having soft silt/clay-based substrata and lacking aquatic plants, and Trichoptera (caddisflies) was most common in the habitat types with either boulder/cobble or hard silt/clay-based substrata.

Reach 3: Burntwood River Downstream

The Proponent indicates the Burntwood River between Taskinigup Falls and Opegano Lake is 12 km long with a width ranging from 60 to 300 m. Reach 3 has 10 backwater inlets that receive inflow from first-order streams, which the Proponent has numbered from Taskinigup Falls downstream. Inlet 9 receives water from a second-order stream. Drainage areas for these streams are relatively small and discharge into the inlets is low after the spring freshet.

Aquatic habitat is predominantly found within the wetted portion of the river mainstem. The IEZ occupies a larger area within the mainstem than in the backwater inlets; however, a greater proportion of aquatic habitat in the backwater inlets is intermittently exposed (53 %) due to the lower relief and shallower water depths. As in Reach 2, the substrata generally reflect the distribution of water velocities, with soft silt/clay-based substrata in areas of lower velocity, and a mixture of bedrock, boulder/cobble, and hard silt/clay in areas of higher velocity. Rooted submergent aquatic plants occupy an area of 3.9 ha in Reach 3, predominantly in the IEZ. Areas within the backwater inlets support the majority of submergent aquatic plant growth (64.5 %). The majority of aquatic plants within the mainstem reside in small notch inlets where water depth is shallower and

velocities are reduced. Except for inlets 4, 9, and 10, the backwater inlets have relatively small flooded terrestrial areas in their upper ends where relief is low. The flooded terrestrial area in Reach 3 occupies approximately 3.4 ha, with the majority (93.0 %) in the backwater inlets. The backwater inlets have soft silt/clay-based substrata throughout; however, inlet 6 has an area of boulder/cobble where the tributary enters the inlet. Typically, the banks of the inlets are silt/clay-based, with the majority having large woody debris (e.g., logs, branches) on shore.

The Proponent reports a mean total abundance of benthos in Reach 3 ranging from a low of 70 individuals/m^2 in the wetted mainstem with boulder/cobble substrata, medium water velocity to a high of 4652 individuals/m^2 in the intermittently exposed mainstem, soft silt/clay-based substrata, low velocity. Abundances measured were substantially less in habitat types with either boulder/cobble or bedrock substrata (range of 70 to 129 individuals/m^2), although the Proponent suspects that the benthic invertebrate community associated with these bottom substrata was not sampled effectively. Intermittently exposed habitat types were dominated by midges, fingernail clams, and mayflies. Midges were most common in the backwater inlets, and fingernail clams and mayflies were most common in the mainstem. Midges, fingernail clams, hydrozoans, and mayflies dominated wetted habitat types.

Reach 4: Opegano

Aquatic habitat in Reach 4 is described by the Proponent at the 95th percentile water level (shoreline elevation 208.6 m). Within Opegano Lake, the intermittently exposed, nearshore, and offshore zones each occupy approximately 49.8 ha (6.3 %), 497.9 ha (63.2 %), and 240.6 ha (30.5 %), respectively. The majority of Opegano Lake's shoreline consists of steep, exposed, silt/clay-based banks. Rooted submergent aquatic plants are present in 45.5 ha in Opegano Lake, with about 48 % in the IEZ and 52 % in the nearshore. Aquatic plants are predominantly found in the flooded terrestrial areas in the north end of Opegano Lake, with small patches of aquatic plants growing in sheltered areas along the west and east shores. As in other reaches, the flooded terrestrial areas support the majority of submergent aquatic plant growth.

According to the Proponent, mean total abundance of benthos in Opegano Lake ranged from a low of 2409 individuals/m^2 in the nearshore with soft silt/clay-based substrate, no plants to a high of 9106 individuals/m^2 in the offshore with soft silt/clay-based substrate. Fingernail clams were the most common taxa in the majority of habitat types, with the exception of the nearshore areas with aquatic plants; Oligochaeta (aquatic earthworms) were most common in the nearshore with soft silt/clay-based substrata, while midges were prevalent within areas with flooded terrestrial substrata. Other insect groups were a relatively less important component of the benthos, with the exception of caddisflies, which were more common in the offshore zone with hard silt/clay-based substrata.

Stream Crossings

Streams crossed by the access road originate in poorly drained fens. The Proponent has classified the majority of these streams as having marginal fish habitat and a low environmental sensitivity rating. The two exceptions were the stream designated R5, a tributary of Birch Tree Brook, and the stream designated at R8, a tributary of the Burntwood River (backwater inlet 6 in Reach 3).

Figure 10: Aerial view of road crossing at R5 (left) and at R8 (right). The line indicates crossing location and the arrow indicates direction of water flow
(Manitoba Hydro and NCN, 2003; Vol. 1, p. 6-46)

The habitat within these two streams is considered adequate to support and over-winter spring-spawners (e.g., white sucker, northern pike), however, the Proponent believes the spawning potential for fish is probably limited by beaver dams and other obstructions to movements. Benthic invertebrates were not sampled at the stream crossings but the Proponent expects that the stream crossing sites support less diverse and/or less abundant benthic invertebrate communities in comparison to the other reaches, because of the relatively small extent of wetted area.

5.2.2 Fish Community and Habitat Use

According to the Proponent, the fish community is fairly typical of relatively shallow, turbid, northern water bodies in the boreal forest region. The Proponent identified a total of 20 fish species, with the principal fish species captured during baseline analyses being walleye (*Stizostedeon vitrium*), sauger (*Stizostedeon canadense*), northern pike (*Esox lucius*), yellow perch (*Perca flavescens*), lake whitefish (*Coregonis clupeaformis*), lake cisco (*Coregonis artedii*), longnose sucker (*Catostomus catostomus*), white sucker (*Catostomus commersoni*), burbot (*Lota lota*), spottail shiner (*Notropis hudsonius*), and emerald shiner (*Notropis atherinoides*). The Proponent employed standard gang index gillnetting to assess the fish community, and forage species were identified only through larval fish surveys and stomach content analysis. At the request of DFO, additional baseline sampling of the forage fish community was conducted by the Proponent in 2003, but no additional forage fish species were identified.

The Proponent reports that white sucker and sauger were the dominant species captured in the lacustrine reaches studied, accounting for 55% and 50% of the catches in Reach 1 (Wuskwatim Lake) and Reach 4 (Opegano Lake) respectively. Lake cisco and walleye

were also abundant in Wuskwatim Lake and Opegano Lake respectively. Where the lakes off the main channel were considered, the dominant species were walleye and white sucker, accounting for 45% of the catch. In Reach 2, the Proponent's catches were dominated by walleye and longnose sucker, accounting for fully 67% of the total catch, although the Proponent cautions that safety considerations in the selection of sampling locations may have biased the results. Walleye, northern pike and white sucker were the most abundant species (65% total) in Reach 3 downstream of the falls. The Proponent reported five species of fish captured during backpack electrofishing at the eight stream crossing sites along the proposed access road. These were brook stickleback (*Culaea inconstans*), fathead minnow (*Pimephales promelas*), pearl dace *(Margariscus margarita),* lake chub (*Couesius plumbeus*) and white sucker.

The Proponent identified walleye, lake whitefish, lake cisco, and northern pike, as Valued Ecosystem Components (VEC's) for assessment of potential Project-related effects on fish communities and fish movements, because these are key domestic and commercial fish species. More extensive information on these species in the Project area was provided by the Proponent and is summarized below.

Walleye

Presently, walleye are one of the most abundant species found in the study area, accounting for 13.9% of the 1998-2001 index gillnet catch in Reach 1, and 37.5% , 35.6% and 22.4% of the 2001 and 2002 index gillnet catches in Reaches 2, 3, and 4, respectively. Based on TK and the results of the EIA studies, walleye spawning habitat in Reach 1 is concentrated in Wuskwatim Brook and Wuskwatim Lake south. Walleye may also spawn in the Burntwood River above Cranberry Lakes, the Muskeseu River, and along the northeast shoreline of Wuskwatim Lake main. The Proponent found some evidence to suggest that walleye spawn in Reach 2, but believes the majority of walleye found in this reach are transients. Downstream of the proposed project, the Proponent suggests that there is walleye spawning in the tributary draining into Backwater Inlet 6, tributaries flowing into backwater inlets 9 and 10 and potentially near the base of the north channel of Taskinigup Falls, near the base of Little Jackpine Rapids, and just upstream of Opegano Lake. Although specific walleye spawning habitat was not identified in Reach 4, the Proponent suggests the Burntwood River inlet appears to provide suitable conditions. The Proponent believes that walleye in Opegano Lake may also travel further up the Burntwood River to spawn.

Stomach analysis conducted by the Proponent on selected walleye samples indicated that in all four reaches walleye fed on a variety of forage fish species (e.g. cyprinids, sculpins, sticklebacks, and trout-perch) but several invertebrate groups were also consumed. Although within a given reach walleye tended to be found (and consequently fed) in all habitat types, the Proponent noted that walleye appeared to favour the "nearshore, no plants" habitat in Reach 1, and "wetted, backwater inlets, soft silt/clay-based, no plants, low water velocity" habitat in Reach 3.

Within Reach 1, the Proponent captured overwintering walleye in the some of the adjacent water bodies and presumes that walleye also overwinter in Wuskwatim Lake

main due to the abundance of suitable habitat. Although safety considerations precluded winter sampling within Reach 2, the Proponent expects that suitable overwintering habitat for walleye would be limited to the low velocity bays. Four walleye, accounting for 8.3% of the Reach 3 catch, were captured at two of three locations in Reach 3 where gill nets were set. Two walleye were captured in the northwest corner of Opegano Lake indicating that at least some walleye overwinter in Reach 4.

Lake Whitefish and Lake Cisco

The Proponent reports that lake whitefish accounted for 5.1% of the 1998-2001 index gillnet catch in Reach 1, and 0.9%, 5.7% , 9.1% of the 2001 and 2002 index gillnet catches in Reaches 2, 3, and 4, respectively. Lake cisco accounted for 18.1% of the 1998-2001 index gillnet catch in Reach 1, and 9.9%, 8.6%, and 2.3% of the 2001 and 2002 index gillnet catches in Reaches 2, 3 and 4, respectively. The Proponent noted that although lake whitefish do not appear to be a major component of the fish fauna of the study area based on overall index gillnet catches, they do form an important component of the commercial catch in Wuskwatim Lake. The Proponent reports that lake cisco are relatively abundant in Reach 1 and in recent years have formed an important component of the commercial catch. However, the Proponent believes that lake cisco abundance in reaches 2 and 3 is likely lower than the data indicated, as sampling was limited to peripheral off-current areas. It was noted that much of these two reaches contain habitat that is not suitable for lake cisco due to water velocities that are greater than their sustained swimming speeds.

The section of the Burntwood River immediately downstream of Early Morning Rapids was identified by TK as a pre-CRD spawning location for both lake whitefish and lake cisco. Based on the results of their EIS studies, the Proponent believes both species spawn along much of the western and eastern shorelines of Wuskwatim Lake main and in Cranberry Lakes, and possibly in the Burntwood River above Cranberry Lakes. The Proponent reports their data did not indicate significant lake whitefish or lake cisco spawning within Reach 2, including at the base of Wuskwatim Falls. Although no direct evidence of spawning in Reach 3 was collected during EIA studies, the Proponent suspects that some spawning may occur within lower velocity habitats near the upstream and downstream ends of the reach. Based on evidence collected from the EIA studies, it is the Proponent's opinion that lake whitefish and lake cisco spawn along rocky shoals in Opegano Lake and lower velocity habitats within the most downstream portion of Reach 3. Although lake cisco were not abundant in Reach 4 index gillnet catches, the Proponent reports that larval lake cisco were captured from several parts of Opegano Lake during early spring, 2001 and 2002.

The Proponent notes that in all four reaches lake whitefish fed on a variety of invertebrates, including clams, scuds, clam shrimp, and snails. Lake cisco also feed on a variety of invertebrate groups, including mayflies, zooplankton, clams, and water bugs. In Reach 1 lake whitefish were most abundant in "offshore, soft silt/clay-based, no plants" habitat, and also appeared to prefer "nearshore, flooded terrestrial, rooted vascular plants" habitat. Lake cisco were most often found in "nearshore, soft silt/clay-based, no plants" and "nearshore, flooded terrestrial, no plants" habitats. In Reach 3, lake whitefish and

lake cisco were more abundant in "wetted, backwater inlets, soft silt/clay-based, no plants, low water velocity" habitat. No distinct habitat preferences could be established for lake whitefish or lake cisco in reaches 2 and 4.

The Proponent believes that both the results of March 2002 gillnetting, and the radio-tagging data, suggest that the majority of the lake whitefish that overwinter in Reach 1 do so in Wuskwatim Lake main. Lake cisco were captured in all four sites in the adjacent water bodies, including a large catch in the south bay of Wuskwatim Lake, and radiotagging data also supported lake cisco overwintering in these areas. Although one radio-tagged lake whitefish resided within Reach 2 until at least November 30, the Proponent believes that few lake whitefish or lake cisco overwinter within this reach due to the medium and high water velocities present. Gillnet catches indicate that some overwintering occurs in Reach 3 and that Opegano Lake may be an important overwintering site for lake cisco and possibly lake whitefish .

Northern Pike

The Proponent reports that Northern pike accounted for 5.9% of the 1998-2001 index gillnet catch in Reach 1, and 7.4%, 14.4%, and 9.6% of the 2001 and 2002 index gillnet catches in Reaches 2, 3 and 4, respectively. It is the Proponent's opinion that northern pike abundance in reaches 2 and 3 is likely lower than indicated by the gillnet catch, as sampling was limited to peripheral off-current areas where northern pike would be concentrated.

According to the Proponent, suitable northern pike spawning habitat (shallow, relatively calm water over inundated vegetation) is abundant in Reach 1. Although habitat within most of Reach 2 is less than optimal for northern pike spawning, the capture of northern pike larvae in nearshore areas during spring 2002 indicates that some spawning does occur within the reach, and the Proponent expects that the majority of larvae drift downstream after hatching. The Proponent reports some evidence of northern pike spawning in backwater inlets in Reach 3 and in Reach 4 although it was noted that there is little typical northern pike spawning habitat in Opegano Lake.

In all four reaches northern pike fed almost exclusively on fish, although some smaller pike consumed invertebrates. Within Reach 1, data suggested that northern pike were most abundant in "nearshore, flooded terrestrial, rooted vascular plants" habitat. In Reach 3, northern pike showed a strong preference for "wetted, backwater inlets, soft silt/clay-based, no plants, low water velocity" habitat, while nearshore habitats were preferred over offshore habitat in Reach 4.

During March 2002, northern pike were captured at all eight gillnetting sites. Within Reach 1, northern pike were shown to overwinter in the adjacent water bodies and the Proponent presumes that they also overwinter in Wuskwatim Lake main. Although winter sampling could not be conducted within Reach 2, the Proponent expects that suitable overwintering habitat for northern pike would be limited to the low velocity bays. Northern pike accounted for 79% of the 48 fish that were captured in Reach 3, indicating

that the backwater inlets provide important overwintering habitat for northern pike. Four northern pike were captured in the one gill-net set in Opegano Lake indicating that overwintering habitat for pike is available in Reach 4.

5.2.3 Fish Movements

The Proponent tracked fish movement both by radio-tagging and/or Floy-tagging the selected VEC fish species, and this data was presented in Volume 1 Section 6.8, and Volume 5, Section 8 of the EIS. At the request of DFO, the Proponent provided supplemental information on fishing effort (Manitoba Hydro and NCN Supplemental Filing, 2003).

A majority of the Floy-tags (88% of the 1259 fish tagged) and all of the radio-tags (14 walleye, 20 lake whitefish and 8 lake cisco) were applied in Reach 1 and the Proponent observed that in general, walleye, whitefish, lake cisco and northern pike tagged in Wuskwatim Lake main were found to remain in the lake. Recapture rates for Floy-tagged fish were generally low (1-5%). It was noted by the Proponent that due to access constraints Reaches 1-4 received little, if any commercial, domestic, or recreational fishing effort between 2000 and 2002. Fishing effort by the Proponent was focused largely on Wuskwatim Lake, which received 305 net sets compared to a total of 88 nets sets for and Reaches 2,3,and 4 combined. The second highest fishing effort was downstream of Opegano Lake in Birch Tree Lake (54 net sets), however, no tags were returned from this lake. The Proponent reported that four Floy-tagged walleye and one whitefish were demonstrated to move between Wuskwatim and Cranberry lakes. Notably, one Floy-tagged walleye was recaptured downstream of Wuskwatim Falls, and one downstream of Taskinigup Falls. One radio-tagged whitefish moved upstream into the Muskeseu River system from the Cranberry Lakes and one radio-tagged lake cisco moved upstream into Wuskwatim Brook from the southwest bay of Wuskwatim Lake.

Of the 126 fish (98 walleye, 5 lake whitefish, 2 lake cisco and 21 Northern pike) Floy-tagged downstream of the Falls in Reaches 3, 4 and in Birchtree Lake, none were recaptured upstream of Wuskwatim or Taskinigup Falls. The Proponent reported that the majority of NCN members who provided Traditional Knowledge on fish movements believed that fish did not move upstream over Wuskwatim Falls or Taskinigup Falls either before or after the CRD, although there were several Elders who were familiar with the area who thought fish had been able to move upstream over Taskinigup Falls prior to the CRD. Based on both Traditional Knowledge and the environmental assessment studies (radio- and Floy-tagging results), it is the Proponent's opinion that fish do not currently move upstream over either Taskinigup Falls or Wuskwatim Falls. However, downstream fish movements over Wuskwatim Falls and Taskinigup Falls were documented during the environmental assessment studies.

The potential for fish from Wuskwatim Lake and further upstream to undertake downstream migrations into reaches 2 and 3 was of significant interest to DFO with respect to possible impacts on fish movements from the Project. The Proponent noted that little, if any walleye, lake whitefish, or lake cisco spawning was expected to occur in

Reach 2 (between Wuskwatim and Taskingup Falls). It was similarly noted that this reach provided little suitable overwintering habitat for walleye, lake whitefish or lake cisco, and therefore, the majority of the fish of these species found in this reach were expected to be transients. However, DFO notes that in the limited catch data presented in the EIS for this reach the highest catch per unit effort (CPUE) for walleye was recorded, the second highest CPUE for lake cisco was recorded, and a number of lake whitefish were also captured. These observations suggest that there may be a significant number of adult fish moving downstream over Wuskwatim Falls and ultimately over Taskinigup Falls.

It is the opinion of DFO that this is further supported by the tagging studies conducted by the Proponent which indicated that walleye (Floy tag data), lake whitefish (five of nineteen radiotagged fish) and lake cisco (one of eight radiotagged fish), and likely several other species, moved downstream over Wuskwatim Falls from Reach 1 into the downstream reaches. While numbers are not known, the Proponent also indicated that larval fish drift downstream out of Reach 1.

5.2.4 Fish Quality

A total of 676 fish (155 lake cisco, 170 whitefish, 156 northern pike, and 195 walleye) taken from Wuskwatim, Opegano and Birch Tree lakes in the 1998 to 2002 period were analyzed by the Proponent for muscle mercury concentrations. The Proponent reports that generally, mean mercury concentrations in lake cisco and lake whitefish were substantially lower than those in northern pike and walleye. Northern pike from Opegano and Birch Tree lakes and walleye from Birch Tree Lake had mean mercury concentrations in excess of 0.5 µg/g, the commercial marketing standard. All individual northern pike and walleye samples from the study area lakes, including lakes not affected by hydroelectric development, had mercury concentrations in excess of 0.2 µg/g, the level usually cited in consumption advisories. However, mercury levels of northern pike, lake cisco and whitefish from all Burntwood River lakes and walleye from Opegano and Birch Tree Lakes were 1.5 to 3.3 times higher than the respective concentrations in the same fish species from a local reference lake not affected by the CRD. For metals other than mercury, concentrations of most metals in tested samples were at, or below, the detection limit of the analytical method.

The Proponent reports that Wuskwatim Lake whitefish sampled in 2001 had *Triaenophorus crassus* cysts but this parasite was not detected in fish tested in 2002. Previous inspections of Wuskwatim Lake whitefish had not identified cysts, and the fish catch had been given the highest grade by the Freshwater Fish Marketing Corporation (FFMC).

In the discussion of palatability, the Proponent summarized a study conducted by the University of Manitoba (Ryland et al. 2002) to compare the palatability of walleye, northern pike, and lake whitefish from Wuskwatim, Footprint, Leftrook, and Baldock lakes. Baldock Lake is located approximately 80 km north of Thompson and is not on the Rat/Burntwood River system. Leftrook Lake feeds into the northern end of Footprint Lake via the Footprint River but is not impacted by flooding. The study found that whitefish and walleye from all locations were liked moderately and Wuskwatim Lake had

the highest acceptability for whitefish. No significant differences were found among the sampled lakes for any species of fish and none of the lakes consistently gave the highest or lowest mean acceptability values. The Proponent notes that these results might be specific to the season of fish sampling (early winter), and the fish caught during another time of the year may have differing sensory qualities.

5.3 Birds

Detailed information on birds in the study area can be found in Volume 1, Sections 7 and 8, and Volume 6, Section 8 of the Wuskwatim Generation Project Environmental Impact Statement (EIS) and Supplemental Information (Manitoba Hydro and NCN, 2003). The Proponent estimates that approximately 184 bird species breed or potentially breed within the Wuskwatim study area, with an additional 34 species migrating through the area to breed further north. Twenty-eight species occur within the study area year-round.

Results of two years of baseline studies lead the Proponent to conclude that waterbodies that will be potentially affected by the Project do not appear to be regionally important areas for large numbers of spring and fall migrating waterfowl or shorebirds. The most important areas for nesting and brood-rearing waterfowl in the Wuskwatim Lake area occur in the Wuskwatim Brook area, at Sesep Lake and at the south arm of Wuskwatim Lake. These three areas contain the majority of marsh habitat within the Wuskwatim lake area, which is often used by brood-rearing waterfowl and for nesting by some waterfowl and other waterbird species such as grebes. During summer helicopter surveys by the Proponent, higher densities of waterfowl broods were observed along the Rat-Burntwood River system compared to off-system waterbodies in 2000 and 2001.

Within terrestrial habitats, the most common birds observed were songbird (passerine) species. The Proponent notes that all of the terrestrial bird species observed are not unique to the study area and are common throughout the boreal region of Manitoba. Terrestrial breeding bird densities were typically higher in moist spruce-dominant forest and fen/bog habitat near shoreline areas compared to dryer upland forested habitats that occur along much of the access road route.

5.4 Threatened or Vulnerable Species

5.4.1 Vegetation

In the Sub-Region, no endangered, threatened or provincially very rare plant species were previously recorded or found during field investigations. Field studies in the Sub-Region found three plant species listed by CDC as provincially rare: (*Vaccinium caespitosum* Michx./dwarf bilberry, *Torreyochloa pallida* (Torr.) Church/grass with no common name, *Nymphaea tetragona* Georgi/pygmy water-lily), two species listed as uncommon (*Bidens beckii* Torr. ex Spreng./water marigold, *Astragalus americanus* (Hook.) Jones/ American milk-vetch) and one species listed as rare to uncommon (*Thalictrum sparsiflorum* Turcz./few-flowered meadow rue).

5.4.2 Aquatic Species

Within the lower trophic communities (including algae, rooted submergent plants, zooplankton, and benthic invertebrates) investigated by Manitoba Hydro between 1998 and 2001 no 'species of conservation concern' were identified. This term includes species that are rare, disjunct (discontinuous or separated distribution), or at risk throughout their range, or the portion of their range within Manitoba, and in need of further research. Also included are species listed under the Manitoba Endangered Species Act (MBESA), the Species at Risk Act (SARA) and those that have special designation by the Committee On the Status of Endangered Wildlife In Canada (COSEWIC).

No fish species listed as endangered, threatened, or of special concern by COSEWIC were captured during field studies. However, the Proponent noted the presence of a dwarf form of lake cisco (*Coregonis artedii)* in the Rat-Burntwood system. The Proponent performed meristic (countable characteristic) and morphological (organism structure and form) analysis on a sample of 56 of these fish and confirmed, based principally on gill raker counts, that the dwarf cisco captured were not the SARA listed shortjaw cisco (*C. zenithicus*).

5.4.3 Reptiles and Amphibians

The Proponent reports three amphibian species whose documented ranges include the study area: the leopard frog (*Rana pipiens*), wood frog (*Rana sylvatica*) and boreal chorus frog (*Pseudacris triseriata*; Preston 1982). While wood frogs and boreal chorus frogs are common throughout most of Manitoba, leopard frog populations in Manitoba are classified by Committee on the Status of Wildlife in Canada (COSEWIC 2002) as being of Special Concern. The results of field studies suggest that boreal chorus and wood frogs occur in very low numbers in the study area. No other amphibian species was observed during field surveys. There are no reptile species whose documented ranges extend as far north as the Wuskwatim study area, and reptiles were not observed during field studies conducted by the Proponent or by local resource users.

5.4.4 Birds

The Proponent indicates that no threatened or endangered bird species, as listed by COSEWIC or MBESA were observed within the bird study area during field studies conducted in 2000 and 2001. No nationally, regionally or locally important migratory bird habitat occurs within the Project study area as indicated by Environment Canada and the Canadian Wildlife Service.

5.4.5 Mammals

At least 39 species of mammals occur in the region representing six taxonomic orders. Neither MBESA nor COSEWIC list any mammal found in the region as 'Endangered'. However, woodland caribou and wolverine, which have been respectively designated by COSEWIC as 'Threatened' and of 'Special Concern', occur in the Study Area. The

Proponent used woodland caribou, a SARA listed species, as the VEC to assess impacts to Upland habitat.

Woodland Caribou

The Proponent estimates, based on field studies and traditional knowledge, that about 200 woodland caribou live in the Region. During winter, the majority of animals are believed to live near Partridge Crop Hill, while moderate numbers have been identified near Harding Lake, and small numbers occur near Eagle Hill. Other small, scattered herds are likely distributed throughout the Region. During summer, caribou are widely scattered in the Region as individuals, or in small groups. According to the Proponent, upland areas are primary habitat for woodland caribou, although caribou do use riparian habitats. Caribou are adaptable, but appear to prefer mature upland forest environments because they provide abundant food sources. Wetter sites are preferred for predator avoidance**.** Caribou winter range and calving habitat are also considered important. Forested habitats and wet sites such as sparsely treed peatland are considered primary habitat; hardwood-dominated mixedwood forests or young forests (i.e., recent burns) are poor habitat. These primary habitats likely provide woodland caribou with better availability and abundance of lichens such as *Cladina* spp. or *Cladonia* spp. during summer, or protection from predators, especially during calving. During the summer, TK suggests that woodland caribou stay around the 'muskegs' , likely for this reason**.**

Woodland caribou have been observed at Wuskwatim Brook, Wuskwatim South Bay, Wuskwatim Lake, Cranberry Lakes, and the Burntwood River. Approximately 73% of the Region and 75% of the Sub-region contain primary woodland caribou habitat. The Proponent used a combination of TK, aerial surveys and radio-collar tracking to identify important use areas (including winter range and calving sites), and currently known use areas. Secondary habitat for woodland caribou consists of younger-aged forest (excluding hardwood-dominated mixedwood) or water/ice that may be used occasionally for feeding, predator avoidance or travel. Approximately 23% of the Region and 19% of the Sub-region contain secondary woodland caribou habitat.

DFO and TC note that, at the time of writing, critical habitat for woodland caribou has not been identified, and a recovery strategy and action plan pursuant to the SARA has not been released. For more detailed information on woodland caribou habitat in the Region the reader is referred to the Wuskwatim Generation Project Environmental Impact Statement (Manitoba Hydro and NCN, 2003; Volume 1, Section 7.9, and Volume 6, Section 9).

5.5 Human Environment

The information in the following sections was summarized from the Wuskwatim Generation Project Environmental Impact Statement (Manitoba Hydro and NCN, 2003; Volume 1, Sections 8 and 9).

5.5.1 Socio-Economic Overview

In their discussion of the socio-economic environment (Wuskwatim Generation Project Environmental Impact Statement (EIS), Manitoba Hydro and NCN, 2003 Vol. 1 Sec. 9, and Vol. 8), the Proponent described present conditions in what it defined as Local and Project regions as follows:

Local Region

The Proponent defined a Local Region by the boundaries of the Nelson House Resource Management Area (RMA), which includes the First Nation community of Nelson House, and the Northern Affairs communities of Nelson House and South Indian Lake. According to year 2000 data, approximately 3,300 Nisichawayasihk Cree Nation (NCN) members lived in these communities. The economy of the Local Region is based primarily on providing goods and services to the resident populations of Nelson House and South Indian Lake. Wage employment in Nelson House is found primarily in the areas of government services, education services and health and social services. In South Indian Lake, the main sources of employment are in education, government services and commercial fishing and trapping. NCN also has a growing commercial economy, which includes investments by the First Nation and its members in businesses in both Nelson House and Thompson. However, unemployment is up to six times higher in Nelson House (45 per cent) and South Indian Lake (31 per cent) than in the Province as a whole (8 per cent). According to the Proponent, the potential labour force in Nelson House and for NCN members living on Crown land is expected to increase by 40 to 70% by 2011.

The Proponent indicates that commercial and domestic resource harvesting were once the mainstay of the Nelson House economy, but their relative economic importance in terms of dollar value has diminished in recent years. However, the Proponent also notes that substantial numbers of NCN members continue to participate in traditional resource-based activities throughout the Nelson House RMA and view these activities as important for economic, social and cultural reasons.

Project Region

The Proponent defined a Project Region which includes the Local Region but also extents eastward to Gillam and the Fox Lake First Nation community on the lower Nelson River, as well as south to the Cross Lake and Norway House communities on the upper Nelson River. Except for Thompson and Gillam, the communities in the Project Region are Aboriginal communities. The 1996 Census reported that 29,551 people lived in the Project Region with almost half (46 per cent) living in Aboriginal communities. The Proponent notes that, according to Statistics Canada (1996), average annual family and household incomes for the North were considerably less than the corresponding provincial figures and in 1996, 23 per cent of Northern residents 15 years of age or older had less than a Grade 9 education, which is almost double the provincial average of approximately 13 per cent

In the Project Region, the City of Thompson is the next closest community to the proposed Wuskwatim Generating Station site, after Nelson House. The size and close proximity of Thompson mean that the City will play a service centre role during the construction phase, for construction workers during their leisure time, for some contractors (e.g., bulk fuel), and for the transportation of most supplies and equipment and some workers. Elsewhere in the Project Region the degree of economic effect is likely to be limited to employment opportunities for local workers. The Proponent notes that in general, service industries accounted for the greatest proportion of the employment in the North, while commodity industries and service industries were of equal importance throughout the whole of Manitoba. Primary industries like mining, forestry, fishing and trapping and service industries had a higher share of the labour force in the North in 1996 (60 per cent) than in the rest of Manitoba (52 per cent).

5.5.2 Resource Use for Traditional Purposes by Aboriginal Persons

The majority of the study area lies within the Nelson House Resource Management Area (RMA). According to the Proponent, resource use by Nisichawayasihk Cree Nation (NCN) members has a long historical record and NCN community leaders have stated that it will remain an important part of NCN's future. NCN Elders have also stated that resource harvesting, including hunting, fishing, trapping and gathering, is not just an economic activity but is a key link to traditional lifestyles and past generations.

The Proponent reports that NCN resource managers estimate that approximately 55% of NCN households participate in traditional harvesting activities at some time during the year. Residents of NCN use a wide array of plants and animals for traditional purposes, including berries, moose, furbearers, grouse, rabbits, waterfowl, fish, and medicinal plants. Harvests of barren ground caribou, deer, and elk occur outside the RMA on an irregular basis. NCN Resource Program staff report that harvests of woodland caribou are rare and generally restricted to certain Elders within the community. All fur-bearing and large mammals are used by NCN domestically.

Domestic subsistence/domestic resource use fishing occurs throughout the year and includes methods such as angling, snaring, and netting. Catches are often shared within families and the community and provided an estimated 2% of all meals consumed. The harvest was comprised primarily of walleye(43%), followed by northern pike (17%), lake whitefish (16%), lake cisco (8%), suckers (5%), unidentified fish (9%), burbot (1%) and perch (1%). Commercial fishers also reported that they generally keep a portion of non-saleable fish from their catch, such as longnose (red) sucker and burbot (maria), for domestic use.

The Proponent reports that medicinal plants have been, and continue to be, particularly important to NCN members. NCN Elders indicate that the harvesting of medicinal plants, both in regards to harvesting techniques and locations of harvests, have strong cultural and spiritual links. Factors identified by resource harvesters as limiting the collection of traditional plants included knowledge of plants, access, and need. Some plants were identified that are only found in the Wuskwatim area. Elders have also noted that medicinal plants from areas affected by CRD appear to have decreased strength or

potency and resource harvesters indicated that flooding from CRD has made harvesting of medicinal plants at Wuskwatim Lake more difficult than it was prior to 1976.

According to the Proponent, access is an important factor limiting where traditional resource use activities occur. Resource harvesting areas are accessed by boat, car, truck, all-terrain vehicle, snowmobile, aircraft, or on foot. The majority of harvest attempts are concentrated close to Nelson House. The importance of roads is evident in the Project study area, where the Proponent estimates 84% of harvest activity occurred along PR 391 or on water bodies that are considered safe for navigation (e.g., Sapochi River, Birch Tree Creek). Navigational hazards on waterways were reported by Nelson House residents to be a major concern with regard to traditional resource harvesting activity in the RMA, particularly in relation to fast water and debris on the Burntwood River system. Safe access to locations where traditional plants grow was a concern noted by commercial trappers. Access is also a key factor limiting the subsistence/domestic resource use fishery in the RMA, and the Proponent reports that because of poor access there is currently little use of the Wuskwatim Lake area for hunting.

5.5.3 Commercial Fishing and Trapping

Manitoba's commercial fisheries account for 25% of all freshwater fish harvested in Canada and contribute significantly to the province's economy. The Proponent notes that the commercial fishing industry is extremely important in northern Manitoba, especially within First Nations communities where other economic opportunities are often limited. Commercial fishing is one of the few sectors of the cash economy in which Aboriginal people can participate while maintaining their traditional subsistence lifestyle. In northern Manitoba, lake whitefish are the most valuable species (accounting for 29% of the open-water catch value), followed by northern pike (24%), suckers (22%), and walleye (19%) (Manitoba Conservation 2001).

Wuskwatim Lake has been assigned a quota by Manitoba Fisheries of 18,200 kg for lake whitefish and walleye combined. NCN residents commercially fished the lake in all but six years from 1976 to 2002, primarily during open-water in June and September. The cost of transportation to and from Wuskwatim Lake is a key factor currently limiting the fishery. Nelson House fishers stated that although there is an abundance of fish in Wuskwatim Lake, it is not economically viable to fly them out. The Proponent notes that the Freshwater Fish Marketing Corporation (FFMC) is not currently accepting walleye from Wuskwatim Lake because of mercury levels. Without harvesting walleye, the value of each kg of fish harvested from Wuskwatim Lake decreases significantly. However, the Proponent indicated that recent sampling conducted for the EIS has shown that mercury levels in walleye are now below the limit for commercial sale. It is assumed by the Proponent that FFMC will review the EIS data and the status of Wuskwatim Lake walleye. Opegano Lake is the only other lake within the study area that has been assigned a commercial quota by Manitoba Fisheries Branch (1500 kg of walleye and lake whitefish). However, the Proponent notes that because it is only accessible by air and has a small quota, it has never been fished commercially.

Commercial trapping is also an integral component of the social setting and economy in the north. Similar to commercial fishing, it is one of the few sectors of the cash economy in which Aboriginal people can participate while maintaining their traditional subsistence lifestyle. The study area defined by the Proponent for this component of their EIS lies entirely within the Nelson House Registered Trapline (RTL) District, which is located within the Nelson House RMA. The Nelson House RTL District is the seventh largest in the province with an area of 22,975 km^2 and a total of 54 registered traplines. The Nelson House Local Fur Council assigns traplines within the RTL. Trapline 49 is retained as a community trapline for educational purposes, hobby trapping, and Elders. Trapline 53 is reserved for youth trapping.

The Proponent indicated that the primary species targeted by commercial trappers within the Nelson House RTL District include: beaver, muskrat, ermine, fisher, red fox, lynx, marten, mink, otter, and squirrel. Wolf, wolverine, arctic fox, and bear are also harvested, but in lesser numbers, and coyote and raccoon are harvested infrequently. The annual harvest value from 1989/1990 to 2001/2002 was $53,130, or 14% of the average reported from the previous 14 years ($370,166 annually). The value of the harvest in 2001/2002 was $30,348. Declining fur prices is the key factor that contributed to the reduction in effort and harvests during the early 1980s. Local trappers attribute some of the decrease in value to a decrease in the number of animals and quality of fur in the RMA since construction of the CRD in the mid-1970s.

Access has been identified by local resource users as an important limiting factor in the level of fishing and trapping harvest in the study area, particularly in the trapline areas south of the Burntwood River. The primary concerns are safety and travel conditions on waterbodies affected by CRD. Local trappers stated that slush and unstable ice prevent travel on the main waterbodies, and fluctuating water levels create unstable ice along the shorelines and in tributaries including small creeks. Woody debris is also reported to hinder travel along shorelines, especially on the southeast shore of Wuskwatim Lake. Trappers and fishers have stated that trails and portages to some areas (including those to and around the Wuskwatim Lake area) have deteriorated because of a lack of maintenance and decreased use over the past generation. Manitoba Hydro is responsible for mitigating adverse effects from its operations on travel and access along affected waterways and undertakes a number of safety provisions in this regard, including safe ice trails, navigational aids, and debris management.

5.5.4 Commercial Forestry and Mining

Commercial forestry and mining play an important role in the economy of the study region. According to the Proponent, 292,000 m^3 (approx. 2,430 ha) of timber was harvested from the Forest Section designated the Nelson River Forest Section, much of which overlaps the Wuskwatim study region. The Proponent reports that Tolko Industries Ltd. has indicated they plan to increase annual harvesting levels within the Wuskwatim region by approximately 52% by 2005. Supporting access requirements include 39 km of roads and three bridges. There are two third party quota holders in the Wuskwatim region with a combined volume of 13,230 m^3 of softwood.

The Thompson Nickel Belt runs through the eastern edge of the Nelson House RMA, reaching the outlet of Opegano Lake along its westernmost edge. Despite this, there is relatively little mining activity in the RMA. There are a number of mining claim sites and several exploration licenses throughout the RMA; however, according to the Proponent's EIS, there are presently no operating mines in the Nelson House RMA, other than infrequent aggregate quarries.

5.5.5 Recreation and Tourism

The Proponent reported that one lodge and seven outfitters operate in the Nelson House RMA. There are also four businesses that offer adventure travel and eco-tourism activities in and around the Nelson House RMA. Manitoba Fisheries has indicated that recreational fishing pressure in the Nelson House RMA is relatively low compared to areas southwest of Thompson. The primary locations targeted by recreational fishers during the open-water season are road accessible and include Footprint, Wapisu, and Notigi lakes. The base of the Notigi Control Structure is a popular location for shore-based fishers, and RC Channel at Nelson House and Leftrook Lake are popular destinations for ice-fishers from Thompson. Tourists are known to fish in the RMA but generally focus their effort in areas to the south and north of the RMA. According to the Proponent, recreational fishing at Wuskwatim Lake is limited by access and is currently negligible. The Proponent indicates that recreational hunting within the RMA is also relatively low compared to other areas northeast and southwest of Thompson. Moose is the principal animal targeted, although a small amount of bear hunting also occurs. Due to difficult access, recreational hunting effort at Wuskwatim Lake is considered negligible by the Proponent. Very little other hunting activity occurs in the RMA.

5.5.6 Navigation

The following information is taken from *Manitoba Hydro and Nisichawayasihk Cree Nation's Wuskwatim Generating Station Navigable Waters Protection Information* submitted to the Navigable Waters Protection Program on February 27, 2004 (Manitoba Hydro and Nisichawayasihk Cree Nation, 2004).

The Proponent has indicated that there is little boat travel along this reach of the Burntwood River due to remoteness and lack of accessibility. In the recent past, there have been 4 to 10 waterway users which navigate Wuskwatim Lake for the purposes of commercial fishing. It is reported that some of these individuals access the lake by boat, from up stream, which involves portaging around two sets of rapids. Vessels are often left on the lake year round for the commercial harvest. Access to the lake and the boats is most often by aircraft. Domestic fishers indicate that poor accessibility reduces waterway use to negligible levels. Currently the drop at Wuskwatim Falls is approximately 7 m and the drop at Taskinigup Falls is approximately 15 m. Downstream of this section of water there are three sets of rapids that also impede navigation, and which are expected to continue to be present after the project is complete. The Proponent notes that, historically, a portage did exist on the north side of the river bypassing both Wuskwatim and Taskinigup falls. Archaeological investigations carried out by the Proponent indicate that

the portage has grown over in a number of locations indicating limited current usage of this section of the Burntwood River downstream of Wuskwatim Lake.

5.5.7 Protected Areas and Scientific Sites

The Proponent reported that the Province of Manitoba is in the process of assembling a network of lands to protect and conserve representative examples of each of the province's 18 natural regions. Representation of each natural region requires that adequate examples of all of the characteristic landforms or enduring features within a region be set aside in protected land where, at a minimum, industrial uses and urban or major recreational developments are avoided. These protected areas still allow for activities such as hunting, trapping or fishing and also respect First Nation's rights and agreements such as the Manitoba Treaty Land Entitlement Framework Agreement. Areas of Special Interest (ASI) is the term used to describe "candidate sites" identified as having high potential to efficiently protect groupings of enduring features and associated natural and cultural values. Candidate sites are chosen, wherever possible, to avoid resource allocation conflicts and to protect undeveloped areas of significant size.

The Proponent identified three areas where enduring features have been identified that were traversed by the proposed access road. In addition, an ASI was identified around and including Partridge Crop Hill (the Partridge Crop Hill ASI). Active and dormant research sites in the study area were also identified by the Proponent, and these were classified into three groups as follows: forestry research; pollution studies related to emissions from the INCO smelter in Thompson; and the Boreal Ecosystem-Atmosphere Study (BOREAS).

5.5.8 Heritage Resources

According to the Proponent, the Province of Manitoba Archaeological Site Inventory Register indicated that 44 archaeological sites were reported between Early Morning Rapids and Jackpine Falls on the Burntwood River, including Wuskwatim and Opegano lakes (Figure 11). Of these, the cultural affiliations of 17 archaeological sites were identifiable. The majority of these sites, originally recorded during pre-CRD investigations, were discovered between 196 and 231 m ASL and within 0 to 10 m of the original shoreline. All previously recorded sites have been severely impacted by raised water levels associated with the CRD. In general, the 17 dateable sites cluster at three major locations: the outlet of the Burntwood River into Wuskwatim Lake; the southwest quarter of Wuskwatim Lake; and between Wuskwatim Falls and Taskinigup Falls.

The Proponent indicates that based on an archaeological understanding of the cultural history of Pre-Contact people, there is a moderate to high potential for ceremonial sites to occur at rapids and waterfalls. One archaeological site was recorded at Early Morning Rapids. Six sites were found at the east end of the Cranberry Lakes near the entrance to Wuskwatim Lake. These are mapped in the site cluster (16) for the north end of Wuskwatim Lake (Figure 11).

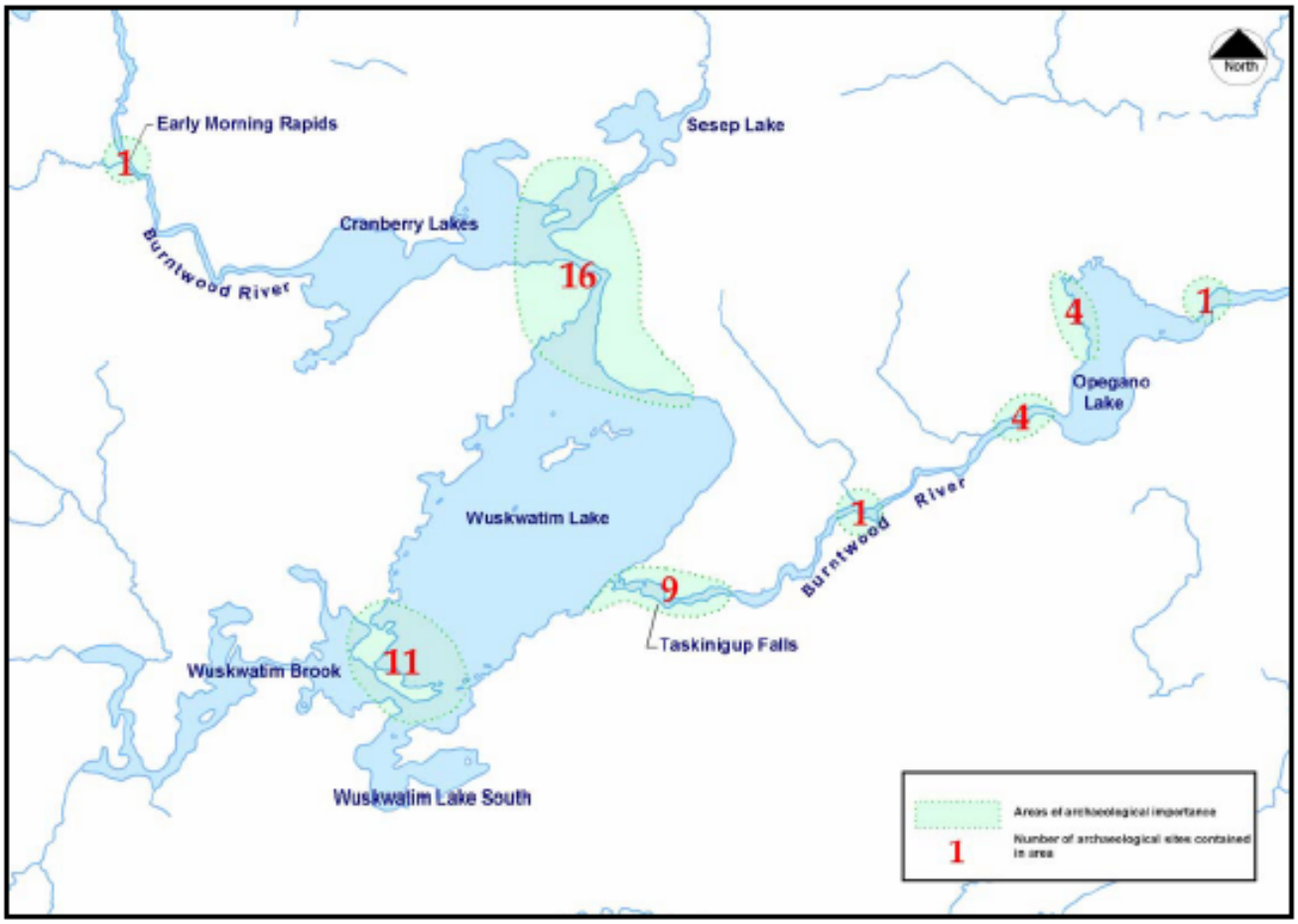

Figure 11: Archaeological sites reported between Early Morning Rapids and Jackpine Falls on the Burntwood River including Wuskwatim and Opegano lakes. (Manitoba Hydro and NCN, 2003; Vol. 1, p. 10-2)

According to the Proponent, twenty-one archaeological sites have been identified on Wuskwatim Lake; 10 at the north end of the lake are included in the cluster shared with the Cranberry Lake (16), and 11 at the south end (Figure 11). Most of these sites have been lost to active erosion. Nine archaeological sites are located between Wuskwatim Falls and the area just below Taskinigup Falls. All have been impacted by erosion as a result of higher water levels between the two falls. *Taskinikahpehk*, signifies "split portage" in Cree and, according to traditional knowledge, while this has been used to name the fall, it does not actually refer to the falls but to the portage. The *Nimihitowananis*, (Wuskwatim) Dancing Circle, which is located in the vicinity of Wuskwatim Lake, is a culturally significant site to NCN Elders and community members.

Ten archaeological sites representing Pre-Contact campsites and workshops have been identified between Taskinigup Falls and Jackpine Rapids. All have been impacted by flooding and extensive erosion. The Proponent indicates that no previously recorded archaeological sites were recorded within the proposed route of the access road from its junction on PR391 to the proposed Generation Project.

For more detailed information on heritage resources in the study area the reader is referred to the Wuskwatim Generation Project Environmental Impact Statement (EIS) (Manitoba Hydro and NCN, 2003) Volume 1, Section 10, and Volume 9.

6.0 Public Consultation

A number of consultation processes have been undertaken in relation to the Wuskwatim Generation Project. These include consultation on the "Guidelines for the Preparation of an Environmental Impact Statement for the Wuskwatim Generation Project"; the Proponent's Public Involvement Program; the Provincial Clean Environment Commission hearings; the Manitoba-Canada government consultations with potentially affected aboriginal communities; public consultations under the Navigable Waters Protection Act; and written comments from the public received by the joint federal-provincial Project Administration Team (PAT) during the cooperative environmental assessment process. These processes, which together constitute extensive consultation with Aboriginals and the public, are described in greater detail below. The concerns expressed and how they were considered in the comprehensive study are also summarized in the following sections.

6.1 Consultation on EIS Guidelines

The Manitoba Clean Environment Commission convened four public meetings on the Draft EIS Guidelines in February 2002, and in April 2002 released a "Report to the Minister of Conservation on Public Meetings: Draft Environmental Impact Statement Guidelines for the Wuskwatim Generation and Transmission Projects". After review by the PAT, Manitoba Conservation then released the final "Guidelines for the Preparation of an Environmental Impact Statement for the Wuskwatim Generation Project" in April 2002. The EIS for the Wuskwatim Generation Project was released in April 2003.

The EIS guidelines were accompanied by a document entitled "Wuskwatim Generation and Transmission Projects – EIS Guidelines, Consultation on Draft Guidelines for the Preparation of the Environmental Impact Statement – What You Told Us". This document summarized comments and recommendations submitted to the PAT by the public, the Technical Advisory Committee members and the CEC, and outlined how these issues were addressed by the PAT in the final guidelines.

6.2 General Public

6.2.1 The Proponent's Public Involvement Plan

The Proponent, in response to Section 4 of the EIS Guidelines, developed a Public Involvement Plan (PIP) outlining an integrated approach to public consultation for the Wuskwatim Generation Project and the Wuskwatim Transmission Project. This plan was submitted to federal and provincial regulators in August 2002. The overall purpose of the PIP was to provide different segments of the public, particularly those who may be potentially affected by the Wuskwatim projects, with meaningful opportunities to receive

information on and provide their views about these projects. The PIP provided for early and ongoing involvement of potentially affected communities and interested organizations and individuals at various stages and through a variety of mechanisms. A focus of the PIP was meaningful consultation with First Nations and Aboriginal peoples. There were five rounds of consultation conducted between 2001 and 2004. A number of public involvement techniques were utilized including meetings with elected officials, newsletters, community meetings, web sites, distribution of informational letters, open houses, a forum for environmental non-governmental organizations (held as part of Round 3), and Open Houses. Details of the PIP are provided in the Wuskwatim Generation Project Environmental Impact Statement (EIS) (Manitoba Hydro and NCN, 2003) Volume 2.

NCN adopted a community-driven approach that made community involvement a key component of their planning for the Project. Community involvement of NCN members included a broad range of activities including the establishment of a Future Development Team; the hiring of local residents to act as Community Consultants to collect and share information in Nelson House and South Indian Lake; open houses and community meetings; Future Development Newsletters and other materials; NCN Opinion Surveys of on- and off-reserve members; a ceremony at an original settlement site on Wuskwatim Lake; and participation in Project studies. NCN members will vote on a Project Development Agreement with Manitoba Hydro at the conclusion of its consultation.

The Proponent identified NCN members at Nelson House at the start of the Project as an affected Aboriginal community, since the Wuskwatim Generation Project would be built in their traditional use area. Other communities in the Project Region potentially affected by the generation project were identified (Figure 12). The Project Region is a broad area defined for the purposes of the PIP. It includes communities and individuals who could potentially see themselves as being affected by the Project.

6.2.2 Proponent Consultation with the Manitoba Métis Federation

In addition to the Proponent's Public Involvement Program, the Proponent engaged in a process of consultation with the Manitoba Métis Federation (MMF) pertaining to the Wuskwatim Generation and Transmission Projects (the Wuskwatim Projects). Funding was provided by the Proponent to the MMF to conduct research and consult with their members and report to the Proponent regarding their perspectives and findings about the effects of the proposed Wuskwatim Projects on Métis people in the vicinity of the projects. MMF conducted the bulk of the research and consultation for the report in a three month period from November 2004 to January 2005. A final report was provided on June 27, 2005, and following additional correspondence, a response was provided by the Proponent on September 15, 2005. These reports were submitted to the PAT for their consideration on September 30, 2005. Concerns of the MMF respecting the Wuskwatim Generation Project are summarized in Table 3 below.

6.2.3 Environmental Impact Statement Workshops

Two technical workshops on the EIS and the Wuskwatim Project Need For and Alternatives To (NFAAT) were held to provide participants with information on the EIS and NFAAT materials, and provide opportunities to ask questions about and comment on the document. The first workshop was held with the TAC in June 2003. The second workshop was held in July 2003 with individuals and organizations that had applied for Participant Assistance Funding to participate in the CEC public hearing process, and communities engaged in separate and ongoing consultation work plans with NCN and/or Manitoba Hydro.

6.2.4 Manitoba Clean Environment Commission Hearings

Manitoba's Minister of Conservation mandated the Manitoba Clean Environment Commission (CEC) to conduct a public hearing for the Wuskwatim Generation and Transmission Projects to consider the justification, need for and alternatives to the proposed projects; and the potential environmental, socio-economic and cultural effects of the construction and operation of the Wuskwatim Projects.

Thirty-two days of hearings were held in Winnipeg, Thompson and The Pas (Opaskwayak Cree Nation (OCN)) from March 1 to June 9, 2004. The Proponent, provincial government regulators and a broad range of funded and non-funded participants took part in the hearings. Participants represented a broad range of interests e.g. First Nations, aboriginal organizations, industry, communities, environmental, consumers, seniors, engineering and trades, labour, economic development, northern training, trappers, youth, and private citizens. The CEC submitted its Report on Public Hearings: Wuskwatim Generation and Transmission Projects to the Manitoba government in September 2004. Table 1,
Table 2, and Table 3 below provide summaries of issues that were raised at the CEC hearings, but do not attempt to include all the information generated in the CEC process. The reader is referred to the Clean Environment Commission Report (Manitoba Clean Environment Commission, 2004) and transcripts for further information.

6.2.5 Written Input

Opportunities for written input were available at various stages of the Project assessment. The draft EIS guidelines were subject to a 90-day review period to allow interested parties to provide their comments and concerns about the project and the draft guidelines. Contacts were identified in the PIP newsletters. A Wuskwatim Web site was developed to link from the Manitoba Hydro web site (www.hydro.mb.ca/wuskwatim). The site included key documents (e.g., newsletters, the Agreement-in-Principle between Manitoba Hydro and NCN, samples of community presentations, and key documents submitted to the regulators). The web site included a mechanism for the public to submit questions or concerns. There was also an advertised review period for comment on the EIS. Only one submission was received by the Project Advisory Team from the public in response to this review.

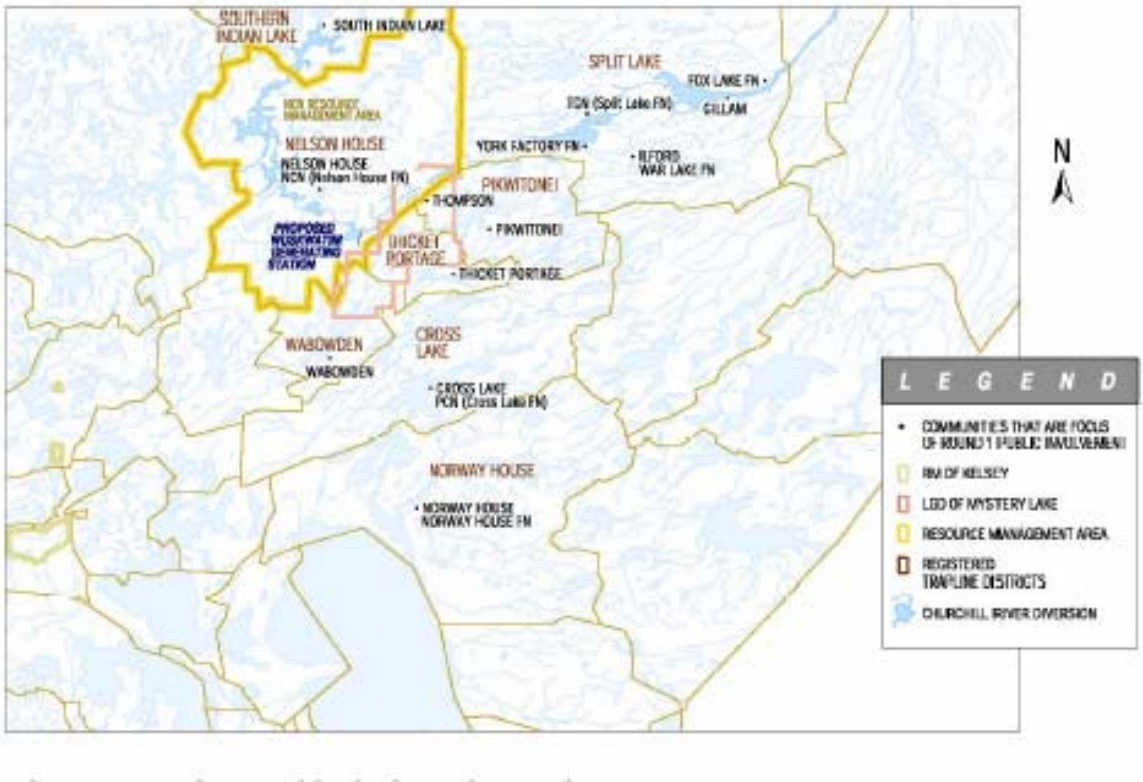

Figure 12: Communities in the Project Region
(Manitoba Hydro and NCN, 2003; Vol. 1, p. 3-13)

6.2.6 Summary of Concerns

Table 1 is a summary of concerns raised by organizations through the various consultation processes for the Wuskwatim Generation Project. The source of issues is noted as follows: PIP (Public Involvement Program), CEC (Manitoba Clean Environment Commission), and WR INPUT (Written Input).

Table 1: Summary of Issues: General Public

Organization	Source of Issues			Issue/Concern
	PIP	CEC	WR INPUT	
Boreal Forest Network		x		• system-wide cumulative effects assessment not completed • Environmental protection plans and monitoring – recommend independent body to monitor MH • climate issues impact in northern Manitoba • caribou population losses • need for consultation under section 35 Constitution Act

Organization	Source of Issues			Issue/Concern
	PIP	CEC	WR INPUT	
City of Thompson	x	x		• baseline data for environmental studies • water levels near Thompson • water quality • training and employment • economic impacts
Consumers' Association of Canada/Manitoba Society of Seniors Inc. (CAC/MSOS)		x		• thresholds not readily identified for VECs • uncertainty associated with the EIS • CRD not included in cumulative effects assessment • Environmental protection plans and monitoring – recommend independent body to monitor MH • economic aspects – business structure, project costs, export market prices • resource options (failure to develop alternative portfolios)
Manitoba Wildlands - Canadian Nature Federation (CNF)		x	x	• selective use of valued environmental components • Environmental protection plans and monitoring – recommend plans be provided for public review • caribou population losses due to diminished habitat • EIS documents deficient on protected areas and mitigation • lack of decommissioning plans • need details on access management plans • insufficient information on wildlife populations and uses • information deficiencies on potential effects on caribou and moose populations • need clarity on mercury effects for all fish species in Wuskwatim Lake • energy alternatives should have been addressed • need for consultation under s. 35 Constitution Act • project cost and time overruns • response of Project Administration Team to CEC interrogatories • concerns with provincial and federal public registries • lack of CEAA review of Wuskwatim Transmission Project • lack of clear relationship between review and EIS guidelines • cumulative effects, system-wide hydrological impacts • risk associated with no firm energy sale
Time to Respect Earth's Ecosystems/Resource Conservation Manitoba (TREE/RCM)		x		• sustainable development • further data required on caribou potentially affected • export market (forecast of future demand) • resource options (failure to develop alternative portfolios) • impact of global warming

6.2.6 Responses to Concerns Raised by the Public

The following is a brief discussion on responses by the Proponent and regulators to concerns raised by the public. The focus is on environmental concerns.

Valued Environmental Components (VECs) and EIS Guidelines

The Proponent submits that VECs were selected in consultation with NCN Elders and resource harvesters during scoping and were used appropriately in the Generation Project EIS. The Proponent further contends that the EIS documents satisfy the requirements of the EIS Guidelines and are consistent with current environmental assessment practice. They contend that the extent to which existing environmental components are vulnerable due to past projects, protected status or other factors, or may be made vulnerable in the future due to interactions with existing and future developments, was fully considered. The Proponent viewed thresholds to be important for follow-up monitoring of Project effects. The Proponent stated that both traditional and scientific knowledge were used in their environmental assessment approach including the evaluation of significance. Therefore, the Proponent does not feel additional measures are necessary to address the concerns raised.

Cumulative Environmental Effects

The Proponent stated that the cumulative-effects assessment framework used for the Projects was based on the approach prescribed in the CEAA's Cumulative Effects Assessment Practitioners Guide and that the cumulative effects of the Projects were determined to be insignificant. Manitoba Hydro/NCN considered the environmental effects of past projects and activities including those of the Churchill River Diversion, Augmented Flow Program, generating stations and transmission facilities to be part of the baseline conditions for the Projects. The Proponent maintains that the cumulative effects-assessment requirements outlined in the EIS Guidelines were fulfilled and that the assessment carried out for the Projects was consistent with best practice as defined by the CEAA. DFO and TC note that the comprehensive study report considers ongoing effects of the CRD in the context of cumulative effects where appropriate.

Environmental Protection Plans and Environmental Monitoring

In response to the question of whether or not an independent monitoring agency is required for the Project, the Proponent stated that Manitoba Conservation fulfills the role of arm's-length monitor. In addition, the Proponent pointed to NCN's Resource Management Board as a mechanism for monitoring and review. Environmental Protection Plans will be required under the provincial Environment Act Licence. DFO and TC note that, at the request of DFO and EC, the Proponent submitted a Draft Aquatic Effects Monitoring Program (North/South Consultants, Inc., 2004), which was made available to the public during the CEC hearing.

Access Management Plans

In response to concerns regarding access management, the Proponent advised that the draft Road Access Management Plan, presented at the CEC hearing (March 2004), was adopted by Manitoba Hydro and NCN. Access management is discussed in detail in Section 7.5 of this report. The Proponent states that implementation will commence during the construction phase.

Water Quality

In response to public concerns regarding water quality, the Proponent advises that an extensive downstream water quality monitoring program, with sampling sites extending from upstream of Wuskwatim Lake to the lower Burntwood River, is in place to verify the predictions that, during construction and operation, no detectable changes in water quality are expected past Opegano Lake. Where potential changes to water quality during some periods of construction (e.g., during coffer dam construction and removal) may extend past Opegano Lake; these will be monitored intensively (i.e., frequent sampling during specific activities) and mitigation implemented as described in the Draft Sediment Management Plan and Draft Aquatic Effects Monitoring Program (North/South Consultants, Inc., 2004) provided to DFO and made available to the public during the CEC hearing. Further information on potential impacts to water quality can be found in Section 7.1.

Water Regime Effects

In response to public concerns regarding water regime effects, the Proponent advises that Manitoba Hydro currently monitors water levels and other key hydraulic input data like flow, water temperature, wind magnitude and direction, ice thickness and ice coverage at several locations within the project area as part of its Hydrometric Program to provide the necessary information for operations and planning. The monitoring sites include designated sites that are monitored continuously in real time and other sites that are field visited on a periodic basis. The locations of the monitoring sites on the Burntwood River are: upstream and downstream of Early Morning Rapids, Wuskwatim Lake, Opegano Lake, Birch Tree Lake and several key hydraulic control points within the reach. Plans are being developed by the Proponent to expand the hydrometric network to include additional sites, including Wuskwatim Lake, Birch Tree Lake, the immediate forebay and the tailrace. These additional sites are required to fulfill the monitoring requirements for the Draft Sediment Management Plan (North/South Consultants, Inc., 2004), an Environmental Protection Plan pursuant to the provincial Environment Act and the Water Power Act Licence should they be issued. The water regime effects that would be reported are the daily average wind and wave effects eliminated water levels as well as the water level variations within a 24-hour period. Specific monitoring procedures and protocols will be required as part of the provincial Environment Act and Water Power Act Licences. Noticeable changes to water levels and flows as a result of the generating station operation are not expected to extend downstream past Opegano Lake; therefore,

this is also the expected to be the downstream extent of most effects related to the operation of the Project.

Woodland Caribou

In response to public concerns raised respecting woodland caribou, the Proponent states that they obtained information on woodland caribou using both traditional and scientific knowledge. They concluded that concerns expressed did not provide fair comment on the detailed technical and traditional work undertaken by Manitoba Hydro/NCN. They anticipated that all potential effects on woodland caribou would be mitigated through their joint planning and management of both Projects. Access management plans are being developed by NCN and Manitoba Hydro to limit potential effects to caribou. The Proponent notes that provincial Environment Act Licence will require Environmental Protection Plans that will address mitigation and monitoring measures. DFO and TC also note that woodland caribou are protected under the SARA (see also Section 7.3 of this report).

Training and Employment

The Proponent noted that pre-project training is available for NCN members and other aboriginal residents in northern Manitoba. Construction of the Generation Project will be governed by the Burntwood Nelson Agreement.

6.3 Aboriginal Consultation

Consultation with Aboriginal communities, organizations and individuals occurred throughout the various processes described above. In addition to these processes, DFO and the Province of Manitoba undertook a consultation with potentially affected First Nations and Northern Affairs communities. All of these processes have informed the CSR of comments and concerns related to potential environmental effects of the Wuskwatim Generation Project.

6.3.1 Crown Consultations with Aboriginal Communities

DFO and the Government of Manitoba undertook a community-based consultation between June 2003 and November 2004 with First Nations and Northern Affairs communities that were potentially affected by the Wuskwatim Projects. These First Nations and Northern Affairs communities were among those identified as potentially affected communities for purposes of the Proponent's public involvement program. The Proponent considered potentially affected Aboriginal communities to include any First Nation or other Aboriginal community (e.g. Northern Affairs Community with predominantly aboriginal population). The communities were involved in the design and implementation of the consultation through the development of consultation protocols and plans. The general objective of the consultation was to hear and understand the concerns of First Nations and aboriginal communities about how their traditional use of resources, lands and waterways might be affected by the proposed Wuskwatim Projects.

DFO's involvement was limited to concerns related to the potential issuance of Fisheries Act authorizations and NWPA approvals (prior to this program being transferred to Transport Canada). The Proponent was requested to participate in any community meetings where the First Nation or Northern Affairs community requested their participation for purposes of information sharing.

DFO and TC will consider the consultation information generated through this consultation process, in addition to other findings, in their decision-making processes on the proposed Project. The information will be considered prior to deciding on the issuance of approvals under the Fisheries Act. TC will consider the consultation information prior to deciding on the issuance of approvals under the Navigable Waters Protection Act. The consultation information has been incorporated into this comprehensive study report for consideration by the Minister of the Environment in his decision under the *CEAA.*

6.3.2 Summary of Concerns

Table 2 Summary of Issues: Aboriginal Communities

Community	Source of Issues				Issue/Concern
	PIP	CEC	WR INPUT	ABOR CONSULT	
Nisichawayasihk Cree Nation Note: NCN participated as a co-proponent in the CEC hearings. Individual members also made presentations at the CEC hearings.	x			x	• ongoing adverse effects from past projects • impacts on resources from increased access • replacement plan for replenishing damaged/affected lands (i.e. trees, medicines, lands, etc) • mercury in fish • impacts to medicinal plants • impacts of blasting on fish • potential health effects • protection of ceremonial and burial sites • adding more damage to the land • erosion • loss of Wuskwatim fishery • need to utilize traditional knowledge • impacts of sedimentation on spawning areas • potential harm to fish from flooding of medicinal plants • infringement of treaty and aboriginal rights • disruption of navigational routes • loss of traditional lifestyle • need to monitor environment continuously • domestic fishing – place a high value on lake whitefish for habitat replacement • commercial fishing – place a value on pickerel for habitat replacement • concern about birds, ducks • effects on water quality upstream • training and employment • economic benefits • youth support for future development

Community	Source of Issues				Issue/Concern
	PIP	CEC	WR INPUT	ABOR CONSULT	
Nelson House Community	x			x	• protection of sacred sites • impacts on medicinal plants • mitigation programs (clearing of shorelines) • water quality • training and employment
Wabowden Community	x			x	• cumulative impacts of past hydro projects • fishery impacts • flooding • impacts on water levels/flows • impacts on caribou • training and employment
Thicket Portage Community	x			x	• impacts on local lakes • cumulative impacts on caribou • turbine mortality rates • past hydro projects adverse effects • training and employment • enduring benefits program
Pikwitonei Community	x			x	• fishery impacts • mitigate unanticipated effects • erosion • road access impacts to caribou • water levels and flows • training and employment
South Indian Lake Community	x				• changes to water regime • impacts on fishing, trapping • water quality • training and employment
Tataskweyak Cree Nation Note: Participated in consultation with Hydro/NCN under the NFA 1992 Implementation Agreement.	x	x			• integration of traditional knowledge • methodology for assessing cumulative effects, socio-economic impacts, integrating traditional knowledge into EIS • availability of data on pre-CRD erosion levels • extent of cumulative effects • air borne mercury • potential water levels and flows • impacts on debris at Split Lake • impact on fishery • water quality • impact on domestic hunting • impact on cultural activities (e.g. camping) • impacts on erosion and accuracy of EIS • operation of GS and related impacts during high water conditions • ongoing adverse effects from past projects • training and employment • support decision by NCN to develop partnership with Hydro and expressed TCN's views on its governance structure and approach to considering future hydro development

Community	Source of Issues				Issue/Concern
	PIP	**CEC**	**WR INPUT**	**ABOR CONSULT**	
York Factory First Nation	**x**			**x**	• mitigation of past project effects • consideration of sturgeon as species at risk • methodology for assessing cumulative effects • Fisheries Act application to Project • erosion • impacts on water levels, flows and existing CRD licences • impacts on mercury • impacts on aquatic life • impacts on fishery • water quality effects • need for monitoring programs • equal standing of traditional and scientific knowledge • influx of workers and effect on YFFN housing • mitigate and compensate adverse effects • external assistance for First Nation to advise about treaty rights • training and employment
Fox Lake Cree Nation	**x**	**x**			• integration of traditional knowledge • mercury levels in fish and fish movement • mitigation of unanticipated effects • training and employment • views on social, cultural, environmental impacts of past projects in Fox Lake's traditional territory • supports NCN's right to determine if project is beneficial to community • need to invest in restoration and rehabilitation of physical environment from hydro projects
War Lake First Nation	**x**				• water quality, levels and flow • cumulative impacts of past hydro projects • use of traditional knowledge • training and employment
Mosakahiken Cree Nation		**x**			• potential impacts of Transmission Line – trapping, visual, cultural • implementation of enduring benefits program

Community	Source of Issues				Issue/Concern
	PIP	**CEC**	**WR INPUT**	**ABOR CONSULT**	
Cross Lake First Nation Note: CLFN also participated in consultation with Manitoba Hydro under Article 9 of Northern Flood Agreement.		**x**	**x**	**x**	• lack of knowledge of effects of current Hydro system • effects on system operations • impacts on resource use • cumulative socio-economic impacts on community • system-wide cumulative effects assessment not completed • purpose of project and implications for community • consultation process concerns (Northern Flood Agreement Article 9) • inability to obtain relevant information from Manitoba Hydro on system effects • increased bank instability and erosion • debris • siltation • fish habitat, quality, stranding • waterfowl • shoreline medicinal plants • health, mental health • navigation safety
Norway House Cree Nation	**x**				• involvement of aboriginal peoples in environmental studies • Wuskwatim commercial fishery • water levels at Wuskwatim Lake • training and employment • distribution of new power • structure of transmission lines
Mathias Colomb Cree Nation	**x**				• effect of Project on water levels in their area • fish movements
O-Pipon-Na-Piwin-Cree Nation (OPCN) Note: NCN members seeking new reserve at South Indian Lake		**x**			• need for consultation separate from NCN • proponents failed to assess effects on South Indian Lake traditional resource use, culture, social structure, or activities within the South Indian Lake Trapline area • proposed employment monitoring needs to separate the effects experienced by South Indian Lake and Nelson House residents

Table 2 is a summary of issues concerns by aboriginal communities through the various consultation processes for the Wuskwatim Generation Project. The source of issues is noted as follows: PIP (Public Involvement Program), CEC (Manitoba Clean Environment Commission), WR INPUT (Written Input), and ABOR CONSULT (Aboriginal Consultation conducted by DFO and the Province of Manitoba).

Table 3 is a summary of issues raised by aboriginal organizations for the Wuskwatim Generation Project. These organizations all participated in the Clean Environment Commission hearings.

Table 3: Summary of Issues: Aboriginal Organizations

Aboriginal Organization	Source of Issues			Issue/Concern
	PIP	CEC	WR INPUT	
Manitoba Métis Federation (MMF) Note: In late 2004, Hydro/NCN developed a consultation workplan with the MMF, and this plan was carried out in 2005. The source here is marked as PIP.	x	x		• impacts to nesting habitat for waterfowl • impacts to medicinal plants • impacts to fish movements • impacts to navigation • access impacts • impacts to caribou • erosion and sedimentation on Wuskwatim Lake • uneven distribution of costs and benefits • visual impacts • socio-economic impacts to Métis • ongoing adverse effects from past projects • failure to incorporate relevant sustainable development legislation and regulations • lack of utilization of traditional Metis knowledge • no meaningful and proper consultation • project will lead to further erosion of their culture
Assembly of Manitoba Chiefs		x		• if project is environmentally acceptable, NCN should have opportunity to make decision as project is in NCN homeland • need for broader forum to address past project effects
Manitoba Keewatinook Ininew Okimowin		x		• unresolved matters related to existing hydroelectric developments need to be addressed • protection of treaty and aboriginal rights
Southern Chiefs Organization		x		• impacts of hydro-electric development on First Nations
Displaced Residents of South Indian Lake (DRSIL)		x		• lack of utilization of traditional knowledge • consultation process lacked proper level of debate and questioning • export market (recommend contracts for export be signed before project approval)
Justice Seekers of Nelson House		x		• potential negative social, cultural and environmental impacts • impact on treaty and aboriginal rights • concern about proposed NCN/Hydro partnership
Community Association of South Indian Lake (CASIL)		x		• lack of utilization of traditional knowledge • significance: EIS was inadequate and inconsistent • baseline conditions excluded effects of other projects on the system • Environmental protection plans and monitoring – recommend community involvement in compliance monitoring • MH can not guarantee that the regime they are proposing will not be subsequently amended • increased suspended solids will add to suspended-sediment load, resulting in cumulative effects • key indicator fish species not given consideration with respect to the significance of residual effects • mitigate residual cultural effects • lack of appropriate consultation • SIL does not receive financial benefits of use of Southern Indian Lake as a reservoir for CRD

Aboriginal Organization	Source of Issues			Issue/Concern
Swampy Cree Tribal Council		x		• should be opportunities for other First Nations to invest in Generation Project • impacts of Transmission Line through their territories
Trap Line No. 18		x		• Environmental Protection Plans and Monitoring – recommend the establishment of joint management process
Pukatawagan Fishermen's Association (PFA)		x		• unresolved water regulation issues from CRD project

6.3.3 Responses to Concerns Raised by Aboriginals

The following is a brief discussion on responses by the Proponent and regulators to concerns raised by Aboriginal communities and organizations. The focus is on environmental concerns. More detailed information on many of the topics briefly discussed here are provided in Section 7 below.

Use of Traditional Knowledge

The Proponent states that both traditional and scientific knowledge were used in the environmental assessment approach including the evaluation of significance. NCN advises that the First Nation has adopted a community-driven approach that will allow for the utilization of traditional knowledge in monitoring activities and provide for ongoing communications with its members. Proposed monitoring programs to address requirements under both the *Fisheries Act* and the *Environment Act* would incorporate both science and traditional knowledge.

Impacts to Medicinal Plants

The Proponent advises that no medicinal plant areas were identified in areas directly affected by the Project in Traditional Knowledge surveys or during overflights of the area (e.g., access road) with Elders. The Environmental Protection Plan to be submitted for the Environment Act licence will provide for monitoring for impacts to medicinal plants.

Protection of Ceremonial and Burial Sites

Manitoba Conservation advises that there would be provisions in any Environment Act Licence issued for protection of heritage resources.

Nesting Habitat for Waterfowl

The Proponent advises that water level fluctuations will be reduced relative to existing conditions, and deterioration of offshore and floating peatlands should also be slowed and even reversed as a result of the project, thus negative impacts to nesting habitat from these sources is not considered likely. The Proponent acknowledges that marsh nesting

habitat will decline but maintains that this type of habitat is abundant in the region. Impacts to waterfowl habitat are discussed in greater detail in Section 7.2

Increased Access

In response to concerns regarding access management, the Proponent advised that the draft Road Access Management Plan, presented at the CEC hearing (March 2004), was adopted by Manitoba Hydro and NCN. Access management is discussed in detail in Section 7.5 of this report. The Proponent states that implementation will commence during the construction phase.

Replenishing/Replacement of Affected Lands

The Proponent advises that the Manitoba Hydro/NCN Project Development Agreement will include a compensation agreement, which will address adverse effects. NCN advises that it will be considering enhancement opportunities e.g. rehabilitation of areas. Traditional and scientific knowledge will be used. Any *Fisheries Act* Authorization issued by DFO in relation to the Project would require mitigation measures that balance unavoidable losses to fish habitat by habitat enhancement and rehabilitation. The Proponent has proposed a number of projects, acceptable to DFO, including enhancement of stream mouth habitat in selected CRD-affected lakes, which may also benefit shoreline plant communities. Manitoba Conservation advises that there would be provisions in any Environment Act Licence issued to address terrestrial impacts.

Erosion, Sedimentation and Woody Debris

The Proponent states that the increased rate of erosion of the Wuskwatim Lake shoreline will result in additional woody debris entering the lake over the first five years of the Project from shorelines that are actively eroding. The Proponent contends that relative to the existing debris along the shoreline, the incremental increase in debris would be insignificant. Based on traditional knowledge, the Elders felt that there would be increased debris mobilization, while the Proponent's consultants were of the opinion that there would probably not be. They agreed on a management strategy to deal with either scenario based on Manitoba Hydro's existing Debris Management Program.

According to the Proponent, erosion of the Wuskwatim Lake shoreline will increase in the short term, resulting in the release of more sediment. The Proponent's water quality monitoring program is described in the Draft Aquatic Effects Monitoring Program (North/South Consultants, Inc., 2004) submitted to DFO and forms part of the Proponent's Environmental Protection Plan pursuant to any provincial *Environment Act* licence issued. Should unanticipated effects be detected, the Proponent would be required to address them. Any *Fisheries Act* Authorization issued by DFO in relation to the Project would require mitigation measures that mitigate erosion and sedimentation impacts to fish habitat.

Monitoring, Impacts to Caribou, Water Quality and Water Regime Effects

See responses under Section 6.2.6

Turbine Mortality/Fish Passage

The Proponent maintains that the existing falls do not allow for upstream passage of fish, thus the Wuskwatim Generation Project will not negatively impact upstream passage. In response to concerns raised respecting turbine mortality, the Proponent has proposed to undertake additional measures, including a study of turbine impacts at existing facilities and additional measures described in Section 7.1.3, to address these concerns.

Environmental Protection Plans

In response to requests for Aboriginal community involvement in Environmental Protection Plans, the Proponent notes that an Environmental Protection Plan would be required under the provincial *Environment Act* Licence if issued. It will describe the protocol for reporting on monitoring and compliance for the construction and operational phases of the project; and contain project-specific environmental protection measures. The Proponent has committed to the involvement of directly affected communities in the development of Environmental Protection Plans.

Fishery Impacts

To address concerns regarding impacts to fish and fish habitat, the Proponent prepared a Draft Sediment Management Plan (Acres Manitoba Ltd., 2004) and a Draft Fish Habitat Compensation Plan (North/South Consultants Inc., 2004) to DFO. Any Fisheries Act Authorization issued by DFO in relation to the Project would require mitigation measures that reduce impacts to fish habitat, including that for pickerel (walleye); enhancement or replacement of fish habitat to balance unavoidable losses; and monitoring to verify impact predictions, detect any unforeseen impacts, and confirm success of habitat rehabilitation.

The Proponent has committed to adhering to DFO's Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters and where this is not possible will require authorization by DFO under S.32 (to kill fish by means other than fishing) of the *Fisheries Act*.

The Proponent has also submitted a Draft Aquatic Effects Monitoring Program (North/South Consultants, Inc., 2004) to DFO, which includes monitoring of mercury in fish. Manitoba Conservation advises that there will be provisions in any *Environment Act* Licence issued to address impacts to the fishery as well as for mercury monitoring.

Mercury in Fish

In their analysis of the potential impacts of the Project on mercury levels in fish, the Proponent concluded that the Project could result in small increases in the mercury levels in fish flesh for lake whitefish, walleye and northern pike, but maintains that mercury is not likely to exceed commercial limits. The proponent has proposed monitoring of mercury in fish in Wuskwatim Lake and two downstream lakes, as well as two reference lakes, in years 4 and 6 of the project. At the request of Health Canada, monitoring of mercury in fish will also be undertaken in year 2 of Project operation, to verify the mercury levels predicted in whitefish, northern pike and walleye harvested from these lakes. Mercury in fish is discussed in greater detail in Section 7.4.

System-Wide Hydrological Effects

The Proponent advises that significant impacts to operation of the hydroelectric system are not expected as a result of the Project. However, in response to concerns raised during the EIS review and through consultation, the Proponent undertook a more extensive analysis of this issue. Details of the analysis are provided in Section 7.1.5 and support the conclusion that adverse effects outside the area of direct impact due to the Wuskwatim Generation Project are not expected.

Training and Employment

The Proponent advises that pre-project training programs are being developed by NCN for its members to prepare for employment opportunities during construction of the Generation Project. The Proponent further notes that training benefits of the Wuskwatim Generation Project are being addressed through the Pre-Project Training Initiative; funding has been made available to MMF, as well as to MKO and to potential partnering First Nations, focusing on the Wuskwatim Generation Project and the Keeyask Generation Project. NCN advises that it has taken a long-term capacity-development approach to securing employment through training programs, expected employment preference for Wuskwatim and negotiated contracts with Manitoba Hydro.

6.4 Other Federal Regulatory Consultation

6.4.1 Canadian Environmental Assessment Act

Pursuant to section 22 of the CEAA, the Agency shall make the CSR available for public comment relating to the conclusions and recommendations and any other aspect of the report. Following this public comment period the Minister of the Environment shall take a course of action pursuant to section 23 of the CEAA after taking into consideration the Comprehensive Study Report and any comments filed pursuant to section 22. To date, a total of five requests for access to the public registry have been submitted.

6.4.2 Navigable Waters Protection Act

As required by the Navigable Waters Protection Act (NWPA), the Proponent placed notices in the Canada Gazette, the Winnipeg Free Press and the Thompson Citizen on May 21, May 24 and May 21, respectively, to inform the public of the project and invite people to share their concerns about navigation and navigation safety. The public had 30 days from the time of advertising to submit written comments to Transport Canada, Navigable Waters Protection Program, Sarnia. No comments were received in response to these advertisements.

7.0 Anticipated Effects, Mitigation Measures and Significance

The following description of environmental effects of the Project and their significance, including proposed mitigation, is summarized from information submitted by the Proponent in sections 1 though 10 of Volume 1 the EIS; supplemental information submitted by the Proponent in response to requests from federal and provincial reviewers and the public; comments from federal and provincial reviewers; comments from the public and aboriginal persons and organizations; and any other information that was considered relevant. This section presents the assessment of the project's effects on the Valued Environmental Components: fish and fish habitat; birds, species at risk, human health (local air quality, quality of drinking water and consumption of fishery products), navigation, use of resources, current use of lands and resources for traditional purposes by Aboriginal persons (hunting, trapping, gathering, subsistence fishing; and heritage sites). This section also includes assessment of the environmental effects caused by potential accidents or malfunctions and the cumulative environmental effects that the project, combined with the existence of other structures or other projects or activities, is likely to have on the environment. A description of the impact assessment methodology and determination of significance was provided above in Section 4.6.

7.1 Fish and Fish Habitat

The Proponent discusses the anticipated impacts on fish and fish habitat in Volume 1, Section 7.8, and Volume 5 of the Environmental Impact Statement (Manitoba Hydro and NCN, 2003) as well as in supplemental information submitted at the request of federal, provincial, Aboriginal, and other public reviewers. According to the Proponent, the residual negative effects of the Project to fish and fish habitat after mitigation are expected to be short or long term depending on the effect, local, and small.

7.1.1 Construction Phase

7.1.1.1 Project Footprint on Aquatic Habitat

The Proponent indicates that approximately 13 hectares (130,000 square meters) of fish habitat in the downstream portion of Reach 2 will be affected by cofferdam placement, dewatering, and removal (North/South Consultants Inc., 2004). Following construction,

the Proponent anticipates that 3 ha (30,000 square meters) of Taskinigup Falls proper would be permanently dewatered, and that 7 ha will be permanently altered as follows:

- the off-current area near the north river bank will become the channel carrying the flow to and from the power house, while the channel currently carrying the majority of the flow will become part of the forebay immediately upstream of the main dam; and
- a short segment of the existing river channel (between Taskinigup Falls and the tailrace) will be converted from high velocity to low velocity habitat (4.2 ha).

Other works that will contribute to the Project's aquatic footprint include the concrete batch plant water intake, and upstream and downstream boat launches, the dimensions of which were not yet finalized at the time of writing. In addition, a proposed construction camp water intake will result in an infill of up to 1000 square meters of near shore habitat to accommodate a rock groin extending into Wuskwatim Lake to contain the water intake and water intake lines. To prevent entrainment in water intakes or impingement on water intake screens, the Proponent indicates that water intakes used during construction will be screened in accordance with the "Freshwater Intake End-of-Pipe Fish Screen Guideline" (DFO, 1995). Final design details are to be provided to DFO for review prior to construction and operation of water intakes. DFO believes that the effective screening of water intakes would prevent significant fish injury or mortality due to either entrainment or impingement of fish during water removals.

Wuskwatim Falls additional outflow capacity channel

The Proponent indicates that a new channel would be excavated to one side of the present Wuskwatim Falls that would have an area of 3.3 hectares (33,000 square meters). As part of the proposed Fish Habitat Compensation Plan (North/South Consultants Inc., 2004) rock placements would be made in the channel for benthic invertebrate colonization habitat and spawning areas for walleye and whitefish. DFO believes that with the proposed enhancements, the constructed channel will provide fish habitat.

Stream Crossings

The access road connecting Highway 391 to the proposed development site will cross 8 small streams and the Proponent has also noted there will be a stream crossing in the construction camp. Crossing wetted widths or channel cross sections impacted range from two to seven meters. Crossing widths, or length of channel impacted, would range from 51 to 76 meters. An estimated 2300 square meters of streams would be infilled by the proposed crossings. Construction will be scheduled to avoid high water flow and periods of intense fish movement, and erosion and sediment control measures will be employed to mitigate potential erosion and sediment deposition in fish habitat.

According to the Proponent, borrow areas will be located 100 m or more from any fish habitat. They would not be expected to encounter groundwater so that pumping and water discharge would not be required. Erosion and sediment controls would be applied. Borrow pits would be rehabilitated, in consultation with Manitoba Conservation, following use.

Effects on Fish and Fish Habitat

According to the Proponent, low velocity areas upstream of Taskinigup Falls support walleye and northern pike as well as some lake whitefish. The Proponent also suspects there may be walleye and lake whitefish spawning in lower velocity habitat downstream of Taskinigup Falls that will be affected by channel alterations as a result of the generating station.

Areas presently wetted as part of the stream channels would be eliminated by infilling eliminating any production by lower trophic levels, like benthic invertebrates, that could provide part of the food base for fishes. Migration up and downstream and on and off the local floodplain could be reduced or eliminated leading to less available reproductive and feeding areas. Habitat heterogeneity at the crossings would be reduced leading to less cover for some species. Any reproductive habitat in the footprint of the crossings would be lost.

Comments/Conclusion

To achieve the objectives of no net loss, DFO will require habitat compensation for the habitat lost by the footprint of structures built in association with the Project. The Proponent has submitted to DFO a detailed habitat compensation plan which provides for replacement and/or enhancement of fish habitat harmfully altered, disrupted or destroyed by the Project (North/South Consultants Inc., 2004). DFO believes that the changes to fish habitat from access road stream crossings will be mitigated by the construction of compensatory habitat, the integration of fish passage capabilities at two of the crossings (designated R5 and R8) where suckers and northern pike movements may occur, and the application of standard erosion and sediment control measures for all stream crossings. Monitoring will confirm the effectiveness of mitigation and identify the need for any further remedial measures. Considering the proposed mitigation and fish habitat compensation, DFO and TC conclude that habitat losses due to the footprint of the proposed structures are not likely to be significant.

7.1.1.2 Sediment

Construction Sediment

According to the Proponent, the most important source of construction-related sediment entering the Burntwood River would be from fines associated with rock and other fills used to build in-water cofferdams, from the disturbance of existing sediments during cofferdam installations and removals, and from erosion during first operation of the spillway and powerhouse. The Proponent indicates that six cofferdams will be constructed , mostly in the wet, to divert the Burntwood River over the course of the proposed construction phase. The cofferdams will utilize over 123,600 m^3 and 130,700 m^3 of rockfill, granular, and impervious fill material for Stage 1 and 2 cofferdams, respectively. Five of these cofferdams will require removal, two of them in partial wet conditions. A majority of the fill material will be removed and used in subsequent construction of other structures or be disposed of in the excavated materials placement area. Details of cofferdam construction and removal are provided in the Wuskwatim

Generation Project Environmental Impact Statement (EIS) (Manitoba Hydro and NCN, 2003) Volume 3, and the Draft Sediment Management Plan (Acres Manitoba Ltd., 2004).

Sediment may also be generated during a variety of other activities associated with the construction camp, including construction of primary roads, site drainage, the water treatment plant, and the proposed sewage lagoon. The camp water intake would be buried in the shoreline of Wuskwatim Lake and run into the lake through a rock fill groin. Sediment could enter the lake from fine materials inadvertently remaining with the fill, disturbance of the lakebed during fill placement and through excavation of the lakeshore or lakebed. The concrete batch plant and aggregate processing area may also be a source of sediment for the Burntwood River. In addition, sediment may be generated during construction of the eight stream crossings associated with the access road, and the stream crossing in the construction camp.

Erosion During Construction Phase

During construction, the Proponent expects water level changes due to construction to be restricted to the upstream area between Wuskwatim and Taskinigup Falls. The Proponent predicts no changes in erosion or sedimentation rates in Wuskwatim Lake or downstream of Taskinigup Falls during construction, as no changes in water levels and flows are expected during construction in these reaches. The Proponent similarly expects no measurable changes in ice processes up or downstream that would affect either water levels or erosion rates. In the supplemental information response to DFO, the Proponent noted that CRD flows would not be modified from normal operation to assist construction, for example, by reducing flows through the Notigi control structure during cofferdam placement. The Proponent indicates that water levels are expected to rise between 0.2 and 0.7 meters in Reach 2 during stage I diversion around parts of Taskinigup Falls, and between 0.5 and 1.0 meter during stage II diversion through the spillway, depending on flows in the Burntwood River at the time of diversion. During stage I and II flow diversions, the Proponent estimates between 1 and 2 km of shoreline between Wuskwatim and Taskinigup Falls will be exposed to higher water levels leading to minor erosion where there are lacustrine clay areas. Erosion prevention associated with construction activity is expected to protect the north shore, and the Proponent expects low wave energy and low water velocity conditions to limit erosion of the south shore. In winter, water levels in Reach 2 would be approximately 0.1 meter higher during construction diversions.

During the development of the forebay, the flow through the spillway gates will be regulated in a controlled manner to raise the water level between Wuskwatim and Taskinigup Falls approximately 7 m, and if required, in the reservoir (Wuskwatim Lake) to the Full Supply Level of 234 ASL. The Proponent notes there will not be any flow through the turbines during this event as the turbine installation will be incomplete at that time. Impoundment is currently scheduled by the Proponent for October of year 4 of construction. According to the Proponent, the rate of water level increase in the immediate forebay area will be limited to approximately 0.5 to 1.0 m per day, depending on the CRD inflow at the time, which will result in impoundment being complete in about 7 to 14 days. The Proponent will be required by DFO to maintain adequate downstream flows for fish habitat at all times during this period.

The Proponent expects that first-time spillway use during stage II diversion would erode some of the river channel and the stage I cofferdam remnant, and elevation in TSS could be as much as 100 mg/l. The Proponent also indicates that first-time powerhouse use would erode a relatively small amount of the stage II downstream cofferdam.

Effects on Fish and Fish Habitat

During construction, the Proponent estimates that the maximum short term increases in total suspended sediments (TSS) due to construction activities, at approximately 1 km downstream of Taskinigup Falls, could equal or exceed 200 mg/l above background levels. Information provided by the Proponent indicates that waters in the lower Burntwood River including Wuskwatim, Opegano, and Birch Tree lakes can be described as having total suspended solids (TSS) typically ranging from <2 mg/l to 24 mg/l. The Proponent also stated that increases in daily average TSS of up to 25 mg/l after complete mixing, for up to six weeks duration during construction, might occur as far downstream as Opegano Lake, and possibly beyond. These estimates were based on hydraulic modeling for in-river construction, and included consideration of riverbed geotechnical properties. DFO notes that the Canadian Water Quality Guidelines for the Protection of Aquatic Life (2002) advise maximum increases of 25 mg/l from background levels for any short term exposure (e.g., 24-h period) and a maximum average increase of 5 mg/l from background levels for longer term exposures (e.g. inputs lasting between 24 h and 30 d) under clear water (<25 mg/l) conditions. There may also be small a increase in metal concentrations associated with increased sediment suspended sediment during construction in Reaches 2,3, and 4.

In addition to short term increases in suspended sediment, deposition of sediment from construction may also impact fish habitat by reducing the quality of streambed substrate composition, permeability, and stability. Some of the sediment would likely be deposited in low velocity areas, eddies, and elsewhere in the river at various points along the transport route. Sediment may be transported, according to the Proponent's model, considerable distances before dropping to the river bottom and may also be transported along or close to the river bottom as bed load.

The Proponent maintains that the short-term changes in water quality due to sediment mobilization will not substantially affect lower trophic communities, although there may be some temporary effects (e.g., downstream movement of invertebrates exposed to a sediment plume), which may result in a short-term (1-2 years), small decrease in local abundance and distribution. DFO notes that elevated water column turbidity, sediment deposition, and sediment transported as bed load all could have negative impacts on benthic macroinvertebrate production and periphyton communities. Elevated suspended sediments may alter physical habitat by scouring of streambeds and dislodgement of invertebrates; smothering of benthic communities; clogging of interstices between gravel, cobbles, and boulders; and abrasion of respiratory surfaces and interference of food intake for filter-feeding (CCME, 2002).

The Proponent contends that the proposed target levels of 25 mg/l and 200 mg/l are well below acute toxicity thresholds for freshwater fish, which range from the hundreds to hundreds of thousands. DFO notes however that the literature also indicates that fish and fish habitat may be affected at much lower levels of TSS (eg. CCME, (2002)), for

example by affecting lower trophic levels thereby affecting food production; by clogging and abrasion of gills, behavioural effects (e.g., movement, feeding and migration), resistance to disease, and blanketing of spawning gravels and other habitat changes.

Comments and Mitigation Measures

NRCan requested additional information on how increased concentrations of TSS were derived. On receipt of additional information from the Proponent (Acres Manitoba Ltd., 2004) NRCan concluded that the report provided a satisfactory summary of how erosion associated with the project was determined.

DFO notes that construction sediment could affect a significant length of the Burntwood River at levels exceeding those recommended in the Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, 2002). DFO and Environment Canada requested that the Proponent consider additional mitigation measures to reduce the amount of sediment released during construction, in particular during activities that posed a high risk for sediment release, such as during cofferdam and groin installation and removal. In response, the Proponent developed a construction sediment management plan (Acres Manitoba Ltd., 2004). The Draft Sediment Management Plan notes a number of modifications to the Project design and construction methods that were made to reduce the potential for sediment release to the Burntwood River including:

- Re-alignment of the spillway discharge channel to direct discharge away from the Burntwood River's south bank into the centre of the channel to reduce bank erosion.
- Incorporation of an additional short-term upstream cofferdam (cofferdam Ib) in stage I diversion to prevent downstream dispersal of suspended sediment from the stage I cofferdam rock-fill groin.
- Modification of the stage II south upstream cofferdam construction sequence by constructing a rockfill groin across the main channel before placing finer material that might erode.
- Incorporation of settling ponds at the up and downstream ends of the Excavated Materials Placement Area to minimize sediment deposition in the Burntwood River.
- Revision of the removal sequences of excavation isolation plugs for the spillway Wuskwatim Falls expansion channel to allow removal of more material upstream of rock fill berms.

General, or primary, erosion and sediment control measures outlined by the Proponent include Project design, construction practices and sequencing to minimize sediment mobilization and transport; minimization of area disturbed at any time prior to stabilization; facility location in suitable topography and soil conditions; diversion of runoff from disturbed areas and further treatment as required; soil excavation techniques to minimize erosion and sediment; vegetated buffer zones adjacent to water; minimization of the area of in-stream disturbance; and use of settling ponds, silt fences and other standard mitigation methods as detailed in available guidelines. The Proponent indicates that specific mitigation measures will be the responsibility of the contractors, and that the contractors will be required to use best management practices and to meet water quality guidelines specified by the Proponent or as subsequently required by Project licensing.

The Proponent also developed an "Adaptive Action Plan" for the Sediment Management Plan (Manitoba Hydro and Nisichawaysihk Cree Nation, September, 2004) which establishes continuous monitoring (visual and turbidity) downstream of construction and action levels, including a primary action level when TSS levels increase to 25 mg/L above background at the monitoring site approximately 1 km downstream of Taskinigup Falls. Actions include review of the effectiveness of primary mitigation, work stoppages or slowdown, and deployment of additional mitigation measures (such as turbidity curtains) where necessary and feasible. The Proponent maintains that, based on their review of the literature, the target limitation of a maximum daily average increase of 25 mg/L in the fully mixed zone and a maximum instantaneous limit of 200 mg/L above background, will be protective of aquatic life.

The Proponent has committed to acquiring additional information on pre-project variation in TSS and turbidity in the project area and to monitoring the magnitude, spatial extent, and temporal variation of TSS during construction. Water quality monitoring prior to, during, and post-construction is described in detail in the Aquatic Effects Monitoring Program submitted by the Proponent to DFO (North/South Consultants, Inc., 2004) for both generating station and stream crossing construction components. At the request of Environment Canada, the Proponent will also incorporate particle size analysis to allow for modeling and/or prediction of downstream transport and deposition rates. The Proponent proposes to base its work on samples from the inlet and outlet of Wuskwatim Lake and the inlet of Opegano Lake. In addition to physical sediment monitoring, at the request of DFO, the Proponent has incorporated a component in the benthic monitoring program specifically to detect impacts to aquatic organisms resulting from sediment release to the Burntwood River and Opegano Lake during the construction phase. The Proponent has committed to continue monitoring after the completion of construction to determine any effects and undertake any remedial measures necessary. The Proponent maintains that effects to the aquatic environment, including fish and fish habitat, from construction-related sediment would be insignificant in the long term.

Conclusions

DFO notes that the use of cofferdams for project construction will allow most of the Project's construction to be carried out in the dry, thus mitigating many of the major impacts to fish habitat that could arise from Project construction. Additional mitigation as described in the Proponent's Draft Sediment Management Plan and supplemental material are expected to further reduce the risk of significant impacts to the aquatic environment from construction-related sediment. DFO also notes that the proposed monitoring during construction will allow for early detection of increases in TSS and timely deployment of additional mitigation as required. Verification of the Proponent's predictions that long term effects will not occur are to be provided through the Proponent's Draft Aquatic Effects Monitoring Program (North/South Consultants, Inc., 2004). In consideration of the proposed mitigation and monitoring described above DFO and TC conclude that significant adverse effects to the aquatic environment from construction sediment are not likely.

7.1.1.3 Blasting

The Proponent indicates that use of explosives during construction of the generating station and stream crossings would be required. Most blasting operations will be completed in the dry and the Proponent believes that the "Guidelines for the Use of Explosives in or near Canadian Fisheries Waters" (DFO 1998) can be met . Blasting may result in the release of ammonia and nitrate into Reach 2 and upper Reach 3, which may be toxic to aquatic organisms.

While most blasting will occur in the dry, the Proponent notes that blasts for the removal of temporary rock plugs in the spillway channel, channel improvement area, and at the station may cause fish mortality in the immediate vicinity of the blast. The Proponent noted that these rock plug removals would each involve a relatively small, single blast. In response to a request by DFO, the Proponent identified additional mitigation measures to reduce fish mortality including a low-intensity pre-blast to displace fish present in the immediate area; air bubbler systems upstream and downstream of the rock plug to absorb/reduce the explosive pressure wave; increasing the number of drill holes, reducing the size of the explosive charge and increasing the number of delays in the explosive charges. Unspent charges would be removed from blasts conducted in the dry (majority of blasting). The Proponent also indicated an excavation/blasting plan will be produced in consultation with DFO and Manitoba Conservation prior to initiation of construction activities.

DFO and TC conclude that with the mitigation measures outlined above, fish mortality due to blasting will be small and localized, and therefore significant adverse effects due to blasting are not likely.

7.1.1.4 Other Potential Effects on Water Quality from Construction

The Proponent identified a number of other construction-related processes that may impact water quality in the Burntwood River. Discharge of treated sewage effluent into the backwater inlet of Reach 4 may lead to increases in nutrients, with subsequent effects to algal and plant growth and oxygen levels. Sewage effluent may also increase fecal coliform bacteria during and immediately after discharge, increase oxygen demand, and decrease dissolved oxygen. The Proponent has indicated that treated effluent will meet provincial standards. The Proponent also indicated that safe handling procedures and spill response measures will minimize the risk of harmful quantities of various deleterious substances, in particular hydrocarbons, being released to surface waters by accidental spills.

The potential for waste rock used during construction for the main dam and excavated materials placement area to generate acid leachate was assessed by the Proponent. Acid-generating leachate may decrease pH and/or increase metal concentrations in receiving waters. The Proponent reports that preliminary results of chemical testing indicate a low potential for acid generation and leaching of metals.

Environment Canada noted that pH control may be required for ponds receiving significant volumes of concrete washings, since cement/water mixtures may have high pH (up to 12 or so). The Proponents indicated that they would monitor settling pond pH

and take action to ensure pH in the range of 6.5 to 9.0 in water being discharged into the Burntwood River**.**

The Proponent will monitor water quality as described in the Draft Aquatic Effects Monitoring Program. Environment Canada was satisfied that water quality issues had been adequately addressed and concluded that the draft monitoring program appeared to have the necessary elements. Environment Canada also noted the Proponent's commitment to add additional details and/or to modify plans once additional baseline data has been collected and/or as a result of monitoring findings. In consideration of the proposed mitigation and monitoring, and the expert advice of Environment Canada, DFO and TC conclude that significant adverse effects to water quality are not likely.

7.1.2 Operation Phase

7.1.2.1 Alterations in Water Regime Upstream (Reaches 1 and 2)

According to the Proponent, the Wuskwatim GS would operate in a "modified run-of-river" mode with higher daytime (increased downstream flow) and lower nighttime (decreased downstream flow) power production. Variations from present flow conditions would occur between Early Morning Rapids upstream and Opegano Lake downstream.

The Proponent indicates that changes as a result of Project operation in the water regime upstream of the dam will be experienced as far upstream as Eary Morning Rapids, and will include an estimated 7 m increase in water levels between Wuskwatim and Taskinigup Falls, resulting in permanent flooding of approximately 0.5 km^2 (37 ha) of land; a reduction in water velocity through Wuskwatim Falls from a range of 4 to 10 m/s down to 0.5 to 0.7 m/s; and stabilization of water levels in Wuskwatim Lake and areas upstream to Early Morning Rapids at a mean water level elevation of 234 m ASL, increasing the median lake level by approximately 0.3 m. Stage variations within the day are predicted by the Proponent to be at a median of 0.06m, and up to 0.13 m in the immediate forebay (Reach 2). The Proponent does not predict any backwater effects at Early Morning Rapids and notes that pre-Project water level fluctuations due to the CRD operation would no longer occur on Wuskwatim Lake. Wuskwatim Lake is expected to experience daily water level fluctuations of less than 0.06 meters (wind and wave effects eliminated).

In the supplemental information response to NRCan (Manitoba Hydro and Nisichawayasihk Cree Nation, 2004), the Proponent indicated that the mean water level of Wuskwatim Lake would only begin to increase above full supply level for inflows with a frequency of occurrence of less than 1 in 10,000 years. Excess flows in the CRD that would result in the exceedance of licensed lake levels would be directed through the Missi Falls control structure into the lower Churchill River.

Effects on Fish and Fish Habitat

The Proponent predicts that the changes in the water regime upstream of the proposed dam will alter fish habitat quantity and quality primarily in relation to the amount of time it is wetted. To assess changes in fish habitat the Proponent defined "nearshore habitat" as that habitat wetted greater than 95% of the time, and "intermittently exposed habitat"

as that wetted between 5% and 95% of the time. The Proponent expects nearshore habitat to have greater aquatic productivity than that which is intermittently exposed.

In the Draft Fish Habitat Compensation Plan (North/South Consultants Inc., 2004) the Proponent estimates that stabilization of water levels on Wuskwatim Lake will result in a conversion of approximately 1587 ha of intermittently exposed habitat to nearshore habitat. The Proponent expects that production of the four VEC species (walleye, lake whitefish, lake cisco, and northern pike) considered in their assessment will increase slightly due to greater habitat availability, and estimated that in the long term the area for lake whitefish and lake cisco spawning would increase by 12%, after an initial reduction due to increased erosion in the first five years following impoundment. In addition, the proponent predicts there would be a 4% reduction in the over-winter loss of lake whitefish and lake cisco eggs due to freezing.

In the proposed 53.3 ha forebay between Wuskwatim Falls and Taskinigup Falls habitat alterations from changes in water regime will include a 6-7 m increase in water depth through much of the reach from a mean water depth of 6.4 m (maximum 19.0 m); a reduction in high velocity habitat throughout the reach; a net loss of approximately 1.5 hectares of macrophytes; flooding of approximately 25 hectares of terrestrial vegetation (cleared but otherwise undisturbed) and 9 hectares of dyke built over former terrestrial habitat; and the addition of 3.4 hectares of new aquatic habitat in the excavated channel joining Wuskwatim Lake to the forebay.

The Proponent expects an increase in total benthic invertebrate numbers and a change in invertebrate species composition to that more typical of a lake than a river due to increased wetted area, reduction in water velocity, and reduction in water level fluctuations. The Proponent also predicts an increase in forage fishes in this reach. In general, the Proponent expects more use of this reach by fish, and upstream migration of fish from the reach into Wuskwatim Lake will become possible due to flooding of Wuskwatim Falls. Any spawning habitat presently available at the base of Wuskwatim Falls will likely be lost from flooding of the falls, but new spawning areas may be established at the falls location where velocities had previously been too high. The Proponent does not expect a net decrease in productive fish habitat in this reach.

Comments/Conclusion

DFO agrees with the Proponent that the conversion of intermittently wetted habitat to permanently wetted habitat in Reach 1 will likely result in greater productivity for that habitat and could reduce some of the adverse effects currently resulting from CRD water level fluctuations. However, DFO notes that, in operating as a reservoir, other benefits of natural seasonal variation will not be restored from CRD conditions by Project operation. DFO commented that greater consideration needed to be given to the relative quality of the habitat affected by reduced water level fluctuations, for example in relation to such parameters as substrate type (e.g. cobble, silt/clay) and light penetration, that may be affected by increased erosion and sedimentation (see below) and increases in water depth. In response, the Proponent provided substrate information collected along transects at 8 sites off eroding banks on Wuskwatim Lake and committed to collecting more detailed substrate information at sites along the southeastern shore of Wuskwatim Lake being considered for habitat compensation work, and sites subject to benthic invertebrate and

water quality monitoring. The Proponent has included a component of substratum monitoring in the Draft Aquatic Effects Monitoring Program (North/South Consultants Inc., February 2004, Manitoba Hydro and Nisichawayasihk Cree Nation, September, 2004), which includes monitoring of substrate type, sediment deposition, and presence/absence of aquatic plants in Wuskwatim Lake.

DFO notes that newly flooded terrestrial habitat in the Wuskwatim to Taskinigup falls area might not function as high quality habitat until some time after flooding. Similarly, habitat gains from flooding may not achieve expected quality in comparison with lost habitat when possible increases in sedimentation in Reach 2 are considered. The large increase in water depth could also result in harmful alteration of currently productive littoral areas. However, in consideration of the mitigation and compensation proposed in the Draft Fish Habitat Compensation Plan, and the proposed monitoring, DFO and TC conclude that the alterations in the water regime upstream of the proposed generating station will not result in significant adverse effects to aquatic habitat.

7.1.2.2 Alterations in Water Regime Downstream (Reaches 3 and 4)

The Proponent expects that during operation, the principal change in Burntwood River habitat downstream of the proposed dam to Opegano Lake (Reaches 3 and 4) would be an increase in the frequency and magnitude of water level fluctuations. Variation in the number of units operating in the generating station will superimpose water level changes within the day on the month-to-month changes that presently occur downstream of Taskinigup Falls as a result of the CRD. The Proponent reports that the largest fluctuations within the day will occur at the tailrace with a median fluctuation of 0.4 m and a maximum of 1.5 m, decreasing with increasing distance downstream. Opegano Lake (Reach 4) is also expected to be affected by increased daily water level fluctuations, although these are expected to be of lesser magnitude than those in Reach 3. The Proponent predicts that daily fluctuation due to station operation would be 0.0 to 0.4 m, but 69% of the time variation would be less than 0.2 m. Minimum water levels in Reaches 3 and 4 are expected to be lower and the Proponent notes that several hours of minimum water levels (associated with a discharge of 328 m^3/s) may occur each day when the generating station discharge is less than 600 m^3/s.

Effects on Fish and Fish Habitat

The Proponent predicts a loss in general productivity of the intermittently exposed zone that would have the greatest effect on the 10 backwater inlets downstream of the proposed dam that receive inflows from small streams, as 50% of the backwater inlets are intermittently exposed. The loss of 3.9 hectares of macrophyte beds is expected. The Proponent estimates that approximately 19 ha of habitat in the intermittently exposed zone could be harmfully altered by the project, and an additional 17 ha of habitat that is currently classified as nearshore would be converted to intermittently exposed habitat that would be alternately exposed and flooded more frequently. The Proponent notes that feeding and spawning of walleye and northern pike, and to a lesser extent lake whitefish and lake cisco, in backwater inlets and main stem bays would be most affected.

At Opegano Lake, the Proponent predicts growth of 46 ha of macrophytes would be reduced. Increased water level fluctuations would affect 50 ha of intermittently exposed habitat resulting in a decrease in productivity, and approximately 28 ha of near shore

habitat would be converted to intermittently exposed habitat. According to the Proponent, feeding and spawning of walleye and northern pike, and to a lesser extent lake whitefish and lake cisco would be most affected.

Comments/Conclusion

Aside from the design features noted by the Proponent that reduce the overall magnitude of expected water level fluctuations for Project operation (low head over high head dam, modified run-of-river operation mode), the Proponent did not identify any additional measures that would mitigate the negative impacts of increased water level fluctuations downstream of the Project. The Proponent has committed to monitoring changes in aquatic habitat downstream of the proposed dam, and benthic invertebrate monitoring includes components specifically designed to detect impacts resulting from increased water level fluctuations within the Burntwood River downstream of Wuskwatim Lake and any impacts resulting from increased water level fluctuations in Opegano Lake. Fish community composition and condition will also be monitored downstream of the Project. Losses of fish habitat downstream of the Project are expected to be balanced by habitat compensation as proposed in the Draft Fish Habitat Compensation Plan (North/South Consultants, Inc. 2004)**.** DFO commented that, although habitat losses are expected downstream of the Project, the proposed compensation plan did not contemplate habitat enhancement or restoration measures in the downstream area. However, the Proponent maintains that compensatory works will have greater benefit upstream of the proposed dam, as any downstream habitat enhancement may be negatively affected by Project operation, and commercial, recreational and domestic fishing effort is expected to be concentrated in Wuskwatim Lake, where access is safer and productivity generally thought to be higher. DFO agrees that this approach is reasonable, and that with the proposed habitat compensation, DFO and TC conclude that significant adverse effects to fish habitat as a result of water level fluctuations downstream of the Project are not likely. DFO is satisfied that the proposed monitoring of downstream aquatic habitat, the benthic invertebrate community, and the fish community will be able to verify the Proponent's conclusions and/or detect any unforeseen effects to aquatic habitat due to changes in the water regime resulting from operation of the Project.

7.1.2.3 Thermal Regime and Ice Processes

According to the Proponent, ice conditions are not expected to change significantly as a result of the Project, with the exception of formation of ice cover on portions of the immediate forebay between Wuskwatim Falls and Taskinigup Falls, which does not form ice cover under present conditions. The Proponent considered the possibility that operation of Project could affect the thermal regimes upstream and downstream of the dam through increased erosion which may increase water temperature by greater heat retention by sediment; and through increased depth in the reservoirs affecting the temperature and temperature profiles in the reservoir. However, in assessments related to potential ice regimes the Proponent concluded that hydraulic changes as a result of the project would not affect water temperature. In addition, the Proponent believes that predicted changes in TSS are also not sufficient to cause a change in temperature.

Considering the Proponent's analysis, DFO and TC conclude that the Project is not likely to cause significant adverse environmental effects from changes in ice cover formation and water temperature.

7.1.2.4 Upstream Erosion (Reaches 1 and 2)

During operation, the present erosion of Wuskwatim Lake and nearby waters shorelines would be increased. Approximately 30% of the Wuskwatim Lake and adjacent waters shorelines are presently experiencing erosion, both natural and in large part due to increased flows from the CRD. The Proponent has predicted that, with operation of the Wuskwatim GS, greater erosion rates would occur in the first 5 years following construction and would gradually decline over the next 20 years to pre-Wuskwatim GS erosion rates. The primary erosion agent of the lakeshore would be increased wave action from relatively constant water levels occurring more frequently near the upper end of the range of pre-dam, post CRD water levels.

In consideration of ice ramping as requested by NRCan, the Proponent indicated ice ramping was not expected due to the relatively small size of the lake, and if it did occur on occasion it would not be expected to have a significant effect on shoreline erosion relative to dominant wind and wave action. The Proponent suggested ice shove on the shoreline could cause some movement in the leading edge of the shoreline debris fields. During the spring snowmelt, the lake ice generally melts from the shoreline first and the remaining lake ice melts in place limiting debris movement. The Proponent also noted that the mean water level of Wuskwatim Lake would only begin to increase above full supply level for inflows with a frequency of occurrence of less than 1 in 10,000 years. Excess flows that would mean exceeding licenced lake level limits on Threepoint Lake and Footprint Lake upstream would be directed through the Missi Falls control structure into the lower Churchill River. As such, the Proponent concluded that ice effects that could lead to increased shoreline erosion would not be greater due to high inflows in wet years. In addition, in response to inquiry by NRCan, the Proponent felt that that erosion would not be increased due to melting of permafrost as in their view, based on available information (i.e., exploratory test pits, air photo and video interpretation of the shoreline) there is no evidence of extensive permafrost around the shorelines of Wuskwatim Lake.

According to the Proponent, the reach between Wuskwatim Lake and Taskinigup Falls, which will be converted from a river to a lake environment continuous with Wuskwatim Lake, is expected to incur only modest erosion. This area is expected to be a low-wave energy environment. The majority of the north shore will not undergo erosion because of the placement of rock materials associated with the excavated material placement area and the construction of the road to the channel excavation area at Wuskwatim Falls. The south shore is predicted to experience lower wave energy and lower water velocity conditions, and thus is expected to be less prone to erosion.

The Proponent estimates that average annual bank-recession rates in silty-clay banks and silty-clay banks over low bedrock, subject to high-wave energy, would increase from 1.0 to 1.5 m/yr and from 0.5 to 1.5 m/yr, respectively, in the first 5 years of operation. Erosion rates in silty-clay banks would decrease to an average of 1.2 m/yr during the following 20 years of operation, while rates in silty-clay banks overlying low bedrock would decrease to an average of 0.65 m/yr. Silty-clay shorelines in high wave-energy

environments would recede, on average, about 32 m, versus 25 m without the project. Silty-clay shorelines overlying low bedrock in high wave-energy settings would recede, on average, about 21 m, versus 13 m without the project. Erodible shorelines in moderate wave-energy environments would recede 2/3 of the above recession distances, on average. The Proponent does not expect appreciable change in erosion rates in other shorelines, which are considered stable.

The Proponent estimates the incremental increase in erosion in the main part of Wuskwatim Lake is expected to be about 72,000 tonnes/yr in the first 5 years of operation. The Proponent expects that 50% of eroded material in Wuskwatim Lake main would settle in the near shore zone and the remaining 50% would enter deeper water where approximately half (25% of total) might be transported downstream. Approximately 36,000 tonnes/yr would be added to the near shore area of the lake and a similar amount added to deepwater deposition. Estimated deepwater deposition could be in the range of 0.30 g/cm^2/yr or approximately 2 mm/yr. Alternately, if increased sediment was transported downstream, the Proponent assumed a 25% incremental increase in sediment outflow from Wuskwatim Lake, finding that total suspended solids (TSS) concentrations in the outgoing flow would rise by less than 1 mg/l (0.7 mg/l), an amount the Proponent notes is unlikely to be detectable given the range of existing variation. With a portion of the sediment being transported downstream, the expected deepwater deposition in the lake is predicted to decline from 0.30 g/cm^2/yr to 0.26 g/cm2/yr. In response to DFO and NRCan requests for additional information out of concern that the Proponent's model may have underestimated nearshore sedimentation, the Proponent's additional sensitivity analyses indicated that there may be a need to adjust nearshore deposition to 80%. Under an 80-10-10 split (nearshore-deepwater-downstream) analysis, the Proponent found that predicted downstream increases in TSS would be approximately 0.27 mg/l. The Proponent expects that increases in sedimentation will decrease significantly after the first 5 years of the Project and return, in the following 20 years, to background levels. After 25 years, it is expected that bank recession rates in erodible materials would be the same as they would have been without the Project.

Woody Debris

According to the Proponent, there is active ongoing erosion within the main part of Wuskwatim Lake, which is adding additional woody debris over time to the existing debris densities around the edge of the lake. With the Project, the Proponent predicts that there will be an increase in shoreline erosion in these actively eroding areas in the short-term, which will likely result in doubling the debris inputs in the first 5 years after the Project. In the following 6 to 25 years after the Project, debris inputs are estimated by the Proponent to be slightly above the long-term average, back to the long-term average after 25 years and to remain relatively constant thereafter. It is the Proponent's opinion that, relative to the existing debris levels around the lake, the increase in incremental debris densities from eroding areas around the lake is insignificant, and that any new debris would be trapped against existing shoreline debris fields and be relatively immobile.

The Proponent predicts woody debris generation from the Wuskwatim to Taskinigup falls forebay area will be negligible due to clearing of all trees in the immediate forebay during construction. The Proponent noted that clearing would occur in two stages so as to leave

as much vegetation in place for as long as possible to minimize the potential for exposed land to erode. The Proponent also predicts additional debris generation in Wuskwatim Lake's back-bays and adjoining lakes (Sesep and Cranberry Lakes) will be negligible, as they experience little active erosion at present. The Proponent has committed to monitoring and mitigating navigational debris hazards as required through Manitoba Hydro's Debris Management Program. More details on woody debris can be found in Volume 4, Section 9.4.2 of the EIS submitted by the Proponent (Manitoba Hydro and NCN, 2003).

Effects on fish and fish habitat

According to the Proponent, increased exposure to highly turbid waters could affect benthic invertebrate abundance and distribution. The Proponent maintains that the effect would be limited to a relatively small amount of very turbid water adjacent to eroding shorelines and boulder/cobble/bedrock areas that might be covered with silt. In addition, the Proponent predicts that this effect would be greatest in the first 5 years of operation during the greatest increases in erosion rates. The Proponent considers the effects insignificant as, in their analysis, the expected increase in benthic invertebrate production due to the greater post-dam Wuskwatim Lake volume would exceed reductions due to turbidity and sediment deposition.

The Proponent predicts that increased erosion and sedimentation in parts of Wuskwatim Lake main and Cranberry Lakes might result in short-term losses in the quantity and quality of spawning habitat available to some species (e.g. lake whitefish and lake cisco). However, the Proponent considered the effect insignificant because their predicted increase in fish production due to the increase in permanently wetted habitat in Wuskwatim Lake post-construction would exceed reductions due to sedimentation.

Comments/Conclusion

DFO notes that relatively small amounts of boulder/cobble and bedrock substrates might be disproportionately important to invertebrate production and/or spawning for some species, and these seem to be the habitats most affected by potential sedimentation. DFO believes there is uncertainty in the Proponent's predictions of net increases in production over the long term due solely to the larger size of permanent waters upstream of the Wuskwatim GS. In DFO's view, the quality of habitat gained by stabilization of water levels on Wuskwatim Lake would be more certain if the predicted increases in turbidity and sediment deposition were mitigated. In response to DFO's concerns, the Proponent has proposed a plan to implement shoreline stabilization works at sites identified as high-risk erosion sites, and to conduct monitoring over the medium and long term to determine the effectiveness of the mitigation measures and if there's a requirement for further mitigation (Manitoba Hydro and Nisichawayasihk Cree Nation, September 2004). DFO also notes that, following on the advice of DFO, the benthic monitoring component of the Draft Aquatic Effects Monitoring Program was modified to include a component specifically intended to detect impacts of increased shoreline erosion and resulting suspended sediment and sedimentation in Wuskwatim Lake (Manitoba Hydro and Nisichawayasihk Cree Nation, July 2004). In addition, a sentinel species approach to fish monitoring was proposed by the Proponent in its supplemental information to assist in

differentiating effects from project operation from the expected increased use of the fishery following construction of the access road.

In response to a question by NRCan regarding timber removal in areas susceptible to erosion as a means of minimizing effects on the reservoir, the Proponent indicated that while clearing around the edge of eroding shorelines on Wuskwatim Lake would reduce the amount of new trees entering the water over time, this could also facilitate destabilization of the shorelines and potentially result in terrestrial shoreline impacts. DFO also notes that instream woody debris can be an important component of fish habitat. The Proponent maintains that Manitoba Hydro's Debris Management Program will address existing and future debris densities around Wuskwatim Lake.

DFO believes that, overall, the changes to fish habitat from turbidity and sediment deposition will not cause a harmful alteration, disruption or destruction of fish habitat if the additional mitigation measures proposed are developed and applied as required, and the proposed monitoring is undertaken to confirm the Proponent's predictions and adapt mitigation as necessary. The continuation and expansion of present programs being undertaken by the Proponent at various locations in Manitoba for mitigation of hydro-development related erosion, such as various bank stabilization measures, are considered promising by DFO. With the implementation of the measures proposed, DFO and TC conclude that significant adverse impacts to fish and fish habitat from increased erosion due to the Wuskwatim Generation Project are not likely.

7.1.2.5 Downstream Erosion (Reaches 3 and 4)

During operation, the Proponent expects that bank erosion along the Burntwood River downstream of the proposed generating station would be unchanged. The Proponent believes there will be no change in peak flood flows as a result of the Project so that channel-forming processes would be unchanged. Daily water level fluctuations from station operation are not expected to decrease riverbank shear strength so that increased riverbank erosion is also not predicted by this mechanism. However, the Proponent does indicate that increased erosion of riverbanks and riverbed in response to new flow patterns initiated in the construction phase may extend into the early operation phase and result in increased TSS in the initial period of operation. The Proponent predicts that the effects of this on fish habitat will be negative, short term, small to moderate and local to regional.

Comments/Conclusion

DFO noted that rapid and frequent tail water fluctuations of up to 1.5 m would occur 54% of the time and asked for further comment on the potential for compromised downstream riverbank stability. In response, the Proponent clarified that 54% of the time units would be cycled on and off but that the resulting water level change within the 0.9 to 1.5 m range was dependant on which unit was on or off and whether this occurred in the open-water or ice-cover seasons. The Proponent indicated that the riverbanks are low permeability clay soils that would not experience significantly more wetting by the expected sub-day short duration increases in water level above the mean water level. In addition, the riverbanks are generally low and would be expected to have a low

susceptibility to bank failure. In places where bank heights of 3 to 4 meters occur, the Proponent maintains that the relatively great channel depths of 10 m or more are expected to provide a large enough mass of water against the base of the channel side slope to counteract potential slope failures. The Proponent noted that their analysis did not apply to the peat lands in off channel embayments.

NRCan observed that the river channel does not appear to be an alluvial channel so channel-forming discharge may not be the major force that determines channel size and shape. Nevertheless, NRCan agrees that minor changes to flood flows downstream imply that changes to erosion risk areas would be minimal.

DFO notes that while significant long term increases in riverbank erosion are not expected by the Proponent, the short-term increases in erosion of riverbed and riverbanks expected by the Proponent in response to new flow patterns during initial operation may also be harmful to fish habitat. However, DFO also notes that the mitigation and monitoring to be carried out during the construction phase as described in the Draft Sediment Management Plan (Acres Manitoba Limited, 2004) will adequately address the potential impacts of initial operation and provide information to assess the need for further longer term mitigation and monitoring of streambank erosion. The Proponent also anticipates gathering additional riverbed information during dewatering and reconstruction of the spillway area channel to refine mitigation strategies. Manitoba Conservation has indicated that they will require the Proponent to develop a multi-year monitoring program for measuring rates of shoreline erosion at representative sites along potentially-affected downstream reaches of the Burntwood River. In consideration of the Proponent's analysis, advice from NRCan, and the mitigation and monitoring measures described, DFO and TC conclude that significant adverse effects to fish habitat will not result from riverine erosion downstream of the Project.

7.1.2.6 Other Potential Effects on Water Quality from Project Operation

In addition to the sediment impacts described above, the Proponent noted that conversion of intermittently wetted to permanently wetted habitat in Reach 1, in particular in waters adjacent to Wuskwatim Lake (Sesep Lake, Wuskwatim Brook) may cause measurable increases in nutrients, including organics that may lead to decreased oxygen levels on decomposition, particularly under ice. The Proponents expects these impacts to Wuskwatim Lake water quality to be small, site-specific, and last less than five years. Similarly, the Proponent indicates that flooding of terrestrial areas in Reach 2 could increase inputs of nutrients, organics, metals and sediment. The Proponent predicts these impacts will also be small to moderate and localized, but longer term. Beyond the potential short-term increase in TSS described above, the Proponent does not expect impacts to water quality downstream of the generating station during operation.

The Proponent will verify the accuracy of their predictions with monitoring as described in the Draft Aquatic Effects Monitoring Program (North/South Consultants Inc., 2004). In response to concerns raised by downstream communities, the Proponent expanded downstream core monitoring to include a site upstream of Thomson below Birchtree Lake and 4 sites downstream of Thompson, with the furthest site just upstream of Split

Lake. Environment Canada reviewed the Proponent's impact assessment respecting the Project's potential impacts to water quality and the subsequent water quality monitoring program submitted at theirs and DFO's request. Environment Canada was satisfied that water quality issues had been adequately addressed and concluded that the draft program has the necessary elements for an aquatic effects monitoring program. Environment Canada also noted the Proponent's commitment to add additional details and/or modify plans once additional baseline data has been collected and/or as a result of monitoring results/findings. In consideration of the proposed mitigation and monitoring, and the advice of Environment Canada, DFO and TC conclude that significant adverse effects to water quality are not likely.

7.1.3 Fish Movements and Turbine Mortality

In their assessment of the impacts of the Project on fish movement (Volume 1, Section 6.8, Volume 5, and supplemental information) the Proponent notes that the reduction of water velocities at Wuskwatim Falls is expected to result in more fish being retained in Reach 1 due to fewer larval fish being swept downstream out of Reach 1 and the ability of most non-larval fish to move freely between Reaches 1 and 2. Reduction of water velocities at Wuskwatim Falls will allow most fish to move upstream from Reach 2 into Reach 1 and thereby have access to fish habitat within all of Wuskwatim Lake and adjacent water bodies. Additionally, due to less favourable habitat at the downstream end of the forebay, combined with the reduction of water velocities at the generating station intake as compared to Taskinigup Falls, the Proponent expects fewer fish to move downstream out of Reach 2 into reaches 3 and 4. The Proponent acknowledges that some proportion of those fish that do move downstream through the generating station will be susceptible to turbine mortality (discussed below). Consequently, the Proponent expects that the fish community in reaches 3 and 4 will be affected by the smaller number of migrants from upstream of the generating station. The Proponent predicts that fish movements downstream of Opegano Lake will not be affected by operation of the generating station. In addition, as it is unlikely that upstream passage is currently possible at Taskinigup Falls, the Project will not likely change the present condition with respect to upstream passage

The Proponent maintains that downstream passage facilities are not necessary in the design of the Project for the following reasons:

- there is currently no upstream fish passage; therefore, any fish moving downstream are permanently lost to upstream locations which are utilized by domestic, commercial, and recreational fishers;
- fish located downstream of Taskinigup Falls (e.g., Opegano Lake) are not currently utilized by either domestic, commercial, or recreational fishers due to poor access, unsafe travel conditions, and low fish abundance;
- fish moving downstream would move from an area being positively effected by the Project (e.g., stabilized water levels in Wuskwatim Lake) to an area being negatively effected by the Project (e.g., increased water level fluctuations downstream of the generating station); and

- the number of downstream migrants during operation of the Project is expected to decrease relative to the present condition.

DFO recognizes that some data was collected in support of the EIS to indicate the implications of fish passage at the Wuskwatim Generating Station, but believes that the data provided does not unequivocally support a lack of need for fish protection at the Wuskwatim GS. DFO notes that the information contained in the EIS indicates that a large number of fish presently reside (at least at certain times of year) between the Wuskwatim Falls and Taskinigup Falls (Reach 2), that Walleye CPUE (catch per unit effort) was higher in this reach than in any other reach surveyed (Volume 5, Section 8, Page 8-23), and that the Proponent believes it unlikely that individual Walleye carry out their entire life cycle within the Reach. Furthermore, the CPUE for lake cisco was also higher in Reach 2 than in all but one of the other reaches studied, and the Proponent thinks it unlikely that significant spawning or overwintering of this species occurs in Reach 2. In DFO's view, these observations suggest that a considerable number of adult fish may be presently moving downstream over Wuskwatim Falls and ultimately over Taskinigup Falls. Significant downstream fish movement is further supported by tagging studies as summarized in Volume 5, Section 8.3.1 p. 8-19. The Proponent acknowledges that presently an unknown proportion of the Wuskwatim Lake fish community moves downstream over Wuskwatim Falls and in most cases Taskinigup Falls, and notes that the results of radio and floy-tagging data have shown that walleye, lake whitefish, lake cisco, and likely several other species move downstream over Wuskwatim Falls from Reach 1 into the downstream reaches. DFO notes that 5 of the 19 lake whitefish radiotagged in Wuskwatim Lake (26%) that were relocated, were relocated downstream of Wuskwatim Falls. As noted above, larval fish also drift downstream out of Reach 1.

Turbine Mortality

The three turbines selected by the Proponent for the Project are fixed blade vertical shaft turbines, which are considered to result in lower fish mortality than many alternative designs. The Proponent indicates that information on fish mortalities passing through turbines is limited for fish species typical of boreal lakes and rivers and that mortality estimates are variable between studies, fish species, fish lengths, turbine types, and the specific configurations of the generating stations studied. However, the Proponent estimates that for fish lengths between 15 and 40 cm, mortality is generally expected to fall between 10 and 20% of the fish moving downstream through the turbines. DFO noted, however, that in the proposed design, the trash rack spacing (165x500 mm) will allow entrainment of fish larger than 40 cm, for which mortality rates may be higher, and that potential losses of the large spawning fishes may impact productivity in the area. The Proponent also suggested that some unknown level of natural mortality likely exists for fish passing over Taskinigup Falls under current conditions.

Various options to address the issue of turbine mortality and fish passage at the site of the Wuskwatim Generating Station have been investigated to a certain extent by DFO (Northwest Hydraulic Consultants, April 2003) and the Proponent. These options include:

- Various mechanisms to provide safe downstream passage for fishes past the generating station, thus bypassing the turbines;
- Minimization of fish mortality resulting from passage through the turbines or over the spillway through modification of the spillway and turbine design; and
- Prevention of fish from entering the turbines.

Comments

DFO agrees with the Proponent's prediction that the raising of water levels in Reach 2 and a reduction of current through the outlet of Wuskwatim Lake (presently Wuskwatim Falls) as a result of the Project may reduce larval drift into Reach 2 as well as result in an option for potential migration of adult fish back to Reach 1. However, DFO notes this may also more readily allow for a greater number of fish to move out of Reach 1 into Reach 2 due to increased ease of passage through this area.

DFO also notes that traditional users of the fisheries resource from the Nisichawaysihk Cree Nation have consistently identified Wuskwatim Lake as historically a very important area for fishing, through many consultation processes. Historical fishing of the area downstream of Reach 2 (Reach 3) has also been identified by NCN resource users in consultation with DFO and Manitoba Water Stewardship. The Proponent predicts the increased access to Wuskwatim Lake afforded by the Project will result in increased exploitation by fishers from NCN. While the Proponent also suggested lack of safe access is expected to limit exploitation of the fishery resource downstream (Reach 3) in the near future, DFO observes that the Project will afford greater access to this area as well and its long term potential use is uncertain.

DFO agrees that the low head station design and slow rotating propeller style turbines selected are generally believed to result in lower mortality then many alternative designs. DFO also agrees that there is significant uncertainty pertaining to fish mortality at the proposed Wuskwatim Generating Station due to a general lack of research in turbine mortality of fish types present at the Wuskwatim Generating Station; a general lack of research in turbine mortality for dams and turbine styles of similar type to the proposed Wuskwatim Generating Station; limited knowledge regarding the overall numbers of fish expected to pass through the turbines; and the survival rates of fish passing through the turbines. Some of the uncertainty in fish behavior near similarly designed intakes, and impacts to fish on passage through the kinds of turbines included in the station design are expected to be addressed through the proposed study impacts to fish as a result of downstream passage through hydroelectric generating stations in northern Manitoba to be conducted at the Kelsey generating station (Manitoba Hydro, October 2004).

DFO also requested that further methods to limit entrainment and/or minimize fish mortality at the Wuskwatim Generating Station be investigated and implemented as part of the Project and that a proposal for monitoring the effectiveness of these measures be developed. Measures to further exclude fish from potential entrainment would have the benefit of retaining fish, as noted by the Proponent, in an area of higher quality habitat and heavier exploitation by NCN members, and of preventing fish from entering a reach

of the river expected to experience a reduction in habitat quality as a result of the Project. In response to this request the Proponent has proposed the following additional measures to address uncertainties and mitigate adverse impacts:

- A review of the station design to minimize station mortality.
- The identification and implementation as required of suitable mechanisms to reduce entrainment following additional review of hydraulic information from turbine performance studies; and additional study of trashrack effects and trashrack design options.
- The development of a post-Project monitoring program and implementation of appropriate follow-up mitigation if necessary.

Conclusion

With the measures proposed DFO is satisfied that Manitoba Hydro and NCN are committed to reducing the potential for fish mortality at the proposed Wuskwatim Generating Station and that the undertaking of the proposed studies will provide information that will allow Manitoba Hydro and NCN to develop a modified design to limit entrainment and/or minimize fish mortality, as well as a monitoring program capable of evaluating the effectiveness of those measures developed. DFO also notes NCN and Manitoba Hydro's commitment to further mitigate turbine effects should post-Project monitoring indicate that necessity, and Manitoba Hydro's commitment to improving the certainty of impact predictions through their study of turbine impacts and fish behavior at the Kelsey generating station. With the implementation of the measures proposed DFO and TC conclude that significant adverse impacts to fish movement and survival from the Wuskwatim Generation Project are not likely.

7.1.4 Abnormal Operations

According to the Proponent, normal operation is considered to be when water levels on the reservoir are maintained between 233.75 and 234.00 m ASL, which is expected for 97.5% of the time. During periods when inflow to Wuskwatim Lake declines to below 660 m^3/s (estimated at 7% of time), the Proponent notes that conditions may arise when storage in the reservoir would be used, with the result that water levels on the lake would be gradually decreased below 233.75 and then respond for a period of several days or weeks. The Proponent estimates that use of reservoir storage will occur approximately 2.5% of the time.

The Proponent notes that the effect of abnormal operation depends to a large extent on the frequency, magnitude and duration of drawdown. The nearshore and intermittently exposed environment will tend to shift towards conditions seen during low flow conditions in the pre-Project environment. The greatest relative change would occur when a prolonged period of normal operation was followed by an extended period of abnormal operation. In this case, the Proponent predicts that benthic invertebrate abundance and the biomass of aquatic plants in the nearshore and intermittently exposed environments would be reduced, and the die-off of plants could result in localized effects

to water quality. According to the Proponent, changes in lower trophic levels would also impact the fish community, with the relative effect depending on the magnitude and duration of the change in the lower trophic levels. Certain fish species could also be directly affected (e.g., access to spawning areas, exposure of eggs), depending on the timing of the drawdown.

The Proponent expects that periods of abnormal operation will be followed by periods of recovery as the aquatic community returns to the condition typical of the normal operating regime. As these events are predicted to be infrequent, the Proponent maintains that they will not affect the overall lake environment in the long term.

Comments/Conclusion

DFO agrees that depending on the timing, magnitude, duration and frequency of the drawdowns, the impacts of the abnormal operation described could vary. DFO notes that the predicted benefits of water level stabilization by the conversion of intermittently exposed areas to those permanently wetted in Reach 1 could be reduced by the abnormal operations.

At the request of Environment Canada, the Proponent provided additional information on the impacts of emergency operations under low flows on the downstream water levels. The Proponent ran additional operational scenarios, finding that water levels on Birchtree Lake could rise slightly more than the proposed maximum daily change restriction of 0.1 m if inflow was low, only one unit was operating, and there was a failure in the HVDC transmission system. The joint probability of these events was predicted to be very low at less than 1 in 90 years (i.e. $p<0.01$). The Proponent indicated that it would install additional monitoring sites on Birchtree Lake to provide sufficient data to allow lake level averaging for removal of wind and wave effects to determine water level changes resulting from Wuskwatim GS operation.

DFO is satisfied that monitoring as described in the Draft Aquatic Effects Monitoring Program and supplemental information (North/South Consultants Inc., 2004, and Manitoba Hydro and NCN, July, 2004 and September, 2004) will detect any incremental impacts that may result from abnormal operations. In consideration that any incremental impacts to fish habitat expected due to abnormal operations will be compensated for as proposed in the Proponent's Draft Fish Habitat Compensation Plan (North/South Consultants Inc., 2004), DFO and TC conclude that significant adverse impacts to fish habitat as a result of abnormal operation of the Project are not likely.

7.1.5 Potential Effects on Fish Habitat from Changes in Hydroelectric System Operation

As described in Section 2.3, the proposed Wuskwatim Generation Station will form a part of Manitoba Hydro's province-wide generation system. A number of stakeholders, including DFO, Environment Canada, environmental non-government organizations and Aboriginal communities expressed concern regarding how the operation of the

Wuskwatim Generation Station would influence operations on the larger Churchill/Nelson generation system. DFO requested the Proponent provide more information on the effects to fish habitat that might result from changes in system operation. The Proponents responded in both the first and second Supplemental Filings (Manitoba Hydro and Nisichawayasihk Cree Nation, August and October, 2003 respectively), and in addition, conducted further analysis on potential changes to operation of Lake Winnipeg Regulation (LWR) in response to concerns raised by the Cross Lake First Nation.

The Proponent maintains that operation of the Wuskwatim Generating Station will not cause changes in the operation of the Churchill River Diversion. According to the Proponent, the Wuskwatim Generating Station will normally operate in a modified run-of-river mode, where the station will produce more power during the day and less during the night (accomplished by varying the flow through the station). Water levels and flows along the Rat and Burntwood River systems are expected by the Proponent to continue to vary from year-to-year and month-to-month as they do presently, except in the area between Early Morning Rapids and Opegano Lake (those areas directly affected by the Project), the impacts of which are discussed in previous sections of this report.

The Proponent did, however, indicate that the Project may have a small effect on the LWR and operations at the Stephens Lake reservoir on the lower Nelson River, because the energy as sold may not exactly match the energy as generated at the Wuskwatim Generating Station, and these operations would compensate for any mismatches in seasonal generation and daily energy generation, respectively. At the request by DFO to provide more information on these potential effects, the Proponent analyzed two scenarios, one whereby the Wuskwatim energy is used for domestic energy or “firm sales” and one whereby the Wuskwatim energy is sold on the export market with the intent of maximizing return (non-firm). The Proponent noted that hourly and/or daily mismatches would be balanced using the Stephens Lake reservoir and concluded that the maximum difference Wuskwatim energy was expected to make in the operation of this reservoir was less than 1 cm within an operating range of approximately 1.7 m.

The Proponent predicts that any impacts to flows and water levels in the system, outside of that area on the Burntwood River directly affected by the Project, would be most evident at Cross Lake, which is immediately downstream of the Jenpeg station which controls outflows from Lake Winnipeg. The Proponent also analyzed two “worst case scenarios” involving a 15% reduction in all water supply and a modification of the price pattern for export sales by increasing summer season prices relative to winter. Outcomes from the analyses are shown in Table 4.

These water level changes were compared to an average weekly fluctuation of over 6 cm (largely from daily cycling of Jenpeg under normal summer operating conditions) and an average annual range of over 1.3 meters (maximum 2.7 m). Other factors affecting water levels noted by the Proponent are waves (maximum 1.3 m), ice effects (maximum 0.27 m), and wind setup (maximum 0.17 m).

Table 4: **Predicted changes in Cross Lake water levels under various scenarios as modeled for the load year 2012.**

Scenario Modeled	**Summer** Total Range of Cross Lake Water Levels = 2.1m (1.7 m for 15 % reduction scenario)		**Winter** Total Range of Cross Lake Water Levels = 1.2 m (1 m for 15% reduction scenario)	
	Average Water Level Change (cm)	**Maximum Water Level Change (cm)**	**Average Water Level Change (cm)**	**Maximum Water Level Change (cm)**
Firm Sale	-1.2	-3.6	1.5	0.14
Non-firm sale	3.9	10.8	-3	-7.8
15% overall flow reduction, firm sale	-0.6	3.9	0.6	3
15% overall flow reduction, non-firm sale	0.3	6.6	-0.9	5.7
Increased summer pricing, firm sale	0.9	9.6	-.9	7.5
Increase summer pricing, non-firm sale	0.9	9.9	-0.9	9.6

In their analyses the Proponent identified a number of constraints that limit how much impact Wuskwatim energy could have at Cross Lake with the key constraints being:

- Wuskwatim represents only 4.1% of existing system and 5% of lower Nelson River capacity, respectively.
- Flow patterns on the Burntwood River are already regulated at the Notigi control structure to best accommodate demand for power generation in the lower Nelson River.
- The travel time from Jenpeg to the lower Nelson generating stations, where 75% of Manitoba's generation capacity is, is 4 to 6 weeks, which would preclude accommodating day/night mismatches of energy generation and sale using outflows at Jenpeg.
- Constraints on Jenpeg operation including a two-week notification requirement prior to changing outflows at Jenpeg; a 15,000 cfs/day limit on flow changes in a 24hr period, a minimum outflow from Lake Winnipeg of 25,000 cfs and a minimum water level in Lake Winnipeg at 711 ft ASL below which outflows are set by the Minister of Water Stewardship, and a requirement to regulate for flood control above 715 ft ASL in Lake Winnipeg.
- Limits in channel capacity in the outlet area of Lake Winnipeg under ice conditions and limits in flows under ice forming conditions.

The Proponent also stated that the power requirements during construction of the generating station will not cause any change to the way the northern hydroelectric system will be operated and that the CRD operation will not be modified to assist in the closure of the cofferdam.

Comments/Conclusion

The Proponent predicts that the effects on fish and fish habitat from water level changes of the magnitude indicated in Table 4, within the existing fluctuation range, would not be perceptible and would not have a significant effect on fish habitat productivity. DFO is in agreement with this view.

The Water Sciences and Management Branch of Manitoba Water Stewardship reviewed the information submitted by the Proponent and concluded impacts to Cross Lake water levels as a result of changes in operation of the LWR due to Wuskwatim energy, if any, would be minimal.

In consideration of the constraints under which Manitoba Hydro is required to operate, that any variation in water levels and flows in the system to accommodate sales of Wuskwatim energy would be very small and within the existing physical and licence limitations, and in consideration of the expert opinion provided by the Water Sciences and Management Branch of Manitoba Water Stewardship, DFO and TC conclude that significant adverse impacts to fish habitat as a result of changes in the Manitoba hydroelectric system operation due to the Project are not likely.

7.1.6 Compensation Program for Fish Habitat

In keeping with DFO's *Policy for the Management of Fish Habitat* (1986), an Authorization under Section 35 (2) of the *Fisheries Act* will not be issued until acceptable measures to compensate for the loss of productive fish habitat are developed and specific terms and conditions for the development of new habitat or enhancement of existing habitat are agreed upon. DFO's policy outlines the following order of preferences for achieving no net loss through habitat compensation.

- create or increase the productive capacity of like-for-like in the same ecological unit;
- create or increase the productive capacity of unlike habitat in the same ecological unit;
- create or increase the productive capacity of habitat in a different ecological unit; and
- as a last resort, use artificial production techniques to maintain a stock of fish.

To replace habitat harmfully altered, disrupted or destroyed as a result of the Project, the Proponent has proposed the following compensation work and activities:

- In combination with mitigation measures to stabilize two low-lying areas on the eroding north shore of the peninsula that separates the main basin of the lake from the Wuskwatim Brook area on the south end of the Wuskwatim Lake (designated Site W1), the Proponent proposes to enhance lake whitefish and lake cisco spawning opportunities through the creation of three to five reefs of approximately 16 m^2 basal created along the eastern shore of Wuskwatim Lake south of Wuskwatim Falls. The stabilization measures will directly protect productive habitat in the Wuskwatim

Brook area and indirectly protect an habitat in a bay just to the southeast. Productivity is expected to be enhanced through the creation of the reefs.

- Placement of suitable rock substrate within the excavated bedrock channel between Wuskwatim Lake and the immediate forebay (Site W2), with the intention of creating suitable habitat for the colonization of invertebrates and providing spawning areas for lake whitefish and walleye. DFO expects that with appropriate engineering, the proposed habitat enhancements to the excavated channel may provide suitable spawning areas for lake whitefish and walleye, and may therefore provide benefits to the productive capacity in Wuskwatim Lake.

- Restoration of degraded habitat on Wuskwatim Lake (Site W3) that resulted from the CRD. The intent at this location is to remove selected debris from the stream mouth and along the stream banks, leaving anchored material in place, and armouring the narrow peninsula at this site with rock to prevent further erosion, thus offering protection to the mouth of the tributary.

- Stream mouth enhancement works further upstream of Wuskwatim Lake on the Burntwood River system in the Nelson House area. The intent of the works in the Nelson House area is to increase the productive capacity of fish habitat through the improvement of habitat diversity in the lower sections of small streams and associated bays where the littoral and riparian areas have been adversely affected by CRD, and by the provision of improved fish access to tributary streams that are currently blocked by debris generated largely by the impacts of the CRD. Three sites have been selected on Threepoint and Wapisu lakes, based on Traditional Knowledge from NCN Elders and site surveys conducted by Project biologists and NCN members. Methodology currently being examined includes methods to re-establish emergent and riparian vegetation and methods to enhance in-stream structure at the lower end of the stream.

The first project appears to address specific objectives of no net loss as it would mitigate the cumulative impacts of erosion resulting from the Wuskwatim Generation Project in combination with the CRD, while also providing habitat remediation/enhancement for lake whitefish and lake cisco. The remaining projects proposed are also consistent to varying degrees with the first, second and third preferences in the hierarchy. While the proposed sites on Threepoint and Wapisu lakes are further removed from the impacts of the Project, and are therefore unlikely to positively impact productive capacity in the same ecological unit as the Project area, they are on the same system experiencing impacts from the Project, and in an area impacted by a previous project (CRD). NCN has identified these areas as important to them, and compensatory works near Nelson House are unlikely to be confounded by Project impacts. It should be noted that the effectiveness of the compensation program will be measured through a follow-up program over several years to allow for verification of the evolution of the environment during work and following its completion, as well as to verify the effectiveness of the compensation measures and to determine the necessary adjustments, where applicable. DFO is of the opinion that the above combination of proposals, with monitoring to demonstrate their

function as productive habitat, will adequately compensate for fish habitat harmfully altered, disrupted or destroyed as a result of the Project.

7.2 Birds

The Proponent discusses the anticipated impacts on birds in Volume 1, Section 7.8, and Volume 6, Section 8 of the Environmental Impact Statement (Manitoba Hydro and NCN, 2003). According to the Proponent, the residual negative effects of the Project to birds after mitigation are expected to be long-term, local, and small.

The Proponent indicates that potential construction-related effects on birds are primarily associated with:

- the clearing of habitat along access roads, borrow areas and at the generating station site area;
- clearing and staged flooding of the forebay area between Wuskwatim Falls and Taskinigup Falls; and
- noise associated with machinery, people and activities such as blasting.

The Proponent estimates that Project construction will change as much as 1,605 ha of terrestrial habitat (Figure 13) through clearing, excavation, grading, infilling and erection of structures. The Proponent notes that this disturbance area includes all nine major potential borrow pits; and that likely only three of these borrow areas, yet to be identified, will ultimately be used, reducing the total area actually cleared by as much as 35%.

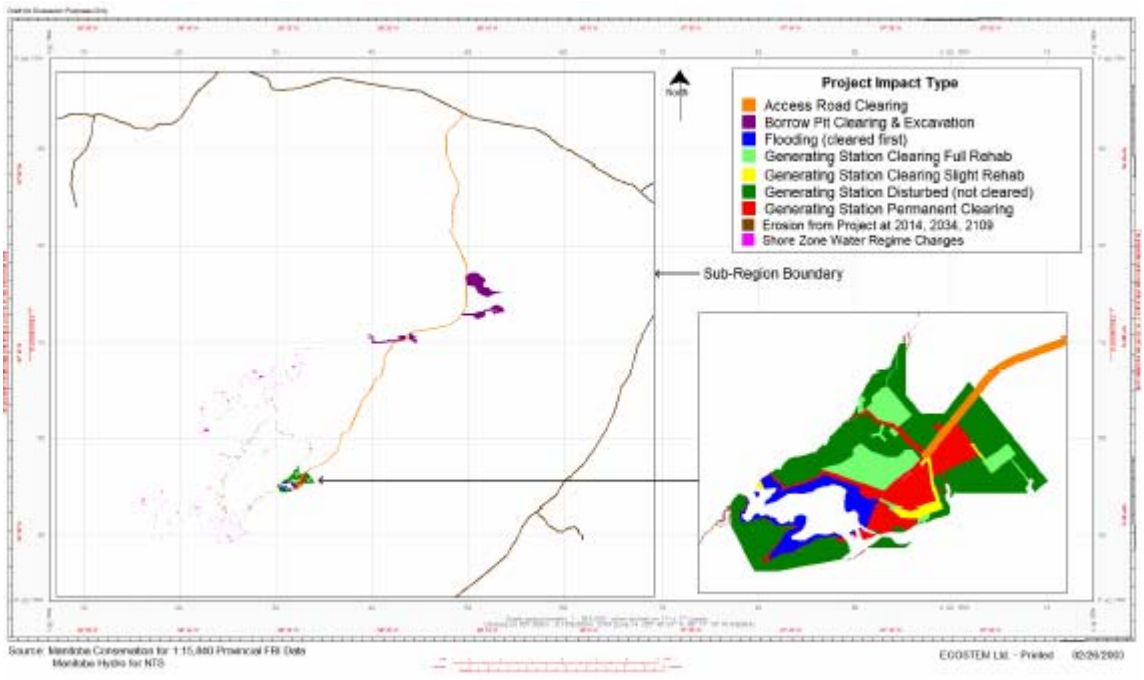

Figure 13: Areas cleared or physically altered during construction and/ or operation. Note: Shore Zone and incremental project erosion impact areas appear spotty because the areas affected are small (Manitoba Hydro and NCN, 2003; Vol. 1, p. 7-24).

Stabilization of water levels within a narrow range slightly below post-CRD high water levels will affect the shore zone, lake peatlands, and mineral islands. The average width of the Shore Zone beach habitat will be substantially reduced by stable water levels and a small band of incremental upland/ mainland habitat loss will occur in susceptible areas due to Project related erosion (Figure 13).

Field studies carried out by the Proponent suggested that sites proposed for construction did not contain rare or endangered bird species, but generally consisted of spruce-dominant forests that supported bird species common to the region. Some potential construction-related effects to birds, such as those resulting from clearing and blasting, can be minimized by restricting those activities to outside the most sensitive breeding and brood-rearing months (i.e., May to late July). Where possible, blasting schedules will be augmented to minimize potential impacts to the critical life functions of birds. Upon completion of construction, the Proponent has committed to removing all Project structures and features not required for operation. Rehabilitation of these areas will be assisted by removal of gravel pads, loosening compacted soils and spreading available organic material on exposed mineral soil. The Proponent states that through these mitigative measures, construction-related impacts to birds are expected to be small to moderate, site-specific, and short to long-term.

According to the Proponent, the operation-related effects on birds are primarily associated with:

- long-term loss of marsh and peat island habitat due to stabilized water levels in Wuskwatim Lake;
- land loss through erosion; and
- increased human access to the Wuskwatim Lake area .

Water level stabilization will reduce the frequency of nest flooding of those bird species that nest near water level such as loons, grebes and many waterfowl (geese and ducks). However, water level stabilization is also expected to gradually degrade offshore marsh areas, which will reduce marsh nesting and cover habitat for some species (e.g., many waterfowl, grebes, rails, and red-winged blackbird). ‘Off-shore marsh habitat’ for the purpose of bird impact evaluation, is described by the Proponent as peatland habitat consisting of Typha (i.e., cattails), Carex (i.e., sedge) with Typha fringe or, low shrub habitat with Typha fringe. Over the long-term, the Proponent predicts that those birds that require marsh habitat would gradually be displaced to other marsh habitat available within the local bird study area. The long-term loss of peat island habitat will reduce the amount of optimal nesting habitat for several waterbird species including geese, loons and some ducks.

Considering the predicted decline of offshore marsh habitat and offshore peat islands over the long-term, and expected increase in access for hunters to the Wuskwatim Lake area, operation of the Project is expected by the Proponent to have an overall long-term negative effect to waterfowl in the Wuskwatim Lake area. Access-related effects, such as

opportunistic hunting of waterfowl, are expected to be mitigated through the implementation of an Access Management Plan for the access road (see Section 7.5.1). The Proponent notes that a limited amount of forested shoreline habitat will be affected by the operation of the Project due to increased erosion, which may marginally impact some songbird and raptor habitat.

Operation of sirens warning users of the waterway in the vicinity of the dam of gate operations that will result in water level fluctuations has also been identified as a potential source of disturbance to birds. It is the Proponent's opinion that overall, negative effects to birds associated with Project operation are expected to be small to moderate, local, and long-term.

Monitoring

Monitoring by the Proponent of Project-related impacts to birds will occur during the construction and operation phases of the Project to confirm predictions of effects and to determine whether unexpected effects are occurring. Included in the proposed program will be monitoring of local bird population reactions to construction-related disturbances that are either least understood and less accurately predictable due to lack of relevant previous studies, or which require investigation because of the potential for substantive effects. Among the construction related disturbances that require additional study to deduce the effects to birds include blasting and forebay water level increase. Therefore, the Proponent has proposed boat and helicopter-based bird surveys in habitats near where clearing and construction activities would occur.

The Proponent expects three to four years of bird survey data, followed by a monitoring program review, will need to be carried out during Project operation to test EIS predictions regarding bird impacts and to determine if any mitigation efforts are required due to unexpected impacts. The level of effort during Project operation monitoring studies by the Proponent (2010 to 2014) will duplicate the baseline studies conducted in 2000, 2001 and during additional baseline studies for boat- and helicopter-based surveys. The Proponent proposes the level of effort with respect to terrestrial breeding bird surveys be focused on those transects that occur within key habitat types that are expected to be most affected by the new water regime. Recommended bird monitoring activities to be carried out by the Proponent during the operation phase of the Project include terrestrial breeding bird surveys, boat-based surveys and helicopter surveys. All monitoring results would be submitted to Manitoba Conservation.

The Proponent has also proposed monitoring the water regime and providing a report to Manitoba Water Stewardship and/or Manitoba Conservation every five years (starting in year three of operation) for the first 25 years of operation. The upstream and downstream water regime review will be based on an analysis of water elevation data provided by Manitoba Hydro. Each report will include an analysis of relevant data, a comparison with assumptions included in the EIS, an assessment of how any changes alter the effects of the assessment, and a recommendation on whether or not contingent monitoring is required.

Comments/Conclusion

Environment Canada reviewed the Proponent's impact assessment respecting the Project's potential impacts to migratory birds and their habitat and concluded that in their opinion, the information was well-presented and addressed the areas of concern and interest to Environment Canada. Environment Canada also advised that while the slower start-up of a siren may not be as likely to startle birds, the sirens would also be sounding at a frequency at which birds are not as likely to habituate. In general, Environment Canada'a view is that the siren would have a minimal effect on local birds. The Proponents monitoring program will be able to detect any unforeseen impacts.

In consideration of the Proponent's analysis, proposed mitigation and monitoring, and the expert advice of Environment Canada, DFO and TC conclude that significant adverse effects to birds are not likely.

7.3 Species at Risk – Woodland Caribou

The Proponent summarizes effects to woodland caribou as negative, short-term, small, and regional during construction, and long-term, small and regional during the operation of the Project. The Proponent estimates that impacts from habitat disturbance, sensory disturbance, access, and accidental events will cause a small loss of caribou habitat, may cause changes to movements and habitat use, and could reduce caribou abundance from mortality related to hunting, collisions, fire or increased predation risk.

The Proponent estimates that the combined final footprint of the generating station's structures (i.e., spillway, powerhouse, main dam, etc.) and the excavated materials placement area will be approximately 61 ha. The gravel surfaced, all-weather access road, leading from Provincial Road 391 to the site, will be approximately 48 km in length. The Proponent predicts that woodland caribou will experience a small loss and alteration of habitat at the generating station footprint, access road, and borrow areas, and notes this is within a large area that these animals use. Direct long-term habitat losses are associated with permanently clearing or altering vegetation in the access road ROW, and indirect changes in soil moisture and fertility that may affect adjacent habitat. The Proponent notes that primary caribou habitat covers 73% of the Region, and is concentrated in peatland habitats. The maximum extent of physical losses of primary habitat (excluding future site rehabilitation) in the Upland Project Areas is estimated by the Proponent to be less than 0.2% of the Region.

The Proponent identified a small amount of calving habitat at the proposed generating station site but noted this was one of an estimated 100 or more sites and therefore, predicts that the loss of this site should not be significant. Other known calving areas were avoided by the Proponent during access road routing. According to the Proponent, early winter range, utilized by approximately 16 of an estimated 200 animals, and movement corridors in the Sub-region will be affected by the access road. Limited caribou summer range will also be affected. The Proponent notes that current scientific

uncertainty will be managed by monitoring and post-construction reestablishment of natural vegetation communities in disturbed areas, especially in borrow areas, work sites, and rock disposal areas. However, it was also noted that it is unlikely rehabilitated habitat will return to pre-disturbance conditions within the time frame of the Project.

The Proponent predicts that woodland caribou will experience small effects from sensory disturbances such as vehicle traffic, machinery operation and blasting during construction, as well as a loss of habitat effectiveness and possibly habitat fragmentation. Increased access may cause increased sensory disturbances to caribou from snowmobiles, ATVs and watercraft involved in recreational, commercial and domestic harvest activities. If construction or operation affect important movements within an individual's territory, it is possible that habitat abandonment may occur. Manitoba Conservation notes that if development displaces caribou from traditional areas, this will expose them to additional predation. Any increases in other ungulate species as a result of the project may also attract additional predators.

Certainty regarding the potential effects is moderate, because of uncertainty concerning harvest mortality and accidental effects such as large fires that may affect caribou habitat. Accidental fires resulting from construction activities or human activity may affect preferred food and/or cover or may cause direct mortality. Accidental vehicle-wildlife collisions can also result in animal injury or mortality.

Mitigation

The Proponent indicates that effective habitat loss will be reduced during construction by limiting traffic volumes, preventing unnecessary access, and Project planning. Effective habitat loss should be lower during operation when many disturbance factors are reduced or terminated. The maximum extent of the effects to caribou involving primary habitat is less than 1% of the Region. It is the Proponents opinion that scientific uncertainties concerning access effects with respect to increased mortality due to hunting, predation and disease are manageable through access management, Project planning and monitoring. The importance of these effects may be reduced if woodland caribou can bypass or cross the affected areas. The possibility of vehicle and wildlife collisions will be reduced by vehicles complying with posted speed limits and installing wildlife warning signs where appropriate.

The Proponent’s evaluation of access road routing alternatives noted that the unavoidable provision of access into the area/site was a key issue common to all of the alternative road alignments. It was noted that caribou, which have low population recruitment rates, are more likely to be affected by access, and access effects have the potential to become widespread throughout the Sub-region during operation. If increased harvest mortalities exceed sustainable levels the number of individuals in a population will be reduced. To address this issue, the Proponent developed a Draft Access Management Plan (AMP, Manitoba Hydro and NCN, 2004) which includes provisions for education and communication, restrictions on use of the access road, and restrictions on hunting and firearms. The AMP is discussed in greater detail in Section 7.5.1. The Proponent also

noted that, according to NCN Resources Program staff, NCN residents do not generally target caribou when hunting, with the exception of occasional harvests by Elders who share the animals within the community. As a result, NCN Resource Program staff do not anticipate that additional harvests of caribou by NCN members as a result of the road will be significant. The Proponent has proposed a Woodland Caribou Conservation Awareness Program stressing the vulnerability and scarcity of the species, for implementation during road construction to mitigate the potential for increased harvests.

Planned mitigation measures such as access restrictions, training in fire response protocols, and the presence of fire suppression equipment at the generating station site and Thompson will reduce the risk of fire damage in the area.

Monitoring

The Proponent believes there is a need to collect additional data, monitor, and assess the outstanding scientific uncertainties regarding Project effects on the Wapisu woodland caribou population. The Proponent and Manitoba Conservation have developed and initiated a program to monitor caribou during the Project. Both VHF and GPS radio-collars are deployed in the range of caribou that may be impacted during construction and operation. Caribou will be monitored yearly during construction, and periodically during operation. In addition, traditional knowledge will also form a major component of the monitoring program. Information will be collected from NCN Elders and resource harvesters during both the construction and operational phases of the Project. Any changes in the behaviour, distribution, or abundance of woodland caribou (as documented through TK) will be recorded and used to design additional monitoring programs if required. The Proponent has also proposed providing a fire regime report annually to Manitoba Conservation during construction and annually for the first 10 years of operation and every five years following that period for 15 years.

Comments/Conclusion

In their review of the Proponent's EIS, provincial reviewers indicated concerns with the Habitat Suitability Index (HSI) models referenced in the documents in that they are not Manitoba based models but were developed for the Model Forest area and that the models are literature based and have not been validated. However, the Proponent noted in response that the Caribou HSI models were developed cooperatively by the Manitoba Forestry/Wildlife Management Project for the Manitoba Model Forest and incorporate Manitoba-based studies. Manitoba Conservation's expert recommends the HSI models be run using data from the area and include the availability of lichen.

At the request of DFO, Parks Canada reviewed the Wuskwatim Generation Project Environmental Impact Statement (EIS), supplemental filings and supplemental information provided by North/South Consultants with respect to the predicted impacts on woodland caribou. Parks Canada determined that the data collected on woodland caribou for the EIS had not been adequately analyzed, and noted as an example that the habitat analysis and production of the HSI map were not derived from data gathered in

the study area but rather, that decisions were based on qualitative information. Parks Canada considers this map critical for the monitoring and management of project impacts on caribou and notes it requires further development. Parks Canada noted that the data collected for the Project pointed to some critical areas for the woodland caribou, including movement corridors. Parks Canada determined that since corridors are key to the overall quality of a range, they need to be further assessed, mapped and mitigation identified where necessary. Additional comment by Parks Canada are included in the discussion of cumulative effects to woodland caribou (Section 7.11.3)

In order to address concerns including those related to cumulative effects described in Section 7.11.3, Parks Canada recommends that the Proponents establish a scientific advisory committee, within six months of approvals being granted, comprised of representatives of directly affected communities, Manitoba government representatives, scientists and where appropriate, Government of Canada representatives. This committee should assess ongoing impacts of project activities and recommend adaptive management actions. Specifically, the committee would:

a) identify additional research and monitoring requirements to protect ecosystems, with particular consideration for woodland caribou and other species at risk;
b) establish long-term monitoring and research programs to assess impacts;
c) annually review the results of monitoring and research programs;
d) annually report on impacts of project activities and adaptive management actions;
e) collaborate with forestry companies, the transmission line committee/advisors, and other land users in research, monitoring and adaptive management of cumulative effects.

Environment Canada has noted that, under the 1996 Accord for the Protection of Species at Risk, the federal, territorial and provincial governments agreed that the protection of species at risk is a collective responsibility in Canada (Environment Canada, 2005). Environment Canada affirmed their commitment to this partnership, but also indicated that although the boreal population of woodland caribou is listed as a Threatened species on Schedule 1 of the SARA, management of woodland caribou continues to be a provincial/territorial responsibility. Environment Canada is confident that Manitoba has clearly demonstrated a strong commitment to managing its woodland caribou. The province is undertaking consultation regarding the decision to list the boreal population under the Manitoba Endangered Species Act. It has established a Woodland Caribou recovery team and participates on the National Boreal Caribou Technical Steering Committee ("national recovery team"). It has developed an integrated Woodland Caribou Forestry Management Plan; and it has drafted a provincial Boreal Woodland Caribou Conservation Strategy for Manitoba, in addition to conducting research and monitoring activities on an ongoing basis.

Environment Canada believes that the partnership arrangement that has been put in place is an effective approach for overseeing the management of species at risk, including the specific case of the boreal population woodland caribou which may be impacted as a result of the Wuskwatim Project. In addition to the actions taken by the province of

Manitoba, Environment Canada notes that they co-lead and participate in the national recovery team for the boreal population and therefore are involved in the development of a National Recovery Strategy for this species, as well as monitoring the linkages with the component provincial recovery strategies.

Environment Canada agreed to receive copies of the follow-up monitoring reports from the proposed committee for the Wuskwatim Project that relate to woodland caribou. Environment Canada has indicated that, if any future action is needed under SARA to address woodland caribou population impacts, they would continue to be involved, through existing mechanisms in cooperation with the province of Manitoba as described above, or other measures as provided under SARA, to ensure that appropriate mitigation measures are taken.

Considering the above-described mitigation and monitoring with the proposed oversight of the scientific advisory committee, the expert opinions provided by Parks Canada and Manitoba Conservation, and the assurance by Environment Canada respecting their ongoing commitments under SARA, DFO and TC conclude that the Project is not likely to have significant adverse effects to woodland caribou.

7.4 Human Health

Impacts to human health during construction and operation of the Project are discussed in Volume 1, Sections 4 and 9, and Volume 8 of the Environmental Impact Statement (Manitoba Hydro and NCN, 2003). In these sections the Proponent also describes the roles of the on-site construction Safety Supervisor and security officers (for security and fire watch) and personnel, as well as the development of emergency response programs. Fish quality is discussed in Volume 5. Please see also Section 7.5 of this CSR for further discussion of human safety with respect to the Proponent's access management plan.

7.4.1 Air Quality

Construction activities may result in temporary localized changes to air quality, particularly dust impacts relating to road traffic and blasting and crushing operations. These effects are considered by the Proponent to be site specific and short-term. The Generation Project will reduce winter ice fog in the vicinity of Taskinigup Falls. This decrease in ice fog will be a site-specific, long-term unavoidable effect of Project operations. The Proponent indicates that to minimize dust emissions from road traffic, the Contractor will be required to keep roads well maintained to facilitate efficient traffic flow, using such measures as surface improvement (e.g., grading) and/or surface treatment (e.g., watering, chemical-dust suppressants).

Environment Canada requested additional details how the operation of the proposed concrete batch plant will impact air quality. The Proponent described a short-term localized increase in particulate when the concrete batch plant is operated, from which there will be a short-term localized increase in particulate matter when it is in use, largely

from transfer of sand and aggregate, truck loading, mixer loading, vehicle traffic and wind erosion of sand and aggregate piles. The Proponent has proposed to mitigate fugitive emissions from sand and aggregate transfer by washing all sand and coarse aggregate prior to its use which will reduce the dust emissions from these sources.

Environment Canada reviewed the Proponents information related to air quality provided in Volumes 1 and 4 of the EIS(Manitoba Hydro and NCN, 2003), and in the supplemental information. Environment Canada indicated satisfaction with the information provided. In consideration of the proposed mitigation and the expert advice of Environment Canada, DFO and TC conclude that significant adverse effects to air quality from Project construction, and therefore consequent effects to human health, are not likely.

7.4.2 Fish Quality

To assess the impacts of the Project on fish quality the Proponent examined trace metals, internal parasites, and fish palatability in selected VEC species (walleye, northern pike, lake whitefish, and lake cisco). The Proponent predicts that construction of the Project will have no effect on the quality of fish in the study area because significant releases of substances that may cause tainting (such as hydrocarbons) are not expected due to safe handling procedures, emergency response plans, and spill containment measures. Potential effects on fish quality from Project operation are discussed below.

Mercury and Other Trace Metals

For its assessment of potential increases of mercury (Hg) in fish, the Proponent focused on assessing the relationships between habitat changes and fish mercury levels within the broader geographical and historical context of the topic, and noted that monitoring and research have shown that mercury accumulation is a common consequence of flooding. Mercury concentrations in fish in hydroelectric reservoirs generally show a pattern of increase and decline over time, with maximum values usually occurring six to 11 years after flooding and declining to pre-impact levels after approximately 20-30 years.

Two scenarios were developed by the Proponent for anticipated mercury production as a result of the Project (Table 5). The minimum scenario incorporated the effects of the newly flooded area between Wuskwatim Falls and Taskinigup Falls. The maximum scenario incorporated additional inputs into Wuskwatim Lake from the erosion of shorelines and the die-off of peatlands affected by the stabilization of water levels near the upper end of the current range. The Proponent notes that these peatlands are not expected to die off; therefore, it maintains that the maximum scenario over-estimates the potential for mercury production. The Proponent predicts changes will be between these two extremes as follows: mean standardized mercury concentrations in lake whitefish will likely slightly exceed 0.10 µg/g; concentrations may reach 0.35 µg/g in walleye, and could increase to a level slightly below the commercial limit of 0.5 µg/g for pike.

Table 5: Predicted mercury levels in fish flesh (Manitoba Hydro and NCN, 2003; Vol. 1, p. 6-114).

Species	Increase due to the Project (µg/g)		Current Hg (µg/g)	Predicted Hg Levels (µg/g)	
	Min	Max		Min	Max
Whitefish	0.006	0.042	0.097	0.10	0.14
Northern pike	0.025	0.184	0.372	0.40	0.56
Walleye	0.015	0.112	0.282	0.30	0.39

The Proponent predicts that if the time course of mercury concentrations in fish follows the typical pattern for northern reservoirs, maximum levels will be observed 3-5 years post-flooding. Considering that the predicted increases in mercury concentrations in fish associated with the Project will be substantially lower than those due to the CRD, the Proponent predicts that a period of perhaps up to 10 years will be required for concentrations to return from maximum to pre-impact values. The Proponent notes that the impacts on fish mercury concentrations in Wuskwatim Lake and the peripheral smaller lakes are, to some extent, influenced by the amount of mercury imported from upstream waterbodies. The Proponent expects the effects of this process to be minor and within the presently observed variability.

Downstream of the station, in backwater inlets of the Burntwood River and along the northern shore of Opegano Lake, the Proponent expects changes in the water regime to result in the die-off of some areas of peat. Mercury levels in fish resident near decomposing peatlands may increase slightly; however changes in overall mercury levels are not expected by the Proponent due to the large amount of flow in comparison to the small area affected. The Proponent expects no effects to mercury levels in fish downstream of Jackpine Falls (near the outlet of Opegano Lake).

As a result of expected increases in fish mercury concentrations, the Proponent predicts that daily consumption limits for walleye and pike from Wuskwatim Lake could be reduced by approximately 100 g or 19% and 23%, respectively from current safe levels. The Proponent indicates that a 70 kg (155 lb.) adult would still be able to safely eat one meal of whitefish a day even after the expected maximum post-Project mercury levels have been reached.

The Proponent reports that there may be increases in some metals in the nearshore zone of Wuskwatim Lake main, in relation to increased rates of erosion. These increases will be most pronounced in the first five years of operation. However, the Proponent does not predict this pathway to result in increases in the concentrations of metals in fish muscle, because, with the exception of mercury, it does not believe metals are likely to accumulate in that tissue.

Parasites

Operation of the project is expected by the Proponent to result in a small increase in the number of northern pike and lake whitefish in Wuskwatim Lake and adjacent water bodies. Due to the projected increase in pike, a host of the *T. crassus* cyst, the density of

the infective stage of the parasite could increase. Lake whitefish is the secondary host of *T. crassus* and, although its abundance is expected to increase, the Proponent noted it is difficult to predict whether there will be an increase in the incidence of *T. crassus* infestation. Consequently, the Proponent has proposed monitoring of cyst density in commercial catches. Operation of the Project is not expected by the Proponent to release any substances into the aquatic environment or cause any other changes that will compromise or alter fish palatability.

Comments/Conclusion

DFO reviewed the Proponent's analysis and was satisfied that the Proponent's mercury predictions were reasonable. By minimizing flooding through the project design, the potential for significant mobilization of mercury is largely mitigated. DFO notes that the worst-case scenario is based on a model that assumes that all of the previously intermittently flooded areas are in fact new flooding. Because these areas have been intermittently flooded for the last 25 years, they should have lower potential to convert mercury to methyl mercury (the more biologically active form) than previously unflooded upland and wetland areas, thus the Proponent's modeling can be considered conservative. The proponent has proposed monitoring of mercury in fish in Wuskwatim Lake and two downstream lakes, as well as two reference lakes, in years 4 and 6 of the project. At the request of Health Canada, monitoring of mercury in fish will also be undertaken in year 2 of Project operation, to verify the mercury levels predicted in whitefish, northern pike and walleye harvested from these lakes. Given the low likelihood that mercury will be increased by measurable amounts by the Project, DFO considers this relatively low frequency of sampling, as well as the methods for collection of fish and analysis of samples, appropriate.

At the request of Health Canada, the Proponent revised their analysis to place greater emphasis on impacts to sensitive subgroups of the population including women of childbearing age, infants and children. Referring to the table presented in the Proponent's EIS, Health Canada suggested that the Proponent include the statement that "The developing fetus and children are more sensitive to the effects of mercury. Therefore, women of child-bearing age should limit their intake of walleye (pickerel), pike and whitefish to approximately half of the levels presented above for adults in general. Children and infants should be limited to much lower levels. For example, a child weighing 20 kg should limit consumption to approximately one-sixth of the level presented in the above table. For whitefish from Wuskwatim Lake, for example, this would be equivalent to less than two weekly meals of 100 g of whitefish (based on Health Canada's provisional tolerable daily intake of 0.20 µg/kg bw/day for sensitive members of the population)." The Proponent incorporated this advice into their assessment in a revised table (Supplemental Filing #2, Manitoba Hydro and Nisichawayasihk Cree Nation, October 9, 2003). The fish consumption levels suggested by Health Canada for whitefish, northern pike and walleye harvested from watersheds in the Project area and consumed by adults, women of childbearing age, and young children are attached in Appendix 2. These intake figures are estimated from calculations of recommended

maximum weekly intakes based on predicted mercury levels in the filet of these fish species and currently available provisional tolerable daily intakes for methylmercury.

In consideration of DFO's review of the Proponent's analysis of potential mercury accumulation, the proposed monitoring, and the expert advice of Health Canada, DFO and TC conclude that the Project is not likely to have significant adverse effects on human health due to fish consumption.

7.4.3 Drinking Water Quality

According to the Proponent, use of water in Wuskwatim Lake is limited to that by resource users. There is little resource use currently or expected immediately downstream of the proposed Project. The Project may have local impacts to water quality in Wuskwatim Lake due to increased erosion as described in Section 7.1.2. However, proposed mitigation to reduce erosion in selected sites (Manitoba Hydro and NCN, July 2004) should reduce the potential for reductions in water quality from this source. As with all surface waters considered for drinking, the Proponent recommends that any surface waters used for drinking should be sterilized prior to consumption.

Further downstream, the City of Thompson uses the Burntwood River as a source of drinking water. The Proponent has noted that aerial emissions from the INCO smelter may be contributing to on-going metal enrichment in the aquatic environment in that area. However, the Proponent does not predict significant cumulative effects to water quality because impacts to water quality from the Project are not expected as far downstream on the Burntwood River as Thompson. As part of the Draft Aquatic Effects Monitoring Program submitted to DFO (North/South Consultants, Inc., 2004), water quality will be monitored by the Proponent in Wuskwatim Lake and downstream of the Project to verify the Proponent's predictions and to detect unanticipated impacts to water quality. DFO and TC conclude that the Project is not likely to cause significant adverse environmental effects to drinking water quality.

7.4.4 Conclusion

The Proponent's predictions with respect to impacts by the Project on human health were reviewed by Health Canada and Manitoba Health. In addition to the comments from Health Canada noted above, Manitoba Health indicated that in their opinion, the process that has been followed by the Proponent and with respect to the review, with particular note of the public consultation process, has been adequate to ensure the protection of human and environmental health during and after the construction period. With consideration of the expert opinions provided by Health Canada and Manitoba Health, DFO and TC conclude that the Project will not result in significant adverse effects to human health.

7.5 Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons

The Proponent has identified environmental impacts resulting from increased access; the presence of a large workforce; terrestrial habitat loss; disturbances from Project construction and operation; and change in water levels and flows as having the potential to affect resource use for traditional purposes by Aboriginal people during construction and operation of the Project.

7.5.1 Resource Harvesting

In general, the Proponent believes the largest impacts to use of resources for traditional purposes will come as a result of increased access to the Project area. The Wuskwatim road will provide access to an area that is currently only accessible by foot, boat, snow machine, or all-terrain vehicle on relatively rough trails. The Project will also provide a safe all-season means of crossing the Burntwood River and accessing resource-harvesting areas to the south, although the Proponent noted that access downstream of the Wuskwatim generating station will remain difficult after completion of the Project because of dangerous water conditions and a lack of trails. Once road access is provided, the Proponent expects that Nisichawayasihk Cree Nation (NCN) residents will engage in increased traditional resource harvesting activities in the Wuskwatim Lake area, including hunting, trapping, fishing and gathering of berries and traditional medicines. In particular, the Proponent has identified increased domestic harvest of moose and waterfowl, lake whitefish, and berries as likely.

NCN has identified increased access and harvesting by non-NCN members, and subsequent effects on resource abundance and/or populations, as a key concern related to the Project. Increased access is expected by the Proponent to result in increased utilization of the two existing cabins on the lake and construction of several more cabins on or in the vicinity of the lake and access road. Increased numbers of people utilizing the Wuskwatim area for resource use activities and the presence of a large workforce in the area during construction will increase the chances of cabin vandalism, environmental disturbances, and/or forest fires in the area.

Hunting, Fishing and Trapping

In addition to the impacts noted above, the Proponent identified disturbances related to construction of the access road and generating station, and to the presence of increased people and traffic, as having a potential to cause animals to avoid the areas during the construction phase. The Proponent expects this effect to be small and short-term, and therefore not likely to have a significant effect on the long-term abundance of animals in the area available to resource harvesters. In addition, the Proponent notes that decreases in animal abundance due to loss of terrestrial habitat are expected to be small and should have no noticeable effect on resource use.

During operation, changes to shoreline habitat as a result of changes to the water regime upstream of the generating station are not expected by the Proponent to have a significant effect on animal abundance in the Wuskwatim area and, therefore, should have no affect on the availability of animals for harvest. The Proponent reported that mercury concentrations may increase marginally in fish-eating mammals such as mink and otter as the concentrations increase in consumed fish. However, the Proponent notes that the limited historic data from the study area following the CRD indicated elevated, but not toxic, mercury concentrations in mammals. As only very minor changes in mammal mercury concentrations are expected due to the small amount of flooding associated with the proposed Project, the Proponent predicts this effect will not be significant.

Increased erosion resulting from stabilizing water levels in Wuskwatim Lake near historic highs may impact fish habitat and increase debris inputs as described in Section 7.1.3. The Proponent reported that NCN fishers expect that the increased levels of debris will be mobilized by ice and high water and will have a negative effect on domestic fishing efforts by causing increased levels of debris in nets, and increased difficulty accessing shorelines and securing boats. The Proponent also noted that the potential increase in mercury concentrations in some fish species could decrease the demand to harvest fish for domestic consumption.

Gathering

The Proponent indicates that Project construction will change as much as 1,605 ha of terrestrial habitat through clearing, excavation, grading, infilling and erection of structures. The Proponent notes that this disturbance area includes all nine major potential borrow pits; if only three are used as planned, the total area actually cleared may be reduced by as much as 35%. According to the Proponent, a stand of balsam fir, which is used for medicinal purposes, will be lost in the footprint of the generating station, and other medicinal plants are expected to be lost where vegetation clearing occurs. Because the majority of habitat loss associated with construction will occur in areas where little resource harvesting has occurred in the recent past, the Proponent predicts the effects to current resource use will be negligible.

Medicinal plants may also be affected through indirect affects to adjacent upland, shoreline and island habitat from construction activities. Pathways identified by the Proponent include:

- Changes to soil moisture and fertility due to ditching & drainage;
- Soil warming and permafrost melting in peatlands due to adjacent clearing;
- Introduction of invasive species on incoming people, vehicles and equipment;
- Edge effects on plants adjacent to cleared areas;
- Deposition of airborne road dust and airborne emissions from vehicles and construction equipment;
- Accidental spills of contaminants;
- Accidental disturbance of plants;
- Effluent discharge and waste disposal from the construction camp and activities;

- Change in forest fire frequency and/or severity due to better access to and more people in the area.

The Proponent also noted there is uncertainty in impact predictions due to the lack of detailed information for understorey species and vegetation succession in the Region and Sub-Region as well as the unknown response of soils, plants and habitat to long-term changes in water regimes, water nutrient status, climate and the fire regime.

In considering the VECs they assessed, the Proponent predicted that changes in abundance of sweet flag, mountain cranberry, velvet blueberry, and bog cranberry would be negligible or positive as a result of higher and stable water levels. Wild mint is the only domestic resource identified as a VEC by the Proponent for which a reduction in abundance is expected as a result of the change in water level regime. The Proponent notes, however, that wild mint is widespread in the region, and losses due to the Project are expected to have no effect on resource use. Some NCN residents have stated that flooding decreases the potency of some medicinal plants. This may further decrease interest in harvesting some medicinal plants along shorelines in the Wuskwatim area. In addition, the increases in water levels are expected by the Proponent to have a long-term negative effect on the opportunity to harvest medicinal plants along shorelines and near the generating station.

Mitigation for potential impacts on medicinal plants includes removal of structures and termination of activities not required for operation to reduce construction effects; use of only native and/or non-invasive introduced grasses in revegetation of ditches to reduce the risk associated with invasive plants; assistance of vegetation recovery through grading the terrain and spreading stockpiled organic material; restricting access at Highway 391 during construction and operation, roving fire patrols in the generating station area and along the access road during construction, and maintaining fire suppression equipment in the generating station work area during construction and operation to reduce the risk of a large fire; and mitigation of increased erosion on Wuskwatim Lake as proposed to mitigate impacts to fish and fish habitat.

The Proponent predicts that potential construction and operational effects on terrestrial habitat composition are expected to be negative, extend into the 1 km buffers, be small in magnitude and continue for at least 26 years. However, with mitigation, the Proponent predicts that residual effects on the six VECs assessed in relation to impacts on medicinal plants will not be significant.

Comments/Conclusion

In their review of the proponent's EIS, Manitoba Conservation commented that mitigation of access-related impacts were addressed in the EIS only in a rudimentary way and that the AMP needed to be developed and reviewed for reference in the Environment Act Licence. To satisfy this requirement from Manitoba Conservation and to address access concerns and potential disturbance impacts resulting from the construction workforce, the Proponent developed a Draft Access Management Plan (AMP, Manitoba

Hydro and NCN, 2004) and submitted it to regulators supplemental to the EIS. One of the stated objectives for the AMP is that "road access to this part of the NHRMA (Nelson House Resource Management Area) will be managed to support sustainable use of natural resources of the area, protection of natural resources of the area and safety of people and property. This includes the cultural, spiritual and heritage values of the NHRMA, which are very important to NCN". Key features of the draft AMP include

- a plan for early, effective and frequent communication and education of NCN leadership and members, other First Nation leadership and members, construction contractors and managers, job referral services, construction employees, neighboring communities, forestry and mining interests, and recreational organizations regarding safety, protection of sensitive species and respect for resources (including cultural resources);
- the intent for the access road to be a private road or the equivalent (through purchase of road right-of-way or NCN Treaty Land Entitlement);
- a security gate (staffed 24 hours per day) at the junction with PR 391 to control access to the site during construction;
- restrictions regarding firearms (including long bows and cross bows) on the Project site during construction;
- implementation of harvest restrictions along the access road;
- a framework for enforcement and dispute resolution;
- a framework for monitoring and follow-up that includes provision for adaptive management and
- a commitment to develop a long-term access management plan for the period of project operation in consultation with the Nelson House Resource Management Board and the Province of Manitoba.

The Proponent has also indicated it will document changes in traditional resource harvesting activity by repeating the Harvest Calendar study during and after construction.

Commitments by the Proponent to mitigate erosion is selected areas to mitigate impacts to fish and fish habitat submitted to DFO (Manitoba Hydro and Nisichawaysihk Cree Nation, July 2004) will mitigate increases in debris inputs as a result of the Project, and reduce impacts to fish habitat. Residual losses to fish habitat will be balanced through habitat restoration and rehabilitation as described in the Proponent's Draft Fish Habitat Compensation Plan. Floating debris hazards will be monitored and mitigated by the Proponent through Manitoba Hydro's Debris Management Program. The Proponent does not expect ice conditions to change on Wuskwatim Lake but has proposed an extension of safe ice trails to ensure winter travel safety.

When consideration is given to the mitigation and monitoring identified in the Draft Aquatic Effects Monitoring Plan and the Draft Fish Habitat Compensation Plan submitted to DFO, the Access Management Plan submitted to Manitoba Conservation for their Environment Act Licence, mitigation associated with Manitoba Hydro's Debris Management Program, and the ongoing dialogue between the Proponent and the resource

users, DFO and TC conclude that significant adverse effects to resource harvesting for traditional purposes are not likely.

7.5.2 Heritage Sites

The Proponent indicates that impacts to heritage resources as a result of construction and operation of the Project and associated facilities will primarily be confined to the area between Wuskwatim Falls and Taskinigup Falls. Shorelines on the south basin of Wuskwatim Lake also will be affected as a result of increased erosion. According to the Proponent, components of the development that have the potential to impact heritage resources include:

- the channel modifications at Wuskwatim Falls;
- portions of the Taskinigup Falls spillway;
- the north bank of the Burntwood River within the area designated as the reservoir (234.0 m contour);
- level areas along the south bank of the Burntwood River within the reservoir (234.0 m contour);
- the area of the switchyard;
- the area of the construction camp;
- portions of the Wuskwatim Lake shoreline;
- borrow locations; and
- the Mile 17 Access Road.

Increased erosion on Wuskwatim Lake and upstream is expected by the Proponent to pose a risk to heritage sites in the vicinity of Early Morning Rapids, at the south end of Wuskwatim Lake, at Wuskwatim and Taskinigup Falls, and possibly downstream as far as Jackpine Rapids. Flooding of the area between Wuskwatim and Taskinigup Falls may also impact heritage resources. Artifacts consistent with post-1900 construction techniques, as well as artifacts from the Pre-contact period have been found in these areas. The Proponent conducted assessments of the Mile 17 Access Road route and two proposed borrow locations that the Proponent believed had the potential for heritage resources. No heritage resources were located.

The Proponent also reports that concerns have been expressed by NCN that the Wuskwatim Dancing Circle, while not located in the directly impacted area, may be vulnerable because of changes in soil stability as a result of an increased water table. In addition, increased access to the Wuskwatim Dancing Circle by NCN and non-NCN members has the potential to impact the physical integrity of this sacred site and/or cause loss of cultural significance.

In addition to the work conducted to date, additional archaeological surveys will be conducted by the Proponent at sites directly affected by the Project to further manage potential risks to heritage resources and to reduce the potential for work stoppages. Cultural mitigation of Taskinigup Falls is planned prior to the start of construction.

According to the Proponent, NCN has developed a plan to undertake 10 ceremonies from the start of access road construction to first power generation, with timing to be determined by the construction schedule.

It is anticipated by the Proponent that impacts from erosion and flooding will be mitigated by ongoing Historic Resources Branch mitigation surveys through the Churchill River Diversion Archaeological Program. In addition, the Proponent proposes to strike a Cultural and Heritage Resources Committee prior to the start of construction to manage potential effects on cultural and heritage resources. The Committee will consist of NCN members, a Manitoba Hydro representative (sitting on the Committee to assist in the implementation of management plans developed by the Committee), and other expertise as required. The Committee will manage concerns associated with the impacts to heritage resources, in consultation with NCN Elders. These concerns include: increased access, including impacts to the physical integrity of sites sacred to NCN as well as losses of cultural significance of some sites. A management plan will be developed by the Committee and all cultural and heritage sites will be subject to ongoing mitigation, as required.

In the Proponent's opinion, no residual effects are expected because all heritage resources sites that are at risk will be properly mitigated. Additional monitoring will be conducted by the Proponent during construction of the Project to ensure any physical objects related to former cultural groups which may not be evident until construction has commenced are identified and mitigated.

Comments/Conclusion

On review of the EIS, Health Canada noted that control of access to culturally valuable sites through a well implemented access management plan is important to the health of the community. The Proponent noted that control of access to culturally valuable sites will be among the considerations addressed by the joint Manitoba Hydro and NCN Access Management Committee in preparing the construction and operations portions of the Road Access Management Plan in consultation with the Nelson House Resource Management Board.

Parks Canada reviewed the information provided by the Proponent in the EIS submitted and concluded that the Proponent had, both through project design and mitigation, proposed adequate measures to ensure that heritage resources are protected. Manitoba's Historic Resources Branch also indicated they had no further concerns with regard to the Projects potential to impact historic resources. In view of the expert opinions expressed, DFO and TC conclude that the Project's residual effects to heritage resources will not be significant.

7.6 Use of Renewable Resources

Overall, NCN resource harvesters have indicated to the Proponent that, primarily because of the benefits of increased access, the project will result in a significant, positive, long-

term, moderate, and regional effect on traditional resource use and a significant positive, long-term, large, local effect on commercial fishing and commercial trapping. The Proponent indicates that improved access may also result in a marginal increase in mineral exploration activity, tourism and recreational activities in the Wuskwatim Lake area and on either side of the Burntwood River, but these are not expected to be significant.

7.6.1 Commercial Fishing and Trapping

The impacts from Project construction and operation to commercial fishing and trapping in the Project area described by the Proponent are very similar to those described for fishing and trapping for traditional purposes. It is noted that NCN members are the principal users of these resources in the Resource Management Area. The Proponent adds, however, that once the road is completed, NCN commercial fishers will have an interest in using it to access the lake and to transport their catch to the Nelson House fish plant, which will reduce the costs of processing and transportation. The Proponent predicts that improved access will significantly decrease operating costs for the Wuskwatim Lake commercial fishery. Decreased costs are expected by the Proponent to increase the potential for higher net revenues, increasing interest in the fishery, and ultimately lead to increased commercial harvests. Similarly, increased access is expected to result in increased harvests from four Registered Trap Lines (RTLS) in the vicinity of the Project (particularly RTLs 2, 4, 9, and 47) that have not previously had road access. Based on average harvests from road accessible RTLs and affected RTLs, the Proponent predicts that harvests could increase by as much as 68%. The Proponent reports that, according to NCN Resource Programs staff, production may also increase from other trap lines south of the Burntwood River that have been difficult to access since completion of CRD (e.g., RTLs 1, 62, 63).

The Proponent believes that although the ultimate harvest levels and magnitude of effects are uncertain, the combined effect of increased domestic, commercial and recreational fishing pressure on Wuskwatim Lake has the potential to have a long-term negative effect on the fish population and, ultimately, on the commercial fishery. However, the Proponent also notes the large long-term positive effects to the commercial fishery resulting from savings associated with transportation costs. Other potential effects on commercial fishing such as the effect on fish habitat from the footprint of the dam are expected to be offset by the enhancement of habitat associated with the Draft Fish Habitat Compensation Plan submitted to DFO. Harvests of furbearers by domestic and recreational resource users are expected by the Proponent to be negligible. The Proponent expects that effects related to changes in water levels and flows will be neutral in relation to commercial trapping activity. Post project monitoring of fish populations in Wuskwatim Lake as discussed in the Draft Aquatic Effects Monitoring Program (North/South Consultants, Inc., 2004), will address fish quality issues for resource harvesters including mercury concentrations and infestations of *Triaenophorus crassus* (a tapeworm which encysts in the flesh of whitefish).

The Proponent notes that Manitoba Conservation is responsible for implementing regulatory measures to control harvests of resources. Manitoba Conservation,

cooperatively with the Nelson House Resource Management Board, will be responsible for using the domestic and recreational harvest monitoring data in conjunction with annual commercial fishing and trapping data to assess resource harvesting pressures and implement suitable regulatory measures to ensure sustainable harvests and protect resources. According to the Proponent, individual trap line holders are responsible for managing harvests on their own trap lines.

When consideration is given to the mitigation and monitoring identified in the Draft Aquatic Effects Monitoring Plan and the Draft Fish Habitat Compensation Plan submitted to DFO, the Access Management Plan submitted to Manitoba Conservation for their Environment Act Licence, regulatory measures implemented by the Province of Manitoba in relation to commercial resource harvesting, mitigation associated with Manitoba Hydro's Debris Management Program, and the ongoing dialogue between the Proponent and the resource users, DFO and TC conclude that significant adverse effects to commercial fishing and trapping are not likely.

7.6.2 Commercial Forestry

According to the Proponent in Volume 7, Section 5.2.2. of the EIS (Manitoba Hydro and Nisichawayasihk Cree Nation, 2003), effects on forestry resources from the construction and operation of the Project can occur as a result of clearing (access road, borrow pits and generating station footprint), flooding, and erosion, all of which are limited to the confines of the sub-region. The Proponent predicts that the Project will result in a loss of 1566 ha due to clearing, 38 ha due to flooding and 45 ha due to erosion (incremental erosion up to the year 2034), and estimates a total of 61,660 m^3 of softwood and 10,060 m^3 of hardwood may be affected by the Project.

The Proponent believes that reductions to the Annual Allowable Cuts (AACs) in the affected Forestry Management Units will have no immediate effect on current harvest levels by the FML holder or third party operators as these are well below the current AAC levels. According to the Proponent, clearing requirements will be well planned and carefully monitored during clearing operations to minimize the amount cleared. Where logistically and economically feasible, merchantable timber will be salvaged. Those sites not required after project construction will be rehabilitated. In consideration of the Proponent's analysis, DFO and TC conclude that significant adverse impacts to commercial forestry as a result of the Project are not likely.

7.6.3 Protected Areas and Scientific Sites

The Proponent has noted that the northern two-thirds of the access route traverses a complex of two enduring features. These features extend north of PR 391 some 80 kms into the former Amisk Park Reserve and into the two associated ASIs of the Amisk North and Amisk South Addition. Consequently, Manitoba Hydro notes that the selection of this route for the access road highlights the importance of the re-designation of the Amisk Park Reserve and protecting the designated ASIs (Amisk South and North additions) that encompass the association of these features.

Partridge Crop Hill was identified as an area of cultural importance to NCN. In addition, an ASI has been identified around and including Partridge Crop Hill and extending northwards to the Burntwood River and east to Wuskwatim Lake. The Proponent indicates that development of the Wuskwatim generating station would not directly impact this ASI (i.e., construction of permanent facilities and flooding associated with the Project are well away from this area). Manitoba Hydro notes that the Project would affect the existing water regime and rates of erosion on segments of Wuskwatim Lake and the Burntwood River, which form boundaries for the ASI; however, these waters are presently regulated for hydroelectric generation (i.e., the CRD). Active and dormant research sites present in the area are not directly affected by the Project.

The Proponent's information on protected areas and scientific sites was reviewed by Manitoba Conservation's Sustainable Resource Management Branch, which has responsibility for the Protected Areas Initiative. It was recommended that the Proponent should contact Parks and Natural Areas for clarification and updates in relation to Protected Areas, and it was also noted that not all ASIs and candidate sites under consideration for protection would automatically become park reserves. Manitoba Conservation has advised that an Environment Act Licence issued to the Proponent would require them to establish baseline monitoring and ecosystem research that included the identification of additional research and monitoring requirements to protect designated protected areas; establish long-term monitoring and research programs within the designated study area to assess impacts; and annually review the results of monitoring and research programs and facilitate adaptive management.

In consideration of the involvement of Manitoba Conservation in the Protected Areas Initiative, and the Proponent's analysis, DFO and TC conclude that significant adverse impacts to protected areas and scientific sites as a result of the Project are not likely.

7.7 Navigation

The following information is taken from Manitoba Hydro and Nisichawayasihk Cree Nation's Wuskwatim Generating Station Navigable Waters Protection Information submitted to the Navigable Waters Protection Program on February 27, 2004 and October 27, 2004. For details on specific applications the reader is referred to these documents.

7.7.1 Access Road Stream Crossings

The access road connecting Highway 391 to the proposed development site will cross 4 water bodies which have been identified as navigable waters which could be used by small recreational vessels. The unnamed water bodies have been designated by the Proponent as R2, R5, R6 and R8 (see EIS Volume 1, Manitoba Hydro and Nisichawayasihk Cree Nation, 2003). Culvert crossings are proposed at each location and Manitoba Hydro has proposed to install and maintain a portage route around each crossing to facilitate navigation around these structures. The portages locations will be safe and publicly accessible. Signage will be posted up and downstream of each crossing

location notifying waterway users of the portage location. Signage will also be posted on the access road, notifying roadway users of the portage locations.

With the implementation of these mitigation measures TC and DFO conclude that no significant impact on navigation at the access road crossing locations is anticipated.

7.7.2 Generating Station

As indicated above, the Proponent will be installing two boat launches at the generating station site, both upstream and downstream. The Proponent suggested that access to the downstream boat launch should be restricted for private use only. At the direction of TC, this boat launch will be available for public use both during and upon completion of the project. TC notes it is a legal requirement pursuant to the Section 7.2(b) of the Navigable Waters Works Regulations to provide and maintain a road or footways for the free passage of the public around the structure. Waterway users will be permitted access around the generating station via a portage connecting the up and downstream boat launches. The Proponent notes that the river downstream of the dam will have water level fluctuations in the tailrace typically ranging from 0.4 m to a maximum of 1.3 m within a 24-hour period. These fluctuations combined with the three existing natural sets of rapids between the proposed project site and Opegano Lake may make conditions dangerous for inexperienced boaters. The Proponent will post signs notifying potential waterway users of the conditions downstream. An audible warning system will be maintained that will notify users of gate movements and changing water levels resulting from dam operations. The Proponent will build the boat launches during construction of the Wuskwatim Project and ensure that they are clearly marked and available for public use both during and upon completion of the project.

The proposed portage location will allow waterway users to safely bypass around the generation facilities, including the excavated material placement area. During construction and operation, boaters will be guided to the upstream landing by a large sign and beacon. The sign will provide instructions (complete with map) on how to safely bypass the site. An application has been submitted to TC for approval of the upstream launch and designs for the downstream launch are in progress, which will be required to accommodate potential water level fluctuations resulting from dam operation. These facilities would be similar to other existing boat launch facilities in the region.

During construction the Proponent will be required to install a temporary safety boom upstream of the outlet of Wuskwatim Lake to secure the work area during the navigation season. Large temporary signs will be placed along both shorelines warning waterway users that construction is underway. It has been identified that there may be a potential hazard if a boat were to capsize or if someone were to swim in the forebay area. Manitoba Hydro has committed to installing a boat restraining barrier upstream of Wuskwatim Falls to exclude waterway users from this area prior to commissioning of the dam. TC has not yet reviewed plans for the proposed boat restraining barrier; however, a safety boom with visible markings of international yellow or orange will be required to enclose the forebay area. Permanent signs will be erected by the Proponent on both sides

of the river upstream and downstream of the generating station warning of potentially dangerous boating and swimming conditions. All signage will be in both English and Cree. The signs and portages would be required to be operated and maintained for the life of the Project. With the implementation of the mitigation measures described, TC and DFO conclude that significant impacts to navigation from the generating station and associated structures are not likely.

7.7.3 Associated Works

Manitoba Hydro has proposed the installation of two water intake structures, to provide water for the main camp and to service the concrete batch plant. The proposed water intakes will be submerged with sufficient water clearance over top to allow for safe navigation and will not pose any interference to navigation. If sufficient clearance to allow the safe passage of vessels over top of the water intakes is not possible, the lines and intakes will be marked with buoys that are complaint with the Private Buoy Regulation under the Canada Shipping Act.

Two boat launches are also proposed. The upstream boat launch will be located on Wuskwatim Lake and will be open for public use. The downstream boat launch will be located downstream from the generating station in a small bay. A foot path and/or access road will connect these two boat launch locations. Both facilities will be clearly marked with a day beacon. TC has stated that it is not anticipated that the boat launches will present any negative impacts to navigation safety.

7.7.4 Flow and Water Level Variations

The construction and operation of the Wuskwatim Generating Station will alter water conditions upstream and downstream of the station. No negative impact is predicted by the Proponent for navigation in the upstream area as a result of these alterations. The Proponent will be required, pursuant to Section 7.4 of the Navigable Waters Works Regulations to maintain the limits of flow and water level elevations for navigation purposes. During operation, Wuskwatim Lake levels will be kept relatively constant at or near 234 m.

In the downstream area, the Proponent notes that the river will continue to be very dangerous and travel will not be recommended due to the high river velocities resulting from the operation of the generating station, the water level fluctuations in the tailrace area, the steep gradient in the river and the existence of three sets of rapids in the 12 kilometres of river before Opegano Lake. The Proponent indicates that the largest fluctuations, resulting from normal operation of the Wuskwatim generating station, would occur at the tailrace with water levels varying up to 1.3 m within a 24-hour period during open water conditions. According to the Proponent, water level fluctuations will attenuate moving downstream by the available channel and lake storage. Further downstream, at Opegano Lake, the Proponent indicates that daily water level fluctuation will be in the order of 0.4 m under certain specific flow conditions, however for over 50% of the time the Proponent predicts that water level fluctuation will be 0.1 m or less.

As indicated above, a siren system will be installed by the Proponent to provide advance warnings of the movement of the spillway gates. The siren system will be initiated in advance of a spillway gate operation and will continue throughout the gate movement and will stop when the gate setting has been established. Large signs at both the upstream and downstream boat launch will provide information regarding the Spillway Gate operation warning system. With the implementation of the mitigation measures described, TC and DFO conclude that significant impacts to navigation from operation of the generating station are not likely.

7.7.5 Excess Woody Debris

In the case of Wuskwatim Lake in its current state, it is the Proponent's opinion that the woody debris density that may cause navigational safety concerns is relatively high, but waterway usage is relatively low. The low-head Wuskwatim hydroelectric development is not expected by the Proponent to significantly affect the nature of local debris. During construction, the effects of woody debris on the physical environment are considered to be small, short-term, localized in nature and capable of being mitigated. Prior to the generating station becoming operational the immediate forebay area that will be flooded will be cleared prior to impoundment to mitigate the short-term increase in debris levels. The Proponent states that the increased rate of erosion of the Wuskwatim Lake shoreline will result in additional woody debris entering the lake over the first five years of the Project from shorelines that are actively eroding, but will decline in the following 6 to 25 years to pre-project conditions. The net result in the Proponent's opinion is that risk to navigation at Wuskwatim Lake is deemed to be relatively low, so debris management efforts by the Proponent will be concomitant with its assessment of relatively low risk.

The Proponent notes that Manitoba Hydro operates a Debris Management Program (DMP) to meet all existing and emerging regulatory, contractual and settlement obligations as well as the Proponent's Corporate Vision. The DMP produces a system wide inventory of woody debris, which allows for prioritization of debris management activities across the northern hydroelectric generation system, based on relative risk to navigation and proportionately focuses debris management efforts based on that ranking. The Proponent also notes that Manitoba Hydro and NCN discuss debris management in the Nelson House Resource Management Area on a regular basis. Management activities include boat patrols and debris clearing. Boat patrols have several functions; they map and record daily routes, mark deadheads and reefs via GPS, place hazard markers identifying safe travel routes for resource users, gather floating debris such as deadheads and old nets and relocate them to safe areas. The Proponent projects that improved site access during and after construction may increase general use of Wuskwatim Lake, thus the Proponent will be required to increase debris management efforts at Wuskwatim Lake accordingly during and after construction to address increased risk to navigation caused by increased waterway use. TC is satisfied that the DMP can address any incremental effects to navigation from increased woody debris generation resulting from the Project, thus TC and DFO conclude that significant impacts to navigation from operation of the generating station are not likely.

7.7.6 Habitat Compensation Works

The Proponent will be required to submit application for all proposed habitat compensation works that may be necessary under the provisions of the *Fisheries Act* and associated departmental policy for any in-water projects located in navigable bodies of water. Habitat compensation plans are currently being developed and once finalized the proposed projects will be reviewed under the NWPA prior to commencement of construction. TC will review the proposed fish habitat compensation plans and identify any necessary measures to mitigate any potential impact on navigation safety. These mitigation measures may include but are not limited to marking underwater hazards with buoys or lights and the installation of signage or other public notification tools.

7.8 Effects of the Environment on the Project

7.8.1 Climate Change

At the request of Environment Canada and NRCan for more information on the potential impacts of climate change on the Project, particularly with respect to precipitation, the Proponent provided the following information (Manitoba Hydro and Nisichawayasihk Cree Nation, August 2003).

In terms of hydraulic risk, the Proponent predicted that a warmer-drier climate scenario could result in less runoff and streamflow on average, which could impact the economics of the Project, but not to a degree that the Project would be rendered uneconomic. Conversely, according to the Proponent, a warmer-wetter climate scenario that results in higher runoff and streamflow on average would have a positive impact on the long-term water supply to Wuskwatim Generating Station since the Project would be capable of producing even more energy. The Proponent considered any risk posed to public safety by the effects of climate change to be minimal for this Project.

In assessing the risk that precipitation events may become more variable and intense, the Proponent noted this could impact the frequency and magnitude of future flood events. The Proponent concluded, however, that the structural integrity of the dam site would not be affected, as the Project has been designed to safely pass the Probable Maximum Flood (PMF), which the Proponent views as a conservatively high design flood for this site, and is capable of passing flow up to 10% larger in an emergency situation. The PMF represents an upper limit for all current design standards, including the Canadian Dam Association (CDA) Dam Safety Guidelines referenced in the design of the plant. The Proponent also indicated that, in the extremely unlikely event that the dam should ever fail, dam break analyses have shown that there is minimal risk to loss of life downstream.

Environment Canada and Natural Resources Canada were satisfied that the effects of climate change on the Project had been adequately considered by the Proponent.

7.8.2 Seismicity

In their review of the Proponent's information with respect to seismicity, NRCan noted that the low head modified run-of-river design provided negligible storage and that the Project was located in a region of low seismicity. NRCan indicated that, in their opinion, the Canadian Dam Association Guidelines would not require assessment for 1 in 10,000 year events such as earthquakes for the Project and concluded that, while a safety check (treating the event as an "accident") against the shaking from rare large shield earthquakes, which may occur close to the site, would be prudent, the project does not need earthquake resistant design. The Proponent indicated in their response that some checking had been undertaken, and that none of the seismic events analyzed was found to govern the structures' design. In addition, it is Manitoba Hydro's intention to analyze the structures during final design for probable ground acceleration values equal to or in excess of those recommended by NRCan.

7.9 Accidents or Malfunctions

Impacts to the environment caused by accidents and malfunctions during construction and operation of the Project are discussed in Volumes 1, and 3 of the Environmental Impact Statement (Manitoba Hydro and NCN, 2003). In these sections the Proponent also describes the roles of the on-site construction Safety Supervisor and security officers (for security and fire watch) and personnel, as well as the development of emergency response programs. In addition, a discussion of dam failure is provided in Section 7.8.1 of this report.

7.9.1 Bedrock and Structural Geology

In it's review of the information supplied by the Proponent in Volumes 1 and 3 of the EIS (Manitoba Hydro and Nisichawayasihk Cree Nation, 2003), NRCan noted the presence of two faults through the dam site which it thought were likely "fossil" and unlikely to be of concern. NRCan noted the small size of the basin is such that even if there are added hazards due to these faults, they are minor. However, NRCan also noted that if the faults are still planes of weakness, or rocks of non-typical properties (e.g., poorly cemented fault breccias or gouge), then this may need to be addressed in the design of the foundation. The Proponent maintains that none of the faults in the vicinity of the proposed structures are active, the ancient faults noted are well healed and, though they are more pervious than the adjacent bedrock, are of relatively low permeability. The Proponent further noted that there will be a grout curtain installed within the dam's foundation throughout its entire length to ensure that seepage losses are low and to minimize water pressures within the downstream portions of the foundations. NRCan acknowledged the Proponent's response, but requested that the Proponent provide a study/report of field investigations, conducted by a competent geologist and geotechnical engineer consisting of visiting the site, assessing the structures, presenting the findings and stating the conclusions.

Based on the expert advice from NRCan, DFO and TC have concluded that, with provision of the required information verifying the insignificance of the faults noted to NRCan, hazards from bedrock-related geology are insignificant for this Project.

7.9.2 Fires and Accidental Spills and Releases

The Proponent has indicated that the likelihood of accidental spills and releases exerting a significant impact on the environment during construction and operation of the project is low due to application of good management practices, including safety and handling procedures, emergency response plans, and spill containment measures. These are described in the Volume 1, Section 4 and Volume 3 of the Proponent's EIS (Manitoba Hydro and Nisichawayasihk Cree Nation, 2003). The Proponent noted that an accidental fire along the access road right-of-way has the potential to affect a large proportion of the Sub-Region's dry jack pine forest. Fire protection measures and fire watch equipment in the camp and the entrance to the access road are expected to mitigate these effects. Access limitations and education as set out in the Draft Access Management Plan (Manitoba Hydro and Nisichawayasihk Cree Nation, 2003) are also expected to mitigate accidental events such as chemical spills, fires or wildlife-vehicle collisions. The Proponent notes that an Emergency Preparedness Plan will be prepared for the Wuskwatim Generating Station to deal with potential major emergency scenarios, which may occur during the life of the plant. In addition, Manitoba Hydro has developed an Environmental Management Systems (EMS) to document operating procedures such as spill containment and response. Part of the EMS procedures is a training component in implementing these procedures. DFO and TC conclude that the Project is not likely to cause significant adverse environmental effects from accidental spills and fires.

7.10 Cumulative Effects

7.10.1 Fish and Fish Habitat

Construction-Related Sediment
According to the Proponent, erosion rates for a portion of the shorelines on the Burntwood River in the study area are currently elevated as a result of the CRD. It is likely that TSS values are also higher than what would be expected without the CRD in many places. DFO believes that TSS generated during construction may add to the TSS generated in areas of active erosion in the Burntwood River downstream of the Project (at least as far as Opegano Lake). DFO notes, however, that the use of cofferdams for Project construction will allow most of the Project's construction to be carried out in the dry, thus mitigating many of the major impacts to fish habitat that could arise from Project construction. Additional mitigation as described in the Proponent's Draft Sediment Management Plan (Acres Manitoba Ltd., 2004) and supplemental material (Manitoba Hydro and Nisichawayasihk Cree Nation, July and September, 2004) are expected to further reduce the risk of significant impacts to the aquatic environment from construction-related sediment. DFO also notes that the proposed monitoring during construction will allow for early detection of increases in TSS and timely deployment of

additional mitigation as required. Verification of the Proponent's predictions that long term effects will not occur will be provided through the Proponent's Draft Aquatic Effects Monitoring Program (North/South Consultants, Inc., 2004). With the proposed mitigation and monitoring measures, DFO and TC conclude that significant cumulative effects to fish and fish habitat due to construction-related sediment are not likely.

Erosion on Wuskwatim Lake

According to the Proponent, with the commissioning of the CRD in 1977, and the resulting rise in average Wuskwatim Lake water levels of approximately 3 m, erosion rates on Wuskwatim Lake rose from a pre-CRD average shoreline recession rate of 0.7 m/yr to a post-CRD average rate of 2.0 m/yr. The Proponent states that over the past 25 years, shoreline-erosion rates have been declining through the development of nearshore beaches and a related increase in the prevalence of nearshore downcutting. However, current erosion rates in Wuskwatim Lake have not yet reached the long-term pre-CRD values. Increasing the average water level on Wuskwatim Lake to 234 m ASL is expected by the Proponent to increase erosion rates on Wuskwatim Lake in the first five years following Project commissioning, which could result in cumulative effects to fish habitat through sedimentation and a reduction in nearshore water quality in some areas. However, when considering the proposed stabilization works, and the proposed monitoring to determine the effectiveness of the mitigation measures and if there's a requirement for further mitigation (Manitoba Hydro and Nisichawayasihk Cree Nation, September 2004), DFO and TC conclude that significant cumulative effects to fish habitat from increased turbidity and sedimentation are not likely.

Water Regime Changes

The Proponent expects that during operation, the principal change in Burntwood River habitat downstream of the proposed dam to Opegano Lake (Reaches 3 and 4) would be an increase in the frequency and magnitude of water level fluctuations. Variation in the number of units operating in the generating station will superimpose water level changes within the day on the month-to-month changes that presently occur downstream of Taskinigup Falls as a result of the CRD. The potential for short-term increases in erosion of riverbed and riverbanks in response to new flow patterns during initial operation has also been identified by the Proponent, which may also act cumulatively with ongoing erosion resulting from operation of the CRD. Increased water level fluctuations will result in losses of fish habitat due to further conversion of permanently wetted habitat to intermittently exposed areas. Losses of fish habitat downstream of the Project are expected to be balanced by habitat compensation as proposed in the Draft Fish Habitat Compensation Plan (North/South Consultants, Inc. 2004)**.** DFO is satisfied that the proposed monitoring of downstream aquatic habitat, the benthic invertebrate community, and the fish community will be able to verify the Proponent's conclusions and detect any unforeseen effects to aquatic habitat due to changes in the water regime resulting from operation of the Project. DFO and TC conclude that with the proposed habitat works upstream to compensate for harmfully altered habitat downstream, and mitigation of potential effects from erosion as described in the Draft Sediment Management Plan,

cumulative adverse effects to fish habitat as a result of water level fluctuations downstream of the Project will not likely be significant.

Fish Movements and Turbine Mortality

Fish movements in the Project area may presently be impacted by the CRD. However, as little information is available for the period prior to commissioning of the CRD, the impacts are unknown. Some Traditional Knowledge suggests that the eight-fold increase in flows in the Burntwood River due to CRD may have rendered falls that were previously passable by fish impassable. The increased flows due to CRD may also have affected downstream movements. However, according to the Proponent, the flooding of Wuskwatim Falls will allow for upstream and downstream fish passage through the outlet of Wuskwatim Lake. Stabilization of water levels in Wuskwatim Lake at historic highs is not expected to impact fish passage at Early Morning Rapids, which at present is not believed to be passable, but if it does, its effects would likely increase the probability of fish passage. Specific design parameters presently included in the proposed Project and additional modifications as requested by DFO are expected to mitigate any impacts of the Project on downstream fish movements and survival. Therefore, DFO and TC conclude that cumulative impacts to fish movements, if any, will not be significant.

7.10.2 Cumulative Effects to Birds

To assess cumulative effects to birds of the Project's effects in combination with projects that have been or will be carried out, the Proponent used an ecosystem-based approach utilizing a federally/provincially established ecodistrict classification system. The cumulative effects to birds are considered by the Proponent to be primarily associated with habitat loss and habitat fragmentation, particularly associated with the forestry industry. Effects to bird habitat within those ecodistricts potentially affected by the Project were assessed. The Proponent predicts that approximately 0.15% of the bird habitat area within the relevant ecodistricts will be affected by the Project, with an additional 9.8% potentially affected by other developments including forestry activities.

Environment Canada reviewed the Proponent's impact assessment respecting the Project's potential impacts to migratory birds and their habitat and concluded that in their opinion, the information was well-presented and addressed the areas of concern and interest to Environment Canada. In consideration of the expert advice of Environment Canada, DFO and TC conclude that significant adverse cumulative effects to birds are not likely.

7.10.3 Cumulative Effects to Woodland Caribou

In their consideration of cumulative effects to woodland caribou the Proponent considered the following projects: Wuskwatim Transmission Project; ongoing CRD losses of certain forest types associated with riparian areas; increased number of cabins; Treaty Land Entitlement (TLE) from NCN; designation of Partridge Crop Hill Area of Special Interest as a protected area; and forestry activities. The Proponent considered two scenarios for the fifty-year period assessed (2009 to 2059): one with and the other

without the designation of the Partridge Crop Hill Area of Special Interest (ASI) as a protected area.

The Proponent indicates that the direct long-term impacts of the proposed Wuskwatim Transmission Project consist of a band of modified vegetation in the right-of-way (RoW), construction access roads and construction borrow pits. The Sub-Region portion of the transmission line RoW is approximately 445 ha. Direct and indirect habitat effects have been assessed by the Proponent in the EIS for the Wuskwatim Transmission Project (Manitoba Hydro and NCN, 2003). According to the Proponent, small, incremental negative changes to woodland caribou habitat are expected for the Sub-region, and small, incremental negative changes to wintering and calving habitat are expected for the Region. Short-term sensory disturbances will occur during construction, while long-term sensory disturbances related to increased winter access along the RoW, and possible incremental changes to loss of habitat effectiveness and fragmentation will occur near the RoW. The Proponent indicates that the largest potential effect is mortality related to winter access and caribou harvest near the core range south of Partridge Crop Hill. Mitigation during construction and operation, including access control measures that will be identified in the Draft Access Management Plan (Access Management Committee, 2004), co-operative agreements, and Resource Management Board decisions concerning sustainable harvest are expected to minimize effects to caribou. If the Partridge Crop Hill area of special interest (ASI) were designated as a protected area it is the Proponent's opinion that this action would have a large positive impact for woodland caribou in the Region. The Proponent indicates that a large portion of the current core range (including what the Proponent has suggested to be critical winter habitat and critical calving habitat) would be protected from potential habitat-related effects, sensory disturbances, habitat effectiveness and habitat fragmentation effects, access effects and accidental events.

According to the Proponent, locations and timing of forestry activities in the Region are highly uncertain, especially if the Partridge Crop Hill ASI were to be protected. Unless a high forestry activity threshold is reached, it is the Proponents opinion that negative habitat effects would remain insignificant. If this currently unknown activity threshold is reached, it might affect the abundance and/or seasonal movements of woodland caribou in the Region. The Proponent notes that replanting and avoidance of unique wildlife features would minimize potential effects. Negative sensory disturbance effects related to winter access, and changes to and loss of habitat effectiveness and fragmentation could occur near harvest sites. Mortality due to winter access and caribou harvest could occur. Forestry mitigation measures, including possible access control measures, co-operative agreements, and Resource Management Board decisions concerning sustainable harvest would minimize effects to caribou. Changes in future forestry practices (e.g., harvest techniques) add uncertainty about the nature of the effects and how the effects will interact with this Project.

In the Proponent's opinion climate change could have the largest cumulative effect on caribou over the long-term, as it would occur throughout the Region. The Proponent notes that although there is uncertainty in regards to whether precipitation will increase or decrease, there appears to be a consensus that temperatures will increase and boreal forest

areas will decrease. If climate change does reduce the extent of the boreal forest in Manitoba, the Proponent expects woodland caribou abundance and movements could change considerably. The Proponent believes an increase in the frequency of fire would have the largest effect on caribou abundance, movements and habitat use. In the Proponent's opinion, the greenhouse gas (GHG) implications of the Project are very small. The Proponent maintains that compared with most Canadian or international hydro projects the amount of flooding and potential for increased GHG emissions is extremely low, due the redesign of the Project to reduce flooding to less that 0.5 km^2 and the displacement of GHG intensive natural gas and coal fired resources.

Environment Canada and NRCan requested more information on GHG emissions by the Project. The Proponent responded that the GHG emissions over the complete lifecycle of the Wuskwatim project are estimated to be about 0.571 Mt CO2e (including material, transportation, land-use change, etc.). When the Proponent annualized this over the life of the project is was about 0.006 Mt / year. Of this total, land-use changes account for about 0.300 Mt CO2e or 0.003 Mt CO2e / year. The Proponent noted that according Canada's Greenhouse Gas Inventory (1990 – 2000) released in June of 2002, Canada's and Manitoba's total annual GHG emissions for the year 2000 are 726 Mt CO2e and 21.4 Mt Co2e, respectively. Wuskwatim's total annualized emissions are equivalent to less than 0.001% and 0.02% of the national and provincial annual emissions respectively. The Proponent compared these emissions to those that would result from fossil fuel energy, which is the form of energy the Proponent believes the project would be most likely to displace, and estimated a net global benefit 0.76 Mt / year (more than 126 times the project's emissions) or more. Manitoba Hydro committed to monitoring emission levels from the reservoir over time, and to monitoring the effects of erosion and water fluctuations on peatlands. Manitoba Hydro has committed to continuing to participate in and support many research programs with respect to aquatic and forest GHG implications and to participating in national and international efforts to establish GHG accounting frameworks for electricity projects. NRCan and Environment Canada considered the additional analysis provided with the supplemental information to be adequate.

The Proponent concludes that with the exception of the possible effects of climate change, all other insignificant residual effects at the Sub-regional level were unchanged by cumulative effects. The Proponent predicts the negative effects on woodland caribou in the Region will remain insignificant unless climate change has a larger than expected effect and/or other developments do not provide appropriate and effective mitigation. The Proponent estimates the magnitude of negative effects ranges from small to large. The Proponent states that the combined effects of the Project and other potential developments or activities are expected to influence woodland caribou abundance and seasonal movements in the Region, but not in the Sub-region.

Comments/Conclusion

NRCan and EC concluded that the implications of GHG emissions had been adequately considered by the Proponent.

With respect to cumulative impacts to woodland caribou Parks Canada noted that the data collected for the EIS provided limited population parameters which are essential baseline data for the ongoing assessment of long-term and cumulative impacts, and that the proposed approach to monitoring the impacts of the project on the species movement around the construction site and access road is insufficient considering the aforementioned issues. It is Parks Canada's view that the design of the monitoring program needs to be revisited and improved in order to adequately assess the effectiveness of the mitigation. Manitoba Conservation's specialist also suggested that further consideration be given to the cumulative effects relating to forestry activities and to strengthening the monitoring program. Placement of additional radio-collars to increase certainty in movements and important use areas, and improving the information on the population dynamics of the herds, was recommended.

Parks Canada considers analysis of cumulative effects a particular concern because woodland caribou are listed as "threatened" under the *Species at Risk Act* and are very sensitive to anthropogenic landscape disturbances. Surrounding projects and activities of concern identified by Parks Canada include the Wuskwatim Transmission Line, other linear features, and forestry activities. Analysis of cumulative effects and collaborative management of cumulative effects is considered by Parks Canada to be critical to the survival of the woodland caribou in this area.

In order to address these concerns, Parks Canada recommends that the Proponents establish a scientific advisory committee, within six months of approvals being granted, comprised of representatives of directly affected communities, Manitoba government representatives, scientists and where appropriate, Government of Canada representatives. This committee should assess ongoing impacts of project activities and recommend adaptive management actions. Specifically, the committee would:

a) identify additional research and monitoring requirements to protect ecosystems, with particular consideration for woodland caribou and other species at risk;
b) establish long-term monitoring and research programs to assess impacts;
c) annually review the results of monitoring and research programs;
d) annually report on impacts of project activities and adaptive management actions;
e) collaborate with forestry companies, the transmission line committee/advisors, and other land users in research, monitoring and adaptive management of cumulative effects.

Environment Canada has noted that, under the 1996 Accord for the Protection of Species at Risk, the federal, territorial and provincial governments agreed that the protection of species at risk is a collective responsibility in Canada (Environment Canada, 2005). Environment Canada affirmed their commitment to this partnership, but also indicated that although the boreal population of woodland caribou is listed as a Threatened species on Schedule 1 of the SARA, management of woodland caribou continues to be a provincial/territorial responsibility. Environment Canada is confident that Manitoba has clearly demonstrated a strong commitment to managing its woodland caribou. The province is undertaking consultation regarding the decision to list the boreal population

under the Manitoba Endangered Species Act. It has established a Woodland Caribou recovery team and participates on the National Boreal Caribou Technical Steering Committee ("national recovery team"). It has developed an integrated Woodland Caribou Forestry Management Plan; and it has drafted a provincial Boreal Woodland Caribou Conservation Strategy for Manitoba, in addition to conducting research and monitoring activities on an ongoing basis.

Environment Canada believes that the partnership arrangement that has been put in place is an effective approach for overseeing the management of species at risk, including the specific case of the boreal population woodland caribou which may be impacted as a result of the Wuskwatim Project. In addition to the actions taken by the province of Manitoba, Environment Canada notes that they co-lead and participate in the national recovery team for the boreal population and therefore are involved in the development of a National Recovery Strategy for this species, as well as monitoring the linkages with the component provincial recovery strategies.

Environment Canada agreed to receive copies of the follow-up monitoring reports from the proposed committee for the Wuskwatim Project that relate to woodland caribou. Environment Canada has indicated that, if any future action is needed under SARA to address woodland caribou population impacts, they would continue to be involved, through existing mechanisms in cooperation with the province of Manitoba as described above, or other measures as provided under SARA, to ensure that appropriate mitigation measures are taken.

Considering the above-described mitigation and monitoring with the proposed oversight of the scientific advisory committee, the expert opinions provided by Parks Canada and Manitoba Conservation, and the assurance by Environment Canada respecting their ongoing commitments under SARA, DFO and TC conclude that the Project is not likely to have significant adverse cumulative effects to woodland caribou.

7.10.4 Cumulative effects to Human Health – Mercury in Fish

Mercury analysis in fish considered by the Proponent indicated that levels in northern pike, lake cisco and lake whitefish from all Burntwood River lakes and walleye from Opegano and Birch Tree Lakes were presently 1.5 to 3.3 times higher than the respective concentrations in the same fish species from a local reference lake not affected by the CRD. The Proponent indicated there was a potential for operation of the Project to marginally increase mercury levels in fish in the upstream area between Early Morning Rapids and Taskinigup Falls. DFO reviewed the Proponent's analysis and was satisfied that the Proponent's predictions of small to negligible increases in mercury were reasonable. By minimizing flooding through the project design, the potential for significant mobilization of mercury is largely mitigated. DFO believes that the proposed monitoring for mercury in fish will be adequate to verify the Proponents predictions and detect any unforeseen impacts. Health Canada reviewed the Proponent's analysis and

concluded that, with the inclusion of consideration of impacts to sensitive subgroups of the population including women of childbearing age, infants and children, the risks to human health had been adequately assessed. In consideration of DFO's review of the Proponent's analysis of potential mercury accumulation in fish, the proposed monitoring, and the expert advice of Health Canada, DFO and TC conclude that the Project is not likely to have significant adverse cumulative effects on human health due to fish consumption.

7.10.5 Cumulative Effects to Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons

Resource Harvesting

In consideration of cumulative effects to resource use for traditional purposes by Aboriginal persons, the Proponent notes that the Wuskwatim Transmission Project and future forest harvesting activity by Tolko would provide additional access which could further increase pressure on traditional use of resources in the Wuskwatim region, particularly south of the Burntwood River. Future development and inhabitation of Treaty Land Entitlements near Wuskwatim Lake would cause an additional incremental increase in harvesting activity in the area. The Proponent suggests that designation of the Partridge Crop Hill Area as a protected area would counteract some of the increased access.

The Proponent believes that resource users would generally view the increased access resulting from the additional projects as a positive effect. Negative impacts from increased access will be managed according to the Access Management Plan in consultation with the Province of Manitoba and the NHRMA to ensure resources continue to be available for traditional use purposes. The Proponent's cumulative effects assessments of terrestrial and aquatic resources in the EIS (Manitoba Hydro and Nisichawayasihk Cree Nation, 2003) concluded that there will be no significant long-term negative effects (although there is some uncertainty with regard to woodland caribou, the Proponent noted this species comprises a negligible proportion of current resource use). Consequently, according to the Proponent, the cumulative effects of the projects considered would not change the significant positive, long-term regional effect on resource use that will result from the Project.

DFO agrees that provision of increased access to traditional resource users may counteract some of the negative impacts to access resulting from the CRD identified by resource users. When consideration is given to the mitigation and monitoring identified in the Draft Aquatic Effects Monitoring Program and the Draft Fish Habitat Compensation Plan submitted to DFO, the Access Management Plan submitted to Manitoba Conservation for their Environment Act Licence, mitigation associated with Manitoba Hydro's Debris Management Program, and the ongoing dialogue between the Proponent and the resource users, DFO and TC conclude that significant adverse cumulative effects to the harvesting of resources for traditional purposes are not likely.

7.10.6 Cumulative Impacts to Use of Renewable Resources – Commercial Forestry

The Proponent indicates that the Wuskwatim Transmission Project**,** Treaty Land Entitlements, and conservation initiatives have the potential to cumulatively affect the forest industry through reductions in productive forest land available under forest management. Such cumulative effects may limit potential forest industry expansion opportunities in the area. The Proponent estimates that the combined withdrawals from the Wuskwatim Generation and Transmission Projects constitute 0.1% of the total productive forest land within the NRFS, which in the Proponent's opinion represents an insignificant effect on the long-term sustainability of the timber resources. DFO and TC agree, and conclude that significant adverse cumulative effects to commercial forestry as a result of the Project are not likely.

8.0 Environmental Monitoring and Follow-up

Section 6 of Volume 1 of the environmental impact statement (Manitoba Hydro and Nisichawayasihk Cree Nation, 2003) describes the monitoring and follow-up program proposed by the Proponent. Details regarding monitoring design (e.g., equipment used, parameters measured, methods and reporting mechanisms) can be found in Volume 4 of the EIS. At the request of DFO, the Proponent prepared additional documents describing mitigation and follow-up monitoring of the aquatic environment, as well as proposed actions should monitoring indicate that necessity. These are described briefly below along with other measures deemed necessary by DFO, TC and expert federal authorities. The purposes of the proposed follow-up programs are to verify the accuracy of the environmental assessment predictions, determine the effectiveness of any measures taken to mitigate the adverse environmental effects of the Project, clarify uncertainties and generally monitor changes to the physical environment as a result of the Project. The key elements of the follow-up program proposed by the Proponent in their EIS include monitoring of the physical environment (climate, stability of banks, woody debris, and water quality), the biological environment (terrestrial and aquatic vegetation, fish, invertebrates, birds, woodland caribou and other terrestrial animals), and the human environment (recreational and commercial activities, economic benefits).

According to Manitoba Conservation, any licence provided to the Proponent under the Environment Act will require submission to the Minister of Conservation of an Environmental Protection Plan (EPP) prior to commencement of construction activities for the Project. The EPP shall contain the project-specific environmental protection measures referenced in the Wuskwatim Generating Station EIS, and all additional measures identified and agreed to by the Licencee following the filing of the EIS; and describe the approach to be used by the Licencee to monitor environmental conditions during the construction and operation of the Generation Station's components to ensure that mitigative measures are applied by the contractors and subcontractor(s) systematically, and in a manner consistent with the commitments made in the Wuskwatim Generating Station Environmental Impact Statement (EIS). The Manitoba Clean Environment Comission has recommended that, in addition to the monitoring described by the Proponent in the EIS, any Environment Act Licence issued for the

Project should specifically include, among other things, a requirement for monitoring rates of shoreline erosion on Wuskwatim Lake, and along potentially-affected downstream reaches of the Burntwood River; a requirement for monitoring sediment concentrations and their downstream transport in the Burntwood River during construction, and their related effects on water quality; a requirement for monitoring fish production and fish harvesting in Wuskwatim Lake; and a requirement for monitoring of the woodland caribou Population, distribution and behaviour during construction and operation.

DFO and TC are satisfied that the proposed follow-up measures would provide for attainment of the major objectives of these programs. However, DFO requested modification of some follow-up programs to allow for better assessment of the expected environmental effects. Additional elements were considered as described below:

- At the request of DFO, the Proponent prepared a Draft Sediment Management Plan (Acres Manitoba Limited, 2004) which specifies key mitigation measures, monitoring, and action levels to address sediment impacts during Project construction. A final Sediment Management Plan must be submitted to DFO and Environment Canada prior to construction.

- Before any blasting work is undertaken the Proponent must submit an excavation/blasting plan for review and approval by DFO.

- At the request of DFO, the Proponent strengthened their Draft Aquatic Effects Monitoring Program (North/South Consultants, Inc., 2004). In addition to monitoring proposed in the EIS, the revised monitoring program now includes monitoring of forage fish species, monitoring of a "sentinel" fish species not targeted by commercial, domestic or recreational fishing, a more responsive monitoring program for benthic invertebrates better able to detect ecosystem effects, and incorporation of Traditional Knowledge in ecosystem monitoring. Results of monitoring according to this program will be submitted to DFO and Environment Canada.

- In response to concerns by DFO the proponent is undertaking a study of turbine impacts and fish behavior at representative existing generating stations, which is expected to improve the certainty of impact predictions. Results from this study will be provided to DFO for review.

- At the request of DFO, the Proponent will develop a modified station design to limit entrainment and/or minimize fish mortality, as well as develop a monitoring program capable of evaluating the effectiveness of those measures developed for DFO's review.

- At the request of DFO, the Proponent prepared a Draft Plan (North/South Consultants, Inc., 2004), which includes provisions for monitoring the

effectiveness of the compensation measures and the implementation of corrective measures where necessary.

- Environment Canada agreed to receive and review copies of the follow-up monitoring reports for the Wuskwatim Project that relate to woodland caribou. Environment Canada has indicated that, if any future action is needed under SARA to address woodland caribou population impacts, they would continue to be involved, through existing mechanisms in cooperation with the province of Manitoba as described above, or other measures as provided under SARA, to ensure that appropriate mitigation measures are taken.

- NRCan has requested that the Proponent provide a study/report of field investigations, conducted by a competent geologist and geotechnical engineer consisting of visiting the site, assessing the structures, presenting the findings and stating the conclusion in relation to the presence of two faults identified as present on the proposed dam site. This report has been submitted by the Proponent to NRCan for review.

9.0 Conclusions

Following analysis of the nature of the project, the description of work, the infrastructures and the proposed changes to the hydraulic regime, Fisheries and Oceans Canada and Transport Canada, as responsible authorities as defined in the *Canadian Environmental Assessment Act*, have assessed the potential impacts that the Wuskwatim Generation Project is likely to have on the environment. This review was completed on the basis of the information provided by the Proponent in their Environmental Impact Study and Supplemental Filings, expert advice provided by federal authorities, results of discussions with provincial regulatory agencies and advice from provincial experts provided through the cooperative review process, and comments provided by Aboriginal groups and other public stakeholders through various consultation exercises.

Taking into account the implementation of any mitigation that was considered to be appropriate, including the proposed habitat compensation measures, as well as the follow-up programs and the Proponent's commitments, Fisheries and Oceans Canada and Transport Canada have determined that the proposed Project, as defined by the scope of the study, is not likely to cause significant adverse environmental effects.

10.0 References

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Appendix 1

Summary of the Project's effects on the Valued Environmental Components (VEC), special mitigation and habitat compensation measures and significance of residual effects.

VEC	Structures or activities	Main effects before the application of mitigation and habitat compensation measures	Main mitigation/ habitat compensation	Significance of the residual effect on the VEC
Fish and Fish Habitat	**Construction Phase**			
	Suspended solids and sediment inputs due to discharge from wash water settling ponds, cofferdam placement and removal, removal of rock plugs, and erosion of riverbank and riverbed during river management.	Increases in TSS for several weeks at and downstream of the construction site; magnitude of increase varying among activities. Increase in metals associated with sediment suspended solids. Short term effects to lower trophic levels.	Measures to minimize inputs as described in Draft Sediment Management Plan. Continuous monitoring during construction and implementation of additional mitigation as necessary.	Not significant
	Blasting	Release of ammonia and nitrate into Reach 2 and upper Reach 3. Large increases in ammonia may be toxic to aquatic life. Blasts for the removal of temporary rock plugs in the spillway channel, channel improvement area, and at the station may cause fish mortality in the immediate vicinity of the blast and may result in mobilization of sediment.	Conduct majority of blasting in the dry. Unspent charges will be removed from blasts conducted in the dry . Mitigation as described in proposed excavation/blasting plan.	Not significant
	Footprint of cofferdams and construction of generating station and other structures. Footprint of water intakes and boat launches.	Temporary (cofferdams) and permanent (generating station, main dam, boat launches) loss of fish habitat.	Replacement of lost or altered fish habitat by fish habitat compensation as described in Draft Fish Habitat Compensation Plan	Not significant
	Construction and footprint of culvert(s) at nine stream crossings.	Loss of aquatic habitat; possible changes in water depth and velocity at crossings; introduction of rip-rap; some increase in sedimentation downstream of crossing. Long-term (due to construction of permanent structures), small, site-specific.	All stream crossings will meet the "Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat". Permanent loss of fish habitat compensated according to Draft Fish Habitat Compensation Plan	Not significant
	New flow patterns immediately downstream of Project during	Short-term increases in erosion of riverbed and riverbanks, mobilization of sediment.	Mitigation and monitoring to be carried out during the construction	Not significant

VEC	Structures or activities	Main effects before the application of mitigation and habitat compensation measures	Main mitigation/ habitat compensation	Significance of the residual effect on the VEC
	initial operation.		phase as described in the Draft Sediment Management Plan to address the potential impacts of initial operation	
	Accidental spills	Release of harmful quantities of various deleterious substances, in particular hydrocarbons, into surface waters.	Safe handling procedures and spill response measures. Monitoring of water quality as described in Draft Aquatic Effects Monitoring Program.	Not significant
	Operation Phase			
	Stabilization of water levels near the upper end of the existing range in Reach 1 (Wuskwatim Lake)	Conversion of intermittently exposed habitat to permanently wetted habitat, generally beneficial to fish habitat, but could be reduced under low flow conditions. Increase in erosion and sedimentation. Increase in inputs of woody debris. Possible small increases in nutrients and organics, and decrease in winter oxygen levels.	Mitigation of erosion in targeted areas. Debris management program. Monitoring of aquatic environment as described in Draft Aquatic Effects Monitoring Program.	Not significant
	Increase in water levels in Reach 2 (falls) by approximately 7m. Flooding of 37.2 ha.	Increase in flooded aquatic habitat of 37.2 ha. The large increase in water depth could also result in harmful alteration of currently productive littoral areas. Small increases in nutrients and organics, and localized decrease in winter oxygen levels.	Harmful alteration of fish habitat compensated according to Draft Fish Habitat Compensation Plan. Monitoring of aquatic environment as described in Draft Aquatic Effects Monitoring Program.	Not significant
	Daily water level fluctuations superimposed on present (CRD) fluctuations in Reach 3 and Reach 4 (downstream). Slightly lower minimum water levels in these reaches.	Increase in intermittently exposed area. Decrease in permanently wetted habitat. Loss of aquatic plant beds. Decrease in invertebrate productivity. Loss of fish feeding and spawning habitat.	Permanent loss of fish habitat compensated according to Draft Fish Habitat Compensation Plan .Monitoring of aquatic environment as described in Draft Aquatic Effects Monitoring Program.	Not significant
	Generating Station structure and operation.	Impacts to downstream fish movement including turbine mortality.	Turbine design is lower impact. Other design modifications to exclude fish from GS intakes.	Not significant

VEC	Structures or activities	Main effects before the application of mitigation and habitat compensation measures	Main mitigation/ habitat compensation	Significance of the residual effect on the VEC
	Changes in operation of Lake Winnipeg Regulation and Stephen's reservoir to match power generation at Wuskwatim GS to sales.	None to very small effects on water levels in Cross Lake and Stephen's reservoir, within existing operating constraints.	No mitigation considered necessary.	Not significant
Birds	**Construction Phase**			
	Clearing along access roads, borrow areas and at the Generating Station site area	Short-term, site specific and small negative effects. Disturbance to nesting, foraging and brood-rearing; loss of some foraging and nesting habitat.	Restrict clearing to outside nesting and brood-rearing periods where possible; rehabilitation of some areas following use.	Not significant.
	Clearing and staged flooding of the forebay area between Wuskwatim Falls and Taskinigup Falls	Long-term, site specific and small negative effects, loss of some nesting, foraging and brood-rearing habitat.	Restricting clearing and flooding activities to outside the most sensitive breeding and brood-rearing months. Additional mitigation if need identified by monitoring.	Not significant.
	Noise associated with machinery, people and activities such as blasting	Short-term, site specific and small negative effect Disturbance to nesting, foraging and brood-rearing.	Restrict blasting to outside nesting and brood-rearing periods where possible. Additional mitigation if need identified by monitoring.	Not significant.
	Operation Phase			
	Wuskwatim lake level increased to 234 ASL and kept relatively stable.	Long-term, local, small negative and/or positive effects. Decrease in some nesting, foraging and cover habitat. Erosion of shoreline nesting habitat, and increased turbidity. Decline of off-shore marsh habitat. Potential increase in shrubby bog and peatland nesting habitat. Reduced incidence of nest flooding in lowland bog areas.	Stabilization of selected eroding shorelines. Restoration of some stream mouth habitat as part of Draft Fish Habitat Compensation Plan may also provide benefits to bird habitat.	Not significant.
	Access road operation and maintenance.	Long-term, local, small negative effects Increased mortality due to road kill and increased hunting opportunities. Loon mortality due to entrapment in fishing nets.	Access restriction – Access Management Plan	Not significant.
Species at	**Construction Phase**			

VEC	Structures or activities	Main effects before the application of mitigation and habitat compensation measures	Main mitigation/ habitat compensation	Significance of the residual effect on the VEC
Risk - Woodland Caribou	Clearing and construction of access roads, borrow areas, GS area; sensory disturbances from noise and people; access-related events; possible accidental events from collisions, spills or fire.	Negative, short-term, small, and regional effects. Small loss of primary and secondary habitat; loss of one known calving site at GS; possible changes to movements and habitat use (including loss of habitat effectiveness and fragmentation near the road); possible mortality from hunting, collisions, fire or increased predation risk.	Limiting of traffic volumes, preventing unnecessary access as well as other measures identified in the Access Management Plan. Minimizing clearing, encouraging re-growth of vegetation, and posting wildlife warning signs where beneficial. No blasting within 5 km of the calving area along the access road from mid-May to early-July. No temporary roadbed borrow operations will occur within 2 km of the known calving area along the access road from mid-May to early-July.	Not significant
	Operation Phase			
	Wuskwatim Lake water level increased to 234 m ASL; small flooded area; sensory disturbances from noise and people; access-related events; possible accidental events from collisions, spills or fire.	Negative, long-term, small, and regional effects. Small loss of primary and secondary habitat; possible changes to movements and habitat use (including loss of habitat effectiveness and fragmentation near the road); possible mortality from hunting, collisions, fire or increased predation risk.	Access Management Plan. Establishment of a scientific advisory committee, comprised of representatives of directly affected communities, Manitoba government representatives, scientists and where appropriate, Government of Canada representatives, to assess ongoing impacts of project activities and recommend adaptive management actions.	Not significant
Human Health	**Construction Phase**			
	Access road construction, concrete batch plant.	Short-term localized increase in particulate may affect local air quality.	Proponent will keep roads well maintained to facilitate efficient traffic flow, using such measures as surface improvement (e.g., grading) and/or surface treatment (e.g.,	Not Significant

VEC	Structures or activities	Main effects before the application of mitigation and habitat compensation measures	Main mitigation/ habitat compensation	Significance of the residual effect on the VEC
			watering, chemical-dust suppressants). Mitigation of fugitive emissions from sand and aggregate transfer by washing all sand and coarse aggregate prior to its use.	
	Operation Phase			
	Stabilization of water level at the upper end of existing range in Wuskwatim Lake (Reach 1); inundation of 34 hectares between Wuskwatim Falls and Taskinigup Falls (Reach 2).	Small, local, long-term increase in mercury concentration in fish used for consumption upstream of dam. No detectable increases in mercury expected downstream.	Low head Project design to minimize flooding. Clearing of shoreline vegetation in Reach 2 prior to flooding. Monitoring of mercury in fish as described in Draft Aquatic Effects Monitoring Program.	Not significant.
	Stabilization of water level at the upper end of existing range in Wuskwatim Lake (Reach 1).	Increase in TSS near eroding shorelines likely to result in decrease in drinking water quality near those sites.	Erosion mitigation at targeted sites on Wuskwatim Lake. Monitoring of water quality as described in Draft Aquatic Effects Monitoring Program.	Not significant.
Current Use of Lands and Resources for Traditional Purposes by Aboriginals	Increased Access	Road access will increase opportunities to harvest resources in Wuskwatim area by NCN residents. Increased opportunity for recreational resource harvesters to harvest resources in the Wuskwatim area. Increased poaching. Increased resource use in Wuskwatim area may reduce animal and plant populations available for resource users	Access Management as described in Draft Access Management Plan, including gated access at PR 391, access granted by special permission only.	Not significant.
	Stabilization of water level at the upper end of existing range in Wuskwatim Lake (Reach 1). Increase in water levels in Reach 2 (falls) by approximately 7m. Flooding of 37.2 ha. Daily water level fluctuations superimposed	Impacts to habitat due to increased erosion and sedimentation. Increased debris inputs further impacting access for resource gathering.	Mitigation identified in the Draft Fish Habitat Compensation Plan submitted to DFO. Mitigation associated with Manitoba Hydro's Debris Management Program.	Not significant.

VEC	Structures or activities	Main effects before the application of mitigation and habitat compensation measures	Main mitigation/ habitat compensation	Significance of the residual effect on the VEC
	on present (CRD) fluctuations in downstream.			
	Wuskwatim lake level increased to 234 asl.	Increase erosion of shoreline areas, flooding of proposed forebay - impacts to heritage resources.	Historic Resources Branch mitigation surveys, Cultural and Heritage Resources Committee	Not significant.
Use of Renewable Resources - Commercial fishing and trapping	Footprint of cofferdams in Reach 2 and construction of generating station and other structures. Footprint of water intakes and boat launches. Stabilization of water level at the upper end of existing range in Wuskwatim Lake (Reach 1). Increase in water levels in Reach 2 (falls) by approximately 7m. Flooding of 37.2 ha	Increased lake access viewed as beneficial for harvesting and transportation for commercial fishers and trappers. Loss off fish habitat, potential small increases in mercury in animals harvested may adversely affect product quantity and quality.	Access Management Plan. Project design to minimize newly flooded areas. Mitigation and compensation to achieve no net loss of fish habitat as identified in the Draft Fish Habitat Compensation Plan.	Not significant.
Use of Renewable Resources - Commercial Forestry	Footprint of cofferdams in Reach 2 and construction of generating station and other structures. Stabilization of water level at the upper end of existing range in Wuskwatim Lake (Reach 1). Increase in water levels in Reach 2 (falls) by approximately 7m. Flooding of 37.2 ha. Clearing of access road.	Reductions in productive forest land available due to clearing, flooding, footprint of structures and erosion.	Minimization of land cleared. Salvage of merchantable timber where feasible. Rehabilitation of sites not required after project construction.	Not significant.
Navigation	**Construction Phase**			
	Access Road crossings designated R2, R5, R6, and R8 by Proponent.	Culvert crossings will interfere with navigation of the small vessels that could use these streams.	Installation and maintenance of a portage route around each crossing to facilitate navigation around these structures.	Not significant.
	Generating station and associated structures.	Potential interference with navigation. Safety concerns.	Temporary safety boom upstream of the outlet of Wuskwatim Lake	Not significant.

VEC	Structures or activities	Main effects before the application of mitigation and habitat compensation measures	Main mitigation/ habitat compensation	Significance of the residual effect on the VEC
			during construction. Upstream and downstream boat launches with portage route. Signage to ensure hazards and safe routes are clearly identified.	
	Water intake structures for construction camp and concrete batch plant.	Potential interference with navigation	Sufficient water clearance over top of structures to allow for safe navigation. Lines and intakes will be marked with buoys that are complaint with the Private Buoy Regulation under the Canada Shipping Act.	Not significant.
	Operation Phase			
	Operation of the Project resulting in water level fluctuations downstream of the dam in the tailrace typically ranging from 0.4 m to a maximum of 1.3 m within a 24-hour period.	Navigation safety concerns for waterway users traveling through the generating station area via the portage connecting the up and downstream boat launches, and using the waterway downstream of the station.	The Proponent will post signs notifying potential waterway users of the conditions downstream. An audible warning system will be maintained that will notify users of spillway gate movement and changing water levels resulting from dam operations	Not significant.

Appendix 2

Fish Consumption Levels Recommended by Health Canada for Watersheds in the Wuskwatim Generation Project Area

Wuskwatim Hydro Project Mercury in Filet of Fish - Adults

Species	Hg Level "Current" Level Found (ug/g)	Fish Intake g/day	Hg Intake ug/kg bw/day	PTDI (MeHg) ug/kg bw/day	% PTDI	RMWI g/week
Whitefish	0.097	40	0.06	0.47	11.8%	2374
Northern Pike	0.372	40	0.21	0.47	45.2%	619
Walleye	0.282	40	0.16	0.47	34.3%	817

Species	Hg Level Minimum Predicted Level (ug/g)	Fish Intake g/day	Hg Intake ug/kg bw/day	PTDI (MeHg) ug/kg bw/day	% PTDI	RMWI g/week
Whitefish	0.10	40	0.06	0.47	12.2%	2303
Northern Pike	0.40	40	0.23	0.47	48.6%	576
Walleye	0.30	40	0.17	0.47	36.5%	768

Species	Hg Level Maximum Predicted Level (ug/g)	Fish Intake g/day	Hg Intake ug/kg bw/day	PTDI (MeHg) ug/kg bw/day	% PTDI	RMWI g/week
Whitefish	0.14	40	0.08	0.47	17.0%	1645
Northern Pike	0.56	40	0.32	0.47	68.1%	411
Walleye	0.39	40	0.22	0.47	47.4%	591

Notes:

Adult Body Weight - 70 kg as used in the CSR
RMWI - Recommended Maximum Weekly Intake

Wuskwatim Hydro Project — Mercury in Filet of Fish - Women of Child Bearing Age

Species	Hg Level "Current" Level Found (ug/g)	Fish Intake g/day	Hg Intake ug/kg bw/day	PTDI (MeHg) ug/kg bw/day	% PTDI	RMWI g/week
Whitefish	0.097	40	0.07	0.2	36.1%	776
Northern Pike	0.372	40	0.28	0.2	138.3%	202
Walleye	0.282	40	0.21	0.2	104.8%	267

Species	Hg Level Minimum Predicted Level (ug/g)	Fish Intake g/day	Hg Intake ug/kg bw/day	PTDI (MeHg) ug/kg bw/day	% PTDI	RMWI g/week
Whitefish	0.10	40	0.07	0.2	37.2%	753
Northern Pike	0.40	40	0.30	0.2	148.7%	188
Walleye	0.30	40	0.22	0.2	111.5%	251

Species	Hg Level Maximum Predicted Level (ug/g)	Fish Intake g/day	Hg Intake ug/kg bw/day	PTDI (MeHg) ug/kg bw/day	% PTDI	RMWI g/week
Whitefish	0.14	40	0.10	0.2	52.0%	538
Northern Pike	0.56	40	0.42	0.2	208.2%	135
Walleye	0.39	40	0.29	0.2	145.0%	193

Notes:

Women Body Weight - 53.8 kg

RMWI - Recommended Maximum Weekly Intake

Wuskwatim Hydro Project **Mercury in Filet of Fish - Young Children**

Species	Hg Level "Current" Level Found (ug/g)	Fish Intake g/day	Hg Intake ug/kg bw/day	PTDI (MeHg) ug/kg bw/day	% PTDI	RMWI g/week
Whitefish	0.097	20	0.13	0.2	67.4%	208
Northern Pike	0.372	20	0.52	0.2	258.3%	54
Walleye	0.282	20	0.39	0.2	195.8%	71

Species	Hg Level Minimum Predicted Level (ug/g)	Fish Intake g/day	Hg Intake ug/kg bw/day	PTDI (MeHg) ug/kg bw/day	% PTDI	RMWI g/week
Whitefish	0.10	20	0.14	0.2	69.4%	202
Northern Pike	0.40	20	0.56	0.2	277.8%	50
Walleye	0.30	20	0.42	0.2	208.3%	67

Species	Hg Level Maximum Predicted Level (ug/g)	Fish Intake g/day	Hg Intake ug/kg bw/day	PTDI (MeHg) ug/kg bw/day	% PTDI	RMWI g/week
Whitefish	0.14	20	0.19	0.2	97.2%	144
Northern Pike	0.56	20	0.78	0.2	388.9%	36
Walleye	0.39	20	0.54	0.2	270.8%	52

Notes:

Young Children Body Weight - 14.4 kg

RMWI - Recommended Maximum Weekly Intake

Wuskwatim Hydro Project — Mercury in Filet of Fish - Young Children

Species	Hg Level "Current" Level Found (ug/g)	Fish Intake g/day	Hg Intake ug/kg bw/day	PTDI (MeHg) ug/kg bw/day	% PTDI	RMWI g/week
Whitefish	0.097	20	0.10	0.2	48.5%	289
Northern Pike	0.372	20	0.37	0.2	186.0%	75
Walleye	0.282	20	0.28	0.2	141.0%	99

Species	Hg Level Minimum Predicted Level (ug/g)	Fish Intake g/day	Hg Intake ug/kg bw/day	PTDI (MeHg) ug/kg bw/day	% PTDI	RMWI g/week
Whitefish	0.10	20	0.10	0.2	50.0%	280
Northern Pike	0.40	20	0.40	0.2	200.0%	70
Walleye	0.30	20	0.30	0.2	150.0%	93

Species	Hg Level Maximum Predicted Level (ug/g)	Fish Intake g/day	Hg Intake ug/kg bw/day	PTDI (MeHg) ug/kg bw/day	% PTDI	RMWI g/week
Whitefish	0.14	20	0.14	0.2	70.0%	200
Whitefish*	0.12	20	0.12	0.2	60.0%	233
Northern Pike	0.56	20	0.56	0.2	280.0%	50
Walleye	0.39	20	0.39	0.2	195.0%	72

Notes:

Young Children Body Weight - 20 kg - body weight used in previous Health Canada (HPFB) Comments

*** - 0.12 mg/kg in whitefish used by HPFB in previous comments to calculate the RMWI for the filet of this fish species (233 g/week)**

RMWI - Recommended Maximum Weekly Intake

Appendix 3

List of Acronyms

List of Acronyms

AAC - Annual Allowable Cut
ASI - Area of Special Interest
ASL - Above Sea Level
CEAA – Canadian Environmental Assessment Act
CCME - Canadian Council of Ministers of the Environment
CEC – Clean Environment Commission
COSEWIC - Committee on the Status of Endangered Wildlife in Canada
CRD - Churchill River Diversion
CSR – Comprehensive Study Report
CWQI - Canadian Water Quality Index
DFO – Fisheries and Oceans Canada
DO - dissolved oxygen
EC – Environment Canada
EIA - Environmental Impact Assessment
EIS - Environmental Impact Statement
FA – Fisheries Act
FML - Forest Management License
FMU - Forest Management Unit
GHG - greenhouse gas
GIS - Geographic Information System
GW - gigawatt
GW.h - gigawatt hours
ha – hectares
HC – Health Canada
INAC – Indian and Northern Affairs Canada
km - kilometres
LWR - Lake Winnipeg Regulation
m - metres
MBESA - *Manitoba Endangered Species Act*
MSQG - Manitoba Sediment Quality Guideline
MW - megawatts
MWQSOG - Manitoba Water Quality Standards, Objectives, and Guidelines
NCN – Nisichawayasihk Cree Nation
NFA - Northern Flood Agreement
NRFS - Nelson River Forest Section
NTU - Nephelometric Turbidity Units
NWPA - Navigable Waters Protection Act
PAT – Project Administration Team
PC – Parks Canada
PDA - Project Development Agreement
PEL - Probable Effects Level
PIP - Public Involvement Plan
RMA - Resource Management Area
RoW - Right-of-Way
RTL - Registered Trapline
SARA – Species at Risk Act

TAC – Technical Advisory Committee
TC – Transport Canada
TDS - total dissolved solids
TK - Traditional Knowledge
TLE - Treaty Land Entitlement
TSS - total suspended solids
VEC - Valued Environmental Component
WQ - water quality
WQI - Water Quality Index