1. Introduction

The Joint Venture Partnership of Constance Lake First Nation (CLFN) and Northland Power Inc. (Northland) is proposing to jointly construct, own and operate four small run-of-river hydroelectric facilities on the Kabinakagami River, approximately 20 km north of Highway 11 and 40 km west of Hearst, Ontario (Figure 1.1). The four facilities, collectively known as the Kabinakagami River Project (the "Project"), will have a combined generating capacity of up to 26 megawatts (MW). The four facilities were originally numbered Sites 3, 4, 5 and 6, but were subsequently given names in the language of the CLFN, as follows:

- Site 3 – Neeskah (Goose)
- Site 4 - Peeshoo (Lynx)
- Site 5 – Wahpeestan (Marten)
- Site 6 – Wapoose (Rabbit).

Each facility will be of similar design, with main components of each including an earth-fill dam, a concrete overflow spillway, a switchyard and a close-coupled powerhouse containing two Bulb Style turbines, an intake, draft tube, tailrace and energy dissipation plunge pool. An intake channel will convey flow from the river into the intake of the powerhouse and a tailrace channel will convey the flow from the powerhouse back into the river. Each facility will create a small head pond upstream from the dam. The facilities will be operated in a run-of-river mode to prevent changes in flow and water level in the Kabinakagami River downstream from the facilities.

The Project is subject to a number of environmental approval processes and permits from various regulatory agencies. This Environmental Report (ER) combines and consolidates the needs of various environmental review and approval agencies, and addresses the following processes and requirements:

- A Class Environmental Assessment (Class EA) in accordance with the Ontario Waterpower Association's (OWA) Class Environmental Assessment for Waterpower Projects (hereinafter referred to as the OWA Class EA) (OWA, 2012). This is an approved Class EA under the *Ontario Environmental Assessment Act*.
- A Class EA under the Ministry of Natural Resources (MNR) Class EA for Resource Stewardship and Facility Development Projects (Class EA for RSFD) for the 44-kilovolt (kV) transmission line option on Crown land running from the facilities to the interconnection point. (Note: the 115-kV transmission line option, as discussed in Section 1.4.5, would be covered under the OWA Class EA).
- A greenfield Water Management Plan (WMP) for the four sites under the *Lakes and Rivers Improvement Act* (LRIA) as part of the environmental screening process to meet the key steps in the Water Management Planning Guideline for Waterpower (MNR, 2002).

This version of the ER is being issued at the Notice of Completion in the provincial Class EA process. Throughout earlier stages in the process (e.g., draft report for agency review and draft for Notice of Inspection public review), this document was being prepared as a combined provincial Class EA Environmental Report and a federal Environmental Screening under the *Canadian Environmental Assessment Act* (CEAA). The federal Environmental Screening was triggered as a result of the need to acquire certain federal approvals for the Project [i.e., pursuant to the *Fisheries Act* and *Navigable Waters Protection Act* (NWPA)]. However, in July 2012, Fisheries and Oceans Canada (DFO) advised Northland that a federal Environmental Screening was no longer required for the Project as a result of recent changes to the CEAA. Therefore, this version of the document addresses the provincial processes noted above and continues to address federal information requirements but it is not formally a federal Environmental Screening.

1.1 Organization of Report

This ER has been organized into the following sections:

- Section 1 (this section) describes the Project, including a discussion of the Project's background, purpose/need, alternatives considered and preferred alternative and regulatory environmental and WMP requirements.
- Section 2 describes the Aboriginal, agency and public consultation processes that were followed and the results of consultation, including how the Project has been amended in response to comments provided.
- Section 3 describes in detail the permanent Project components, the construction activities, including temporary components and the operations of the proposed facilities.
- Section 4 describes the existing natural and socio-economic conditions of the Study Area (i.e., the "existing environment").
- Section 5 documents the potential negative effects during Project construction and operation, identifies mitigation measures to be implemented to prevent or minimize adverse effects, identifies net (residual) effects that will remain following implementation of mitigation, and assesses the significance of each net negative effect.
- Section 6 discusses the potential effects of accidents and malfunctions on the environment as a result of the Project and the mitigation measures that will be used during construction and operation to minimize the risk of accidents and malfunctions and minimize the impact on the environment should they occur.
- Section 7 discusses the potential effects caused by the environment on the construction and operational phases of the Project.
- Section 8 discusses cumulative effects, potential mitigation and the significance of any residual cumulative effects.
- Section 9 describes the preliminary Dam Operating Plan and Water Management Plan for the facilities.

- Section 10 describes the proposed monitoring and follow-up programs to be implemented during the construction and operation phases.
- Section 11 provides a detailed summary of the potential environmental permits and approvals required for construction and operations.
- Section 12 presents the conclusions, a summary of the overall advantages and disadvantages of the Project and the recommendations.

The Scoping Document for the federal screening provided by the Federal Environmental Assessment Team (December 2011) is provided in Appendix A. Although this ER is no longer formally prepared as a federal Environmental Screening, it continues to meet federal information requirements; therefore, the scoping document has not been removed, since it served as guidance in preparation of this report. Representative cross-section drawings of the proposed overflow weir and earth-fill dam are provided in Appendix B. Appendix C contains the record of all consultation activities. Appendix D presents the results of natural environment field studies and other investigations and Appendix E provides the Stage 1 Archaeological Assessment. Appendix F provides the results of the fluvial geomorphological assessment. Appendix G provides the results of the fish tissue mercury concentration assessment.

1.2 Project Background

Northland originally identified the waterpower potential of the Kabinakagami River in 2007 and recognized that the higher potential part of the river was within the CLFN traditional territory and close to CLFN lands. With the desire to enter into a joint venture partnership with CLFN, Northland commenced discussions regarding the feasibility of constructing waterpower facilities within the CLFN traditional territory in May 2007.

Initial discussions indicated that CLFN would be supportive of moving forward with the Project in a Joint Venture arrangement with Northland. In July 2008, CLFN and Northland signed a first Letter of Intent to jointly develop a project(s) on the Kabinakagami River.

Hatch Ltd. (Hatch) was commissioned in April 2009 to prepare a prefeasibility level engineering study to assess the feasibility of a potential waterpower development on the Kabinakagami River.

This study identified eight potential sites on the river (Figure 1.2), as follows:

- Site 1 Muskoo (Bear)
- Site 2 Mahekun (Wolf)
- Site 3 Neeskah (Goose)
- Site 4 Peeshoo (Lynx)
- Site 5 Wahpeestan (Marten)
- Site 6 Wapoose (Rabbit)
- Site 7 Neekik (Otter)
- Site 8 Amisk (Beaver).

Applications were issued to the MNR for each of these sites as potential waterpower developments under the MNR's Direct Site Release Process in April 2009.

Following discussions with CLFN members and analysis of the baseline environmental investigations undertaken in 2009, CLFN and Northland decided not to pursue Site 8, given the potentially significant environmental and socio-economic impacts of that proposed site (see Section 1.6 for additional discussion on this alternative).

In May 2009, the Ontario Government passed the *Green Energy and Green Economy Act*, which revised the Ontario Power Authority's (OPA) energy contracting system by implementing a Feed-In Tariff (FIT) Program, with revised rules. The FIT Program was launched in September 2009.

In November 2009, CLFN and Northland signed a formal agreement to proceed with the Project. Northland submitted applications for FIT program contracts for Sites 1 to 7 to the OPA also in November 2009. Four sites (Sites 3, 4, 5 and 6) were awarded FIT contracts in April 2010. The remaining sites (Sites 1, 2 and 7) were placed within the OPA's Economic Connection Test (ECT) queue under the FIT program. Should additional transmission capacity become available in the area at some point in the future, these sites may also be awarded FIT contracts and they would be subject to all environmental regulation requirements at that time.

For clarity, only Sites 3, 4, 5 and 6 are investigated in this ER. For the purposes of this report, particularly in Section 4 (Description of the Existing Environment) the discussion of environmental features uses the other Sites (1, 2, 7 and 8) as landmarks to note location of features and investigations. For the remainder of this report these will be referred to as Areas 1, 2, 7 and 8, as opposed to Sites.

CLFN and Northland were awarded Applicant of Record status for these four sites by the MNR in April 2011.

CLFN and Northland are proceeding with the Project using the Engineering, Procurement, Construction (EPC) contracting model. Accordingly, CLFN and Northland will retain an Engineering Procurement and Construction Company ("EPC"), also referred to in this document as a "Contractor" to prepare the detailed engineering design for the proposed facilities. The Contractor will follow the constraints and guidance contained within this ER to prepare the detailed design for the overall Project. The detailed design of the project will then be subject to a number of regulatory permits and approvals (see Section 11).

1.3 Project Location and Study Area

The Project will be located on the Kabinakagami River, from approximately 29 to 37 river km downstream (north) from Highway 11 (Figure 1.1). The Project will be situated on provincial Crown land and land tenure instruments will be required from the Crown, in particular the MNR. No portion of the Project will be situated on the CLFN community. The proposed transmission line will primarily run across Crown land, although a crossing of the Ontario Northland rail corridor and crossing of the TransCanada Pipeline right-of-way will be required. Both crossings are located in the vicinity of the Calstock power plant. The new switchyard and the interconnection point with the existing transmission line from the Calstock power plant will be near Highway 11. The Project Area (i.e., the footprint of the Project) is shown in Figure 1.3.

Proposed aggregate pits are located along Roger's Road and in the vicinity of the development sites, the spoils areas are located in close proximity to the development sites and a proposed rock quarry is located along Pelican Road.

The boundaries of the Study Area are considered to be the geographic extent of the components that may be potentially affected by the Project and are defined as follows: the Kabinakagami River from approximately Highway 11, north to the confluence with the Nagagami and the surrounding terrestrial areas, as depicted in Figure 1.3.

1.4 Project Overview

The Project will consist of four run-of-river hydroelectric generating stations (GS), each with a nominal capacity of 6.5 MW, for a total Project capacity of 26 MW. The facilities have the same basic design in order to minimize the design complexity, facilitate the construction process and maximize ease of operation. The following sections briefly describe the main structural components of the Project, the proposed construction methodology and the proposed operational regime for the facilities. A detailed description of the Project components and construction methodology is provided in Section 3.1 and detailed description of the proposed operational regime (water levels and flows) is provided in Section 9.

The details described in the following text are based on the recommendations from the Project. Prefeasibility Study (Hatch Ltd., 2009) as well as additional engineering prepared by Hatch as part of the optimization studies and preliminary design.

1.4.1 Project Components

Numerous common elements have been introduced into the development concept and have been built into the layout arrangements, including:

- identical generating units
- identical balance-of-plant and switchyard components
- identical powerhouse arrangements
- nearly identical dam heights and generating heads
- same earth-fill dam and concrete structure designs
- all powerhouses located on the west bank of the river
- all permanent access and transmission routes located on the west bank of the river only.

The proposed development at each site includes an earth-fill dam as the main water retaining structure and a 50-m long concrete overflow spillway to pass flood flows. The close coupled intake/powerhouse structure is an integrated part of the dam structure and is located on the west bank (left side of the river, looking downstream) of the river at each site. Each powerhouse is sized to contain two Bulb style turbine units. A plunge pool is located downstream from the overflow spillway to provide energy dissipation. Typical earth dam, concrete overflow spillway and plunge pool sections are shown in Appendix B.

1.4.2 Common Hydraulic Characteristics

Each site contains a number of common hydraulic characteristics as summarized in Table 1.1.

Table 1.1 Common Hydraulic Characteristics of the Four Sites

Average operating gross head	9.8 to 10.7 m
Estimated net head	9.5 to 10.4 m
Long-term average flow	51 m^3/s
Total rated turbine flow	82 m^3/s

1.4.3 Installed Capacity

The installed capacity at each site will be two nominally 3.25-MW units for a total installed net capacity of 6.5 MW per site and 26 MW overall delivered to the provincial grid. Each turbine would be capable of generating up to 3.45 MW under certain circumstances, such as increased head due to higher spring water levels or increased flow above the rated maximum of 41 m^3/s (which would only occur if one turbine is shut off and the other turbine is operated up to the absolute maximum of 45 m^3/s). The combined outflow from the turbines will not be greater than 82 m^3/s, even though they are capable of operating at nominally higher flows for short durations of time.

1.4.4 Site Access

General access to the sites will be from Highway 11. Local access will be required to both the east and west banks of the Kabinakagami River, at each of the four proposed development locations.

Permanent access to the west side of the river will be via Highway 663, Roger's Road (utilizing the Constance Lake Bypass) and an upgraded Pelican Road (Figure 1.1) to Site 3 - Neeskah. Two short (approximately 300 m) sections of new access road will be developed to tie the existing Pelican Road into the facility locations at Site 3 - Neeskah and Site 4 - Peeshoo. A new (approximately 8 km long) access road will be required to connect Pelican Road to Site 5 - Wahpeestan and Site 6 - Wapoose.

Access to the east bank of the river at each site will be required for construction purposes only. This access will occur via a series of causeways and travel lanes built upon the cofferdams which will be crossing the river. There will be no temporary or permanent access road joining each of the four sites on the east side of the Kabinakagami River.

1.4.5 Transmission

As shown on Figure 1.1, the transmission line from the facilities will consist of a single 44-kV or 115-kV line from Site 6 - Wapoose, south along the (new) access road to Site 3 - Neeskah, and then through a new corridor running south to a new switchyard and then to interconnect with the existing 115-kV transmission line adjacent to the Calstock power plant, owned by Atlantic Power. The voltage of the line has not yet been determined and both options (44-kV and 115-kV) will be carried through the ER until the optimal voltage is selected. From there, power will be transmitted through the existing 115-kV line to enter the provincial electricity grid at the

Hearst Transformer Station, owned and operated by Hydro-One Networks Inc (HONI), located in Hearst, Ontario.

If the transmission line is 44-kV, it would not require assessment under the OWA Class EA, since only 115 kV or greater lines are included. However, a disposition of Crown land (e.g., through land use permits or other tenure instrument) will be necessary to authorize construction of the line and its long-term occupation of Crown land. Therefore, the 44-kV transmission line option is subject to the MNR Class EA for RSFD Projects. As mentioned previously, this ER has been prepared to the meet the requirements of that Class EA.

1.4.6 Powerhouse

The four powerhouses will be virtually identical. Typical sections are shown in Appendix B.

Each powerhouse is an integral part of the dam structure and is located on the west bank of the river. They are sized to contain two Bulb style turbine units, each with a diameter of about 2.4 m. It is envisaged that roller-type gates will be included for either the intake or draft tube to allow emergency closure of the units and stop log bulkheads will be provided for the other set of gate slots.

1.4.7 Maintenance and Control Facility

A centralized maintenance and control facility for all four sites will be located at the Site 3 - Neeskah powerhouse location.

1.4.8 Project Construction and Schedule

Construction of the Project is anticipated to commence following completion of the Class EA process, preparation of the detailed engineering design and receipt of all required environmental permits and approvals. The construction period will be approximately 30 months long. The proposed construction schedule could be subject to change pending the timelines associated with receipt of permits and approvals and detailed engineering design, as well as uncontrollable variables during construction (e.g., weather conditions, unforeseen difficulties, etc.). Project timelines will follow constraints such as in-water works timelines and clearing restrictions. Construction activities are briefly described below. Figures showing the locations of the Project features are provided in Section 3, along with more detail on the proposed construction.

The first construction activities that will be implemented will include the upgrading of existing access roads and construction of new access roads to each of the proposed facility locations, as discussed in Section 1.4.4. A construction camp will be built near the Site 3 - Neeskah facility. Works and laydown areas will be constructed to provide designated locations for site trailers and equipment and material storage. Section 3 provides the details of these facilities. Site preparation will commence with the removal of vegetation and topsoil in working areas and associated land grading to prepare for construction. As well, borrow areas for rock, aggregate and impervious fill will be developed (see Section 3 for additional information).

The construction methodology for each of the facilities will be similar. Construction of the main components of each facility will occur in a two-phased approach. Phase 1 will involve the construction of the powerhouse, intake and tailrace channels in a dry condition on the west bank. In addition, diversion works, consisting of a portion of the proposed overflow concrete weir with temporary flow through openings, will also be constructed beside the powerhouse in the first phase, to provide a path for flow diversion in Phase 2. Cofferdams will be required to isolate the project areas at Site 3 - Neeskah and Site 4 - Peeshoo from the river and permit construction activities in the dry. Only minor in-water works are necessary during Phase 1 at Site 5 - Wahpeestan and Site 6 - Wapoose. Construction of the powerhouse, flow diversion works, intake and tailrace channels, including excavation of soil and bedrock, foundation preparation, concrete structure work and installation of the equipment will occur isolated from the flow of the river so the work area can stay dry. Phase 1 will last approximately 12 months.

Once the powerhouse is complete, Phase 2 will be implemented. Phase 2 involves the construction of cofferdams upstream and downstream from the proposed earth-fill dam locations, installation of travel lanes across the cofferdams and new causeways to access the east side of the river, diversion of all river flow through the diversion works constructed in Phase 1, dewatering of the work area and construction of the earth-fill dam as well as the remainder of the overflow spillway structure and excavation of the plunge pool. Phase 2 will last approximately 12 months.

Following the completion of construction of the main Project civil components, the final project features will be installed, including the transmission line, completion of interior powerhouse works and site rehabilitation (e.g., removal of all equipment and debris, final grading and landscaping). Head ponds will then be slowly filled to the Target Operating Level (TOL) and testing and commissioning of the generating units will commence.

1.4.9 Project Operation

Once operational, the four facilities will transmit electrical power to the existing transmission line running along and primarily north of Highway 11, which connects into the HONI Hearst Transformer Station (Figure 1.1), where the power will enter the provincial electricity grid.

The facilities will each operate in a run- of-river mode, by passing some or all of the inflow through one or more turbines on a continuous basis, with the remainder, if any, going over the spillway. The river’s flow will not be stored or altered due to manipulation for power production purposes. The run-of-river mode of operation means that both the amount and timing of water entering the head pond will equal the combined flow going through the powerhouse and/or over the dam (including any allowance for local inflows to the river).

Each facility will be operated under a ‘water level control’ strategy whereby, when river inflows are at or below the rated flow capacity of 82 m^3/s, (which occurs approximately 89% of the time in an average flow year) the powerhouse will be operated to maintain the head pond level approximately 0.05 m below the level of the overflow spillway crest, with all flow passing through the turbines. This head pond water level, measured at a point immediately upstream from each facility, is a constant elevation termed the TOL (Target Operating Level). The head pond will be maintained at the TOL by the use of water level transducers upstream from each facility. Once the water level reaches a specified threshold above or below the TOL (anticipate targeting +/- 0.05 m), the flow through the powerhouse will be varied to bring the head pond level back to the TOL. The zone of +/- 0.05 m around the TOL is called the Target Operating Zone. When the river’s flow decreases below 20 m^3/s, limitations of the selected turbine may prevent the head pond from being operated within the Target Operating Zone and may cause water levels to decrease slightly outside this zone, to a maximum of 0.10 m below the Target Operating Level, called the Absolute Minimum Water level. The 0.05 m wide band between the Target Operating Zone and the Absolute Minimum Water Level is called the Low Water Zone. Northland will attempt to operate above this zone at all times.

The minimum flow required for facility operation is 8 m^3/s, which is the lowest flow that one turbine can operate at. Below 8 m^3/s, the facilities will be shut down and all flow will go over the spillway.

During periods of high flow (beyond rated flows of each powerhouse), the head pond water level will increase and start flowing over the overflow spillway. For the 1:2-yr flood, the head ponds will increase by approximately 1.35 m. For the 1:100-yr flood, the head pond levels will increase by approximately 1.84 m under maximum conditions (i.e., conservatively assuming that the facilities will not be operated during such high flow events) so this elevation assumes all flow is going over the spillways, and therefore provides the maximum water level that could occur during such a flood (this water level is also used for the purposes of the dam safety analysis). Such a non-operational scenario could occur if a power outage occurs due to bad weather during a high precipitation storm event. However, under most circumstances, Northland would likely continue to operate during such a flood event and due to the plant operation; the water levels may be lower. The zone of water levels above the spillway crest is called the High Water Zone. The facilities will have no ability to control water levels when flow exceeds the powerhouse capacity and water levels in the head ponds will rise and fall according to natural inflows. Inflow will be measured by a new flow gauge that will be installed just downstream from Highway 11 before Phase 2 construction commences.

1.4.10 Project Decommissioning

Waterpower projects are designed for long life spans, typically in excess of 100 years with ongoing maintenance, repair and upgrade programs. As such, decommissioning of the facility is highly unlikely to happen in less than 100 years. If facility decommissioning is to occur, an environmental assessment process based on the environmental knowledge, standards, and legislative requirements in place at that time would need to be undertaken as required and all necessary permits and approvals would have to be obtained prior to implementation of the decommissioning.

1.5 Purpose and Need

The primary purpose of the Project is to generate electrical power and sell it to the provincial electrical grid under the FIT contract with the OPA in order to derive financial benefits for CLFN and Northland. As a run-of-river operation, power generated from the facilities will be sold to the grid immediately as it is generated, during both peak and off-peak hours, based solely on the river's natural flow. The facilities will not be operated to alter the river's flow to skew power generation preferentially to peak hours.

The FIT contract program was enacted as part of the Ontario Government's *Green Energy and Green Economy Act*. The goal of the Act is to encourage the development of privately funded renewable energy sources, such as small hydro, wind and solar generation in order to produce clean electricity and reduce reliance on more polluting forms of electric energy production (e.g., coal generation). In doing so, the *Green Energy and Green Economy Act* will also encourage creation of jobs in the green energy industry, which will provide economic benefits for the province and its residents.

1.6 Development Alternatives

Several development alternatives have been explored in the initial phases of the Kabinakagami River Project. The following sections discuss the alternatives investigated and the reasons why the proposed alternatives were favoured.

Section 1.6.1 discusses the overall development schemes. The dam types and alternative site layouts are discussed in Sections 1.6.2 and 1.6.3, respectively. The alternative turbine types considered are discussed in Section 1.6.4. Several alternative routings for the transmission line were considered, as discussed in Section 1.6.5.

1.6.1 Development Schemes

The overall project scheme has undergone several changes since the initiation of the project by CLFN and Northland.

In November 2008, CLFN and Northland commenced with preparation of a submission to MNR for Direct Site Release of a waterpower development for the Kabinakagami River. This scheme, illustrated in Figure 1.2, consisted of eight hydropower sites, including regulating reservoirs at Site 2 and Site 8. The reservoirs allowed for daily peaking operations at Site 2 and the next five downstream sites. Water would be stored in the Site 2 reservoir at night when electrical demand and the price for energy are lowest. It would then be used to generate during the peak periods in the day when electrical demand and energy prices are high. The reservoir at the most downstream site, Site 8, enabled re-regulation of flow so that downstream flows would mimic the inflows at the upstream end of the development. This was important because the river downstream of Roger's Road Landing is heavily used for fishing and navigation.

Application for this scheme was submitted by CLFN and Northland in January 2009. The applications for the sites were accepted by MNR through the direct site release process.

Through the course of the baseline studies and collection of Traditional Ecological Knowledge (TEK) conducted in 2009, it was decided to drop Site 8 from the development scheme due to the potential environmental impacts it entailed. The river reach from Roger's Road up to a point upstream from Site 7 is very important to Lake Sturgeon in the river and passage would be blocked by developing the site. Upstream fish passage would likely have been required and there is no precedent for upstream passage of Lake Sturgeon over significant heads. As well, there are numerous small islands that are important for moose calving in the reach that would have been flooded. For these reasons, Site 8 was not included in further development schemes.

However, development of a re-regulating reservoir at the downstream end of the development was critical to the concept of daily peaking without affecting flow rates downstream. Taking this into account, as well as the lost energy generation potential of the dropped site, new locations for a downstream reservoir were investigated. Two new locations were identified for Site 7 at Sites 7A and 7B (Figure 1.2).

In December 2011, Hatch published a pre-feasibility report which described three development alternatives:

Base Scheme: Sites 1 to 8, with fish passages at Sites 7 and 8

Alternative Scheme A: Sites 1 to 6 plus 7A

Alternative Scheme B: Sites 1 to 6 plus 7B.

The prefeasibility report concluded that Alternative Scheme B was the preferred scheme based on environmental and economic criteria. Sites 7A and 7B may have also required fish passages and spawning site mitigation.

The current Project proposal only includes the four sites offered contracts by the OPA: Sites 3 through 6, Neeskah, Peeshoo, Wahpeestan and Wapoose.

1.6.2 Dam Construction Materials

There are several options available with respect to construction materials for dams. The material selected impacts the site layout, including the spillway facilities. Hatch considered the following dam types in the design process: roller compacted concrete (RCC), conventional concrete, earth fill and a hybrid design with part earth fill and part conventional concrete. Both the RCC and conventional concrete structures would be comprised of overflow spillway sections that spanned the width of the river; no gate structures would be required. The earth-fill dam required a separate, gated spillway structure. The hybrid design includes earth-fill dams spanning part of the river width with an overflow spillway of conventional concrete.

The RCC dam was dropped for several reasons, including:

- RCC can be cost effective in comparison with conventional concrete; however, the cost is highly dependent on the quantity of concrete required. This development is quite small and in addition, is to be executed in a two-stage construction effort; it therefore does not leverage the entire potential benefit of RCC.
- Construction with RCC can be time consuming and this Project has an extremely tight construction schedule.
- There is little experience in Canada with RCC construction design and construction methodologies and few contractors have suitable experience.

Cost estimates were prepared for the remaining three alternatives and the hybrid earth-fill/concrete overflow layout was preferred.

1.6.3 Site Layout

Two alternative layouts were developed for each Site 3 - Neeskah and Site 4 - Peeshoo: above and below the rapids at each site.

When presented with a set of rapids like at these sites, conventional waterpower design would place the dam structure at the top of the rapids with a penstock or intake channel to the powerhouse which would then discharge downstream. This allows for a small dam to be built and is generally the most economic option. However, this results in dewatering the rapids, which is environmentally unattractive, unless compensation flow is provided to wet them, which can be significant in terms of lost generation. Another layout option is to construct the dam at the foot of the rapids such that no river section is dewatered.

Layout schemes were developed for dams both above and below the rapids for each Site 3 - Neeskah and Site 4 - Peeshoo and construction costs were estimated for both. The alternatives above the rapids were significantly more cost effective than those below the rapids; however, the value of any required compensation flow would reduce the net difference between the two.

In this case, Northland has committed to CLFN that the development would not dewater any sections of the river; therefore, the options at the bottom of the rapids were selected.

1.6.4 Turbine Types

Waterpower developments of approximately 10 m head can use either Pit-Type, S-Type, or Bulb style turbines. As well, they are on the edge of whether or not a gearbox (connecting the turbine to an electrical generator) is cost effective. Therefore, when Northland solicited Water-to-Wire (W2W) bids from turbine manufacturers, the manufacturers were allowed to suggest the turbine that they thought best suited the proposed developments, without being limited to a specific type.

The bids submitted by the manufacturers included Pit-Type and S-Type turbines, both with and without gearboxes as well as Bulb style turbines without a gearbox. Northland has selected the Bulb style turbine as the preferred turbine for the Project, based on economics driven by ease of installation of Bulb style turbines.

1.6.5 Transmission Routing

The 44-kV or 115-kV electrical transmission line will run from Site 6 - Wapoose along the proposed permanent access road on the west bank of the river to Site 3 - Neeskah and then travel south to a newly constructed switching station near the Atlantic Power Calstock biomass power plant. The Project’s new transmission line will terminate at the new switching station, where it will connect with Calstock’s existing 115-kV transmission line, which interconnects with the provincial electrical grid east of the HONI Hearst TS. Several alternative routings for the transmission line from Site 3 - Neeskah to Calstock power plant were investigated, including:

- along Pelican Road to Roger’s Road, south to Constance Lake By-Pass and then along Highway 11
- overland, south from Site 3 - Neeskah (the preferred routing, shown in Figure 1.1)
- overland, south-east from Site 3 - Neeskah to Fushimi Road, south to Highway 11 and then overland south, intercepting the 115-kV line.

The first alternative is entirely along existing roads, but this routing is significantly longer than the other the two, with corresponding electrical losses making it comparatively uneconomical.

The second alternative has most of its length through existing forested areas. This alternative has the shortest overall length and associated electrical losses and there are no significant

Safety • Quality • Sustainability • Innovation environmental concerns along the routing. This alternative is the preferred and proposed for construction.

The third alternative has an overall length between the other two alternatives. However, this routing is over 6 km longer than the preferred alternative, increasing the electrical losses. Also, although this routing has less length in existing forested areas, the environmental impacts are thought to be higher due to large areas of wetland along the routing. For these reasons, this routing was dismissed in favour of the second alternative.

1.7 Regulatory Requirements

The Project is subject to the requirements of the provincial *Environmental Assessment Act* (i.e., the OWA Class EA and the MNR Class EA for RSFD (if the 44-kV transmission line voltage is identified as preferred)) and the WMP policy and guidelines of MNR, as well as federal information requirements. This document has been prepared to address the requirements of these regulatory processes. These various pieces of legislation are briefly discussed in the following sections. In addition, the Project will be subject to other provincial and federal legislation that will require permits and approvals be obtained to authorize construction and/or operation (see Section 11 for a list of environmental permits and approvals).

1.7.1 Canadian Environmental Assessment Act

As noted previously, a screening under CEAA was triggered as a result of the need for the following federal approvals that are listed on the Law List Regulations of CEAA:

- authorization for the harmful alteration, disruption or destruction (HADD) of fish habitat under Section 35(2) of the *Fisheries Act*
- authorization for the destruction of fish by means other than fishing under Section 32 of the *Fisheries Act*, and
- approval under Section 5(1) and 5(2) of the *Navigable Waters Protection Act* (NWPA).

However, in July 2012, DFO advised Northland that the Project would not require a federal environmental screening, due to changes in the CEAA. However, since the Project was started under the CEAA environmental screening process, the information requirements specific to CEAA have been left within the ER.

The CEAA screening evaluates project features in much the same manner as the provincial process, and includes an evaluation of cumulative effects, alternatives to the project, an assessment of the potential effects of adverse environmental conditions (i.e., drought, flood, fire, etc) on the project, and the environmental effects of accidents and/or malfunctions. More information on CEAA screening requirements is included in Section 1.8. The Federal Scoping Document, which provides the complete scope of assessment identified by the Federal Review Team, is provided in Appendix A. This document was used as guidance in the preparation of this ER.

The required federal approvals listed above are issued by DFO and Transport Canada (Marine). Consequently, these two agencies were originally named as the responsible authorities (RAs) under CEAA. Expert advice was also being provided by Environment Canada (EC), Natural

Resources Canada (NRCan) and Health Canada (HC). Comments provided by federal agencies on previous versions of this document have been included here and addressed as comments to the provincial Class EA process.

1.7.2 Ontario Environmental Assessment Act

1.7.2.1 OWA Class EA for Waterpower Projects

All components of the Project, with the exception of the 44-kV transmission line (if ultimately identified as the preferred transmission line voltage), are subject to the OWA Class EA under the *Ontario Environmental Assessment Act*, which is administered by the Ontario Ministry of the Environment (MOE). The Project is considered to be a new project on an unmanaged waterway, since there are no existing hydroelectric or water control structures on the Kabinakagami River. A flow chart depicting the OWA Class EA process for such a project is provided in Figure 1.4.

1.7.2.2 MNR Class EA for Resource Stewardship and Facility Development Projects

The MNR Class EA is used by MNR for their own projects or projects undertaken by others that require a disposition of Crown Lands, such as a Work Permit under the *Public Lands Act* or other tenure instrument. The MNR can delegate the responsibility to complete the requirements of the MNR Class EA process to project proponents. For the Kabinakagami River Project, the MNR Class EA is potentially required, since the 44-kV transmission line option on Crown land would not be covered by the OWA Class EA (which only covers 115-kV lines or greater). Since MNR will have to issue a permit and tenure for the transmission line and associated step-up transformer facility, they are required to ensure that the MNR Class EA requirements are fulfilled. Since the 44-kV transmission line option is being carried in this ER, this document has included the requirements of MNR's Class EA.

1.7.2.3 Water Management Planning Requirements

Under Section 23.1(1) of the LRIA, the MNR has the authority to order preparation of a WMP to guide the operation of water control structures on a river system in order to achieve the best balance between environmental, social and economic attributes that are impacted by water levels and flows. MNR has indicated that one WMP will be required for the combined operation of the four facilities.

It is the intention of Northland to satisfy as much of the WMP requirements within this ER as possible. Following completion of construction of the facilities, MNR will require Northland to finalize the WMP. The WMP will be posted on the Environmental Bill of Rights Registry by the MNR for public review. The draft final WMP will also be circulated for agency review. After addressing agency and public comments (as applicable) the final WMP document will be provided to the MNR Regional Director for final approval. DFO will be advised of the WMP agreement.

1.8 Guidance Provided in Federal Scoping Document

Although this document no longer serves as a federal environmental screening, it continues to address federal information requirements that were previously required when the Project was subject to a CEAA screening (pre-July 2012). As stated in the *Scoping Document for the Federal Screening for the Kabinakagami River Hydroelectric Project* dated December 2011 (see

Appendix A), provided by the Federal Environmental Assessment Team, the Scope of Project includes:

"all physical works and activities associated with the construction and operation of the four proposed hydroelectric generating facilities on the Kabinakagami River, including dams, overflow weirs, powerhouses and associated intakes and tailraces, associated storage sites, working areas, new transmission lines and associated structures, new and upgraded access roads and any other works or undertakings directly associated with the four hydroelectric facilities, including those that are temporary."

The Scope of Assessment includes:

- environmental effects of the project
- environmental effects of malfunctions or accidents that may occur in connection with the project
- any cumulative environmental effects that are likely to result from the project in combination with other projects that have been, are being or will likely be carried out
- significance of the residual environmental effects
- measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project.

Environmental Components and corresponding Valued Ecosystem Components (VECs) and Valued Socioeconomic Components (VSCs) examined in the assessment process covered both the natural and socioeconomic environments. These are listed in Table 1.2.

Table 1.2 Valued Ecosystem Components

Environmental Component	**Valued Ecosystem Components and Valued Socioeconomic Components**
Surface Geology and Soils	- Terrain and topography - Soil quality, quantity and structure - Sediment quality and type
Surface Water Quality and Quantity	- Quality pertaining to aquatic biota, potable water and recreational water uses - Water levels, flows and movement
Hydrogeology, Groundwater Quality and Quantity	- Quality, pertaining to potable water uses - Groundwater levels, flux, movement - Recharge and discharge functions, including seepage areas
Air Quality and Climate	- Air quality as affected by Project emissions - Greenhouse gas emissions - Local and regional smog, fog, icing effects, microclimate
Fish and Fish Habitat	- Aquatic habitat and biota (fish, benthic invertebrates) - Species at risk

Environmental Component	Valued Ecosystem Components and Valued Socioeconomic Components
Vegetation, Wetlands and Wildlife	- Vegetation type and quantity - Wetlands (type, form and function) - Wildlife (mammals, birds, reptiles and amphibians) - Species at risk - Significant natural areas
Social/Socioeconomic Environment	- Local population - Local residents - Employment and industry - Local businesses - Traffic - Land tenure, Crown land use and land use - Resource harvesting and industrial activities - Recreation - Navigation - Lands and resources used for traditional purposes by Aboriginal persons - Archaeology and heritage resources - Public safety - Waste management

1.9 Methodology of Environmental Report/Environmental Screening

The preparation of the ER has followed the OWA Class EA (2012), while incorporating the requirements of the MNR Class EA, WMP Process and addressing federal information requirements.

The following steps outline the methodology for the ER:

1. Identification of the temporal and spatial boundaries based on the project-environment interactions and therefore the potential to affect the VECs/VSCs.
2. Background data collection, identification of data gaps and the design and implementation of baseline studies to fill data gaps on the natural and socioeconomic features and conditions of the study area.

   Data was collected from the following sources:

   - field investigations
   - local government agencies
   - input from the local community, including TEK from CLFN community members
   - published sources (e.g., MNR Natural Heritage Information Centre).
3. Consideration of Aboriginal, public and agency issues and comments as a result of consultation.
4. Identification of the effects that are likely to occur on the VECs and VSCs as result of implementing the Project based on information obtained on the existing conditions.

5. Development of mitigation measures to eliminate, alleviate or avoid the net effects where possible.
6. Determination of any net effects and the significance of net negative effects.
7. Determination of the likely environmental effects from malfunctions and accidents (such as spills and fires) and development of mitigation measures.
8. Identification of the effects of the environment on the Project (such as flooding and severe weather).
9. Determination of cumulative environmental effects that the Project may have taking into consideration the combination of other past, present and future projects and activities within spatial and temporal boundaries identified that would have overlapping residual effects and if applicable, development of mitigation measures.
10. Design of a monitoring and follow-up program to assess predicted effects and the effectiveness of mitigation measures.
11. Summary of the advantages and disadvantages of the Project.

Figures