EXPLOITS GENERATION:
PROPOSED GRAND FALLS MAIN DAM REHABILITATION

Environmental Assessment Registration

Pursuant to the Newfoundland and Labrador *Environmental Protection Act*

Submitted by Nalcor Energy

May 2016

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Pursuant to the Newfoundland & Labrador *Environmental Protection Act* (Part X)

Submitted by:

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May 2016

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1.0 INTRODUCTION

PROJECT NAME: *Exploits Generation: Proposed Grand Falls Main Dam Rehabilitation*

1.1 Nature of the Undertaking

Since 2009, Nalcor Energy has managed and operated the hydroelectric facilities on the Exploits River on behalf of the Government of Newfoundland and Labrador.

The existing generating facility at Grand Falls-Windsor (Figure 1.1) is the largest of three existing stations on the Exploits system, and has an electrical generating capacity of 75 megawatts (MW). The facility includes a main dam extending across the Exploits River, a gated intake structure, power canal and penstocks, two vertical generating units and four double runner horizontal units with spill gates, fish bypass systems, and nearby transformers and terminal stations which are used to transmit the electrical output of the facility to and through the Island grid.

Nalcor Energy's main areas of focus for its Exploits Generation operations include a commitment to safety, the environment and the operational performance of these assets. In keeping with these objectives and principles, the company is proposing to undertake a number of required modifications and rehabilitation works at the Main Dam at Grand Falls-Windsor (hereinafter also referred to as the Project), including:

- Rehabilitation of the existing concrete dam structure to refurbish deteriorated concrete, along with the installation of additional concrete mass shaped to improve the hydraulics of the spillway;
- Replacement of the existing, temporary flashboard system along the top of the dam with an inflatable system;
- Construction of a single lane vehicle bridge across the existing power canal to provide access for vehicles and equipment during construction and for future maintenance activities; and
- Construction of a pedestrian bridge over sections of the above described dams works to provide additional, safe access to the dam structure for construction and maintenance activities.

Construction activities are planned to be completed in various phases over a three year period, during and after which the dam and overall Grand Falls generating facility will continue to function as per current operational activities and parameters.

Figure 1.1 Location of the Grand Falls Hydroelectric Generating Facility

1.2 Purpose of the EA Registration

The proposed Project is subject to Part 10 of the Newfoundland and Labrador *Environmental Protection Act* and the associated *Environmental Assessment Regulations*. This document is intended to initiate the provincial environmental assessment (EA) review, and in doing so it:

- Identifies the Project's proponent and describes its goals, core values, and environmental management approaches and procedures;
- Describes the proposed Project, including its overall purpose and rationale, as well as its key components and planned construction and operational activities;
- Describes a number of recent Project-related consultation activities undertaken by Nalcor Energy and their main findings; and
- Provides an overview of the existing environmental setting for the Project, some of the potential environmental considerations that have been identified to date, and Nalcor Energy's planned approaches for addressing these in moving forward with Project planning and eventual implementation.

This *EA Registration* document has been prepared and submitted by Nalcor Energy, with assistance from Amec Foster Wheeler Environment and Infrastructure.

1.3 The Proponent

Newfoundland and Labrador has an immense and diverse energy warehouse. In 2007, guided by a long-term *Energy Plan* to manage these energy resources, the Government of Newfoundland and Labrador created a new provincial energy corporation.

That corporation - Nalcor Energy - is the operator of the existing electrical generation facilities on the Exploits River, and is therefore the Proponent of this proposed Project.

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Nalcor Energy's foundation is built on its core business - the generation and transmission of electrical power – and the corporation has a strong commitment to providing safe, reliable and dependable electricity to its utility, industrial, residential and retail customers. Beyond that core business, the corporation's focus has expanded into the broader energy sector, including oil and gas, wind energy, and research and development. Nalcor Energy's vision is to build a strong economic future for successive generations of Newfoundlanders and Labradorians. As a proud, diverse energy company, its people are committed to a bright future for the province, united by the following goals and core values:

Goals

Safety: To be a world class safety leader

Environment: To be an environmental leader

Business Excellence: Through operational excellence to provide exceptional value to all consumers of our energy

People: To ensure a highly-skilled and motivated team of employees who are strongly committed to our success and future direction

Community: To be a valued corporate citizen in Newfoundland and Labrador

Core Values

Open Communication: Fostering an environment where information moves freely in a timely manner

Accountability: Holding ourselves responsible for our actions and performance

Safety: Relentless commitment to protecting ourselves, our colleagues, and our community

Honesty and Trust: Being sincere in everything we say and do

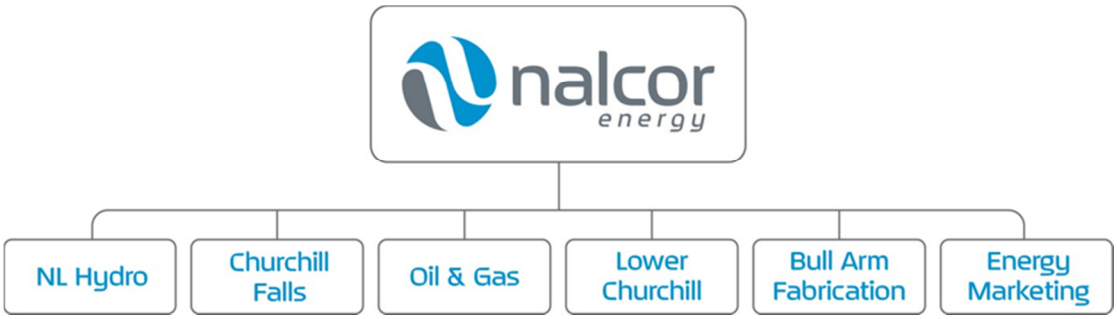
Teamwork: Sharing our ideas in an open and supportive manner to achieve excellence

Respect and Dignity: Appreciating the individuality of others by our words and actions, and

Leadership: Empowering individuals to help guide and inspire others

Nalcor Energy is leading the development of the province's energy resources, and is focused on environmentally-responsible and sustainable growth. The corporation currently has six lines of business (Figure 1.2):

Figure 1.2 Nalcor Energy Organizational Structure



In addition to these overall lines of business, Nalcor Energy operates and maintains several other projects, each unique and crucial to the province's energy future:

a) *Ramea*: In this small community on Northwest Island, Nalcor has built one of the first projects in the world to integrate generation from wind, hydrogen and diesel in an isolated electricity system.

b) *Menihek*: Nalcor assumed full operating control of the Menihek Generating Station in 2008, and has since entered into a 40-year power purchase agreement with Hydro-Québec to supply electricity to Hydro-Québec for its customers in the Schefferville region.

c) *Exploits River*: Since 2009, Nalcor has managed and operated the hydroelectric facilities on the Exploits River on behalf of the provincial government, an overview of which was provided earlier and which are described in further detailed in a later section of this document.

Additional information on Nalcor Energy, including its overall organization, values, priorities and activities, can be found at: *www.nalcorenergy.com*

As reflected in its above listed corporate goals and values, Nalcor Energy is striving to be a leader in environmental protection and sustainability, and is committed to maintaining a high standard of environmental responsibility and performance. Through its various subsidiaries, Nalcor Energy has constructed and currently operates and maintains an extensive electricity generation and transmission system throughout Newfoundland and Labrador (Figure 1.3).

Environmental protection planning is an integral part of Nalcor Energy's planning, construction, operations and maintenance programs. The corporation has state-of-the-art and proven policies and procedures related to environmental protection and management which will be implemented throughout this Project. The corporation has an outstanding record of environmental protection and stewardship, and this objective and experience will be applied to the planning and development of this Project to avoid or reduce potential environmental effects during its various phases.

Figure 1.3 Existing Newfoundland and Labrador Generation and Transmission System

1.4 Environmental Assessment Process and Requirements

The Newfoundland and Labrador *Environmental Protection Act* (*NL EPA*) requires anyone who plans a project that could have a significant effect on the natural, social or economic environment (an "Undertaking") to present it for examination through the provincial EA process.

Under the *NL EPA* (*definitions*), an Undertaking "*includes an enterprise, activity, project, structure, work or proposal* ***and a modification****, abandonment, demolition, decommissioning,* ***rehabilitation and an extension of them*** *that may, in the opinion of the minister, have a significant environmental effect*" (emphasis added).

The associated *Environmental Assessment Regulations* (Part 3) list those projects (potentially including proposed modifications, rehabilitations and extensions of same) that require registration and review. These include, for example:

> *34. (1) An undertaking that will be engaged in electric power generation and the provision of structures related to that power generation, including*
>
> *(a) the construction of dams and associated reservoirs where the area to be flooded is more than 50 hectares;*
>
> *(b) the excavation of reservoirs where the area to be flooded is more than 50 hectares;*
>
> *(c) Inter-basin or intra-basin water transfers;*
>
> *(d) the construction of hydroelectric power developments with a capacity of more than one megawatt*

In addition, Section 28 of the *Environmental Assessment Regulations* state that:

> *28. An undertaking that will occur within 200 metres of the high water mark of a river that is a scheduled salmon river under the Fisheries Act (Canada) shall be registered.*

Following public and governmental review of this EA Registration, the Minister of Environment and Conservation will determine whether the Project may proceed, subject to any terms and conditions and other applicable legislation, or whether further assessment is required.

In addition to approvals under the provincial EA process, the Project may also require a number of other authorizations from relevant regulatory authorities. These are identified and discussed further later in this document and in Appendix A.

2.0 PROJECT DESCRIPTION AND SCOPE

The proposed Project will involve a number of modifications and rehabilitation works at the Main Dam at Grand Falls, including the repair and addition of concrete, the installation of an inflatable dam mechanism along its crest, and construction of vehicle and pedestrian bridges for construction and maintenance access. Construction activities are currently planned to be completed in various phases over a three year period.

The following sections provide a description of the proposed Project, including an overview of the existing Grand Falls dam and its operation as background and context, as well as the primary components and activities that will be involved in the planned rehabilitation work. It should be reiterated here that the proposed Project that is the subject of this EA Registration - and for which EA approval is being sought - includes only the planned rehabilitation work at the Grand Falls Dam that is described in this document. Once these proposed construction activities are completed, the dam and other associated generating infrastructure at Grand Falls will continue to function in the same manner in which the facility is currently operated. The scope of the Project for EA purposes therefore does not include the on-going and future operation of these long-standing generation facilities by Nalcor Energy.

2.1 Overview of Existing Exploits Generation

The Exploits River watershed drains a land area of approximately 10,000 km^2 extending from the southwest corner of the Island of Newfoundland northeast to the Bay of Exploits, with approximately half of the watershed draining into Red Indian Lake and the remaining portion into the Exploits River. Nalcor Energy currently operates three hydroelectric generating stations in the Exploits watershed, including facilities at Buchans, Bishop's Falls and Grand Falls, as well as various water control structures, gauging stations and other associated infrastructure throughout the system (Figure 2.1).

The generating station at Grand Falls is the largest of these three stations, and is located approximately 85 km downstream from the main storage dam at Red Indian Lake and immediately adjacent to the former Abitibi paper mill on the southwestern side of the community of Grand Falls – Windsor (Figure 2.2).

2.1.1 Grand Falls Dam and its Operation

The hydroelectric potential at Grand Falls was first harnessed in 1906 by the Anglo Newfoundland Development (AND) Company, and the facility has since been modified, expanded and upgraded to the current installed capacity of 75 MW. Nalcor Energy has managed and operated this and other hydroelectric facilities on the Exploits River on behalf of the Government of Newfoundland and Labrador for the past number of years.

The Grand Falls generation facility consists of a main dam extending across the Exploits River, which is comprised of an overflow concrete gravity dam structure, as well as a gated intake structure consisting of 17 gates (nine submerged and eight at surface), a 1,500 foot (467 m) power canal with roller compacted concrete (RCC) spillway, three steel penstocks (ranging from 4.6 m to 6.2 m in diameter), two spill gates (one in the main dam and the other in the power canal) and a powerhouse (Figures 2.2 to 2.4).

Figure 2.1 Existing Dam Structures on the Exploits Watershed

The total plant output of 75 MW is produced from a head of approximately 100 feet (30.5 m), and the facility is a completely run of river plant with virtually no water storage in its head pond.

The Grand Falls power plant consists of two vertical generating units and four double runner horizontal units, as follows: Unit #4 (29 MW), Unit #9 (also referred to as the Beeton Unit, 30 MW) and Units 5 to 8 (4 MW each). From the facility's overall drainage area of approximately 8,390 km^2, water is released or impounded at the main storage dam at Red Indian Lake to maintain the required level of water flow and electrical generation at Grand Falls and other facilities. The existing dam structure creates a small reservoir in the river for ice control.

The operation of the Grand Falls Dam also involves the installation and use of temporary flashboards that are put in place along the spillway each year by crews working from small boats. These are used to provide the required head for optimal power production, as well as for environmental (fishway operation, see below) and safety reasons. These 0.9 m high timber flashboards installed at the crest increase the full supply level (FSL) to approximately elevation 61 masl.

An RCC Dam forms one side of the power canal which conveys water from the Exploits River to the penstock intakes and has a power production maximum flow of 310 m^3/s. A fish bypass system that is used to keep Atlantic salmon smolt and kelt from entering the Grand Falls turbines is located on the downstream end of the RCC Dam. This dam also has three feet (0.9 m) of wooden flashboards, which are also designed to fail during larger floods (and ice rafting), thereby increasing the capacity of the overflow spillway.

Figure 2.2 Grand Falls Generating Facility: Overall Layout and Main Components (Site Plan View)

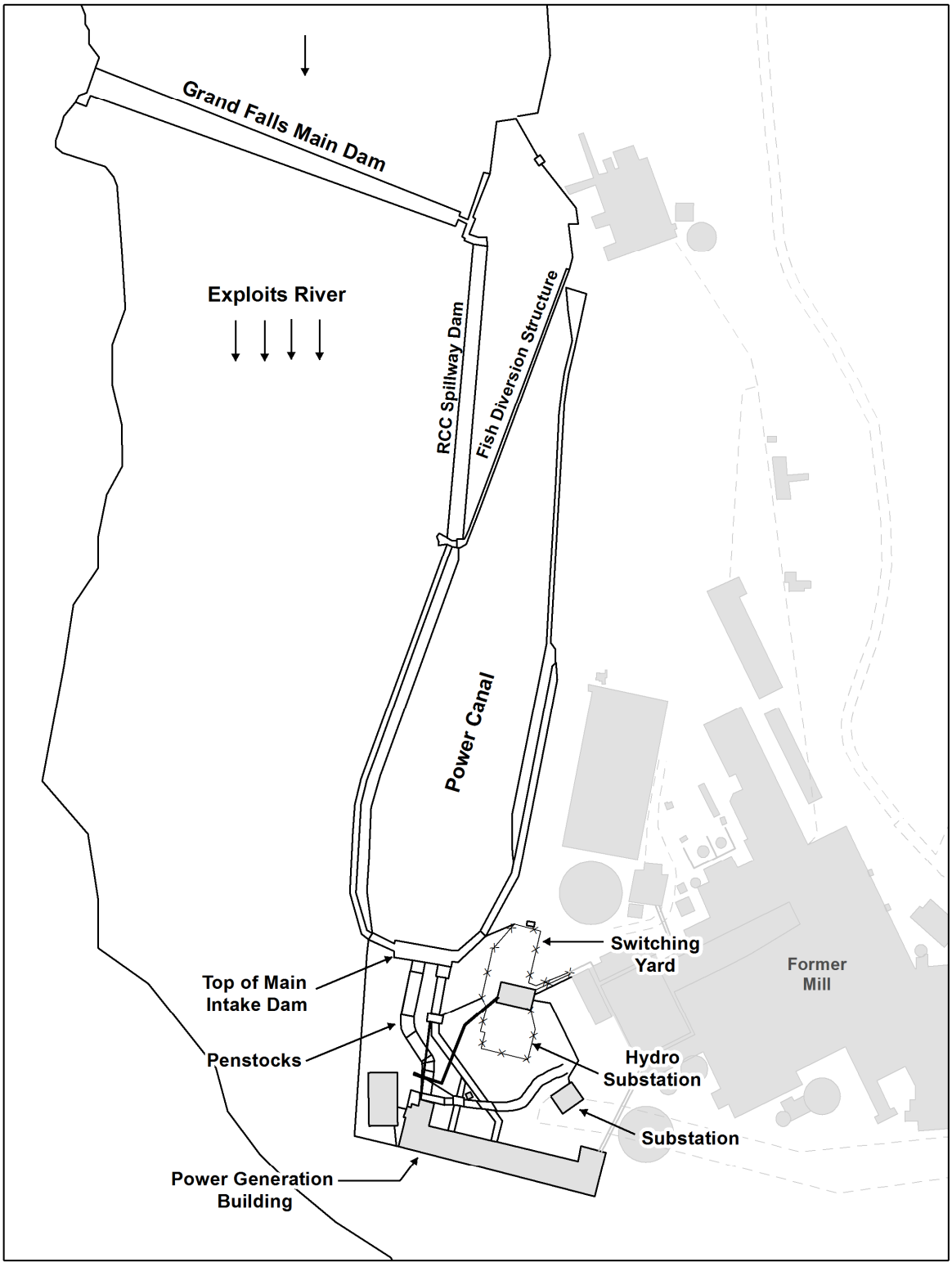


Figure 2.3 Grand Falls Generating Facility: Overall Layout and Main Components (Air Photo View)

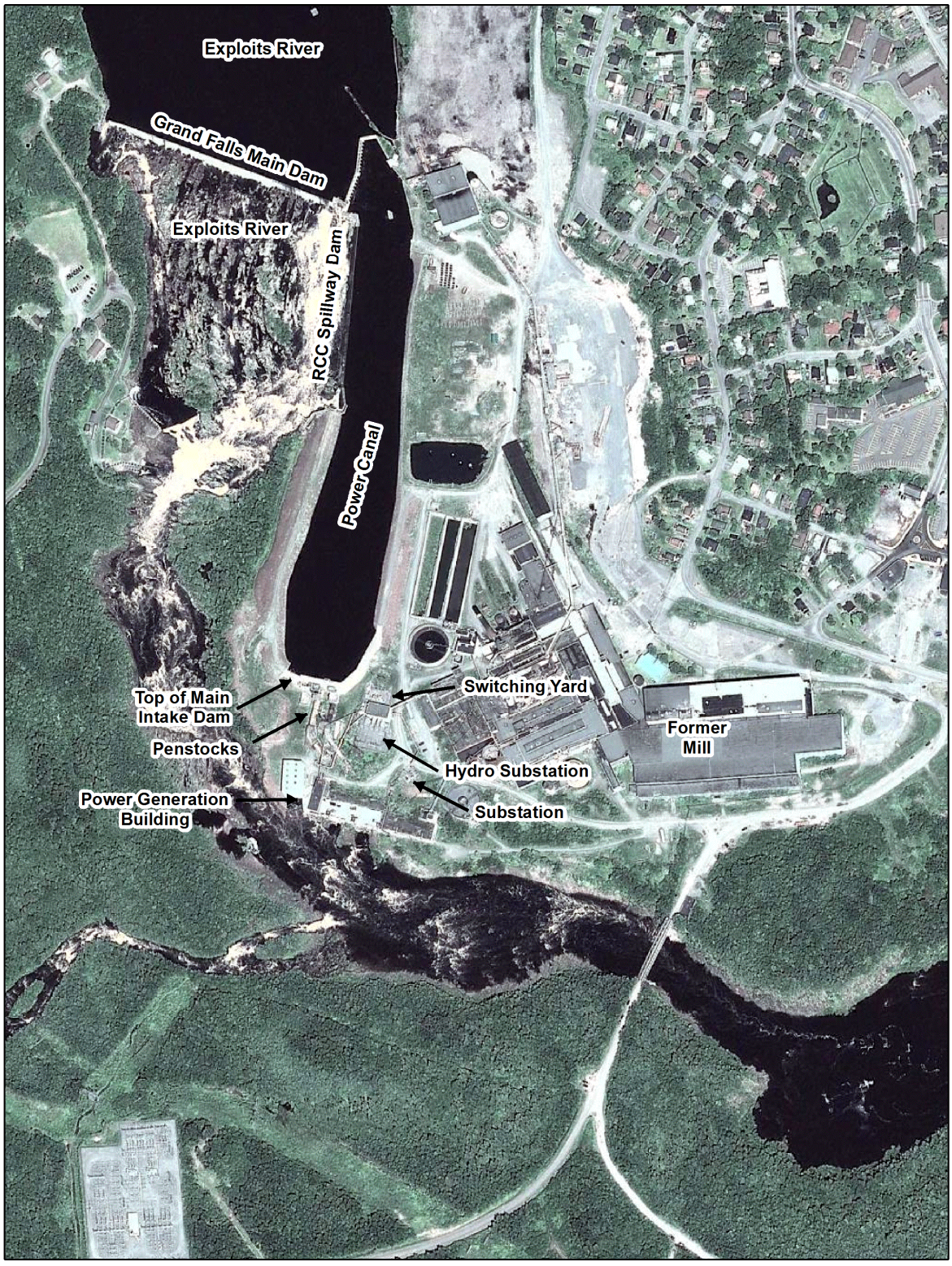


Figure 2.4 Grand Falls Generating Facility (Photographs)

Grand Falls Generating Facility (Photographs - *Continued*)

A summary of the current features and key characteristics of the Grand Falls Main Dam is presented in Table 2.1.

Table 2.1 Grand Falls Main Dam: Primary Components and Dimensions

Component / Feature	Dimensions
Length	259 m
Maximum Height	6.1 m
Concrete Sill Elevation	60.1 m
Top of Flashboards	61.0 m
Inflow Design Flood (IDF)	3,248 m^3/sec
Full Supply Level (FSL)	61.0 masl

Across from the Grand Falls generating station on the side of the river between the main dam and the tailrace, there is a fish ladder owned by Fisheries and Oceans Canada (DFO) and operated by the Environmental Resources Management Association (ERMA) (Figure 2.5). The fishway allows upstream migrating Atlantic salmon adults to get past the dam. This facility also has an interpretation center, gift shop, restaurant and office. ERMA also operates a fish hatchery on behalf of NL Hydro as part of the Star Lake compensation package required by DFO. Access to the dam on this side is via a gravel / paved road which is maintained by ERMA, and access to the north side is via a concrete pedestrian walkway.

Figure 2.5 ERMA Fishway and Associated Facilities

There are transformers at Grand Falls which are used to transmit the generated power to the grid at the Stoney Brook Terminal Station, located across the river from the Grand Falls generating facility. A number of these are used to transform the power from the Grand Falls station prior to its transmission to and distribution through the Island of Newfoundland's electrical system.

2.1.2 Water Flows and Fish Conveyance Systems at Grand Falls

As described in further detail elsewhere in this document, the Exploits River system is one of the largest Atlantic salmon rivers in Eastern North America, and the salmon population in this river has been established and maintained through an extremely successful fish stocking program and fishway systems.

Nalcor Energy plays a key stewardship role in helping maintain a large and healthy fish population in this portion of the Exploits River system. This occurs through its operational practices and the associated management of water levels and flows at specific times of the year, as well as the establishment and the operation of fish conveyance structures at Grand Falls. These include (Figures 2.6 to 2.8):

- A Nalcor Energy owned and operated fish bypass system at the Grand Falls Main Dam;
- A DFO-owned fish ladder downstream of the Main Dam at the ERMA Salmon Interpretation Center; and
- A Nalcor Energy owned and operated fish guidance louver and bypass structure in the power canal.

Figure 2.6 Overview of the Grand Falls Generating Station and Associated Fish Conveyance Systems

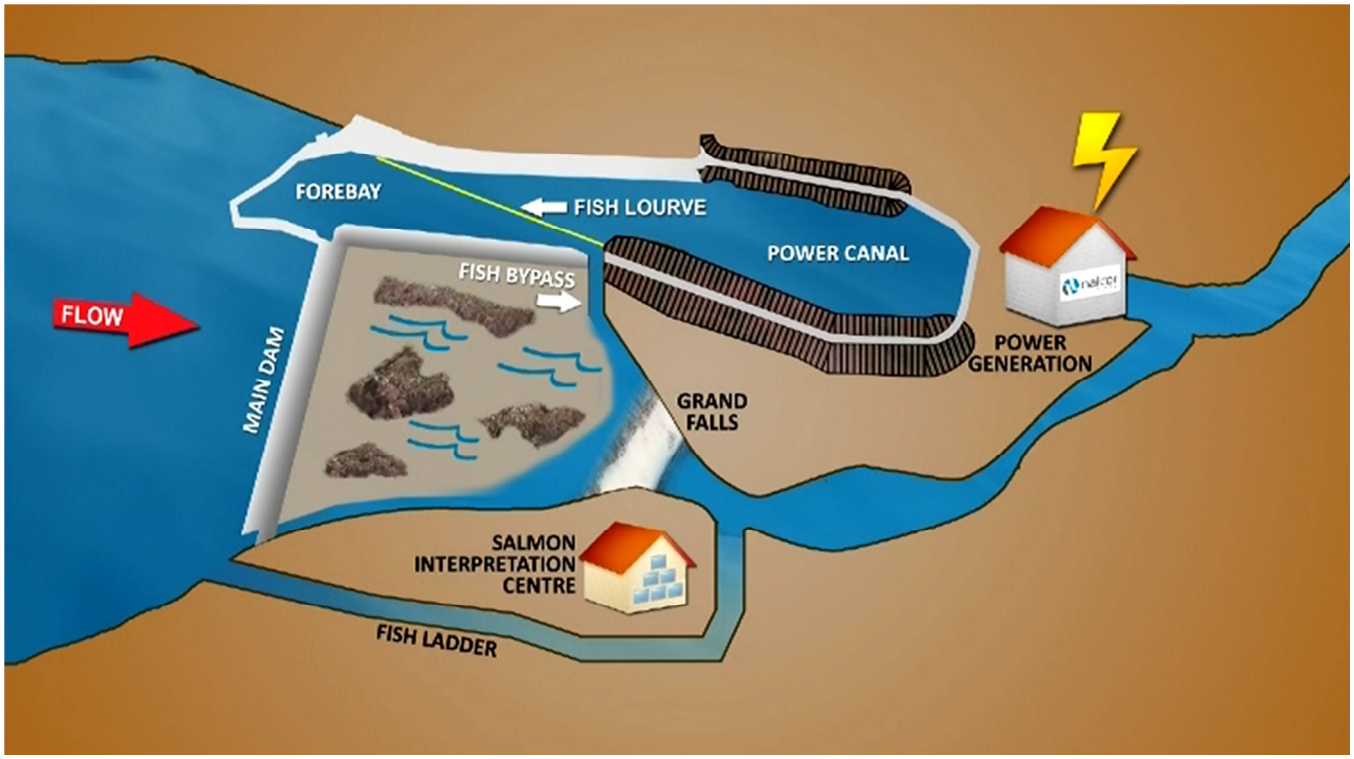


Figure 2.7 Fish Conveyance System at the Power Canal

As part of these initiatives, Nalcor Energy has entered into a *Minimum Flow Agreement* with DFO to ensure that juvenile salmon (smolt) are successfully moved downstream past the dam and adult salmon are successfully moved upstream to spawn. Minimum flow regimes are in place and adhered to for most of the existing dams in the watershed, including the Grand Falls Dam, which are intended to maintain adequate flow for habitat maintenance (late fall to early spring) and fish migration flow (remainder of the year).

Upstream Migration

During the period from approximately mid-June to mid-September each year, adult Atlantic salmon pass through the Grand Falls fishway structures on their way upstream to spawn. Adequate and appropriate water flows over the dam and through the gates are required to ensure that these migrations occur. Of particular concern is proper attraction flows at the downstream entrances of the fishway structures, as too much flow can mask the fishway intake and cause salmon to become stranded below the Grand Falls Dam and delay their upstream migration.

Periods of heavy rainfall and runoff can also cause uncontrolled water levels that may not only mask fishway intake flows, but can cause the existing flashboard system to fail (usually where there is more than two feet of water over the boards). The flashboard system assists in maintaining upstream water levels that are needed to provide the required hydraulic conditions for the fishways to function. Until water levels and conditions are safe to repair the flashboards, adult salmon could be stranded below the Grand Falls Dam. The flows are monitored to minimize the risk of flashboard damage occurring.

Downstream Migration

Downstream migration of salmon includes both adult and juvenile life stages. Adults that have spawned the previous fall and have overwintered within the Exploits River system begin moving downstream in the spring (typically April-May, during spring runoff). Juvenile salmon (smolt) will also begin downstream migrations during the spring and early summer (late-April to early July). Downstream migration of fish through the Grand Falls dam area is facilitated by several features: the dam structure / flashboards, the fishways and the fish louver / bypass structure.

During high spring runoff flows, adult and juvenile salmon migrating downstream are directed through an 8.3 m wide gap in the existing flashboard system at the eastern end of the Grand Falls Main Dam. This bypass arrangement remains in place until the ERMA fishway facilities are operational (typically after high spring runoff). Once the fishways are operational, both downstream and upstream migrating salmon can be accommodated through these facilities. Studies have shown that approximately 65 percent of downstream migrating fish move through this opening, which is facilitated through minimum water flows maintained by Nalcor Energy in accordance with the above described agreement with DFO.

A fish behavioral system is also installed each year across the power canal and below the water surface to help guide downstream migrating fish to the entrance of the fish bypass structure (Figure 2.8). This system is comprised of a series of louver panels on a floating boom (approximately 205 m in length) that stretches across the power canal and guides them to the bypass system, where they are entrained in high velocity water and transported back to the Exploits River via a plunge pool. This system remains operational until the completion of the annual fish transfer from the generating station's power canal to the Exploit's River below the power canal (typically mid to late July, as described below).

It should be noted that while most salmon are directed away from the Grand Falls hydroelectric plant, some downstream migrating adults can enter the power canal. Existing structures and barriers prevent them from entering the power generation turbines, but these individuals are then unable to complete their downstream migration without assistance. As a result, Nalcor Energy staff began a visual monitoring program in 1997, which commences each spring within the power canal when water temperature begins to rise in April and May. Any salmon within the power canal are captured through a seining procedure that is carried out in cooperation with local fishers (Figure 2.9), and are then transported around the generating station for release downstream.

Figure 2.8 Louver System in Place in the Grand Falls Power Canal

Figure 2.9 Seining Procedure

2.2 Project Purpose, Rationale and Need

Nalcor Energy's foundation is built on its core business - the generation and transmission of electrical power – and the corporation has a strong commitment to providing safe, reliable and dependable electricity to its utility, industrial, residential and retail customers.

The Main Dam and other aspects of the existing hydroelectric generating station at Grand Falls are ageing structures that have been in place for over a century. This infrastructure has and will continue to require periodic maintenance and upgrading to help ensure that it continues to function in an effective, efficient, safe and environmentally sound manner. Nalcor Energy's planned rehabilitation work at Grand Falls is intended to help achieve these objectives, and to allow the company to continue to maintain and operate these important energy assets on behalf of the people of Newfoundland and Labrador.

The planned maintenance of, and modifications to, the existing dam and spillway are intended to make these facilities consistent with current engineering standards, including the 2007 Canadian Dam Association (CDA) Dam Safety Guidelines and others, including:

- *CSA A23.1-04*: Concrete Materials and Methods of Concrete Construction / Methods of Test and Standard Practices for Concrete;
- *CSA A23.3-04*: Design of Concrete Structures;
- *S6*: Canadian Highway Bridge Design Code;
- *C22, 1-12* Canadian Electrical Code, Part 1;
- *S16-01*: Limit States Design of Steel Structures; and the
- National Building Code of Canada (2010)

In addition to helping maintain and improve the overall integrity and functionality of the Grand Falls dam structure and its operations, the planned installation of the inflatable dam structure along the spillway is designed to increase and improve the operators' ability to adjust dam height (and thus water levels and flows) for power production, environmental (fish passage) and safety reasons. It will also address any potential safety and environmental considerations associated with the annual installation and removal of the temporary flashboards system by Nalcor Energy crews working along the dam crest in small boats, as well as from the periodic failure of these timbers during flood and ice events.

2.3 Project Components and Lay-out

The Project, for the purposes of EA review, includes the construction of the following components:

1) Refurbishment of existing, deteriorated concrete on the main dam and installation of new concrete mass;

2) Installation of an inflatable dam structure along the crest of the main dam to replace the existing flashboard system;

3) A single lane bridge to span the existing power canal to provide access to the abutment; and

4) Pedestrian bridge(s) located at the dam abutments supported on piers at the spillway.

The following sections provide an overview description of the Project's key components, based on previous and ongoing engineering studies and reflecting the current stage of Project planning and design.

As described below, the Project is the subject of ongoing engineering, and as with any development project this will be subject to continued refinement and optimization as its planning and eventual implementation move forward.

2.3.1 Concrete Refurbishment and Reshaping

The Project will include the rehabilitation of the existing main dam structure to refurbish deteriorated concrete, along with the installation of additional concrete that will be designed and shaped to enhance the overall hydraulics of the spillway (Figure 2.10). It is currently estimated that approximately 2,500 cubic metres of new concrete will be required to complete the Project.

The existing concrete dam will be salvaged where competent concrete remains, and the main dam itself will form part of the diversion structure required during construction activities (see below). The existing crest section will be removed and replaced with a new concrete cap that will bond with the existing concrete and be fastened with anchors. The new dam crest will be modified to incorporate the inflatable dam structure described below, which will help to provide more effective water flow management by Nalcor Energy's operators.

Rehabilitation work on the existing dam will also include the installation of additional concrete on the upstream side of the dam. This will change the curvature of the top portion of the dam and modify the toe of the dam to allow more effective energy dissipation. The dam height will rise slightly to reduce the requirement for the current flashboard system.

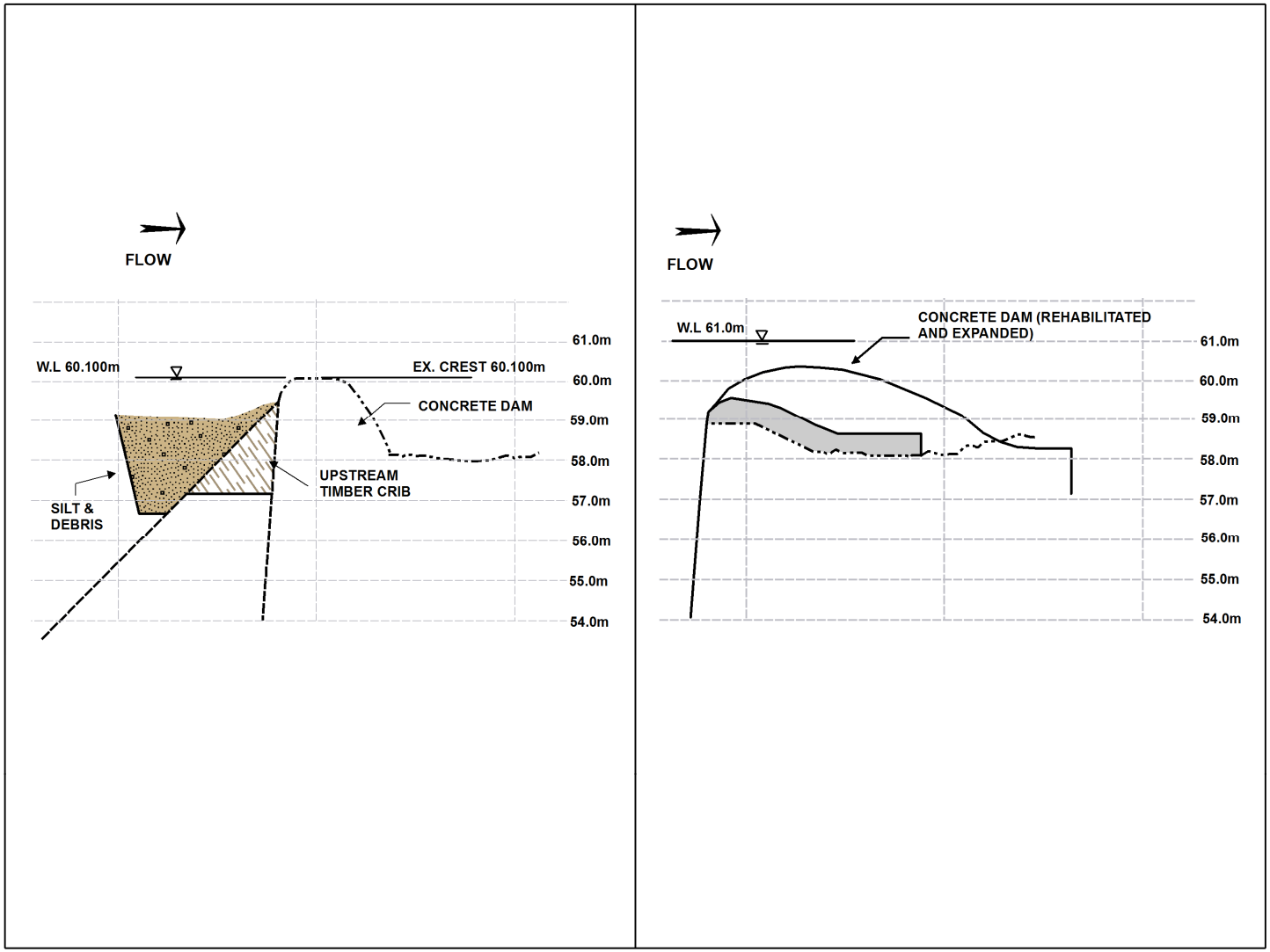
2.3.2 Inflatable Crest Gates

Water level control during normal and flood conditions will be enhanced by replacing the existing flashboard system with a variable head inflatable pneumatic dam along the crest. This new system will be an Obermeyer structure or similar design (Figure 2.11), which includes a rubber bladder that can be inflated and deflated to raise and lower the gates, thereby controlling the water flow over the spillway.

Sections of the inflatable dam can be installed and adjusted in independent sections which can control flows differently along the dam in the most beneficial manner. Controlling the flows across the dam in independent sections provides, for example, attraction water for fish ladders, and debris or ice can be passed over the spillway such that power generation activities are not adversely affected.

These inflatable dam sections will be installed in three stages, as follows (see Section 2.4 for a description of planned construction activities):

Figure 2.10 Proposed Concrete Refurbishment and Reshaping – Existing (Left Pane) and Modified (Right Pane) Dam Structure



1) *Phase 1*, where a nine metre long section of inflatable dam (approximately 1.5 m high) will be installed at the west abutment of the dam, near the ERMA fish ladder.

2) *Phase 2* will see the installation of a 122 m section of inflatable dam (also approximately 0.9 m high) at the east abutment of the dam.

3) *Phase 3* will involve the installation of a 128 m long section of 0.9 m high inflatable dam on the remaining (middle) section of the dam.

The inflatable dam sections will be attached to the dam crest via anchor bolts and will be connected together in approximately six metre long sections. The nine metre long section from Phase 1 will consist of two 4.5 m sections with position control to allow for increasing and/or decreasing the amount of water discharged during the fish migration season.

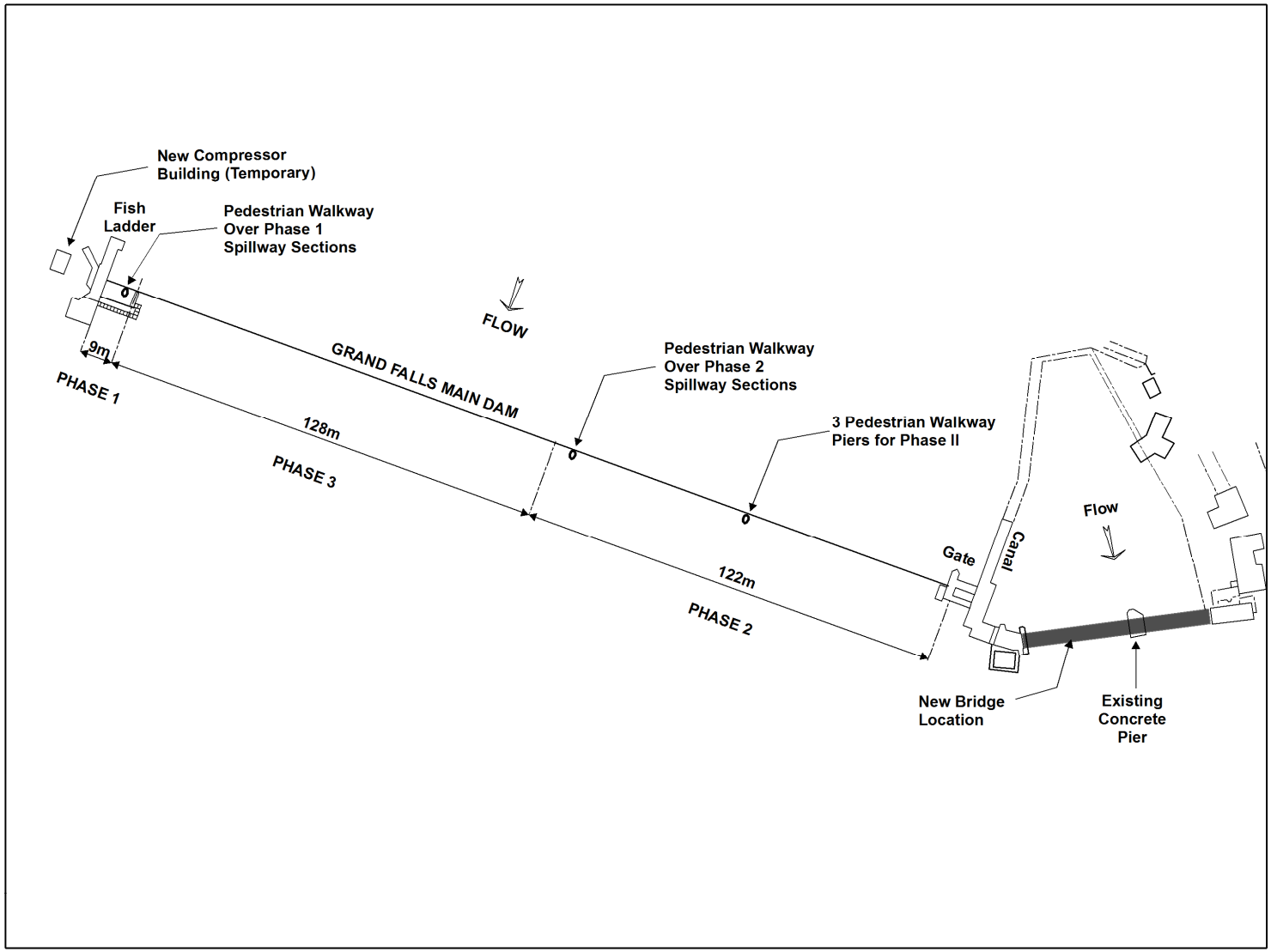
Figure 2.11 Inflatable Crest Gates (Representative Diagrams, For Illustration)

2.3.3 Improved Access

The Project will also include the establishment of a single lane vehicle bridge at the Main Dam, which will be installed in a continuous span across the power canal to provide access for vehicles and equipment during construction and for future maintenance (Figure 2.12). This bridge will be comprised of a pre-fabricated steel truss bridge or similar structure, which would span from the eastern canal embankment to the existing concrete pier in the canal and from there to the concrete dam abutment.

The Project will also see the installation of a prefabricated pedestrian bridge over the above described Phase 1 and 2 works to give safe access to the dam during construction and for future maintenance (Figure 2.12).

Figure 2.12 Proposed Vehicle and Pedestrian Bridges



2.4 Construction

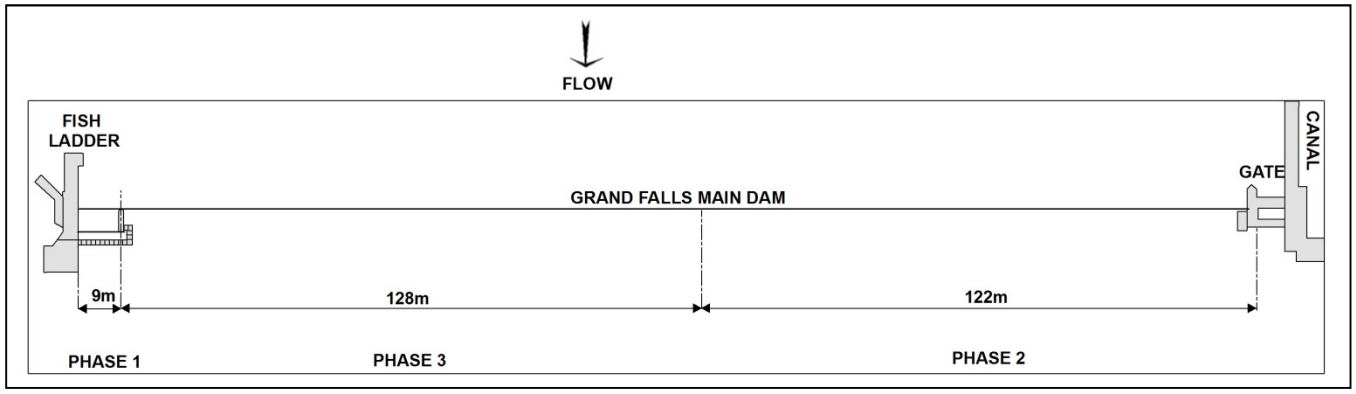
A general overview of the primary activities that will be associated with the construction phase of the Project is provided in the following sections. The Project will be constructed with commonly used construction practices and in accordance with standard procedures and applicable regulatory requirements.

2.4.1 Construction Activities and Sequence

As described above, the current (tentative) Project schedule would see planned Project construction activities (concrete work and inflatable dam installation) completed in three phases over a three year period, as follows (Figure 2.13):

- *Phase 1:* In Year 1, a nine metre long section would be completed at the west abutment to provide attraction flows for the fishway and water management for construction Phases 2 and 3;
- *Phase 2:* In Year 2, a 122 m long section would be completed at the east abutment to direct large flows during significant flood events away from the fishway and to provide water management for construction; and
- *Phase 3:* In Year 3, a 128 m long section will be completed along the centre portion of the dam to complete construction.

Figure 2.13 Proposed Construction Phases and Sequencing



Specific construction approaches and methodologies will be determined and proposed by the Contractor(s) that is eventually retained by Nalcor Energy to complete this work. The following sections therefore provide an overall and conceptual overview of likely and potential construction methods, which may be subject to further refinement as Project design and planning move forward. Any and all construction techniques and activities will, however, be in full compliance with applicable environmental legislation, regulations and authorizations (EA and permitting) and in accordance relevant Nalcor Energy policies, plans and other requirements.

All construction work will be completed in a dry environment to the extent possible. Water diversion and the associated establishment and maintenance of a dry work site during construction will potentially include the

installation of an upstream cofferdam consisting of a cantilevered water retention wall attached to the vertical concrete face of the existing concrete gravity dam.

Based on this concept, vertical steel stanchions will be installed every 2-3 m along the dam, bolted to the existing concrete face, with seals (neoprene gasket) secured to the concrete face and square stop logs installed. Any such cofferdam installation will require demolition of the existing timber below water on the upstream side of the existing dam. These structures will be installed in the Fall of Year 1, coinciding with Phase I completion of the nine metre long section on the west abutment. Additional stop logs would then be added during Phase 2 and Phase 3 construction. Downstream cofferdams consisting of sandbag type gravity structures will also likely be required up to 3 m in height to keep work areas dry. Upstream reservoirs will be operated during the construction period to ensure appropriate and manageable water volumes and flows.

Local single phase power is available from a nearby pole mounted transformer, and access to the site will be through the ERMA parking area. Ready mix concrete is locally available and will be supplied from an existing, licenced facility and trucked to the work site as required. A medium size crane will likely be used to deliver materials and concrete to the work areas themselves. Phase 2 and 3 construction activities will be completed primarily through temporary ramps installed at strategic locations along the work areas, and/or through the use of a barge to be located on the upstream side of the main dam. Work crews will have additional access to the dam structure once the pedestrian bridge is installed as part of this Project.

For all Phases of construction, the existing, deteriorated concrete along the dam will be chipped with a hydraulic buster to the pre-determined lines and grades. Concrete debris will be collected and disposed of in an approved manner. Dowels will be installed in a pattern and grouted into the existing concrete, with pull out tests being used on select dowels to verify reliability. Bedrock for all the new concrete installations will be cleaned prior to placement, and concrete will be formed and cast-in-place, with reinforcing structures being comprised of conventional steel. Where required, rock anchor reinforcement will be used to stabilize the concrete section, and pressure relief holes will also be used as appropriate to improve stability.

In all Project construction phases, the inflatable gates will be installed along the dam crest and include a hard shell that lies flat to the crest when they are not engaged. These hard shells are resistant to ice loads and UV deterioration, and the pneumatic lines and communication lines to operate the gates will be embedded in the concrete dam crest and protected from damage.

Phase 1 Construction

Phase 1 construction will commence after mid-September in Year 1 to accommodate fish migration requirements. At that time, the removal of the existing timber cribbing and silt / debris along the upstream face of the full length of the dam will be completed to an elevation of approximately 59 masl, and the stanchions for the full cofferdam (as required, for all Phases) would be installed. This work would be completed using dive teams with the reservoir water level lowered.

Based on this approach, cofferdam components (stop logs) will be installed along the Phase 1 section and the existing flashboard system will be removed. A downstream cofferdam constructed of sand bags to an elevation

of the top of the dam will also be put in place to help keep the work area dry. Piers for the installation of the pedestrian walkway will then be constructed, and the concrete between the existing abutment and the new pier will be rehabilitated. At this point the inflatable dam will be installed along this section and the temporary cofferdams will be removed. A temporary control building will also be established along the west bank, utilizing the existing single phase power line.

Phase 2 Construction

At the commencement of Phase 2 (mid June of Year 2) the cofferdam structures will be installed along this section of the Main Dam, after which the existing flashboard system would be removed. This will be followed by the demolition and replacement of the existing, deteriorated concrete along this section and the construction of several new piers for the pedestrian bridge. The inflatable gate system will then be established along this section of the dam, after which the temporary cofferdam structures can be removed.

As part of Phase 2 construction, a permanent control building will be constructed on the intersecting point of the RCC Dam, Main Dam and the vehicle bridge or on the side of the canal embankment, to provide control and monitoring functions. Control for the gates will be connected via air pipes put in place as part of the Phase 2 work. The control building will eventually operate all three sections of gates, and will utilize three phase power located in the existing forebay electrical room.

Phase 3 Construction

Phase 3 construction (to commence in mid June of Year 3) will see very similar construction activities and sequencing as those for Phases 1 and 2. Cofferdams structure will again be installed both upstream and downstream, and the existing flashboards system and concrete will be removed along that section of the main dam. Once all deteriorated concrete has been removed and new concrete has been poured, the inflatable dam system will be installed, followed by removal of the temporary cofferdam structures.

2.4.2 Construction Workforce

Project construction will be carried out on a contractual basis, with workers hired at the discretion of the Contractor and in accordance with its own hiring practices and policies. Once construction is completed, the facility will continue to be operated using Nalcor Energy's existing workforce. Nalcor Energy supports employment and gender equity in its hiring and contracting practices.

An initial estimate of the Project's required construction labor force, by number, occupation and National Occupational Classification (NOC) code, is provided in Table 2.2. These occupations will be full time equivalent for the three phases of the Project.

Table 2.2 Occupations Likely to be Represented in the Construction Work Force

Project Phase	Number (Approximate)	Occupation	National Occupational Classification (NOC)
	1	Supervisor / Foreperson	NOC 7205
	5	Heavy Equipment Operators	NOC 7521

Project Phase	Number (Approximate)	Occupation	National Occupational Classification (NOC)
Construction	1	Crane Operator	NOC 7371
	5	Concrete Finishers	NOC 7282
	2	Electricians	NOC 7241
	5	Steel Erectors	NOC 7235
	2	Roofers	NOC 7291
	2	Plumbers	NOC 7251
	5	Truck Drivers	NOC 7511
	2	Mechanical Technicians (compressors)	NOC 7311
	10	Labourers	NOC 7611
	2	Divers	NOC 7384
	1	Environmental Monitor	NOC 2231

2.5 Operation and Maintenance

Once construction is completed, the above described new or rehabilitated aspects of the existing Grand Falls generating station will continue be operated as per Nalcor Energy's current operating practices and processes for the facility (including the associated *Minimum Flow Agreement* with DFO). Project maintenance activities will include regular inspection and on-going repair and maintenance of the facility as required.

The various components that comprise this Project, and the Grand Falls generation station overall, will be operated for an indeterminate time period, and decommissioning is not contemplated. Should decommissioning activities eventually be considered for some or all of the facility, these will be planned and conducted in accordance with the relevant standards and regulatory requirements of the day, and in consultation with relevant regulatory agencies.

2.6 Project Schedule and Cost Estimate

Following detailed and on-going engineering design and planning, the current (tentative) Project schedule would see the initial phase of construction activity in the field beginning in the Fall of 2016 (after mid-September to accommodate fish migration requirements) and concluding that year with the onset of winter conditions. Phase 2 and 3 construction will commence in approximately mid-June of 2017 and 2018, respectively. Project sanction, initiation and scheduling is, however, subject to final Project planning and engineering activities, and the receipt of all required corporate and regulatory approvals to proceed.

The estimated capital cost of the Project, based on the current stage of engineering design and planning, is approximately $20 million, which includes future engineering requirements, construction activities (labour and materials) and other components and activities.

2.7 Project Documents

Apart from this EA Registration, no other EA-related documents have been produced by Nalcor Energy in relation to this Project.

2.8 Environmental Management and Protection

The number and diversity of environmental challenges facing large companies and their development projects and operations require a structured and consistent management approach. Nalcor Energy's subsidiaries have chosen the ISO 14001 Environmental Management System (EMS) standard developed by the International Organization for Standardization (ISO) to manage environmental aspects. This decision has resulted in continual improvement of environmental performance, while fulfilling the corporation's mandate to provide customers with cost-effective and reliable power. Existing Nalcor Energy facilities have been individually registered by an external auditor (Quality Management Institute, QMI) as compliant with the ISO 14001 standard. This Project will be undertaken in accordance with Nalcor Energy's EMS.

2.8.1 Environmental Protection Planning

Environmental protection planning is an integral part of Nalcor Energy's construction, operations and maintenance programs.

As noted previously, Nalcor Energy and its subsidiaries currently operate an extensive electricity generation and transmission system in Newfoundland and Labrador. This includes interconnected electrical power systems in Labrador and on the Island as well as isolated distribution systems throughout rural areas of the province. As a corporation with significant experience in constructing and maintaining hydroelectric and other generation facilities and transmission infrastructure in Newfoundland and Labrador, Nalcor Energy has state-of-the-art and proven policies and procedures related to environmental protection and management which will be implemented during the various phases of this proposed Project.

An Environmental Protection Plan (EPP) is an important tool for consolidating environmental information in a format that provides sufficient detail for the implementation of environmental protection measures in the field during construction. An EPP provides concise instructions to personnel regarding protection procedures and descriptions of techniques to reduce potential environmental effects associated with any construction activity. The main objectives are to:

- Consolidate information for planning;
- Ensure that environmental standards are current and complied with;
- Provide details of corporate commitments to environmental protection and planning; and
- Provide guidelines for field activities and decision-making on environmental issues relevant to construction, operations and maintenance activities.

Depending on construction sequencing, one or several activity-specific EPPs will be prepared and implemented by the selected Contractor(s) for the Project's construction phase. Each EPP will be a field-useable document, addressing provisions that will avoid or reduce environmental effects which may be associated with

construction. As appropriate, each EPP will include items relating to work in or near water, demolition and removal of concrete and other structures, handling and installing cement and formwork, contingency plans for unplanned events such as spills, rehabilitation and compliance monitoring, and others.

2.8.2 Safety, Health and Environmental Emergency Response Plan

In the construction, operation and maintenance of any development project, an accidental release or other unplanned event is an unlikely, but unfortunately possible, event. Nalcor Energy proactively identifies potential emergency situations and develops response procedures, including Safety, Health and Environmental Emergency Response Plans (SHERPs).

The purpose of a SHERP is to identify responsibilities in the event of an unplanned incident, including the accidental release of fuel or other hazardous material, on-site or during transportation, and to provide the information required for the effective response and reporting of such an incident. Nalcor Energy will conform to both provincial and federal legislation with the intent of meeting both its legal and corporate responsibilities.

The establishment and maintenance of emergency response procedures addresses the:

- Protection and maintenance of human health and safety;
- Identification of the potential for accidents and emergency situations;
- Planned response to accidents and emergency situations; and
- Prevention and mitigation of potential environmental effects associated with accidents and emergency situations.

Depending on construction planning and sequencing, one or several site/activity-specific SHERPs will be prepared and implemented for the Project. The Project-specific SHERP will address: roles and responsibilities, personal protective equipment, materials storage, driving safety, working at heights, working near or over water, emergency response communications, spill response, personnel injury response, search and rescue, fire response, and vehicle / equipment accidents.

2.9 Environmental Permits and Approvals

In addition to approval under the provincial EA process, the Project will also require a number of other provincial and federal permits and authorizations. Nalcor Energy is committed to obtaining, and complying with the conditions of, these required permits and approvals during Project construction and operations, and will require the same of any and all contractors that are involved in this Project.

A number of key environmental permits and approvals that may be required in relation to the Project include those listed in Appendix A.

3.0 CONSULTATION

Consultation is an important and integral component of the EA process, and is a key aspect of Nalcor Energy's approach to project planning and development. The Newfoundland and Labrador EA process provides considerable opportunity for interested parties to bring forward their views and to identify issues and ask questions about a Project for consideration in its review and in eventual decision-making. This includes consultation by the proponent and by government at various stages of the EA review process.

A number of consultation activities have been undertaken by Nalcor Energy in relation to the proposed Project. These include the provision of information to, and discussions with, the local community, stakeholders, relevant government departments and agencies and others, the nature and key outcomes of which are summarized in this Chapter.

3.1 Public Open House

As part of its on-going Project planning and the associated preparation of this EA Registration document, Nalcor Energy conducted a public meeting in Grand Falls – Windsor to provide information on the Project and to identify any associated questions or concerns that local residents and other interested members of the general public may have regarding the Project.

This consultation initiative took the form of a Public Open House, held at the Mount Peyton Hotel in Grand Falls – Windsor on the evening of Tuesday, March 31, 2015. This public session was advertised through newspaper ads that provided details on the purpose, location and timing of the open house, as well as through other means as follows:

- Advertisements were placed in the local (bi-weekly) newspaper *The Advertiser* in the three editions prior to the event: Monday March 23, Thursday March 26 and Monday March 30 (see Appendix B);

- A notification was emailed to the Grand Falls – Windsor Town Council for posting in the Town Office and on its website, as well as to several local businesses (hotel and retail establishments) for posting within their public areas; and

- Nalcor Energy staff were interviewed about the Project and its associated consultation events on local radio (CBC – Central Morning Show) and in the local newspaper several days prior to the event.

The public open house took the form of an evening "drop in" session, held from 7-9 pm at the identified venue in Grand Falls - Windsor. This format was selected as it allowed all interested parties to come to the consultation session on their own time, and to proceed to receive information, ask questions and provide input at their own pace and in whatever manner and format that they feel most comfortable. It was also used in order to establish a relatively informal and relaxed environment, where participants could provide input and ask questions through one-on-one conversations, and/or in small groups, however they preferred.

Representatives of Nalcor Energy and its EA Consultant (Amec Foster Wheeler) were present to provide information and clarification, answer questions, and to record any and all questions, issues and perspectives raised. This included the following personnel:

- Willmore Eddy, Manager – Exploits Generation, Nalcor Energy
- Marion Organ, Manager - Environmental Services, Nalcor Energy
- Brent Sellars, Team Lead - Capital Projects / EA, Environmental Services, Nalcor Energy
- Derek Rendell, Program Manager – Exploits Generation, Nalcor Energy
- Jill Kenny, EHS Representative - Exploits Generation, Nalcor Energy
- Steve Bonnell, EA Practice Leader, Amec Foster Wheeler E&I
- Heather McCracken, EA Specialist, Amec Foster Wheeler E&I

Upon arrival, participants were greeted by a Study Team representative at a sign-in table, who provided an overview of the open house purpose and format. The session included five information stations arranged throughout the open house venue, consisting of tables with large information panels (Appendix B) that focused on the following themes:

1) An overview of Nalcor Energy in general and Exploits Generation in particular;

2) A description of the existing Grand Falls Hydroelectric Generation Station;

3) A description of the existing fish conveyance systems and water management at Grand Falls;

4) A description of the proposed Project (primary components and planned construction / operations activities);

5) An overview of some Project-related environmental considerations and planned mitigation, and of the Newfoundland and Labrador EA process.

The purpose of these information panels was to provide general background information, and to serve as a basis for prompting dialogue and the sharing of information and input by consultation participants.

At the public open house, Nalcor Energy and Amec Foster Wheeler personnel were clearly identified through name tags, and were positioned at and/or between stations. A key focus was on obtaining and recording information and input related to:

- Questions, issues or concerns regarding Project and its potential environmental or socioeconomic effects;

- Local knowledge regarding the existing biophysical or socioeconomic environment in or near the Project Area; and

- Suggestions for any mitigation measures or other means through which any identified issues could be addressed in future Project planning and decisions / actions.

A total of four individuals attended the public open house. The consultation team members continuously took notes and recorded any and all input received throughout the session, and also met as a group to debrief, record and compile all information and input received.

3.2 Meeting with Grand Falls – Windsor Town Council

Nalcor Energy and its EA Study Team also met with the Grand Falls Windsor Town Council (Mayor, Councilors and Senior Municipal Staff) as part of its consultation initiatives for this Project.

This meeting took place at the Town Office on Tuesday, March 31, 2015, immediately prior to the above described public open house. It included a short welcome and introduction period, followed by a presentation by Nalcor Energy on the Project and a general round table discussion. Notes were again taken by the Proponent's team throughout the meeting, highlighting the various questions, issues and perspectives raised.

3.3 Overview of Consultation Findings

A number of topics and themes were identified and noted during the above described consultation activities. These are summarized in Table 3.1, along with a general indication of where each of these is addressed in this EA Registration document.

Table 3.1 Summary of Environmental Questions and Considerations Raised During EA Consultations

Question / Issue Raised	Where Addressed in EA Registration
Existing fish bypass structures and associated operations by Nalcor Energy	Section 2.1
Location and purpose of the planned bridge installations	Section 2.3.3
Public access restrictions and adjacent land uses	Section 4.2.4
Water flows and levels, and possible changes to same as a result of the Project (and any associated implications for other environmental components and activities)	Sections 2.1, 2.4, 2.5, 4.2
Project capital costs and budget	Section 2.6
Other existing dams and water control infrastructure on the Exploits River system	Section 2.1
Visibility and potential visual aesthetics issues	Section 4.2.4

These public and stakeholder consultation activities have provided Nalcor Energy with useful information on, and a good understanding of, the key questions and perspectives that local residents and others have regarding the Project. These issues have influenced and informed the focus and content of this EA Registration.

Overall, there were no significant, negative environmental concerns or other issues raised in relation to the proposed Project, and most consultation participants appeared to view it as a very positive environmental initiative.

The eventual governmental and public review of this EA Registration will also help to identify any important environmental questions and issues related to the proposed Project, for consideration by government in determining whether further EA review is required, and/or any terms and conditions that may be associated with EA approval.

The Project will also eventually require a range of additional environmental permits and other authorizations (Appendix A). The post-EA permitting process will provide the opportunity for relevant government departments and agencies to receive and review additional Project design information, and to establish specific terms and conditions to avoid or reduce environmental effects.

Nalcor Energy and/or its contractors will identify, apply for and adhere to all required permits and other authorizations that are required for Project construction and/or operations.

4.0 ENVIRONMENTAL SETTING, POTENTIAL INTERACTIONS AND MITIGATION

This Chapter provides an overview of the existing environmental setting for the proposed Project, including a description of relevant components of the biophysical and socioeconomic environments. This is followed by an analysis of the Project's potential environmental interactions and the identification and description of mitigation measures which will be put in place to avoid or reduce any such effects.

4.1 Existing Environment

The following sections provide a general description of the existing natural and human environments in the area within which the Project will be located, based on existing and available information. The objective is to present an overview summary of the environmental setting and context for the Project.

4.1.1 Biophysical Environment

The proposed Project site is located in Central Newfoundland, on the Exploits River to the immediate southwest of the Town of Grand Falls – Windsor.

The climate of Grand Falls-Windsor is typical of the larger region, which has the most continental climate of any part of insular Newfoundland including the highest summer and lowest winter temperatures in the area. A summary of the key climatic characteristics of the Grand Falls-Windsor area is presented in Table 4.1, based on climate normals data for the years 1981 to 2010.

Table 4.1 Climate Normals for Grand Falls-Windsor (1981-2010)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Temperature (^{o}C)	-8	-8	-4	2	8	13	17	17	12	6	1	-4	5
Precipitation (mm)	94	94	91	84	79	89	89	107	96	94	94	90	1,099
Rainfall (mm)	32	30	37	53	74	89	89	107	96	90	73	37	806
Snowfall (cm)	62	64	54	31	5	0	0	0	0	4	21	53	293
Source: Environment Canada (2014)													

Overall, the mean monthly temperature at this location is 5^{o}C, and ranges from -8^{o}C in January and February to 17^{o}C in July and August. The Grand Falls-Windsor area also receives fairly consistent precipitation throughout the year, averaging 1,099 mm annually. May is generally the driest month with 79 mm of precipitation, while August is the wettest on average with 107 mm. The total annual snowfall is 293 cm each year, generally occurring between October and May.

The NL Department of Environment and Conservation maintain a National Air Pollution Surveillance (NAPS) monitoring station adjacent to the former Abitibi mill site. The station measures concentrations of various air pollutants including particulate matter, ozone, nitric oxide, nitrogen dioxide, other oxides of nitrogen, carbon monoxide and sulfur dioxide. During 2013, all measured concentrations in Grand Falls-Windsor were below the national average, and during this period monthly averages of all the parameters did not exceed applicable air quality guidelines.

The underlying bedrock of the Grand Falls area is characterized primarily by the lower Silurian, Wigwam Formation (Rogers and van Staal 2005), and is comprised predominantly of sandstone, siltstone and conglomerate. Surficial geology within and around the Project area is primarily of fluvial origin, and consists of clays and silt deposited by the Exploits River. Surficial formations within the area are dominantly bedrock outcroppings and bog (Taylor et al 1994; Batterson 1999). Within the immediate Project site, bedrock outcroppings are the primary surficial feature, as the majority of overburden has been eroded by the Exploits River.

The Project area is located within the Central Newfoundland Ecoregion (Meades 1990; DNR 2014), which encompasses much of the north-central portion of the Island of Newfoundland. This ecoregion is again characterized by a continental climate with relatively high summer temperatures and low winter temperatures. Due to the warm summer and high evapo-transpiration losses, soils in the northern part of this ecoregion display soil moisture deficiency. The hylocomium-balsam fir forest type occupies the zonal soils of this area. These soils are generally lighter in colour and have lower organic matter content compared to other ecoregions. Forest fires have played an important role in the natural history of this region, and much of the balsam fir-feathermoss forest types have been converted to black spruce and some of the richer site types to hardwood forests dominated by white birch and aspen. Although aspen occurs in other regions, it is most abundant and vigorous in Central Newfoundland, but yellow birch is absent from this region primarily because of the short frost-free period. Alders rather than mountain maple are the most common species on wet seepage slopes.

Within the larger Central Newfoundland Ecoregion, the Northcentral Subregion encompasses the proposed Project area itself. This area has higher summer maximum temperatures, lower rainfall and higher fire frequency than anywhere else in Newfoundland, and for the most part exhibits a rolling topography below 200 m. The rolling to undulating topography is characterized by shallow, medium quality till with a soil texture range from sandy loam to loam. Pure black spruce forests and aspen stands dominate this area because of the prevalence of fire in the natural history of the subregion. Where tree regeneration is lacking, succession to dwarf shrub heath dominated by *Kalmia angustifolia* occurs on the nutrient-poor coarse textured till that is prevalent through much of this area (Meades 1990; DNR 2014). The proposed Project site itself is primarily cleared ground interspersed with pockets of black spruce and shrubs.

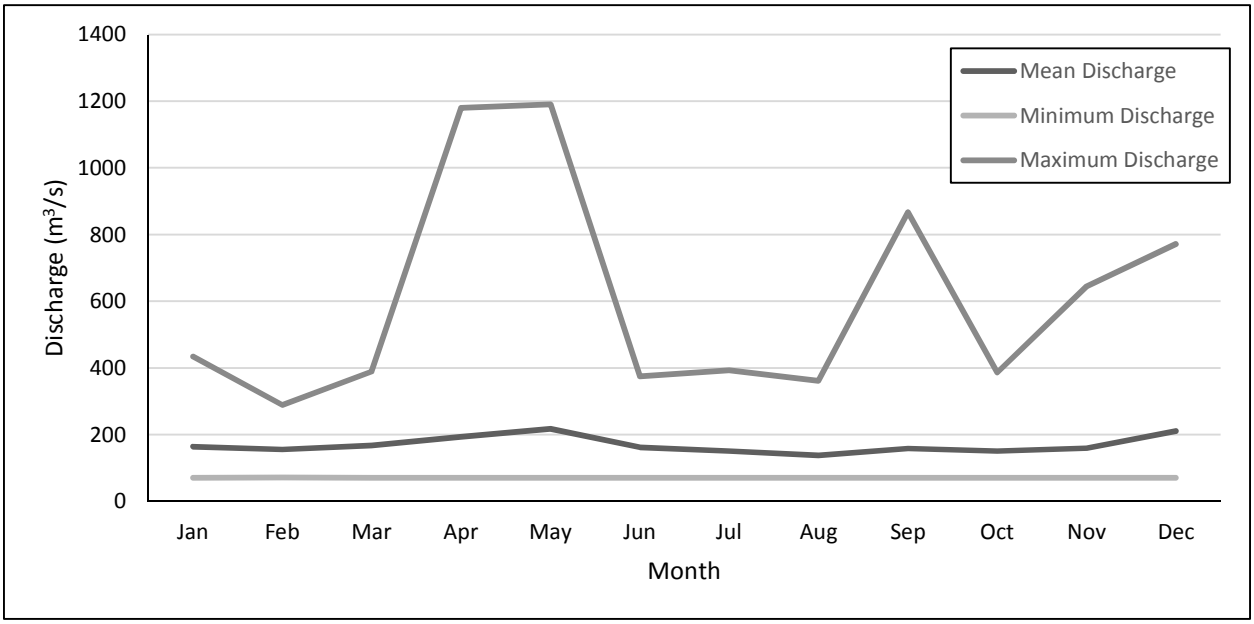
The Central Newfoundland region, with its productive and scrub forests, extensive wetlands and barren areas also provides habitats for a range of wildlife that are typical of boreal forest ecosystems. Wildlife species that are known or likely to occur in the general region include large mammals (moose and black bear), furbearers and small mammals (such as fox, hare, red squirrel, voles) as well as various resident and migratory species of birds, including raptors, waterfowl, passerines and upland game birds. There are also several species of gulls that nest in the cliffs and other surfaces along Exploits River. Gulls often begin to arrive in March (following the spring freshet), and leave following fledging of the young, typically around mid-August. They have been known to nest in high densities in some locations, upwards of several hundred birds per year.

No plant or animal species that are listed under the Newfoundland and Labrador *Endangered Species Act* (NL ESA) or the Canadian *Species at Risk Act* (SARA) are known or likely to occur within the proposed Project area itself.

The Exploits River flows through the Exploits Valley in the central portion of the Island of Newfoundland. The river extends from Red Indian Lake at its starting point and discharges into the Bay of Exploits near the Town of Botwood on Newfoundland's northeast coast. At approximately 246 km in length, it is the longest river on the Island (and the second longest in the province), and drains an area of over 10,000 km^2.

Water flows have been measured and monitored in the Grand Falls area since the early 1940s, initially at the hydroelectric facility itself and since 2010 at a monitoring station located just upstream of Grand Falls. Typical low flows are observed in June, July and August with high flows occurring in April and May during the spring freshet. Mean daily flows are approximately 170 m^3/s and have not been measured below 70m^3/s. Although the highest flows measured were just below 1,200 m^3/s, they only periodically exceed 285 m^3/s (Figure 4.1).

Figure 4.1 Exploits River Water Flows (Monthly Discharge, 2010-2013)



Source: Water Survey of Canada (2014)

The Government of Newfoundland and Labrador conducted water quality monitoring on the Exploits River from 1987 to 1994. In general, water quality fluctuated from poor to fair and showed an overall improving trend from 1988 to 1994 (NL WRMD, undated).

Various fish species inhabit the Exploits River, including; Atlantic salmon (*Salmo salar*), brook trout (*Salvelinus fontinalis*), Arctic char (*Salvelinus alpinus*), American eel (*Anguilla rostrata*), rainbow smelt (*Osmerus mordax*) and threespine stickleback (*Gasteroteus aculeatus*). Each of these (with the exception of stickleback) hold recreational and/or commercial value. A brief summary of the overall life history and uses of these species is presented in Table 4.2.

Table 4.2 Fish Species Known to Occur in the Exploits River

Common Name	Scientific Name	Biological/Habitat Details
Atlantic salmon	*Salmo salar*	Typical Habitat • Preferred temperature: 8-16°C • Preferred depth: Variable • Preferred substrate: gravel, cobble, boulder Biology and Ecology • Distributed throughout Newfoundland and Labrador • Occurs as landlocked (Ouananiche) and anadromous life histories • Spawn in clean, well aerated, gravel bottom riffle sections of stream • Diet depends on the size and habitat of fish, as well as season • Juvenile anadromous salmon remain in natal watersheds for 2-4 years • Adult salmon generally remain at sea for 1-3 years before returning to their natal stream to spawn Recreational/Commercial Value • Recreational fishery • There has not been a commercial salmon fishery in Newfoundland since 1997
Brook trout	*Salvelinus fontanalis*	Typical Habitat • Preferred temperature: 11-16°C • Preferred depth: 0.06-0.90 m • Preferred substrate: gravel, cobble, boulder Biology and Ecology • Inhabits lakes and rivers throughout Newfoundland and Labrador • Can be landlocked or anadromous • Feed mainly on aquatic and terrestrial insects and fish • Can hydribize with other salmonid species Recreational/Commercial Value • Recreational fishery • No commercial fishery in Newfoundland
American eel	*Anguilla rostrata*	Typical Habitat • Preferred temperature: variable; below freezing to over 19°C • Preferred depth: ≤1m • Preferred substrate: boulder, rubble, silt, muck, clay Biology and Ecology • The only catadromous (spawn at sea) species in Newfoundland and Labrador • All American eels spawn in the Saragasso Sea. • Can survive in very shallow water, and can move across wet grass or rocks during migrations • Eels hibernate over the winter in soft substrates Recreational/Commercial Value • Recreational / commercial fishery • Few commercial licenses in Newfoundland

Common Name	Scientific Name	Biological/Habitat Details
Arctic char	*Salvelinus alpinus*	Typical Habitat • Preferred temperature: 3-16°C • Preferred depth: >1m • Preferred substrate: boulder, rubble, gravel Biology and Ecology • Populations in Newfoundland are typically landlocked, and considered to be "relict" species • Anadromous life histories only found north of Pistolet Bay in Newfoundland. • Slower growing than other salmonids due to their northern distribution • Primarily found in deeper lakes on the Island. Recreational/Commercial Value • Recreational fishery • Several commercial fisheries throughout Arctic Canada
Rainbow smelt	*Osmerus mordax*	Typical Habitat • Preferred temperature: approximately 15°C • Preferred depth: >2m • Preferred substrate: cobble, gravel, sand, clay Biology and Ecology • Schooling pelagic species found in lakes and nearshore marine habitats. • Anadromous populations spawn in rivers in April to June • Landlocked populations are known to exist in both normal and dwarf form. Recreational/Commercial Value • Recreational fishery • Food source for other recreational / commercial fish species
Threespine stickleback	*Gasteroteus aculeatus*	Typical Habitat • Preferred temperature: 9-12°C • Preferred depth: variable, generally <1m • Preferred substrate: within or near vegetation Biology and Ecology • Common throughout Newfoundland and Labrador, in fresh, brackish and marine environments • Maximum lifespan is typically 2-2.5 years Recreational/Commercial Value • Limited; may be a food source for larger recreational / commercial species
Sources: Grant and Lee (2004), DFO (2012, 2014a, 2014b)		

Of these species, only the American eel is designated as a species of special conservation status, being listed as vulnerable under provincial legislation (*NL ESA*) as well as being identified as threatened by COSEWIC (2012).

All of the fish species present in Exploits River can undertake migrations (to varying degrees), which may occur as part of their seasonal changes in habitat associated with feeding and/or spawning or to avoid adverse environmental conditions (such as water temperatures). Table 4.3 presents a summary of known high intensity fish migration periods for these species.

Table 4.3 Summary of Key Migration Times for Fish Species Known to Occur in the Exploits River

Species	Season	Direction of Migration
American Eel	Spring Fall	Upstream Downstream
Atlantic salmon	Spring-Fall Fall	Upstream Downstream
Brook trout	Spring Fall	Downstream Upstream
Arctic char[1]	Spring Fall	Downstream Upstream
Stickleback[2]	Spring	Upstream
Rainbow smelt	Spring	Upstream

[1] Arctic char do not migrate south of Pistolet Bay

[2] Large scale migrations can occur in anadromous populations; landlocked populations undergo localized migrations

Source: Grant and Lee (2004); Scott and Crossman (1973)

4.1.2 Socioeconomic Environment

The community of Grand Falls was originally founded in 1905 to support the development of the pulp and paper industry in Central Newfoundland, which was established and flourished due to the rich timber resources, hydroelectric potential and nearby port site. The Anglo-Newfoundland Development (AND) Company was incorporated in 1902 and the Grand Falls Pulp and Paper mill opened in October 1909. Grand Falls was the official company town established to accommodate mill employees, business owners and support workers, and was eventually incorporated as the Town of Grand Falls in 1961. Other residents settled to the north of the railway in an area known as Grand Falls Station and later the Town of Windsor, which was incorporated in 1938. In 1991 both municipalities were amalgamated to form the Town of Grand Falls-Windsor (GFW 2014a).

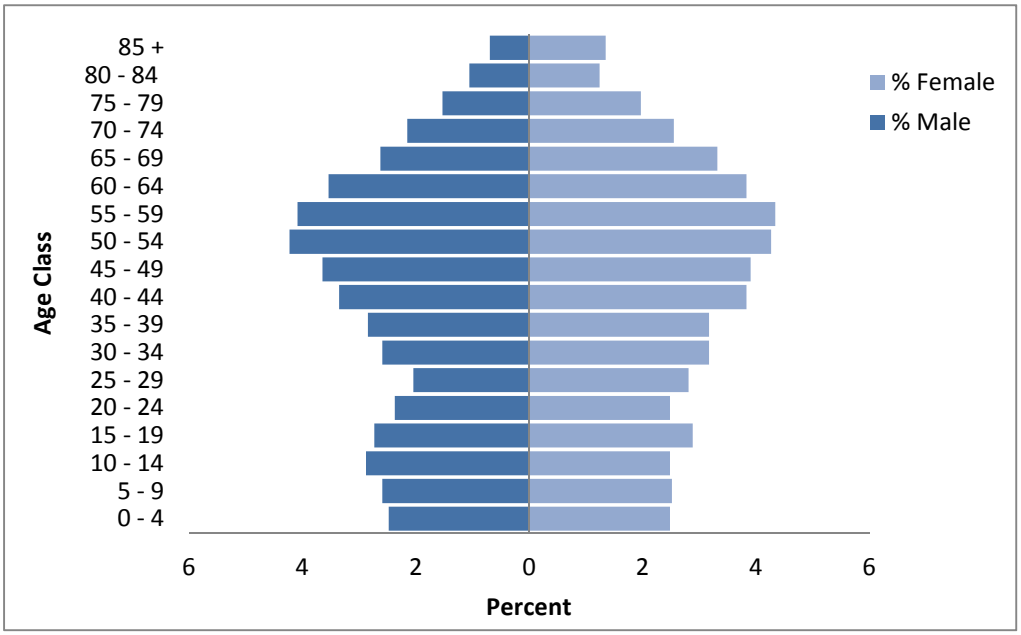
The Town of Grand Falls-Windsor currently has a population of nearly 14,000 residents. Despite trends elsewhere in the province and the recent changes in the community's economic activity and focus, the community's population has been largely stable over the past decade (Table 4.4).

Table 4.4 Population of Grand Falls – Windsor (2001-2011)

Year	Population	Change from Previous Census
2001	13,340	-5.8%
2006	13,558	1.6%
2011	13,725	1.2%

Sources: Statistics Canada (2006a; 2006b; 2011a)

Figure 4.2 Population of Grand Falls – Windsor: Age / Gender Structure (2011)



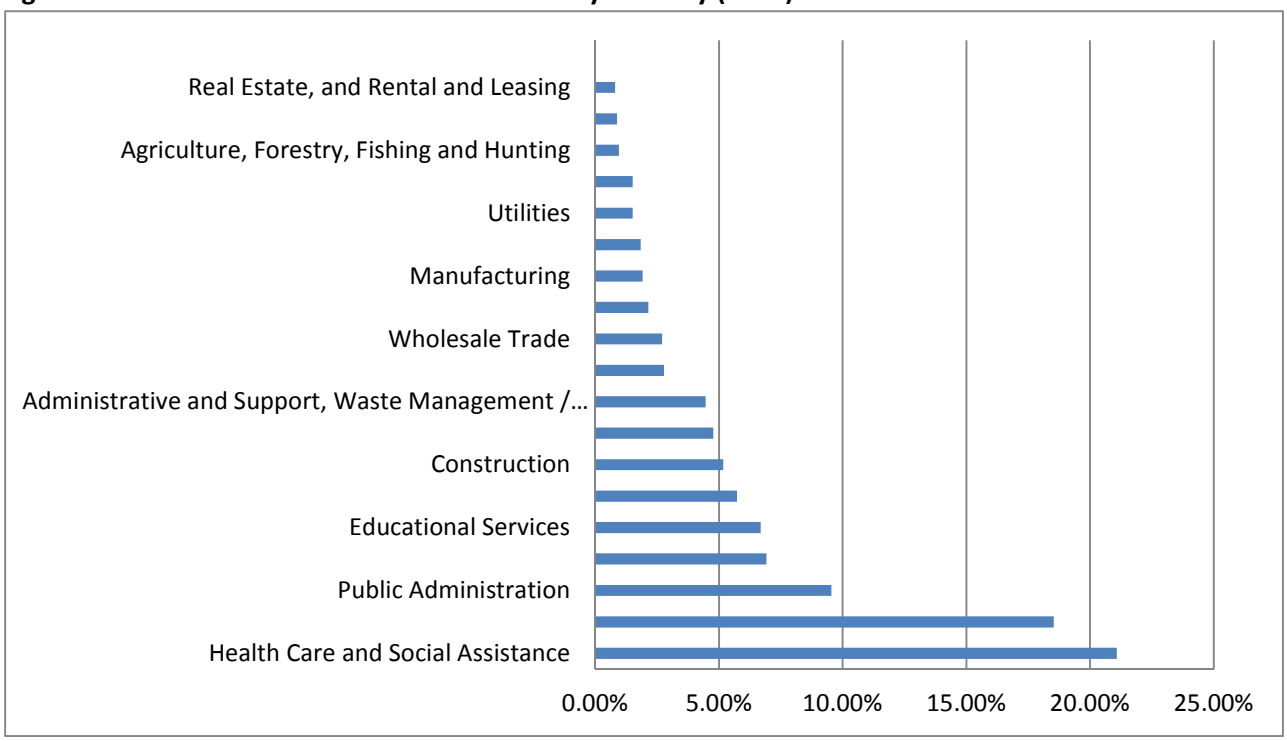
Source: Statistics Canada (2011a)

The Town of Grand Falls – Windsor is a modern, vibrant community, which includes a wide and diverse range of public and commercial services and infrastructure for their residents and the general region, including municipal (administration, waste management, water and sewer, roads) and provincial / federal (safety and security, health care, employment and social programs, training and education) services and facilities.

The economy of Central Newfoundland has traditionally been based primarily on natural resource extraction and industrial development. Much of the population lives in the general Grand Falls-Windsor / Bishop's Falls area, which is the industrial, service and government centre for Central Newfoundland. The forestry sector and associated pulp and paper industry has been a major employer in this area for decades. Since the December 2008 announcement that the Grand Falls-Windsor paper mill would close, local residents, industry and stakeholder groups, and municipal and provincial governments have been working together and taking action to help the Town and region retain its current economic activity, as well as exploring employment, business and economic diversification opportunities.

Manufacturing, commercial, retail and government services currently employ a significant portion of the labour force of the Town and the larger Central Newfoundland region (GFW 2014b), and tourism and recreational activities and associated facilities are also currently a key component of the area's economy (Figure 4.3).

Figure 4.3 Grand Falls-Windsor: Labour Force by Industry (2011)



Source: Statistics Canada (2011b)

Grand Falls-Windsor is an incorporated municipality with a Municipal Plan and associated Development Regulations. The current Grand Falls generating station is located immediately adjacent to the former Abitibi paper mill on the south side of the community, in an area zoned as Heavy Industrial (IH). Most of this area includes a narrow strip of land zoned as Conservation (CON) along the River's edge. On the opposite side of the river, the dam connects to an area zoned as Rural (RUR) which is the location of the ERMA Fishway and Salmonid Interpretation Centre (GFW 2012; ERMA 2014).

The Exploits is a Scheduled River (#46) for fishing Atlantic salmon, and attracts anglers from throughout the province as well as from elsewhere in Canada and the United States. Recreational fishing is regulated by DFO through the *Newfoundland and Labrador Fishery Regulations*. The Exploits River is included in Zone 4, where the 2014 season was from June 1 to September 7 with fall angling from September 8 to October 7, 2014. Catch-and-release angling with a daily limit of four salmon was available in the fall of 2014 on the main stem of the lower Exploits River from Stoney Brook to the river mouth. DFO maintains a Watershed Management Plan for the Exploits River to meet fish conservation objectives. Regulations for class and retention limits (from 0 to 6 salmon) are established for various sections of the Exploits River based on the abundance of fish in those areas (DFO 2014c). The Exploits River is also used for canoeing and kayaking, and every year hundreds of people take advantage of this activity along the river, primarily above Grand Falls-Winsor.

A number of other recreational and / or commercial land and resource use activities occur along this section of the Exploits River and in nearby areas, including (RILOT 2014; RIAL 2014; P. Devereaux 2014; ERMA 2014; NLDMIA 2014; GFW 2014b; GFGC 2014b; NLDTW 2014: Figure 4.4):

- Riverfront Chalets and Rafting Newfoundland (formerly Red Indian Adventures) is a private tourist operation that offers white water rafting and kayaking tours on the Exploits River. The operation is set up upstream of Grand Falls next to Aspen Brook, and generally runs from mid June to late September;

- Sanger Memorial RV Park, with 45 camping sites, is located three kilometers to the east;

- Beothuk Family Park, a privately owned park with serviced and unserviced campsites, is located on Big Rushy Pond approximately three kilometers to the west of the dam site;

- The Newfoundland T'Railway Provincial Park, former Canadian National railbed, is located approximately two kilometers to the north and runs through the Town;

- The Grand Falls Golf Club is located on the Exploits River approximately four kilometers to the west;

- A Provincial Cottage Planning Area is located on the opposite side of the Exploits River approximately five kilometers to the west of the dam;

- The nearest outfitter, Central Newfoundland Outfitters' Rattling Brook Lodge, is located 15 km to the east;

- Red Indian Lake Outfitting & Tours Inc. which offers white water rafting, kayaking, hunting, fishing and snowmobiling is located on Red Indian Lake about 135 km to the west.

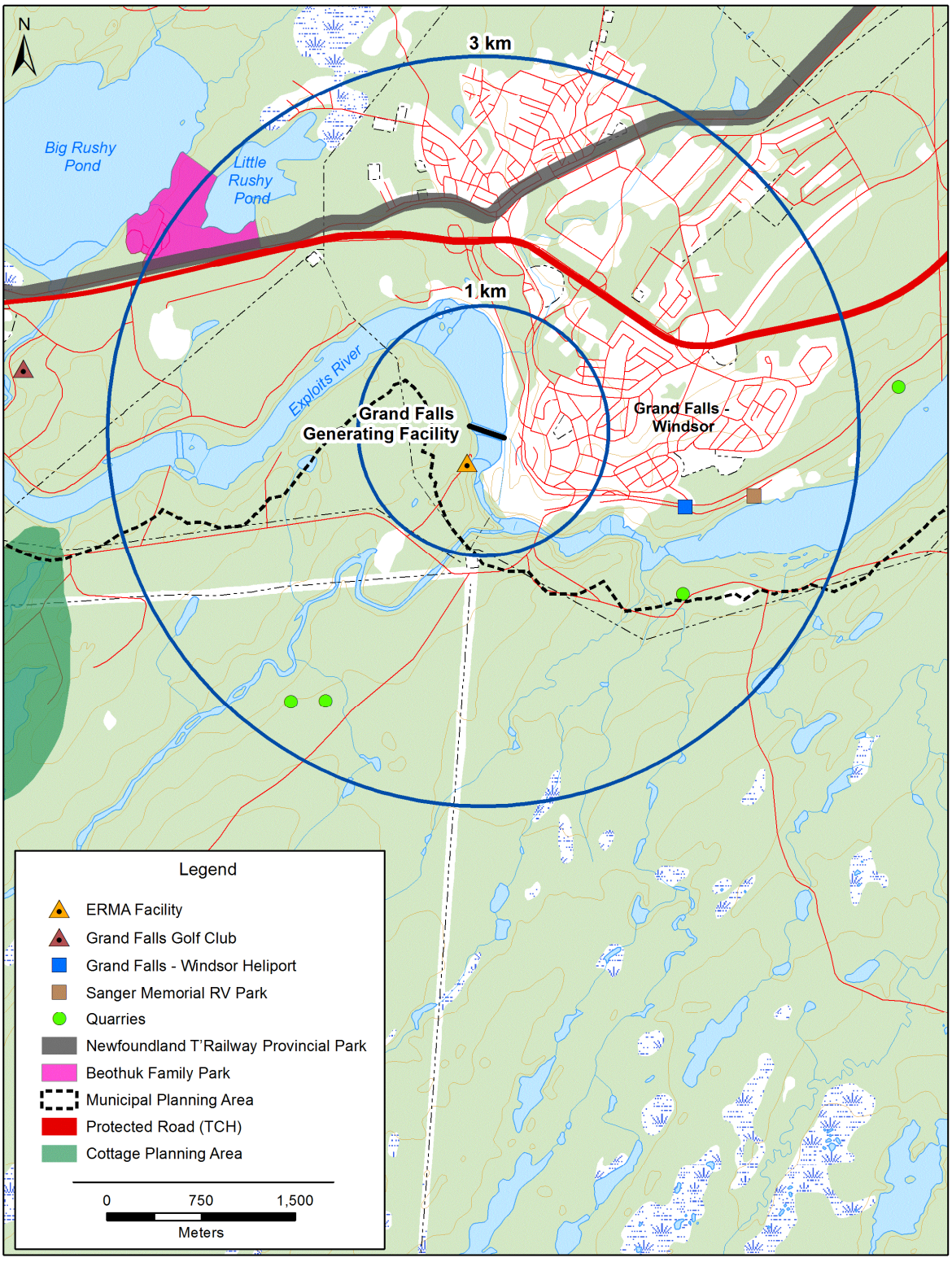
- The Trans-Canada Highway (Route 1, NL Protected Road) is located approximately two kilometers to the north;

- Grand Falls-Windsor Heliport is located approximately two kilometers to the east of the dam;

- Several quarries are located between three and five kilometers to the south and east of the dam site; and

- There are two former waste disposal sites located approximately five kilometers to the north and west.

Figure 4.4 Existing (Regional) Socioeconomic Environment



4.2 Potential Environmental Interactions and Planned Mitigation

Nalcor Energy has well over four decades of experience in planning, designing, building, maintaining and operating electrical generation and transmission infrastructure projects in Newfoundland and Labrador, and currently maintains an extensive electricity transmission and distribution system throughout the province. This, along with the fact that the environmental effects of proposed development activities such as those being proposed here are well understood and manageable, means that there is a very good understanding of potential environmental issues and interactions that may be associated with the proposed Project as well as appropriate and effective measures for avoiding or reducing any such effects.

The following sections provide an environmental effects analysis for the proposed Project, including each of its associated components and activities. The analysis focuses upon, and is organized according to, the following themes:

1) Atmospheric Environment;

2) Terrestrial Environment;

3) Freshwater Environment; and

4) Socioeconomic Environment

The analysis for each component includes a discussion and description of the likely environmental considerations (adverse and positive) that may be associated with the Project, with separate subsections for the Construction and Operations and Maintenance phases. Environmental planning and mitigation measures to avoid or reduce environmental effects are identified and considered integrally within the analyses. The assessment also includes possible accidental events and malfunctions that could potentially occur during each phase of the Project. This is followed by a summary and evaluation of the likely residual (with mitigation) environmental effects of the Project.

The environmental analysis concludes with an overview of any environmental monitoring and follow-up which may be required during one or both phases of Project implementation.

4.2.1 Atmospheric Environment

The environmental analysis for the Atmospheric Environment includes consideration of any likely implications of the Project on air quality and noise levels within and around the Project area and the adjacent community.

Construction

The main potential interactions between the Project and the Atmospheric Environment relate to the use of equipment, primarily during Project construction, and the noise, dust and engine emissions that may be associated with these activities. Construction will include various activities associated with equipment

mobilization and set-up, site preparation, movements of construction materials, concrete removal and installation, the construction of control buildings and other site infrastructure, and other activities, which will result in some minor, temporary and localized air emissions due to project-related dust and emissions from vehicles and equipment.

Project construction will, however, be characterized by fairly standard and routine activities and practices, and will occur within a localized area over a relatively short period. It will take place within an industrial area that has been subject to previous site development and has existing industrial infrastructure and activity in place, and which is not currently accessible to the public and is somewhat removed from the adjacent community. Project-related vehicles and equipment will be maintained in good repair and inspected regularly, and any associated air emissions from equipment and vehicles will conform to applicable regulations and guidelines. Any fugitive dust from construction activities will be controlled as necessary using dust control agents such as water.

Any potential emissions or interactions with the Atmospheric Environment during Project construction are therefore likely to be negligible (and within existing regulations or standards), localized and short-term (intermittent over the construction period).

Operations and Maintenance

During Project operations, the nature and degree of on-site activity will be considerably less than that during the construction phase, and will be characterized primarily by the continued operation of the facility and periodic maintenance. These operational activities are not particularly noisy, nor are they characterized by significant air emissions or other planned environmental discharges.

Environmental Effects Summary and Evaluation

A summary of potential environmental interactions, identified mitigation measures, and the residual environmental effects of the Project on the Atmospheric Environment is provided in the Table below.

Table 4.5 Environmental Effects Assessment Summary: Atmospheric Environment

Environmental Component	Project Phase / Potential Interaction			Key Considerations and Environmental Mitigation
	Construction	Operations	Issues / Interactions	
Air Quality	•		▪ Construction works (noise, dust) ▪ Equipment use (vehicles, fuel consumption, exhausts) ▪ Possible accidental event (fire, others)	▪ Localized and short-term construction activity. ▪ Project location within existing industrial area, no public access. ▪ Standard construction and operational practices. ▪ Regular inspection and maintenance of equipment. ▪ Accidental event prevention and response.
Noise Levels	•			

The proposed Project is not likely to result in significant adverse environmental effects on the Atmospheric Environment.

4.2.2 Terrestrial Environment

The Terrestrial Environment is comprised of relevant components of the "on-land" biophysical environment which may interact with the Project, including vegetation, soils, landforms and wildlife.

Construction

The proposed Project site occurs within an already developed area, and Project construction will not involve additional vegetation clearing, grubbing, excavation or other on-land site preparation activities. No listed (protected) plant species are known or likely to occur within or near the proposed Project area.

Adverse interactions with wildlife are also not likely to occur during the Project's construction phase. The long-standing presence and on-going operation of the existing hydroelectric generation facility and the previous industrial (paper mill) activity at this location has somewhat limited the use of the site itself by most wildlife. Any wildlife (such as avifauna) that do use the area have likely habituated somewhat to on-going human activity. There are no *SARA* and/or *NL ESA* listed species that are known to occur within or near the proposed Project area. The potential for interactions between the Project and wildlife is therefore limited.

Any wildlife that may be present in the immediate area that may be disturbed by Project-related noise, human presence or other interactions may temporarily avoid the immediate vicinity of such works during the short-term period of construction. Any such avoidance and disturbance associated with the Project is not expected to affect the overall presence or health of any wildlife population in the area, and there is similar habitat available throughout the larger, surrounding area.

The following additional mitigative measures will be implemented to further reduce the potential for interactions between Project activity and any wildlife that may occur in the area at those times:

- Work areas will be kept clear of garbage;
- Project personnel will not hunt or harass wildlife;
- Equipment and vehicles will yield the right-of-way to wildlife; and
- Any nuisance animals will be dealt with in consultation with the NL Inland Fish and Wildlife Division.

Nalcor Energy currently has procedures and facilities in place for the management of solid, liquid and hazardous wastes at its Exploits Generation operations, which will apply to the construction and operations phases of the proposed Project. Waste materials generated through construction activities will be removed from the area and disposed of at an existing, approved site. Non-hazardous construction refuse will be stored in covered metal receptacles, and will be disposed of on an as-needed basis at an approved landfill site, as per Nalcor Energy's on-going operations and practices. Waste materials will be reused / recycled where possible.

Any hazardous wastes will be stored in sealed, labeled containers and disposed of according to applicable regulations and Nalcor Energy practice. These include procedures for the characterization / identification, storage, inspection, labeling and transportation of hazardous wastes produced at the facility, as well as emergency preparedness / prevention and training. There will therefore be no adverse interaction between construction waste materials and the environment.

There will not be any new fuel storage facilities or fuelling locations established as part of this Project. Any chemicals and other materials that are being used during construction at the worksites will be handled and used in accordance with Nalcor Energy procedures and in compliance with all relevant regulatory requirements for such activities. Personnel responsible for the use and handling of any such products will be appropriately trained prior to commencing work at the site.

Nalcor Energy maintains a supply of hydrocarbon spill response equipment and materials at its Grand Falls generation station, and appropriate equipment and supplies will be maintained at the work site in an accessible location. Personnel working on the Project will be appropriately trained and knowledgeable about these spill response procedures, and any such incidents will be reported to environmental authorities as applicable.

Operations and Maintenance

During the operations phase of the Project there will be no soil or vegetation disturbance, and therefore, little or no potential for effects to these aspects of the terrestrial environment. Wastes, fuels and other such materials and substances will continue to be handled, used and disposed of properly throughout the life of the Project, as outlined earlier. None of the facility's operational activities are or will be particularly noisy or otherwise disruptive to the surrounding environment.

No additional interactions with or adverse effects on the Terrestrial Environment are therefore anticipated during this phase of the Project.

Environmental Effects Summary and Evaluation

A summary of potential environmental interactions, identified mitigation measures and the residual environmental effects of the Project on the Terrestrial Environment is provided in the Table below.

Table 4.6 Environmental Effects Assessment Summary: Terrestrial Environment

Environmental Component	Project Phase / Potential Interaction			Key Considerations and Environmental Mitigation
	Construction	Operations	Issues / Interactions	
Vegetation	•	•	• Possible fuel or chemical spills	▪ Project location in existing industrial area • No new Project-related ground disturbance • Localized and clearly delineated work areas • Compliance with applicable regulations and permits • Accidental event prevention and response
Soils	•	•		

Environmental Component	Project Phase / Potential Interaction			Key Considerations and Environmental Mitigation
	Construction	Operations	Issues / Interactions	
Wildlife	•	•	• Noise, human presence, vehicle and equipment use, other disturbances	• No harvesting or harassment of wildlife by Project personnel • Waste and other materials management (facilities and procedures) • Accidental event prevention and response

The proposed Project is not likely to result in significant adverse environmental effects on the Terrestrial Environment.

4.2.3 Freshwater Environment

The Freshwater Environment includes surface water (quantity and quality) and fish and fish habitat which may interact with the Project.

Construction

As described in Chapter 2, the proposed construction work will be undertaken in the dry, through the establishment of appropriate water diversion infrastructure and procedures. These may include upstream and downstream cofferdam structures attached to the vertical concrete face of the existing dam during each construction phase.

During each of the three seasons of planned construction activity, all work within and near the river itself will be scheduled so as to avoid interactions with fish and their movements. Specifically, Phase 1 construction will commence after mid-September in Year 1 to accommodate fish migration requirements, and Phase 2 and 3 construction will commence in approximately mid-June. Construction activities will be planned and completed such that the Grand Falls Main Dam and overall generating facility will continue to function as per current operational activities and parameters, including continued compliance with the *Minimum Flow Agreement* with DFO and Nalcor Energy's other measures and methods regarding water management and fish conveyance.

The proposed construction work will be performed in a manner that ensures no deleterious substances, such as (but not limited to) new and demolished concrete, sediment, fuels and oils, and other such materials enter the river, either directly or indirectly. Tools and equipment will not be washed in any body of water and wash water will not be discharged directly into any waters. A designated cleaning area for tools will be established. Wastes, fuels and other such materials and substances will be handled, used and disposed of properly throughout the life of the Project, as outlined earlier, with appropriate equipment and procedures in place to respond to an accidental spill should one occur.

Operations and Maintenance

During planned operations activities there will be no additional, direct interactions with the Freshwater Environment. Project infrastructure will continue to be used, inspected and maintained / repaired as required,

and all such activities will occur in compliance with relevant regulations and permits. Again, the Grand Falls dam and overall generating facility will continue to function as per current operational activities and parameters, including continued compliance with the *Minimum Flow Agreement* with DFO and Nalcor Energy's other measures and methods regarding water management and fish conveyance.

No additional interactions or adverse effects to the Freshwater Environment are therefore anticipated during this phase of the Project.

Environmental Effects Summary and Evaluation

A summary of potential environmental interactions, identified mitigation measures, and the residual environmental effects of the Project on the Freshwater Environment is provided in the Table below.

Table 4.7 Environmental Effects Assessment Summary: Freshwater Environment

Environmental Component	Project Phase / Potential Interaction			Key Considerations and Environmental Mitigation
	Construction	Operations	Issues / Interactions	
Surface Water (Quantity and Quality)	•	•	• Drainage / sedimentation • Potential accidental spills	• No water use / extraction associated with this Project • Construction work will be undertaken in a dry environment • Measures to prevent deleterious substances from entering water • Compliance with regulations and permits • Accidental event prevention and response
Fish and Fish Habitat	•	•	• Drainage / sedimentation • Potential accidental spills	• Construction work will be undertaken in a dry environment • No fish habitat loss / alteration • Measures to prevent deleterious substances from entering water • Compliance with regulations and permits • Scheduling of project construction activities • Continued compliance with *Minimum Flow Agreement* and other Nalcor Energy operational procedures • Accidental event prevention and response

The proposed Project is not likely to result in significant adverse environmental effects on the Freshwater Environment.

4.2.4 Socioeconomic Environment

The Socioeconomic Environment includes relevant components of the human and cultural environments, including historic and heritage resources, land and resource use (commercial, municipal, recreational), human health and well-being, community services and infrastructure, and economy.

Construction and Operations

Historic resources include sites and objects of historic and archaeological, cultural, spiritual and paleontological importance, which may be protected under the Newfoundland and Labrador *Historic Resources Act* (1985) administered by the Provincial Archaeology Office (PAO) of the NL Department of Tourism, Culture and Recreation. Ownership of all archaeological objects is vested in the Crown. Development activities and associated ground disturbance have the potential to disturb or destroy archaeological sites and other historic resources, where they exist.

There are no known historic resources within or near the Project area. The proposed Project does not involve ground clearing, and occurs within an existing disturbed (industrial) area that has already been subject to past development. It is therefore very unlikely that the Project will result in the disturbance or destruction of historic resources. During Project construction, however, standard precautionary and reporting procedures will be implemented. Should an accidental discovery of historic resources occur, all work will cease in the immediate area of the discovery until authorization is given for the resumption of the work. Any archaeological materials encountered will be reported to the PAO, including information on the nature of the material discovered and the location and date of the find. During the operations phase of the Project there will be no further ground disturbance, and therefore, little or no potential for effects to historic and heritage resources. The precautionary and reporting procedures implemented for construction will, however, continue to be in place throughout the life of the Project.

Project construction will be characterized by fairly standard and non-intrusive activities and practices, will occur within a small and localized area over a relatively short period. The proposed Project site is located within an existing and long-standing industrial area on the south side of the Town of Grand Falls – Windsor, and is not expected to interact negatively with the community or its residents either directly (it does not overlap with any municipal infrastructure) or indirectly (Project activities will not likely be seen or heard by adjacent residents or others). No other commercial or recreational land and resources uses occur in the immediate Project area. The proposed Project site is currently private (and gated) property with no public access. The Project will therefore not adversely affect public access to, and use of, this area which is in a portion of the municipality that is currently zoned as “Heavy Industrial”.

Again, construction activities will be planned and completed such that the Grand Falls generating facility will continue to function as per current Nalcor Energy operations, including continued compliance with the *Minimum Flow Agreement* with DFO and Nalcor Energy’s other measures and methods regarding water management and fish conveyance.

The Project is therefore not expected to have any negative implications for other existing commercial, municipal or recreational land use activities in the area, or on human health and well-being in local communities or elsewhere.

Some development projects can result in increased demands on local, regional and provincial services and infrastructure. This may include both direct Project requirements, such as in the use of local transportation and accommodations, as well as indirect demands from project workers and their families. Given the relatively small size and duration of the Project's construction labour requirements (Chapter 2) and because its operations will not increase or otherwise change Nalcor Energy's current labour force at Grand Falls , no adverse effects related to the availability or quality of community services and infrastructure are anticipated. Nalcor Energy will continue to consult with the local communities and other stakeholders regarding Project related activities, schedules and requirements including, for example, the transportation of any large loads to and through Town during Project construction.

Project construction will be carried out by a qualified and experienced Contractor selected by Nalcor Energy through a competitive bid process. The Project will therefore create business opportunities during its construction phase (Section 2.4), and the requirement for labour and for goods and services during Project construction may provide opportunities for local and provincial workers and businesses. These direct economic benefits will be supplemented by indirect and induced "spin-off" effects through, for example, spending by Project employees and contractors.

Environmental Effects Summary and Evaluation

A summary of potential environmental interactions, identified mitigation measures, and the residual environmental effects of the Project on the Socioeconomic Environment is provided in the Table below.

Table 4.8 Environmental Effects Assessment Summary: Socioeconomic Environment

Environmental Component	Project Phase / Potential Interaction			Key Considerations and Environmental Mitigation
	Construction	Operations	Issues / Interactions	
Historic Resources	•		• Any new ground disturbance	▪ Location within existing industrial area • No new Project-related ground disturbance, localized and clearly delineated work areas • No known (and low potential for) historic resources in the area • Standard precautionary and reporting procedures
Land and Resource Use	•	•	• Potential direct interaction with current uses and other disturbances (noise, dust, visibility, access, etc)	▪ Project location within existing industrial area, private / gated property • Localized and short-term construction activity • Distance from local community, no likely overlap or interaction • Continued compliance with *Minimum Flow Agreement* and other current Nalcor Energy operational procedures

Environmental Component	Project Phase / Potential Interaction			Key Considerations and Environmental Mitigation
	Construction	Operations	Issues / Interactions	
Human Health and Well-Being	•	•	• Potential implications of Project-related disturbances for human health and well-being in local communities or elsewhere	▪ Project location within existing industrial area, private / gated property • Localized, routine and short-term construction activity • No construction or operational discharges or emissions to the environment • Distance from and low potential for interaction with community and residents • Accidental event prevention and response
Community Services and Infrastructure	•	•	• Potential Project use of, and demands for, local services and infrastructure	• Localized and short-term construction activity, small construction workforce • No new operational employees • Timing and scale of Project activities • Distance from and minimal interaction with the community
Economy	•	•	• Employment and business opportunities	• Positive effects (direct and indirect)

The proposed Project is not likely to result in significant adverse environmental effects on the Socioeconomic Environment.

4.3 Environmental Monitoring and Follow-up

Any potential environmental issues which may be associated with the Project can be addressed and mitigated through the use of good construction and operational practices and procedures. These will be further addressed through the specific environmental permitting requirements and compliance standards and guidelines which will apply to Project activities and components.

Once operational, the Project will be subject to regular inspections and maintenance as required. The Proponent is committed to obtaining all required authorizations for the proposed Project, and to complying will all applicable regulations. No other follow-up is considered necessary in relation to the proposed Project.

5.0 SUMMARY AND CONCLUSION

Nalcor Energy has managed and operated the hydroelectric facilities on the Exploits River on behalf of the Government of Newfoundland and Labrador since 2009, including the existing 75 MW generating facility at Grand Falls. This hydroelectric station has been in place for over a century, and requires periodic maintenance and upgrading to help ensure that it continues to operate in an effective, efficient, safe and environmentally sound manner.

The proposed Project that is the subject of this EA Registration includes a number of required modifications and rehabilitation works at the Main Dam at Grand Falls over a three year period, including:

- Rehabilitation of the existing concrete dam structure to refurbish deteriorated concrete, along with the installation of additional concrete mass shaped to improve the hydraulics of the spillway;
- Replacement of the existing, temporary flashboard system along the top of the dam with an inflatable system;
- Construction of a single lane vehicle bridge across the existing power canal to provide access for vehicles and equipment during construction and for future maintenance activities; and
- Construction of a pedestrian bridge over sections of the above described dams works to provide additional construction and maintenance access.

This *Environmental Assessment Registration* is intended to initiate the provincial EA process for the Project, which will undergo review in accordance with applicable regulatory requirements.

The Project will be planned and implemented so as to avoid or reduce any potential adverse environmental effects. Given the nature, scale and characteristics of the proposed Project, including its location within the existing dam facility and immediately adjacent to long-standing industrial (mill) infrastructure, it is not likely to have significant environmental issues or effects associated with it. The Project will be undertaken in accordance with Nalcor Energy's proven environmental policies, plans and practices to help ensure that it is constructed in a safe and environmentally-responsible manner, and once completed the Grand Falls generating facility will continue to function as per current operational activities and parameters.

Nalcor Energy's planned rehabilitation work at the Grand Falls Dam will help the company continue to maintain and operate these important energy assets on behalf of the people of Newfoundland and Labrador, as well as to improve the operators' ability to adjust dam height (and thus water levels and flows) for power production, environmental (fish passage) and safety reasons.

Date

Name: Edmund J. Martin
Position: President and CEO

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APPENDIX A

List of Potentially Applicable Permits and Authorizations

APPENDIX A List of Potentially Applicable Permits and Authorizations (Provincial, Federal, Municipal)

Approval Potentially Required	Legislation / Regulation	Project Component / Activity Requiring Approval or Compliance	Department or Agency	Requirements
Government of Newfoundland and Labrador				
Certificate of Approval for any Alteration to a Body of Water	*Water Resources Act*	Any activities which may alter a water body	Water Resources Management Division, Department of Environment and Conservation	Permits are required for construction activities within 15 m of the high watermark of any water body. An application form is required for each alteration.
Certificates of Approval for any Instream Activity	*Water Resources Act*	Any in-stream activity	Water Resources Management Division, Department of Environment and Conservation	Approval is required for any in-stream activity before undertaking the work.
Certificate of Approval for Construction Site Drainage	*Water Resources Act*	Any run-off from the project site being discharged to receiving waters	Water Resources Management Division, Department of Environment and Conservation	Approval is required for any run-off from the project site being discharged to receiving waters.
Policy Directives	*Water Resources Act*	Project activities (as applicable)	Water Resources Management Division, Department of Environment and Conservation	The Department has a number of potentially applicable policy directives in place for particular types of in or near water work
Compliance Standard	*Fire Prevention Act,* and *Fire Prevention Regulations*	On-site structures (temporary or permanent)	Engineering Services Division, Service NL	All structures must comply with fire prevention standards.
Compliance Standard	*Environmental Control Water and Sewage Regulation* under the *Water Resources Act*	Any waters discharged from the Project	Pollution Prevention Division, Department of Environment and Conservation	A person discharging sewage and other materials into a body of water must comply with the standards, conditions and provisions prescribed in these regulations for the constituents, contents or description of the discharged materials.
Compliance Standard	*Occupational Health and Safety Act* and Regulations	Project-related occupations	Service NL	Outlines minimum requirements for workplace health and safety. Workers have the right to refuse dangerous work.

Approval Potentially Required	Legislation / Regulation	Project Component / Activity Requiring Approval or Compliance	Department or Agency	Requirements
				Proponents must notify Minister of start of construction for any project greater than 30 days in duration.
Compliance Standard	*Workplace Hazardous Materials Information System (WHMIS) Regulations*, under the *Occupational Health and Safety Act*	Handling and storage of hazardous materials	Operations Division, Service NL	Outlines procedures for handling hazardous materials and provides details on various hazardous materials.
Government of Canada				
Applications for Authorization under Paragraph 35(2)(b) of the *Fisheries Act*	*Fisheries Act* and *Regulations*	Project activities in or near water	Department of Fisheries and Oceans	This federal legislation provides protection to commercial, recreational, and Aboriginal fisheries by protecting the fish resources and habitats that support these activities. Any potential serious harm to fish as a result of a project that results in the death of fish or the permanent alteration to, or destruction (PAD) of, fish habitat as determined by DFO requires authorization under Section 35(s) of the *Fisheries Act*, including adequate and appropriate measures to offset any such serious harm. Proponents may prepare and submit a request for review to DFO to determine/ confirm whether or not such an approval is needed.
Permit(s) under the *Navigation Protection Act*	*Navigation Protection Act* Associated *Regulations* and *Minor Works Order*	Project activities in or across water	Transport Canada	The Navigation Protection Program (NPP) is a Transport Canada initiative focused on the administration and enforcement of the *Navigation Protection Act*. A permit may be required for certain works located below the high water mark, either over, under, through or across any navigable waters.

Approval Potentially Required	Legislation / Regulation	Project Component / Activity Requiring Approval or Compliance	Department or Agency	Requirements
Compliance Standard	*Fisheries Act*, Section 36(3), Deleterious Substances	Any run-off from the project site being discharged to receiving waters	Environment Canada Department of Fisheries and Oceans	Environment Canada is responsible for Section 36(3) of the *Fisheries Act*. However, DFO is responsible for matters dealing with sedimentation. Discharge must not be deleterious and must be acutely non-lethal.
Compliance Standard	*Migratory Birds Convention Act* and *Regulations*	Any activities which could result in the mortality of migratory birds and endangered species and any species under federal authority	Canadian Wildlife Service, Environment Canada	Prohibits disturbing, destroying or taking a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird, and possessing a live migratory bird, carcass, skin, nest or egg, except when authorized by a permit. The Canadian Wildlife Service should be notified about the mortality of any migratory bird in the project area.
Compliance standards; permits may be required.	National Fire Code	On-site structures (temporary or permanent)	Service NL	Approval is required for fire prevention systems in all approved buildings.
Compliance standards; permits may be required.	National Building Code	On-site structures (temporary or permanent)	Service NL	Approval is required for all building plans.
Municipalities				
Development or Building Permit	*Urban and Rural Planning Act, 2000,* and Relevant Municipal Plan and Development Regulations	Development within municipal boundary	Community Council	A permit is required for any development or building within municipal boundaries.
Approval for Waste Disposal	*Urban and Rural Planning Act, 2000,* and Relevant Municipal Plan and Development Regulations	Waste disposal	Community Council	The use of a community waste disposal site in Newfoundland and Labrador by proponents/contractors to dispose of waste requires municipal approval. Restrictions may be in place as to what items can be disposed of a municipal disposal site.

APPENDIX B

Public Consultation Materials

- Advertisement
- Public Open House: Information Panels
- Town Council Meeting: Presentation