Environmental Report

Frederick House River – Wanatango Falls

Hydroelectric Generating Station Project

FOREWORD

Xeneca Power Development Inc. (Xeneca) is pleased to provide a copy of the Class EA for the proposed project: the Wanatango Falls Hydroelectric Generating Station on the Frederick House River. This represents the culmination of a considerable joint effort by our scientists and engineers working in co-operation with agencies and stakeholders.

The completion of the Class EA is not the end of the environmental review and permitting process. A series of regulatory approvals will be required post EA under various Federal, Provincial and municipal statutes. For example, Xeneca must provide detailed design information to the Ministry of Natural Resources ("MNR") which would consider approvals under the *Lakes and Rivers Improvement Act.*

The purpose of a Class EA is to ensure that positive and negative impacts of the proposed project are identified, evaluated and considered in the planning and execution stages and to undertake meaningful engagement of all interested stakeholders who may wish to be involved in the project planning and development process. In this context, the environment being considered includes the natural/physical, socio/economic and cultural/human landscape.

In order to meet the Milestone Date for Commercial Operation as set out in the Feed-In-Tariff ("FIT") contract requirements, Xeneca would need to commence site preparation in mid-2012, followed by the construction of the facility between 2012 and 2014. This approach allows the Agencies to complete the necessary environmental review required by the conceptual planning period in the Class EA and subsequently focus on detailed design, permitting and approvals.

Process and Approach

The Class EA document suggests a timeline of 12-18 months to prepare a project specific Class EA document. Xeneca began work on notification of Agencies immediately upon receipt of the FIT contract and began Class EA activities in the summer of 2010. It should be noted that certain preliminary work on the project dates back to 2007-8 with an application for Site Release to the MNR.

The Class EA process suggests the collection of field data for a minimum of one season including a spring freshet which, for the project, was completed in 2010. As a proactive position, Xeneca is continuing environmental studies in 2011 and, to some extent beyond 2011, to develop a fuller information database for use in post-EA permitting and EA verification purposes. This work will also be invaluable to support any requirement for Adaptive Mitigation if any unplanned effects arise during construction or operation. This document identifies work and field studies which are either underway or that are planned through 2011. An Adaptive Management workshop is

proposed in the early post-EA period well in advance of any potential major permitting or construction activities. Xeneca is continuing to implement this study program in anticipation of timely issuance of a Statement of Completion (MOE) and Notice to Proceed (OPA).

Under the waterpower process, detailed design is undertaken following issuance of a Statement of Completion of the Class EA. Xeneca continues to work with agencies, municipalities, the public and various stakeholders in a collaborative manner to address issues that may arise during the project review process.

Review of detailed designs and associated issues will be considered through the post-EA approvals process under *the Fisheries Act, Lakes and Rivers Improvement Act, the Navigable Waters Protection Act, the Public Lands Act,* and, if applicable, the *Endangered Species Act* using results from engineering studies, Class EA conformance and verification work and permitting activities. Adaptive Management Planning has been applied to ensure every appropriate level of review is performed at each stage of the project planning, execution and operating period. This is a practical approach arising from the Ontario Power Authority's FIT schedule to simultaneously ensure the objectives of the *Environmental Assessment Act* and the Class EA. This approach allows progressive review by Agencies before construction and operation as information becomes available from detailed design or other work. This will allow Agencies opportunity to review detailed design and incorporate Agency input into approvals.

The *Ontario Environmental Assessment Act* obligates a project proponent to adhere to the requirements of the Class EA and the commitments made in the Class EA. As such the Class EA forms a binding commitment between Xeneca, the government and the citizens of Ontario. Xeneca is fully committed to this process and will continue to work co-operatively with Agencies after the Class EA submission to see completion of approved post-EA studies and address any findings in refining detailed designs and/or plant operating plans, as required.

Xeneca is providing a 30-day period for receiving comments on the ER as provided in the Class EA. Xeneca is committed to ensuring compliance with the Class EA and will develop assurance and verification measures to progressively assess conformance with Class EA commitments and environmental requirements throughout the project planning, execution and operational periods.

Xeneca is committed to continuing to engage specific stakeholders on issues of relevance after the issuance of the Statement of Completion and into the project detail development phases.

Government Agency Engagement Process:

During this Class EA, Xeneca has engaged with a number of federal, provincial and municipal governments, ministries and agencies and each has its mandate and mechanisms for permitting/authorizations processes towards ensuring that the proponent has met all legal requirements. These processes may explicitly or implicitly require the involvement of First Nations. It is helpful to understand the role of the agencies in reviewing this Class EA and providing context to the information:

(a) Ontario Ministry of the Environment:

The MOE has various primary responsibilities provided by the *Environmental Assessment Act* for the Class EA process and post-EA responsibilities for the Ontario *Water Resources Act* and the *Environmental Protection Act*. The MOE is responsible for the issuance of the Permit to Take Water - Category 2 prior to construction, Category 3 prior to commissioning, and any required Certificates of Approval prior to construction or commissioning of the facility.

(b) Ontario Ministry of Natural Resources:

The MNR plays a key role in permitting and approvals of this project because it is being built on provincial Crown lands. Two key acts govern MNR's processes are:

- *Lakes and River Improvement Act,*
- *Public Lands Act.*

Under the *Lakes and Rivers Improvement Act,* prior to permitting the proponent must request Location Approval at which time the MNR can request certain activities to be completed which include:

- Class EA with a Statement of Completion,
- A Letter of Advice from the Federal Department of Fisheries and Oceans ("DFO"), and
- Any Crown Land related issues.

(c) Department of Fisheries and Oceans:

As noted above, DFO works in a complementary relationship with the MNR. After the DFO Letter of Advice is issued to MNR, the MNR may choose to issue Location Approval. Upon granting Location Approval and when detailed design is complete, DFO will review and determine whether to issue an Authorization under the *Fisheries Act* for a HADD ('Harmful Alteration, Disruption or Destruction') of fish habitat.

As a result of these dependent processes, Xeneca is required to ensure that both MNR and DFO are continually satisfied with the project detailed design prior to construction occurring. Oversight by each agency will continue through the construction and operation period.

(d) Transport Canada:

Transport Canada ("TC") has an important role under the *Navigable Waters Protection Act* to review plans for construction of a dam in a waterway and deal with any waterway crossing for the project. Final detailed engineering designs are reviewed by TC and require approval under this Act.

(e) Other:

Many other agencies are also important: Health Canada, Natural Resources Canada, Ontario Ministry of Energy and Infrastructure and the Ontario Ministry of Tourism and Culture, to name a few, have an important role in the post-EA detailed design and permitting process. The Ontario Ministry of Tourism and Culture ("MTC") oversees the *Ontario Heritage Act* towards the protection of archaeological sites and heritage properties. The MTC will review all archaeological investigation reports completed in support of this undertaking.

Xeneca is committed to working with these agencies to facilitate the completion of these many processes and will cooperate in responding to reasonable requests for additional information. A table outlining potential regulatory permits, approvals and authorizations that may be required for the proposed project is provided in Section 9 of this Class EA.

First Nations and Aboriginal Communities

The development of waterpower resources on Crown Land will necessarily involve First Nations and Aboriginal communities as part of the Crown's duty to consult and as part of the specific requirements of certain regulatory processes. Prior to the Class EA process, the MNR's site release policy and procedures required the proponent to engage First Nations and Aboriginal communities. This Class EA summarizes Xeneca's efforts to seek input from and consult with the appropriate communities.

Xeneca has been respectful of each First Nation's and Aboriginal community's culture, governance and desired manner of communication in order to foster a long-term relationship throughout the lifecycle of the project. The Class EA is being submitted to the First Nations and Aboriginal communities and Xeneca will follow-up, and if requested, meetings with the First Nations and Aboriginal communities will occur during the review period and will be on-going to project commissioning.

The Aboriginal Consultation Plan and the record of Aboriginal Consultation and Engagement are appended to this Class EA. Additional discussion on consultation with First Nations and Aboriginal communities is provided in Section 4.5 of the Class EA.

Other Stakeholders

Xeneca is also sensitive to stakeholders whose primary vehicle to express concerns is through the environmental assessment process. Communication with the various stakeholders occurred during the Public Information Centres and Project Information Meetings, through public notices, Xeneca's website, individual meetings, conversations and communications. Stakeholder engagement is discussed in Section 4 of the Class EA, and a detailed consultation record is provided in the ER appendices of the Class EA. Table 4 of the Class EA includes a tabular presentation of the issues raised during the public consultation process and the proposed management strategies towards the resolution of those issues.

Based on the information presented above, Xeneca is confident that issues have been addressed or can be addressed through mitigation measures applied in the final project design. Xeneca believes there is good support for the project within the community. Further, Xeneca will continue to meet and communicate with stakeholders throughout the development of the project.

Conclusion

The Wanatango Falls Class EA provides a review of the potential effects, both positive and negative, of the project. The Class EA also incorporates the information and views expressed by First Nations and other Aboriginal communities, local residents, stakeholders and regulatory agencies and ministries. This is the beginning of the planning and development process and the Class EA will be used to inform the subsequent permitting and approval processes. The Class EA provides the basis for the binding commitments of the proponent as to how it will proceed through development and detailed design of the project.

Overall, this Class EA and the conceptual plans for the proposed project meet requirements of the Ontario environmental assessment process and the objectives of the *Green Energy and Green Economy Act, 2009.* Xeneca believes that the proposed project will create positive environmental and socio-economic benefits for the people of Ontario.

Xeneca looks forward to comments provided by reviewers of this Class EA. If reviewers provide written comment to the MOE, we request that Xeneca be provided with a copy of such comments.

Thank you to all participants for your kind consideration of this Class EA.

EXECUTIVE SUMMARY

Xeneca Power Development Inc. (Xeneca) proposes to construct a 4.67 MW hydroelectric power generating station (GS) at the site known as "Wanatango Falls" on the Frederick House River. The project site is located at Wanatango Falls in Mann Township, approximately 26 km northwest of Iroquois Falls and 22 km south of Cochrane on the Frederick House River.

The project received a Feed-in-Tariff contract from the Ontario Power Authority which stipulates facility commissioning no later than October 2014. The project represents a significant socio-economic benefit to the local community during both the construction phase and operations phase. The initial construction cost is estimated to be $5 million per megawatt, and it is estimated that the project will return approximately $23.4 million in tax revenue to the province during the life of the 40 year OPA contract.

This Environmental Report (ER) describes the environmental assessment (EA) carried out as part of the planning process for the proposed project. This EA was completed in accordance with provincial requirements, and was undertaken to meet the requirements of the Class Environmental Assessment for Waterpower Projects as required under the *Ontario Environmental Assessment Act*. The purpose of an environmental assessment is to ensure that potential effects are identified, evaluated and considered in the planning of a project, allowing for the avoidance or minimization of the negative impacts and the optimization of the positive impacts before construction begins. Furthermore, the EA process requires that the proponent of a project undertake meaningful engagement of all stakeholders who wish to be involved in the planning process. In this context, the environment being considered includes the natural/physical, socio/economic, and cultural/human landscape in which the project is proposed to be developed and operated.

Impacts may be either positive or negative, and are assessed for their significance and potential cumulative effects of other known (occurring) or foreseeable effects to a specific area or resource from future development. Negative impacts can then be mitigated through planning and further refinement of the proposed project, or afforded compensation in alternate ways in accordance with the mandatory regulatory approvals framework. Significant negative impacts which cannot be mitigated against or compensated for may lead to project redesign or rejection of the proposal.

This Environmental Report has been organized in the following format:

- Introduction and project overview;
- Description of the regulatory framework under which the project is being assessed;
- Identification of the existing conditions of the environment in which the project would be developed;
- A technical description of the proposed project, including its physical makeup, construction requirements, and operational regime;
- Discussion of stakeholder engagement efforts undertaken throughout the EA process, and the results of those engagements;
- Identification of the likely effects of the project both positive and negative, proposed mitigation measures to avoid the negative impacts, residual effects (those which cannot be mitigated), and any requirements for future monitoring;
- Identification of regulatory approvals which will be required as part of this undertaking;
- Conclusions and recommendations.

The process is meant to inform and enhance the project plan through investigation and consultation with affected landowners, stakeholders, First Nations and Aboriginal communities and the general public. At the EA stage, conceptual project design information is presented to ensure that stakeholders are informed about the general scope and extent of the project, particularly as it relates to understanding the socio-economic benefits of the project and how the project may potentially affect other uses of the river and the environment.

The identification of effects and mitigation plans has been developed in close liaison with environmental regulatory agencies at the Federal and Provincial level. Xeneca will continue to work closely with these agencies during the regulatory review of this document, and into the detailed design, construction, and operational periods of the project. Xeneca is committed to confirm and verify the implementation of all effects and mitigation measures identified in the ER. As part of this effort, Xeneca will regularly issue a Project Implementation Report to agencies to update the project status, provide results of on-going environmental assurance and verification programs, and results of monitoring and mitigation programs.

A summary of the existing conditions at the proposed project site, the project details and the findings of the environmental assessment is presented below.

Physical Environment

The general topography of the area is characterized by extensive low lying flats and poorly drained areas and slow flowing streams. In proximity to the site, the Frederick House River flows through a well-defined, narrow flood plain. The proposed project site is located in the northern Clay Belt, within the Abitibi greenstone belt of the Canadian Shield.

Ecology

The project zone of influence is dominated by a black spruce forest community, interspersed with a few tributary-related wetlands. No significant vegetation species are known to exist in the study area.

A total of 80 bird species have the potential to regularly occur and/or breed within the vicinity of the project area. Field studies noted breeding evidence of two species at risk: Canada warbler (*Wilsonia canadensis*) and bald eagle (*Haliaeetus leucocephalus*) and seven additional Species at Risk birds have the potential to occur within the zone of influence.

Walleye, Northern pike, Sauger and Lake whitefish were judged to be the primary valued ecosystem components within the study area by the EA team. Lake sturgeon are also known exist below the proposed facility on the Frederick House River.

No significant herpetofaunal species were identified in the vicinity of the proposed project area. Most of the mammals identified by the EA team are common with secure populations in Ontario, However, one significant mammal species, the provincially rare northern long-eared bat (*Myotis septentrionalis*), may be present within the project area according to the Ontario Mammal Atlas.

Archaeological Sites

Two registered archaeological sites are present within 30 km of the project area. Due to the presence of pre-contact portage routes, it was concluded that areas of high archaeological potential exit for the proposed Wanatango Falls site. The Stage I Archaeological Assessment was completed in January 2011, and the report was submitted for review with the Ministry of Tourism and Culture. Given that areas of high archaeological potential along the river will be inundated as a result of the proposed development, a Stage II Assessment was recommended at the proposed project site. Stage II Assessments were also recommended if the final location of access roads, new transmission lines, aggregate pits and other infrastructure also fall within areas of high archaeological potential.

General Land and Water Use

The Frederick House River is considered a managed waterway due to the presence of other water control structures (i.e. Frederickhouse Lake Dam) as well as an existing water management plan on the waterway.

A review of the operating history of the Frederickhouse Lake dam for roughly the last decade (1999 to 2010 data excluding 2007) suggests that there is very little flow in the reach of river below the dam (and including the site of the proposed project), except for a small amount of dam leakage flow, as much as 30% to 35% of the time. This reach of river is currently subjected to considerable unnatural flow variation.

The Frederick House River is considered a navigable waterway as defined under the *Navigable Waters Protection Act*. The river is a recognized canoe route, and the falls at the site are navigated using existing portages located along each shoreline. The area is used for recreational activities (e.g. snowmobiling, hunting, fishing) commercial trapping, bear management areas and baitfish harvesting.

No protected areas are located in the immediate vicinity of the proposed project.

Aboriginal Land and Water Use

The site falls within the Taykwa Tagamou Nation, Mattagami First Nation and Matachewan First Nation area of interest, other First Nations with an interest in the project include Wahgoshig and Flying Post. An Aboriginal Consultation Plan for the project has been forwarded to the Communities for their input. Community benefits are being discussed with Identified Aboriginal Communities as directed by the Ministry of Natural Resources. Consultation with individual community members to understand the land and water use of these communities will be undertaken.

Project Description

The proposed hydroelectric facility would use a gross head of 7.5 m, however negotiations are ongoing with upstream riparian landowners regarding the possibility of increasing the upstream operating water level by 1.5 m and, if successful, the head would be increased to 9 m. The creation of the dam will result in a headpond extending either 0.5 km (low-dam option) or 9.4 km (high head option) upstream of the dam.

The proposed headworks structures consist of a single water control structure composed of a 35 m long fill embankment, 40 m long control dam, 215 m long overflow dam and a 35 m long concrete spillway. Additionally, two 50 m long embankment dams flank the powerhouse.

An open conveyance channel situated on the west shore of the river will conduct flows from the river to an intake before directing them through one or more turbines with a combined name plate capacity rating of 4.67 MW.

The station will be connected to the provincial electrical power supply grid via a 27.6 kV connection line as per its FIT Contract extending approximately 42 km from the GS. Xeneca will continue to work with MNR to finalize the line route and seek further route and voltage efficiencies which may involve discussions with the Ontario Power Authority on the viability of alternate connection points.

Old logging roads on the east and west banks of the river will be used to access the site. These roads will require significant surface regrading and widening to support construction vehicles and equipment. Some new access road construction will be required.

The detailed design will benefit from input by the public and regulatory agencies during the review of the Environmental Report. The proponent necessarily reserves the right to variances between the conceptual design presented herein and the detailed engineering design subsequent to the completion of the environmental assessment, provided that such variances do not materially and negatively impact the environment beyond the scope of the impacts described herein. Based on First Nation input, alternate materials other than concrete, will be considered in construction pending approval by the Ontario Ministry of Natural Resources (MNR). Plan and Specification Approval (*Lakes and River Improvement Act*) will determine the final design using the Class EA as a guideline.

Construction Strategy

Site preparation is currently proposed to begin in mid-2012, followed by the construction of the generation facility from 2012 through 2014. The construction of the connection line corridor is currently proposed to start in 2013 with completion in 2014. As per the terms of the FIT contract, commissioning will follow no later than October 2014.

Construction activities will begin following the issuance of regulatory approvals and authorizations, and will meet the requirements of applicable legislation, industry guidelines and best management practices.

Operation Strategy

The operation strategy was developed based on the conceptual engineering design, available environmental data and the findings of various studies. A “modified run-of-river” mode of operation is proposed for Wanatango Falls, in which the operation of the facility would vary between run-of-river and intermittent depending on the flows in the river. This is in alignment with Ministry of Energy (formerly Ministry of Energy and Infrastructure) definition of run-of-river with modified peaking and their desire for electricity to be generated during peak hours in an

environmentally sustainable manner to displace fossil fuel generation. When natural flows are below the maximum capacity of the turbines but above the required ecological flow, water will be stored during off-peak hours for use during peak hours, affecting water levels upstream and flows downstream. This approach allows for operating the facility in an environmentally responsible manner while maximizing waterpower potential of the site for the delivery of clean electricity that produces no air emissions or greenhouse gases especially during peak demand periods. This is in alignment with the Ontario Ministry of Energy (the "One Window") stated desire for clean electricity during peak demand periods. All electricity produced by the project displaces the need for electricity from fossil or nuclear sources. Distributed generation to remote areas also "Islands" consumers against service interruptions (e.g., ice storms and black-outs) and provides positive benefits to the power grid. Long-term, the electricity produced will provide positive financial benefits to local and provincial government and help reduce electricity costs.

Operations will not impact the Frederickhouse Lake Dam located approximately 10 km upstream. In order to minimize negative environmental impacts, limits will be set to the depth and area of the inundation zone, which in turn limits storage to a few hours operation time during moderate and low flows.

Upstream water levels may be managed by controlling various operating parameters, such as the maximum daily fluctuation and the rate of changes to the water level. Downstream flows and levels may be managed by the established environmental flows, and the compensatory bypass flow. The proposed operating parameters for the facility may be subject to change subsequent to regulatory and public review of this ER.

The downstream variable flow reach will extend approximately 2.0 km downstream of the proposed Wanatango Falls GS site.

The operating plan of the facility at Wanatango Falls will ultimately be incorporated into the existing Abitibi River Water Management Plan (WMP) in cooperation with MNR as outlined in the *Lakes and River Improvement Act* after achieving commercial operation.

Federal, Provincial, and Municipal Agency and Stakeholder Consultations

In accordance with the Class EA for Waterpower Projects, consultation was conducted with government agencies, public and Aboriginal communities to identify concerns and issues related to the proposed development.

Key concerns identified through public consultation include impacts to water levels, the local economy, recreation and fur trapping. Ontario Power Generation owns and operates several generating stations on the Frederick House River, and is recognized as a stakeholder for the proposed Wanatango Falls development.

Notices of Commencement and project descriptions were sent to relevant federal and provincial agencies throughout the planning process; an EA Coordination meeting was held to discuss the undertaking, collect information on regulatory approvals and permitting requirements, and project scoping. The Canadian Environmental Assessment Agency is acting as the Federal Environmental Assessment Coordinator (FEAC) for the undertaking; Fisheries and Oceans Canada and Transport Canada have been identified as Responsible Authorities due to project triggers

under the *Fisheries Act* and the *Navigable Waters Protection Act*. It is anticipated that Environment Canada, Health Canada and Natural Resources Canada will provide expert advice on the undertaking.

Key concerns identified by agencies during the planning process to date include potential impacts to fisheries and fish habitat; mercury levels in fish tissue; and wildlife.

Potential Project Effects

Negative Impacts:

The environmental assessment examined the project's potential environmental impacts. Where possible, adverse impacts will be avoided or prevented and mitigation measures will be implemented to minimize those impacts that cannot be avoided or prevented.

The proposed development will result in the creation of a head pond extending approximately 0.5 km upstream in the "low dam" option, and 9.4 km in the "high dam" option.

The modified run-of-river operation of the facility will result in fluctuating water levels upstream of the dam.

In order to minimize potential erosion effects, the maximum daily fluctuations and the rate of change of upstream water levels will be limited. Measures have been incorporated into the conceptual design and the operational plan to minimize or avoid negative impacts to civil structures and private property.

The fluctuations in water levels upstream of the dam may also impact aquatic habitat along the shorelines and/or shallow water areas. In order to minimize negative impacts, the proposed daily fluctuations were established to be less than the magnitude of historic seasonal fluctuations experienced in the project area.

Water temperatures are expected to be uniform across the water column and, given the significant variations in river flows currently experienced (as a result of the operating regime of the Frederickhouse Lake dam), and that operations will be modified run-of-river, water temperatures in the head pond are not expected to change significantly. Modified run-of-river will also produce downstream variability in water depth, flow velocity and wetted perimeter

until the river reaches a lake or a confluence with a major tributary. A downstream minimum environmental flow of 2.0 m^3/s during the summer and autumn and 5.0 m^3/s in winter is proposed to be continually passed over the dam spillway to maintain ecological habitat viability within the variable flow reach. Operations during spawning seasons will not be intermittent in order to ensure fish reproduction is not adversely affected.

The applicable regulations will be respected in order to ensure the health and safety of all contractors, construction crews and operational staff. For the safety of the public, access will be restricted during construction activities. Safety measures will be erected to restrict public access to the work areas. These measures will include fencing and signage while ensuring that routes are maintained to allow the public to bypass the construction area.

Once operational, access to the facility will be restricted to maintain public safety. Safety measures including signage, fencing, gates, barriers and warning devices will be considered during the development of a Public Safety Plan (PSP). The PSP will be completed prior to commissioning and will address both access and operation- related safety issues. It is not the intent to restrict access to fishing or recreational uses where safety considerations are not an issue.

Consideration was also given to impacts specifically related to potential accidents and malfunctions that may occur during the construction and operation of the facility. The proper implementation of mitigation measures and best management practices will minimize the likelihood of accidents such as spills and leaks during the construction period. A spill response plan will be developed for the construction program to manage any accidental releases of contaminants required for the operation of construction equipment; any releases of contaminants will be reported to the Ministry of the Environment Spills Action Centre. A detailed list of mitigation measures to be implemented during the construction program is provided in this Environmental Report.

In order to preserve the aesthetic quality of the project area, the proponent will strive to maintain and enhance vegetative buffers between the river, roads and any ancillary works. The proponent will seek to preserve or enhance recreational values in the area of Wanatango Falls.

Positive Impacts:

The development of a head pond extending upstream (either 0.5 km or 9.4 km, depending on the development option ultimately chosen), would introduce a zone with less variable water levels which could potentially improve the aquatic habitat in comparison with the existing condition.

The construction and operation of the proposed facility will introduce new employment opportunities to the towns of Cochrane and Iroquois Falls and the surrounding region, including First Nations and Aboriginal communities. Direct economic activity to build a waterpower

project in Ontario is approximately $5 million per megawatt, half of which is generally spent locally in procuring construction labour and materials, consulting and legal services, trucking and other services such as accommodation, food and fuel. The initial capital construction cost is estimated to be a $23.4 million investment in Ontario with approximately $11.7 million spent in the region. There will also be a significant return to the people of Ontario paid through the Gross Revenue Charges (GRC) and provincial and federal income taxes. Returns to the people of Ontario will continue past the 40 year contract, for as long as the facility is in operation. Direct and indirect job creation associated with the construction activities is estimated to be approximately 46,700 and 70,050 person hours of work, respectively.

Benefits to Aboriginal communities, including employment opportunities, are being discussed as outlined in the Aboriginal Consultation Plan (ACP). Discussions also include MNR's "Business to Business" relationship process for Identified Aboriginal Communities. Xeneca has voluntarily committed to support the Crown's consultation responsibilities to the Aboriginal Communities and its fiduciary obligations as defined within *Bill 150, Green Energy and Green Economy Act, 2009 (GEA),* and the Ontario Power Authority's Feed In Tariff process and other related Crown objectives.

Additional economic benefits will include revenue generated from local sourcing of materials, equipment and services (where available). The project will improve local infrastructure to the benefit of mines, forestry, and tourism and recreational users.

The project will provide to the region a source of reliable and clean electricity for 75+ years that will help meet local demand for homes and support local supply during interruptions to service such as ice storm and blackouts.

As a lower cost source of electrical production, waterpower will assist in keeping provincial electricity prices economical and help displace fossil fuel and nuclear sources of generation, and improve system reliability.

The development of Wanatango Falls and other current projects will help support and enhance Ontario's existing waterpower industry, which currently employs some 1600 direct and 2000 indirect jobs within a renewable sector that has significant potential for global growth according to the International Energy Agency.

New projects such as Wanatango Falls will help Ontario's waterpower industry facilitate a generational knowledge transfer that will allow it to compete in the global market for the potential 575,000 MW of new supply and 875,000 MW of refurbishments. Domestic development of waterpower has been stagnant in Ontario since the 1990s and Wanatango Falls also provides this Ontario industry an opportunity to showcase its talents and expand so as to meet the growing global demand for equipment and expertise for waterpower maintenance and development.

Positive environmental effects certainly include the production of approximately 19,000 MWh per year of clean electricity with no air emissions for 75+ years, providing a reliable source of electricity that is economical. Environmental benefits are estimated at:

- The displacement of 13,226 metric tons of carbon dioxide equivalent per annum;
- Reduction of annual greenhouse gas emissions equivalent to 2,593 passenger vehicles or, the sequestering of carbon from nearly 1141 hectares of pine or fir forests.

Effects of the Environment on the Project

As required for projects subject to the *Canadian Environmental Assessment Act*, the effects of the environment on the project were evaluated. Events such as flooding, extreme winter and summer conditions, lightning strikes, accidental fires, earthquakes and climate change were considered it is anticipated that such events may necessitate plant shut-down and result in an interruption to the delivery of electricity to the provincial supply grid. In the event of a power failure during peak flow periods, it will be the proponent's responsibility to ensure that peak discharge can be passed. The powerhouse will be equipped with a diesel-powered back-up generator for station service needs.

Residual Adverse Effects

The effects of a project that are expected to remain despite the application of mitigation measures are referred to as residual effects. The residual effects of the proposed Wanatango Falls development, both positive and negative, and their significances were evaluated.

No significant negative residual effects are expected as a result of the construction and operation of the facility.

Positive residual effects are expected for local and regional employment, the reduction of emissions, and for the reliability and security of electricity and energy in the region.

Cumulative Effects

Cumulative effects are the long term changes resulting from the combined effects of successive actions on the environment, and can result from the interaction of residual effects from multiple projects in a given area or multiple activities acting on a single ecosystem component.

No significant cumulative effects as a result of the construction and operation of the facility have been identified.

Monitoring and Follow-up Programs

Monitoring programs have been proposed for the construction and operation phases of the development. These programs will ensure that mitigation measures and industry best management practices are being properly implemented and adverse effects are minimized.

Commitments

The proponent is committed to:

- ensuring compliance with all regulatory requirements;
- the adoption and application of the mitigation, compensation and monitoring measures detailed in this document;
- abiding by commitments to all stakeholders including Aboriginal Communities.

In cooperation with the regulators, the proponent has reached an agreement on flow parameters in the operating plan and will work with agencies to confirm and verify these parameters as the project proceeds. Xeneca will confirm the specific operational parameters and environmental protection measures for the facility and ensure that there will be no adverse effects on valued environmental components of the Frederick House River within the zone of impact of the project. In coordination with MNR, these measures will be incorporated into the existing water management plan process.

The proponent will also regularly issue a Project Implementation Report to agencies, providing updates on the project status and results from ongoing environmental effects, monitoring and mitigation programs.

Following integration of the Wanatango Falls Operating Plan into the Abitibi Water Management Plan (WMP), the proponent will participate in the WMP process.

Conclusion

It is the conclusion of this environmental assessment that the majority of the identified adverse effects were determined to be "not significant", meaning that they are not likely to cause unacceptable harm to environmental quality, productive capacity of the effected environment, or the socio-economic and cultural attributes of the area.

It is acknowledged that the construction of the Wanatango Falls GS has the potential to result in the harmful alteration, disruption or destruction (HADD) of aquatic habitat within the project footprint. There may be a requirement for an Authorization under Section 35 of the *Fisheries Act* for the harmful alteration, disruption or destruction (HADD) of fish habitat. If required, a compensation measures plan will be developed in consultation with the regulators.

There are also many positive environmental effects associated with the project which are considered to off-set any potential environmental impacts. These are: the tangible economic benefits for the local communities and the regional/provincial economy, employment and training opportunities, the creation of reliable and secure green energy for the province, and the generation of electricity through a renewable energy supply in support of the province's *Green Energy and Green Economy Act*.

The proponent believes the project provides net positive environmental and socio-economic impacts to the region and the province. The EA Report and the project also meet the desired direction of the "One Window" on energy procurement and the objectives as defined within the *Green Energy and Green Economy Act*.

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Acronyms

AAND	Aboriginal Affairs and Northern Development (formerly Indian and Northern Affairs Canada)
ARD	Acid Rock Drainage
BMP	Best Management Practice
CEAA	Canadian Environmental Assessment Act
CEA Agency	Canadian Environmental Assessment Agency
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
EC	Environment Canada
ESA	Endangered Species Act
ER	Environmental Report
FEAC	Federal Environmental Assessment Coordinator
FIT	Feed-In Tariff
GEA	Green Energy and Green Economy Act
GS	Generating Station
LTAF	Long term annual flow, average annual mean
ME	Ministry of Energy
ML	Metal leaching
MNDMF	Ministry of Northern Development, Mines and Forestry
MNR	Ministry of Natural Resources
MOE	Ministry of the Environment
MTC	Ministry of Tourism and Culture
NOC	Notice of Commencement
NRCan	Natural Resources Canada
NWPA	Navigable Waters Protection Act
OBBA	Ontario Breeding Bird Atlas
OMNR	Ontario Ministry of Natural Resources
OPA	Ontario Power Authority
OPG	Ontario Power Generation
PIC	Public Information Centre
QP	Qualified Person
Q_{99}	Streamflow exceeded 99% of time
Q_{95}	Streamflow exceeded 95% of time
Q_{80}	Streamflow exceeded 80% of time
Q_{50}	Streamflow exceeded 50% of time
Q_{20}	Streamflow exceeded 20% of time
Q_{EA}	Downstream environmental flow target
Q_{COMP}	Compensatory flow (between dam and tailrace)
Q_{MED}	Median streamflow value

Q_{TMAX}	Maximum turbine capacity
Q_{Tmin}	Minimum turbine flow
Q_{TL}	Limited turbine flow – modified ROR
Q_{HWM}	Streamflow corresponding to high water mark
7Q2	2 year return period 7-day-average-low flow
7Q10	10 year return period 7-day-average-low flow
7Q20	20 year return period 7-day-average-low flow
Q1:2	High streamflow event; occurrence of 1 in 2 yr
Q1:100	High streamflow event; occurrence of 1 in 100 yr
RA	Responsible Authority
ROR	Run of River
ROW	Right-of-way
SAR	Species at Risk
SARA	Species at Risk Act
TC	Transport Canada
TS	Transformer Station
UTM	Universal Transverse Mercator Units

Units

kW	kilowatt
kWh	kilowatt hour
m	metres
m^2	square metres
masl	metres above sea level
m/s	metres per second
m^3/s	cubic metres per second
MW	megawatt
MWh	megawatt hour
r/min	revolutions per minute
µg	microgram
umho/cm	micromhos per centimetre

1. INTRODUCTION

This section presents an introduction to waterpower in Ontario, an overview of the proposed project, and the methods used to complete the work presented herein.

1.1 WATERPOWER IN ONTARIO

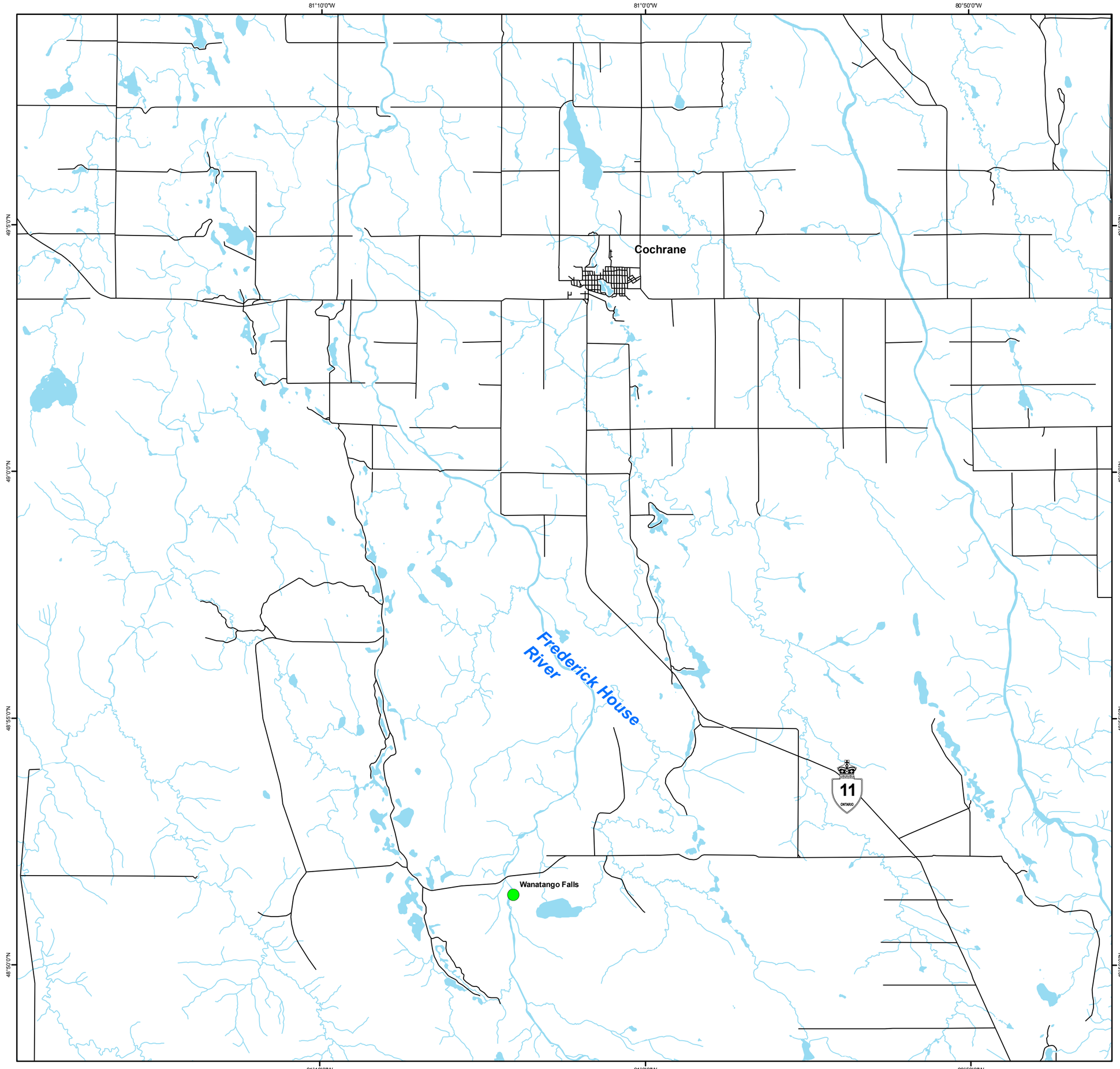
Waterpower (hydroelectricity) is generated from a naturally replenished source (water) making it both a renewable and sustainable resource. Hydroelectricity is considered the most widely-used form of renewable energy. Once constructed, hydroelectric generating station greenhouse gas emissions are effectively zero. Waterpower generation provides peak and base load energy, which replaces non-renewable sources of power such as coal and gas. Some waterpower facilities can store energy (water) until it is needed at peak periods of usage.

Hydroelectric generating stations are long-lived, lasting upward of 80 years; there remain operating waterpower facilities in the province that were constructed at the turn of the 20th century. In 2009, the Ontario *Green Energy and Green Economy Act* (GEA) was enacted with the aim of making the province a global leader in clean, renewable energy. The Feed-In-Tariff (FIT) Program administered by the Ontario Power Authority (OPA) was established under the GEA to encourage the development of renewable energy in Ontario while phasing out the province's coal-fired electricity by 2014. The FIT also promotes economic activity, the development of renewable energy technologies and the creation of new green industries and jobs.

1.2 INTRODUCTION TO PROJECT

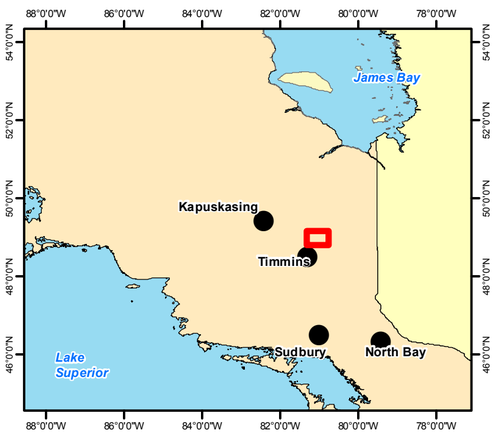
Xeneca Power Development Inc. (Xeneca) is proposing the construction of a 4.67 MW hydroelectric generating station (GS) at the Wanatango Falls site on the Frederick House River to meet government and energy regulatory goals and objectives to generate sustainable and reliable hydroelectric power. The proposed project was awarded a 40-year FIT contract from the OPA which, subsequent to a successful EA outcome, would see the facility commissioned and delivering electricity to the provincial supply grid by October 2014.

The proposed project is located on the Frederick House River in Mann Township, approximately 26 km northwest of Iroquois Falls and 22 km south of Cochrane; a site location map is provided as Figure 1.



LEGEND

- Site Locations
- Roads
- Water Features



REFERENCE

Note: MNR & Geogratis Data Services (2010)
UTM Zone 17

0 3,500 7,000
Meters

1:100,000

PROJECT

WANATANGO FALLS GS

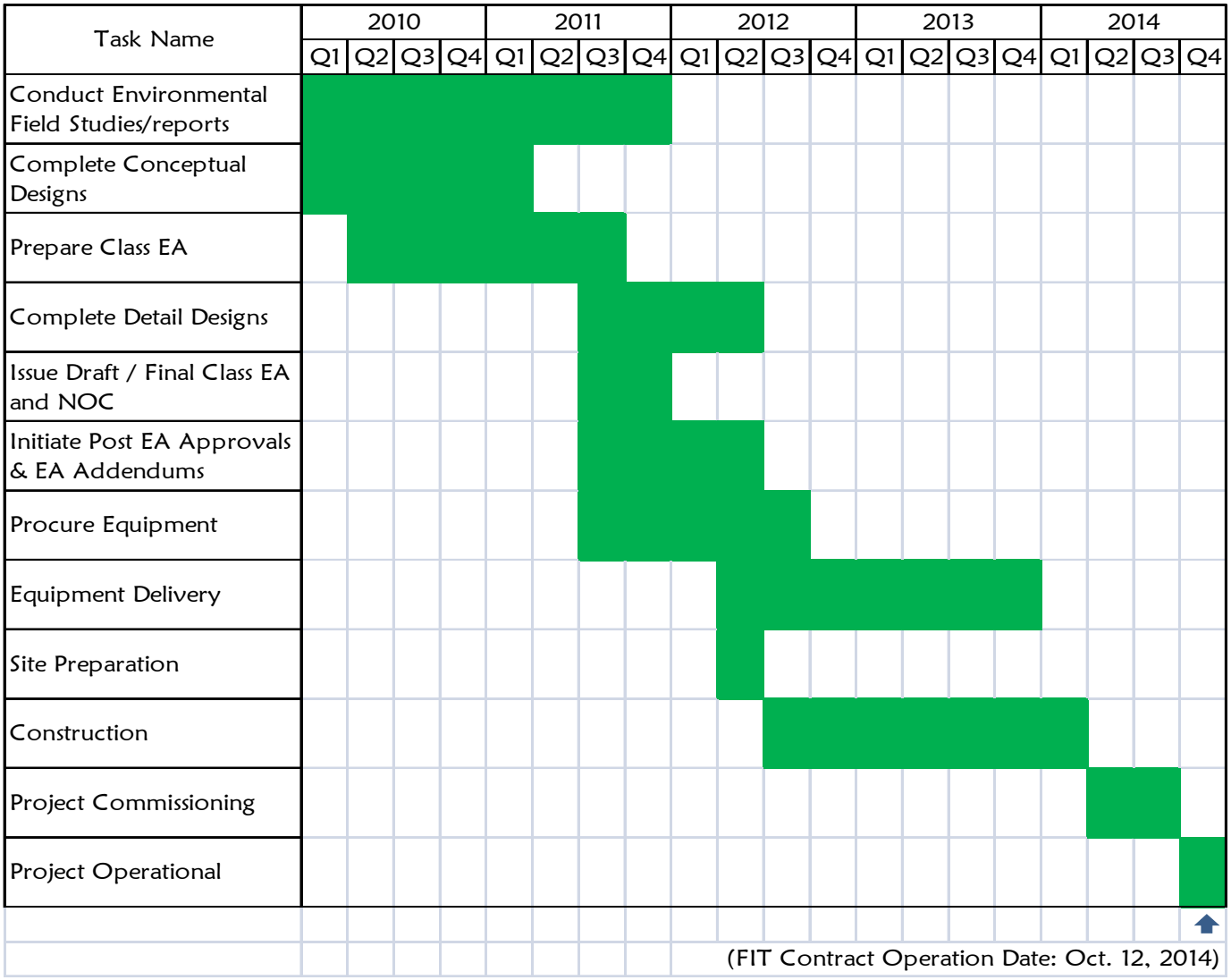
TITLE

SITE LOCATION MAP

PROJECT No.			FIGURE
DESIGN	KC	06/10/2010	
GIS	KC	06/10/2010	1
CHECK	TS	06/10/2010	
REVIEW	KM	06/10/2010	

A tentative project development schedule outlining key project phases which have been or will be completed is provided below in Figure 2.

Figure 2: Project Development Schedule



1.3 OVERVIEW OF THE ENVIRONMENTAL SCREENING PROCESS

The purpose of an environmental assessment (EA) is to recognize the potential effects of a project early in the project planning phase and take these effects into account during the development and design of the project. Environmental effects include both the positive and negative effects that a project would have, or could potentially have, on the environment at any stage in the project life cycle. The assessment also considers the effects of the environment on the project.

The environment is defined as a combination of natural/physical, socio-economic, and cultural-human factors.

The components of hydroelectric projects can include reservoirs or head ponds, water control structures (dams or weirs), water conveyance structures (canals or penstocks), powerhouses, access routes, connection lines and transformer stations. For each of these components, there are three main life-stages of development: construction, operation and maintenance, and decommissioning. There are also indirect activities related to the maintenance and operation of these facilities, including small volumes of non-hazardous waste generation and their disposal, and backup generating systems powered by fuel.

The process of conducting this environmental assessment entailed the examination and evaluation of each component (i.e. dam) and life-stage (i.e. operation) of the proposed development and its potential effect on each aspect of the environment. Environmental effects may include, but are not limited to, alteration/loss/gain of natural features, flora or fauna and their habitat, ecological functions, natural resources, air and water quality, and cultural or heritage resources. Environmental effects may also include the displacement, impairment, or interference with existing land uses, land use and resource management plans, businesses or economic enterprises, recreational uses or activities, cultural pursuits, social conditions and economic attributes.

The environmental assessment team (EA team) used a team consultative approach to avoid:

- attempts to quantify impacts which are dissimilar on a comparative basis;
- use of sophisticated matrix methods using mathematical calculations to weigh the importance of impacts;
- lack of balance in assessments due to factors such as the tendency for individual experts to concentrate on the areas of the assessment in which they are most familiar.

1.4 Approach to the Environmental Screening Process

The environmental assessment team retained by Xeneca included:

- OEL-HydroSys Inc.
- Natural Resource Solutions Inc. (NRSI)
- Woodland Heritage Services (WHS)
- ORTECH Consulting Inc.
- WESA Inc.
- KBM Resources Group
- Hatch

- Canadian Projects Limited
- BPR
- AMEC
- R.J. Burnside and Associates Limited
- Northern Bioscience

1.4.1 Legal Framework

As a waterpower development with an installed capacity less than 200 MW, this project is subject to the Class Environmental Assessment for Waterpower Projects (herein referred to as the Waterpower Class EA) planning process developed by the Ontario Waterpower Association as approved by the Ministry of the Environment in October 2008 (revised in March 2011) under the Ontario *Environmental Assessment Act (EAA)*. The Frederick House River has water control infrastructure in place in other sections of the waterway and the river is managed for water levels and flows. The proponent has categorized the proposed waterpower facility at Wanatango Falls as a 'new project on a managed waterway' in accordance with the definitions found in the Waterpower Class EA (Appendix A-1).

The EA team also reviewed other applicable environmental assessment guidelines and legislation regulating small hydroelectric developments in the Province of Ontario, and determined that the following regulatory processes and guidelines may be applicable to this undertaking:

- The Screenings under the *Canadian Environmental Assessment Act (CEAA)*;
- The Federal Requirements for Waterpower Development Environmental Assessment Processes in Ontario – Practitioner's Guide (DFO-OWA); and
- The Water Management Planning Guidelines for Waterpower, Ministry of Natural Resources.

The proposed project will also require an authorization from Fisheries and Oceans Canada (DFO) under the *Fisheries Act* and an approval from Transport Canada under the *Navigable Waters Protection Act* (NWPA). These federal approvals triggered the requirement for a screening-level environmental assessment under *CEAA*.

Based on a preliminary review of the project, the MNR indicated that the assessment of the connection line to be constructed as part of the project would also be subject to review under the Class Environmental Assessment for MNR Resource Stewardship and Facility Development Projects, Ministry of Natural Resources (MNR-RSFDP Class EA). However, as a result of more recent decisions within MNR it has since been determined that the MNR-RSFDP Class EA will not apply to the development.

Xeneca has elected to meet the requirements of the Provincial EA and the Federal Screening separately for the project. As such, this document is only intended to address the provincial process requirements; the environmental report fulfilling the requirements of the screening-level environmental assessment under *CEAA* will be provided under a separate cover at a later date when more detailed project information is available.

The EA team worked closely with many stakeholders at the local, provincial and federal levels to ensure that the local environment including physical, social/cultural and economic aspects were well understood.

The EA team collaborated in the completion of the Potential Effects Identification Matrix [(Table 3, Class Environmental Assessment for Waterpower Projects (OWA, Revised March 2011)] included in the Project Description document developed by Xeneca and circulated to the regulators in order to begin the planning process.

Based on the review of these documents and consultation with the key provincial and federal authorities assigned to the project, the EA team determined that there was an overlap of many of the requirements for the above noted processes.

1.4.2 Characterize Local Environment of Proposed Development

The EA team completed the following tasks to characterize the local environment in the proposed development areas:

- A detailed literature review of existing information available through provincial and federal databases. The reviewed documents are identified in the References section in this document and in the technical reports referenced throughout this document;

- Field investigations to supplement the terrestrial and aquatic biology record available for the site. The EA team undertook detailed field investigations throughout the project area to document existing conditions and assess the potential effects of the project on these conditions. The results of these studies are presented throughout this document. This information and the expert advice of the EA team members are presented throughout this document;

- Stage 1 Archaeological Assessment to supplement the available historical record for the site.

- Field investigations to supplement the topography, water depth and hydrology data. A statistical analysis of historical hydrological data was completed. Hydraulic modeling was also undertaken to assess depths and velocities at various flows. A one dimensional hydraulic model was developed using HEC-RAS. Detailed reports are found in Annex I.

- Aerial photography was undertaken from which approximate connection line and access road routes were determined.

1.4.3 Identify Potential Environmental Effects

As noted above, the EA team used a consultative process to identify the potential effects of the project in the early stages of the planning process and to determine the data gathering and analysis program, which was then used to identify the effects of the project on the environment. In examining the potential effects of this project, the EA team considered all stages of the project including construction, operation/maintenance and decommissioning (Appendix B).

1.4.4 Identify Required Mitigation, Monitoring or Additional Investigations

The EA team developed a summary of recommended actions to prevent or mitigate negative effects of the proposed undertaking on the environment. These mitigation measures were compiled based on the information collected during the study period (field and desktop), through consultation with government agencies, the public and Aboriginal communities and the EA team's knowledge of hydroelectric developments. The residual effects, those that cannot be prevented, avoided or mitigated, are identified and classified based on their significance. It should be noted that residual effects also include the positive benefits that would be achieved through the lifecycle of this project to ensure that all potential net effects are afforded consideration.

The EA team has also provided recommendations for environmental monitoring, where on-going data collection will be required to confirm the short-term or longer term effects (i.e. those that would be experienced during construction and those that may be experienced subsequent to commissioning).

The proponent has made commitments related to the undertaking which may include additional data and information collection activities. A list of commitments proposed by Xeneca in support of the Wanatango Falls waterpower development is presented within the main document and annexes.

1.4.5 Agency and Public Consultation and Aboriginal Communities Engagement

The objectives of the Consultation and Engagement Programs were to combine the public and Aboriginal community notification/engagement/consultation requirements of the federal and provincial environmental assessment planning and subsequent regulatory approval processes, and present the results of the initiatives within this document. The agencies, ministries, First Nations, other Aboriginal groups and other stakeholders that were identified during the EA planning process include:

Canadian Environmental Assessment Agency (CEA Agency)
Aboriginal Affairs and Northern Development Canada formerly known as Indian and Northern Affairs Canada (INAC)
Fisheries and Oceans Canada (DFO)
Transport Canada (TC)
Environment Canada (EC)
Natural Resources Canada (NRCan)
Health Canada (HC)
Mattagami Conservation Authority
Ministry of Aboriginal Affairs
Ministry of Tourism and Culture
Ministry of Energy Ministry of the Environment
Ministry of Natural Resources
Ministry of Transportation
Ministry of Northern Development, Mines and Forestry
Ontario Waterpower Association

Town of Iroquois Falls in Mann Township
Town of Cochrane

Flying Post First Nation
Matachewan First Nation
Mattagami First Nation
Taykwa Tagamou First Nation
Wahgoshig First Nation
Northern Lights Métis Council
Wabun Tribal Council
Métis Nation of Ontario

AbitibiBowater
Abitibi River Forest Management Inc.
Cochrane Board of Trade
Coureurs de Bois Adventures
Friends of High Falls
Iroquois Falls Community Development
Jackpine Snowmobile Club
Kirkland Lake District Game & Fish Protective Association
Ontario Federation of Anglers and Hunters
Ontario Federation of Snowmobile Clubs
Ontario Power Generation

Temiskaming Shores & Area Chamber of Commerce
Temiskaming Shores & Area Tourism Information Centre
Tri-Town & District Chamber of Commerce
Interested members of the public

A summary of the key consultation activities is provided below:

- A Notice of Commencement (NOC) and a subsequent revision to the Notice were issued by Xeneca. The NOCs were concurrently advertised in local media. The first NOC was issued on July 29, 2010. The NOC was revised and re-issued on November 11, 2010.

- A Project Description for the hydroelectric generating station was issued on March 18, 2011 to provincial ministries, municipal stakeholders and the Ontario Waterpower Association and circulated federally through the Federal Environmental Assessment Coordinator (FEAC).

- The Project Description was distributed to eight First Nations and Aboriginal communities (Taykwa Tagamou First Nation, Matachewan First Nation, Mattagami First Nation, Flying Post First Nation, Wahgoshig First Nation, Northern Lights Métis Council, Métis Nation of Ontario, and Wabun Tribal Council) in December 2010 and/or May 2011.

- A Public Information Centre was held at the Tim Horton Event Centre in Cochrane, Ontario on March 24, 2011. A complete record of Agency consultation is provided and is summarized in Section 4.3. An EA Coordination meeting attended by federal and provincial regulators and municipal representatives was held on April 20, 2011.

- Aboriginal consultation and engagement events in support of this undertaking are detailed in Section 4.5.

- Copies of all advertisements, notifications, and correspondences in support of this undertaking are included in their respective appendices.

- The formal Notice of Completion and this Environmental Report (ER) is being provided to the agencies, ministries, First Nations, Aboriginal groups and other local stakeholders that were identified during the EA planning process for a 30 day formal review period. The review will follow the steps below:

- Submission of ER document to regulatory agencies, First Nations and public for review.

- Notice of Completion issued for publication in local media, emailed to stakeholders and posted on the Xeneca and the Ontario Waterpower Association's websites

- Stakeholders to review ER and provide written comment indicating outstanding issues and requests to meet with Xeneca.
- Xeneca and stakeholders attempt to resolve issues.
- If, at the end of the review period, the stakeholder is not satisfied with Xeneca's proposed resolution, the stakeholder may make a written request to MOE for a Part II Order, such requests to be compliant with requirements of the Waterpower Class EA.
- Once outstanding issues have been resolved or if Xeneca feels its proposal for resolution is satisfactory, Xeneca will ask the Crown to accept the Statement of Completion.

2. EXISTING CONDITIONS

This section provides a description of the existing environmental conditions in the proposed project area.

2.1 LOCATION AND LAND OWNERSHIP IN PROJECT AREA

The proposed project is to be located at the Wanatango Falls site on the Frederick House River, approximately 26 km northwest of Iroquois Falls and 22 km south of Cochrane (Figure 1). The site is located in the Township of Mann in the District of Cochrane. The Wanatango Falls facility will be located on provincial lands; however, depending on the design of the dam and the connection line route selection, private lands may be intersected by the inundation and connection line construction. Conceptual design details are found in Annex II.

The approximate geographic coordinates for the site are (latitude, longitude): 48.8573 -81.0675. The watershed drainage area at the site is approximately 2970 km^2.

2.2 EXISTING INFRASTRUCTURE

The Frederick House Lake Control Dam is located approximately 10 km upstream from the Wanatango Falls site. The dam is operated by Ontario Power Generation. Water level/flow manipulations at the Frederick House Lake Control Dam by OPG already significantly affect the levels and flows between the existing dam and the Wanatango Falls site, and beyond.

The operating regime for the Frederick House Lake Control Dam is specified in the Water Management Plan (WMP) for the Abitibi River under the Ontario *Lakes and River Improvements Act* (LRIA). Under the LRIA, facility operators are required to comply with the established operating regimes (required flows and levels).

2.3 TOPOGRAPHY

The general topography of the area is characterized by extensive low lying flats and poorly drained areas and slow flowing streams. In close proximity to the site, the Frederick House River flows through a well-defined, narrow flood plain.

2.4 CLIMATE

In Northern Ontario the climate is primarily continental, with cold winters and mild summers moderated by the effects of the Great Lakes. Most precipitation falls in the form of summer showers and thunderstorms; winter snowfall amounts can be significant. During the winter months, Northern Ontario can have prolonged periods of extreme cold.

For the city of Cochrane, mean daily temperatures range from a high of 17.4°C in July to a low of -17.5°C in January. Mean maximum daily temperatures (mean of past 30 years) reach a peak in July of 24.2°C, with 38.9 °C being the highest daily temperature on record. The mean minimum daily temperatures are reached in January (-23.9°C) with -44.2°C being the coldest day on record. Annual precipitation averages 831.3 mm with rainfall accounting for 558.1 mm of that total. On average, July is the wettest month and February is the driest. (Canada's National Climate Archive, 2009).

2.5 SOILS

The site is located in the northern Clay Belt and as a result gray luvisols and gleysols found on the clayey lacustrine and loamy tills are the dominant soils in the ecoregion. Poorly drained soil conditions also result in areas of muskeg, organic peat and black muck.

2.6 GEOLOGY

The project study area is situated in the Abitibi greenstone belt of the Canadian Shield. Bedrock immediately surrounding the study area (within approximately 500 m) consists of the ultramafic intrusive rock dunite. Further out from the study area, bedrock is formed by mafic and intermediate volcanic rocks in addition to dunite. In the study area, the Frederick House River follows deposits of glacial till belonging to the Cochrane Formation. Approximately 50 m away from either bank of the river are coarse-grained glaciolacustrine deposits of the Barlow-Ojibway Formation.

2.7 HYDROGEOLOGY

A review of Ontario Ministry of the Environment's electronic well records database revealed there are no water well records within a 1-km radius of the project site.

2.8 RIVER HYDROLOGY

The following information was sourced from existing background data and data collected during field investigations.

The Frederick House River originates from Night Hawk Lake and flows north for approximately 9 km to Frederick House Lake before continuing on to where it joins the Abitibi River. The outlet of Frederick House Lake is controlled by the Frederick House (High Falls) Dam which is owned and operated by Ontario Power Generation.

The river flows through the Northern Clay Belt which results in turbid water conditions as a result of suspended particulate. Bottom substrates typically consist of lacustrine or glacial sediments (clay, sand, gravel). Channel morphology is well defined with steep banks with little vegetation. Water levels on the river can fluctuate between two and three metres on a seasonal basis.

2.8.1 Water Levels, Flow and Movement

Flow values for Frederick House River at Wanatango Falls were prorated using drainage basin area, from Water Survey of Canada gauge 04MD002 (Frederick House River at the Frederickhouse Lake Dam). Hydrographs and flow duration curves have been developed for this site and are provided in Annex I-B.

The development and operation of the proposed generating station will alter the existing river system and impact the hydrological characteristics of the Frederick House River both upstream and downstream of the Wanatango Falls site. Currently, flows on this reach of river are controlled by the OPG-owned Frederickhouse Lake dam which is operated to provide seasonal storage and flow regulation for the operation of generating stations downstream on the Abitibi River. As a result, the Frederick House River, below the Frederickhouse Lake Dam, is subject to highly variable flows and water levels over the course of any given year. Regulatory agencies expect that the proponent will determine through study the flows required to maintain aquatic ecosystem integrity in the zone of influence of the project. The potential impacts of the proposed facility development and operation on the hydrological regime at Wanatango Falls are described within this environmental report.

2.8.2 Surface Water Quality

A surface water quality investigation was undertaken in 2010 to establish ambient (baseline) characteristics of the waterway. Two sampling events (spring and summer) were conducted at three locations (SW1, SW2 and SW3), at the Frederick House (Wanatango Falls) site. Sampling locations are shown in Annex III. During the sampling events, general observation and characteristics of each sampling location were assessed and recorded (i.e. water level, current,

color and odour). The spring event was undertaken on May 29th; the summer event was completed on July 27st, 2010.

The results were compared to the Provincial Water Quality Objectives (PWQO) to establish ambient water quality conditions in the vicinity of the proposed project location. The PWQO were established by the Ministry of the Environment in 1994. Under the *Ontario Water Resources Act* the MOE has the supervision of all surface and ground waters in Ontario. The reader will note that several of the parameters subjected to analyses do not have a PWQO objective. For the May event, aluminum, chromium and iron exceeded their PWQOs at SW1, while aluminum, chromium, iron and total phosphorus exceeded their PWQOs at SW2. For the July event, aluminum, chromium, iron and total phosphorus exceeded their PWQOs for SW1, while aluminum, chromium and iron exceeded their PWQOs for SW3. The source of the elevated metal and phosphorus concentrations is unknown. Surface water sampling results are provided in Annex IV.

Additional surface water collection events will be scoped with MOE, MNR and EC in 2011 to supplement information collected in 2010.

2.9 ECOLOGY

A Site Information Package (SIP) for Wanatango Falls was provided to the proponent by the Ministry of Natural Resources.

Fish and Fish Habitat

The SIP contained a reference to the Frederick House RIN Project (2009).

Terrestrial and Aquatic Flora and Fauna

No information was available in the SIP.

A copy of the Site Information Package is provided in Appendix A-2.

2.9.1 Study Area and Scoping of Natural Heritage Investigations

The background Information and records review was supplemented by data collected from other sources including existing reports, mapping, and occurrence records. In addition, the EA team began conducting fisheries and aquatic habitat, and terrestrial habitat investigations in support of the proposed generating station project in 2010 to supplement the information provided by the Ministry of Natural Resources. These studies are ongoing in 2011.

The field investigations completed during the 2010 work program were designed to address aquatic habitat downstream of Wanatango Falls as well as the proposed inundation area. The scoping of the biological assessment was based on preliminary project information and accordingly the study area for biological field investigations included the reach of river extending 8.2 km upstream of the facility and 400 m downstream as well as all lands within approximately 120 m. In early 2011, following the refinement of engineering details, the length of the variable flow reach was extended to 2 km downstream of the facility. Additionally, dynamic hydrological modeling has determined that inundation and water level fluctuations for the high-dam option may be experienced up to 9.4 km above the proposed facility. We note again that the operation of the existing Frederick House Lake dam by OPG has a significant impact on water levels and flows in the reaches both upstream and downstream of Wanatango Falls. Xeneca has committed to a 2011-2012 acquisition strategy for the natural heritage environment data and information required for the previously unstudied area. A copy of the 2011 work plan is appended to the Natural Environment Characterization Report provided in Annex III of this document.

The detailed findings of the field investigations to date are provided in Annex III of this document. A brief summary of the findings are presented below.

2.9.2 Terrestrial Habitat and Species

The proposed Wanatango Falls GS project area is located approximately 10 km downstream of the existing Frederickhouse Lake Dam, operated by Ontario Power Generation. The construction and operation of the proposed facility will result in the creation of a head pond upstream of the proposed dam location.

The study area is dominated by a black spruce forest community, interspersed with a few tributary-related wetlands. Within 120 m of the proposed development activities and resulting inundation area, there are a total of four vegetation communities (one forest and three wetland communities):

- Black Spruce-Pine Conifer-Moist, Fine
- Mineral Thicket Swamp
- Mineral Meadow Marsh
- Mineral Shallow Marsh

No significant vegetation species are known to exist in the study area.

A total of 80 bird species have the potential to regularly occur and/or breed within the vicinity of the project area. Field surveys during 2010 confirmed the presence of 61 bird species. Of these, 35 species demonstrated possible breeding evidence, 19 species demonstrated probable breeding evidence, and 4 demonstrated confirmed breeding evidence: American robin (*Turdus*

migratorius), spotted sandpiper (*Actitis macularia*), bald eagle (*Haliaeetus leucocephalus*) and hooded merganser (*Lophodytes cucullatus*). Three species were observed without any breeding evidence: turkey vulture (*Cathartes aura*), herring gull (*Larus argentatus*) and ring-billed gull (*Larus delawarensis*).

Although the Ontario Breeding Bird Atlas has no records of significant bird species in the project area, field studies noted breeding evidence of two species at risk: Canada warbler (*Wilsonia canadensis*) and bald eagle (*Haliaeetus leucocephalus*). Seven additional Species at Risk birds have the potential to occur within the study area: olive-sided flycatcher (*Contopus cooperi*), chimney swift (*Chaetura pelagic*), peregrine falcon (*Falco peregrinus*), short eared owl (*Asio flammeus*), common nighthawk (*Chordeiles minor*), bobolink (*Dolichonyx oryzivorus*) and rusty blackbird (*Euphagus carolinus*).

Seven species of herpetofauna are known to occur within the vicinity of the study area. Spring and summer field work has confirmed the presence of the eastern garter snake (*Thamnophis sirtalis sirtalis*), American toad (*Bufo americanus*), spring peeper (*Pseudacris crucifer*) and wood frog (*Rana sylvatica*). No species at risk were observed during field visits.

A total of 38 mammal species have been identified as being potentially present within the project area. Evidence of nine species was observed during field visits, all of which are common species with secure populations within Ontario, such as the black bear (*Ursus americanus*), moose (*Alces alces*) and beaver (*Castor canadensis*).

One significant mammal species, the provincially rare northern long-eared bat (*Myotis septentrionalis*), may be present within the project area according to the Ontario Mammal Atlas. No other significant mammal species have been identified within the project area.

For a full description of the results of the 2010-2011 terrestrial ecological assessment, including complete lists of all documented species and assessment methods, please refer to the Natural Environmental Characterization and Impact Assessment Report which is appended to this document as Annex III.

2.9.3 Aquatic Habitat and Species

The 2010-2011 field surveys of aquatic habitat and species consisted of habitat characterization, fish community surveys, Walleye and sturgeon spawning surveys and fish passage studies.

A total of 20 fish species were documented during the field studies:

- Lake Sturgeon (Southern Hudson Bay - James Bay population) *Acipenser fulvescens* Pop.2
- Longnose Sucker (*Catostomus catostomus*)
- White Sucker (*Catostomus commersoni*)

- Cisco (*Coregonus artedi*)
- Lake Whitefish (*Coregonus clupeaformis*)
- Mottled Sculpin (*Cottus bairdi*)
- Brook Stickleback (*Culaea inconstans*)
- Northern Pike (*Esox lucius*)
- Goldeye (*Hiodon alosoides*)
- Burbot (*Lota lota*)
- Shorthead Redhorse (*Moxostoma macrolepidotum*)
- Emerald Shiner (*Notropis atherinoides*)
- Spottail Shiner (*Notropis hudsonius*)
- Yellow Perch (*Perca flavescens*)
- Logperch (*Percina caprodes*)
- Longnose Dace (*Rhinichthys cataractae*)
- Sauger (*Sander Canadensis*)
- Saugeye (*Sander canadensis x Sander vitreus*)
- Walleye (*Sander vitreus*)
- Creek Chub (*Semotilus atromaculatus*)

Of these, only Lake Sturgeon is listed as a Species at Risk both provincially and federally, the remainder being relatively common and widely distributed across Ontario. The majority of the sampling occurred upstream of Wanatango Falls, so this species list is more representative of the fish community located between Wanatango Falls and the Frederickhouse Dam. Lake Sturgeon is the only species listed above that was captured exclusively downstream of the falls.

For the study area as a whole, the documented fish community represents a varied and diverse group of species with a range of feeding and temperature preferences which allow the existing fish community to function as a self-sustaining ecosystem.

Based on available background information, an additional 9 fish species are known to exist in the area:

- Mooneye (*Hiodon tergisus*)
- Brown Bullhead (*Ameiurus nebulosus*)
- Rock Bass (*Ambloplites rupestris*)
- Golden Shiner (*Notemigonus crysoleucas*)
- Blacknose Shiner (*Notropis heterolepis*)
- Trout-perch (*Percopsis omiscomaycus*)
- Johnny Darter (Etheostoma nigrum)
- Iowa Darter (*Etheostoma exile*)
- Brook Trout (*Salvelinus fontinalis*)

These 9 species are relatively common and widely distributed in Ontario.

For a full description of the results of the 2010 and 2011 aquatic ecological assessment, including complete lists of all documented species and assessment methods, please refer to the Natural Environmental Characterization and Impact Assessment Report which is appended to this document as Annex III.

2.9.4 Valued Ecosystem Components

In the opinion of the EA team, Lake whitefish, Walleye and Sauger are considered the primary Valued Ecosystem Components (VEC) with regards to fish community in the study area. Background information sources identified Northern Pike, Lake Whitefish and Brook Trout as being present in the area and having the potential to be considered VECs, but none of these have been captured in the study area.

Walleye

Walleye are a predatory fish species with broad distribution covering much of the eastern United States and central Canada. Found in both lakes and rivers, they are tolerant of a broad range of environmental conditions. Walleye is a widely sought-after recreational and subsistence fishery, and is often considered the finest freshwater foodfish. It may also be the most economically valuable fish species in Canadian inland waters.

Field studies conducted in 2010 indicate that resident populations of Walleye occur both upstream and downstream of Zeverley's Landing and Wanatango Falls.

Sauger

Sauger bear similarities to Walleye in terms of feeding and spawning habitat, but have slower growth and may be less adaptable. They do, however, usually succeed over Walleye in very turbid waters. Sauger spawn during a 2-week period in the spring, often immediately after Walleye spawning. The two species are known to hybridize in natural settings. Within the Frederick House River, Sauger are limited to portions of the river falling within the Clay Belt. During the 2010 field studies, Sauger were captured both upstream and downstream of Wanatango Falls.

Northern Pike

Northern Pike on the Frederick House River represent a VEC as they are a targeted species for recreational and subsistence fishing. Northern Pike spawn in the spring over aquatic vegetation and seasonally inundated vegetation such as the marshes and wetland found throughout the project area (both upstream and downstream of the proposed project location). The west side of

the island immediately downstream of Zeverly's landing is another potential spawning area for Northern Pike. During field studies in the spring of 2011 Northern Pike were captured downstream of the proposed dam site.

Lake Whitefish

Lake Whitefish on the Frederick House River represent a VEC as they are a targeted species for recreational and subsistence fishing. Lake Whitefish is widely distributed in North American fresh waters. They are a coolwater species that prefer deeper waters of lakes and large rivers. These fish move from deep water to shoals in early spring and back to deep water in the summer months. The area from Zeverley's Landing to Wanatango Falls contains three areas of boulder/cobble/gravel that represent potential spawning habitat for Lake Whitefish. Additional areas of potential spawning habitat are present in the proposed inundation area upstream of Wanatango Falls. During field studies in the spring of 2011 Lake Whitefish were captured downstream of the proposed dam site.

2.9.5 Endangered and Threatened Species

The project team has compiled a list of species from background review and direct field observation which are listed as Species at Risk either provincially or nationally. These species and their general habitats are afforded protection under either the Ontario *Endangered Species Act*, 2007 or the Canadian *Species at Risk Act*, 2002. Further information about these species, their conservation status and their preferred habitat can be found in Annex III.

The following Species at Risk have been identified and have suitable habitat within the study area:

- Bald Eagle (*Haliaeetus leucocephalus*)
- Common Nighthawk (*Chordeiles minor*)
- Olive-sided Flycatcher (*Contopus cooperi*)
- Chimney Swift (*Chaetura pelagic*)
- Canada Warbler (*Wilsonia Canadensis*)
- Lake Sturgeon (*Acipenser fluvescens*) - Southern Hudson Bay - James Bay population

The following Species at Risk have been identified through background review but do not have suitable habitat within the study area:

- Peregrine Falcon (*Falco peregrines anatum/tundrius*)
- Bobolink (*Dolichonyx oryzivorus*)

2.9.6 Significant Wildlife Habitats

The project team has identified species of conservation concern candidate and confirmed significant habitats in accordance with the Significant Wildlife Habitat Technical Guide (OMNR, 2000). Specific discussions and rational for the selection and of these habitats are provided in Annex III. Based on the evaluations completed to date, the following candidate wildlife habitats have the potential to exist within the study area. Further work is required to assess the significance of these habitats.

- Denning Sites for Mink, Otter, Gray Wolf, Eastern Wolf, Canada Lynx, Marten, Fisher, Black Bear
- Common Nighthawk Nesting and Foraging Habitat;
- Olive-sided Flycatcher Nesting and Foraging Habitat; and
- Northern Long-eared Bat Habitat.

Based on the evaluations completed to date, the following confirmed significant wildlife habitats exist within the study area;

- Bald Eagle Nesting and Foraging Habitat
- Canada Warbler Nesting and Foraging Habitat.

2.10 CULTURAL HERITAGE

A Stage 1 Archaeological Impact Assessment was completed for the proposed project by to gain an understanding of the cultural heritage of the area. The report is appended in Annex V. A summary of key findings is presented below.

The location of the proposed project at Wanatango Falls, as with most sites with waterpower potential, was determined to have high archaeological potential due to its proximity to a major water source and the existence of rapids. In the past, rapids would have required river travellers to go around the rapids by means of a portage. It is therefore reasonable to assume that a portage trail exists at this location on one or both sides of the river.

2.10.1 Archaeological Sites

The registered site database maintained by the Ontario Ministry of Culture (MTC) indicated that 2 archaeological sites have been registered within 30 km of the project area. Due to the existence of pre-contact portage routes, it was concluded that areas of high archaeological potential exist for the proposed Wanatango Falls project site.

There are no previous archaeological studies on record for the project area. It is important to note, however, that the lack of archaeological studies does not indicate or suggest that there is no archaeological or cultural heritage potential within the project area. Rather, it should be interpreted to mean simply that no archaeologist has conducted a study in this area.

Given that areas of high archaeological potential along the Frederick House River will be inundated as a result of the proposed development, a Stage 2 archaeological assessment was recommended in the vicinity of the proposed hydropower development. Similarly, it was recommended that Stage 2 assessments be carried out if the final location of access roads, new transmission lines, aggregate pits and other infrastructure also fall within areas of high archaeological potential. It was also recommended that once the final location of new connection corridors and any areas that will be disturbed as a result of construction be subject to Stage 2 assessments if they are determined to have high archaeological potential.

2.10.2 Buildings and Structures

Based on the results of the Stage 1 Archaeological Assessment, the potential for the presence of built heritage structures within the project area was expected to be negligible. This expectation will be confirmed through the Stage 2 Archaeological Assessment.

2.11 Current Land and Water Use

2.11.1 Access

The Wanatango Falls site is accessed via the Newmarket Concession Road 5 & 6, and by trails leading from this road. These trails run along both side of the river and serve as access to several camps located between Wanatango Falls and Zeverley's Bridge

2.11.2 Navigation

The Frederick House River is considered a navigable waterway as defined under the *Navigable Waters Protection Act*. The Act prohibits construction in navigable waters unless an Approval is issued for the undertaking for the site, work and plans. The Wanatango Falls present a barrier to navigation, however there are hiking/ATV trails running along the downstream shoreline. A boat launch, accessible by ATV is also located just upstream of the dam site.

2.11.3 Recreation Use and Commercial Tourism

The Ministry of Natural Resources SIP noted that the project area and the surrounding area are valued for snowmobiling, hunting and fishing (Appendix A).

The proposed Wanatango Falls GS site is located about 10 km downstream of the exiting OPG Frederick House Lake Control Dam. Nearby Nighthawk Lake is located upstream of the Frederick House Lake Control Dam. The Nighthawk Lake Cottagers Association represents the cottaging community on Nighthawk Lake. The proposed Wanatango Falls GS project will not have any effects on the operation and water level of the Frederick House Control Dam or on Nighthawk Lake.

Snowmobiling is a popular pastime for local residents and tourists in the area. The area around the proposed site is located in the Ontario Federation of Snowmobile Club's District 15, known as the Polarbear Riders Club. The Jackpine Snowmobile Club of Iroquois Falls is an additional Club in the broader area.

2.11.4 Forestry

The Wanatango Falls site is located within the Abitibi River Forest Management Plan. The SIP identifies a forest access road to the west of the site as being in the current Annual Work Schedule for the Abitibi River Forest.

2.11.5 Hunting/Fishing Opportunities

The Ministry of Natural Resources has identified the Frederick House River and surrounding area as valued area for hunting and fishing (Appendix A). Large game species include black bear and moose, while small game species include varieties of hare and fowl.

Open hunting seasons for the various wildlife species potentially hunted in the site vicinity are provided below:

Species	Open Hunting Season
Black Bear	August 15 – October 31
Moose	Bow – September 16 – October 5 Gun – October 7 – November 15
Duck	September 15 – December 25
Weasel	October 25 – end of February
Red Fox	September 15 – end of February
Snowshoe Hare	September 1 – June 15

Members of the angling community noted their use of the trail system along the east side of the river during the March 24, 2011 PIC.

The site is located within Bear Management Area CC-30-011 and CC-30-016, (Appendix A-2).

2.11.6 Trapping and Baitfish Harvesting

Commercial trapping, bear management areas and baitfish harvesting are all identified activities within the project area. It does not appear that any trap / baitfish cabins are present within the expected zone of influence. All Crown land open for trapping in the province has a registered trapline system to control trapping. Each trapline represents a specific geographical area, in which the holder of the trapline licence is allowed to conduct trapping activities. Each trapline is issued a quota for the animals which can be trapped within the area. Only one trapper is licensed to trap in each trapline area.

The site is located within trapline CC033; the trap line is identified in Appendix A.

The site is also located within one Baitfish license (CO2249) (Appendix A-2).

2.11.7 Protected Areas

There are no protected areas in the immediate vicinity of the proposed project.

2.11.8 Mineral Resources

The MNR Site Description Package identifies mining claims in the project area. According to Ministry of Northern Development, Mines and Forestry CLAIMaps, there are several claims located within proximity of the projects zone of influence.

2.11.9 Aboriginal Land and Water Use

Reserves, Communities and Land Claims

The MNR Site Information Package identified the following Aboriginal communities for consultation with respect to possible Business to Business Relationships: Taykwa Tagamou First Nation, Mattagami First Nation and Matachewan First Nation. Local Aboriginal communities that may have an interest or concern with the proposed project as identified in the SIP included the Flying Post First Nation and Wahgoshig First Nation, Northern Lights Métis Council and the Métis Nation of Ontario.

Spiritual, Ceremonial, Cultural and Burial Grounds

All waterways are viewed in traditional Aboriginal culture as the 'veins or lifeblood of Mother Earth'. Water quality and water ecosystem health and function are typically mentioned as concerns by Aboriginal people in relation to natural resource management and development projects.

Xeneca has engaged with Aboriginal communities from the onset of the project and continues to do so. Our work in engagement continues and it is considered very important by Xeneca.

Information on the engagement of members of the Aboriginal communities during the project development is provided in Section 4.5.

To date no environmental information specific to lands and water has been provided by individual Aboriginal community members.

2.12 SOCIAL AND ECONOMIC

The proposed project is located at Wanatango Falls in Mann Township. The closest municipalities to the site are Iroquois Falls which is 26 km southeast of the site and the Town of Cochrane which is 22 km north of the site. The site is approximately 10 km downstream of the existing Frederick House Lake Control Dam, operated by Ontario Power Generation (OPG) and approximately 600 m upstream of Zeverley's Road.

The Statistics Canada 2006 Population Census lists the population of the Town of Cochrane to be 5487 persons. The town functions as a service centre for a wide tributary area. The Corporation of the Town of Cochrane provides business services for its residents and has a strong base in forest industries, farming and government services. All of these activities give the Town a reasonably stable economic base. Communications services are readily available through the partnership between the Cochrane Public Utilities Commission and the Ontario Northland Telecommunication Commission.

The Stats Can census tabulated a population change in the Town of Cochrane between 2001 and 2006 of -3.6 % compared with the Ontario average of + 6.6%.

The Statistics Canada 2006 Population Census determined the population for the town of Iroquois Falls to be 4,729 persons, with a population change of -9.4% from 2001 to 2006.

2.12.1 Employment & Economic Setting

The major industries in the Cochrane area are tourism, transportation and lumber industries. The equine industry has also been cited as an important contributor to the economy of Northeast

Ontario (Rees and Bertrand, 2006). The AbitibiBowater mill is the largest employer in the Town of Iroquois Falls (Foresttalk.com, 2008).

In July 2011, Detour Gold Corporation began construction of its new regional office in Cochrane as part of a large mine development project. The project is expected to have a significant impact on the economy of Cochrane and all of northeast Ontario (Globe and Mail, 2011).

2.12.2 Water Supply

A search of the Ministry of Environment's electronic Water Wells database did not return any well records within a 1 km radius of the project site. An October 2010 land title search in the vicinity of the project area noted that there are privately owned lands within the area of the proposed reservoir. Therefore, permanent or seasonal domestic water supplies that might draw from the Frederick House River as a source are a possibility.

The Town of Cochrane, approximately 22 km to the north of the project site, draws its water supply from three drilled wells ranging between 43 and 51 m in depth. The hydrogeology is conceptualized as consisting of three main hydrostratigraphic units, a silty clay aquitard, an upper sand aquifer, a lower sand and gravel aquifer all overlaying the Precambrian bedrock which functions as an aquitard underlying the region.

The river, both upstream and downstream of the project site is used predominantly for recreation (fishing, swimming, boating, etc). It is possible that recreational users are taking river water for personal consumption.

2.12.3 Area Aesthetics

The area has been used for many years by residents of the region for various recreation activities and nature appreciation. The falls have an aesthetic value with local residents and recreational users of the area. There are several camps located between the project site and Zeverley's road bridge.

3. DESCRIPTION OF PROPOSED PROJECT

This section provides a description of each element of the proposed development. The reader is referred to Annex II-A for diagrams showing relevant features of the development.

The intent and purpose of the Environmental Assessment planning process is to describe the project and its potential impacts on the natural, social and economic environment, to determine suitable mitigation measures (i.e. project design modifications) which can reduce or eliminate

negative impacts, and to identify suitable compensation measures for impacts that cannot be mitigated. The process is meant to inform and enhance the project plan through investigation and consultation with stakeholders, First Nations and the general public.

At the time the Environmental Assessment is undertaken, preliminary project information is presented to ensure that stakeholders are informed about the general scope and extent of the project, particularly as it relates to understanding how the project may impact other uses of the river and the environment. At this stage conceptual plans for the project have been developed. Detailed engineering design and specification work will occur after the Environmental Assessment is completed.

The proponent necessarily reserves the right to variances between the conceptual design presented herein and the final detailed engineering design, provided that such variances do not materially and negatively impact the environment beyond the scope of the impacts described herein.

Possible variances from conceptual to final design include:

1. Detailed design may incorporate changes that are specifically meant to address and/or accommodate stakeholder issues agreed to during the consultation process.
2. Construction materials may vary from those shown on conceptual drawings. Earth material may be interchanged with concrete or steel material as required in the final engineering design. Where alternative material is specified, volumes and footprints may be adjusted to reflect safe engineering design requirements.
3. Physical sizes and orientation of structures.
4. Physical size of construction site areas may be adjusted where it is required for safe site management.
5. Specifications of mechanical and electrical equipment may vary, including the physical size, number of units, and total rating.
6. Design specifications for protection of fish, such as inflow velocities and inlet spacing of trash racks.
7. The powerhouse angle and alignment may be adjusted. The location of spillway and powerhouse structures may be adjusted along the dam axis to optimize engineering design and safety.
8. Road and connection line routes may be refined.

3.1 DESCRIPTION OF PROPOSED HYDROELECTRIC FACILITY

Xeneca is proposing to construct a hydroelectric facility at the Wanatango Falls site, located on the Frederick House River, approximately 22 km south of Cochrane. Wanatango Falls can be accessed off a trail from the TransCanada Highway via Newmarket Concession Road 5. A trail leading south off the road is used to access the east side of the Frederick House River at the site.

The proposed project at Wanatango Falls would utilize a gross head of 7.5 m. Negotiations are ongoing with upstream riparian landowners regarding the possibility of increasing the upstream operating water level by 1.5 metres and, if successful, the head would be increased to 9 m. The conceptual development incorporates the use of a dam/weir. An open conveyance channel situated on the west shore of the river will conduct flows from the river to an intake before directing them through one or more turbines with a combined name plate capacity rating of 4.67 MW.

A road upgrade as well as new road construction will be required to access the site.

A 27.6 kV connection line extending approximately 42 km from the GS to the point of connection at the Hoyle DS will be required to connect the station to the provincial electrical power supply grid. Connection and access road mapping is detailed in Annex II-B.

3.2 DESIGN OPTIONS AND RATIONALE

There are presently two conceptual design options under consideration for the proposed dam, these include what has been described as the 'low dam' and the 'high dam'. Each alternative would result in a different upstream area of inundation. Hydrological modeling indicates that the low-dam inundation effects would extend 0.5km upstream whereas the high dam inundation effects would extend 9.4 km upstream. The high dam alternative would impact privately owned land upstream and is subject to landowner agreements. The low dam inundation area is contained within crownlands. If landowner approvals are successful, the high dam alternative will be selected as the preferred alternative.

3.3 GENERATING STATION COMPONENTS

The following is a description of the generating station components. The reader is referred to Annex II-A for conceptual engineering drawings in support of the information detailed below. It should be noted that final engineering drawings for the components of the proposed undertaking must be submitted for applicable regulatory approvals prior to issuing of provincial permits and federal Authorizations in advance of construction. The details presented below are based on conceptual engineering design calculations and subject to some modification at the final design stage.

3.3.1 Installed Capacity and Annual Energy Output

The approximate installed capacity of this project will be 4.67 MW and will provide approximately 19,180 MWh of renewable energy annually. The production of 19,180 MWh of renewable energy represents the equivalent of:

- The displacement of 13,226 metric tons of carbon dioxide equivalent; or
- The annual greenhouse gas emissions from 2,593 passenger vehicles; or
- The sequestering of carbon from nearly 1047 hectares of pine or fir forests.

3.3.2 Headworks Structure

The proposed headworks structures consist of a single water control structure composed of a 35 m long fill embankment, 40 m long control dam, 215 m long overflow dam and a 35 m long concrete spillway. Additionally, two 50 m long embankment dams flank the powerhouse.

The dam and embankment may be constructed from any or all of the following materials within the engineering constraints for the same; reinforced concrete; RCC – rolled and compacted concrete; earthen/stone, clay and 'rubber' (impermeable barriers). Typical construction will feature a broad overflow weir topped by a control feature (i.e.: an Obermeyer or similar, pneumatically operated dam). Headgate structures may be either included in the dam design or built as a separate riverside structure dependent upon water conveyance routing.

3.3.3 Conveyance System

Water would be directed from the Frederick House River to the facility's intake through a 110 m long, 15 m wide, open approach channel to the facility intake at the powerhouse. The majority of the channel would be excavated to an elevation of 254 masl. However, approximately 50 m upstream of the powerhouse the channel would begin to slope down to reach an approximate bottom elevation of 243 masl at the base of the powerhouse intake.

3.3.4 Powerhouse

The proposed powerhouse will have a footprint of approximately 400 m^2 including the water intake. The powerhouse will be constructed with reinforced concrete floors and walls to a level above the historical flood level and existing ground levels. Construction above this defined line can be reinforced concrete, insulated steel panels or a combination of the two based on existing physical needs and constraints. A coffer dam will be required to make initial excavations of the powerhouse, draft tube and flow transition features, as these are below the tailrace water level.

The water passage within the powerhouse will be constructed from a combination of concrete and steel conduits.

3.3.5 Turbines

Turbine selection is based on the project site head, flow and economics. In instances of low head and intermediate to large flows, Kaplan, Propeller or Cross Flow (Banki-Ossberger) type turbines are deemed most efficient. For very low heads, a horizontal Kaplan is the preferred option as it requires less excavation than the vertical turbine and can maximize turbine efficiency over a wide range of flows. Regarding additional economics of the turbine selection, cost varies directly with the maximum operating flow, but because a large component of cost is fixed for a development regardless of the flow, an optimum size results through balancing the cost versus the revenue generated from turbines of various sizes (diameters).

Based on the rationale described above a horizontal or vertical SAXO-type turbine will likely be selected for Wanatango Falls due to low head (9 m); intermediate flows (Long Term Annual Flow 33.2 m^3/s) and economic concerns.

3.3.6 Tailrace

The facility's tailrace will have an overall area of 400 m^2 and extend approximately 30 m downstream of the powerhouse. The excavation will be to an elevation of approximately 243.72 masl at the powerhouse outlet and taper up towards the end of the canal.

3.4 ANCILLARY WORKS

The following describes the ancillary works proposed for the project.

3.4.1 Connection line Route

A Connection line Summary Report for Wanatango Falls has been prepared and is included in this document in Annex II-B. A summary of the report is provided below.

The preliminary connection line route was prepared based on the location of the facility. The point of common coupling (PCC) and the point of connection (PC) are identified in the conditionally approved FIT application. The proposed line location was then overlain with assembled values layers and a summary of the potentially impacted values was compiled and summarized. Data layers used for this exercise included:

- Land Information Ontario dataset
- NRCan Topographic data
- 2008 Forest Resource Inventory data

- Medium resolution SPOT panchromatic orthoimagery from Natural Resources Canada
- NRVIS Data Layers (circa Feb 2011)

Consultation with the Sustainable Forest Licenses holders linked to the project was also undertaken and most of the license holders provided GIS datasets including all road networks, planned harvest block locations and aggregate pit locations.

The line route was reviewed using all available information and revised where appropriate in an effort to:

- reduce environmental impact (i.e. streams & wetland crossings);
- minimize landscape footprint and fragmentation;
- coincide with existing road corridors; and
- reduce total line length.

Xeneca is proposing a single 27.6 kV distribution line traveling south from the powerhouse to the Point of Connection at Hoyle DS, approximately 4 km east of the town of Hoyle. The total line length is 41.3 km, of which 81% will be along pre-existing roads. The proposed line would require 18 water crossings at pre-existing points and 3 new water crossings on new line corridor sections. The proposed route would also skirt a single wetland.

Several minor detour options have been proposed to avoid crossing private lands located along the length of the proposed route. All of these detours are located entirely on crown land and will require no additional wetland or water crossings.

Further operational ground truthing of the proposed lines and access routes was completed following the processing of digital aerial photography captured in early June, 2011. Existing roads and water crossings were assessed so as to determine their current condition, structural integrity and upgrade requirements.

Where line or new road corridors could impact adjacent wetlands a Rapid Assessment Technique of potential PSWs will be undertaken. Where potential PSWs are identified in proximity to the route, the corridor will be realigned with sufficient setback to avoid impacts to these features.

Ecological Land Classification using *Ecosite Crosswalk* will be used to determine the potential for significant wildlife habitat to be impacted and field investigations to verify this information will be scheduled for the summer and fall of 2011 and spring of 2012, where needed.

3.4.2 Electrical Substation

A transformer substation will be required and located adjacent to the powerhouse at the site. It is expected that the transformer substation will have an approximate footprint of 500m^2 and will be surrounded by security fencing.

3.4.3 Access Roads

Access road planning to the project site was determined in close consultation with the forest management companies which hold Sustainable Forest Licenses (SFL) for the project area. The goal is to dovetail Xeneca Inc.'s road access needs with the SFL holder's current and future operational access plans and develop with the forest management companies a long term cost sharing and road maintenance plan. Further consultation with government agencies will be required to ensure that regional and provincial access policies and guidelines are met.

The Wanatango Falls site can be accessed from Highway 17 via Newmarket Concession Road 5 & 6 or from Highway 11 via Dunn Road. Old logging roads on the east and west banks of the river will be used to access the site. These roads will require significant surface regarding and widening to support construction vehicles and equipment.

New road construction will require the clearing of a 10 - 30 m ROW. Access road details are provided in Annex II-B.

3.4.4 Other Civil Works

A permanent bridge structure spans the Frederick House River roughly 500m north of the proposed dam site. The bridge spans 40m and has a width of 3.35m. The bridge was observed to be in good condition and is rated to a maximum weight capacity of 35 tons.

3.5 CONSTRUCTION STRATEGY

The following is a summary of the construction activities and temporary works required during the construction of the project. A construction management plan, including conceptual drawings, has been prepared and is presented in Annex ll-B. It should be noted that final engineering details for these temporary works will be submitted for applicable regulatory approval in advance of the construction stage of the undertaking. The details presented below are based on conceptual engineering design calculations and subject to some modification at the final design stage.

Site preparation activity will commence in May 2012. Construction of the proposed facility is scheduled to take place between 2012 and 2014 with commissioning of the facility anticipated by October 2014. Under the terms of the FIT contract awarded to Xeneca, the facility must be commissioned no later than October, 2014.

Tentative dates for the commencement and completion of various project components are presented in Table 1:

Table 1: Project Component Construction Schedule

Component	Dates	
Roads and Bridges	Start	May 2012
	Finish	August 2012
Powerhouse	Start	Sept 2012
	Finish	April 2013
Control Structures	Start	Sept 2012
	Finish	Feb 2013
Intake and Penstock	Start	Oct 2012
	Finish	Feb 2013
Connection Line and Associated Components	1st Phase	Jan 2013 to Mar 2013
	2nd Phase (if required)	Jan 2014 to Mar 2014
Civil/Mechanical Equipment	Installed	June 2013
Water-to-Wire Equipment	Installed	Dec 2013
Final Construction and Commissioning		Jan 2014 to Sept 2014
FIT Contract Operation Date		Oct 12, 2014

The following construction stages are proposed for the construction of the generating station and its appurtenant facilities:

- road upgrades and construction of new road access on both banks of the river;
- clearing and grubbing of the site, including work area and laydown areas;
- partial blasting and excavation of intake channel
- construction of phase 1 cofferdams;
- excavation of powerhouse, intake and tailrace;
- construction of powerhouse and intake structure;
- construction of embankment dams and substation adjacent to the powerhouse
- partial construction of overflow dam
- construction and dry commissioning of stoplog spillway
- clearing and construction of connection line right-of-way
- headpond clearing

- removal of phase 1 cofferdams and installation of phase 2 cofferdams
- complete construction of overflow dam
- construction of adjustable gate spillway
- complete blasting and excavation of intake channel
- equipment installation and other electrical works required to meet project completion schedule;
- removal of phase 2 cofferdams;
- site rehabilitation/reclamation.

Construction will be initiated once all applicable regulatory approvals and authorizations have been issued. The construction program will be advanced to meet the requirements of relevant legislation, industry guidelines and best management practices aimed at ensuring the highest level of protection of the environment. Specific proposed mitigation measures that will be integrated into the site's construction strategies are presented in Section 5 and explained in further detail throughout the supporting Annexes of this report. In-water construction related timing restrictions will be stipulated by the regulatory agencies during the permitting and approvals stage. Some general construction strategies are presented below.

3.5.1 Clearing and Grubbing

Trees cut within the inundation area and along the ROW for the connection line and access roads right-of-way will have their roots left intact wherever possible.

Merchantable timber will be segregated for removal by the sustainable forest license holder within the area to be inundated, along new access road corridors and along the connection line route. Clearing will be managed in accordance with applicable forestry management guidelines and best management practices. All clearing of timber will conform to the *Crown Forest Sustainability Act*, The Forest Operations and the Silviculture Manual.

3.5.2 Aggregate Borrow and Laydown Areas

Aggregate for the construction of roads, embankments, yards, cofferdams and concrete structure backfill will be sourced from re-used granular material excavated from the road alignment, if the material is suitable for this use. Earth borrow material may be excavated from the up-slope side of the access road on the north bank. The total volume of borrow materials required is not known at this time as it will depend on the final project design. Granular materials may require on-site processing to improve the engineering characteristics.

Sand and gravel may be rare or unavailable in the project area, so geotechnical materials may need to be trucked to the site. Possible construction resources and borrow pits have been identified in the surrounding area.

Two 1000 m^2 construction laydown areas will be established. The first, located near the powerhouse, will be used for construction materials and equipment storage, construction offices, parking, etc. The second will be located near the adjustable gate spillway, and will be used for the same purposes as the first laydown area, except that it will not likely contain site offices or parking. The laydown area near the powerhouse can also be reduced following construction, with some of the area remaining for operation purposes. The other laydown area can be completely reclaimed. If needed, an additional area of up to 5000 m^2 may be used to stockpile topsoil, excavated soil material unsuitable for construction use and excess blast rock material. The overflow dam on the large island will be constructed using a combination of concrete and earthfill, the relative amounts of which will depend on the final project design. Earthfill will be sourced to the extent available on-site. The primary borrow locations will include the abutment areas of each spillway at each shoreline and the rock blasting excavations for the powerhouse and other structure foundations. Excess material from the access road construction and ditching operations will be used should additional borrow material be needed. Additional blast rock material can be obtained by extending the excavation area for the foundation or powerhouse. The required rock borrow areas are not expected to extend beyond the construction site area.

3.5.3 Cofferdams

Cofferdams will be required to allow for the construction of all components which are below existing or final water levels. Drawings No. 00-151 and No. 12-151, in Annex II-B identifies the proposed cofferdam locations.

Two types of cofferdams will be used for the construction activities. Type A cofferdams will be constructed of cargo bags filled with clean, local granular material transported to site in trucks or trailers (see Annex II-B, Drawing 00-151). They are installed using an excavator and/or a crane to place the bags sequentially in the river. Type B cofferdams will consist of rockfill with an impermeable liner and will have 2H:1V side slopes and a top width as necessary for expected construction traffic. The type and precise length of these cofferdams will depend on the construction phase and their location within the construction site. The footprint of the cofferdams will depend on the height/elevation of the dam required to manage the 1:20 year flow rate and the depth to suitable substrate within the river. Although the dimensions are subject to change pending further investigation and design work, type A cofferdams are anticipated to be two cargo bags wide at the base and two bags high, whereas type B cofferdams will be 6 m wide at the crest. Phase 1 cofferdams are estimated to have a footprint of be approximately 3900 m^2 while Phase 2 cofferdams are estimated to have a footprint of be approximately 5000 m^2.

3.5.4 Dewatering

Water that accumulates behind the cofferdams will be discharged in accordance with the *Environmental Protection Act*. Category 2 Permits to Take Water (PTTW) and Certificates of

Approvals for Discharge of Sewage Waste Water to the environment will be required from the Ministry of the Environment prior to the initiation of in-water construction activities.

3.5.5 Excavation of Powerhouse and Tailrace Canal

Excavation for the powerhouse and tailrace will be completed using appropriate methods. Tailrace excavation at the intersection with the river will be completed within the in-stream work window. The excavation will be carried out from the powerhouse working towards the water course so that flowing water does not infiltrate the cut until the final phase of excavation.

3.5.6 Concrete Production

A concrete batch plant, whose location is dependent on the final location of the borrow pit, will be required for the production of concrete for the construction of the facility. The batch plant may be located in the borrow area, should the latter be sufficiently close to the project site. This placement would not add any incremental area of development to the project. If the borrow area is deemed too far away, a discrete area closer to the project will be selected, and would be expected to cover a surface area of approximate 2400 m^2.

3.5.7 Connection line

Regardless of which route is selected, the connection line will consist of an indeterminate number of wood poles extending approximately 10 m above the ground surface. The construction of a 10 - 30 m (approximate) wide ROW is required for the connection line.

3.5.8 Management of Waste Materials during Construction

Solid nonhazardous construction waste (e.g. material packaging) generated during the construction process will be removed from the site to an approved disposal location. The MOE advised that the local licensed waste disposal site did not have sufficient capacity to accept the project's construction waste. Therefore, the proponent is required to find an alternative disposal site and/or recycling/composting facility (e.g. licenced waste management facility). The receiving facility may be required to amend its' licence accordingly.

No gaseous wastes other than construction equipment emissions are anticipated. Industrial liquids such as paints, sealants, fuels and lubricating fluids will be stored in secure containment areas and disposed of in accordance with provincial and federal liquid waste disposal regulations (e.g. *Environmental Protection Act*, *O. Reg. 347*, and *Transportation of Dangerous Goods Act*).

3.5.9 Water Crossings

Access to the project area will be by existing roads and access the Frederick House River and construction sites will require approximately 300 m of new road construction as well as road upgrades/repairs to old logging roads. Upgrades to access roads, including upgrades for drainage (culverts, ditches, etc) may be required to allow for the increased volume of construction related traffic.

As noted in Section 3.3.1. a preferred route for the connection line has been identified including several short detours. The route will be constructed almost entirely adjacent to an existing access road and will traverse 18 existing water crossings along its length and skirt 1 wetland

The DFO Overhead Line Construction Operational Statement (v. 3.0, 2007) will be adhered to in order to minimise impacts to fish and fish habitat associated with construction or upgrades to all water crossings.

3.6 OPERATION STRATEGY

This section summarizes how the facility will be operated and how the operation will be modified to address potential effects on the river including seasonal considerations, proposed operating rules and target limits. The full draft operating plan for Wanatango Falls is presented in Annex I-C.

The operations strategy is based on the conceptual engineering design and environmental data available at the time of writing and was developed subsequent to data analysis collected through various studies, including:

- Lidar Survey: detailed topographic mapping of the upstream and downstream river reach;
- Conceptual Design: drawings of the structures as conceptually proposed for the project;
- Hydrology Study: an analysis of the natural river flows;
- Bathymetric Study: a field study of water depths upstream and downstream of the project location and a spot measurement of flows required for hydraulic model calibration;
- HEC-RAS Study: a hydraulic engineering model was carried out under separate cover (i.e. a 1-dimentional HEC-RAS model) to better understand the various hydraulic parameters relevant to assess operational and environmental matters;
- Erosion Survey: a desktop analysis of upstream locations that could be sensitive to future shoreline erosion after the project is built;

- Sediment Study: a review of available sediment transport data and an assessment of the potential for sedimentation concerns related to the project;

- Environmental field studies: studies of environmental areas and aspects of interest as documented in other parts of this environmental report.

As the engineering design is finalized and other environmental information becomes available this strategy may be adjusted to ensure that potential impacts are mitigated.

3.6.1 Site Operating Strategy

The electricity generated from this project has been contracted to the Ontario Power Authority under a FIT Contract. The terms and conditions of the FIT Contract encourage the facility to generate electricity between the hours of 11 am and 7 pm (on-peak hours) from Monday to Friday, when needed most in Ontario.

It is proposed that the Wanatango Falls GS will operate as a "*modified run-of-river*" generating facility. Effectively, the operations of the facility would vary between run-of-river and intermittent operation depending on the flows present in the river. This mode of operation takes into account the objective of building and operating the project in an environmentally sensible manner, while trying to achieve the socio-economic objective of generating power when it is most needed in the Province.

When natural flows exceed the amount of water that can be passed through the turbine, excess water would be bypassed through/over the dam. The combined flow of the water used in the turbine to generate electricity and the water bypassed over the spillway will therefore be equal to the natural flow of the river. This situation occurs primarily during spring run-off conditions and during/after significant precipitation events in the spring, summer and fall.

At low flow periods of the year when natural flows are so low that any available water must be released downstream to protect the environment, flows will be too low to allow for electricity generation. All available water will be passed through/over the dam to maintain aquatic habitat downstream. This situation occurs primarily in late summer and late winter when natural flows are typically very low.

At other times, the facility would "modify" the natural flow in the river by storing some of the natural river flow during off-peak hours to be used during on-peak hours (i.e. intermittent operation) when the need for electricity in the Province is greater.

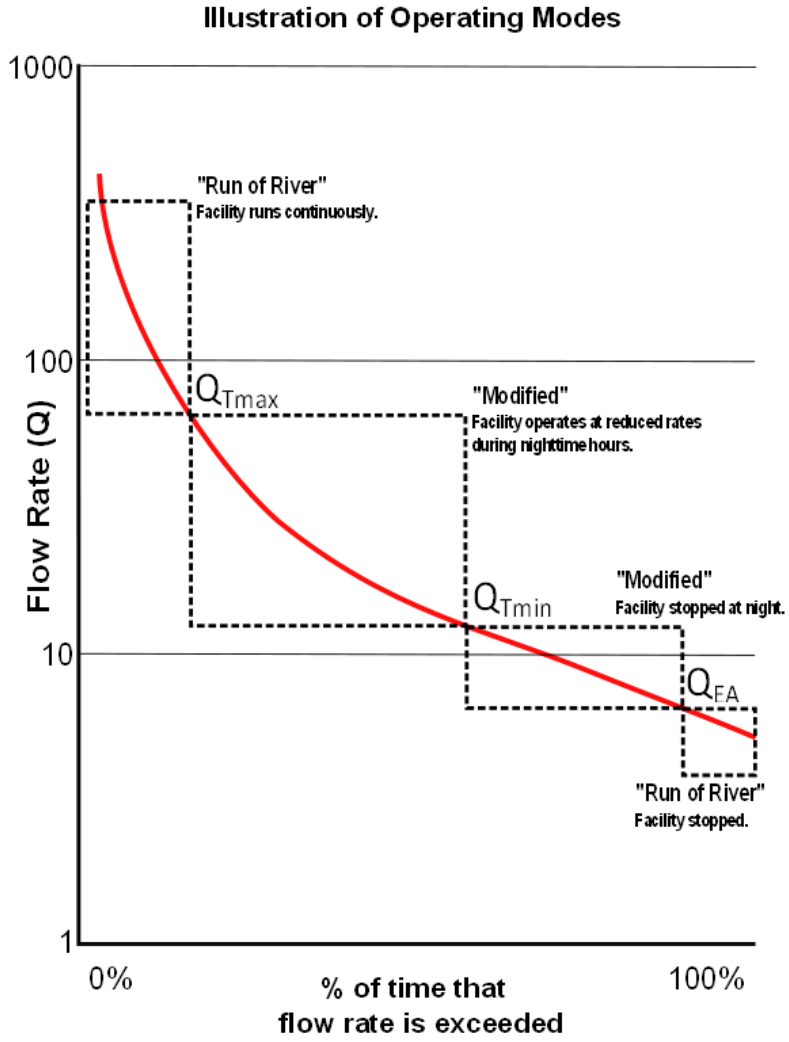
Modified run-of-river operation would occur during moderate and low flows when the natural flow in the river is below the maximum capacity of the turbines but above the minimum flow required to protect the environment. During these flow conditions, some of the natural river flow during off-peak hours can be saved and used to produce electricity during on-peak hours.

When natural river flows are between the minimum and maximum turbine capacity, the facility runs continuously, but some of the water is saved during off-peak hours. This operation results in downstream flows that are smaller than natural river flows during off-peak hours and larger than natural river flows during on-peak hours when electricity use is higher. It is expected that the difference in flow rate would be up to four times greater during on-peak hours in this operating mode. Downstream flows during the off-peak hours can be reduced to less than half of natural river flows.

When natural river flows are below the minimum turbine capacity, the facility will need to stop operation during some off-peak hours to store water until operation is again possible. The lower the natural river flow, the longer the period of stoppage will be. When the facility operates in this scenario, it operates at a rate less than maximum turbine capacity. To ensure that the river downstream of the facility receives enough water flow to protect the environment, an appropriate amount of water is released through a bypass while the turbine operation is stopped. Typically, the facility operation will be stopped during off peak hours to allow the head pond to fill in preparation for operation during on peak hours.

Figure 4 below illustrates the mode of operation that occurs depending on the amount of natural flow in the river.

Figure 4: Modes of Operation



An important factor in modified run-of-river operation is the availability of water storage upstream of the facility. Based on the dynamic modeling (HEC-RAS) of the river channel completed to date, the Wanatango Falls facility may result in inundation and backwater effects up to 0.5 or 9.4 km upstream of the dam, depending upon which project option is chosen.

To achieve the objective of building a project with limited environmental impact, the conceptual design of the facility limits the height of the dam structure, and therefore the depth and the area of inundation upstream. Consequently, the amount of storage available for operation is inherently limited in relation to the natural flow in the river, thereby limiting the storage to a few hours during moderate and low flows. The ability to use this storage is further controlled by environmental constraints outlined in other parts of the environmental assessment document. It

is the limited storage in head ponds that differentiates modified run-of-river projects from hydroelectric projects that create large storage reservoirs with the ability to store water for weeks or seasons to "peak" when seasonal periods of hot or cold weather raise the need for extra electricity production. Typically, modified run-of-river projects have significantly less environmental impact than peaking hydroelectric projects. The proposed Wanatango Falls GS will be operated as a modified run-of-river facility.

3.6.2 Summary of Hydraulic Characteristics

Estimated water levels:	
Normal operating headwater level ("high dam" option)	259 masl
Normal tailwater level downstream of powerhouse	250 masl
Normal operating gross head	9 m
1:100 year flood flow	467 m^3/s
1:100 year low flow	0.01 m^3/s
Long-term average flow	33.2 m^3/s

3.6.3 Operating Parameters for Water Control Structures

In selecting the operation parameters for the facility, the environmental aspects outlined in the previous sections were considered so as to provide a reasonable balance among operational constraints, environmental aspects and mitigation of possible impacts.

It should be noted that changes in upstream levels and downstream flows related to operation occur only when the facility is in modified run-of-river operations mode. While the facility is in run-of-river mode and subject to the amount of natural flow in the river, the upstream levels will be maintained at a constant level and downstream flows will equal the natural flow in the river.

The definition of operating parameters affecting the channel upstream and downstream of the facility has not been completed. These parameters will be developed following the completion of the environmental assessment, based on discussions with key regulators and stakeholders. Xeneca is committed to the construction and operation of the project in an environmentally sensible manner while realizing the socio-economic objective of generating power when it is most needed in the Province.

<u>Operation Parameters</u>

The operating parameters that can be used to manage upstream water levels are:

- Maximum Daily Fluctuation of Upstream Water Levels: Under normal operation and during normal river flows, upstream water levels can be controlled as required by the rate of water use and hence electricity production. In modified run-of-river facilities, a portion of the

normal river flow is typically stored during off-peak hours causing water levels to rise upstream until the rate of production is increased again during on-peak hours when electricity demand is higher. The range of daily water fluctuation in the inundated area upstream of the facility will be determined to mitigate upstream impacts.

- Rate of upstream water level change: To a limited degree, the rate of change of upstream water levels within the daily fluctuation range can be managed by the rate of electricity production while the facility is operating. The possible production rates range from the minimum to maximum turbine flow capacity. The rate of water level and flow increase/decrease within the maximum daily range of fluctuation will be acceptable to protect shorelines and habitat.

- Minimum Upstream Operating Water Level: The minimum upstream operating water level is the water level below which no power is generated during normal operations. It should be noted that the need to provide environmental flows may result in drops of upstream water levels below the minimum water level even if no power is generated. This situation can occur during prolonged periods of drought and cannot be controlled by plant operation.

- Maximum Upstream Operating Water Level: The maximum upstream operating water level is the water level beyond which water is bypassed through the spillway during normal operations to avoid further water level rise upstream. During flood conditions (i.e. the spring freshet), water levels may rise above this level due to natural factors. Various engineering documents or drawings may refer to this level as the "Normal Operating Level (NOL)" or the "Full Supply Level (FSL)".

The operating parameters that can be used to manage downstream flows/levels are:

- Upper Turbine Limit (Q_{TL}): The maximum amount of flow generated by the facility operation while intermittent turbine operation is occurring. The turbine(s) can be operated in a range of flows and outputs ranging from minimum turbine capacity to the maximum turbine capacity. When it is desirable to minimize the difference between on-peak and off-peak flows, the upper limit of turbine operation can be set as an operating parameter. Setting the upper limit has to take into account that the turbines do not operate very efficiently below roughly 65% of their maximum capacity.

- Turbine Ramp Time: This parameter defines how quickly a turbine can shift from being stopped (i.e. not operating) to the desired operating flow. Turbine start up involves going from being stopped to the minimum turbine capacity in a very short period of time. Once the turbine is operating, the turbine capacity can then be increased gradually to the desired operating flow. By increasing the flow gradually, downstream impacts can be reduced.

- Turbine Down Ramp Time: Essentially the reverse of Turbine Ramp Time. The time during which a turbine is taken down to minimum turbine capacity prior to shut down. By decreasing the flow gradually, downstream impacts can be reduced.

- Environmental Flow: The amount of flow that is provided to the Variable Flow Reach during intermittent operation when the turbine is stopped. It should be noted that the environmental flow provided through operations cannot be larger than the natural flow upstream in the river.

- Compensatory Bypass Flow: The amount of flow that is provided at all times to the river reach between the control structure and the powerhouse tailrace outflow. This flow is only relevant where the final design involves a separation between the containment structure and the powerhouse tail water outflow (i.e. where the design creates a section of river that is by-passed by the facility). This flow is not applicable where the final design involves a close coupled design where the powerhouse tailrace outlet is immediately downstream of the containment structure. Where this parameter is applicable it is independent of the facility operation mode.

Potential operational impacts to environmental components vary significantly depending on the mode of operation and flow conditions which are in turn typically dependent on seasonal conditions. For the purposes of the operating plan, the operating seasons have been determined by reviewing a hydrograph of average annual flows and periods of special environmental significance (i.e. fish spawning). Table 2 summarizes the start and end dates for each season as they relate to the operations of the Wanatango Falls facility.

Table 2: Seasonal Hydrological Periods

Spring	April 16th – June 1st (46 days)
Summer	June 2nd – September 1st (92 days)
Fall	September 2nd – November 1st (61 days)
Winter	November 2nd – April 15th (166 Days)

Table 3 provides a description of the proposed operating parameters which have been determined for the facility. As mentioned above, these parameters will be further refined following the completion of the environmental assessment, based on discussions with key regulators and stakeholders.

Table 3: Wanatango Falls Proposed Operating Parameters

Description	Acronym	Project & Streamflow Conditions (m^3/s)			
		Spring	Summer	Fall	Winter
Streamflow Exceeded 99% of the time	Q_{99}	0.2	0.1	0.1	0.2
Streamflow Exceeded 95% of the time	Q_{95}	0.7	0.3	0.3	1.3
Streamflow Exceeded 80% of the time	Q_{80}	2.6	2.7	1.9	17.0
Streamflow Exceeded 50% of the time	Q_{50}	23.3	14.6	18.3	35.0
Streamflow Exceeded 20% of the time	Q_{20}	81.3	40.6	45.2	50.2
Downstream environmental flow target	Q_{EA}	No Int. Op.	2.0	2.0	5.0
Compensatory flow (between tailrace and dam)	Q_{COMP}	2.0	1.0	1.0	1.0
Maximum turbine flow capacity	Q_{TMAX}	50.0			
Minimum turbine flow capacity	Q_{TMIN}	15.0			
Limited turbine flow – Modified ROR	Q_{TL}	32.5			
Long term annual flow, average annual mean	LTAF	33.2			
Median streamflow value	Q_{MED}	27.0			
2 year return period 7-day-average-low flow	7Q2	0.43			
10 year return period 7-day-average-low flow	7Q10	0.14			
20 year return period 7-day-average-low flow	7Q20	0.11			
Streamflow corresponding to high water mark*	Q_{HWM}	160			
High streamflow event; occurrence of 1 in 2 yr	Q1:2	180			
High streamflow event; occurrence of 1 in 100 yr	Q1:100	467			
Turbine Ramp Time	N/A	N/A			
Turbine Ramp Down Time	N/A	N/A			

Notes: Flow percentile information based upon period of record
Low flow statistics based upon Gumbel distribution, High stream flow events (instantaneous) based upon General Extreme Value (GEV)
Qin – instantaneous river inflow, m^3/s
* value obtained from field observation and Hydraulic modeling

3.6.4 Special Event Operation

Operation during special events, such as floods, droughts and safety emergencies may need to deviate from the normal operating parameters to manage flows and mitigate impacts.

- Normal Flood Operation: Normal flood events are defined as flows that exceed the maximum capacity of the plant up to and including the one in two year flood event level. Flood events of this magnitude are normal occurrences in the river and present minimal concern for public safety or environmental impacts. During these periods, the facility is operated to manage water levels upstream below the maximum upstream operating water level where possible. This is achieved by allowing any water that is in excess of the maximum turbine capacity to bypass the facility through the spillway.

- High Flood Operation: High flood events are defined as events that exceed the one in two year flood event level but are within the safe design level of the facility. Flood events of this frequency are anticipated to occur only infrequently over the life of the facility. The objective of this type operation is to ensure public safety. This is typically achieved by allowing any water that is in excess of the maximum turbine capacity to bypass the facility through the spillway and by operating the spillway and the power generation facility in a manner that achieves this objective.

- Extreme Flood Operation: Extreme flood events are defined as events at which the facility cannot be attended safely by operators and where the risk of flooding of the generation equipment is possible. The emphasis on operation is on ensuring public and operator safety. Where advance warning is received that an extreme event may occur, the operation of the facility will be adjusted in advance of the flood peak to maximize its ability to pass water and provide minimal obstruction to the passing of flood waters.

The inundation map and river profile mapping provided in Annex I-C show the water depths and extents for various flood conditions. The objective of flood operation for the spillway, turbine and bypass is to ensure that the backwater inundation effect is minimized and kept within the projected distance limits.

3.6.5 Compliance Considerations

The operation of the facility will be aligned with the existing Abitibi River Water Management Plan (WMP) during a comprehensive review in 2014. The Wanatango Falls Operating Plan will be available to all identified stakeholders (Annex I-C), and will become part of the Abitibi River WMP as an amendment. Xeneca will have the right and obligation to participate in the Abitibi River WMP process.

There is one stakeholder upstream of the proposed generating station: a dam owned by Ontario Power Generation (OPG). The Frederick House Dam is operated to ensure that wildlife, fisheries, navigation and recreational activities are all addressed.

There are a number of stakeholders (proceeding) downstream subsequently. These include:

- Several remote cottages
- A waste disposal site;
- Island Falls Generating Station operated by OPG;
- Six designated camping sites;
- Abitibi Canyon Generating Station operated by OPG;
- Five designated camping sites;
- One remote cottage
- One work camp

- Otter Rapids Generating Station operated by OPG;
- Several remote cottages
- Two designated camping sites; and
- The communities of Moose Factory and Moosonee.

In addition, the closest protected area, Nahma Bog and Poor Fens Conservation Reserve, is located approximately 16 km northeast of the site.

The operating plan for Wanatango Falls should not result in any adverse effects on identified downstream stakeholders. In anticipation of a comprehensive review Xeneca will work with the downstream stakeholders to ensure there are no adverse affects on any stakeholder on the Frederick House River and, within the existing Abitibi River WMP, support positive change for all concerned.

Xeneca suggests that the Operating Plan be accepted based on the Class EA process. Additional issues raised by the Ministry of Natural Resources and stakeholders identified in the Frederick House River WMP will be addressed as part of a comprehensive review related to regulatory approvals that will be required subsequent to the EA but prior to construction.

3.6.6 Provisions for Plan Reviews, Amendments and Plan Renewals

An amendment to the Abitibi River WMP will be required to include the new facility and operator and to incorporate the approved operation plan for the facility/dam. Once this is completed, Xeneca will adhere to any provisions for plan reviews, amendments and plan renewals required by the Abitibi River WMP.

4. FEDERAL, PROVINCIAL AND MUNICIPAL AGENCY AND STAKEHOLDER CONSULTATIONS

This section presents the methods and scope of stakeholder consultation conducted for this proposed development.

4.1 CONSULTATION GUIDELINES

One of the main objectives of the Waterpower Class EA process is to coordinate and integrate the requirements of regulatory agencies under the provincial *EAA* and the federal *CEAA*. This involves gathering information from public, private and Aboriginal stakeholders to identify environmental concerns and to inform project decision makers.

To meet this objective and to effectively engage with agencies and stakeholders, the Waterpower Class EA builds on the public notification requirements mandated under the *EAA*, and other EA processes (i.e. MNR-RSFDP Class EA) which recommend that consultation and engagement planning be incorporated as an integral component of the planning process.

Xeneca's consultation programs are designed to provide the outreach to identify potential stakeholders, engage stakeholders and provide the means and opportunity for participation in the development planning process. The goals of the consultation programs are to:

- Identify and notify potentially interested and affected stakeholders;
- Identify and assess the range of positive and negative environmental and socio-economic effects of the project;
- Address the concerns of adjacent property owners, local and regional interest groups, individual members of the public and Aboriginal communities that may be directly affected by the project.

To achieve these goals, the consultation programs strive to:

- Identify potentially affected stakeholders;
- Describe how the project may affect the natural and socio-economic environment;
- Provide notification to identified stakeholders as prescribed by CEAA and the Waterpower Class EA;
- Inform the public, Aboriginal communities and regulatory agencies where, when and how they can engage in the process;
- Identify public and Aboriginal community benefits, concerns and issues related to the project;
- Address public, Aboriginal community and regulatory agency concerns and issues raised regarding the development and operation of the project;
- Document public, Aboriginal community and regulatory agency input and how concerns were addressed, issues avoided and mitigation measures put into place during project planning.

The records of public, government agency and aboriginal community consultation undertaken in the planning of this development proposal are provided in Appendices C, D and E, respectively.

4.2 CONSULTATION STRATEGIES

The consultation programs undertaken by Xeneca were intended to meet all mandatory consultation requirements as well as to assist in the identification and resolution of environmental concerns relating to the project. Xeneca was responsible for direct consultation with First Nations and Aboriginal communities and the public at large. Public and Aboriginal Community Consultation Plans were prepared by Xeneca for the proposed development and are presented in Appendices D and E, respectively. Key components of the consultation plans including the specific tools and approaches to consultation are described below.

4.2.1 General Print and Mailing

General mailing of reports, notices and letters through postal, courier and electronic methods were used. To promote environmental sustainability, the EA team did attempt to minimize printed media; however, hard copy print was used where electronic formats were not guaranteed to reach the intended target audience and where specifically requested.

4.2.2 Print Media

All print advertising in support of the undertaking was circulated in the Cochrane Times Post and Northern Times to ensure broad formal notification of key project milestones and key meeting dates to members of the public. Public Information Centres (PICs) advertisements were circulated in advance of meeting dates. Advertisements were placed in the Cochrane Times Post in both English and French; copies of the advertisements issued in support of this undertaking are presented in the Appendix D.

4.2.3 Web Media

Throughout the planning process Xeneca has provided regular project status updates through emailing and through its website to complement the consultation and engagement program for the project. Key documents (Project Descriptions, etc) and notifications were provided through emailing and Xeneca's website at www.Xeneca.com; preliminary distribution of Project Descriptions was through the OEL-HydroSys Inc. website at www.wesa.ca. Xeneca personnel also employed other social media communication tools such as regular mass e-mails to stakeholders to gather and provide feedback to the public.

4.2.4 Meetings

Direct and/or teleconference meetings with various stakeholders such as municipalities, and public interest groups were a component of the consultation initiative intended to assist in the identification and resolution of environmental concerns. A summary of these events is presented in Section 4.3.3 and 4.4.

Meetings were held with identified Aboriginal communities as part of the business to business aboriginal consultation initiative. As part of these meetings, considerations to the concerns of First Nations and other Aboriginal communities located in the vicinity of, and/or having a potential interest in the project was afforded. To help facilitate these activities, Xeneca assisted interested Aboriginal communities in accessing government programs and funding.

First Nations and other Aboriginal communities located within or having traditionally used the project area were identified in the MNR Site Information Package provided to the proponent and through dialogue with the Ministry. A copy of all notifications of the proposed undertaking provided by the proponent to First Nation and Aboriginal communities is provided in Appendix E. In addition, Xeneca solicited participation of Aboriginal communities in the Stage II archaeological study for the site and requested their participation in project planning.

4.2.5 Public Information Centres (PICs)

In addition to direct correspondence, a public information centre (PIC) was held to collect information on concerns as well as to allow the EA team to inform members of the public and to provide direct and immediate feedback. The date and time for the PIC was advertised in local publications and notification was sent either by electronic or mail to participating members of stakeholder groups and government agencies well in advance of the scheduled date. Members of Xeneca staff as well as key experts from the EA team were on hand to answer public questions and to address concerns related to the development. The PIC featured posters and maps with information about the project, a copy of which is provided in Appendix D. Attendees of the meeting were asked to provide their name and contact information, to identify whether they wished to be provided with project updates, and to provide feedback on the project. A summary of these events is presented in Section 4.4.

4.3 GOVERNMENT AND AGENCY CONSULTATION

The EA team was tasked with provincial and federal regulatory agency consultation. Xeneca issued a Notice of Commencement for the proposed undertaking on July 29th, 2010. A revised Notice of Commencement was issued on November 11th, 2010. A copy of each NOC is provided in Appendix D. The Project Description document was provided to regulators on March 18th, 2011. A complete record of contact and evidence of the provincial and federal government consultation effort is presented in Appendix C.

The EA team engaged federal and provincial agencies during an EA Coordination meeting on April 20th, 2011 to introduce the project and collect feedback for regulatory approvals, permitting and requirements and project scoping. Both the municipalities of Iroquois Falls and Cochrane were invited to the meeting but unable to attend.

A summary of the consultation events with government regulators and stakeholders is presented below. For the reader's convenience, a summary of the issues identified during the regulatory agency and public consultation process is provided in tabular format as Table 4 (Identified Issues and Management Strategies). The table also identifies whether and how resolution of the identified issue has been or may be addressed, and which issues remain unresolved. Future efforts proposed towards the resolution of these issues are outlined in Section 5 of this report.

4.3.1 Federal

Canadian Environmental Assessment Agency

The Canadian Environmental Assessment Agency (CEA Agency) was provided with an introductory letter and project overview by Xeneca in June 2010. In a July 12, 2010 response to Xeneca, the CEA Agency acknowledged receipt of the project overviews for several Xeneca proposed waterpower projects including the Wanatango Falls on the Frederick House River. The proponent was advised that the Agency would be acting at the Federal Environmental Assessment Coordinator (FEAC) for the proposed projects. The CEA Agency requested a detailed Project Description and clarification as to whether federal funding was being contemplated for the project. The proponent was advised that federal agencies to be contacted through the FEAC would include Environment Canada, Fisheries and Oceans Canada, Health Canada, Indian and Northern Affairs Canada, Natural Resources Canada, and Transport Canada. Xeneca was informed that documents may be made available to the public, and that information related to the EA will be included in the Canadian Environmental Assessment Registry.

A copy of the project description was provided to the FEAC and each of the above referenced federal agencies on March 18, 2011. The baseline surface water quality investigation report was sent to CEA Agency on March 22, 2011. This report documented the results of the surface water monitoring program undertaken throughout the 2010 field season.

An EA coordination meeting was held on April 20, 2011 at Timmins District MNR but no representative from the CEA Agency was able to attend. In an April 20th email, the agency notified the proponent that triggers were identified under the *Navigable Waters Protection Act* and the *Fisheries Act* and that Transport Canada and Fisheries and Oceans Canada would be acting as the Responsible Authorities for the project. Natural Resources Canada, Environment Canada and Health Canada would be providing expert advice and information as required.

The proponent was provided with the scoping document for the federal screening of the proposed project on June 29, 2011. The document established the scope of the project and the environmental components to be assessed in the screening report. The scoping document stated that the report must contain enough information to be understandable as a stand-alone document and which will constitute the basis for the Responsible Authorities' decision under

Section 20 of the *Canadian Environmental Assessment Act*. The Scoping Document for the Federal Screening of the Wanatango Falls Hydroelectric Generation Station Project on the Frederick House River is provided in Appendix C.

On June 30, 2011, the proponent provided the CEA Agency with an electronic copy of the Public Consultation Plan for Wanatango Falls.

Fisheries and Oceans Canada

A meeting was held on February 11, 2011, between Xeneca, NRSI, OEL, Fisheries and Oceans Canada (DFO) and the Ministry of Natural Resources, to discuss the necessary *Fisheries Act* authorizations for Xeneca's proposed projects (including the Wanatango Falls), potential impacts on fish habitat and habitat compensation.

DFO was provided with the baseline surface water quality investigation report on March 22, 2011.

DFO was in attendance during the April 20, 2011 EA coordination meeting via teleconference, during which its role as a Responsible Authority under the *Fisheries Act* for the project was confirmed. The agency representative stated that in order to obtain Authorizations under the *Fisheries Act*, the proponent would also be required to satisfy the Ministry of Natural Resources' Fisheries Management Objectives.

The agency participated in a meeting on April 28th -29th 2011, to discuss the proposed operational strategies for multiple waterpower projects in the province proposed by Xeneca. For each project, the general layout of engineering, connection line and access road routing methodologies and preliminary results, summary of hydrology assessments (including HEC RAS modeling), environmental aspects (natural heritage) and consultation program summary was presented. Outcomes of this event identified the requirement to meet with DFO and MNR to discuss seasonal flow and water level requirements in order to establish the operating regime for the facility. Meeting minutes are provided in Appendix C.

DFO participated in a teleconference meeting to assist in the scoping of the 2011 biological field investigations. During the meeting, DFO commented on the importance of replacing critical fisheries habitat that could be lost or altered, acknowledging that it is not always possible to provide compensation on a 1:1 basis. Additionally, DFO cautioned that any compensatory habitat does not create opportunities for invasive species.

The agency had not yet completed its review of the federal scoping document when it was released on June 29, 2011, but the department agreed to the release provided that any comments they may have at a later date be incorporated into a revised scoping document.

In a July 20, 2011 letter, DFO informed the proponent that the proposed project at Wanatango Falls would require one or more Authorizations under the *Fisheries Act.* The agency confirmed that Authorizations will be required under Sections 32 and 35 (prohibiting the destruction of fish by any means other than fishing, and the harmful alteration, disruption or destruction (HADD) of fish habitat, respectively). The proponent was also advised that project location and design elements and effective mitigation measures can be applied to satisfy the requirements of *Fisheries Act* habitat provisions under Sections 20(1), 22(1) and 22(3) which concern the obstruction of safe fish passage, the obstruction of downstream passage, and the effects to downstream flows, respectively.

Transport Canada

On September 28, 2010, Transport Canada (TC) provided comments to the CEA Agency on the draft Project Descriptions issued by the proponent. TC noted that where there is a proposal for new works including dams, booms, and watercrossings, the *Navigable Waters Protection Act* (NWPA) will be triggered. TC requested that when required to confirm its role under CEAA prior to receiving a Request for Project Review under NWPA (from the proponent) it was that advised that navigability inquiry to the Navigable Waters Protection Office be submitted in advance of the issue of the Project Description. The agency could provide an opinion as to the navigability of the waterway and whether or not the NWPA will apply to the project. The proponent was advised to include the results of this navigability assessment in the Project Description if possible.

The baseline surface water quality investigation report for Wanatango Falls was provided to the agency on March 22, 2011. In an email dated April 19, 2011, TC noted that the project may cross or affect a potentially navigable waterway, and therefore TC would be acting as a Responsible Authority. TC is responsible for the administration of the NWPA which prohibits the construction or placement of any "works" in, on, over, under, through or across navigable waters without first obtaining approval. TC added that Xeneca would have to submit a NWPA application.

Environment Canada

Environment Canada (EC) received the baseline surface water quality investigation report for Wanatango Falls on March 22, 2011. EC was in attendance during the April 20, 2011 EA coordination meeting via teleconference, during which it was confirmed that it would be providing expert advice and information for the proposed undertaking as required.

Natural Resources Canada

Natural Resources Canada attended the April 20, 2011 EA coordination meeting via teleconference. It was noted during this meeting that NRCan will also provide expert advice and as required.

4.3.2 Provincial

Various provincial ministries were provided copies of an introductory letter, a Notice of Commencement, a revised Notice of Commencement and the Project Description document for the Project. A record of government agency consultation is provided in Appendix C.

The following is a synopsis of correspondence and consultation undertaken with provincial agencies.

Ontario Ministry of Natural Resources

The Ontario Ministry of Natural Resources (MNR), owing to its mandate to manage natural resources and to promote renewable energy in the province, has been engaged on the proposed project from an information request, baseline research permitting, and environmental assessment planning perspective.

Prior to the EA planning phase of the project, the Ministry of Natural Resources, Cochrane District office, provided instructions specific to site release issues Site 4MD02. The MNR provided field investigation scoping guidance to the EA team throughout 2010-2011 and detailed issues pertaining to the project that the ministry would like to see addressed through the environmental assessment of the proposed project. A summary of ministry correspondence is provided below:

- July 18, 2007, the proponent received confirmation of receipt of the Non-Competitive Site Release Application for Waterpower for the Wanatango Falls site
- On January 22, 2010, Xeneca informed the MNR that they would initiate scoping of environmental issues in preparation for field studies scheduled in the spring of that year, and requested a Site Description Package for the proposed project site.
- Additional correspondence between the Ministry and the proponent regarding project status during February 2010.
- April 12, 2010, comments from MNR to EA regarding field study methodology in support of scientific collectors permit.
- April 28, 2010, correspondence from MNR noting that proponent should be in receipt of Site Information Package, and a request for an update on First Nation consultation.
- September 24, 2010, teleconference call with the proponent and EA team members to discuss endangered species in the project area. Subsequent to the background review, 2010 field investigations and MNR Species at Risk (SAR) mapping that there were as yet no known or confirmed SAR in the study area, as such no permits under the Endangered Species Act were presently required. However the presence of Lake Sturgeon below Zeverley's Rapids and Wanatango Falls means that they must be included as a Valued Ecosystem Component for this project. MNR has conducted radio tagging monitoring of 90 Lake Sturgeon from this population to date. No studies have been conducted to confirm the limit of the upstream

migration presently believed to be Zeverley's Rapids. Upstream migration of the Sauger over the falls has been confirmed through telemetry studies. Further discussions ensued relating to migration and telemetry studies; meeting minutes are provided in Appendix C.

- January – February 2011, correspondence between members of the EA project team and the Ministry for Natural Heritage information requests and applications for Scientific Collectors Permits.
- February 11, 2011 meeting with DFO and EA team to discuss *Fisheries Act* authorizations potential impacts on fish habitat and habitat compensation.
- May 2, 2011 meeting with DFO and EA team to discuss scoping for 2011 field investigations.
- May 11, 2011, clarification requested from MNR regarding proposed operational plan.
- June 15, 2011, operational discussions between the proponent, the ministry, and the EA team.

The Ministry was provided with a copy of the baseline surface water quality investigation on March 22, 2011.

MNR met with members of the EA team for field studies on March 24, 2011, and advised that First Nation consultation in advance of any telemetry (radio tracking) studies is recommended. Ministry staff were in attendance at the March 24, 2011 PIC.

An EA coordination meeting was held on April 20, 2011 at the Ministry's Timmins District office. A number of topics were discussed at the meeting, a summary of which is provided below. Meeting minutes are included in Appendix C.

- A synopsis of the project site including a second development option which would extend the zone of inundation was discussed.

- Confirmation of a harmonized environmental assessment process to integrate federal and provincial EA planning requirements was given. It was agreed that the planning requirements under the MNR Resource Stewardship and Facility Development Projects Class EA for the connection line corridor could be harmonized under the Class EA for Waterpower Projects.

- It was noted that although there may be gaps in the data collected to date, the proponent was committed to completing any further studies prior to the permitting phase. MNR responded that there remained a public consultation requirement to present the findings of these investigations which could otherwise lead to a Part II Order request.

- The Ministry reminded the proponent of the First Nation rights to consultation, noting that the absence of a consultation record could lead to a Part II Order request, stating that the MNR did not recommend the proponent's present approach to Aboriginal consultation.

- MNR requested additional detail in the connection line mapping, that since the line crosses to Ministry districts, additional public consultation may be required.
- The MNR identified both Iroquois Falls and Cochrane as PIC locations, and noted that the proponent should seek to include additional project information in any future PICs. The MNR offered to facilitate public consultation through an internal stakeholder distribution list. public consultation processes
- Also discussed during the coordination meeting were legislation, permits/approvals and field studies.

On April 28th and April 29th 2011 a meeting to discuss the proposed operational strategy for the facility was held with district and regional level staff of the MNR, MOE and DFO. The proponent presented the conceptual engineering design for the site, and the proposed Operation Plan, which included maps of the upstream inundation zone of influence for the Wanatango Falls site. During the meeting, it was noted that two design options were being considered due to land ownership issues. The MOE raised the issue of mercury levels in fish tissue and results from the 2011 tissue sampling investigation, recommending that data on mercury levels be made available for public use.

At the June 15th 2011 meeting the ministry was presented with the updated operational strategy for the facility and preliminary results from the 2011 field season. The ministry was then engaged in discussions on what operational or design parameters could be modified in order to avoid or mitigate impacts to identified habitat features and what further work would be required to satisfy data collection requirements prior to the completion of the EA and permitting.

On June 30, 2011, MNR was sent an electronic copy of the Public Consultation Plan for Wanatango Falls.

Ontario Ministry of the Environment

The Ministry (MOE) was provided with an early information package from the proponent in June 2010. On August 12, 2010, the proponent received a letter from the Regional Environmental Assessment Coordinator of the Technical Support Section, Northern Region, in response to the information package. Within this correspondence issues pertaining to the "managed" status of waterways, Notice of Commencement requirements and requested revisions, the coordination of planning meetings, suggested MOE contacts for the project, Aboriginal and public engagement and consultation, permitting, and issue resolution requirements were identified. The proponent subsequently replied to the correspondence via email on September 30, 2010, clarifying a number of issues, and as advised re-issued improved Revised Notice of Commencement in November, 2010.

The baseline surface water quality investigation report was sent to MOE on March 2011. MOE was in attendance during the April 20, 2011 EA coordination meeting, noting that the accelerated timeline for the EA required a minimal level of field investigations and evaluation in order to satisfy regulatory requirements. The ministry commented that the proponent's approach to commit to the investigation of outstanding issues in the ER may not satisfy the requirements of the Class EA. MOE clarified that there remained a public consultation requirement to present the findings of investigations and that not doing so could lead to a Part II Order request. The MOE also suggested that the local landfill may not have sufficient capacity to accept construction waste that would be generated by the project, advising the proponent to investigate alternatives. Meeting minutes are provided in Appendix C.

The ministry was present at the June 15th 2011 meeting was presented with the updated operational strategy for the facility.

A copy of the Public Consultation Plan for Wanatango Falls was provided to the ministry on June 30, 2011.

Ontario Ministry for Municipal Affairs and Housing

In a December 3, 2010 email, the Ministry of Municipal Affairs and Housing stated that it does not need further notification in the EA planning process for the Wanatango Falls project.

Ontario Ministry of Northern Development, Mines and Forestry

In correspondence dated July 8, 2010, the Ministry of Northern Development Mines and Forestry (MNDMF) provided a response to the review of Xeneca's project proposals. Several mining claims were identified within the proposed project area. MNDMF detailed the status of land tenure and mining-related hazards at the dam sites, whether past mineral exploration activity has been reported in the vicinity of the sites, and conditions in regards to various policies and acts. MNDMF indicated that a similar review will be required for the connection corridors for all the projects as they range in length from 1.1 to 22 km.

Further, changes to the *Mining Act* in Ontario now recognizes waterpower and other resource development and provision exists for the claim holder to cede first right of refusal on surface rights to the developer of a renewable energy facility (note excerpts from Mining act and attached letter from Ministry of Northern Development and Mines stating terms of the mining act as it applies to renewable energy development Appendix C).

To properly close this file, the mining claim holder must sign off on surface rights. Xeneca will contact all claim holders in the project area, and an agreement for signature that will acknowledge the project and the terms under which Xeneca will develop the site.

Ontario Ministry of Energy

The baseline surface water quality investigation report was sent to the Ministry of Energy on March 22, 2011. A ministry representative was in attendance for the April 2011 EA coordination meeting, stating that the ministry's role in the undertaking was as an observer only.

4.3.3 Municipal

The proponent met with the mayor and council of the Town of Iroquois Falls on November 22, 2011 to present a briefing on the proposed project. Information presented in PowerPoint included:

Background on Xeneca
Xeneca's consulting team members
Benefits of waterpower
Overview of the Development Process
Overview of the Class EA process
Project design concept
Economic impacts

The proponent met with Cochrane Town Council on March 25, 2011 to present a briefing on the proposed undertaking. Council was provided with a copy of the Project Description in advance of the meeting. Xeneca presented a project briefing and overview entitled "Waterpower on the Frederick House Addressing Multiple Objectives". Members of council asked specific questions concerning revenue and potential impact throughout the process. The proponent intends to follow-up with the Corporation of the Town of Cochrane regarding passing a resolution in support of the Wanatango Falls GS project.

Currently, Xeneca is in discussions with the Town of Cochrane regarding providing a project update and Environmental Assessment briefing to Mayor and Council. Dates unconfirmed at publish time.

4.4 PUBLIC CONSULTATION

Public Consultation was undertaken by the proponent in the form of a Public Information Centre (PIC) in Cochrane on March 24. 2011. The PIC was advertised in local publications at least ten days prior to the event; copies of the print advertising are provided in Appendix D.

Initial contact with the public interest groups listed below was in the form of a letter dated October 15, 2010, containing details of a potential PIC which was subsequently rescheduled.

Coureurs de Bois Adventures
Jackpine Snowmobile Club
Kirkland Lake District Game & Fish Protective Association
Temiskaming Shores & Area Chamber of Commerce
Temiskaming Shores & Area Tourism Information Centre
Tri-Town & District Chamber of Commerce

Other public interest groups that were subsequently added to the contact list include:

Iroquois Falls Community Development
Cochrane Town Council
Friends of High Falls
Cochrane Board of Trade

A brief summary of Xeneca's public consultation initiative, and the concerns raised during the consultation process is presented below.

The proponent received inquiries from members of the public regarding water levels and proposed routes for connection lines and roads. When requested, these were added to the proponent's list of stakeholders. A representative from the Iroquois Falls Community Development requested, via a November 4, 2010 phone message, that a PIC be held in the town of Iroquois Falls. The representative was informed that the proponent would be meeting with the Council on November 22, 2010, to give a project briefing. An email was issued by the proponent to its stakeholder list on March 15, 2011 extending an invitation to the PIC on March 24, 2011.

A PIC was held at the Tim Horton Event Centre in Cochrane on March 24, 2011; approximately 25 individuals attended. During the PIC, an attendee identified a hiking trail along the east side of the river, going southward from Zeverly's Road, and expressed concerns about the connection line intersecting the trail. A local landowner requested that he receive advance notice of any biology studies requiring that fish be anesthetizing owing to possible effects to humans subsequent to consumption of fish tissue. An agricultural landowner downstream of the proposed project location expressed concerns about impacts to property from water level fluctuations. Two trappers in attendance at the PIC noted that changes in upstream water levels would restrict their boat access for trapping beavers, adding that higher water levels may push beavers into deeper parts of the river, or further inland to less accessible areas along the trap line; however, they indicated that this was not viewed as a significant impact to their activities. A member of the Ontario River Alliance requested information about the Part II Order process, and was advised to bring project concerns to the proponent as soon as possible to facilitate the resolution of those concerns. One PIC attendee expressed satisfaction about the information provided at the PIC, adding his support for the proposed development.

In an April 12, 2011 email, a representative from Friends of High Falls requested that all information presented at the March 24 PIC be made available on the company website. The proponent responded that the PIC featured both generic waterpower panels and project specific panels, and that only the latter were presently posted on the corporate website. All PIC panels were subsequently added to the website, and an electronic copy was sent to the representative.

At the PIC, Xeneca was approached by the president of the Cochrane Board of Trade and asked to speak at their Annual General Meeting. Xeneca was unable to attend the 2011 AGM but will consider this request in the future.

In an email dated September 13, 2011, the president of the Nighthawk Lake Cottagers Association contacted Xeneca to request project information, specifically regarding potential impacts on Nighthawk Lake. Xeneca responded that Nighthawk Lake is outside the boundaries of the zone of influence.

Xeneca has recorded all public comments and concerns for the proposed Frederick House River projects over the course of the EA planning process and will continue to do so throughout the development process. A record of public participation compiled by Xeneca is provided in Appendix D.

Due to the confidential nature of some stakeholder correspondence, requests for specific documents or correspondence will be taken under consideration by Xeneca. Please submit requests for specific correspondence documents to Xeneca's Public Affairs team at (416) 590 9362.

A summary of the identified issues and concerns raised during the public consultation process is provided in Table 4.

4.4.1 Industry

In a June 1, 2011 email, OPG noted that they own and operate a control dam immediately upstream, as well as several generating stations downstream, of the proposed project site. As requested by OPG, the proponent added the latter to the stakeholder list, along with confirmation that the proponent's engineering group would contact OPG.

4.5 ABORIGINAL ENGAGEMENT

Aboriginal communities hold a unique position in Canada, and have a legally protected right to participate in the development and review of resource management strategies or plans in areas they assert to be traditional territories, including Crown lands outside areas where treaties apply.

While it is understood that consultation with Aboriginal communities is the responsibility of government and that consultation is deemed to be a government to government mandate, Xeneca supports the approach harmonizing government duty to consult and the proponent's engagement and consultation requirements as directed by the Waterpower Class EA planning process. Corporately, Xeneca also supports the development of business to business relationships with identified Aboriginal communities and the company believes in providing economic opportunities to Aboriginal communities in support of GEA and Ministry of Natural Resources Site Release Process objectives.

A complete list of involved Aboriginal communities, a record of engagement to date and an Aboriginal Consultation Plan is presented in Appendix E. A brief summary of the consultation outcomes to date is presented below.

Xeneca corresponded with the following identified First Nations regarding the proposed undertaking:

- Taykwa Tagamou First Nation (TTFN)
- Wahgoshig First Nation
- Wabun Tribal Council
    - Matachewan First Nation
    - Mattagami First Nation
    - Flying Post First Nation
- Northern Lights Métis Council
- Métis Nation of Ontario

Subsequent to receipt of the Ministry of Natural Resources' Site Information Package which categorizes First Nations and Aboriginal communities into "Identified" and "Local" designation, the final list of communities involved at Wanatango Falls were determined to be:

Identified	Local
Matachewan First Nation	Flying Post First Nation
Mattagami First Nation	Wahgoshig First Nation
Taykwa Tagamou First Nation	Northern Lights Métis Council
	Métis Nation of Ontario

In addition to the above noted communities, the proponent also provided Information to the Northern Lights Métis Council and the Métis Nation of Ontario.

Letters were sent out to TTFN (June 24, 2010) and the Métis Nation of Ontario (June 10, 2010), informing them that Xeneca is preparing the necessary documents for the Class EA process, and that they will soon be engaging the affected communities in Class EA consultation. The Wahgoshig FN received this letter in August 2010.

A meeting was held between TTFN and Xeneca on July 12, 2010, during which the proposed development at Wanatango Falls and the Class EA and associated field investigations were discussed, and a possible business relationship and/or partnership were explored. During the meeting members noted that the community has knowledge of Pickerel (Walleye) Sturgeon, Pike and Sauger in the Frederick House River.

In a September 16, 2010 letter, Xeneca invited Identified, Local First Nation and Northern Lights Métis Council to participate in archaeological studies that would be conducted in the project area.

In a September 20, 2010 email to Xeneca, Wahgoshig FN expressed interest in the proposed project, and requested that a meeting be held in the community.

On October 1, 2010, the Métis Nation of Ontario submitted a Letter of Support for Xeneca's decision to issue a Notice of Commencement for eighteen FIT projects across the province.

On October 13, 2010, the TTFN, Wahgoshig FN and the Métis Nation of Ontario, were issued invitations to attend a Public Information Centre scheduled for November 2010; this PIC was later re-scheduled.

On October 14, 2010 a meeting was held in Timmins with Wabun Tribal Council and 5 member communities, Matachewan, Mattagami, Flying Post, Chapleau Ojibwe, and Brunswick House First Nations. Xeneca provided a presentation about the projects and described the FIT contract process and its First Nation engagement strategy. The dialogue included Wabun and member community's approach to resource development and the requirement for an agreement to support environmental assessment and business relationships. A teleconference was held in February 2011 to continue the development of the Memorandum of Understanding (MOU) and to provide more background information on project economics and partnerships. In August 2011 another meeting was held with Wabun to further develop the MOU and define economic participation. Discussion with Wabun Tribal Council is ongoing and progress towards a Memorandum of Understanding continues.

In November 2010, TTFN issued their consultation protocol to Xeneca. The protocol provides details related to economic benefits, environmental considerations, capacity building and in general how resource development proponents are to engage with the community.

Project Descriptions were distributed to all the Identified and Local Aboriginal Communities, in December 2010 and/or May 2011.

The proponent was informed by the Wabun Tribal Council in early 2011 that until a MOU between Xeneca and the Tribal Council is accepted by all parties, the consultation and engagement process cannot begin. Similarly, in early February 2011, TTFN indicated that it will not support the project until the proponent enters into discussions and the development of an IBA as per the Protocol set out by the First Nation. Xeneca responded to the TTFN that they would draft an MOU in line with the TTFN Protocol.

A meeting was held between TTFN and Xeneca on March 24, 2011, during which business relationships, funding, economic benefits, environmental effects (including fish passage at the water control structure, water levels), consultation protocols, participation in archaeological studies, and the project timeframe were discussed.

The Stage 1 archaeological summary report was provided to the Identified and Local Aboriginal Communities.

The proponent received correspondence from legal counsel to the Wahgoshig First Nation on August 11, 2011, requesting a meeting between WFN and Xeneca.

A draft Aboriginal Consultation Plan was provided to all the Identified Aboriginal and Local Aboriginal Communities on August 31, 2011.

Due to the confidential nature of some stakeholder correspondence, requests for specific documents will be taken under consideration by Xeneca. Xeneca is also aware of the sensitivity of Aboriginal communications and must consult with the Communities regarding the release of this information. Please submit requests for specific correspondence documents to Xeneca's Aboriginal Affairs Liaison, Dean Assinewe, at (416) 590-9362.

5. EVALUATION OF POTENTIAL PROJECT EFFECTS

Environmental assessment legislation in Ontario defines an effect as:

"(a) any change that the project may cause in the environment, including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by First Nations persons, or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance and (b) any change to the project that may be caused by the environment, whether any such change occurs within or outside of Canada."

The purpose of an environmental assessment is to identify all the ecosystem components that make up the environment (biological, social and economic) within the project area, and evaluate how the project would affect these valued ecosystem components during its construction, operation and end of life cycles. The EA team has adopted the conceptual hierarchy of avoidance, prevention and mitigation for the project. Where an impact cannot be avoided or prevented, mitigation measures were considered.

Mitigation measures include:

- Reducing the magnitude and duration of the impact;
- Repairing the situation post-impact to return to a pre-impact state;
- Offsetting the impact through other means.

Investigations undertaken in support of this project identified the anticipated effects of the project, at both the generating station site and ancillary components as presented in Sections 3.2 and 3.3, respectively. Once identified, the EA team worked collectively to apply its expertise to finding solutions to avoiding, mitigating or minimizing the identified effects.

The results of the project life-cycle potential impact analysis based on available data and information and recommended mitigative measures are presented and discussed within this report. Additionally, the results of the technical investigations completed by the EA team members are provided in the Annexes which accompany this document. A summary of the recommended mitigative measures is presented in tabular format for the reader's convenience in Table 4.

5.1 IDENTIFIED POTENTIAL EFFECTS

Project effects and management strategies considered by the EA team during the preparation of conceptual site designs, construction plans and operation plans, and those identified through the consultation program, are discussed below. The discussion is divided into areas of the proposed development as indicated:

- identified zone of influence - upstream;
- area of impact of the facility site and ancillary components; and,
- identified zone of influence – downstream.

An additional assessment of effects will be undertaken subsequent to the 2011 field investigations, and further discussion is planned between the EA team and interested parties.

The results of the project life-cycle impact analysis and recommended mitigative measures have been presented and discussed within the main report as well as in the appended investigation reports. A summary of the recommended mitigative measures is presented in Table 4.

TABLE 4: Identified Issues and Management Strategies

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
General Natural Environment				
Air quality	Noise from operation of electrical generator and transformer at powerhouse/electrical connection	• design powerhouse to reduce level of noise outside the powerhouse building.	Low negative impacts - impacts mitigated or eliminated where ever possible through design	Yes
	Exhaust emissions from equipment and vehicles (construction and operation of facility)	• implement standard construction site best management practices • reduce equipment engine idling • limit the use of diesel generator during operation (typically only in emergency situations)	Low negative impacts - impacts mitigated or eliminated where ever possible, C of A for emergency generator will be required	Yes
	Odour	• utilize approved waste disposal sites and best practices for VOC/organic waste disposal • appropriate disposal containers will be available for the prompt disposal of waste • full disposal containers will be removed to the appropriate waste disposal facility on a regular basis • organic/food waste will be collected daily and stored in closed, animal resistant containers until disposed of at an approved waste disposal site or incinerated on-site according to project permitting standards • an attractant management policy to minimize the effect on wildlife from the storage, preparation and disposal of food products at the construction camp will be implemented	No impacts anticipated - proper management policy implementation and handling of VOC/organic waste onsite and offsite disposal at an approved disposal location will mitigate potential impacts	No
	GHG Offsets	• waterpower can offset GHG emissions from coal fired generation.	Positive effects due to GHG offsets by building a hydroelectric generating station to generate 19,180 MWh per year of renewable energy represents the displacement of 13,226 tons of carbon dioxide equivalent	Yes
	Dust emissions from construction activities and vehicles	• project personnel will control dust at work sites when it is warranted by the conditions • a water truck or alternate method will be used to suppress dust on all project roads and work areas when required as a result of dry or dusty conditions • dust control techniques will be implemented prior to reaching critical conditions • trucks will be required to use dust covers when traveling through populated areas	Low negative impacts - impacts mitigated or eliminated wherever possible.	Yes
	Local/regional smog, fog, thermal effects, icing and micro-climate	• project will be a small modified run-of-river hydroelectric facility located in a relatively pristine and remote rural area and will produce no emissions during normal operations	No impacts anticipated	No

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Water quality (surface and groundwater)	Surface water - general construction activities along shoreline of waterway at facility and water crossings along connection line route and access roads	• implement standard construction site best management practices • construction machinery should arrive on site in a clean condition • ensure a spill response and contingency plan is in place • maintain appropriate emergency response measures • implement wet weather restrictions • stabilize all waste materials above the high water mark • use mechanical means (not chemical) to clear and manage vegetation within ROW • all concrete work will be completed in dewatered areas, water will not be reintroduced to dewatered areas until concrete is cured • project personnel will be made aware of safe concrete handling procedures. Concrete handling will employ watertight forms, spill contingencies, and designated truck clean out pits. • contractors will have prepared and will follow a Care of Water Plan • construction of earthworks will be scheduled to minimize duration of exposure • turbidity of water close to construction site will be monitored; • contain material when working near water bodies; cofferdam, silt curtains, sediment traps and settling ponds • removal of riparian vegetation should be minimised • no excavation or borrowing will be done without the appropriate plans, surveys, permits, and approvals in place • where practical, existing borrow sites and associated roads, trails or cut lines will be used instead of developing new sites • borrow sites for aggregate will be located in upland locations and separated from streams and lakes by a minimum 30 m wide buffer of undisturbed terrain in order to minimize potential for siltation • borrow area will be staked to prevent accidental over-extension of the affected area	Low negative impacts - impacts mitigated or eliminated wherever possible through implementation of mitigation measures	Yes
	Surface water - In-water works construction and removal of the cofferdam: potential for excess sediment to be suspended and carried downstream by river flow	• Ensure that all rock materials placed into the river have been prewashed. • Construct and remove the cofferdam during an appropriate low flow period. • Ensure that construction takes the least possible time by having all construction materials and necessary equipment available prior to construction or removal of the cofferdam. • Avoid construction and removal during the time typically associated with spawning and egg incubation times of warm water fish species (typically April 1 to July 15). Specific timing windows should be agreed to with the local MNR as part of the permitting process; • where conditions permit, implement further sediment control measures as required according to prepared sediment control plan	Low negative impacts - Due to the velocities present in this section of river, it may not be possible to isolate the cofferdam construction from the channel using a silt curtain or equivalent, in this case; Adhere to all applicable standard best management practices available to the industry as applicable	Yes

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Water quality (surface and groundwater)	Contamination from spills or leaks of hazardous substances	• spill prevention and containment measures to be put in place throughout operational period • ensure that workers are adequately trained in the implementation of a prepared spill response plan • personnel will be trained in the requirements for the storage and transport of hazardous material • ensure availability of spill control equipment and materials • store hazardous materials at least 150m away from water bodies • provide impervious dikes and liners around oil, fuel and chemical storage areas • avoid in-water works during periods of high precipitation • refuel machinery on impermeable pads or pans designed to allow full containment of spills a minimum of 30m from water bodies • fuelling and maintenance activities should occur within an area where sediment erosion control measures and all precautions have been made to prevent oil, grease, antifreeze or other materials from inadvertently entering the ground or the surface water flow • monitor area for leakage; in the unlikely event of spillage the supervising engineer would halt all construction activities and corrective measures would be implemented; any spills would be immediately reported to the MOE Spills Action Centre (1.800. 268.6060) • All hydrocarbon fuels, oils, and lubricants will be stored in a secondary containment area • Drip pans will be installed on equipment to intercept minor leaks • Sumps will be installed including an oil trap to prevent contaminated water from being pumped into a water course • All fuel or lubricant contaminated materials will be collected and trucked to an approved regional disposal facility, or will be treated with in situ bio-remediation techniques approved by the Proponent and Regulators	Low negative effect - impacts possible in the event of accident/malfunction; impacts mitigated or eliminated wherever possible through implementation of mitigation measures	Yes
	Surface water - Inundation area at Wanatango Falls site may alter water quality (methyl-mercury) in reservoir	• woody debris will be removed from inundation area prior to headpond filing • headpond created in association with the project will be relatively small when compared to other hydropower projects where mercury enrichment has occurred	No impact anticipated - The headpond at Wanatango is relatively small. The proponent will meet with regulators in order to determine further sampling (fish tissue, soil, surface water) and follow-up monitoring requirements and establish a mitigation and monitoring plan for this section of the Frederick House River	No
	Surface water - Fluctuation of inundation area upstream and fluctuation flows downstream caused by intermittent operation of facility increasing suspended sediment	• maximum suspended sediment concentration should not decrease the Secchi disc reading by more than 10% • Limit maximum daily fluctuations of upstream water levels • Limit the rate of change of upstream water levels • Where the potential for shoreline erosion or ice scour is observed, inspect and monitor for signs of erosion in year one and year five of operation to document degree of erosion and develop and implement additional mitigation measures as required • Facility will operate as a modified run of river facility (run of river operation during extreme high and low flow periods of the year	Negative impacts possible - impacts mitigated or eliminated wherever possible through use of mechanical and vegetative erosion controls at key points along shoreline. Monitoring undertaken to document continued effectiveness of mitigation measures. Additional mitigation measures will be developed as required. The proponent will meet with regulators in order to determine further sampling (fish tissue, soil, surface water) and follow-up monitoring requirements and establish a mitigation and monitoring plan to address requirements and mitigation	Yes
	Surface water - impacts associated with acid rock drainage (ARD) and metal leaching	• if deemed necessary by a geotechnical engineer, a detailed assessment of ARD potential will be completed • if ARD potential is deemed likely, an ARD Management Plan will be prepared including measures for avoidance, mitigation, and treatment methods for ARD as well as long-term storage methods for acid-generating spoils.	No impacts anticipated	No

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Species at Risk	Impact to habitats of identified terrestrial Species at Risk due to construction and operation of facility	• a discovery protocol will be developed and in place should a SAR species be encountered • a permit under Section 17(2)C of the Endangered Species Act will be required and an overall benefit to the species will be required/discussed. • once operation commences an Agreement for Operation and monitoring protocols under the Endangered Species Act will be required/discussed with the MNR. • Comparable habitat is commonly available in the surrounding landscape	Low negative impacts possible - impacts mitigated or eliminated where ever possible Permit/ Agreement required for construction/ operation. Effect on species and their habitat on a regional level is estimated to be negligible given the small size of the area of impact related to the amount of available habitat. Proponent will continue to monitor for the presence of SAR species which have the potential to be present within the project zone of influence and will contact the MNR to discuss requirements should individuals be identified	Yes
	Impact to habitat of Lake Sturgeon due to construction and operation of facility	• ensure that a suitable minimum ecological flow is passed over this habitat during key life history stages for Lake Sturgeon • ensure the continued viability of identified spawning habitat downstream of facility	No impacts anticipated - proposed mitigation measures will maintain the continued function of identified Lake sturgeon habitat downstream of the facility	No
Significant earth or life science features	No issues	• No ANSI identified in project area as indicated by MNR Site Description Package	N/A	No
Land subject to natural or human made hazards	No issues	• No land subject to natural or human made hazards identified	N/A	No
Terrestrial wildlife (numbers, diversity, distribution)	General disturbance to habitat during construction and maintenance of facility (dam, powerhouse, etc)	• limit use of machinery in and around watercourses and sensitive terrestrial areas • clearly define access and transportation routes to minimize disturbance • use woody debris and non-merchantable logs from corridor clearing to establish brush piles and downed logs adjacent to the cleared right-of-way to improve habitat • allow for detour around sensitive habitat areas • use mechanical means (not chemical) to clear and manage vegetation within ROW • limit removal of vegetation during construction/maintenance to maintain habitat connectivity • all construction traffic should adhere to speed limits and construction crews should be aware of the potential for wildlife crossings • any roadway mortalities of herpetofauna should be reported and a reduction in speed limits should be imposed in specific areas to prevent additional mortalities • the area of disturbance within the overall site boundaries will be kept to a minimum and clearing will only occur where necessitated by construction. • high visibility snow fencing will be installed to restrict heavy equipment traffic to the area identified for clearing. • travel paths, stockpile areas and staging areas will be carefully planned and followed. • Where possible, avoid important habitats • Where possible, activities will be scheduled to avoid sensitive nesting, rearing, mating, or staging periods • All food and food waste will be properly stored and disposed of to prevent attracting wildlife • All Project personnel will use proper care and caution when operating vehicles to avoid collisions with wildlife •Wildlife are relocated as required during the work and after the work has been completed	Low negative impact - Construction Management Plan will be finalized to include protocols and procedures for minimizing the disturbance to wildlife during the construction program. The clearing and grubbing of land will result in a loss of some vegetation and in turn potential wildlife habitat. In-direct impacts also have potential to occur during active construction and during operation of facility (i.e. noise, human presence and activity)	Yes

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Terrestrial wildlife (numbers, diversity, distribution)	Access road construction - habitat fragmentation, increased predation, introduction of invasive species	• gating roads to prevent further human access • re-claim temporary/unused access roads following completion of work • enforce speed limitations on construction vehicles along access roads to limit road kills • inform workers on potential for road mortality of wildlife	Once the access road alignment is finalized it is Xeneca's intention to conduct detailed field surveys along the alignment in order to identify specific impacts and develop appropriate mitigation.	Unknown due to outstanding data and information
	Connection line construction	• The existing natural environment features along the proposed route have been reviewed from a biological perspective by the EA team in a screening study including route refinement analysis to avoid sensitive areas. This work was completed on preliminary route options and is presented under a separate report entitled Xeneca Power Hydroelectric Developments Transmission Line and Access Road Natural Environment Preliminary Analysis (see Annex III). • Additional work was then undertaken by the EA team to determine more refined route options (i.e. desktop database search GIS mapping). These results are presented under separate report entitled Distribution Line Summary for the Wanatango Falls Hydroelectric Project (Frederickhouse River) (see Annex II-B). • Additional work (flyover mapping and a Rapid Assessment Technique (RAT) review) of the entire length of the refined route options is being undertaken to determine the preferred route, further reporting will be issued to agencies as it becomes available and as routes are refined.	As the routing studies currently underway conclude and the alignment is finalized, it is Xeneca's intention to conduct field surveys (ground truthing and specific ecosite mapping) in identified areas of special concern along the preferred route and where there is significant potential for identified species in order to resolve potential impacts and develop appropriate adaptive mitigation .	Yes, expected, however additional data is required to complete the determination of the significance of the residual effect
	Impacts related to the creation of facility and headpond creation - impacts to general and Significant Wildlife Habitats	• relative to the areas to be impacted, comparable habitats are abundant in the surrounding region	Low negative impacts anticipated - small inundation area and impacts to regional populations will be negligible as similar habitat is abundant in the area	Yes
	General disturbance to wildlife	• Where possible, avoid important habitats • Where possible, activities will be scheduled to avoid sensitive nesting, rearing, mating, or staging periods • All food and food waste will be properly stored and disposed of to prevent attracting wildlife • All Project personnel will use proper care and caution when operating vehicles to avoid collisions with wildlife •Wildlife are relocated as required during the work and after the work has been completed	Construction Management Plan will be updated to include findings from ELC survey and other terrestrial studies. Minimize the disturbance to wildlife during the construction program.	Yes
Natural vegetation and habitat linkages	Effects on vegetation and habitat during connection line and access roads ROWs construction and maintenance	• schedule construction during winter months, when possible, to minimize habitat disturbance • limit use of machinery in and around watercourses and sensitive terrestrial areas • clearly define access and transportation routes to minimize disturbance • allow areas of exposed soil to naturally regenerate with native species • use mechanical means (not chemical) to clear and manage vegetation within ROW • limit removal of vegetation during construction/maintenance to maintain habitat connectivity • erosion control and run off control measures will be implemented to encourage the recolonization of impacted areas by native plant species	Low negative effects anticipated - construction Management Plan will be finalized to include instructions and protocols for minimizing the disturbance to terrestrial ecosystem during the construction program.	Yes

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Natural vegetation and habitat linkages	Access road and connection line construction - habitat fragmentation, increased predation, introduction of invasive species and increased potential for forest fires	• gating roads to prevent further human access and reduce the risk of forest fires • re-claim temporary/unused access roads following completion of work • project personnel will be prepared and be familiar with the site Fire Preparedness Plan • fire fighting equipment will be available to all workers and the location of such equipment will be outlined in the Fire Preparedness Plan • Locations of equipment and muster points will be advertised as necessary around the site • project personnel will be familiar with fire-fighting techniques and the use of supplied equipment • uncontrolled fires will be immediately reported to the nearest fire emergency service and the MNR in the case of an uncontrolled fire on Crown land • smoking will only be permitted in designated smoking areas equipped with fire extinguishers • disposal and storage of waste will be into proper waste containers to prevent fires	No impacts anticipated - proper implementation of construction management plan and best management practices will mitigate impacts wherever possible.	No
	Access road and connection line construction - habitat fragmentation, increased predation and introduction of invasive species	• restrict construction vehicles to existing access routes and staging areas • minimize access requirements around wetlands to minimise disturbance • retain vegetation to the extent practicable • During clearing, trees will be felled into the proposed site wherever possible • Clearing will comply with the requirements of all applicable permits and approvals, the Crown Forest Sustainability Act, The Forest Operations and the Silviculture Manual • Wildlife trees and other significant trees will be marked for protection; marked trees will only be removed if they are a safety concern that cannot be addressed in other practical ways • Brush will be disposed of by burning or chipping. When burning is carried out, it will be under permit with the MNR and according to the Forest Fires Prevention Act • gating roads to prevent further human access to reduce habitat fragmentation • re-claim temporary/unused access roads following completion of work to reduce habitat fragmentation	As the routing studies currently underway conclude and the alignment is finalized, it is Xeneca's intention to conduct field surveys (ground truthing and specific ecosite mapping) in identified areas of special concern along the preferred route and where there is significant potential for identified species in order to resolve potential impacts and develop appropriate adaptive mitigation .	Yes, expected, however additional data is required to complete the determination of the significance of the residual effect
Soil and sediment quality	Soil compaction in construction footprint and ROW for connection line and access roads	• schedule construction of temporary access road and connection line ROW to minimize ground disturbance (winter) • stop activities when ground conditions could potentially severely disturb soil profile (high precipitation, etc) • be prepared to alter construction activities as a result of sudden thaw conditions • stabilize high traffic areas with gravel surface layer or other suitable cover material • establish a designated construction access route to minimize area of impact • time construction activities to minimize effects on surface vegetation and subsurface rooting zones • vehicles and equipment access will be restricted to the minimum area necessary • conduct site reclamation activities as soon as possible following the disturbance	No impacts anticipated - proper implementation of construction management plan and best management practices will mitigate impacts wherever possible. Soil compaction will reverse naturally over time if left undisturbed.	No
	Impacts to pre-existing contaminated sites	• project will be a small modified run-of-river hydroelectric facility located in a relatively pristine and remote rural area • no contaminated sites located in project zone of influence	No impacts anticipated - project is located in an undisturbed rural area	No
	Management of excavated materials (blast rock, fill, aggregates, etc)	• transport blast rock to lay down area for stockpile and/or crushing; laydown areas will be situated at acceptable distances from water bodies (i.e. greater than 30 m) • install mechanical erosion control measures at blast rock storage site near water body • re-use blast rock for aggregate and shoreline stabilization • apply water to dry soil/rock to minimize dust • instruct workers and equipment operators of dust control methods • install mechanical barriers to prevent run off from dust piles into water bodies • If Acid Rock Drainage (ARD) is determined to be an issue, an ARD Management Plan will be prepared including measures for avoidance, mitigation, and treatment methods for ARD as well as long-term storage methods for acid-generating spoils which would entail isolation of spoils from water and air to prevent leaching	No impacts anticipated - proper implementation of construction management plan and best management practices will mitigate impacts wherever possible. A Sediment and Erosion Control Plan will be prepared prior to construction. If required, an ARD Management Plan will be adhered to.	No

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Aquatic and Riparian Ecosystem				
Shoreline Dependent Species	*Shoreline dependant Fish Species - See Fish Habitat Section below*			
	Inundation effects on aquatic mammals (beaver and otter, etc) and their habitat	• Planning for flooding of new reservoirs should avoid the winter/ice over period when filling could cause direct mortality by drowning furbearing mammals in their dens	No impacts anticipated - proper construction and operations planning will mitigate impacts to aquatic mammal species	No
	Facility construction activities impacts on shoreline habitats and vegetation	• impacts largely isolated to localized clearing and grubbing of riparian vegetation • inundation will affect only a small area in relation to the abundance of similar habitat in the surrounding area	Low negative impacts anticipated - impacts to regional populations will be negligible as similar habitat is abundant in the area	Yes
	Loss of emergent riparian vegetation as a result of water level fluctuations	• similar vegetation is abundant on the surrounding landscape	Low negative impacts anticipated - impacts anticipated to be minor in the context of the surrounding landscape	Yes
\Wetland Dependent Species	Potential for impacts to general and significant wildlife habitats as a result of inundation and facility operations	• inundation will affect only a small area in relation to the abundance of similar habitat in the surrounding area	Low negative impacts anticipated - small inundation area and impacts to regional populations will be negligible as similar habitat is abundant in the area	Yes
Fish Habitat	Potential effects on habitat associated with water crossings on ROWs for access roads and connection line	• Impacts to local fish populations and their habitats will be discussed with DFO and MNR as part of overall strategy for dealing with fish habitat at water crossings • DFO Operational Statement for Overhead Line Construction will be adhered to in order to minimise impacts to fish and fish habitat. • appropriate mitigation measures could include but would not be limited to adequate culvert design, appropriate erosion control measures, etc.	As the routing studies for access roads and connection line ROWs currently underway conclude and the alignment is finalized it is Xeneca's intention to conduct detailed field surveys along the alignment, especially at key water crossings, in order to identify potential impacts and develop appropriate mitigation.	Unknown due to outstanding data and information
	Construction activities in general	• respect all-in water timing restrictions • isolate in-water construction area before or after in-water timing restrictions to avoid impacts • placement of intakes near natural barriers to migration • ensure a qualified person is on hand to oversee de-fishing activities prior to dewatering • design habitat mitigation and compensation measures through discussion and guidance with relevant authorities • employ best management construction practices including fish relocation plan, work site isolation and sediment control measures • blasting will occur outside of appropriate fish spawning and incubation periods (specific requirements to be established with DFO and MNR) • other blasting mitigation measures may include bubble curtains, isolation and dewatering of blast area, use of smaller charges, staggering of blasts • adhere to DFO operational statements for application during crossing of waterways for construction of transmission line, including Overhead Line Construction, Temporary Stream Crossings and Maintenance of Riparian Vegetation in Existing Right-of-Ways • conduct environmental monitoring to ensure that predicted conditions are accurate • Prompt and effective clean up and restoration once construction is complete	No impacts anticipated - impacts mitigated or eliminated wherever possible. Construction Management Plan will be finalized to include instructions and protocols for minimizing the disturbance to aquatic ecosystem during the construction program.	No

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Fish Habitat	Permanent alteration or loss of fast water habitats upstream of the facility as a result of inundation	• a compensation plan, including provisions for the creation of compensatory habitat, will be developed and discussed with DFO once the engineering details for the project have been advanced during the permitting phase of the project. • effectiveness goals will need to be discussed with MNR and DFO to ensure that the effectiveness and intended function of the compensation habitat can be demonstrated • follow-up monitoring will be carried out to ensure compensatory habitats are functioning appropriately	No impacts anticipated - the compensation plan and measures developed for the project will result in no net impact to fish habitat	No
	Construction of in-water facility components. The construction of the headrace and tailrace will result in the permanent alteration or destruction of river habitat.	• dam construction will take place in isolation from the river flow through the use of cofferdams. • during construction, it is assumed that flow will be maintained uninterrupted downstream through staging and sequencing of construction. • a compensation plan, including provisions for the creation of compensatory habitat, will be developed and discussed with DFO once the engineering details for the project have been advanced during the permitting phase of the project. • effectiveness goals will need to be discussed with MNR and DFO to ensure that the effectiveness and intended function of the compensation habitat can be demonstrated	No impacts anticipated - the compensation plan and measures developed for the project will result in no net impact to fish habitat	No
	Temporary impacts and loss of habitat related to the construction of cofferdams	• Phase 1 and 2 cofferdam construction will result in the temporary occupancy of river bed in the are of the dam, spillway facility intake, powerhouse and tailrace •The cofferdam is anticipated to be constructed in accordance with the appropriate in-water timing window dictated by the Ministry of Natural Resources. • During construction, the flow will be maintained uninterrupted downstream through staging and sequencing of construction. • Construction best management practices will be implemented to minimize the risk of off-site migration of sediments as well as adherence to in-stream timing window restrictions for construction activity. • a compensation plan, including provisions for the creation of compensatory habitat, will be developed and discussed with DFO once the engineering details for the project have been advanced during the permitting phase of the project. • effectiveness goals will need to be discussed with MNR and DFO to ensure that the effectiveness and intended function of the compensation habitat can be demonstrated	Temporary negative impacts are anticipated - direct impacts to aquatic habitat may occur. The cofferdam is to be placed to minimize impacts and the size of the cofferdam to be installed and how long the cofferdam remains in place will be kept to a minimum. The compensation plan and measures developed for the project will result in no net impact to fish habitat	No
	Potential effects on habitat and spawning from dewatering operations	• Dewatering activities will be done in a controlled manner so as not to discharge turbid water to the receiving watercourse. • Materials such as filter bags, straw bales, filter fabric and Paige wire fencing will be on site to create a dewatering corral for waste water as a contingency plan in the event that groundwater is encountered and additional filtering properties are required. • Suitable containment/treatment areas will be identified by the Contract Administrator. • The discharge point in the receiving watercourse will be carefully chosen as an area with low scour potential (i.e. bedrock bottom). • If scour potential does exist, the contractor will use energy dissipation in the form of a splash pad or rock protection for the stream bottom.	No impacts anticipated - Effects will be mitigated through construction best management practices and the ultimate discharge point to the receiving watercourse will be monitored to ensure that the filtering is effective in removing excess sediment.	No
	Potential effects on aquatic habitat in the by-pass and variable flow reach due to facility operations	• Ensure that a suitable minimum ecological flow is passed over this habitat during key life history stages for fish (including Lake sturgeon and Walleye) and invertebrates to ensure ecological function • a compensation plan, including provisions for the creation of compensatory habitat, will be developed and discussed with DFO once the engineering details for the project have been advanced during the permitting phase of the project. • effectiveness goals will need to be discussed with MNR and DFO to ensure that the effectiveness and intended function of the compensation habitat can be demonstrated	No impacts anticipated - Xeneca will meet with MNR and DFO to confirm minimum flow and compensation requirements in order to mitigate impacts so that no net impact to fish habitat results	No

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Fish Migration	Construction of the dam represents a potential barrier to the upstream movement of fish	• It is expected that upstream movement of non-jumping fish unlikely and would be highly dependent on water levels and velocities	Impacts anticipated - strategies to facilitate upstream fish passage (fish ladders, flow passage, etc), compensation for impacts and follow-up monitoring will be discussed with MNR and DFO and will be incorporated into engineering and operational design.	Yes, expected, however additional data is required to complete the determination of the significance of the residual effect
	Downstream passage of larval and adult fish	• Minimum ecological flow will be provided to ensure that fish passage over/through the dam will remain unimpeded • Turbine selection may allow for the safe downstream passage of fish through the facility	No impacts anticipated	No
Fisheries	Impacts to fisheries within the project zone of influence	• the Frederick House River within the projects zone of influence is utilised for recreation and no commercial fisheries are known • see "Angling, Hunting Opportunities" below	It is unclear what impact the project will have on fisheries on the Frederick House River. Xeneca is committed to continued public consultation to address any issues	Unknown due to outstanding data and information
Fish injury or mortality	Fish impingement or entrainment resulting in injury or mortality	• Engineer facility intake and design velocities to account for fish swimming capabilities to minimise potential for impingement or entrainment through turbine(s) • If significant entrainment potential is identified, consider diversion methods for vulnerable fish species including lighting, electrical barriers, air bubbling and sound barriers to prevent entrainment • Possible strategies to mitigate injury/mortality of entrained fish include: - Minimize the number of blades or amount of blade leading edge; - Maximize the open space between blades and other structures; - Use blunt leading edges instead of sharp ones; - Minimize runner speed; - Direct fish toward the runner hub and not the runner periphery; - Minimize gaps between fixed and moving parts.	Specific turbine information such as diameter, number of blades, operational speed (r/min) and hydraulic capacity ranges (cms) is required for determining turbine mortality and needs to be determined. However, recent DFO position on waterpower facilities anticipate that market turbines may not prevent some fish kill as a result *Fisheries Act* determination under Section 32.	Yes
	Fish injury or mortality as a result of cofferdam placement and dewatering	• Placement of the cofferdam will be outside of in-water work restriction period and will be placed so as to minimize mortality. • Fish salvage will be carried out prior to the dewatering process to relocate species.	CMP will consider this potential effect and fish salvage will be carried out prior to dewatering	Yes
Erosion and sedimentation	Construction related impacts related to the relocation of sediments and soils - Surface water overland flow paths within the construction areas have the potential to carry construction-related sediment to the watercourse.	• Areas will be identified in advance of construction and receive added protection and scrutiny during routine construction inspections particularly during the periods before and after rain events. • Sediment and erosion control measures will be installed prior to construction and maintained diligently throughout the construction operations. • Planting of vegetative cover will then follow in the next growing season. • Maintenance and inspection of the vegetative cover will continue until such time as the disturbed areas are sufficiently stabilized through vegetative growth to prevent overland runoff of suspended materials. • If construction finishes in a cleared area, with insufficient time left in the growing season to establish vegetative cover, an overwintering treatment such as erosion control blankets, fibre matting or equivalent will be applied to contain the site over the winter period. • Stockpile and staging areas will be well removed from the watercourse and be isolated with sediment and erosion control measures to prevent migration of material to the watercourse and natural areas. • Excess material from in-water excavation will be removed immediately from the channel area and temporarily stockpiled in suitable locations identified by the design drawings and on-site areas approved by an environmental inspector.	No impacts anticipated - Adhere to all applicable standard best management practices available to the industry. A Sediment and Erosion Control Plan will be prepared prior to construction.	No

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Erosion and sedimentation	Operation - Increased shoreline erosion and sediment deposition due to inundation area and variable flow reach water level fluctuations	• the potential for shoreline erosion along shorelines within the zone of influence will be assessed prior to construction by a qualified person • Limit maximum daily fluctuations of upstream water levels (1 m fluctuation) • Limit the rate of change of upstream water levels • Facility will operate as a modified run of river facility (run of river operation during extreme high and low flow periods of the year) • inspect and monitor for signs of erosion in year one and year five of operation to document where and degree of erosion and develop and implement additional mitigation measures as required	No impacts are anticipated - Operations will be established to minimise erosion where possible. Follow-up monitoring will be completed in Year 1 and Year 5 to determine where and to what extent erosion and sedimentation are occurring as a result of operations.	No
Water levels, flows and movement (surface water)	Creation of headpond and fluctuation in levels/flows	• Limit maximum daily fluctuations of upstream water levels (1 m fluctuation) • Limit the rate of change of upstream water levels • Facility will operate as a modified run of river facility (run of river operation during extreme high and low flow periods of the year)	Impacts anticipated - Creation of headpond required for the operation of the facility.	No
	Variation in flows within downstream variable flow reach	• Facility will operate as a modified run of river facility (run of river operation during extreme high and low flow periods of the year approximately 2 months of the year) • A downstream minimum environmental flow is proposed to be continually passed over the spillway of the dam and/or through the powerhouse to maintain ecological habitat viability within the variable flow reach	DFO authorization and provincial water management planning for seasonal minimum environmental flow in variable flow reach will be sought following consultation with DFO with MNR and incorporated into the approved operating plan for the facility	No
Water Temperature	Changes to thermal regime of waterway within headpond as a result of inundation and temporary storage	• Temporary storage would occur during night time hours when additional solar absorption is limited	No impacts anticipated	No
Drainage, flooding and drought patterns	Alteration from natural patterns	• Limit maximum daily fluctuations of upstream water levels • Limit the rate of change of upstream water levels • Facility will operate as a modified run of river facility (run of river operation during extreme high and low flow periods of the year • Final facility design to ensure flood passage capacity and public safety issues are adequate to meet the requirements of the *Lakes and Rivers Improvement Act* approval following the completion of the EA	Low negative impacts anticipated - dynamic modeling shows facility will modify normal flooding patterns	Yes
Aboriginal Community				
First Nations reserves or other aboriginal communities	Local Aboriginal Communities (LAC), Identified Aboriginal Communities (IAC) have expressed an interest in engagement in regards to the project and potential impacts	• Proponent has corresponded with identified and Local Aboriginal communities in the EA process • Proponent commits to engage in discussion after the issuance of a Notice of Completion at which time EA will be provided to communities for review for a minimum of 30 days	Ongoing engagement and consultation with Aboriginal communities will continue after completion of EA	No
Spiritual, ceremonial, cultural, archaeological or burial sites	Impacts to these environmental components have not yet been identified	• Proponent has corresponded with identified and Local Aboriginal communities in the EA process • Proponent commits to engage in discussion after the issuance of a Notice of Completion at which time EA will be provided to communities for review for a minimum of 30 days • A request for identified and local Aboriginal communities to enter into discussions regarding projects within their traditional lands and an invitation to share information about the project site was issued in June 2010	Ongoing engagement and consultation with Aboriginal communities will continue after completion of EA. In addition, a Stage 2 archaeological survey will be conducted in 2011 to identify the presence of and assess impacts to cultural heritage in the footprint of the project. Participating Aboriginal community members will be engaged during this assessment.	Unknown pending completion of Stage 2 investigations

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Traditional land or resources used for harvesting, hunting, fishing, trapping	Impacts to these environmental components have not yet been identified	• Proponent has corresponded with identified and Local Aboriginal communities in the EA process • Proponent commits to engage in discussion after the issuance of a Notice of Completion at which time EA will be provided to communities for review for a minimum of 30 days • A request for identified and local Aboriginal communities to enter into discussions regarding projects within their traditional lands and an invitation to share information about the project site was issued in June 2010 • keep trap lines and trails clear of slash • minimize alteration and turbidity of fish habitat • minimize harassment of wildlife • keep staging areas tidy and free of litter	Ongoing engagement and consultation with Aboriginal communities will continue after completion of EA	Unknown pending completion of consultation with Aboriginal communities
Lands subject to land claims	None identified	• Xeneca legal department indicate that their inquiries have not revealed land claims in the projects area of impact	N/A	No
Economic Development	Business to business relationships	• Formal requests issued and meetings held with leadership of First Nations and Aboriginal communities to meet and discuss the potential benefit sharing for the Wanatango development	Ongoing engagement and consultation with Aboriginal communities will continue after completion of EA.	Unknown pending completion of discussions with Aboriginal communities
Land and Resource Use				
Access to inaccessible areas	Facilitation of access as a result of upgrades/maintenance of area access roads and bridges New roads can act as vectors leading to increased exploitation and introduction of new species	• install gates, fencing and signage to limit unauthorised public access where required • operational staff to monitor for signs of unauthorised access and report to appropriate local authorities/MNR	Low negative impacts - road upgrades and ongoing maintenance activities could result in increased access to the area	Yes
Navigation	Construction, inundation and variable flows may alter navigational access within the project zone of influence	• The feature at Wanatango presents an obstacle to navigation • consult with MNR and local boaters to determine periods of use and minimum flow and water level requirements to maintain downstream access • provide for and maintain portage and canoe passage around the site and within the zone of influence to ensure safe passage and area to be inundated and variable flow reach (if required) • portage routes will be subject to review under the *Navigable Waters Protection Act*	Minor impacts anticipated - The Frederick House River is utilised for recreational navigation by a limited number of users; impacts will largely be limited to construction to maintain public safety but access may be facilitated during operation.	Yes
Riparian rights or privileges	Impacts associated with inundation	• the final design of the facility will be dependant on the outcome of land ownership negotiations which are ongoing.	No impact anticipated - Design will be selected based on the outcome of land ownership negotiations to avoid undesirable impacts associated with inundation	No
Angling, hunting opportunities	Projects fall within Bear Management Areas - effects on bear hunting	• keep trap lines and trails clear of slash • minimize harassment of wildlife • keep staging areas tidy and free of litter	No impact anticipated - impacts to the habitat of targeted species is anticipated to be negligible in proportion to the availability of suitable habitat surrounding the area.	No
	The project site is a utilised by anglers	• consult with MNR and anglers to determine periods of use and values • provide for and maintain access around the site and within the zone of influence to ensure safe passage access for anglers	Impact will be assessed following conclusion of EA to fully understand the impact of the proposed development on the fisheries and recreational enjoyment of the Frederick House River	Unknown due to outstanding data and information

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Trapping	Projects fall within registered trap line areas	• keep trap lines and trails clear of slash • minimize harassment of wildlife • keep staging areas tidy and free of litter	No impact anticipated - impacts to the habitat of targeted species is anticipated to be negligible in proportion to the availability of suitable habitat surrounding the area.	No
Baitfish harvesting activities	Projects fall within registered commercial baitfish harvesting areas	• see Fisheries and Fish Habitat issues and mitigation above • minimize alteration and turbidity of fish habitat	No impact anticipated	No
An existing land or resource management plan	Forest resources on Crown Land in the vicinity of the site are allocated under a Sustainable Forestry License to Abitibi River Forest Management Inc.; clearing of resource in alignment with FMP and knowledge of SFL	• negotiate with SFL holder and MNR to permit for the harvesting/clearing of forest resources within the proposed inundation area/road construction/connection line ROW prior to construction/flooding	Ongoing engagement and consultation with SFL holder will continue after completion of EA; agreement will be sought with SFL to ensure first rights to merchantable wood and improved access routes.	No
	If and when the facility is commissioned, an amendment to the Abitibi River WMP will be required	• The operation of the facility will be aligned with the existing Abitibi River WMP during a comprehensive review in 2014 • Water management planning principles taken into account during project planning and incorporated into operating plan for the facility	Engagement and consultation with Abitibi River WMP SAC will continue after completion of EA	No
Protected areas	No protected areas identified	N/A	N/A	No
Forestry	Harvesting of merchantable timber during construction	• restrict clearing to approved right-of-way to minimize area of impact • negotiate with SFL holder and MNR to permit for the harvesting/clearing of forest resources within the proposed facility footprint/inundation area/road construction/connection line ROW prior to construction/flooding • stumpage fee for merchantable timber on Crown land	Positive impact - Timber removal represents a potential benefit to local SFL holder by sale/processing of merchantable timber.	Yes
	Processing of non-merchantable timber	• make useable fuel wood available to local communities • chip brush and slash to minimize fire hazards • site ROW along existing access where possible to limit soil/habitat disturbance • ROW maintenance should be completed using mechanical (not chemical) controls	No impacts anticipated - following removal of merchantable timber, ROW maintenance will be required every 4-5 years.	No
Mine claims	Wanatango Falls project Zone of Influence is within several existing mine claims	• verification of claims in the vicinity through CLAIMS (checked September 29, 2011) • presence of hydro electric generation and connection lines may make the claim more valuable. • changes to the Mining Act in Ontario now recognizes waterpower and other resource development and provision exists for the claim holder to cede first right of refusal on surface rights to the developer of a renewable energy facility	No impacts anticipated - claim remains undeveloped though presence of hydropower facility may benefit development of the claim at some point in the future.	No
Existing Dams	Impacts to operations of Frederick House Lake Dam upstream of facility	• Inundation area from proposed facility will extend to approximately 450 m below Frederickhouse Lake Dam • The operation of the facility will be aligned with the existing Abitibi River Water Management Plan (WMP) during a comprehensive review in 2014.	No impacts anticipated	No
Agricultural land	Impacts to agricultural lands due to water level and flow fluctuations downstream of facility	• variable water levels and flows will not extend beyond variable flow reach which will not intersect agricultural lands	No impacts anticipated	No

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Cultural Heritage Resources				
Archaeological sites	Disturbance or destruction to archaeological resources	• Stage 1 archaeological review identified areas or high archaeological potential within the project area • Stage 2 when completed may identify existence of archaeological resources in project area and determine whether additional archaeological investigations/management strategies are required. • If archaeological or heritage resources are discovered during clearing or construction, work will be stopped until an archaeologist has assessed the find and a course of action is determined. • A Discovery Protocol will be prepared and implemented for project construction	Incorporate the results of the Stage 2 Archaeological Assessment.	Unknown pending completion of Stage 2 investigations
Buildings or structures	Disturbance or destruction to heritage buildings or structures	• Stage 1 archaeological assessment did not identify potential for built heritage structures within the project area. Stage 2 field investigation will determine the whether any existing buildings or structures in project area may require built heritage assessment.	Stage 2 survey to be conducted in 2011/2012 and any findings will be shared with Ministry of Culture. Mitigation will be developed, as appropriate.	Unknown pending completion of Stage 2 investigations
Cultural heritage landscapes	Disturbance or destruction to cultural heritage landscapes	• Stage 1 did not identify potential for cultural heritage landscapes within the project area.	Stage 2 survey to be conducted in 2011/2012 and any findings will be shared with Ministry of Culture. Mitigation will be developed, as appropriate.	Unknown pending completion of Stage 2 investigations
Social and Economic				
The location of people, businesses, institutions or public facilities	Disruption to access, schedules and activities	• limit disruptions to traffic flow by maintaining adequate access along travelled routes, and alternate access if required • avoid sensitive time periods and advise residents of planned activities that may cause a disruption in access • construction materials and equipment should be segregated in staging areas during off hours • monitor condition of gravel roads and if construction traffic is causing damage, ensure that repairs are undertaken promptly	No impacts anticipated - the project site is remotely located and accessed via logging access roads which are not widely utilized	No
Community character, enjoyment of property or local amenities	Potential effects on property enjoyment, recreational water use, tourism values, aesthetic image	• project Zone-of-Influence is remotely located • consult with MNR and local users to determine periods of use and potential mitigation strategies to minimize effects • facility will operate as a modified run of river facility (run of river operation during extreme high and low flow periods of the year) • intermittent operation would only occur during low flows, most of which occur during the winter months when the river is frozen and recreational uses are limited. • provide for and maintain access around the site and within the zone of influence to ensure safe passage access for anglers and campers	Impact will be assessed following conclusion of EA to fully understand the impact of the proposed development on the fisheries and recreational enjoyment of the Frederick House River	Unknown due to outstanding data and information
Employment - Local and regional labour supply	Construction activities will support direct and indirect local employment	• promote contract bids and offers of service from local communities including Cochrane	Positive impact - construction and operation represents a potential benefit to local communities	Yes
Public health and/or safety	Forest or brush fires caused as a result of project activities	• project personnel will be prepared and be familiar with the site Fire Preparedness Plan • fire fighting equipment will be available to all workers and the location of such equipment will be outlined in the Fire Preparedness Plan • Locations of equipment and muster points will be advertised as necessary around the site • project personnel will be familiar with fire-fighting techniques and the use of supplied equipment • uncontrolled fires will be immediately reported to the nearest fire emergency service and the MNR in the case of an uncontrolled fire on Crown land • smoking will only be permitted in designated smoking areas equipped with fire extinguishers • disposal and storage of waste will be into proper waste containers to prevent fires	No impacts anticipated - proper implementation of construction management plan and best management practices will mitigate impacts wherever possible.	No

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Public health and/or safety	Forest or brush fires caused as a result of project activities	• project personnel will be prepared and be familiar with the site Fire Preparedness Plan • fire fighting equipment will be available to all workers and the location of such equipment will be outlined in the Fire Preparedness Plan • Locations of equipment and muster points will be advertised as necessary around the site • project personnel will be familiar with fire-fighting techniques and the use of supplied equipment • uncontrolled fires will be immediately reported to the nearest fire emergency service and the MNR in the case of an uncontrolled fire on Crown land • smoking will only be permitted in designated smoking areas equipped with fire extinguishers • disposal and storage of waste will be into proper waste containers to prevent fires	No impacts anticipated - proper implementation of construction management plan and best management practices will mitigate impacts wherever possible.	No
	Impacts associated with facility construction	• Restriction of public access to the site during construction (fencing, signage, etc) • provide and maintain routes for the public to be able to bypass the site (portage, etc) • proper barriers and warning devices installed following construction to restrict public access to intake/tailrace areas during operation, including safety booms, fencing and signage	No impacts anticipated - proper implementation of construction management plan and best management practices will mitigate impacts wherever possible.	No
	Impacts for navigation and recreation associated with facility operation	• A public safety measures plan will be developed for the site to identify hazards and suggest mitigation measures to address identified safety issues • proper barriers and warning devices installed following construction to restrict public access to intake/tailrace areas during operation, including safety booms, fencing and signage	No impacts anticipated - proper implementation of construction management plan and best management practices will mitigate impacts wherever possible.	No
	Production of waste in and around work site	• Appropriate disposal containers will be available for the prompt disposal of waste • full disposal containers will be removed to the appropriate waste disposal facility on a regular basis • Organic/food waste will be collected daily and stored in closed, animal resistant containers until disposed of at an approved waste disposal site or incinerated on-site according to project permitting standards • keep staging areas tidy and free of litter • Bear awareness training will be provided to all Project personnel.	No impacts anticipated - proper implementation of construction management plan and best management practices will mitigate impacts wherever possible.	No
Water Supply	Impacts to local water supply	• Ministry of the Environment well records search revealed no private or municipal ground water wells within 1 km of the site • It is possible that recreational users are taking river water for personal consumption - see Water Quality	No impacts anticipated	No
Aesthetic image of the surrounding area	Disruption due to presence and operation of proposed facility	• Minimize site clearing. Landscape to rehabilitate the construction site. • Apply Best Management Practices and traffic planning to contain construction equipment in designated work areas. • Re-vegetate areas as soon as possible following construction. • Use natural materials in the new structures wherever practicable.	Impacts anticipated - Requirements for compensation flow or other aesthetic requirements will be determined in consultation with project stakeholders and in consideration of area usage (based upon a future visitor survey).	Unknown due to outstanding data and information
Energy/Electricity				
Reliability	Voltage support	• Capacity of new power generation units are relatively small	Operation of facility in parallel with the existing power grid will provide minor impact on the overall power system reliability and power quality (voltage and frequency)	Yes

Environmental Component	Issue	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Security	Black Start capability	• The island mode of operation could require the change of the interconnection protection and control scheme/settings in the HONI distribution system. Further consultation with HONI required.	Operation of the projects will improve distribution customer service reliability in this area. The power generation units will be able to provide a black start and island mode of operation (assuming that is allowed by HONI) to continue to supply or electrically energize in a safe, controlled and reliable manner, part of the distribution system, including customer load that is separated from the rest of distribution system.	Yes
Electricity flow patterns	Power flow system	• Appropriate mitigation technical measures will be proposed in the control system of the power grid and new generation units if required	Operation of the new power generation units will redistribute power flow in the existing distribution system.	Yes
Other	Protection control settings	• Appropriate mitigation technical measures will be proposed in protection and control system of the power grid.	Operation of the new power generation units will affect existing protection and control settings in the distribution system.	Yes

A summary of Table 4 results which indicate the residual effects identified through the assessment is provided below:

- Air Quality
    - Noise from operation of facility
    - Exhaust from vehicles and equipment
    - Greenhouse Gas Offsets
    - Dust from vehicles and equipment
- Water Quality
    - Contamination from construction activities
    - Increased levels of suspended sediment
    - Contamination from accidental spills
- Species at Risk
- Terrestrial Wildlife
    - General disturbance to wildlife and wildlife habitats due to construction and maintenance activities
    - Effects on habitat during ROW and access road construction and maintenance
    - Effects on habitat during facility construction
    - Habitat disturbance and destruction resulting from inundation
- Natural Vegetation and Habitat Linkages
    - Effects on habitat during ROW and access road construction and maintenance
- Shoreline Dependant Species
    - Impacts to shoreline habitats and vegetation
- Wetland Dependant Species
    - Impacts to general and significant wildlife habitats
- Fish and Fish Habitat
    - Potential impacts to fish migration
    - Entrainment and impingement effects due to facility operation
    - Fish injury or mortality as a result of cofferdam placement and dewatering
- Drainage, flooding and drought patterns
    - Alteration from natural patterns
- Access to Inaccessible Areas
    - Effects of increased access as a result of upgrades/maintenance of access roads
- Navigation
    - Alteration of access around dam structure
- Forestry
    - Harvesting of merchantable timber during construction
- Employment
    - Construction activities will support direct and indirect local employment
- Energy and Electricity

An extended discussion of the key issues are provided in the following sections.

5.1.1 Inundation

The construction of a water control structure at Wanatango Falls will result in the creation of a headpond extending upstream of the proposed facility. Depending on the design option selected inundation and water level fluctuations may be experienced either 0.5 km (low-dam option) or 9.4 km (high-dam option) upstream. The approach to evaluating the potential effects to these areas and any required mitigation were developed by the project team and regulators during a meeting held with MNR on June 15, 2011.

The inundation associated with the high-dam alternative has the potential to affect an additional fast water habitat at the upper extent of the proposed inundation zone which has not been reviewed from a biological perspective as it is located outside the 8.2 km study area. Xeneca is committed to assessing any potential impacts to this habitat.

5.1.2 Flow Effects

Those effects and management strategies associated with the operation of the facility, especially in the head pond and variable flow reach, are summarised in the Proposed Operating Flows and Levels report found in Annex I-C and the Natural Environmental Characterization and Impact Assessment report found in Annex III.

Currently, flows on this reach of river are controlled by the OPG-owned Frederickhouse Lake dam which is operated to provide seasonal storage and flow regulation for the operation of generating stations downstream on the Abitibi River. As a result, the Frederick House River, below the Frederickhouse Lake Dam, experiences highly variable flows and water levels over the course of any given year. The development of a head pond extending upstream either 0.5 km or 9.4 km (depending upon which development option is ultimately chosen), would introduce a zone with less variable water levels which could potentially improve the aquatic habitat.

<u>Erosion</u>

In order to minimize erosion effects, the maximum daily fluctuations of upstream water levels will be limited. The operating plan parameters proposed in Annex I-C for daily fluctuation have been selected to be less than the amount of seasonal and inter-annual fluctuation that has been occurring naturally over time in the upstream river reach. By limiting the daily fluctuation, vegetation will be able to naturally re-establish along the shoreline, thereby limiting the erosion potential.

Rapid changes in shoreline water levels can increase erosion. Where pore water in the soil dissipates too quickly, pore pressure can loosen soil grains and cause loss of stability in the soil structure, thereby enhancing erosion. By limiting the rate of change upstream water levels, this erosion mechanism is avoided.

5.1.3 Aquatic Habitat (Ecological Flow/Water Level Requirements and Effects)

A discussion of identified potential effects and general mitigation measures can be found in the Natural Environmental Characterization and Impact Assessment report found in Annex III, and have been summarized in Table 4.

Water Temperature in Head Pond

The proposed headpond will be relatively shallow with a proposed head of 9 m and water withdrawal will be across the entire depth of the water column. With this head, surface and bottom waters are typically similar in temperature, and no change in water temperature is expected during operations. In addition, given that operations will be modified run-of-river , water temperature within the headpond is not expected to change significantly from that of the inflowing river.

Mitigation for Impacts Associated with Construction

Those effects and management strategies associated with constructing and maintaining the facility and ancillary components are predominantly associated with the natural heritage aspect of the overall environment, and are therefore identified in the Natural Environmental Characterization and Impact Assessment Report found in Annex III. These have been summarized in Table 4.

Under the *Fisheries Act*, authorization for the destruction or disturbance to aquatic habitat associated with the construction and placement of the project will only be granted under the premise that there is no net impact on fish habitat associated with the development. Xeneca will be required to develop a compensation plan in consultation with DFO and other agencies which will include mitigation and compensation strategies as well as post-construction monitoring and effectiveness goals. While there will be impacts to habitats within the footprint of the proposed facility associated with the permanent infilling and covering of habitat it is expected that mitigation and compensation strategies will result in no net residual impact to fish habitat.

Mitigation for Impacts Associated with Operation

To reduce the potential for negative habitat impact upstream during modified run-of-river operation, the maximum daily fluctuations of upstream water levels will be limited. The operating plan parameters proposed herein for daily fluctuation have been chosen to be less than the amount of seasonal and inter-annual fluctuation that has been occurring naturally over time

in the upstream river reach. This does not eliminate the potential for effects, but it limits the potential extent of impact while still maintaining the socio-economic benefit of shifting some electricity production to times when electricity usage is high in the Province.

The design of the facility is intended to minimize the environmental footprint of the project and, in combination with the proposed operating parameters, is believed to avoid significant impacts on the upstream habitat that has been studied.

To reduce the potential for impact within the Variable Flow Reach during intermittent operations, the following approach was employed when selecting operating parameters:

1. Timing of event: Special attention was given to the timing of aquatic habitat events and the relationship to the range of natural flows that could occur during these periods. Where intermittent operation may occur during the identified periods, the bypass flow to be provided while the facility is stopped was given special consideration.

2. Sizing of bypass flows: Bypass flows were considered in the context of the associated water depth, flow velocity and wetted perimeter in the Variable Flow Reach. The objective is to minimize the amount of water released during times when the facility is stopped, while providing enough water to minimize stress on the aquatic environment.

3. Controlled ramping of flows: To minimize the sudden release of water that occurs during start up, a ramping procedure was developed. The ramping procedure requires the facility to start at minimum turbine capacity and gradually ramp up output until the desired operating rate is reached.

4. Limiting maximum turbine flow: During intermittent operation, the turbine flow will be set to not exceed an upper limit to minimize the amount of flow variability that occurs on a daily basis.

The proposed operating parameters have been designed with the objective of avoiding significant impacts on the downstream habitat associated with the project. It should be noted that operating parameters for turbine flows depend on the final design and equipment selected at construction. As such, some variation in the identified parameters may occur, however the objectives of the mitigation and ecological flows provided will not change.

5.1.4 Fish Entrainment and Impingement and Turbine Mortality

A discussion of identified potential effects and general mitigation measures in regards to fish entrainment and impingement will be undertaken once the type of turbine, detailed design of the intake structure and approach velocity are known. Operational management measures that can be considered to reduce the potential risk to fish upstream of the intake can be found in Table 4.

5.1.5 Navigation

The river is not used for commercial navigation but is used for recreational purposes. As mentioned previously, the Frederick House River in proximity to the project site is utilised for primarily for recreational navigation, angling and camping. The construction of a dam across a navigable waterway will require an approval by Transport Canada under the *Navigable Waters Protection Act*. There are ATV trails which allow access to a boat launch immediately upstream of the dam. The proposed facility will require the re-establishment this access to mitigate impacts in relation the project footprint. Special arrangements will be made during the construction phase of the project in order to ensure public safety during this time.

Recreational use and enjoyment of the waterway was discussed during the Public Information Centres and other stakeholder consultation events. Members of the public in attendance appeared to be satisfied with these management strategies.

Navigation impacts downstream of the site could result during times of modified run-of-river operation in the Variable Flow Reach. During certain hours, the flows and water depths would be lower than those presently experienced. At other times, flows and water depth would be greater than normal.

Intermittent operation would occur only in periods while flows are low, most of which occur during the winter months when the river is frozen and not navigable. During summer months, the proponent is committed to the determination of minimum flows that would occur when the facility is stopped to mitigate potential restrictions to watercraft.

5.1.6 Public Safety

Public safety during construction and operation of the project has been identified as a concern. Those effects and management strategies associated with the construction and operation of the facility are summarised in the Proposed Operating Flows and Levels report found in Annex I-C and in the Construction Management plan found in Annex II-B.

5.1.7 Civil Structure and Private Property

The following steps were taken in developing the proposed operating parameters for the Project to mitigate impacts to Civil Structure and Private Property:

The maximum upstream operating water level was set based on the results of the HEC-RAS Study to specifically avoid infringing on the pre-construction High Water Mark at any civil structure or private property. The proposed operating values were reviewed to ensure that any backwater inundation effect does not exceed the natural High Water Mark in areas where the potential for impact exists. The operating plan parameters proposed in Annex II-B for daily fluctuation were

reviewed to ensure that impact on civil structures would not be a concern. During flood passage, where the natural flow exceeds the maximum turbine capacity, the facility will be operated to minimize flood impacts upstream by operating the spillway, turbine and bypass structures accordingly. The spillway and bypass structures will be sized and designed to provide the amount of flood passage capacity required to meet the objectives of the operating plan. This step will be assessed in more detail in the detailed engineering design stage.

5.1.8 Surface Water Quality

Consideration was given to the effects of the project on surface water quality, including the potential use of the waterway as a potable water supply.

There are potential adverse effects on water quality during construction due to erosion and sedimentation, accidental spills, clearing, backfilling, contouring and excavation. As a result, standard construction and industry best management practices will be maintained during the construction program to prevent accidental spills, control erosion and sedimentation, and to manage any groundwater that must be removed from excavations. Spill prevention and emergency fuel supply containment measures (as required by Technical Standards and Safety Authority) will be required within the facility throughout the operational period; mitigation measures are described in detail in Table 4.

During operation, potential effects on water quality may occur as a result of accidental spills and sedimentation as a result of shoreline erosion caused by inundation and water level fluctuation in the head pond.

5.1.9 Area Aesthetics

Preserving the natural aesthetics of the waterway and surrounding area will be considered as part of the proposed development. As mentioned previously, the area of the falls have an aesthetic value with local residents and tourists. People engage in camping, hiking, fishing, hunting and other associated outdoor pursuits.

Maintaining or enhancing vegetative buffers between the river, roads, and any ancillary works should be a consideration during detailed design to preserve the aesthetic quality of the area; proposed mitigation measures are provided in Table 4.

5.1.10 Employment & Economic Effects

Construction and operation of the project will generate a positive economic effect in the Towns of Cochrane and Iroquois Falls resulting in opportunities for employment of community members. Similar employment opportunities will also exist for the First Nations and Aboriginal community members.

Economic benefits will include employment, expenditures on materials, equipment and services and contribution of renewable energy to the Provincial supply mix. The proposed Frederick House River - Wanatango Falls generating station will have a total installed capacity of approximately 4.67 MW. Waterpower creates jobs, generates revenue for the taxpayers of Ontario, and is the longest lived and most reliable source of renewable electricity:

- Direct economic activity to build a waterpower project in Ontario is approximately $5 million per megawatt. Generally, about half of this amount is spent locally (approximately $23.35 million in the case of this project), in procuring construction labour & materials, consulting and legal services, trucking and other services such as accommodation, food and fuel.

- Direct job creation (construction) is estimated to be approximately 46,700 person hours of work. Indirect job creation is estimated to be approximately 70,050 person hours of work supporting the project and personnel.

- A significant return to the people of Ontario paid through Gross Revenue Charges (GRC) and provincial and federal income taxes. Return to the people of Ontario will continue past the 40 year contract, likely as long as the facility is in operation.

- Waterpower lasts. Many power plants built in the early 1900s are still in operation and with regular maintenance and upgrades can last for many generations. In comparison, the life span for other sources of renewable power is: nuclear 40 years, wind 20 years, solar 20 years.

5.2 Specific Consultation Issues and Resolutions

A summary of the specific issues identified during the regulatory agency, government department and public and Aboriginal consultation process is presented in tabular format as Table 4: Identified Issues and Management Strategies, for the reader's convenience. The table identifies how resolution to each identified issue has been or may be resolved, and whether any outstanding issues or concerns remain. The issues are presented by environmental consideration.

5.3 Consideration of Accidents and Malfunctions

This section presents the issues identified specifically related to potential accidents and malfunctions during operation.

Under *CEAA*, the federal environmental assessment of the undertaking must consider the effects to the environment if an accident or malfunction were to occur during the construction or operation of the project. Consideration must be given to such events as spills and leaks, power failures, toxic substances, and worker and public health and safety.

As the mitigation measures and best management practices detailed in Table 4 of this document will be implemented, it is unlikely that spills and leaks would occur during the construction period. The engagement of an environmental monitor to oversee construction activities should further ensure the prevention of releases of deleterious substances to the environment. Additionally, the health and safety of all contractors and construction crews on both federal and provincial lands will be subject to *Ontario Regulation 231.91* which governs construction projects in Ontario. The health and safety of operational staff at the generating station will be governed by the *Occupational Health and Safety Act*. Public access will be restricted during the construction activities at both the GS site and along the connection line.

Toxic substances are rarely employed at hydroelectric generating stations. Generally, only small quantities of normal industrial lubricants are required for operation. A diesel generator for emergency power supply at the generating station will be required, necessitating the installation of an above- ground storage tank (AST) for diesel fuel. The installation and operation of the AST will be subject to the *Technical Standards and Safety Act*, Ontario Reg. 213.01 (fuel oil).

A power failure at the generating station will result in the inability of the powerhouse to discharge water which will affect project revenues. Should this power failure occur during peak flow periods, the proponent will be responsible for ensuring that peak discharge can be passed downriver.

5.4 Effects of Environment on the Project

For projects subject to the *CEAA*, there is a requirement to consider the effects of the environment on the project. These effects may be of short duration such as a heavy rainfall event, or longer duration such as the anticipated effects of climate change on the project.

Disruptions in energy transmission and generation would result in decreased economic returns for the proponent. The powerhouse will be equipped with a back-up generator to ensure that station service power can be restored to the facility should a grid failure occur. However, the facility cannot be operated (i.e. generation cannot recommence) until the electrical grid can accept the power generated. In this situation no water would be passed through the powerhouse but would be directed through the by-pass designed into the facility. The design of this by-pass will represent at least the pre-project capacity of the natural falls. This aspect of the approval process will be dealt with after the environmental assessment process is completed, as the detailed engineering design is being finalized.

5.4.1 Precipitation and Flooding

Operations during extreme events, such as floods, droughts and safety emergencies may need to deviate from the normal operating parameters to manage flows and mitigate impacts. Proposed operational changes in response to floods are described in Section 3.6.4.

It should be noted that the facility is not designated to mitigate the effects of naturally occurring events such as floods and droughts. However, there are circumstances where the existence of the facility can either aid in managing such an event or pose an additional risk. The flood risk aspects are managed, in part, through the government approval under the *Lakes and Rivers Improvement Act* of the engineering plans and specifications for the design of the facility. The purpose of this process is to ensure that the flood passage capacity of the facility is adequate and that the risk to property and public safety is duly considered. This aspect of the approval process will be dealt with after the environmental assessment process is completed and when the detailed engineering design is being finalized.

5.4.2 Extreme Winter Conditions

Extreme cold weather conditions may lead to a build-up of ice at the intake that could necessitate plant shut-down and an interruption to the delivery of electricity to the provincial supply grid.

5.4.3 Extreme Summer Conditions

Drought conditions could necessitate the shut-down of the facility and an interruption to the delivery of electricity to the provincial supply grid as a result of reduced flows within the river.

5.4.4 Lightning Strikes

A direct hit on the facility may lead to facility shut-down and prolonged interruption to the delivery of electricity to the provincial supply grid.

5.4.5 Accidental Fires

Lightning strikes as well as manmade fires could result in uncontrolled forest/brush fires which may interrupt the operation of the facility and the delivery of electricity to the provincial supply grid. Forest fires may also limit the ability of personnel to access the facility to conduct operations or maintenance.

5.4.6 Earthquakes

The continual shifting of large segments of the earth's crust, called tectonic plates, causes more than 97% of the world's earthquakes. Eastern Canada is located in a relatively stable continental region within the North American Plate and, as a consequence, has a relatively low rate of

earthquake activity. Nevertheless, large and damaging earthquakes have occurred here in the past, and will inevitably occur in the future.

The project area is located in the Northeastern Ontario Seismic Zone, and according to Natural Resources Canada (http://earthquakescanada.nrcan.gc.ca) this zone experiences a very low level of seismic zone activity. NRCan reports that from 1970 to 1999, on average, only one or two magnitude 2.5 or greater earthquakes were recorded in this area, and two magnitude 5 earthquakes (northern Michigan and northwest of Kapuskasing) have occurred in this region. The location of the project in this low seismic activity area presents a low potential for the facility to be affected by this type of geological event.

5.4.7 Climate Changes and Other Weather Related Effects

According to the National Round Table on the Environment and the Economy (www.nrtee-trnee.com), widespread impacts are expected across Canada as a result of increasing temperatures and moisture levels. Among the changes predicted, the Round Table is forecasting that Ontario will experience increased disruptions to energy generation and transmission. Among the many predictions offered, there includes a doubling in the frequency of extreme rain events and increasing costs to providing community services in Canada during the 21st century.

6. RESIDUAL ADVERSE EFFECTS AND SIGNIFICANCE

A summary of the specific issues identified during the regulatory agency and public consultation process is presented in Table 4. The final column in Table 4 indicates whether an issue remains unresolved and is therefore considered a residual effect.

The residual effects of a project are those that are expected to remain despite the application of mitigation measures. The Ministry of the Environment's *Guide to Environmental Assessment Requirements for Electricity Projects (*March 2001) provides criteria for assessing significance:

- the value of the resource affected;
- the magnitude of the effect;
- the geographic extent or distribution of the effect;
- the duration or frequency of the effect;
- the reversibility of the effect;
- the ecological/social context of the effect.

By applying these criteria, the residual effects can be then be classified as either **not significant**; the residual effect is minor or insignificant, or **significant;** no additional mitigative measures can be applied to reduce the impact of the effect so the effect remains significant.

An assessment of the residual effects (including the positive impacts) of the proposed undertaking are presented in Table 5.

TABLE 5: Residual Environmental Effects and Significance

Environmental Component	Issue	Residual Effect (Yes/No)	Value of Resource	Magnitude	Geographic Extent (km)	Duration (months) or Frequency	Reversibility	Ecological/ Social Context	Likelihood of Effect	Significance
General Natural Environment										
Air quality	Noise from operation of electrical generator and transformer at powerhouse/electrical connection	Yes	High	Low	< 1	Continuous	Reversible	Relatively Pristine	High	Not Significant
	Exhaust emissions from equipment and vehicles (construction and operation of facility)	Yes	High	Low	1-10	Effects possible during construction. During operation, would only occur as a result of operation of the generator during emergency situations.	Reversible	Relatively Pristine	High	Not Significant
	Odour	No								
	GHG Offsets	Yes	High	Low	> 10,000	Continuous	Reversible	Previously Impacted	High	Positive
	Dust emissions from construction activities and vehicles	Yes	High	Low	1-10	13-36	Reversible	Relatively Pristine	High	Not Significant
	Local/regional smog, fog, thermal effects, icing and micro-climate	No								
Water quality (surface and groundwater)	Surface water - general construction activities along shoreline of waterway at facility and water crossings along connection line route and access roads	Yes	High	Low	1-10	13-36	Reversible	Relatively Pristine	Low	Not Significant

Environmental Component	Issue	Residual Effect (Yes/No)	Value of Resource	Magnitude	Geographic Extent (km)	Duration (months) or Frequency	Reversibility	Ecological/ Social Context	Likelihood of Effect	Significance
Water quality (surface and groundwater)	Surface water - In-water works construction and removal of the cofferdam: potential for excess sediment to be suspended and carried downstream by river flow	Yes	High	Low	1-10	1-12	Reversible	Relatively Pristine	Low	Not Significant
	Contamination from spills or leaks of hazardous substances	Yes	High	Low	1-10	13-36	Reversible	Relatively Pristine	Low	Not Significant
	Surface water - Inundation area at Wanatango Falls site may alter water quality (methyl-mercury) in reservoir	No								
	Surface water - Fluctuation of inundation area upstream and fluctuation flows downstream caused by intermittent operation of facility increasing suspended sediment	Yes	High	Low	1-10	possible for up to 9 months of every year	Reversible	Previously Impacted	Low	Not Significant
	Surface water - impacts associated with acid rock drainage (ARD) and metal leaching	No								
Species at Risk	Impact to habitats of identified terrestrial Species at Risk due to construction and operation of facility	Yes	Medium	Low	1-10	Continuous	Irreversible	Relatively Pristine	High	Not Significant
	Impact to habitat of Lake Sturgeon due to construction and operation of facility	No								

Environmental Component	Issue	Residual Effect (Yes/No)	Value of Resource	Magnitude	Geographic Extent (km)	Duration (months) or Frequency	Reversibility	Ecological/ Social Context	Likelihood of Effect	Significance
Significant earth or life science features	No issues	No								
Land subject to natural or human made hazards	No issues	No								
Terrestrial wildlife (numbers, diversity, distribution)	General disturbance to habitat during construction and maintenance of facility (dam, powerhouse, etc)	Yes	Medium	Low	11-100	Continuous	Reversible	Relatively Pristine	High	Not Significant
	Access road construction - habitat fragmentation, increased predation, introduction of invasive species	Unknown due to outstanding data and information								
	Connection line construction	Yes, expected, however additional data is required to complete the determination of the significance of the residual effect								
	Impacts related to the creation of facility and headpond creation - impacts to general and Significant Wildlife Habitats	Yes	Medium	Low	1-10	Continuous	Irreversible	Relatively Pristine	High	Not Significant
	General disturbance to wildlife	Yes	Low	Low	11-100	During construction period and then once every few years for maintenance along the connection line corridor	Reversible	Relatively Pristine	Medium	Not Significant

Environmental Component	Issue	Residual Effect (Yes/No)	Value of Resource	Magnitude	Geographic Extent (km)	Duration (months) or Frequency	Reversibility	Ecological/ Social Context	Likelihood of Effect	Significance
Natural vegetation and habitat linkages	Effects on vegetation and habitat during connection line and access roads ROWs construction and maintenance	Yes	Medium	Low	11-100	During construction period and then once every few years for maintenance along the connection line corridor	Reversible	Relatively Pristine	High	Not Significant
	Access road and connection line construction - habitat fragmentation, increased predation, introduction of invasive species and increased potential for forest fires	No								
	Access road and connection line construction - habitat fragmentation, increased predation and introduction of invasive species	Yes, expected, however additional data is required to complete the determination of the significance of the residual effect								
Soil and sediment quality	Soil compaction in construction footprint and ROW for connection line and access roads	No								
	Impacts to pre-existing contaminated sites	No								
	Management of excavated materials (blast rock, fill, aggregates, etc)	No								
Aquatic and Riparian Ecosystem										
Shoreline Dependent Species	*Shoreline dependant Fish Species - See Fish Habitat Section below*									

Environmental Component	Issue	Residual Effect (Yes/No)	Value of Resource	Magnitude	Geographic Extent (km)	Duration (months) or Frequency	Reversibility	Ecological/ Social Context	Likelihood of Effect	Significance
Shoreline Dependent Species	Inundation effects on aquatic mammals (beaver and otter, etc) and their habitat	No								
	Facility construction activities impacts on shoreline habitats and vegetation	Yes	Medium	Low	< 1	Continuous	Irreversible	Relatively Pristine	High	Not Significant
	Loss of emergent riparian vegetation as a result of water level fluctuations	Yes	Low	Medium	1-10	Continuous	Reversible	Relatively Pristine	High	Not Significant
Wetland Dependent Species	Potential for impacts to general and significant wildlife habitats as a result of inundation and facility operations	Yes	Medium	Low	1-10	Continuous	Reversible	Relatively Pristine	High	Not Significant
Fish Habitat	Potential effects on habitat associated with water crossings on ROWs for access roads and connection line	Unknown due to outstanding data and information								
	Construction activities in general	No								
	Permanent alteration or loss of fast water habitats upstream of the facility as a result of inundation	No								

Environmental Component	Issue	Residual Effect (Yes/No)	Value of Resource	Magnitude	Geographic Extent (km)	Duration (months) or Frequency	Reversibility	Ecological/ Social Context	Likelihood of Effect	Significance
Fish Habitat	Construction of in-water facility components. The construction of the headrace and tailrace will result in the permanent alteration or destruction of river habitat.	No								
	Temporary impacts and loss of habitat related to the construction of cofferdams	No								
	Potential effects on habitat and spawning from dewatering operations	No								
	Potential effects on aquatic habitat in the by-pass and variable flow reach due to facility operations	No								
Fish Migration	Construction of the dam represents a potential barrier to the upstream movement of fish	Yes, expected, however additional data is required to complete the determination of the significance of the residual effect								
	Downstream passage of larval and adult fish	No								
Fisheries	Impacts to fisheries within the project zone of influence	Unknown due to outstanding data and information								

Environmental Component	Issue	Residual Effect (Yes/No)	Value of Resource	Magnitude	Geographic Extent (km)	Duration (months) or Frequency	Reversibility	Ecological/ Social Context	Likelihood of Effect	Significance
Fish injury or mortality	Fish impingement or entrainment resulting in injury or mortality	Yes	Medium	Low	< 1	Seasonal	Irreversible	Relatively Pristine	High	Not Significant
	Fish injury or mortality as a result of cofferdam placement and dewatering	Yes	Medium	Low	< 1	< 11	Irreversible	Relatively Pristine	Medium	Not Significant
Erosion and sedimentation	Construction related impacts related to the relocation of sediments and soils - Surface water overland flow paths within the construction areas have the potential to carry construction-related sediment to the watercourse.	No								
	Operation - Increased shoreline erosion and sediment deposition due to inundation area and variable flow reach water level fluctuations	No								
Water levels, flows and movement (surface water)	Creation of headpond and fluctuation in levels/flows	No								
	Variation in flows within downstream variable flow reach	No								
Water Temperature	Changes to thermal regime of waterway within headpond as a result of inundation and temporary storage	No								

Environmental Component	Issue	Residual Effect (Yes/No)	Value of Resource	Magnitude	Geographic Extent (km)	Duration (months) or Frequency	Reversibility	Ecological/ Social Context	Likelihood of Effect	Significance
Drainage, flooding and drought patterns	Alteration from natural patterns	Yes	Medium	Low	< 1	frequency dependant on flood event frequency	Irreversible	Relatively Pristine	Low	Not Significant
Aboriginal Community										
First Nations reserves or other aboriginal communities	Local Aboriginal Communities (LAC), Identified Aboriginal Communities (IAC) have expressed an interest in engagement in regards to the project and potential impacts	No								
Spiritual, ceremonial, cultural, archaeological or burial sites	Impacts to these environmental components have not yet been identified	Unknown pending completion of Stage 2 investigations								
Traditional land or resources used for harvesting, hunting, fishing, trapping	Impacts to these environmental components have not yet been identified	Unknown pending completion of consultation with Aboriginal communities								
Lands subject to land claims	None identified	No								
Economic Development	Business to business relationships	Unknown pending completion of discussions with Aboriginal communities								
Land and Resource Use										
Access to inaccessible areas	Facilitation of access as a result of upgrades/maintenance of area access roads and bridges New roads can act as vectors leading to increased exploitation and introduction of new species	Yes	High	Low	1-10	Continuous	Reversible	Previously Impacted	High	Not Significant

Environmental Component	Issue	Residual Effect (Yes/No)	Value of Resource	Magnitude	Geographic Extent (km)	Duration (months) or Frequency	Reversibility	Ecological/ Social Context	Likelihood of Effect	Significance
Navigation	Construction, inundation and variable flows may alter navigational access within the project zone of influence	Yes	High	Medium	1-10	13-36	Reversible	Relatively Pristine	High	Not Significant
Riparian rights or privileges	Impacts associated with inundation	No								
Angling, hunting opportunities	Projects fall within Bear Management Areas - effects on bear hunting	No								
	The project site is a utilised by anglers	Unknown due to outstanding data and information								
Trapping	Projects fall within registered trap line areas	No								
Baitfish harvesting activities	Projects fall within registered commercial baitfish harvesting areas	No								
An existing land or resource management plan	Forest resources on Crown Land in the vicinity of the site are allocated under a Sustainable Forestry License to Abitibi River Forest Management Inc.; clearing of resource in alignment with FMP and knowledge of SFL	No								

Environmental Component	Issue	Residual Effect (Yes/No)	Value of Resource	Magnitude	Geographic Extent (km)	Duration (months) or Frequency	Reversibility	Ecological/ Social Context	Likelihood of Effect	Significance
An existing land or resource management plan	If and when the facility is commissioned, an amendment to the Abitibi River WMP will be required	No								
Protected areas	No protected areas identified	No								
Forestry	Harvesting of merchantable timber during construction	Yes	High	Low	11-100	13-36	Irreversible	Relatively Pristine	High	Positive
	Processing of non-merchantable timber	No								
Mine claims	Wanatango Falls project Zone of Influence is within several existing mine claims	No								
Existing Dams	Impacts to operations of Frederick House Lake Dam upstream of facility	No								
Agricultural land	Impacts to agricultural lands due to water level and flow fluctuations downstream of facility	No								
Cultural Heritage Resources										
Archaeological sites	Disturbance or destruction to archaeological resources	Unknown pending completion of Stage 2 investigations								

Environmental Component	Issue	Residual Effect (Yes/No)	Value of Resource	Magnitude	Geographic Extent (km)	Duration (months) or Frequency	Reversibility	Ecological/ Social Context	Likelihood of Effect	Significance
Buildings or structures	Disturbance or destruction to heritage buildings or structures	Unknown pending completion of Stage 2 investigations								
Cultural heritage landscapes	Disturbance or destruction to cultural heritage landscapes	Unknown pending completion of Stage 2 investigations								
Social and Economic										
The location of people, businesses, institutions or public facilities	Disruption to access, schedules and activities	No								
Community character, enjoyment of property or local amenities	Potential effects on property enjoyment, recreational water use, tourism values, aesthetic image	Unknown due to outstanding data and information								
Employment - Local and regional labour supply	Construction activities will support direct and indirect local employment	Yes	High	High	101-1000	13-36	Reversible	Previously Impacted	High	Positive
Public health and/or safety	Forest or brush fires caused as a result of project activities	No								
	Forest or brush fires caused as a result of project activities	No								
	Impacts associated with facility construction	No								

Environmental Component	Issue	Residual Effect (Yes/No)	Value of Resource	Magnitude	Geographic Extent (km)	Duration (months) or Frequency	Reversibility	Ecological/ Social Context	Likelihood of Effect	Significance
Public health and/or safety	Impacts for navigation and recreation associated with facility operation	No								
	Production of waste in and around work site	No								
Water Supply	Impacts to local water supply	No								
Aesthetic image of the surrounding area	Disruption due to presence and operation of proposed facility	Unknown due to outstanding data and information								
Energy/Electricity										
Reliability	Voltage support	Yes	High	Low	> 10,000	Continuous	Reversible	Previously Impacted	High	Positive
Security	Black Start capability	Yes	High	Low	> 10,000	< 11	Reversible	Previously Impacted	High	Positive
Electricity flow patterns	Power flow system	Yes	High	Low	1001-10,000	Continuous	Reversible	Previously Impacted	High	Not Significant
Other	Protection control settings	Yes	High	Low	1001-10,000	Until installed	Reversible	Previously Impacted	High	Not Significant

7. CUMULATIVE EFFECTS

Cumulative effects can be defined as long term changes that may occur as a result of the combined effects of each successive action on the environment. Cumulative effects may result from interacting effects of multiple projects in a given area, or multiple activities acting on a single ecosystem component. The assessment of the potential cumulative effects posed by a project is a requirement under the *CEAA*. *CEAA* requires that the assessment of cumulative effects examines past, present and "reasonably foreseeable" future activities in addition to the activities posed by the project, and how these would affect the valued ecosystem components within the project area, and beyond, if necessary.

The assessment of cumulative effects outlined below is based on a precautionary approach and the professional judgement of the EA team. As additional information about Wanatango Falls and other projects and activities in the area becomes available, the characterization and assessment of cumulative effects will be further discussed through the impact assessment, detailed design, and permitting stages of the project.

The potential cumulative effects of the proposed development are discussed in the following sections:

7.1 IDENTIFICATION OF OTHER PROJECTS AND ACTIVITIES

There are known activities within the area that should be considered along with any residual effects of Wanatango Falls project in order to undertake an assessment of cumulative effects. These projects or activities are described below.

Frederickhouse Lake Dam

The existing Frederickhouse Lake Dam is located approximately 10 km upstream from Wanatango Falls site. OPG owns and operates the dam to provide seasonal storage and flow regulation for the operation of the Island Falls, Abitibi Canyon and Otter Rapids generating stations downstream on the Abitibi River. The dam operating regime is currently specified in the Abitibi River Water Management Plan and the Frederick House River, below the Frederickhouse Lake Dam, experiences highly variable flows and water levels over the course of any given year. Operation of the Frederickhouse Lake Dam may potentially impact the levels and flows at the proposed Wanatango Falls GS resulting in cumulative effects on recreation, operations, and aquatic or terrestrial natural heritage.

Forestry Harvesting

The study area is located within a forest management area and forest resources on Crown land adjacent to the proposed headpond are currently allocated under a Sustainable Forest License to Tembec and AbitibiBowater.

Access Roads

The site will be accessed via new roads from the Newmarket Concession Road 5 & 6 or Dunn Road. Road upgrades will be required to facilitate the passage of construction vehicles and equipment. Access road planning to the project site was determined in close consultation with the forest management companies with the purpose of incorporating access with existing forestry roads wherever possible. Access road details are provided in Annex VI.

7.2 Assessment of Potential Cumulative Effects

An analysis was undertaken to determine cumulative effects associated with the interaction between each known residual effect of the project and other past, present and future planned projects and activities within the study area. The result of this assessment as well as the significance of each cumulative effect is presented in Table 6: Cumulative Environmental Effects and Significance.

Table 6: Cumulative Environmental Effects and Significance

Component	Four Slide Falls Confirmed Net Impacts	Assessment of Significance										
		Access Roads	Forestry Harvesting	Frederick House Lake Dam	Value of Resource	Magnitude	Geographic Extent (km^2)	Duration (months) or Frequency (events/year)	Reversibility	Ecological/ Social Context	Likelihood of Cumulative Effect	Significance
General Natural Environment												
Air quality	Noise from operation of electrical generator and transformer at powerhouse/electrical connection	✓	✓		High	Low	< 1	37-72	Reversible	Relatively Pristine	Low	Not Significant
	Exhaust emissions from equipment and vehicles (construction and operation of facility)	✓	✓		High	Low	1-10		Reversible	Relatively Pristine	Low	Not Significant
	Dust emissions from construction activities and vehicles	✓	✓		High	Low	1-10	37-72	Reversible	Relatively Pristine	Low	Not Significant
Water quality (surface and groundwater)	Surface water - general construction activities along shoreline of waterway at facility and water crossings along connection line route and access roads	✓			High	Low	11-100	37-72	Reversible	Relatively Pristine	Low	Not Significant
	Contamination from spills or leaks of hazardous substances	✓	✓		High	Low	11-100	37-72	Reversible	Relatively Pristine	Low	Not Significant
	Surface water - Fluctuation of inundation area upstream and fluctuation flows downstream caused by intermittent operation of facility increasing suspended sediment			✓	High	Low	11-100	< 11	Reversible	Relatively Pristine	Low	Not Significant
Species at Risk	Impact to habitats of identified terrestrial Species at Risk due to construction and operation of facility	✓	✓		High	Low	11-100	Continuous	Irreversible	Relatively Pristine	Low	Not Significant
Terrestrial wildlife (numbers, diversity, distribution)	General disturbance to habitat during construction and maintenance of facility (dam, powerhouse, etc)	✓	✓		Medium	Low	11-100	Continuous	Irreversible	Previously Impacted	Low	Not Significant
	Access road construction - habitat fragmentation, increased predation, introduction of invasive species	✓	✓		Medium	Low	11-100	37-72	Reversible	Previously Impacted	Low	Not Significant
	Connection line construction	✓	✓		Medium	Low	11-100	37-72	Reversible	Previously Impacted	Low	Not Significant
	Impacts related to the creation of facility and headpond creation - impacts to general and Significant Wildlife Habitats	✓	✓		Medium	Medium	1-10	Continuous		Relatively Pristine	Low	Not Significant
	General disturbance to wildlife	✓	✓		Medium	Low	1-10	37-72	Reversible	Previously Impacted	Low	Not Significant
Natural vegetation and habitat linkages	Effects on vegetation and habitat during connection line and access roads ROWs construction and maintenance	✓	✓		Medium	Medium	11-100	37-72	Reversible	Relatively Pristine	Medium	Not Significant

Component	Four Slide Falls Confirmed Net Impacts	Assessment of Significance										
		Access Roads	Forestry Harvesting	Frederick House Lake Dam	Value of Resource	Magnitude	Geographic Extent (km^2)	Duration (months) or Frequency (events/year)	Reversibility	Ecological/ Social Context	Likelihood of Cumulative Effect	Significance
Natural vegetation and habitat linkages	Access road and connection line construction - habitat fragmentation, increased predation and introduction of invasive species	✓	✓		Medium	Low	11-100		Reversible	Relatively Pristine	Medium	Not Significant
Aquatic and Riparian Ecosystem												
Fish Habitat	Potential effects on habitat associated with water crossings on ROWs for access roads and connection line	✓	✓		Medium	Low	11-100	Continuous	Reversible	Previously Impacted	High	Significant
Drainage, flooding and drought patterns	Alteration from natural patterns		✓		Medium	Medium	11-100	frequency dependant on flood event frequency	Irreversible	Relatively Pristine	Low	Not Significant
Land and Resource Use												
Access to inaccessible areas	Facilitation of access as a result of upgrades/maintenance of area access roads and bridges New roads can act as vectors leading to increased exploitation and introduction of new species	✓	✓		High	Medium	1-10	Continuous	Reversible	Previously Impacted	High	Not Significant
Forestry	Harvesting of merchantable timber during construction		✓		High	Low	1-10	Continuous	Irreversible	Relatively Pristine	High	Positive
Social and Economic												
Employment	Construction activities will support direct and indirect local employment	✓	✓		High	High	101-1000	37-72	Reversible	Previously Impacted	High	Positive

Air quality

Impacts to air quality associated with the project (dust, odour, exhaust, etc) are all expected to occur mainly during the construction phase of the project and will be curtailed during operation. Given the mitigative measures which will be taken and the remote nature of the project these impacts are anticipated to be both short term and minor and therefore not significant.

Additionally, as a modified run-of-river facility, the project will generate sustainable and renewable energy and, in combination with other green energy projects, contribute to the improvement of air quality and public health in Ontario by facilitating and compensating for the shutdown of coal fired generation facilities throughout the province.

Flow and inundation effects on water quality, movement and erosion

The cumulative effects associated with the alteration from normal flow patterns as a result of the construction of the Wanatango Falls GS on the river, downstream of the Frederickhouse Lake Dam has the potential to have cumulative effects. In order to manage the impacts, a communications protocol between Ontario Power Generation and the Wanatango GS will be implemented. The operating strategy for the Wanatango Falls GS will be incorporated into the Abitibi Water Management Plan. Xeneca is also proposing to monitor the watercourse for the effects of erosion and ice scour following the construction of Wanatango Falls facility and, if required, modifying operations at Wanatango Falls to mitigate any impacts.

Disturbance of terrestrial wildlife and vegetation

The construction and operation of the Wanatango Falls facility will result in an increase in traffic in local access roads as well as the construction the connection line ROW. In combination with the existing access roads and forestry activity these activities will have the potential to disturb terrestrial wildlife. While construction activity will result in higher traffic volume and activity, it will not continue once the project is operational. Route selection for connection lines and roads has been sited along existing roads wherever possible.

Given the relatively large area over which the disturbance will be distributed and the fact that wildlife in the area is disturbed through forestry activity periodically, the overall impacts are not anticipated to be significant.

Alteration and/or destruction of fish habitat

The cumulative effects associated with the alteration from normal flow patterns as a result of the construction of the Wanatango Falls GS on the river, downstream of the Frederickhouse Lake Dam has the potential to have cumulative effects on aquatic habitat. In order to manage the impacts and maintain suitable flow and water levels upstream and downstream of the

Wanatango Falls GS, a communications protocol between Ontario Power Generation and the Wanatango GS will be implemented and the operating strategy for the Wanatango Falls GS will be incorporated into the Abitibi Water Management Plan.

Access to inaccessible areas; community character, enjoyment of local amenities; local, regional or provincial economies

The Frederick House River is recreational destination for anglers, boaters and paddlers, the effects associated with the changes to the waterway from the addition of a hydroelectric generating station may result in cumulative impacts to the populations of local fish species and recreational use and enjoyment of the river.

The cumulative effects associated with the above mentioned components relate to the facilitation of access through the construction of new roads and road upgrades, increased use of the river, and ongoing operations. These may have an effect on tourism values, the viability of local businesses, recreational water use and aesthetic image.

8. MONITORING & FOLLOW-UP PROGRAMS

Proposed monitoring and follow-up programs are presented below. Additional programs may emerge through on-going consultation within the regulatory approvals stages of the development planning.

8.1 CONSTRUCTION MONITORING

Prior to construction, the Construction Management Plan (CMP) presented in Annex II-B will be enhanced to incorporate any construction management strategies outlined in the ER and supporting annexes as well as any permit application or federal approval/authorization requirements. The final CMP will be submitted to the regulators as supporting documentation for construction permits and approvals.

The proponent will:

- Ensure that all necessary regulatory permits and approvals (federal and provincial) have been obtained prior to the start of any site preparation or construction activities.
- Ensure that all contractors are familiar with and are applying the identified mitigation measures outlined in the CMP and industry/regulator best management practices.

- Ensure that controls to minimize environmental effects during construction (e.g. sediment fencing) are regularly inspected and functional, and conduct inspections after any event which might disturb the control measure (e.g. a heavy rainfall event).

- Ensure that the mitigation measures being applied are not creating adverse environmental effects, and that mechanisms are in place for corrective and remedial action to address these if they occur.

- Ensure that all signage and required traffic control measures, including posted speed limits, remain in appropriate locations as construction proceeds and in good visual condition.

- Ensure that all site restoration activities have been implemented.

8.2 Post-Construction / Operation Monitoring

Prior to commissioning, an Operation and Maintenance Plan will be prepared for the facility. The Operation and Maintenance Plan should include:

- The locations where the potential for erosion has been identified will be inspected and assessed at intervals after operation commences.

- Where monitoring reveals significant erosion and the potential for adverse environmental effects, further monitoring and/or mitigation strategies will be developed, as required.

Based on the results of the post construction monitoring, further mitigation strategies will be developed as required. Other items in the Operation and Maintenance Plan include:

- Emergency response plans for hazardous materials spills, fire, etc.

- Health and safety guidelines for powerhouse employees.

- Waste and hazardous materials handling, storage and disposal guidelines.

Environmental Assessment Commitment Implementation and Review Plan

Xeneca will continue to work closely with federal and provincial agencies, during the EA review process and afterwards during the detailed design, construction, and operational phases of the project. As part of this effort, Xeneca will issue a regular Project Implementation Report to agencies to update project status, implementation of commitments, and results from effects and mitigation programs.

9. REGULATORY APPROVALS AND PERMITS

Following the successful completion of the EA and the completion of detailed engineering design, the proponent will make application to various federal, provincial and municipal agencies for regulatory permits, approvals and authorizations. These permits, approvals and authorizations are required before site preparation or construction, or prior to the commissioning of the facility. A list of the regulatory permits that may be required for this undertaking is presented below in Table 7.

Table 7: List of Potential Regulatory Approvals

Permit and Legislative Requirement	Agency
Federal	
Authorization for Works and Undertakings Affecting Fish Habitat - *Fisheries Act* [Section 35(2)]	Department of Fisheries and Oceans
Authorization for Destruction of Fish by Means other than Fishing - *Fisheries Act* (Section 32)	Department of Fisheries and Oceans
Requires construction of fish-ways – *Fisheries Act* (Section 20)	Department of Fisheries and Oceans
Requires fish guards or screens to prevent entrainment of fish at any water diversion or intake – *Fisheries Act* (Section 30)	Department of Fisheries and Oceans
Requires sufficient flow of water for the safety of fish and flooding of spawning grounds as well as free passage of fish during construction – *Fisheries Act* (Section 22)	Department of Fisheries and Oceans
Species at Risk Act (SARA) – authorizations, as applicable	Department of Fisheries and Oceans; Environment Canada
Approval for Construction in Navigable Waters – *Navigable Waters Protection Act* (Section 5)	Transport Canada (Marine)
Explosives Act - Temporary Magazine Licence	Natural Resource Canada (NRCan)
Provincial	
Lakes and Rivers Improvement Act (LRIA) – Section 14 - Location Approval and Plans and Specifications Approval	Ministry of Natural Resources
Lakes and Rivers Improvement Act (LRIA) – Section 23.1 - Water Management Plan amendment	Ministry of Natural Resources
Public Lands Act (PLA) – Work Permits (Parts 1-5, as required).	▪ Ministry of Natural Resources
Public Lands Act (PLA) – Land Use Permit or Licence to Construct	Ministry of Natural Resources
Public Lands Act (PLA) – Licence of Occupation	Ministry of Natural Resources
Public Lands Act (PLA) – Water Power Lease Agreement	Ministry of Natural Resources

Public Lands Act (PLA) – Grants of Easements (Policy PL 4.11.04)	Ministry of Natural Resources
Endangered Species Act (ESA) – permits and agreements, as applicable	Ministry of Natural Resources
Crown Forest and Sustainability Act (CFSA) - Forest Resource Licence and Overlapping Licence Agreement	Ministry of Natural Resources
Crown Forest and Sustainability Act (CFSA) – Use/maintenance agreement	Ministry of Natural Resources
Forest Fires Prevention Act (FFPA) - Burn permit on Crown Land	Ministry of Natural Resources
Aggregate Resources Act (ARA) – Aggregate Permit	Ministry of Natural Resources
Ontario Heritage Act and the *Ontario Heritage Amendment Act (OHA and OHAA)*- Cultural Heritage Clearances and Registration to Database	Ministry of Tourism and Culture
Permit to Take Water – *Ontario Water Resources Act* (Section 34), Category 2 (construction) and 3 (operation)	Ministry of the Environment
Certificate of Approval (Industrial Sewage) – *Ontario Water Resources Act* (Section 53)	Ministry of the Environment
Certificate of Approval (Air and Noise) – *Environmental Protection Act* (Section 9)	Ministry of the Environment
Waste Generator Registration – *Environmental Protection Act* [Section 18(1)], Ontario Regulation 347	Ministry of the Environment
Notice of Project and Registration of Contractors – Construction Regulation 213/91	Ministry of Labour
Ontario Energy Board Act (OEBA) - Electricity Generation Licence Potentially leave to construct (section 92) and Wholesaler license if transmission connected. Note would also require market authorization from the IESO if transmission connected.	Ontario Energy Board
Municipal	
Road Use Agreement	Municipality
Building Permit	Municipality
Fire Protection and Prevention Act (FFAPA) - Burn Permit	Municipality

10. COMMITMENTS

The following commitments are made by the proponent, Xeneca Power Developments Inc. in order to ensure the development of a sustainable waterpower project;

General

- The proponent is committed to ensuring compliance with the ER as a contract with the people of Ontario.

- The proponent is committed to the adoption and application of the mitigation measures outlined within this document for both the construction and operation of the proposed undertaking according to applicable legislation (i.e. adherence to Construction Management Plan and best management practices, such as applicable DFO Ontario Operational Statements as listed at http://www.dfo-mpo.gc.ca/regions/central/habitat/os-eo/provinces-territories-territoires/on/index-eng.htm). This may be achieved through the hiring of an environmental inspector for the duration of the construction program and through operator training on environmental issues within the operational phase of the project.

- The proponent if committed to developing appropriate compensation for any significant adverse impacts in cooperation with the Agencies once the engineering details for the project have been advanced during the permitting phase of the project.

- The proponent is committed to the development and implementation of a regular reporting process including a Project Implementation Report.

Facility Operations

- The proponent is committed to verifying the specific operational parameters in consultation with regulators and to documenting any updates in the operational plan for the facility.

- The operation of the facility will be aligned with the existing Abitibi River WMP during a comprehensive review in 2014. Wanatango Falls Operating Plan will be made available to all identified stakeholders (please see the Plan in Annex I-C and reference to stakeholder list) for consideration during the EA review process and for discussion in subsequent stages of the development. The approved Operating Plan will become part of the Abitibi River WMP through a *Lakes and River Improvement Act*, Section 23.1, Water Management Plan amendment. After the approval of the amendment by the Minister, Xeneca will participate in the Abitibi WMP process.

Consultation

- The proponent is committed to continuing to engage specific stakeholders on relevant issues after the issuance of the Notice of Completion and Statement of Completion.

- The proponent is committed to sharing all information from studies as well as the operational strategy proposed for the site with the interested First Nation, Aboriginal and other communities.

- Xeneca will work with the recreational fishing community, riparian landowners and other interested parties to ensure that access, fisheries, and aesthetics are not negatively affected by the project. Xeneca is also willing to facilitate access by improving boat launches, parking

and portages where possible. Recognizing that there is a potential conflict between these two objectives, given the remote aesthetic of the area, Xeneca will seek to reach a mutually agreeable solution with stakeholders.

Further Investigations

- The proponent will update the Construction Management Plan based on advanced project design to include instructions and protocols for minimizing the disturbance to valued ecosystem components.
- The proponent will document and verify impacts associated with inundation and flow effects within the zone of influence upstream (inundation area) and downstream (variable flow reach) of the facility.
- Hydrological survey cross-sections will be taken across key fast water habitats upstream of the facility in order to refine impact analysis.
- The proponent will enhance shoreline erosion investigations completed to date through further studies of reservoir sedimentation during the detailed design phase of the project.
- The proponent will undertake Stage 2 and, if required under the *Heritage Act*, Stage 3 and/or 4 archaeological investigations within the project area including both the project site in those areas which the Stage 1 archaeological assessment determined to have a high potential for archaeological resources.
- The proponent will continue to actively solicit the involvement of participating Aboriginal communities in any cultural heritage assessment activities to be undertaken for the project.

11. CONCLUSIONS

Xeneca Power Development Inc. (Xeneca) proposes to construct and operate Wanatango Falls hydroelectric power generating station (GS) on the Frederick House River. This document describes the environmental assessment (EA) carried out as part of the planning process for the proposed project.

Throughout the environmental planning process, Xeneca has endeavoured to understand the environment in which the project would be built by undertaking an extensive information and data collection program. Data on areas of the environmental setting of the project was collected by discipline experts including:

- Stage 1 archaeological assessment;
- A natural environment characterization and impact assessment;
- Erosion study on the riverine system in the zone of influence;
- Database analysis and mapping exercise and wetland assessment and flyover to route the connection line and access roads;
- A statistical analysis of historical hydrological data;
- A hydraulic model study analysis;
- Conceptual engineering design; and
- Baseline surface water quality study

A comprehensive agency and public consultation program also contributed key information towards the identification of the potential adverse and positive environmental effects of the project. While Xeneca is committed to continuing the discussion with local groups it is anticipated that any identified issues can be resolved. Agency approval for the proposed operating strategy and permitting and authorizations in support of construction will be sought following consultation with regulators and incorporated into the final design of the facility and its' components.

Aboriginal and First Nation engagement was undertaken with each community's leadership as part of the business to business Aboriginal consultation initiative by the proponent. A comprehensive engagement initiative with each community located within, or having traditionally used the project area has been underway since issue of the Notice of Commencement and will continue beyond Notice of Completion and into project implementation.

Additionally, the Stage 1 archaeological assessment of the project determined the potential for cultural resources to be impacted by the project. As a result, a Stage 2 assessment is underway with participation by First Nation and Aboriginal communities. Further archaeological assessment requirements will be determined subsequent to the findings of the Stage 2 study in accordance with the *Ontario Heritage Act*.

The results of the HEC-RAS modeling of the inundation area revealed that the zone of influence of the variable flow reach had expanded their initial extents. Additional scientific investigations and modeling exercises will be undertaken to assess and verify the potential impacts at this ecosystem.

Throughout this document, management strategies have been developed and applied to known impacts in order to avoid, prevent or minimize any identified adverse environmental effects of the project. It is the conclusion of this environmental assessment that the planned undertaking will result in residual adverse effects. An analysis of the identified residual adverse environmental

effects was undertaken to determine their significance, and commitments for any required additional measures for the further management of these potential residual effects have been made.

The majority of the identified adverse effects were determined to be "not significant", meaning that they are not likely to cause unacceptable harm to environmental quality, productive capacity of the effected environment, or the socio-economic and cultural attributes of the area.

It is acknowledged that the construction of the Wanatango Falls GS has the potential to result in the harmful alteration, disruption or destruction (HADD) of aquatic habitat within the project footprint. The requirement for an Authorization under Section 35 of the *Fisheries Act* for the HADD of fish habitat is anticipated.

The proposed compensation for these anticipated impacts will be developed and discussed with Fisheries and Oceans Canada once the engineering details for the project have been advanced during the permitting phase of the project. It is expected that the mitigation and compensation strategies developed as part of these discussions which may include the replacement of spawning habitats that will be lost or altered as a result of Wanatango Falls development will result in no net residual impact to fish habitat and therefore no significant residual impact.

There are also many positive environmental effects associated with the project which are considered to off-set the adverse environmental effects associated with the project, these include:

- Tangible Economic Outcomes for the Local Communities and the Regional / Provincial Economy:
    - Benefit to the local SFL holder by sale/processing of merchantable timber along the connection line and access road ROWs, and the merchantable timber to be harvested from the area of inundation.
    - Job creation during construction both directly and indirectly in the Northeastern Region of Ontario. Direct employment (construction only) for waterpower projects is estimated at 10,000 person hours per MW; indirect jobs multiply by 1.5; and up to two part time jobs will be available in the operation and maintenance of the facility.
    - An increase in economic activity (direct and indirect) to build the project procuring everything from consulting and legal services to concrete, steel, trucking and other services such as lodging, food and fuel. The majority of this activity will be created within the local/regional economy.
- Employment and training opportunities (planning, construction and operation phases of the project);

- Creation of reliable and secure green energy for the province and reduced Greenhouse Gas emissions:
    - The project will reduce CO_2 emissions by eliminating the need for an equivalent amount of electricity to be produced through the combustion of fossil fuels.
    - Benefits to the population, commerce and industries of Ontario by providing more reliable and consistent renewable power to the provincial grid for many years to come. Many power plants built in the early 1900s are still in operation and with regular maintenance and upgrades can last for generations to come.
    - The operation of the facility in the existing power grid will be compatible with the overall power system reliability and power quality (voltage and frequency) objectives while improving distribution customer service reliability in this area, from a sustainable and consistent power source.
- The generation of electricity through a renewable energy supply in support of the province's *Green Energy and Green Economy Act*.

Preliminary planning discussions towards the development of various management strategies are outlined in this document, and the proponent will continue to work with the regulators and other interested parties in support of securing approvals for this undertaking. The application of the recommended management strategies and adherence to the identified commitments by the proponent will help to realize a sustainable renewable energy development project.

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