

Appendix B
Project Description

Contents

1. Project Description – Big Eddy (Petawawa River) Hydroelectric Generating Station)
Xeneca Power Development Inc.

N.B.

Please note that the following Project Description was issued in November 2010 to federal and provincial regulators for the purposes of introducing the project and initiating discussion at the start of the EA planning process. For the reader's convenience, the Project Description is included as an appendix to this Environmental Report as a reference for the initial scope of the project and to ensure that all relevant project information is presented.

The main Environmental Report represents the most up-to-date document, and its contents supersede what was presented in the Project Description.



Project Description

Big Eddy (Petawawa River) Hydroelectric Generating Station

Distribution:

Canadian Environmental Assessment Agency

Federal Agencies to be contacted by the Federal Environmental Assessment Coordinator

Environment Canada

Fisheries and Oceans Canada

Health Canada

Indian and Northern Affairs Canada

Natural Resources Canada

Transport Canada

Canadian Transportation Agency

Department of National Defence - Canadian Forces Base Petawawa

Provincial Agencies

Ministry of Aboriginal Affairs

Ministry of Tourism and Culture

Ministry of Energy and Infrastructure

Ministry of the Environment

Ministry of Natural Resources

Ministry of Transportation

Ministry of Northern Development, Mines and Forestry

Ontario Parks – including Algonquin Park Superintendent

Ontario Waterpower Association

Municipal

Town of Petawawa

County of Renfrew

City of Pembroke

Town of Deep River

Town of Laurentian Hills

First Nations

Algonquin First Nation through the Algonquins of Ontario Consultation Office

Métis Nation of Ontario

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1. General Information

1.1 General

This Project Description has been prepared by the proponent, Xeneca Power Development Inc. (Xeneca) based on the current conceptual designs for the Big Eddy Generation Station to satisfy the requirements of the federal *Canadian Environmental Assessment Act* (CEAA) as well as the provincial Class Environmental Assessment for Waterpower Projects (Ontario Waterpower Association (OWA) 2008). Conceptual design is subject to change subsequent to the results of studies in support of the proposed undertaking, comment by regulatory agencies, First Nation and Aboriginal Communities and other stakeholders.

1.1.1 Name and Proposed Location of Project

The name of the project is the “Big Eddy Hydroelectric Generating Station.” The proposed water control structure would be located approximately 125 m upstream of the CPR Bridge at the Big Eddy Rapids on the Petawawa River (Figure 1). The proposed water intake structure would be located approximately 250 m upstream of the CPR Bridge; the tailrace structure would be located approximately 350 m downstream from the bridge. The legal description for the site is Lots 19 and 20, Concession 9, Town of Petawawa (Xeneca 2009).

The Big Eddy Hydroelectric Generating Station (GS) project is located approximately 7 km downstream from Xeneca’s proposed Half Mile Rapids Hydroelectric Generating Station. If approved, the Half Mile Rapids project would be constructed on CFB Petawawa land. As such, the environmental assessment process for the Half Mile GS is being completed as a federal screening under the CEAA.

1.1.2 Nature of the Project

The Ontario Ministry of Natural Resources (MNR) released this site as part of a Direct Site Release package, Site ID Number 2KB21. Subsequent to the site release, Xeneca submitted a Waterpower Site Release Application (no. WSR-2008-02) to the Ministry on August 10, 2007. A revised application was submitted on August 18, 2008. The Ministry issued a Site Description Package (SDP) to Xeneca. A Site Development Plan was issued by Xeneca to the Ministry on November 13, 2008. MNR awarded Applicant of Record Status to Xeneca for the Big Eddy Rapids site on July 15, 2010.

Xeneca was awarded a Feed-in Tariff (FIT) contract for this site by the Ontario Power Authority on April 29, 2010.

Xeneca is proposing to construct a hydroelectric generating facility at Big Eddy Rapids on the Petawawa River. The proposed facility will have a generating capacity of 5.3 MW. The main components will include a water control structure (concrete weir), an open approach canal, a powerhouse and electrical power line. Road upgrades as well as new road construction will be required to access the site. A 2.5 km – 44 kV power line connecting at Tower P35 on Circuit D6 near the Petawawa HDVS transformer station will be installed in order to connect the facility to the provincial power supply grid.

Project design information presented herein is based on preliminary investigations and analyses. Design optimization and finalization will be conducted pending the results of feasibility studies, field investigations as well as public and agency consultation. The description of the components of the project will be revised throughout the environmental assessment process as detailed design information becomes available.

1.1.3 Purpose of the Project

The purpose of the project is to:

- Meet government and energy regulatory agency goals and objectives to generate environmentally sustainable hydroelectric green energy in a reliable manner; and
- sell this power under a Feed-In Tariff Contract from the Ontario Power Authority.

In order to meet these objectives, Xeneca will try to maximize utilization of existing infrastructure and distribution lines to deliver power generated by the proposed project to the provincial power grid.

1.1.4 Economic Benefits

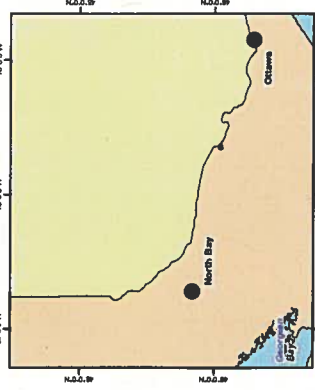
The proposed Big Eddy generating station will have a total installed capacity of approximately 5.3 MW.

Waterpower creates jobs, generates revenue to the taxpayers of Ontario and is the longest lived and most reliable source of clean, renewable electricity.

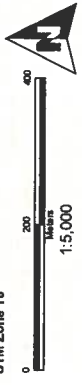
- Approximate economic activity (direct) to build in Ontario is \$5 million per megawatt, about half of which is spent locally procuring everything from consulting and legal services to concrete, steel, trucking and other services such as hotels, restaurant and fuel.
- Direct job creation (construction only) 10,000 person hours per MW. Indirect jobs multiply by 1.5.
- Local/Regional economic boost of \$2.5 million per MW – about \$12 million.
- First Nations and non aboriginal community participation incentives. For overview see Xeneca Website.
- Significant return to the people of Ontario with approximately \$5 million per MW (\$24 million over the 40 year lifespan of the project) paid through Gross Revenue Charges (GRC) and Provincial and Federal Income taxes.
- May assist mining companies or local industry by providing more reliable power with some potential cost savings.
- Waterpower lasts... many power plants built in the early 1900s are still in operation and with regular maintenance and upgrades can last for generations to come. In comparison the life span for other sources of clean power are: nuclear 40 years, wind 20 years, solar 20 years.

LEGEND

- Site Locations
- Road
- Water Feature



REFERENCE
NAD83 - MNR & Geomatics Data Services (2010)
UTM Zone 18



PROJECT

BIG EDDY GS

TITLE

SITE LOCATION MAP

PROJECT No.	DATE
GS	08/20/10
AC	08/20/10
TS	08/20/10
RF	08/20/10

FIGURE
1



1.1.5 Parties who Received the Project Description

This Project Description is being submitted to the Canadian Environmental Assessment Agency (CEAA) for distribution to relevant federal agencies including:

- Environment Canada (EC)
- Fisheries and Oceans Canada (DFO)
- Health Canada (HC)
- Indian and Northern Affairs Canada (INAC)
- Natural Resources Canada (NRCan)
- Transport Canada (TC)
- Canadian Transportation Agency
- Other departments as identified by CEAA

The Project Description will also be submitted to the following Provincial Ministries, municipalities and Aboriginal communities:

Provincial Agencies

- Ministry of Aboriginal Affairs
- Ministry of Tourism and Culture
- Ministry of Energy and Infrastructure
- Ministry of the Environment
- Ministry of Municipal Affairs and Housing
- Ministry of Natural Resources
- Ministry of Transportation
- Ministry of Northern Development, Mines and Forestry
- Ontario Parks - including Algonquin Park Superintendent
- Ontario Waterpower Association

Municipal

- Town of Petawawa
- County of Renfrew
- City of Pembroke
- Town of Deep River
- Town of Laurentian Hills

First Nation

- Algonquin First Nation through the Algonquins of Ontario Consultation Office
- Métis Nation of Ontario

1.1.6 Federal, Provincial, and Municipal Agency and Stakeholder Class EA Consultations

The agencies and organizations shown in Table 1.1 will be engaged and consulted through the environmental screening process. These organizations and any additional stakeholders identified subsequent to the issuance of this project description have or will receive an introductory letter and copy of the Notice of Commencement.

Table 1.1: Government Agencies and Organizations to be Contacted

<p>Federal Government Canadian Environmental Assessment Agency (CEAA) Environment Canada (EC) Fisheries and Oceans Canada (DFO) Health Canada (HC) Indian and Northern Affairs Canada (INAC) Natural Resources Canada (NRCan) Transport Canada (TC) Canadian Transportation Agency Canadian Forces Base Petawawa (CFB Petawawa)</p>
<p>Provincial Government Ministry of Aboriginal Affairs Ministry of Tourism and Culture Ministry of Energy and Infrastructure Ministry of the Environment Ministry of Municipal Affairs and Housing Ministry of Natural Resources Ministry of Transportation Ministry of Northern Development, Mines and Forestry Ontario Parks - including Algonquin Park Superintendent</p>
<p>Municipal Government Town of Petawawa County of Renfrew City of Pembroke Town of Deep River Town of Laurentian Hills</p>
<p>First Nations Algonquin First Nation through the Algonquins of Ontario Consultation Office Métis Nation of Ontario</p>
<p>Industry/Commercial and Public Stakeholders Petawawa Stakeholder Advisory Committee Ontario Waterpower Association Black Bay Ratepayers Association Pembroke Outdoor Sportsmen Club H&H Construction Outdoor Wilderness Adventures Riparian landowners Ottawa Valley Tourist Association Canoe Association of Ontario Whitewater organizations, including Petawawa River Rats Commercial whitewater rafting enterprises (Esprit, Wilderness Tours, Owl Rafting, River Run, etc.) Keetna Snowmobile Club Ottawa Valley Railway Trans Canada Pipeline Ontario Power Generation Ontario Fur Managers Federation</p>

1.1.7 Environmental Assessment Processes

As a new development on provincial land with a nameplate capacity less than 200MW, this project is subject to the Class Environmental Assessment for Waterpower Projects (OWA, 2008) which is an approved Class EA under the *Ontario Environmental Assessment Act*. The proponent has categorized this undertaking as a 'new project on an unmanaged waterway' in accordance with the definition for 'unmanaged waterway' provided in the Class Environmental Assessment for Waterpower Projects (OWA, 2008). Confirmation that this categorization is accurate will be provided subsequent to a review of this project description by applicable regulatory bodies (MNR and MOE) and the OWA. The proponent will assess the project in accordance with the applicable designation.

An authorization from DFO under the *Fisheries Act* and approval from Transport Canada under the *Navigable Waters Protection Act* (NWPA) will be required. Each triggers the need for an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA). Since the proposed project is less than 200 MW, a screening level environmental assessment would be completed in accordance with CEAA and all applicable guidelines.

EA provisions of other provincial Class EAs will be identified at the proponent-agency coordination meeting. Where necessary a coordinated approach will be sought during this meeting.

No federal funding is involved in this project.

1.2 Contacts

1.2.1 Proponent and Contact Information

The project proponent is Xeneca Power Development Inc. At the time of this submission, there were no co-proponents involved in this undertaking. Xeneca is presently pursuing the possibility of partnering with interested Aboriginal communities. Contact information for Xeneca is:

Patrick Gillette
President
Xeneca Power Development Inc.
5160 Yonge Street #520
North York, ON M2N 6L9
Phone: 416-590-9362
Fax: 416-590-9955
Email: pgillette@xeneca.com

1.2.2 Proponent's Consultant

Ontario Resource Management Group Inc. (ORMG) has been retained to conduct the field study program for this project. Contact information for ORMG is:

Kristi Beatty
Ontario Resource Management Group Inc
P.O. Box 1234
Pembroke, ON K8A 6Y6
Phone: 613-638-0283
Email: ormgkb@ormg.org

OEL-HydroSys Inc. has been retained to conduct the Class EA for this project. Contact information for OEL-HydroSys Inc. is:

Tami Sugarman,
OEL-HydroSys Inc.
3108 Carp Road
P.O. Box 430
Carp, ON K0A 1L0
Phone: 613-839-1453 x229
Fax: 613-839-5376
Email: EAinfo@oel-hydrosys.ca

1.3 Land Ownership

The project footprint and potential area of impact (i.e. for the generating station, head pond, switchyard, control structure(s), access road(s) and power line corridor), are located on both provincial and private lands. Portions of the water intake structure and powerhouse would be located on federal lands owned by Canadian Forces Base Petawawa. Some municipal shoreline allowances are designated as being under municipal jurisdiction.

1.4 Authorizations Required

Table 1.2 outlines a potential list of regulatory approvals (federal, provincial and municipal) that may be required during the construction or operation of this project. The list provided below is not meant to be comprehensive; permitting requirements will be confirmed once a detailed design and construction plan is available.

Table 1.2: Potential Federal, Provincial and Municipal Approvals

Permit and Legislative Requirement	Agency
Federal	
Authorization for Works and Undertakings Affecting Fish Habitat - <i>Fisheries Act</i> [Section 35(2)]	Department of Fisheries and Oceans
Authorization for Destruction of Fish by Means other than Fishing - <i>Fisheries Act</i> (Section 32)	Department of Fisheries and Oceans
<i>Species at Risk Act</i> (SARA) – authorizations, as applicable	Department of Fisheries and Oceans; Environment Canada
Approval for Construction in Navigable Waters - <i>Navigable Waters Protection Act</i> (Section 5)	Transport Canada (Marine)
<i>Explosives Act</i> - Temporary Magazine Licence	Natural Resource Canada (NRCan)
Provincial	
<i>Lakes and Rivers Improvement Act</i> (LRIA) – Location Approval and Plans and Specifications Approval	Ministry of Natural Resources
<i>Lakes and Rivers Improvement Act</i> (LRIA) – Water Management Plan	Ministry of Natural Resources
<i>Public Lands Act</i> (PLA) – Work Permits (Parts 1-5, as required).	Ministry of Natural Resources
<i>Public Lands Act</i> (PLA) – Licence of Occupation	Ministry of Natural Resources
<i>Endangered Species Act</i> (ESA) – permits and agreements, as applicable	Ministry of Natural Resources
<i>Crown Forest and Sustainability Act</i> (CFSA) - Forest Resource Licence and Overlapping Licence Agreement	Ministry of Natural Resources
<i>Forest Fires Prevention Act</i> (FFPA) - Burn permit on Crown Land	Ministry of Natural Resources
<i>Conservation Authority Act</i> (CAA) - (Section 28 regulations)	Conservation Ontario
<i>Ontario Heritage Act</i> and the <i>Ontario Heritage Amendment Act</i> (OHA and OHAA)- Cultural Heritage Clearances	Ministry of Tourism and Culture
Permit to Take Water – <i>Ontario Water Resources Act</i> (Section 34)	Ministry of the Environment
Certificate of Approval (Industrial Sewage) – <i>Ontario Water Resources Act</i> (Section 53)	Ministry of the Environment
Certificate of Approval (Air and Noise) – <i>Environmental Protection Act</i> (Section 9)	Ministry of the Environment
Waste Generator Registration – <i>Environmental Protection Act</i> [Section 18(1)], Ontario Regulation 347	Ministry of the Environment
Notice of Project and Registration of Contractors – Construction Regulation 213/91	Ministry of Labour
<i>Electricity Act</i> (EA) - Electricity Generation Licence	Ontario Energy Board
Municipal	
Permit for Noise (from Construction)	Municipality
Road Use Agreement	Municipality
Building Permit	Municipality
<i>Fire Protection and Prevention Act</i> (FFAPA) - Burn Permit	Municipality

2. Project Information

2.1 Description of Proposed Project

2.1.1 General

The proposed project at Big Eddy would capture the surveyed gross head of 9 m. The conceptual development incorporates the use of a concrete weir and an earthen dam. A conveyance channel situated on the north shore of the river would conduct flow from the river to an intake which would power one or more Kaplan turbines coupled to a generator with a combined rated nameplate capacity of 5.3 MW.

The general arrangement and details of the generating facility and access roads are presented in Appendix A; the extent of the lands involved in the development is also shown. The proposed site development is described in more detail in the following sections.

The proposed design of the project could be subject to change subsequent to the results of field investigation, regulatory agency input, First Nation and Aboriginal Community involvement, and comments received from other stakeholders. Project design changes may therefore be implemented based on the valued ecosystem components within the project area, including environmental, social or economic factors.

2.1.2 Summary of Hydraulic Characteristics

Estimated existing water levels and flows (Hatch 2009):

- Maximum headwater level (1:100 yr flood) el 137.4 m
- Normal operating headwater level el 136 m
- Normal tail water level downstream of powerhouse el 127 m
- Normal operating gross head 9 m
- 1:100 year return period flood flow 475.7 m³/s
- 1:50 year return period flood flow 431.5 m³/s
- 1:10 year return period flood flow 326.8 m³/s
- 1:100 year return period low flow 2.34 m³/s
- 1:50 year return period low flow 3.05 m³/s
- 1:10 year return period low flow 5.71 m³/s

2.1.3 Installed Capacity

The installed capacity at this site would be 5.3 MW provided by one or more turbine units.

2.1.4 Site Access

The proposed site access would require the upgrade of an existing 750 m long road which originates at Paquette Road. The construction of a new 200 m long road running east to the powerhouse, and a new 150 m long road running southwest to the north side of the control dam and overflow weir would also be required (Appendix A). There is an existing road in proximity to the south side of the proposed dam site.

2.1.5 Headworks Structures

Appendix A shows the layout and details of the proposed headworks structures. The civil works would include the construction of a 215 m long concrete and earthen control dam structure featuring an 85 m long overflow weir. An earthen embankment would be required to ensure the protection of the Ottawa Valley railway line.

The headworks structures may be constructed from any or all of the following materials within the engineering constraints for the same; 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. (ie: 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 penstock routing. In most cases, a cofferdam is required for temporary diversion of river flows around the intake/dam/weir construction areas.

2.1.6 Conveyance System

Initial conceptual drawings feature a 16 m wide, 360 m long open channel designed to convey water from the start of the intake channel to the turbine/generator set in the powerhouse. A plan view of the conveyance system is provided in Appendix A.

2.1.7 Powerhouse

The powerhouse footprint would be approximately 15.5 m². The powerhouse would 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 cofferdam would 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 would be constructed from a combination of concrete and steel conduits. A second upstream cofferdam would also be required for construction of ‘close coupled’ projects. (ie: powerhouse connected to dam).

2.1.8 Transmission

The proposed project will connect to the electrical grid via a new 44 kV power line, supported by wooden poles, approximately 2 km in length. The required right of way for the power line corridor would extend from 10-30m dependant on site characteristics. The power line would connect at tower structure #35 near the Petawawa-HVDS. Two padmount transformers would be required, one at the project location near the generating station and one adjacent to the HVDS. A conceptual electrical connection figure is provided in Appendix A.

2.1.9 Area of Inundation

Based on preliminary hydrological information, the proposed project would flood riparian lands up to 1.9 km upstream of the weir. The project would inundate approximately 12.1 ha of land, resulting in the creation of a head pond with a total surface area of 42.2 ha upstream of the dam (Appendix A).

2.2 Operating Strategy for Project

2.2.1 Type of Proposed Project

The proposed development would be operated as a run-of-river facility with no provisions for peaking as there is no realistic capacity for storing water at this site.

2.2.2 Operating Strategy

A dam operating strategy will be developed after due consideration of technical and economic aspects of the project, and input from the public, regulatory agencies and other stakeholders. This strategy will be documented in a Dam Operating Plan (DOP) that will respect the requirements of the *Lakes and River Improvement Act* (LRIA, Section 23.1).

2.2.3 Water Management Plan

Downstream of the Big Eddy Rapids are two privately owned water control structures that are used for impounding water for swimming in the summer, known locally as the Catwalk swimming area. Additionally there are a number of MNR dams within Algonquin Park.

There is no existing water management plan (WMP) for the Petawawa River. Water management planning requirements will be specified by the Ministry of Natural Resources.

2.3 Project Activities

2.3.1 Construction Schedule and Activities

Site preparation activities are proposed to commence in the fall of 2011 and continue through to early 2012. Construction of the proposed facility would begin in 2012 and continue through to early 2013. Commissioning is scheduled for summer 2013.

2.3.2 Operation

The generating station will operate as a run-of-the-river facility. The facility will be designed with the capacity to be remotely operated in addition to having on-site controls.

Typically, hydroelectric projects are designed for a 50 to 100 year lifespan. Upgrades and rehabilitation activities may be applied in the future to extend their operating life.

2.3.3 Decommissioning

At the present time there are no plans being developed for decommissioning of the facility. The decision to decommission the facility, or alternatively upgrade and/or rehabilitate the facility to extend its operational life, at the time will depend on the structure, the operational history of the facility as well as economic and other considerations. Responsibility for decommissioning the facility will be borne by the facility owner at such time as the facility is deemed no longer useful; at which point the decommissioning will be completed according to the applicable legal requirements.

2.4 Resource Material Requirements

2.4.1 Energy and Water Requirements and Sources

On-site energy requirements during construction will likely be provided by portable diesel generators. Once operational, the outside energy requirements for the facility will be supplied via a metered station service transformer. Black-start capabilities of this site which would allow for the generation of power from this facility during widespread power outages would be provided by means of a direct electrical connection to the proposed Half Mile Rapids G.S. The Half Mile G.S. would feature auxiliary diesel generation to facilitate emergency power required to enable that G.S. to provide the same.

On-site water requirements for construction are not known at the present time, although it is likely the water will be required during the construction process (i.e. wash water, etc). This water may be supplied from the Petawawa River via portable pumps. The quantities required are anticipated to be small and will likely not require a Permit to Take Water (PTTW) from MOE since the taking is expected to be below the 50,000 L/d threshold. Construction process water might also be trucked in from outside sources if required.

Operational water requirements for the facility are not known at this time. Small amounts of cooling water may be withdrawn from the Petawawa River to cool powerhouse components. A Permit to take water (PTTW) will be obtained if the amount required exceeds the permit threshold. There will not likely be any requirement for potable water at the facility. Operational requirements will be determined during the detailed design process.

2.4.2 Excavation and Quantity of Fill

Excavation will be required for the construction of the dams, open conveyance channel, powerhouse and tailrace. The quantity of excavated material is unknown at this time. Excavated material will include topsoil, underlying soils and bedrock in terrestrial areas, and substrate material and bedrock within the watercourse. Excavated aggregate material will be reused to the greatest extent possible to re-line the excavated portions of the channel downstream from the facility. Any excess or unusable material will be stored for use on roadway construction and upgrades, and other areas requiring fill or material. Excess material will be disposed of in accordance with applicable regulations. Solid waste materials requiring off-site disposal will be chemically tested for waste classification purposes in accordance with the *Ontario Waste Management Regulation* (O. Reg. 347), as amended by O. Reg. 558/00, and then disposed of accordingly.

Some fill materials may be required from commercial sources however quantities are unknown until the completion of detailed engineering.

2.4.3 Toxic/Hazardous Materials

Fuels, hydraulic fluids and lubricants will be used in equipment during construction and operation of the facility. Storage of these materials will comply with all current regulations and guidelines (e.g. *Ontario Fire Code*, *O. Reg 347*, *Occupational Health and Safety Act*). The storage of small amounts of hydraulic fluids and lubricants will be in a contained area, well away from the watercourse. It is not anticipated that any explosives

will be manufactured on site for this project. It is unknown whether explosives magazines will be required for this undertaking. Should explosives be stored on site, the proponent will seek appropriate approvals for usage and storage of explosives in a manner compliant with NRCan requirements and applicable industry standards. Transport of explosives will be completed in accordance with federal legislative requirements (e.g. *Transportation of Dangerous Goods Act*).

2.4.4 Waste Disposal

Solid nonhazardous construction waste (e.g. material packaging) generated during the construction process will be removed from the site to an approved disposal location (likely the municipal landfill) or recycling/composting facility where available. Waste debris from clearing activities (e.g. grubbing, non-merchantable timber) will be disposed of in accordance with regulatory requirements. No gaseous wastes other than construction equipment emissions are anticipated. Industrial liquids such as paints, sealants, fuels and lubricating fluids will be stored in a secure containment area and disposed of in accordance with provincial and federal liquid waste disposal regulations (e.g. *Environmental Protection Act* and *Transportation of Dangerous Goods Act*).

3. Project Site Information

3.1 Project Location

Ministry of Natural Resources Map 2.1 (Appendix A) shows the project location within the Petawawa River Watershed. Table 3.1 provides the geographic coordinates of the site.

Table 3.1: Geographic Coordinates of Site

Site Name	MNR Site No.	Geographic Coordinates (Latitude, Longitude)		Drainage Area (km ²)
Big Eddy Rapids	2KB21	45°54'1.54"	-77.17'30.43"	4155

The proposed project site is located on the northwest side of the Town of Petawawa.

Maps 2.2 and 2.3 (MNR 2008 -Appendix A) detail existing land use and natural environmental features of the study area. These features are described in more detail in the following sections.

3.2 Natural Environmental Features

3.2.1 Physical Environment

Geology and Soils

The project study area is situated in a low-lying area containing Pleistocene sand and gravel deposits (Barnett, 1988). These deposits overlie Precambrian bedrock which is part of a metamorphosed complex of intrusive rocks known as the Algonquin Batholith (Lumbers, 1980).

The area surrounding the proposed project site contains soils of varying types. North of the Big Eddy location exists a large plateau typical of the Renfrew County *Uplands* series, consisting of *Fine Sandy* soils (Ufs). The sandy deposits of the Uplands series are deltaic in nature, being laid down under glacial lakes along the Ottawa River basin. These sandy deposits have no water bearing capabilities and are acidic in nature due to their granite origins (Gillespie et.al., 1964). The south shore of the Petawawa River at the Big Eddy site is largely comprised of remnants of the St. Peters Series (SPg). Soils of this series consist mostly of deposited gravel of granitic origin, making them very acidic in nature. These gravel deposits are not uniform and may be layered with alternating sandy substrate (Gillespie et.al. 1964).

Roadsides, boat launching areas, trailer camps, portages, and the Emerald Necklace sluiceway site contain vegetation significantly disturbed by humans.

Surface Water Resources

The drainage area at Big Eddy is 4155 km².

The mean annual average flow at Big Eddy is 47.8 m³/s. Monthly mean flows at the site are summarized in Table 3.2.

Table 3.2: Monthly Mean Water Flows

Month	Mean Monthly Flows (m³/s)
January	30.9
February	26.4
March	30.5
April	115.9
May	122.8
June	64.8
July	42.0
August	25.3
September	18.5
October	23.1
November	34.7
December	38.1

High and low flow return periods flow are summarized in Table 3.3

Table 3.3: High and Low Flow Return Periods

Return Period (Years)	Flood Flows (m ³ /s)	Extreme Low Flows (m ³ /s)
1.25	154.1	16.09
2	207.5	11.68
5	279.3	7.60
10	326.8	5.71
20	372.4	4.35
50	431.5	3.05
100	475.7	2.34

3.2.2 Biological Environment

As a responsible developer of waterpower resources, the principles of the aquatic ecosystems guidelines within the *Water Management Planning Guidelines for Waterpower* as well as the *MNR Class Environmental Assessment for MNR Resource Stewardship and Facility Development Projects and Federal Requirements for Waterpower Development Environmental Assessment Process in Ontario – Practitioner’s Guide* are recognized and embraced. The operating plan that will be developed for this site will address the natural flow regime of the Petawawa River as well as several other environmental factors. The following natural environment features have been identified to be examined within the project area:

- habitat of endangered or threatened species
- fish habitat
- terrestrial and aquatic flora and fauna
- water quality
- trapping and bait fishing activities
- fish movement

A review of background information concerning the aforementioned natural features was conducted prior to any field surveys to ensure that any potential species occurrences were noted, and in the case of species of concern, appropriate survey methodologies can be incorporated into the field portion of the EA.

Habitat of Species at Risk

By legislation, species listed as Endangered (END), Threatened (THR) or Extirpated (EXP) under the federal *Species at Risk Act* (SARA) and/or provincial *Endangered Species Act* (ESA) receive protection under these Acts, and recovery strategies and habitat protection for listed species is mandated. Where a species is listed on both Acts, the protection afforded the species is determined by the more stringent legislation. If any species at risk are found to utilize the project site, additional surveys and considerations may be required. Consultation with Pembroke District Ministry of Natural Resources (MNR) staff, the Natural Heritage Information Centre (NHIC) website, and other published documentation (COSEWIC status reports, Ontario Breeding Bird Atlas (OBBA), previous survey results, etc.) will assist in drafting a list of potential SAR for this site prior to drafting field survey schedules or methodologies.

Lake Sturgeon (*Acipenser fulvescens*) are confirmed to occur within the Petawawa River system, both upstream and downstream of the Big Eddy Project Site. Designated as a Threatened (THR) species under the *Endangered Species Act* as part of the Upper Great Lakes/St. Lawrence population, this fish is afforded complete protection to individuals and habitat under ESA legislation.

Habitat exists in and around the project area for several additional species listed as being “at risk” provincially and or federally. These potential species and their federal and provincial rankings are listed in Table 3.4 below.

Table 3.4: Potential Species at Risk for the Proposed Project Area

Common Name	Scientific Name	Federal Status (SARA)*	Provincial Status (ESA)*
Wood Turtle	<i>Glyptemys insculpta</i>	Threatened (THR)	Endangered (END)
American Eel	<i>Anguilla rostrata</i>	No Status	Endangered (END)
Lake Sturgeon	<i>Acipenser fulvescens</i>	Threatened (THR)	Threatened (THR)
Blanding’s Turtle	<i>Emydoidea blandingii</i>	No Status	Threatened (THR)
Whip-poor-will	<i>Caprimulgus vociferus</i>	No Status	Threatened (THR)
Eastern Wolf	<i>Canis lupus lycaon</i>	Special Concern (SC)	Special Concern (SC)
Milksnake	<i>Lampropeltis triangulum</i>	Special Concern (SC)	Special Concern (SC)
Northern Map Turtle	<i>Graptemys geographica</i>	Special Concern (SC)	Special Concern (SC)
River Redhorse	<i>Moxostoma carinatum</i>	Special Concern (SC)	Special Concern (SC)
Snapping Turtle	<i>Chelydra serpentine</i>	No Status	Special Concern (SC)

* Species of “Special Concern” status and their habitat are not regulated under the ESA or SARA

Of these species, the fishes and reptiles would be most affected by alteration to the flow regime and levels of the Petawawa River watercourse, as well as to impacts on surrounding wetland areas. Habitat for all other species is considered broad, non-specific and terrestrial and would be less immediately impacted by construction, provided a complete survey of potential building footprint areas is completed prior to development. Wide ranging terrestrial species such as the Eastern Wolf (*Canis lupus lycaon*) would be least impacted by the proposed development.

Additional conversations with MNR and DFO staff will determine whether other species of conservation concern potentially occur within the projected impact area of the proposed site.

Fisheries

Background research as part of the overall information gathering for this site will provide evidence of historic species presence. Additional information will be collected via in-water sampling utilizing approved procedures, as determined by Pembroke District MNR.

The Petawawa River has a cool/warm thermal regime and is known to contain numerous sport fish species in addition to the “at risk” species listed above. Confirmed fishes include:

- Brown Bullhead (*Ameiurus brunneus*)
- Channel Catfish (*Ictalurus punctatus*)
- Common White Sucker (*Catostomus commersoni*)
- Longnose Gar (*Lepisosteus osseus*)
- Muskellunge (*Esox masquinongy*)
- Northern Pike (*Esox lucius*)
- Pumpkinseed (*Lepomis gibbosus*)
- Redhorse, Greater (*Moxostoma valenciennesi*)
- Redhorse, Shorthead (*Moxostoma macrolepidotum*)
- Redhorse, Silver (*Moxostoma anisurum*)
- Smallmouth Bass (*Micropterus dolomieu*)
- Walleye (*Stizostedion vitreum*)
- Yellow Perch (*Perca flavescens*)

Numerous other fish species are anticipated to exist in the system. The presence of Brook Trout (*Salvelinus fontinalis*) in the Algonquin Park headwater areas of the Petawawa River and in its tributaries, as well as of Mottled Sculpin (*Cottus bairdi*) in some sections of the river itself, make it possible that certain areas of the Petawawa support cold water regime species.

Numerous minnows (*Cyprinidae* spp.) are also anticipated throughout the Petawawa River system.

As noted above, Lake Sturgeon are known to occur within the Petawawa River, and River Redhorse and American Eel are potentially present. The presence of Walleye suggests that suitable spawning areas are present within the watercourse. Flows through the project site must also be maintained at levels which will accommodate Sturgeon and Walleye spawning sites known to occur within the impact area of the proposed project, as well as downstream.

Fish passage in the Petawawa River, specifically at the Big Eddy Rapids has been identified by the Department of Fisheries and Oceans (DFO, correspondence - October 5, 2010) as a valued ecosystem component that must be protected and addressed within the environmental assessment planning process for a hydroelectric development on the Petawawa River. Throughout the EA planning processes it may be possible to develop appropriate impact and issue management strategies by adopting the conceptual hierarchy of avoidance, prevention and mitigation in order to resolve the fish passage issue for the project.

Terrestrial and Aquatic Flora/Fauna

A preliminary assessment of the terrestrial and aquatic habitats in the immediate area of the proposed facility site is required in order to describe the habitats, assess the true potential for species at risk as well as all other species to be found in the area, and to assist in the component site selection and design process.

The requirements specifically related to aquatic species, fisheries habitat and navigable waters are specifically the mandate of the Federal Department of Fisheries and Oceans and Transport Canada (Navigable Waters Protection Branch). Detailed information pertaining to these issues is addressed in Section 4.0 of this project description.

Overall, indigenous fauna is typical of the surrounding area, and is expected to include a wide variety of mammals, insects, reptiles, amphibians and avian species. Forest Ecosystem Classification (FEC) data for neighbouring Canadian Forces Base (CFB) Petawawa is available and will be consulted to determine general stand delineation in the area along the Base side of the project site.

Of note, there is confirmed habitat for Northern Map Turtle (*Graptemys geographica*) downstream of the Big Eddy project area, as well as for Blanding's Turtle (*Emydoidea blandingii*) along the entire Petawawa River system. Wood Turtle (*Glyptemys insculpta*) habitat has been confirmed along tributaries of the Petawawa River.

Several Odonate species of conservation concern have been confirmed to exist within the Petawawa River watershed. Examination of naiads, exuviae and adult dragonflies and damselflies will be included in all phases of field studies in order to document presence of confirmed species during all life cycles stages.

Raptor nests are also likely to occur in the vicinity of the proposed development area, and an assessment of the forested areas on and around the project site is required to determine what species are present, and if any active nesting sites exist which may need to be considered during the planning process. All other species encountered during field surveys will be recorded.

Provincially Significant Areas

The MNR Side Description Package identifies the Black Bay Provincially Significant Wetland within the vicinity of the Big Eddy site.

The Barron River Provincial Park is located approximately 8 km upstream of the Big Eddy site on the Barron River.

There are no Areas of Natural and Scientific Interest known to be in the vicinity of the site.

3.3 Socioeconomic Features

3.3.1 Current and Past Land Uses

The proposed project site is located on the Petawawa River, a key transportation route during the fur trade and later during the log drive. The river has become a popular waterway for whitewater kayaking and canoeing.

The site falls within the boundaries of the Algonquin Land Claim.

The project is located within General Use Area 'G396: Multiple Natural Resource Use'. According to the Policy Report, The primary intent for G396 is to be directed to multiple use management (MNR, 2006).

Traditional Canoe and Fur Trade Route

According to MNR's Site Description Package, the Petawawa River is considered to be of cultural and historical significance as a traditional canoe and fur trade route. There are no known archaeological sites within the immediate vicinity of the site. Stage 1 and 2 archaeological assessments will be undertaken to establish the presence of any archaeological resources within the proposed project area.

Forestry

No known commercial forestry is taking place in the vicinity of the project.

Hunting/Harvesting

There are three registered trap lines within the project area (N001, N022, N024). Knowledge of trapping activities within the project area will be gathered through consultations with licensed trappers in the area, as well as the local MNR authorities. In order to ensure that all interest groups are involved, the Ontario Fur Managers Federation will also be invited to participate in consultations, if required. Subsistence trapping, hunting, and fisheries information will be collected in consultation with the local First Nations.

The Big Eddy site is located within MNR Pembroke Baitfish Harvest Area PE-0123 (10), and adjacent to Harvest Areas PE-0124 (6) and PE-0125. Baitfish permit holders may be consulted regarding species captured, in order to confirm species presence within the Petawawa River and surrounding tributary systems.

Mineral Resources

There was no existing mining tenure or claim in the vicinity of the project site on November 5, 2008. According to the SDP, an application was submitted to the Ministry of Northern Development Mines and Forestry to withdraw from staking an area of the bed of the Petawawa River of approximately 75 hectares.

Recreation/Tourism

The Petawawa River is valued based on its recreational and tourism opportunities. The river is a known canoe route and is extensively used for whitewater kayaking and canoeing. There is a snowmobile trail and bridge that crosses the river at the Big Eddy Rapids. An all season trail is located adjacent to the existing road access into the Big Eddy site.

Potential Contamination of the Site from Past Uses

The site's proximity to Canadian Forces Base Petawawa presents the potential for the presence of contaminants.

Proximity to Aboriginal Reserves and Traditional Territory

The site falls within the Algonquin First Nations Land Claim.

Proximity to Important or Designated Environmental or Cultural Sites

Stage 1 and 2 archaeological assessments are scheduled to be undertaken by a licensed archaeologist to determine whether there is potential for archaeological resources to exist within the project area. If required, a Cultural Heritage Evaluation Report will also be completed to assess any cultural heritage resources potentially affected by the project.

Proximity to Residential and other Urban Areas

The site is located within the Town of Petawawa.

4. Additional Requirements Related to Fish, Fish Habitat, Species at Risk and Navigable Waters

4.1 Biological Assessments

The Big Eddy Generating Station would be operated as a run-of-river facility. Due to the presence of confirmed Species at Risk in the project area, impacts to the flow regime of the Petawawa River must be calculated and downstream flows confirmed. Fish passage will be a key component of any proposed development.

The primary goal of the 2010 field season was to determine detailed descriptions of the aquatic and terrestrial habitat, representative floral and faunal communities, as well as a determination of habitat changes that can be expected in the immediate area of the Big Eddy waterpower project. The Petawawa River, both upstream and downstream of the proposed site, was assessed. Cumulative impacts of this proposed project and an adjacent site (Half Mile Rapids) must be considered during all biological, engineering and consultation phases.

The consulting team utilized various methods of data collection including background information queries, interviews with locals and experts, literature reviews, scientific field data collection, aerial imagery analysis and FEC and GIS mapping, to determine what species of flora and fauna are present at the site, and what effects the proposed project may instill upon them. Upon determining the specific ecological communities that utilize the area, changes can be made in the planning phase that will assist to mitigate or even eliminate potential negative impacts.

4.1.1 Background Review

Available information for the site and surrounding area, gathered from the Ministry of Natural Resources (Pembroke District), Algonquin Provincial Park, prior survey reports, online and periodical sources, COSEWIC and ESA status reports, and the Natural Heritage Information Database, were reviewed prior to finalizing survey sites, methodologies or target species. Known natural heritage issues which must be addressed include:

- Confirmed and potential Species at Risk
- Walleye spawning near the proposed dam site
- Other fish species that may use the proposed area for habitat or spawning
- Fish passage

Various environmental assessments were conducted, including:

- Aquatic and terrestrial habitat assessments both immediately upstream and downstream of the proposed dam site, utilizing the Forest Ecosystems Classification (FEC) system (Chambers et.al., 1997)
- Aquatic and terrestrial habitat mapping, including habitat mapping of the inundation area
- Bathymetric mapping of the waterway, in the immediate vicinity of the project site at a *minimum*
- Lake Sturgeon spawning survey in the immediate vicinity of and downstream of the proposed dam site. Telemetry may be required to determine Sturgeon movements within the watercourse.
- Walleye spawning survey in the immediate vicinity and downstream of the proposed dam site.
- Determine, where possible, the species of fish that utilize the project site for spawning
- Assessment of the fish species that utilize the project site for habitat
- Assessment of the substrate as well as benthic invertebrate communities both upstream and downstream of the proposed dam site
- Assessment of current water quality at the project site by obtaining water chemistry data (e.g. temperature, dissolved oxygen, pH, conductivity, turbidity)
- Comprehensive flora and fauna assessment, including species at risk that utilize the river and inundation area
- Assessment of access to the proposed project site

4.1.2 Fisheries Habitat Assessment and Community Sampling Proposed by the Proponent

The habitat assessments, along with anecdotal information of fish communities utilizing the Petawawa River near the project site, will be used to determine the potential impacts of the proposed project to these areas. The following terms of reference have been developed to address the environmental concerns of the project.

Background Data Collection

A request was made on behalf of the proponent to the Ministry of Natural Resources, Pembroke District, for any existing file information on the natural environment of the project site. The request was made for any information related to the following:

- Fisheries assessments
- Fish collection records and rare species
- Drain classifications
- Wetland evaluations
- Areas of Natural and Scientific Interest
- Provincially Significant Wetlands
- Environmentally Sensitive Areas
- VTE species, significant wildlife habitats (i.e. raptor nesting, colonial species nests, deer yards and feeding areas)
- General species lists relating to animals and vegetation
- Vegetation mapping, floristic inventories (FEC, FRI, etc.)

An MNR Site Description Package was received by the Proponent, and details from that document have been incorporated into this Project Description.

Aquatic Investigations

Generalized fish sampling were conducted utilizing several approved techniques, including:

- Angling
- Trap netting
- Short-set Gill Netting
- Minnow traps
- Seining
- Dip netting
- Night-time light reflectance observations

These surveys will help to determine fish species that utilize the Petawawa River both upstream and downstream of the proposed project. The generalized fish sampling will also serve as a method of determining if any federally or provincially listed fish species at risk are present at the site and vulnerable to impacts from the proposed project. As Lake Sturgeon is confirmed within this waterway, a targeted survey for this species was performed (night time reflectance observance, trap netting (access permitting)). Where possible, the fish sampling was conducted during the 2010 field season.

Note that due to potential unexploded ordnance (UXO) Electro-fishing will NOT be possible within the Petawawa River system.

Benthic sampling was performed utilizing kick-and-sweep assessments upstream, at and downstream of the project site. Egg collection mats were employed during the spring spawn to assess spawning activity, species and success.

Terrestrial Assessment

It is presumed that the majority of terrestrial impacts will be due to the construction of roadways, hydro lines and buildings, and that such impacts will be minimized where possible to affect only the footprint of the structure, and the immediate surrounding area. All “footprint” areas were assessed on foot during at least 3 separate surveys, a minimum of 30 days apart. This allowed for varying life cycles and seasonally dependant species to be noted where present.

Habitat on site was evaluated utilizing the Forest Ecosystem Classification (FEC) system (Chambers, et.al., 1997). These evaluations will accompany observations of the potential value of said habitat for particular species, especially those considered to be “at risk” or of “conservation concern”.

Wildlife Surveys

While there are no confirmed SAR species at the specific Big Eddy location other than the aforementioned Lake Sturgeon, habitat for several potential “at risk” species exists within the proposed project area. Targeted species-specific surveys were not performed for these additional species, however habitat and species occurrences were noted during all surveys.

All incidental observations of *any* flora or fauna (including scat, tracks, eggs, fur/plumage, kill sites) were documented during any site visit. These observations will be transcribed into detailed species presence lists, and appended to the final report.

Reptilian surveys were done as incidental surveys in conjunction with habitat evaluations. Any observed reptiles or their sign (eggs, test scrapes, tracks) will be noted, along with the surrounding habitat composition. Confirmed nesting sites will be photographed and GPS coordinates obtained.

Amphibians were surveyed as incidental observations during habitat assessments. In addition, call surveys were utilized to confirm the presence of any amphibians during the appropriate season (May-June) (e.g. Bullfrog (*Rana catesbeiana*) and Spring Peeper (*Pseudacris crucifer*)). All calls were documented including environmental conditions, time and date, and species heard.

Insects were documented as noted during all other surveys. Care was taken to examine shoreline substrate and vegetation for nymphs and exuviae of species such as Dragonflies, Damselflies and Stoneflies.

Avian assessments were done utilizing call surveys during the breeding season, to establish which species of breeding bird are utilizing the project area. Such surveys consisted of recording confirmed calls while walking the shoreline along the waterway, both upstream and down. Surveys were performed during the early morning optimal calling time, during the spring mating season when male territoriality is highest. All avian species observed or heard were recorded.

Life Stage Oriented Investigations

The proposed location of the Big Eddy project is known to be within Lake Sturgeon and Walleye spawning areas. To determine the potential impact of the project on Walleye and Sturgeon spawning, an accurate account of the exact spawning habitat, time of spawning, and the number of fish spawning is required. In order to collect this information, a spawning survey was conducted during the spring freshet. For both species noted, spawning is dependent on water temperature (6-9C for Walleye, 13-18C for Sturgeon). The primary method to obtain the data included night-time visual observations using a light. Limitations exist with this method (depth, turbulence), so additional methods to determine quantities of spawning walleye included sampling through netting and angling, as well as strategic placement of egg collecting mats in suitable spawning habitat. The sexual maturity of any fish captured was also noted to determine the timing and age of the spawn within the local population.

Water Quality Sampling and Physical Attributes

MOE has expressed a need for water quality samples to be collected to document the baseline water quality conditions in the study area. The list of standard water quality parameters which MOE expects to see included in the water quality program:

- Physical measurements including pH, Dissolved Oxygen, conductivity and temperature
- Alkalinity
- Suspended Solids and Total Dissolved Solids
- Cations including H^+ , Na^+ , K^+ , Ca^{+2} , Mg^{+2} , Fe^{+2} , Fe^{+3}
- Anions including OH^- , Cl^- , S^{-2} , HCO_3^- , CO_3^- , SO_4^{-2} , PO_4^{-3}
- Nutrients including nitrate, nitrite, phosphorus and TKN
- Metals (ICP scan)

Two water sampling events were completed during the spring and summer of 2010. On-site measurements of dissolved oxygen, conductivity, temperature, and pH were recorded.

4.1.3 Reporting

Upon completion of the aforementioned surveys, a comprehensive report will be provided. The report will include a description of all aquatic and terrestrial habitat assessed, as well as a list of flora and fauna present at the project site and surrounding area. The report will also outline the potential impacts of the proposed dam, both negative and positive, including type, area affected, duration, and magnitude of the impacts.

Potential impacts associated with the construction and operation of a hydroelectric dam on the Petawawa River include, but are not limited to:

- Change in the aquatic habitat type directly upstream and downstream of the dam
- Localized impacts to fish habitat as a result of excavations and other activities during the construction of the dam
- Potential for fish fatalities as a result of entrainment in turbines
- Potential change in aquatic vegetation
- Loss of terrestrial vegetation along the inundation zone
- Disruption to various terrestrial fauna, including birds
- Potential for accidents during construction that may cause the release of contaminants or deleterious substances into the Petawawa River system

The report will also include any recommended bio-monitoring of the area after the project is complete to determine the extent of the impacts associated with the project.

5. Potential Effects to the Environment

5.1 Zone of Influence

The construction of the dams and other headworks structures required to divert water to the proposed facility will result in the creation of a head pond and the inundation of riparian lands upstream of the dam on the Petawawa River. As a result, it is anticipated that the facility's zone of influence will extend along an estimated 1.9 km of the Petawawa River, extending from the upstream edge of the proposed head pond. The facility's downstream zone of influence will extend to the downstream limit of the tailrace, located approximately 550 m downstream from the proposed dam. The anticipated zone of influence of the operational facility on the downstream waterway is unknown at this time. Hydrological investigations of the waterway are underway and the results will be available by the end of 2010.

5.2 Potential Effects to the Environment

In order to identify the potential effects that the proposed project could have on the environment and to develop a preliminary informational gap analysis, the Potential Effects Identification Matrix from the OWA Class EA document (OWA, 2008) was completed (Table 5.1). It should be noted that the Matrix was completed using preliminary information regarding the existing natural and socioeconomic features of the project study area and preliminary project design. The assessment Matrix will be updated following completion of the proposed baseline studies and the further refinement of the facility engineering design.

The potential level of effect determination (positive or negative) for each criterion is based on the guidance in the OWA Class EA (OWA, 2008). Accordingly, the following effect definitions were utilized:

- A 'nil' effect would be assigned where there is no effect on that criterion
- A 'low' potential effect would be assigned where the potential impact and/or benefit is considered low or minimal
- A 'high' potential effect could be assigned where the potential impact and/or benefit is believed to be considerable
- An 'unk' would be assigned where the potential effects are unknown or there is insufficient information to assign a potential level of effect with reasonable certainty.
- A '-' means a potential negative effect
- A '+' means a potential positive effect.

The potential effect for each criterion is has been rated assuming that no mitigation measures have been implemented. The 'Comments, Rationale' column in the table provides a more detailed description of the potential effects that could occur, and the 'Mitigation Measures' column identifies the measures that could potentially be implemented to prevent or minimize adverse effects. Additional mitigation measures that could potentially be utilized are identified in Appendix B of the Class EA for Waterpower Projects (OWA, 2008).

Table 5.1 Potential Effects Identification Matrix for Construction and Operation

Criteria	Potential Level of Effect					Comments, Rationale	Mitigation Measures
	-H	-L	Nil	Unk	+L		
General Natural Environment Considerations							
Air quality, including GHG Offsets		X				<ul style="list-style-type: none"> Potential adverse effects during construction due to equipment exhaust, smoke from burning waste materials and dust emissions. Potential adverse effects during emergency operations due to diesel generator emissions. Potential positive effects due to GHG offsets. 	<ul style="list-style-type: none"> Standard construction site best management practices to minimize air emissions due to exhaust, waste burning and dust. Diesel generator operates very infrequently (typically only in emergency situations).
Water quality or quantity (surface water)		X		X		<ul style="list-style-type: none"> Potential adverse effects on water quality during construction due to erosion and sedimentation and accidental spills. Potential effects on water quality during operation due to shoreline erosion, inundation of terrestrial land in head ponds (e.g., nutrients, mercury inputs) and accidental spills. Change to flow volume through bypass reach. <p>Operating as a run of river will prevent water level fluctuations in excess of natural flow regimes minimizing shoreline erosion and associated adverse water quality on rivers with loose granular banks (Petawawa)</p>	<ul style="list-style-type: none"> Standard construction site best management practices to control erosion and sedimentation and prevent accidental spills from occurring. Spill prevention and containment measures to be in place throughout operational period. Conditions – shoreline erosion protection utilized on sensitive areas. Increase above ambient river level and clearing of vegetation in proposed head ponds to limit nutrient availability in inundated area. Determine volume required through bypass reach on basis of biological needs.

Water quality or quantity (groundwater)	X						<ul style="list-style-type: none"> Potential adverse effects on groundwater quality during construction due to accidental spills. Potential decreases in local groundwater quantity during construction due to groundwater leakage into project excavations. 	<ul style="list-style-type: none"> Standard construction site best management practices to prevent accidental spills and manage groundwater.
Species at risk and their habitat	X						<ul style="list-style-type: none"> Search of the NHIC database indicates that there are occurrences of species at risk in the study area. <p>Discussions with MNR and Algonquin Park staff, previous survey reports and anecdotal evidence confirms the presence of Lake Sturgeon (<i>Acipenser fulvescens</i>) within the Petawawa River, both upstream and downstream of the project site. There is potential for American Eel (<i>Anguilla rostrata</i>) to be present in the Petawawa River, as they are confirmed in the Ottawa River. Several SAR turtle species are confirmed within the Petawawa River.</p>	<ul style="list-style-type: none"> EA will determine whether suitable habitat is present in study area. Baseline inventories conducted on several occasions in 2010 to document the presence/ absence of species at risk – potential effects and required mitigation will be assessed subsequently in co-operation with MNR. ESA Agreements discussions to be initiated shortly after distribution of this document.
Significant earth or life science features					X		<ul style="list-style-type: none"> It is currently unknown if any significant earth or life science features exist at the proposed development sites. 	<ul style="list-style-type: none"> Field investigations will be conducted to assess presence/ absence of significant earth or life science features.
Land subject to natural or human-made hazards						X	<ul style="list-style-type: none"> It is currently unknown if any natural hazards exist at the proposed development sites. 	<ul style="list-style-type: none"> Field investigations will be conducted to assess presence/ absence of natural hazards (e.g., significant existing erosion areas).

<p>Terrestrial wildlife (including numbers, diversity and movement of resident or migratory species)</p>	<p>X</p>			<p>• Terrestrial wildlife could be affected by loss/ fragmentation of habitat (associated with construction of site facility and associated infrastructure, head pond creation, etc.), and disturbance associated with construction and operations of the proposed facility.</p> <p>For Big Eddy, approximately 12.1 ha of land is to be inundated, resulting in the creation of a head pond with a total surface area of 42.2 ha upstream of the dam, but much of this land is private and previously disturbed.</p>	<p>• Habitat loss associated with the project will be minimized to the greatest extent possible.</p> <p>• Mitigation measures will be developed to minimize potential effects on terrestrial wildlife from loss/ fragmentation of habitat and disturbance.</p> <p>• Analysis of habitat loss to inundation will consider the availability of equivalent habitat immediately outside of the zone of influence of the proposed undertaking</p>
<p>Natural vegetation and terrestrial habitat linkages</p>	<p>X</p>			<p>• Natural vegetation and terrestrial habitats could be affected by clearing associated with construction of site facility, roads, transmission lines and associated infrastructure. Headpond creation, etc., accidental spills/malfunions.</p>	<p>• Extent of clearing associated with the project will be minimized to the greatest extent possible.</p> <p>• Other best management practices including limiting corridor widths, signage for wildlife crossing etc. will be considered to minimize potential impacts.</p>
<p>Soils and sediment quality</p>	<p>X</p>			<p>• Soil and sediment quality could be adversely affected by excavation and removal, compaction, loss due to fugitive dust or erosion or accidental spills during construction or operation.</p>	<p>• Construction site best management practices will be implemented for erosion and sedimentation control, dust management and prevention/containment of accidental spills to limit the potential for adverse effects on soil and sediment quality.</p>
<p>Significant natural heritage features and areas</p>		<p>X</p>		<p>Algonquin Provincial Park is located upstream of Big Eddy but beyond 10 km; Black Bay PSW is located in proximity to the Big Eddy site; significant SAR and deer yard habitat exists at or near the site.</p>	<p>• Field studies will be conducted in 2010 and significance of identified habitats will be determined.</p> <p>• Mitigation measures will be developed to minimize potential effects on any representative features.</p>
<p>Other (specify)</p>		<p>X</p>		<p>• No other components identified to date.</p>	<p>• N/A</p>

Aquatic and Riparian Ecosystem Considerations

Shoreline dependant species	X					<ul style="list-style-type: none"> • It is not possible to mitigate this effect. • Natural regeneration of shoreline habitat will eventually restore these areas for use by shoreline dependent species.
Wetland dependant species			X			<ul style="list-style-type: none"> • Field investigations will be conducted to assess presence/ absence of wetlands.
Fish habitat	X					<ul style="list-style-type: none"> • Fish habitat mitigation and compensation measures will be developed in discussions with MNR and DFO to ensure no net loss of the productivity of fish habitat as a result of the project. • Bypass flow to be determined based on biological need with MNR/DFO. • It is not possible to mitigate this effect. The compensation agreement with DFO will need to consider this change in habitat type as part of the overall strategy for dealing with fish habitat loss. • The EA fieldwork will document if this habitat is being used by spawning walleye. Compensation for habitat loss may be required. • These tributaries will be investigated to determine the significance of habitat and whether significant habitat would be altered. Where habitat alteration is predicted, it is not possible to mitigate this effect. The compensation agreement with DFO will need to consider this change in habitat type as part of the overall strategy for dealing with fish habitat loss.
						<ul style="list-style-type: none"> • Shoreline dependant riparian vegetation will be impacted by the creation of an inundation area.
						<ul style="list-style-type: none"> • It is currently unknown if any wetlands exist at the proposed development sites. • Fish habitat (including confirmed Lake Sturgeon and Walleye habitat) affected by in-stream structures (e.g. dam, tailrace excavations, temporary cofferdams and dewatering, water crossings on access roads and transmission line), changes in flow (bypass reach) and water level (head pond) and sedimentation. Upstream of the Big Eddy site is lacustrine habitat therefore no drastic change is anticipated due to the proposed inundation. There is potential for walleye spawning habitat at the base of Big Eddy/Half Mile to be impacted by the diversion of water away from this habitat to the turbines. There are a number of tributaries where the backwater effect of the headpond inundation could alter stream habitat at the mouths of these tributaries.

Fish migration	X			X		<ul style="list-style-type: none"> The dams could potentially block the movement of fish There is a high potential that the dam will block the passage upstream and/or downstream of SAR fish such as Lake Sturgeon and American Eel, as well as sport fish such as Walleye. There are no known fish passage solutions which could be incorporated for Sturgeon Head pond may result in an overall increase in the amount of aquatic habitat available. 	<ul style="list-style-type: none"> Fisheries investigations will be undertaken to determine where critical spawning habitats are located and if the dams or operating strategies would block migration to these habitats.
Fisheries					X	<ul style="list-style-type: none"> Although the amount may be more it will be lacustrine vs. riverine habitat. This must be discussed with DFO and MNR as part of the overall strategy for dealing with fish habitat loss. 	<ul style="list-style-type: none"> Standard construction site best management practices to minimize erosion and sedimentation potential during construction. Bank stabilization measures, as required, on very susceptible erosion sites.
Erosion and sedimentation	X					<ul style="list-style-type: none"> Potential for erosion and sedimentation due to construction activities. Potential for long term bank erosion due to water level and flow management activities. 	<ul style="list-style-type: none"> Inflow velocities will be compared with swimming capabilities of fish species of concern to determine the likelihood of impingement or entrainment. If a significant impact is predicted it may be necessary to adjust intake velocities to minimize impingement and entrainment potential or to consider diversion methods for fish. Determine expected turbine mortality using published formulas with site and facility characteristics.
Fish injury or mortality (impingement and entrainment)				X		<ul style="list-style-type: none"> Potential for impingement on trash racks and entrainment and mortality through turbine flows. 	<ul style="list-style-type: none"> Field investigation to determine amount and function of habitat in bypass reaches. Flow in bypass reaches established on basis of maintaining biological function.
Flows and movement (surface or groundwater)				X		<ul style="list-style-type: none"> Flows through bypass reaches will be reduced due to diversion of flow through the powerhouse. 	

Drainage, flooding and drought patterns	X						<ul style="list-style-type: none"> Minor changes in local drainage will occur due to facility, lay down, access road and transmission line construction. Extreme flood levels may be somewhat higher in the head ponds due to the water level increase. Changes in water temperature in head pond due to increased surface area and slower flow velocity anticipated to be negligible. No other components identified to date. 	<ul style="list-style-type: none"> A drainage network will be installed around the facility to ensure adequate site drainage. Facility will be constructed to meet flood passage requirements. No mitigation required – overall thermal regime of the river not likely affected. N/A
Water temperature	X							
Other (specify)			X					
Aboriginal Community Considerations								
First Nation reserves or other Aboriginal communities			X				<ul style="list-style-type: none"> It is not known at this time if operation of the project will have an adverse effect on local Aboriginal communities. 	<ul style="list-style-type: none"> Potentially affected First Nations will be consulted and mitigation undertaken as required.
Spiritual, ceremonial, cultural, archaeological, or burial sites			X				<ul style="list-style-type: none"> Disturbance to spiritual, ceremonial, cultural, archaeological or burial sites could occur during construction and operation activities. 	<ul style="list-style-type: none"> Aboriginal consultation to identify local resources will be conducted to mitigate potential negative issues. A Stage 1 and if necessary Stage 2 Archaeological Assessment will be completed to identify local resources (or resource potential).
Traditional land or resources used for harvesting activities			X				<ul style="list-style-type: none"> Effects to the aquatic and terrestrial environment (discussed above) may result in negative effects to traditional lands and resources used for harvesting activities. 	<ul style="list-style-type: none"> Mitigation measures, as appropriate, are provided above.
Employment				X			<ul style="list-style-type: none"> Construction and operation of the project near an Aboriginal community will result in opportunities for employment of community members. 	<ul style="list-style-type: none"> N/A

Lands subject to land claims				X				<ul style="list-style-type: none"> The Algonquin Land Claim is in place in the area of the project. 	<p>Consultation with government agencies (provincial and federal) and the Algonquins of Ontario will be undertaken to understand the impact of the proposed project in the context of the Algonquin Land Claim.</p> <p>To be determined through consultation and business arrangements with the Algonquins of Ontario.</p>
Economic development					X			<ul style="list-style-type: none"> Unknown 	<ul style="list-style-type: none"> To be determined through consultation and business arrangements with the Algonquins of Ontario.
Other (specify)				X				<ul style="list-style-type: none"> No other components identified to date. 	<ul style="list-style-type: none"> N/A
Land and Resource Use Considerations									
Access to inaccessible areas (land or water)			X					<ul style="list-style-type: none"> Access road upgrading to accommodate construction equipment and material delivery will result in improved access to the areas by land. Access to the area by water will remain as is. 	<ul style="list-style-type: none"> Public access to the construction area will be prohibited to ensure public safety. Portage routes around the project could be constructed where required to ensure safe passage around during construction and operation. The necessity of barriers to access along power line routes will be discovered in the consultation program
Navigation					X		X	<ul style="list-style-type: none"> Navigation and portage routes could be affected by the proposed developments <p>Major interest groups include white water rafting and kayaking groups and businesses navigate this waterway.</p> <p>Navigation info has not yet been gathered from MTO for Half Mile. Project area is within restricted DND Range Training Area, but this is not an official barrier to navigability.</p>	<ul style="list-style-type: none"> Existing portage routes will be identified, and a commitment will be made to maintain or temporarily re-route portage routes during construction to ensure safe passage around the sites for canoeists/kayakers. Portage routes will be restored/ maintained during operation. Consultation with Transport Canada will be undertaken.

Riparian rights or privileges	X					<ul style="list-style-type: none"> The project area, including the head pond shoreline will exist on provincial and private lands. At present, the degree of effects to riparian resource use are not known but can be assumed to be low. 	<ul style="list-style-type: none"> Consultation with stakeholders will determine appropriate mitigation.
Recreational use – (land or water)	X					<ul style="list-style-type: none"> Scenic attractions and aesthetic or recreation features along will be assessed. The full extent of effects to recreational use will be determined in consultation with project stakeholders. 	<ul style="list-style-type: none"> Additional mitigation measures will be determined in consultation with project stakeholders.
Angling and hunting opportunities	X					<ul style="list-style-type: none"> The extent of hunting and angling use within the project area is a common occurrence throughout the Petawawa River, with the exception of the CFB Petawawa base, where no hunting or angling are permitted in this stretch of the river. 	<ul style="list-style-type: none"> Effects to angling and hunting opportunities will be determined in consultation with project stakeholders. Appropriate mitigation measures will be determined based on stakeholder consultation.
Trapping activities				X		<ul style="list-style-type: none"> There is no trapping in the area of Big Eddy 	
Baitfish harvesting activities	X					<ul style="list-style-type: none"> Several baitfish licences are issued in the area of Big Eddy. Upstream impacts are presumed to be negligible at Big Eddy due to the lacustrine properties of the river above the project site. 	<ul style="list-style-type: none"> Consultation will be required with bait fishermen to identify harvesting areas and assess effects.
Views or aesthetics	X					<ul style="list-style-type: none"> Construction and operation of the project will result in a change to aesthetics of the area. The determination of this effect as positive or negative is subjective. 	<ul style="list-style-type: none"> 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 visitor usage survey).

An existing land or resource management plan					X		No known land or resource management for Big Eddy, however part of the inundation area for Big Eddy includes private land currently being operated as a licensed Aggregate Pit under the MNR Aggregate Resources Act.	• To be determined through consultation
An existing water management plan			X				There is no existing water management plan for the Petawawa River.	
Protected areas					X		• Unknown at this known	• To be determined.
Other (specify)					X		• No other components identified to date.	• N/A
Cultural Heritage Resources Considerations								
Archaeological sites					X		• Archaeological sites are known to exist within the project area.	• A Stage 1 and if required Stage 2 Archaeological Assessment will be completed to determine potential effects. • Appropriate mitigation measures will be proposed based on assessment findings as required.
Buildings or structures					X		• Structural resources potentially affected by the project are currently unknown.	• Appropriate mitigation measures will be proposed as required.
Cultural heritage landscapes					X		• It is unknown whether a cultural heritage landscape assessment will be required for the project.	• Appropriate mitigation measures will be proposed based on assessment findings as required.
Other (specify)					X		• No other components identified to date.	• N/A

Social and Economic Considerations									
The Location of people, businesses, institutions, or public facilities				X					<ul style="list-style-type: none"> • Appropriate mitigation measures will be determined based on stakeholder consultation.
Community character, enjoyment of property, or local amenities			X						<ul style="list-style-type: none"> • To be determined
Employment				X					<ul style="list-style-type: none"> • N/A
Public health and/or safety		X							<ul style="list-style-type: none"> • Prevention of public access to the construction site through use of mitigation measures such as signage, gates and fencing and/or other security procedures as required. • Proper barriers and warning devices installed following construction to restrict public access to intake/tailrace areas during operation may include such safety measures as safety booms, fencing and signage.
Local, regional, or provincial economies					X				<ul style="list-style-type: none"> • Consultation program with local or regional recreational businesses will be undertaken.
Tourism values						X			<ul style="list-style-type: none"> • N/A

<p>Water supply</p>			X		<ul style="list-style-type: none"> It is currently unknown whether the Fredrick House River is a water supply for local communities. For potential effects to water quality, please see "Water Quality or Quantity" above. It is also unknown if groundwater is used in the area for water supply 	<ul style="list-style-type: none"> Water supply information will be collected. Appropriate mitigation measures will be proposed as required.
<p>Aesthetic image of the surrounding area</p>			X		<ul style="list-style-type: none"> See "Views or Aesthetics" above. 	<ul style="list-style-type: none"> N/A
<p>Other (specify)</p>			X		<ul style="list-style-type: none"> No other components identified to date. 	<ul style="list-style-type: none"> N/A
<p>Energy/Electricity Considerations</p>						
<p>Reliability (e.g. voltage support)</p>			X		<ul style="list-style-type: none"> New power generation units are of a relatively small capability, and operation of them in parallel with the existing power grid will provide minor impact on the overall power system reliability and power quality - voltage and frequency. 	<ul style="list-style-type: none"> N/A Appropriate mitigation technical measures will be proposed in protection and control to minimize a power outage.
<p>Security (e.g. Black Start)</p>			X		<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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.

Electricity flow patterns				X		<ul style="list-style-type: none"> • Operation of the new power generation units will redistribute power flow in the existing distribution system. 	<ul style="list-style-type: none"> • Appropriate mitigation technical measures will be proposed in the control system of the power grid and new generation units if required.
Other (specify)			X	X		<ul style="list-style-type: none"> • Operation of the new power generation units will affect existing protection and control settings in the distribution system. • Oil filled electrical and mechanical equipment can potentially spill oil into the Environment. 	<ul style="list-style-type: none"> • Appropriate mitigation technical measures will be proposed in protection and control system of the power grid. • Appropriate preventive measures will be proposed to eliminate the risk.

6. References

Barnett, P.J., Leyland, J.G. 1988: Geological series, Quaternary geology of the Pembroke area, Renfrew County. Preliminary map P3124, scale: 1:50 000.

Chambers, B.A., Naylor, B.J., Nieppola, J., Merchant, B., Uhlig, P., 1997. Field Guide to Forest Ecosystems of Central Ontario. SCSS Field Guide FG-01. Queen's Printer for Ontario.

Fisheries and Oceans Canada. October 2010. Fish Passage Requirements for Half Mile Rapids and Big Eddy Rapids hydroelectric Projects on the Petawawa River.

Gillespie I.E., Wicklund, R.E., Mathews, B.C., 1964. Soil Survey of Renfrew County Report No. 37 of the Ontario Soil Survey. Canada Department of Agriculture.

Hatch. 2009. Hydrology Review for Petawawa River Hydropower Sites. Half Mile Rapids and Big Eddy Hydropower Projects. Consultant's Report H333385 Rev. A for Xeneca Power Development.

Lumbers, S.B. 1980: Geological series, Pembroke area, western part, southern Ontario; Ontario Geological Survey. Preliminary map P2355, scale: 1:63 360.

Ministry of Natural Resources. 2006. Crown Land Use Policy Atlas Policy Report G396: Multiple Natural Resource Use. Website: <http://www.lio.ontario.ca/imf-ows/sites/clupa/xmlReader.jsp?xsl=XML/web-primary.xsl&polid=G396>

Ministry of Natural Resources. 2008. Direct Site Release-Big Eddy Rapids, Petawawa River: File # WSR-2008-02. Site Description Package.

Ontario Waterpower Association. 2008. Class Environmental Assessment for Waterpower Projects.

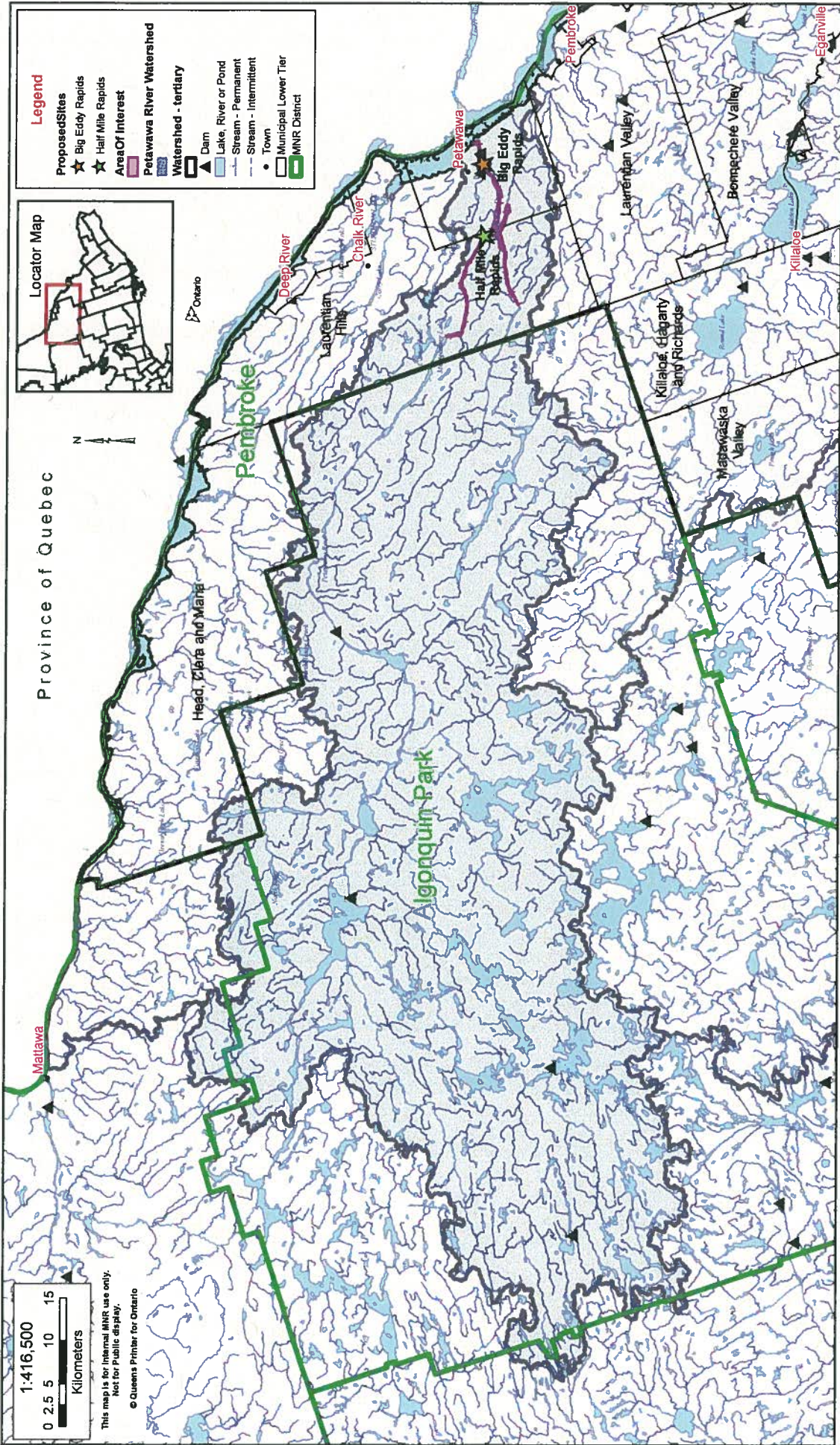
Xeneca. 2009. Petawawa Green Energy Development Big Eddy Waterpower Site Strategy. Submission to MNR.

APPENDIX A

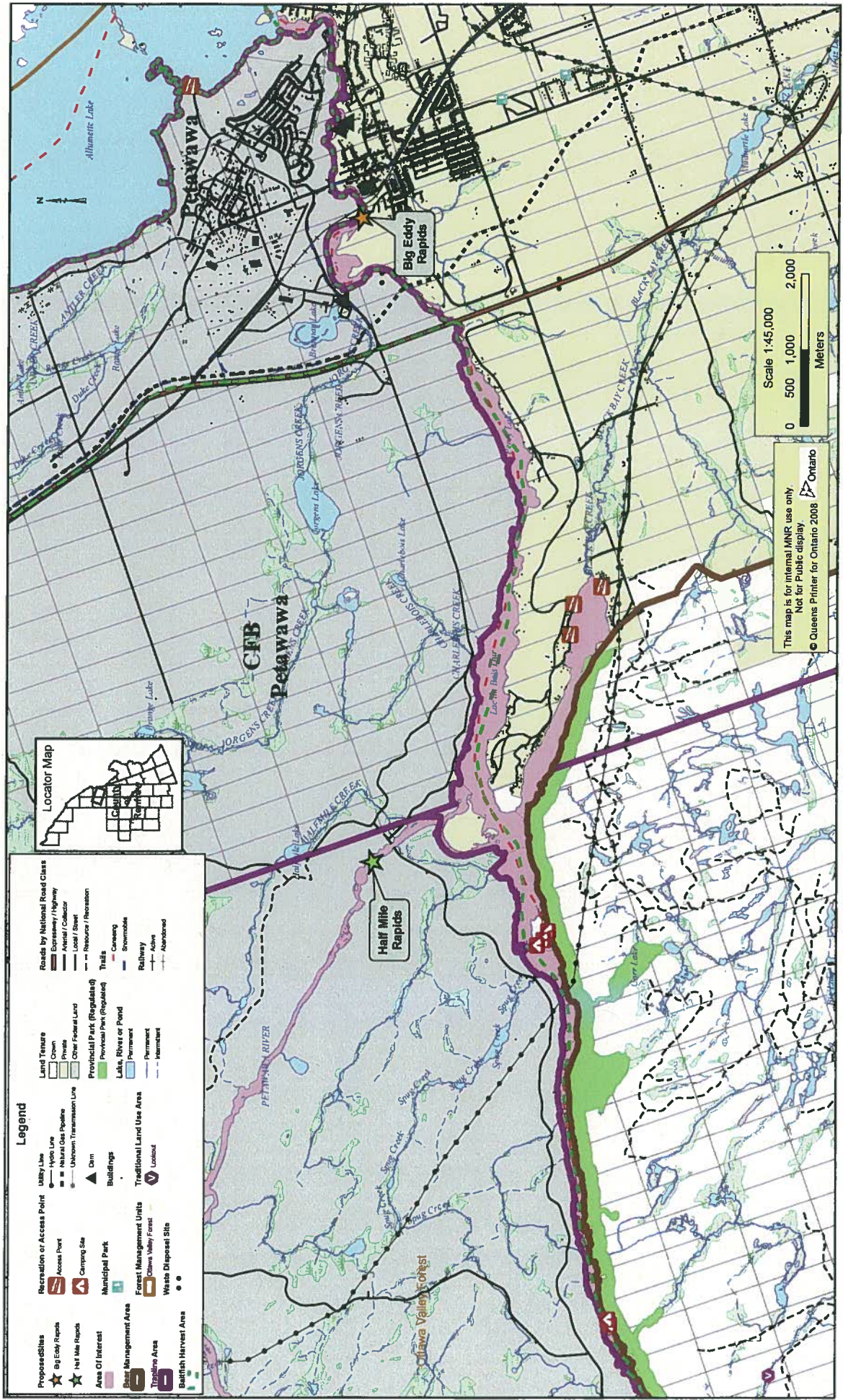
Conceptual Plates and Maps for Big Eddy

Big Eddy Rapids DSR

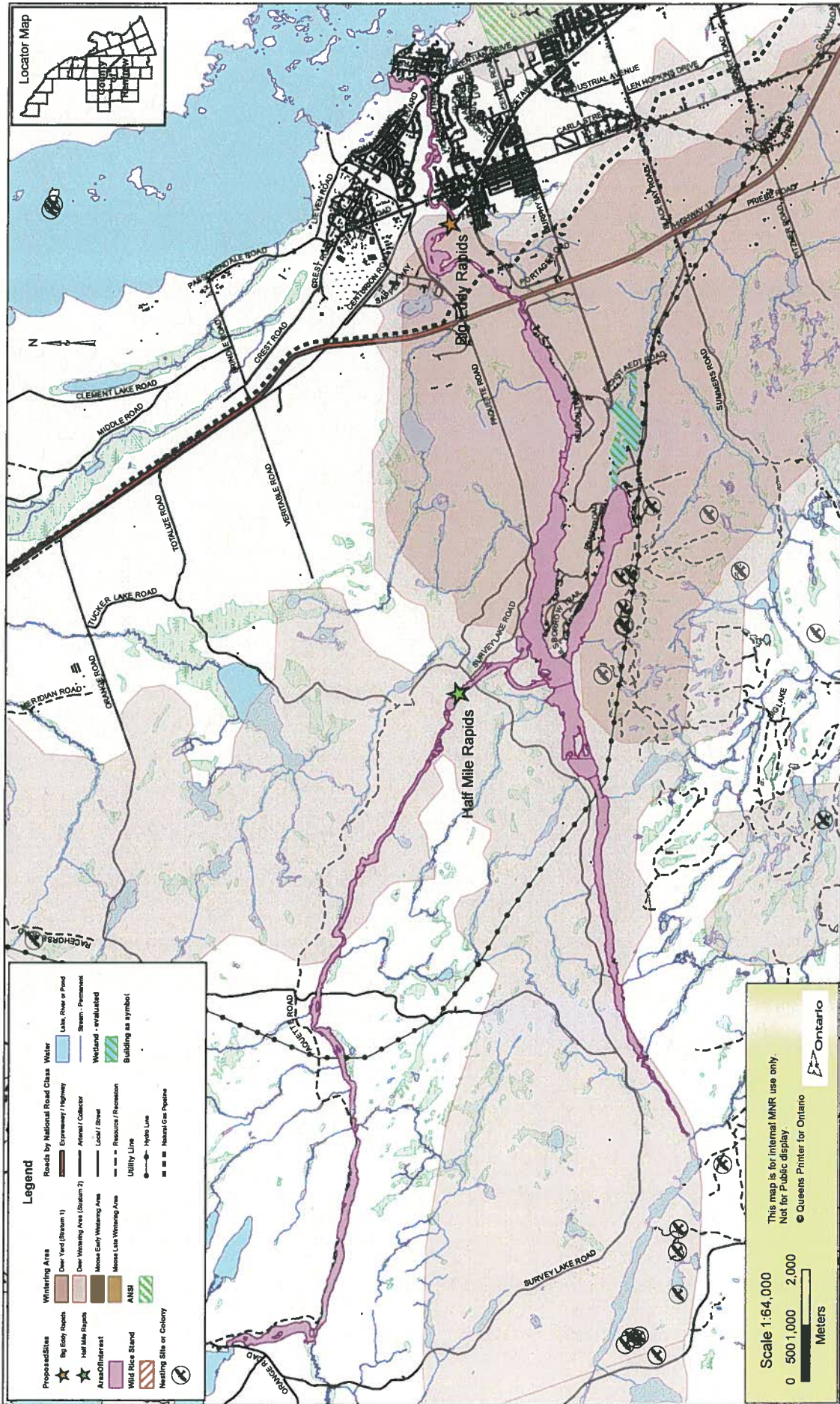
Map 2.1 - Petawawa River Watershed

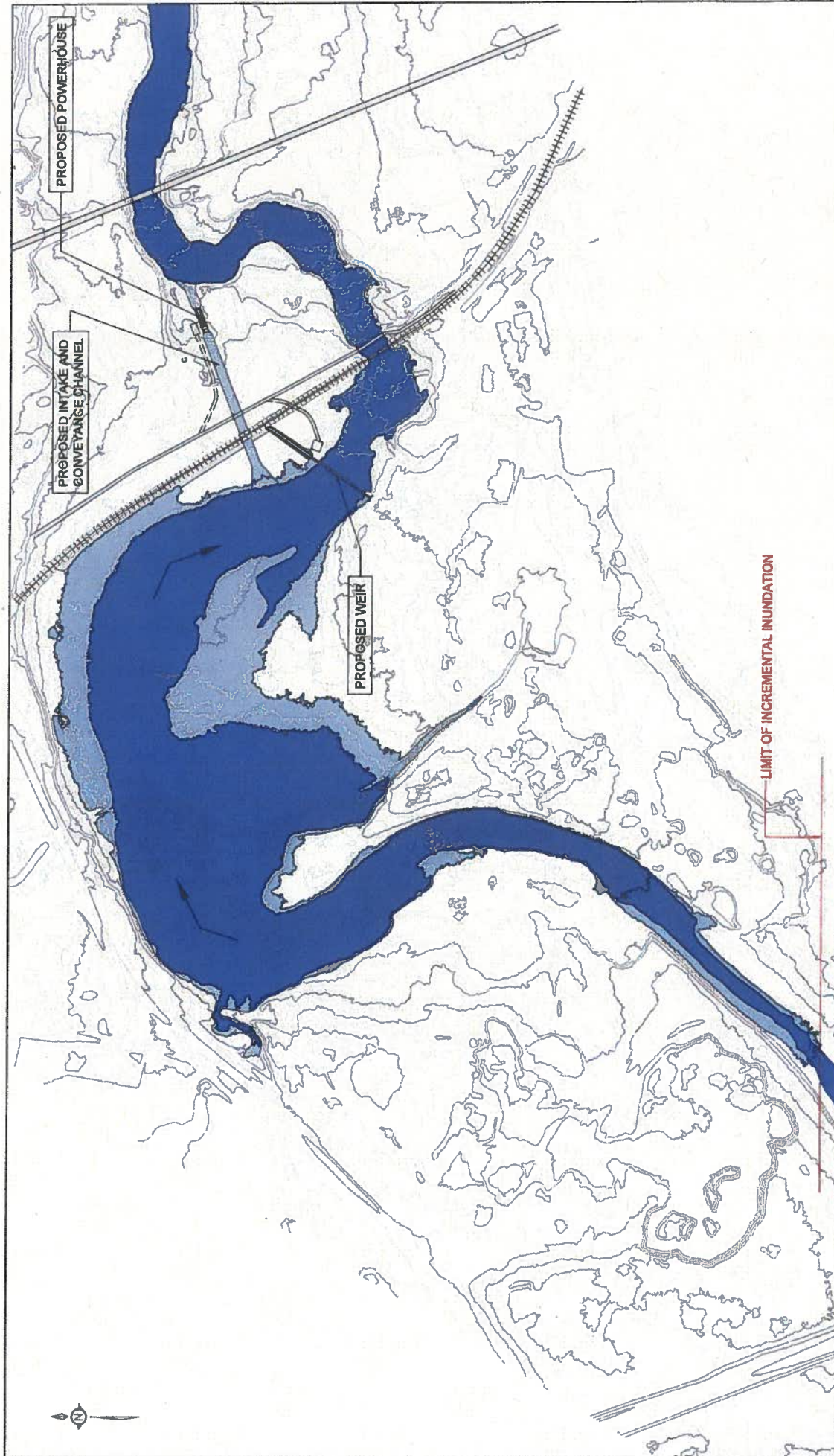


Big Eddy Rapids DSR Map 2.2 - Land Use



Big Eddy Rapids DSR Map 2.3 - Natural Environment





Xeneca
 POWER DEVELOPMENT INC.

HATCH
 POWER DEVELOPMENT INC.

PLATE 11

XENECA POWER DEVELOPMENT INC.
 BIG EDDY RAPIDS HYDROPOWER DEVELOPMENT
 ESTIMATED AREA HEADPOND INUNDATION

NOTE:

1. TOPOGRAPHIC BASE MAPS PREPARED BY AIRBORNE LOUPE BY PROJECT COORDINATOR. ELEVATION DATA IS BASED ON 5' 0.0' METERS SURFACE ELEVATIONS. SURFACE ELEVATIONS WITHIN DAM CORRESPOND TO WATER ESTIMATED AND ADJUSTED FROM TOP OF FLOODPLAIN. PROPERTY BOUNDARIES SHOWN IN BLACK STIPES.
2. HEADPOND ELEVATION ASSUMED LEVEL POOL BASED ON LOW FLOW CONDITION (SEE PLATE 8 FOR 100-YR FLOOD PLAN)

LEGEND:

- AREA OF EXISTING WATER (Upstream of the dam to limit of inundation)
- AREA OF PROPOSED INCREMENTAL INUNDATION (Upstream of the dam to limit of inundation)

TOTAL AREA OF LEVEL POOL AT PROPOSED N.W.L. (EL. 136.00)

- 30.1 Hectares
- 12.1 Hectares
- 42.2 Hectares

LIMIT OF INCREMENTAL INUNDATION

SCALE: 1:50,000

0 100 200 300 400 500 METERS

0 100 200 300 400 500 FEET

PLATE 11

DATE: 05/20/10

PROJECT: XENECA - BIG EDDY RAPIDS

DESIGNER: J. W. HATCH

DRAWING NO.: XENECA-11-01

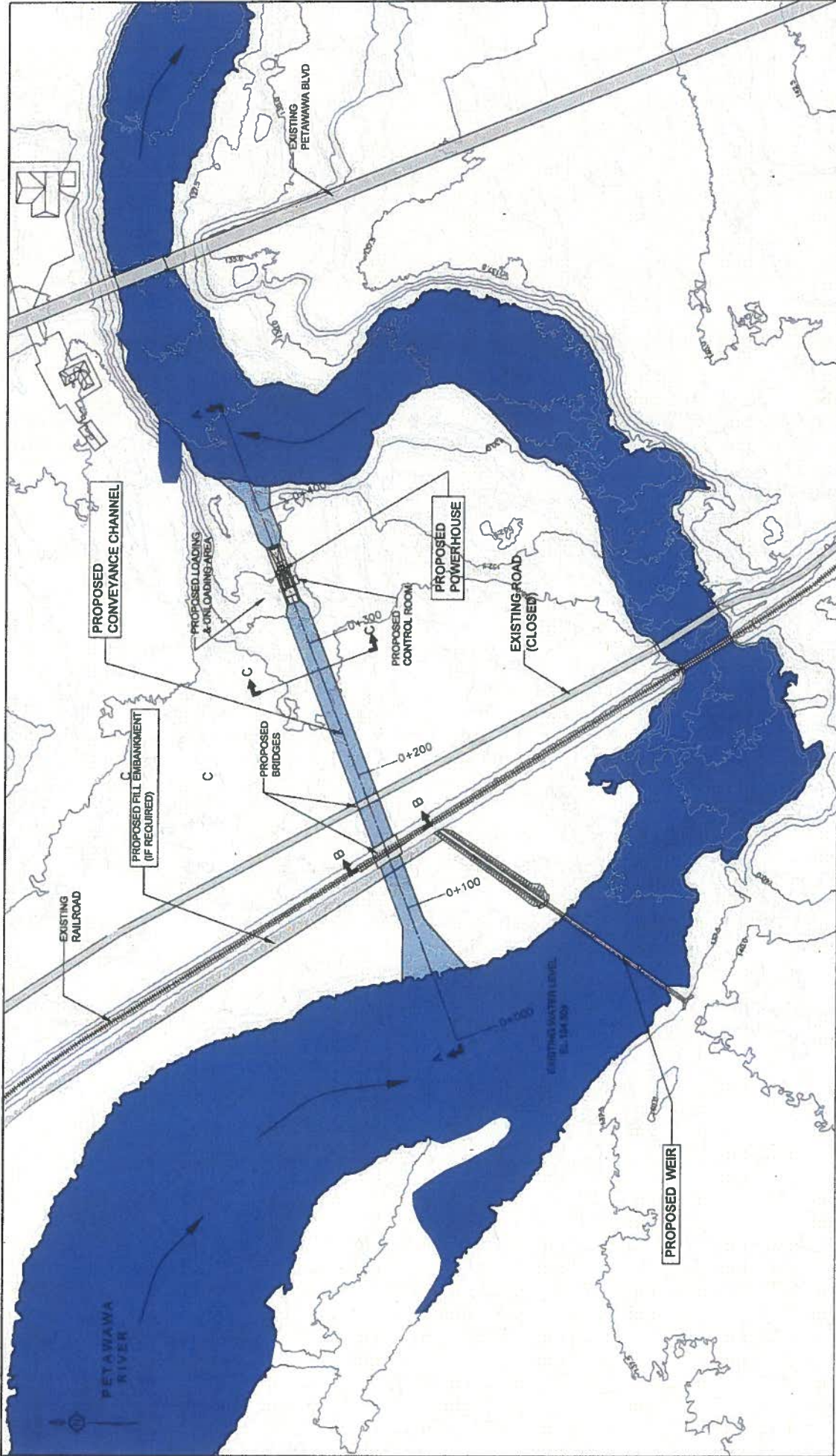
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DATE: 05/20/10

PROJECT: XENECA - BIG EDDY RAPIDS

DESIGNER: J. W. HATCH

DRAWING NO.: XENECA-11-01

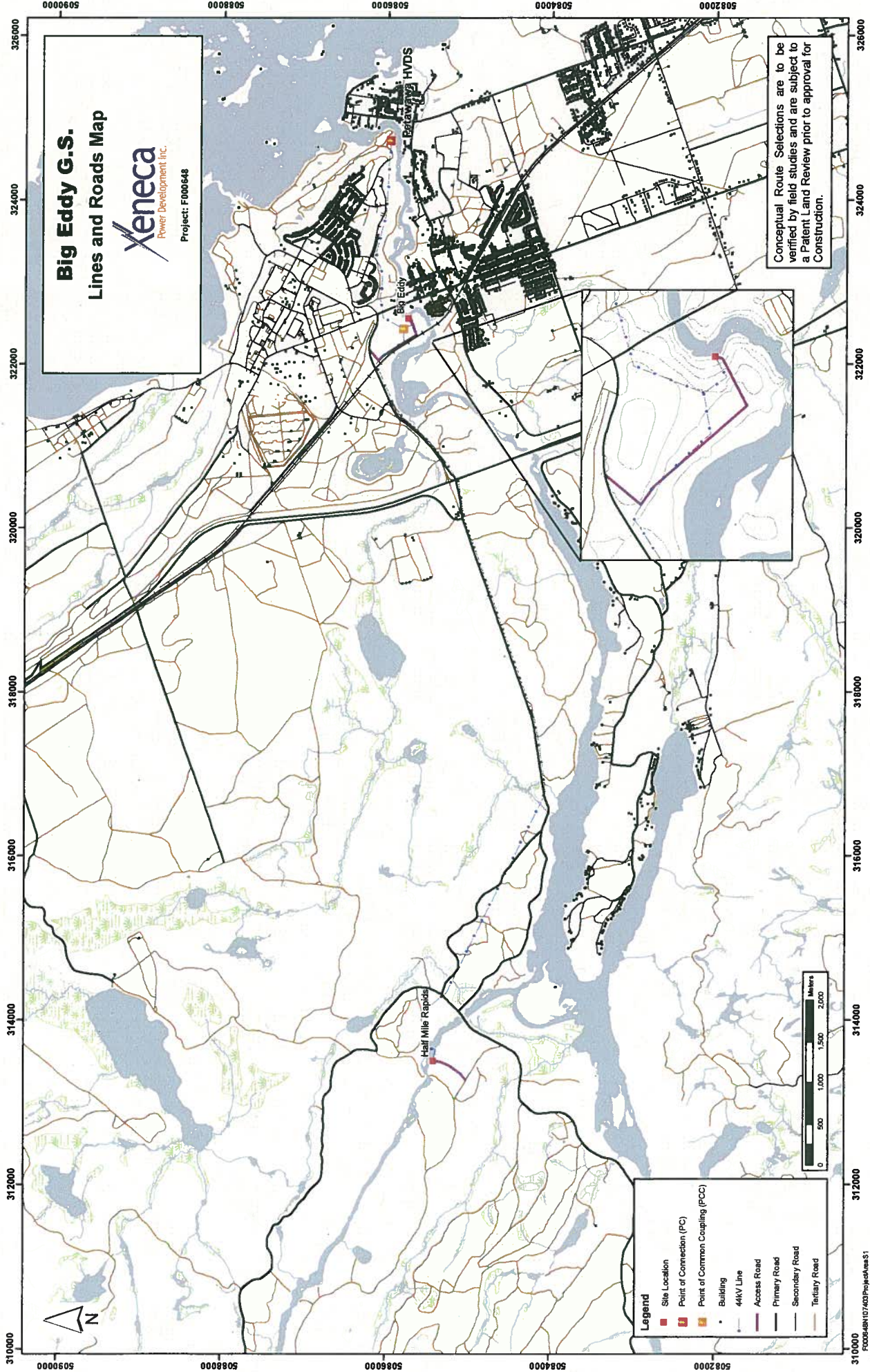


Xeneca
 Power Development Inc.
XENECA POWER DEVELOPMENT INC.
 BIG EDDY RAPIDS HYDROPOWER DEVELOPMENT
CONCEPTUAL SITE DEVELOPMENT LAYOUT
 PLATE 12A
 REV 0

LEGEND:
 - EXISTING WATER LEVEL (APPROXIMATE)
 - PROPOSED CONVEYANCE CHANNEL

NOTES:
 1. TOPOGRAPHIC BASE MAPS PROVIDED BY AMERICAN LOCUS BY TERRACONCEPT, SPRING 2008. CONTOUR INTERVAL IS 0.3 METRES.
 2. PROJECT COORDINATE SYSTEM IS NAD83 UTM ZONE 18U.
 3. SURFACE ELEVATIONS, WITH HIGH CORRECTED TO WATER.
 4. MINOR ROAD ALLOWANCE AND PROPERTY BOUNDARIES SHOWN BY BLACK DOTTED LINES.
 5. HATCHING EL. 136.0 ASSUMED LEVEL POOL BASED ON LOW FLOW CONDITION (SEE PLATE 9 FOR 100-YR FLOOD PLAN)

Drawing Name: C:\XENCA - 00 EDDY\PLATE - 12A.DWG
 Rev 02 - 2010 - X18pca
 Logon name: jacob003
 Plot Scale



Big Eddy G.S.
Lines and Roads Map

xeneca
 Power Development Inc.
 Project: F000648

Conceptual Route Selections are to be verified by field studies and are subject to a Patent Land Review prior to approval for Construction.

- Legend**
- Site Location
 - Point of Connection (PC)
 - Point of Common Coupling (PCC)
 - Building
 - 44kV Line
 - Access Road
 - Primary Road
 - Secondary Road
 - Tertiary Road

