DRAFT FOR DISCUSSION PURPOSES

Environmental Report

Big Eddy

(Petawawa River)

Hydroelectric Generating Station Project

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Acronyms

AANDC	Aboriginal Affairs and Northern Development Canada (formerly Indian and Northern Affairs Canada)
AECL	Atomic Energy of Canada
AOO	Algonquins of Ontario
AST	Above Ground Storage Tank
BBRA	Black Bay Ratepayers Association
BMP	Best Management Practice
CASP	Community Alliance to Save the Petawawa
CDA	Canadian Dam Association
CEA Agency	Canadian Environmental Assessment Agency
CEAA	Canadian Environmental Assessment Act
CFB	Canadian Forces Base
CLUPA	Crown Land Use Policy Atlas Report
COSEWIC	Council on the Status of Endangered Wildlife in Canada
CP	Canadian Pacific
CPL	Canadian Projects Limited
CPUE	Catch per unit effort
DFO	Fisheries and Oceans Canada
DND	Department of National Defence
DZOI	Downstream Zone of Influence
EA	Environmental Assessment
EAA	Environmental Assessment Act
EC	Environment Canada
ESA	Endangered Species Act
ER	Environmental Report
FEAC	Federal Environmental Assessment Coordinator
FIT	Feed-In Tariff
FMP	Forest Management Plan
GEA	Green Energy Act
GS	Generating Station
HC	Health Canada
LTAF	Long term annual flow, average annual mean
LRIA	Lakes and Rivers Improvement Act
MAA	Ministry of Aboriginal Affairs
masl	metres above sea level
ME	Ministry of Energy
MNDM	Ontario Ministry of Northern Development and Mines

MNR	Ontario Ministry of Natural Resources
MNO	Métis Nation of Ontario
MOE	Ministry of the Environment
MOU	Memorandum of Understanding
MTCS	Ministry of Tourism, Culture and Sport
NOC	Notice of Commencement
NOL	Normal Operating Levels
NRCan	Natural Resources Canada
NWPA	Navigable Waters Protection Act
OFSC	Ontario Federation of Snowmobile Clubs
OPA	Ontario Power Authority
ORMG	Ontario Resource Management Group Inc.
OVA	Ottawa Valley Area
OVDED	Ottawa Valley's Department of Economic Development
OVFI	Ottawa Valley Forest Inc.
OVTA	Ottawa Valley Tourism Association
OFAH	Ontario Federation of Anglers and Hunters
OWA	Ontario Waterpower Association
PIC	Public Information Centre
PIM	Public Information Meeting
PLA	Public Lands Act
POSC	Pembroke Outdoor Sportsman's Club
PSAC	Petawawa Stakeholder Advisory Committee
PWQMN	Provincial Water Quality Monitoring Network
PWQO	Provincial Water Quality Objectives
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 run of river
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
RAP	Round Algonquin Park
ROW	Right-of-way
RSFDP	Resource Stewardship and Facility Development Projects
SAR	Species at Risk
SARA	Species at Risk Act
SIP	Site Information Package
SFL	Sustainable Forest Licence
TC	Transport Canada
TS	Transformer Station
UTM	Universal Transverse Mercator Units
VEC	Valued Ecosystem Component
WSC	Water Survey of Canada
WMP	Water Management Plan
WPSMG	Waterway Public Safety Management Guideline
WPSMP	Waterway Public Safety Management Plan
ZOI	Zone of Influence

Units

dBA	decibel
ha	hectare
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

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

Hydroelectricity is generated from water, a naturally replenished source making waterpower both a renewable and sustainable resource. It is considered the most widely-used form of renewable energy. Greenhouse gas emissions from a hydroelectric generating station 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 are designed and operated to store energy (water) until it is needed for peak periods of usage.

Hydroelectric generating stations are long-lived, lasting upward of eighty (80) years; there remain operating facilities within the province that were constructed at the turn of the 20th century. In 2009, the Ontario *Green Energy 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 was designed to promote economic activity, the development of renewable energy technologies, and the creation of new green industries and jobs.

1.2 INTRODUCTION TO PROJECT

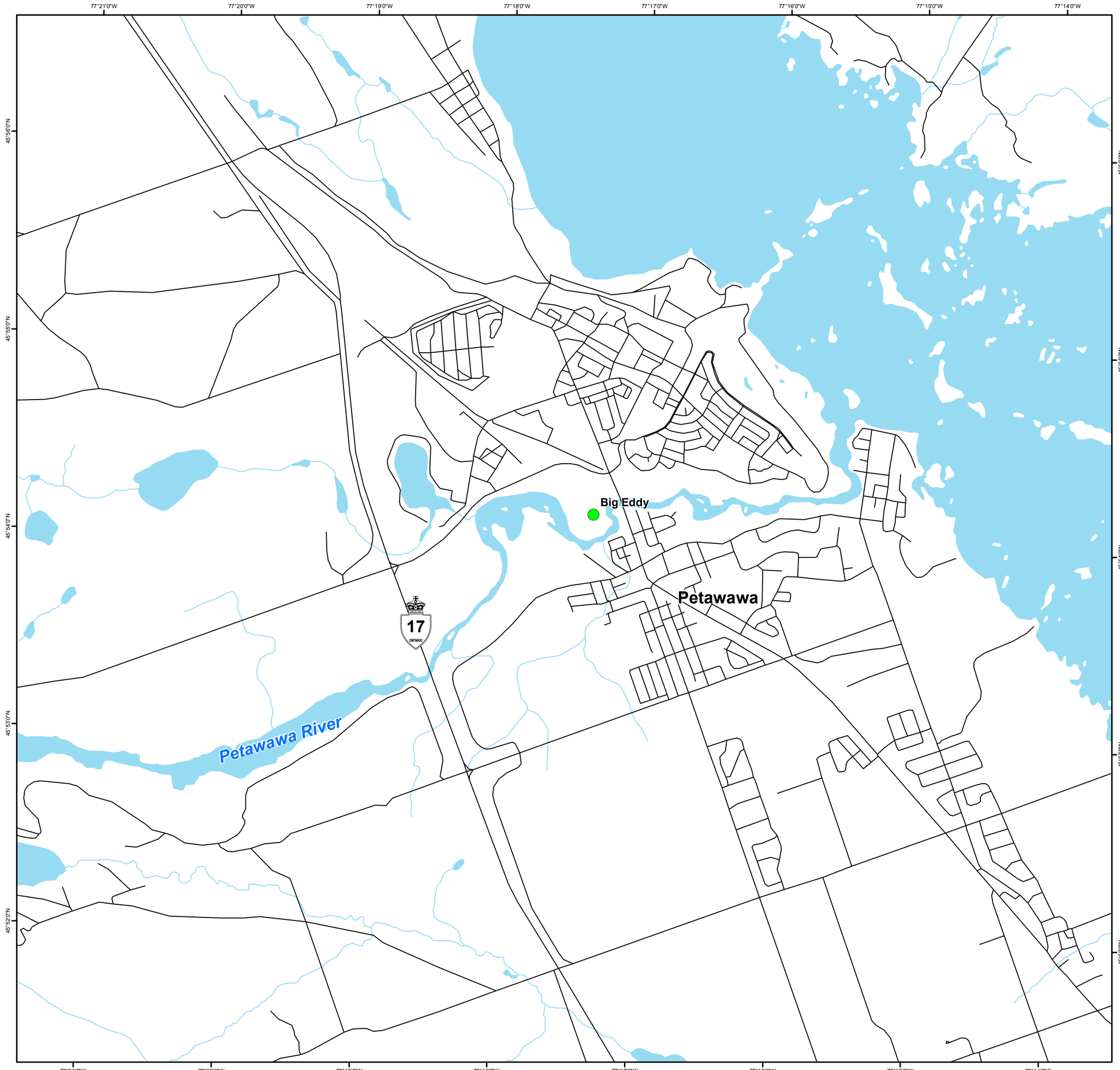
Xeneca Power Development Inc. (Xeneca) is proposing the construction of a 5.3 megawatt (MW) hydroelectric generating station (GS) on the Petawawa River in the Town of Petawawa, Ontario. The proposed project would meet the provincial government's objectives to generate sustainable and reliable hydroelectric power. The project was awarded a 40-year FIT contract from the OPA which, subsequent to a successful Environmental Assessment (EA) outcome and the ensuing permitting and approvals phase, would see the facility commissioned and delivering electricity to the provincial supply grid by October 2015.

The project site is located on the Petawawa River at Railroad Rapids, between the Highway 17 bridge and the Petawawa Boulevard bridge. A site map is provided in Figure 1.

1.2.1 Zone of Influence

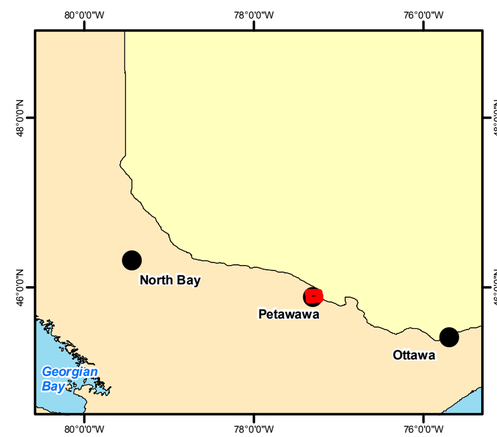
For the purposes of this assessment, the zone of influence of the project consists of the areas which will be affected by the construction and operations of the facility. These areas include the facility and the construction area footprints and access road right of ways. It also includes the full

extent of the Petawawa River and its tributaries extending from 2.7 km upstream of the weir to the tailrace of the Big Eddy facility. In addition, influences that might have a direct effect immediately downstream, such as changes to flow, temperature, water chemistry and sediment were also assessed on a select basis.



LEGEND

- Site Locations
- Road
- Water Feature



REFERENCE

Note: MNR & Geogratis Data Services (2010)
UTM Zone 18

0 1,000 2,000
Meters
1:25,000

PROJECT

BIG EDDY GS

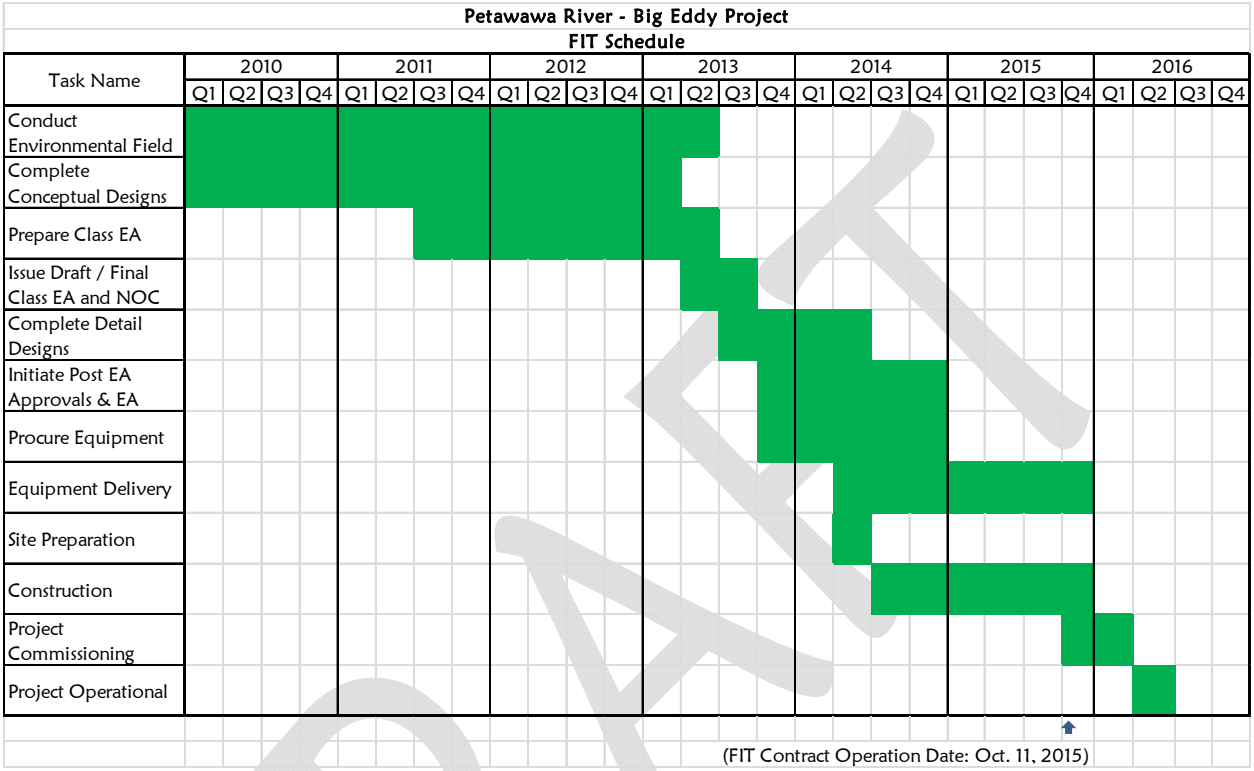
TITLE

SITE LOCATION MAP

PROJECT No.			**FIGURE**
DESIGN	KC	07/03/2013	
GIS	KC	07/03/2013	1
CHECK	CK	07/03/2013	
REVIEW	CK	07/03/2013	

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 EA is to recognize the potential effects of a project life cycle 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 planning process under the Class Environmental Assessment for Waterpower Projects (revised April, 2012) developed by the Ontario Waterpower Association (OWA) allows a proponent to assess the potential effects to the environment using the best information available in order to make an informed decision about whether a project should proceed to implementation. The proponent is required to identify potential effects from the proposed undertaking and propose mitigation on the proposed effects. The proponent is also required to consult with regulatory

agencies, the public and Aboriginal communities on the potential effects and seek resolution to issues that are raised during the EA process. This process is frequently referred to as the Waterpower Class EA.

The components of hydroelectric projects evaluated by the Waterpower Class EA can include reservoirs or head ponds, water control structures, water conveyance structures (canals or penstocks), powerhouses, and access routes. Connection lines and transformer stations are also components of the overall project, but the assessment of these components is not required in the Waterpower Class EA and any information related to the connection line presented in this report is provided for the information of the reader. 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 a backup generating system powered by fuel.

The process of conducting this EA entailed the examination and evaluation of each component (e.g. dam) and life-stage (e.g. operation) of the proposed development and their potential effect on each aspect of the current environment. Environmental effects are changes that 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, and social conditions and economic attributes.

1.4 Approach to the Environmental Screening Process

The EA team included internal departments within Xeneca (i.e. personnel from the Corporate Affairs and Communications (including Public Affairs and Aboriginal Relations), Environmental Affairs, Engineering, and Legal Affairs departments) as well as technical consultant firms retained by Xeneca for the proposed undertaking as such:

- Canadian Projects Limited (CPL)
- Hatch
- HGC Engineering
- Hutchison Environmental Sciences Ltd.
- KBM
- OEL-HydroSys and WESA, divisions of BluMetric Environmental Inc.
- Ontario Resource Management Group Inc. (ORMG)
- ORTECH Consulting Inc.
- Woodland Heritage Services Ltd.

1.4.1 Legal Framework

As a waterpower development with an installed capacity less than 200 MW, this project is subject to the Waterpower Class EA planning process developed by the OWA as approved by the Ministry of the Environment (MOE) in October 2008 (revised in April 2012) under the Ontario *Environmental Assessment Act (EAA)*. Water flows on the Petawawa River are regulated both upstream and downstream of the proposed Generating Station (GS), which will be named the Big Eddy GS. In addition, there are bridges, a highway, and a railway that cross the river in proximity to the project site; therefore the proponent has categorized the proposed waterpower facility as a 'new project on a managed waterway' as per the definitions in the Waterpower Class EA (see 'Designation of Managed Waterway for the Purpose of the Ontario Waterpower Class Environmental Assessment' in Appendix A of this report).

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 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 (MNR).

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). In the early stages of the planning process, these federal regulatory approvals triggered the requirement for a screening-level environmental assessment under the previous *Canadian Environmental Assessment Act (CEAA)*. Since the enactment of the new *Canadian Environmental Assessment Act 2012* (*CEAA* 2012) a federal screening is no longer required. As such, this Environmental Report (ER) document is primarily intended to meet Waterpower Class EA requirements, though federal information requirements have been addressed where possible.

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 (RSFDP), MNR. Subsequent amendments were made to Ontario *Regulation 334* under the *EA Act* (s. 15.0.1) that exempt any undertakings by or on behalf of the Crown that are being carried out only for the purposes of implementing a renewable energy project. Waterpower projects are subject to the requirements of the *EA Act* under Ontario *Reg. 116/01*, with the Waterpower Class EA as the primary planning process. The proposed connection line for the Big Eddy GS falls into a 'Category A' undertaking as per O. *Reg. 116/01* and is therefore exempt from

an *EA Act* requirement. As the Ministry responsible for managing most Crown resources, through disposition, approval and permits under a number of statutes, MNR has indicated that it still requires information to support decisions related to the disposition, approvals or permits required for transmission line projects. Xeneca has included preliminary information on the connection line route in this document and in public information centres towards satisfying future permitting consultation requirements.

Under Section 67 of *CEAA 2012*, a federal authority must not permit a project to be carried out on federal lands if the project would likely cause significant adverse environmental effects. Accordingly, it is understood that CFB Petawawa (DND) will be reviewing this Environmental Report to determine if their environmental assessment requirements have been met or if additional information is required.

1.4.2 Characterize Local Environment of Proposed Development

The EA team collaborated in the completion of the Potential Effects Identification Matrix. This matrix was included in the Project Description document (Appendix B) developed by Xeneca, and circulated to regulators in order to begin the planning process. The EA team worked 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.

Xeneca and 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 documents are identified in the References section (Section 14) in this document and in the technical reports referenced throughout this document;
- Field investigations to supplement the terrestrial and aquatic biology data available for the site. The EA team members 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 and in a detailed report in Annex III;
- Stage 1 and Stage 2 Archaeological Assessments to supplement the available historical record for the site. The results of these studies are presented throughout this document and in a detailed report in Annex V;
- Engineering 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 flow depths and velocities. Steady-state hydraulic models were developed using HEC-RAS. This information can be found in Annex I and II;

- A geomorphic assessment was conducted in order to evaluate potential erosion and sedimentation risks resulting from the proposed project. The final report outlining this assessment was not complete at the time of the Draft ER, however it will be included in the Final Environmental Report;
- Aerial photography and preliminary ground-truthing exercises were undertaken from which connection line and access road route alternatives were determined. This was later augmented by a ground-truthing exercise for route segments running along existing roads. The information provided from these exercises is provided in Annex III;
- A river recreational usage study for the Petawawa River in the vicinity of the proposed Big Eddy project site. Xeneca conducted this study to obtain statistics on the recreational use of the river, and to support negotiations with local residents, business owners and recreational users. This information is provided in Appendix D.

1.4.3 Identify Potential Environmental Effects

The EA team used a consultative process to identify the potential effects of the project in the early stages of the planning process through the completion of the Potential Effects Identification Matrix from the Waterpower Class EA (Appendix B). The matrix is useful in determining the data gathering and analysis program; it was circulated to the regulators at the beginning of the environmental assessment planning process.

In examining the potential effects of this project, the EA team considered all stages of the project including construction, operation/maintenance and decommissioning and their potential impacts within the determined project area of impact and Zone of Influence.

1.4.4 Identify Required Mitigation, Monitoring or Additional Investigations

Based on their areas of expertise, 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 information collected through the public consultation initiative, and Aboriginal engagement efforts. The residual effects, those that cannot be prevented, avoided or mitigated, are 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.

Recommendations for environmental monitoring, where on-going data collection will be required to monitor possible short-term or long-term effects (i.e. those that would be experienced during construction and those that may be experienced subsequent to commissioning) are included within this document. Environmental monitoring during both

construction and operation will be subject to regulatory approval at the permitting stage in advance of construction.

The proponent has offered formal commitments related to the undertaking which may be required in advance of permitting, including additional data collection. A list of commitments proposed by Xeneca in support of the waterpower development is presented in Section 12, and throughout the main document and annexes.

1.4.5 Agency and Public Consultation and Aboriginal Communities Engagement

The consultation and engagement initiatives were designed to co-ordinate all applicable requirements for the regulatory, public and Aboriginal community notification, engagement and consultation. The results of these initiatives are presented within this document. The regulatory agencies, First Nations, other Aboriginal groups, municipalities/townships, public interest groups, and additional stakeholders that may have an interest in the proposed undertaking that were identified during the EA planning process for the project include:

Canadian Environmental Assessment Agency (CEA Agency)
Aboriginal Affairs and Northern Development Canada (AANDC) (*formerly Indian and Northern Affairs Canada*)
Fisheries and Oceans Canada (DFO)
Transport Canada (TC)
Environment Canada (EC)

Natural Resources Canada (NRCan)
Health Canada (HC)

Ontario Ministry of Aboriginal Affairs (MAA)
Ontario Ministry of the Environment (MOE)
Ontario Ministry of Energy (ME)
Ontario Ministry of Municipal Affairs and Housing
Ontario Ministry of Natural Resources (MNR)
Ontario Ministry of Northern Development and Mines (MNDM)
Ontario Ministry of Tourism, Culture and Sport (MTCS)
Ontario Ministry of Transportation

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

Algonquin First Nation through the Algonquins of Ontario (AOO) Consultation Office
Algonquins of Pikwàkanagàn (through AOO)
Algonquin Anishinabeg Nation Tribal Council
Métis Nation of Ontario (MNO)

Petawawa Stakeholder Advisory Committee (PSAC)
Ontario Waterpower Association (OWA)
Ontario Rivers Alliance
Black Bay Ratepayers Association
Pembroke Outdoor Sportsman's Club (POSC)
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

A summary of the key consultation activities is provided below:

- A Notice of Commencement (NOC) and two subsequent revisions to the NOC were issued by Xeneca and advertised in local media. The first NOC was issued on July 13, 2010. The NOC was revised and re-issued on November 13, 2010, and again on December 24, 2010.
- A Project Description for the hydroelectric generating station was issued in November 2010 to provincial ministries, municipal stakeholders, the Ontario Waterpower Association and circulated federally through the Federal Environmental Assessment Coordinator (FEAC). An EA coordination planning meeting was held on January 18, 2011 and was attended by federal and provincial regulators, in addition to representatives from the town of Petawawa and the County of Renfrew. A record of Agency consultation is provided in Appendix C, a summary of the regulatory consultation is presented in Section 6.3.
- A Public Information Meeting (PIM) was held in Petawawa on May 5, 2011 to provide the public with more information on two main stakeholder issues: Safety and Recreation.

- Two Public Information Centres (PIC) were held in Petawawa on May 31, 2011, and August 22, 2012. Public consultation events held in support of this undertaking are detailed in Section 6.4; a public consultation log is presented in Appendix D.
- The Project Description was distributed in December 2010 to the AOO. A record of Aboriginal engagement and consultation in support of this undertaking is provided in Section 6.5; an Aboriginal consultation log is presented in Appendix E.
- Meetings were held with members of the whitewater paddling community in order to discuss a water sharing plan, the major focus of which was the provision of flows into the bypass reach to accommodate recreational use in the river. Details of these discussions are summarized in Section 6.4 of this report.
- Project newsletters were delivered by post to a mailing list of approximately 5,000 businesses and residences that were identified by Canada Post as having a Petawawa postal code.
- Advertisements, mandatory notifications, project newsletters and correspondences for the Big Eddy GS project are discussed further in this report and copies are provided in their respective appendices.

The proponent has categorized the proposed undertaking as a new project on a managed waterway under the Class EA for Waterpower Projects. While there is no formal requirement for an inspection of the Draft ER in the Class EA, this document is being circulated to key agencies in order to facilitate an efficient regulatory review of the final document. This Draft ER is being distributed to:

Ontario Ministry of Natural Resources
Ontario Ministry of the Environment
Department of Fisheries and Oceans
Ministry of Northern Development and Mines (MNDM)
Algonquins of Ontario
Transport Canada
Canadian Forces Base Petawawa

- Subsequent to the receipt of review comments of this document, the proponent and EA team will work to address the comments in the preparation of the Final ER.
- The Final ER will be provided to regulatory agencies, First Nations, Aboriginal groups and made available for electronic review to local stakeholders that were identified during the EA planning process. Hard copies of the Final ER will also be placed in local municipal libraries and municipal government offices for a formal sixty (60) day review.

- A Notice of Completion will be issued for publication in local media, emailed to stakeholders and posted on the Xeneca website.
- Formal review of the ER and submission of reviewer comments (both regulatory and public) identifying outstanding issues and any requests to meet with Xeneca.
- Xeneca and stakeholders will 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 Class EA for Waterpower Projects.
- Once the proponent has met the requirements of the Waterpower Class EA and has resolved any outstanding issues raised during the formal 60-day review period, and satisfactorily addressed any Part II Order requirements (if filed), the proponent may file a Statement of Completion.

2. EXISTING CONDITIONS

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

2.1 LOCATION AND LAND OWNERSHIP IN PROJECT AREA

The proposed Big Eddy GS is located on the Petawawa River at the feature known locally as Railroad Rapids, in the Town of Petawawa. A site location map is provided in Figure 1.

The north bank of the Petawawa River, both upstream and downstream of the site, is owned by the Department of National Defence (DND), as part of Canadian Forces Base (CFB) Petawawa. The south shore of the river is comprised of privately owned lands, including a privately operated quarry. Many of the private parcels are fronted by a municipal road allowance to the Town of Petawawa. The river bed at the project site is provincial Crown land.

The north bank of the Petawawa River in the vicinity of the proposed weir, upstream and downstream of the site, is owned by the Federal Government (CFB Petawawa). The south shore bank of the river is patent land (privately owned). The Town of Petawawa owns the municipal shore road allowance fronting many of the privately owned parcels of land. The bed of the Petawawa River in the vicinity of Big Eddy is Provincial Crown Land.

2.2 EXISTING INFRASTRUCTURE

The area downriver of the proposed weir includes private and municipal property within the Town of Petawawa and a narrow strip of federally-owned DND property on the north shore. Access to the river for small watercraft is provided via a trail at the end of Albert Street. Privately-owned residential property is located along the southern shoreline of the Petawawa River downstream of the proposed weir. The Millennium Trail, a paved 1.2-kilometre multi-use trail along the Petawawa River, is Phase One of the Emerald Necklace Trail system, and is located along the southern shoreline of the river with direct views to the project area. The Millennium Trail is accessed from the east by Summit Trail, a dead-end street. The Millennium Trail ends at Centennial Park to the west. Centennial Park is a public recreational space that includes a swimming area, playground and picnic areas.

The swimming area known locally as “The Catwalk” is located approximately 500 m downstream of the proposed Big Eddy project site, in Centennial Park. Along the south shore of the river, adjacent to The Catwalk, a long concrete wall has been erected along the south shore of the river, allowing flows from the river to enter the swimming area. A large section of rapids flows through a narrow sluiceway in the bedrock just upstream of the swimming area. Petawawa Boulevard is a high-traffic street located on the south side of the river and provides access to commercial and residential properties.

The northern shoreline of the river is federally owned and there are several roads within this area that provide access to DND structures. One road runs adjacent to the Petawawa River shoreline for approximately 1 km and is utilized as a public walking and biking trail. A hydroelectric line runs along the northern border of the federal lands on the north side of the river, providing power to privately owned residential properties to the north. Paquette Road (County Road 55) runs east-west along the northern shoreline of the Petawawa River.

Twin Rivers Golf Course is located on the northern side of the river where it meets the Ottawa River, downstream of the project area. The Trillium Trail, a part of the Emerald Necklace trail system, runs north/south through the proposed weir location. It is a motorized and non-motorized public trail and is part of the Ontario Federation of Snowmobile Clubs Trail System. The Trail begins at Paquette Road and provides access to a large network of trails upstream of the project site.

The Highway 17 bridge and a Canadian Pacific (CP) Railway Bridge cross the Petawawa River approximately 2.8 km upstream and 250 m downstream of the proposed weir of the Big Eddy GS, respectively. On the south side of the river in the proposed inundation area, a private aggregate operation known as H&H Construction exists. Aggregate operations are underway along the southern and western portions of this property.

There are two bridges within the project site that cross the Petawawa River downstream of the proposed weir location; one is part of the 'TOP A' snowmobile trail (Trillium Trail discussed previously), and crosses the river 160 metres downstream of the proposed weir. The other is a CP Railway crossing and crosses the river 140 metres downstream of the proposed weir. Approximately 2 km upstream of the proposed weir, a natural gas pipeline owned by Trans Canada Pipelines crosses the Petawawa River.

Within Algonquin Park, approximately 30 km upstream of the project site, there are a number of MNR-owned dams.

The Petawawa River enters the Ottawa River downstream of the OPG operated Des Joachims GS and upstream of the OPG operated Cheneaux GS on the Ottawa River.

2.3 TOPOGRAPHY

The Petawawa River flows through a bedrock-controlled valley with steep bedrock walls in places.

2.4 CLIMATE

For the Town of Petawawa, mean daily temperatures range from a high of 19.1°C in July to a low of -12.9°C in January (Environment Canada, 2013). Mean maximum daily temperatures

reach a peak in July of 26.3°C, with 38.9°C being the highest daily temperature on record (August 1, 1975). The lowest mean minimum daily temperatures are reached in January (-19.1°C) with -41.1°C (January 24, 1976) being the coldest day on record. Annual precipitation averages 816.2 mm with rainfall accounting for 615.9 mm of that total. On average, August is the wettest month and February is the driest.

2.5 SOILS

Soil composition on the Petawawa River shoreline in the inundation area is predominantly sandy-loam with a high stoniness class.

2.6 GEOLOGY

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 project site is 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 site is largely comprised of remnants of the St. Peters Series. 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).

2.7 HYDROGEOLOGY

A review of MOE's electronic well records database revealed there are a number of wells within a 1-km buffer surrounding the ZOI and area of impact of the proposed development. A cluster of five wells is located 500 m to the south east of the facility and another, more dispersed, cluster of ten wells is located upstream of the H&H Construction quarry on the southern side of the river. For the wells in these clusters with recorded data, ground water was generally encountered either at depths of approximately 25 m or 45 m from the surface which relate to approximate elevations of 114 meters above sea level (masl) or 94 masl respectively.

2.8 RIVER HYDROLOGY

The Petawawa River extends approximately 187 km in length, from its origin at Ralph Bice Lake in northern Algonquin Park, to its confluence with the Ottawa River at the Town of Petawawa. The river has a total watershed area of approximately 4,200 km^2. Some of the Petawawa River's

tributaries include the Barron River, Crow River, Little Madawaska River, Nipissing River and North River.

In the Project Description for the proposed undertaking, issued in November 2010, the project was categorized as a 'new project on an unmanaged waterway'. This categorization was debated during the EA coordination meeting on April 11, 2011, and following a review of the Waterpower Class EA and the structures present on the Petawawa River along its length, the proponent proceeded with categorization of the project as a 'new project on a managed waterway' (see 'Designation of Managed Waterway for the Purpose of the Ontario Waterpower Class Environmental Assessment' in Appendix A).

2.8.1 Water Levels, Flow and Movement

Flow values for the Petawawa River at Big Eddy were prorated using drainage basin area, from Water Survey of Canada (WSC) gauge 02KB001 (Petawawa River near Petawawa). Hydrographs and flow duration curves have been developed for this site and are provided in the Hydrology Review document in Annex I.

Due to the presence of dams on several lakes and tributaries of the Petawawa River watershed, the Petawawa River at the location of the WSC gauge 02KB001 is classified as being regulated. The main purpose of the dams in this watershed is believed to be for recreation (see the Hydrology Review, Annex I).

2.8.2 Surface Water Quality

2010 Studies

A preliminary surface water quality investigation was undertaken in 2010 to establish ambient (baseline) characteristics of the waterway. Two sampling events (spring and summer) were conducted in 2010 at three different locations. During the sampling events, general observation and characteristics of each sampling location was assessed and recorded (i.e. water level, current, colour and odour). The results were compared to the Provincial Water Quality Objectives (PWQO). The PWQO were established by the MOE in 1994, the MOE has jurisdiction of all surface and ground waters in Ontario under the *Ontario Water Resources Act*.

The spring sampling event was undertaken on May 31, 2010; the summer event was completed on August 16th, 2010. All parameter concentrations that have an associated PWQO value were analyzed to be within the acceptable range. A copy of 2010 preliminary surface water investigation is provided in Annex IV.

2012 Studies

A detailed investigation into surface water quality on the Petawawa River was developed subsequent to the release of the MOE's draft guidance document titled "From Class EA to Permit to Take Water: A Guide to Understanding the Ministry of the Environment's (MOE) Technical Requirements for Waterpower," (MOE, 2012) and subsequent discussions between the proponent and the Ministry of the Environment.

Results of the water quality sampling program revealed that the Petawawa River in the project area has very good water quality, indicative of a northern Precambrian Shield River. Substrate is bedrock, sand, gravel, cobble, or stone/boulder dependent on location. The pH of the water generally ranges from neutral to slightly acidic. The water is poorly buffered, and has low suspended solids, dissolved organic carbon, metals and nutrient concentrations. All parameters except pH were below the PWQO. Turbidity is low, dissolved oxygen is high, and depth and flow velocity is variable.

Water quality in the river is linked to seasonal flows, with increasing suspended sediments and adsorbed metals being detected during high spring and fall flows. Detailed methodology and results of the 2012 studies are provided in Annex IV, Surface Water Quality, in the Hutchinson Environmental Sciences May 2013 Report.

A detailed methodology for the surface water quality investigation and the fish tissue sampling program is provided in the Surface Water Quality and Fish Sampling Guidance Report prepared by Hutchinson Environmental Sciences Ltd. in Annex IV.

2.8.3 Thermal Regime

The Petawawa River in the vicinity of the proposed project is currently a coolwater riverine system that supports a wide variety of species.

2.9 ECOLOGY

The EA team analyzed the existing ecological conditions at the project sites based on the Site Information Package (SIP) received from the MNR and field investigations conducted by the EA Team.

During the 2011 field season, the project team's understanding of the Big Eddy–Railroad Rapids zone of influence placed the project inundation extent approximately 1.9 km upriver of the proposed weir location. Surveys performed during the 2011 season reflected this concept, and terrestrial and habitat characterization extended to this point. Updated project designs released in the autumn of 2011 indicate that the proposed inundation limit had been extended by approximately 800 m. This extended inundation area was assessed during the 2012 field season,

thus completing the habitat assessment for the project area as it is currently proposed. Terrestrial habitat assessments in the extended inundation area were restricted to the lands north of the Petawawa River as the lands directly south are privately owned.

2.9.1 Terrestrial Habitat and Species

Riparian habitats alongside the Petawawa River at the project site are dominated by large stones, boulders and exposed bedrock. A mature mixed wood forest extends both upstream and downstream of the proposed site. Riparian vegetation is limited due to the shoreline substrate types which restrict rooting zones for vegetation. Directly upstream and downstream of the proposed project site, gravel substrates have been deposited in small areas along the shoreline by historically high flow velocities. These substrates have created pockets of early successional, immature mixed wood and dense shrub habitats.

The forest types surrounding the project site are fairly uniform in nature and are dominated by deciduous species such as bur oak, black ash, trembling aspen, white birch, yellow birch, silver maple, red maple, black cherry and white elm, with an overstory of conifers including white pine, red pine and balsam fir.

Lands north of the river contain an active aggregate pit which extends to within 30 m of the river at its nearest point, with the nearest pit face situated approximately 50 m from the river. South of the pit, the terrain contains a mixed wood forest stand dominated by conifers, which slopes steeply toward the river. Soils in the area are composed of sandy loam with a high stoniness content.

There are no significant vegetation communities present in the vicinity of the proposed Big Eddy project site located at the Railroad Rapids in the Petawawa River. A black ash swale appears to collect water from the Petawawa River during periods of high water, and runs north from the river for approximately 70 m. At its northern extent, the swale attaches to a series of interconnected intermittent channels and pools that span over an area of approximately 0.4 ha within the lowland hardwood forest.

<u>Birds</u>

In 2010 targeted bird surveys were not undertaken, though passive call monitoring was conducted and incidental sightings were recorded. A list of potential and confirmed species can be found in Appendix D of the 2011 Big Eddy Environmental Baseline Report in Annex III.

A list of bird Species at Risk (SAR) with potential occurrences in the project zone of influence initially included Rusty blackbird (*Euphagus carolinus*), Golden-winged warbler (*Vermivora chrysoptera*), Peregrine Falcon (*Falco peregrinus*), Bald Eagle (*Haliaetus leucocephalus*), Golden Eagle (*Aquila chrysaetos*), Whip-poor-will (*Caprimulgus vociferous*), and Common Nighthawk

(*Chordeiles minor*). During ORMG surveys in 2006-2008, numerous provincially and federally listed SAR were identified within the CFB Petawawa Training Range. These identifications included sightings of Golden-winged warblers and Bald eagles.

For Whip-poor-will and Common nighthawk, no targeted surveys were performed (in 2010) and no whip-poor-wills or common nighthawks were detected. Golden-winged warblers were detected in an ORMG 2007 study of CFB Petawawa lands, however no golden-winged warblers were detected during targeted surveys of the proposed Big Eddy-Railroad rapids site. Intensive surveys were conducted for Peregrine falcon, however no birds were sighted and no suitable habitats were identified along the Petawawa River. Intensive searches for Golden eagles were conducted, however no Golden eagles were detected during 2010 surveys. Intensive searches for Bald eagles were conducted. Although Bald eagles were detected incidentally in a 2007 survey of the CFB Petawawa lands, intensive surveys in 2010 did not result in any sightings.

In 2011, additional bird species were added to the list of species that could potentially occur within the project area. These additional species included Olive-sided Flycatcher, Barn swallow, Bobolink, Canada warbler, Chimney swift and Eastern meadowlark. Field surveys conducted in 2011 resulted in no occurrences for any of the species proposed to be present within the study area.

Incidental bird sightings during 2011 field surveys included detection of the following species within the project area; American crow, American goldfinches, American robin, Black-and-white warbler, Black-capped chickadee, Black-throated Green Warbler, Blue Jays, Broad-winged hawks, Canada Geese, Chestnut-sided warbler, Common grackle, Common Ravens, European Starling, Mourning Warbler, Ovenbird, Pileated woodpecker, Pine warbler, Red-eyed vireo, Red-winged Blackbird, Ring-billed Gull, Song Sparrow, Swamp Sparrow, Veery, Yellow warbler and Yellow-bellied Sapsucker. Additional incidental bird sightings in 2012 included Belted Kingfisher, Black Duck, Black and White Warbler, Brown Creeper, Cedar waxwing, Common goldeneye, Common merganser, Double-crested cormorant, Hermit thrush, Killdeer, Least Flycatcher, Magnolia warbler, Mallard, Northern Flicker, Pine warbler, Red-breasted Nuthatch, Ring-Billed Gull, Sharp-Shinned Hawk, Song Sparrow, Spotted Sandpiper, White-throated Sparrow, Wood Duck, Yellow Warbler, and Yellow-Rumped Warbler.

In October of 2012, a flock of American Woodcocks were detected on the northern shoreline of the Petawawa River, within the inundation area. American Woodcocks are a migratory shorebird, and as such receive mandated protection for individuals and nests under the *Migratory Birds Convention Act* (1994). This species, although not currently listed as a SAR, has experienced population declines across much of its range, and will likely be considered for regulated status in the near future. Because of the timing of the sightings, it was concluded that the American Woodcock were in the midst of their seasonal migration and were utilizing the river site as their staging area. It is unlikely that this site represents a significant breeding or feeding area for this

species. Since American Woodcock do not display site fidelity when migrating, and because additional adjacent habitat is potentially suitable for American Woodcock staging, no further study was recommended for this species.

Turtles

A list of potential and confirmed species can be found in Appendix D of the 2011 Big Eddy Environmental Baseline Report in Annex III.

Previous reptile studies of the CFB Petawawa lands led by ORMG in 2006 had resulted in sightings of Eastern musk turtles (July-August of 2006), Blanding's turtles (May and June 2006), and Northern Map turtles (June 2006). Wood turtles and spiny softshell turtles were not detected. Subsequent surveys were carried out for in the vicinity of the Big Eddy-Railroad Rapids project site in 2010 and 2011. As a result, Blanding's turtles and Northern Map turtles were detected in 2010 surveys. Eastern musk turtles, wood turtles, Blanding's turtles and spiny softshell turtles were not detected during 2011 field surveys, however Snapping turtle and Northern Map Turtles were detected. Blanding's turtles are designated as threatened, both provincially and federally/nationally. Northern Map turtles are designated provincially as of special concern, and nationally/federally, of special concern.

During the 2012 field season, a targeted search was performed for turtles along the shorelines of the Petawawa River in early June. This survey occurred during the peak nesting season, when turtles are most visible in their terrestrial habitats. Surveyors were vigilant for basking turtles within the study area during the course of all other surveys, and all evidence of turtle presence was recorded. A Northern Map turtle was observed nesting on a dead-end street on the south side of the Petawawa River, about 3 km downstream of the proposed weir location. Five turtles were observed basking at Petawawa Point, approximately 4 km downstream of the proposed project location, at the junction of the Petawawa and Ottawa Rivers. Four of these turtles were Midland Painted turtles, and one was a Northern Map turtle.

Snakes

A list of potential and confirmed species can be found in Appendix D of the 2011 Big Eddy Environmental Baseline Report in Annex III.

Snake SAR with potential to be present in the study area initially included milksnake and eastern hog-nosed snake. Previous studies of the CFB Petawawa site in 2007 identified the presence of 6 milksnakes (detected between June and August of 2007). Subsequent study in 2010 of the proposed project site did not result in any sightings of either species. Since there is potential for habitat, it was recommended that routine habitat checks should be performed during future field surveys.

In 2011, reptile surveys were conducted; however milksnakes and eastern hog-nosed snakes were not detected. Milksnakes have very generalized habitat requirements, and are unlikely to be impacted by the proposed Big Eddy-Railroad Rapids project, therefore only routine habitat checks for reptiles and amphibians are required which will allow for continued assessment of the presence of this species during future field seasons. Suitable habitat for eastern hog-nosed snakes only exists downstream of the study area, therefore only routine habitat checks are required for this species.

Terrestrial Invertebrates

A list of potential and confirmed species can be found in Appendix D of the 2011 Big Eddy Environmental Baseline Report in Annex III.

Several Odonate Species of Conservation Concern occur throughout the Petawawa River and have the potential to occur in the Big Eddy project zone of influence. These include the Beaverpond Clubtail (*Gomphus borealis*), Uhler's sundragon (*Helocordulia uhleri*), Cyrano darner (*Nasiaeschna michaeli*), Ski-tailed emerald (*Somatochlora elongate*), Extra-striped snaketail (*Ophiogomphus mainensis*), Maine Snaketail (*Ophiogomphus mainensis*), Arrow Clubtail (*Stylurus spiniceps*), Canada Whiteface (*Leucorrhinia patricia*) and Amber-winged spreadwing (*Lestes eurinus*). Other invertebrates identified are documented in the Mitigation and Recommendations Report, May 2013, which is located in Annex III.

During the 2010 field season, no targeted field surveys were conducted to determine the presence of invertebrate species. However, Monarch sp. were detected at the project site in both 2010 and 2011. It was recommended that incidental sightings continue to be recorded during future surveys.

Additional species observed within the project survey sites included Common Whitetail (*Plathemis Lydia*), *Enallagma* sp., Four-spotted Skimmer (*Libellula quadrimaculata*), Eastern Forktail (Ishnura verticalis), Lake Darner (*Aeschna eremita*), Canada Darner (*Aeschna canadensis*), Stream Cruiser (*Didymops transversa*), Extra-striped Snaketail (*Omphiogomphus anomalus*), White-faced Meadowhawk (*Sympetrum obtrusum*), Cherry-faced Meadowhawk (*Sympetrum internum*), Autumn Meadowhawk (*Sympetrum vicinum*), and Chalk-Fronted Corporal (*Ladona Julia*). No species of conservation concern were identified at the proposed project site.

Mammals

Eastern wolves have been observed on CFB Petawawa lands and as road-kill along Highway 17, however they are unlikely to be impacted adversely by the project since they are mobile, terrestrial, and occupy large territories. Eastern wolves were not detected during 2011 field

surveys at the project site. Significant rendezvous and denning sites were not noted within the survey area.

The necessary habitat requirements exist in adjacent Algonquin Park for Eastern Cougars, and it is likely that they may inhabit the area. However the project would not likely have any significant impact on potential cougar populations due to their large territories and terrestrial nature. General presence/absence surveys were conducted to determine the presence of Eastern Cougar during the course of other field studies. However, Eastern Cougars were not detected during 2011 field surveys at the Big Eddy-Railroad Rapids project site.

Other mammals present at the project site include black bears, eastern chipmunks, eastern grey squirrels, red squirrels, striped skunk and white-tailed deer.

2.9.2 Aquatic Habitat and Species

Upstream of the proposed project site, the Petawawa River is more lacustrine and slower flowing. It supports more abundant and varied shoreline vegetation which grow on sandy and gravelly substrates. The general aquatic habitat of the Petawawa River at the proposed project site is a cool water oligotrophic habitat, with a moderate to strong current, and a stony and gravelly substrate with large areas of exposed bedrock. At the proposed Big Eddy dam location, the river is 40 to 50 m wide.

Upriver of the proposed dam location, the river is 50-70 m in width and runs straight northeast. Approximately 2.4 km upstream of the weir location, the channel widens to 92 m and is divided by a small wooded island. The main channel runs north of this island and is approximately 35 m wide. South of the island, an area of approximately 0.75 ha is seasonally inundated. Downriver of the island, a small peninsula populated by white pine is connected to the northern shoreline, and forms a small protected bay during periods of low water. The current is moderate to fast and is comprised of large boulders, in the upriver extent of the inundation area.

Four aquatic habitat cross sections were established in the project area, to better characterize the existing habitats. The first cross section, located approximately 150 m downriver of the project site, is characterized by bedrock and boulder substrates, with moderately sloped banks and an approximate width of 92 metres. The second cross section located 590 metres downstream of the project site is approximately 55 m wide and banks are moderately sloped. A shallow riffle habitat over stone substrate exists. At cross-section 3, 160 metres downriver, the river channel is 65 m wide to the high water mark and is comprised of stone. A vertical sand face 3 metres in height is located above the high water mark. Flow velocity is moderate to fast in this area. At the fourth cross-section, located approximately 185 m downstream of the proposed tailrace, the channel is approximately 48 m wide, with a steeply sloping north bank and moderate to fast

flows. A more complete overview of the aquatic habitat present is available in the 2012 Environmental Characteristics Report (ORMG, 2013) located in Annex 3.

The following list of fish species confirmed on the Petawawa River is compiled from biological reports authored by ORMG (2006; 2008; 2011; 2012), Jacques Whitford Environmental Ltd (1994), Genivar Consulting Group (2004), and Trent University Watershed Science Centre (2002). The Petawawa River and inline lakes are documented to support a cool/warm water fishery that includes:

- Blackchin Shiner (*Notropis heterodon*)
- Bluntnose Minnow (*Pimephales notatus*)
- Brown Bullhead (*Ameiurus nebulosus*)
- Channel Catfish (*Ictalurus punctatus*)
- Darter (*Etheostoma* spp.)
- Emerald Shiner (*Notropis atherinoides*)
- Fallfish (*Semotilus corporalis*)
- Greater Redhorse (*Moxostoma valenciennesi*)
- Iowa Darter (*Etheostoma exile*)
- Johnny Darter (*Etheostoma nigrum*)
- Lake Sturgeon (*Acipenser fulvescens*)
- Largemouth Bass (*Micropterus salmoides*)
- Logperch (*Percina caprodes*)
- Longnose Gar (*Lepisosteus osseus*)
- Mimic Shiner (*Notropis volucellus*)
- Muskellunge (*Esox masquinongy*)
- Northern Pike (*Esox lucius*)
- Pearl Dace (*Margariscus margarita*)
- Pumpkinseed (*Lepomis gibbosus*)
- River Redhorse (*Moxostoma carinatum*) (unconfirmed)
- Rock Bass (*Ambloplites rupestris*)
- Rosyface Shiner (*Notropis rubellus*)
- Shiner (*Notropis* sp.)

- Shorthead Redhorse (*Moxostoma macrolepidotum*)
- Silver Redhorse (*Moxostoma anisurum*)
- Smallmouth Bass (*Micropterus dolomieu*)
- Walleye (*Sander vitreus*)
- White Sucker (*Catostomus commersonii*)
- Yellow Perch (*Perca flavescens*)

Fish species that have been confirmed to be present through field investigations conducted in 2010, 2011 and 2012 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*)

The Petawawa River is also known to contain historical American Eel habitat and a migration route to other areas within Algonquin Park. Eel are still present in the Ottawa River in low numbers so potential still exists for them to be in the Petawawa River system and this likelihood will be increased as recovery measures are planned on the Ottawa River in the future. Lake Sturgeon and River Redhorse are known to occur within the Petawawa River. More information on these species can be found in Section 2.9.4.

A recreational muskellunge fishery exists upstream of the proposed project site in Algonquin Provincial Park. The presence of Walleye suggests that suitable spawning areas are present within the watercourse.

Other fish species are anticipated to exist in the system though are not considered to be present at the site. These species include 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.

Potential for rare fresh water mussels exists due to the proximity to the Ottawa River.

Frogs

A list of potential and confirmed species can be found in Appendix D of the 2011 Big Eddy Environmental Baseline Report in Annex III.

Amphibians detected during the 2011 field survey included Bullfrog (*Lithobates catesbeiana*), Green Frog (*Lithobates clamitans*), Mink Frog (*Lithobates septentrionalis*), and Northern Leopard Frog (*Lithobates pipeiens*). Although Western Chorus Frogs were identified as having the potential to be present in the study area, 2011 field surveys did not detect any individuals at the project site. A Black Ash swale adjacent to the proposed bypass reach does provide suitable habitat for this species, and this site could be impacted by weir development which could result in drying of the swale and a resulting loss of habitat for any Western Chorus Frogs present.

Suitable habitat for these species could potentially be affected by the proposed project, however it is unlikely this will impact upon the local population.

Aquatic Invertebrates

A list of potential and confirmed species can be found in Appendix D of the 2011 Big Eddy Environmental Baseline Report in Annex III.

A wide variety of invertebrates were identified in the vicinity of the project area during 2011 field surveys. No invertebrate Species of Conservation Concern were detected at the project site during 2011 field studies. Details on invertebrates collected can be found in the Big Eddy Draft 2011 Environmental Characterization Report (Annex III). Dragonflies, caddisflies, stoneflies, mosquitoes and black flies rely heavily on aquatic habitats for a portion of their life cycle, thus alteration to the natural habitats of the Petawawa River could potentially impact these species.

Molluscs

A list of potential and confirmed species can be found in Appendix D of the 2011 Big Eddy Environmental Baseline Report in Annex III.

Mollusc species found during 2011 field surveys included the Eastern Elliptio (*Elliptio complanata*), the Plain Pocketbook (*Lampsilis complanata*), the Black Sandshell (*Ligumia recta*),

the Eastern Lampmussel (*Lampsilis radiate*), and the Fatmucket (*Lampsilis siliquoidea*). The molluscs identified were collected from shoreline and shallow-water feeding beds but are not representative of species present in deeper portions of the river.

2.9.3 Valued Ecosystem Components

A valued ecosystem component (VEC) is an element of the environment that has scientific, economic, social or cultural significance. Key environmental components are based on their socioeconomic value rather than their conservation status. Within the study area, VECs have been determined to be limited to fish species and include Lake Sturgeon, American Eel, Walleye as well as, related fish passage and spawning beds. A summary discussion of the natural environment VECs is provided below.

Fish Passage

Fish passage in the Petawawa River, specifically at the Railroad Rapids was identified by the DFO (correspondence - October 5, 2010, Appendix C) as a valued ecosystem component that must be protected. Designs which incorporate useable fish passage options for Lake Sturgeon and American Eel will likely address passage for other species as well, including American Eel and Walleye.

Spawning Beds

No spawning of VEC fish species was noted in the zone of influence of the project as part of the biological field studies, anectodal research or literature reviews. However, a small gravel riffle exists at the base of Railroad Rapids that might be suitable for VEC spawning under certain flow conditions. This potential VEC spawning location should be considered in future monitoring and operation.

Lake Sturgeon

Lake Sturgeon is of historical and cultural significance. Population numbers have declined and the species is endangered. Maintaining a viable Lake Sturgeon population in the system is a VEC.

American Eel

American Eel is of historical and cultural significance. Population numbers have declined and the species is endangered. Eel were not found in the Petawawa River, but restoration initiatives are under way on a regional basis. Project design should make provision for future fish passage and eel protection in anticipation of successful restoration of eel to the Petawawa River in over time.

Walleye

Walleye populations in the Petawawa River are identified as a VEC as they are a targeted species for both recreational and subsistence fishing. The habitat characteristics favoured by Walleye are present throughout the study area. Sport fishing is a major recreational use of the Petawawa River, and draws tourists to the surrounding communities.

2.9.4 Species at Risk

During 2010, 2011, and 2012 field studies, observations of species designated as Endangered, Threatened, or of Special Concern under the federal *Species at Risk Act (SARA)* and the provincial *Endangered Species Act (ESA)* and their associated habitat were recorded. Mandated protection is afforded to species that are designated as Endangered or Threatened through the *ESA* or the *SARA.*

Table 1 lists all designated species that were identified as potentially being present in the project area through background review. Alongside each species, federal and provincial designations, the results of field surveys, other considerations (such as assumed presence or past confirmation), and habitat presence is recorded. Most of the species originally identified as being potentially present were not detected, although suitable habitat for some species exists in the project area.

Of the species lists in Table 1, Monarch butterfly, Snapping turtle and Northern Map turtle were detected during field studies. Additionally, previous studies in support of other projects have confirmed Lake Sturgeon and River Redhorse on the Petawawa River. Finally, American Eel is known to be present in the Ottawa River, and anecdotal evidence suggests presence upstream and downstream of the project site. Given the importance of Lake Sturgeon, River Redhorse, and American Eel are assumed to be present and have been considered in the development of the project.

Acoustic receiver surveys were initiated in 2011, when one unit was set in the weir zone. In 2012, two locations were selected and were set from May 4 to 7th. The acoustical receivers were equipped with automatic call recognition software capable of detecting target species, and were set in suitable habitats during prime calling hours. Target species included Canada Warbler (*Cardellina canadensis*), Whip-poor-will (*Antrostomus vociferus*), Olive-sided Flycatcher (*Contopus cooperi*), Golden-winged Warbler (*Vermivora chrysoptera*), Common Nighthawk (*Chordeiles minor*), and Rusty Blackbird (*Euphagus carolinus*). No species at risk were detected from any location.

On April 30th, 2012, Western Chorus Frog surveys were conducted in the temporary pond habitats in the vicinity of the swale, utilizing visual searches and passive call monitoring, however no Western Chorus Frogs were detected.

Although targeted surveys were not performed during 2011 field surveys, suitable habitat conditions for Flooded Jellyskin exist in a Black Ash swale located east of the proposed weir site. Targeted searches for flooded jellyskin were performed in October 2012, but no Flooded Jellyskin were detected in the study area.

Table 1: Species at Risk

	Potential SAR in the Project Area	Federal Designation	Provincial Designation	Project Field Surveys	Habitat Potential within ZOI
Birds	Rusty Blackbird (*Euphagus carolinus*)	Special Concern	Not Listed	Not detected	Suitable habitat present
	Golden-winged Warbler (*Vermivora chrysoptera*)	Threatened	Special Concern	Not detected	Suitable habitat present
	Bald Eagle (*Haliaeetus leucocephalus*)	Not Listed	Special Concern	Not detected	Suitable habitat present
	Golden Eagle (*Aquila chrysaetos*)	Not Listed	Endangered	Not detected	None
	Whip-poor-will (*Caprimulgus vociferus*)	Threatened	Threatened	Not detected	Suitable habitat present
	Common Nighthawk (*Chordeiles minor*)	Threatened	Special Concern	Not detected	Suitable habitat present
	Olive-sided Flycatcher *(Contopus cooperi)*	Threatened	Special Concern	Not detected	Suitable habitat present
	Barn Swallow (*Hirundo rustica*)	Not Listed	Threatened	Not detected	Suitable habitat present
	Canada Warbler (*Cardellina canadensis*)	Threatened	Special Concern	Not detected	Suitable habitat present
	Bobolink (*Dolichonyx oryzivorus*)	Not Listed	Threatened	Not detected	None
	Chimney Swift (Chaetura pelagica)	Threatened	Threatened	Not detected	None
	Eastern Meadowlark *(Sturnella magna)*	Not Listed	Threatened	Not detected	None
Fish	Lake Sturgeon (*Acipenser fulvescens*)	-	Threatened	Not detected	Suitable habitat present
	American Eel *(Anguilla rostrata)*	-	Endangered	Not detected	Suitable habitat present
	River Redhorse (*Moxostoma carinatum*)	Special Concern	Special Concern	Not detected	Suitable habitat present

Insects	Monarch Butterfly *(Danaus plexippus)*	Special Concern	Special Concern	Detected	None
	Northern Barrens Tiger Beetle *(Cicindela patruela)*	-	Endangered	Not detected.	Suitable habitat present
Mammals	Eastern Wolf (*Canis lupus lycaon*)	Special Concern	Special Concern	Not detected	Suitable habitat present
	Eastern Cougar *(Puma concolor)*	-	Endangered	Not detected.	Suitable habitat present
Reptiles	Eastern Musk Turtle (*Sternotherus odoratus*)	Threatened	Threatened	Not detected	Unsuitable habitat
	Wood Turtle (*Glyptemys insculpta*)	Threatened	Endangered	Detected	Unsuitable habitat
	Blanding's Turtle (*Emydoidea blandingii*)	Threatened	Threatened	Detected	Potentially suitable habitat present
	Snapping Turtle (*Chelydra serpentina*)	Special Concern	Special Concern	Detected	Suitable habitat present
	Northern Map Turtle (*Graptemys geographica*)	Special Concern	Special Concern	Detected	Suitable habitat present
	Spiny Softshell (*Apalone spinifera*)	Threatened	Threatened	Not detected	None
	Milksnake (*Lampropeltis triangulum*)	Special Concern	Special Concern	Not detected	Suitable habitat present
	Eastern Hog-nosed Snake *(Heterodon platyrhinos)*	Threatened	Threatened	Not detected	Suitable habitat present
	Western Chorus Frog (*Pseudacris triseriata*)	Threatened	-	Not detected	Suitable habitat present
Plants	Flooded Jellyskin (*Leptogium rivulare*)	Threatened	Threatened	Not detected	Suitable habitat present

Protected Species

Lake Sturgeon

Designated as a Threatened 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. Lake Sturgeon is also designated as Threatened by Council on the Status of Endangered Wildlife in Canada (COSEWIC). While no Lake Sturgeon (*Acipenser fulvescens*) were detected during 2011 field surveys at the project site, the species is previously confirmed within the Petawawa River system, both upstream and downstream of the project site. No anecdotal information about Lake Sturgeon spawning at the project site and in the bypass reach (Railroad Rapids) has been identified. A sandbar in proximity to the facility tailrace has been identified as potentially important habitat for young Lake Sturgeon.

American Eel

American Eel are designated as of Special Concern under the federal *Species at Risk Act* and by COSEWIC, and have a Provincial designation of Endangered. They are also considered to have a critical historic and cultural importance to First Nations (see Section 2.12.4). In August of 2011, eel surveys were conducted utilizing eel pots at six locations across the study area, however American Eel were not detected at this time. However, the Petawawa River does provide suitable habitat for American Eel, is connected to confirmed habitat in the Ottawa River and is known historically as sustaining an eel population. As such, American Eel are assumed to be present.

Blanding's Turtle

Suitable habitat for the Blanding's Turtle does exist within the zone of influence, and the species has been confirmed within the project area during field studies. Blanding's Turtles prefer murky, productive sites but can also be found in clear habitats. Individuals are known to travel long distances.

Wood Turtle

Wood Turtles are highly terrestrial, semi-aquatic turtles; suitable habitat for this species exists within the project area in the Weir Site and Inundation Areas. The species was confirmed during 2012 field studies.

Northern Barrens Tiger Beetle

The Northern Barrens Tiger Beetle, (*Cicindela patruela*) has a National designation of Endangered, a Federal Designation of No status, and a Provincial Designation of Endangered.

Although Northern Barrens Tiger Beetles were not detected during 2011 field surveys, suitable potential habitat for them was documented in a sandy pine area along the Trillium Trail (known as potential Habitat No. 2), and an area just north of the proposed weir site (Habitat No. 1) that contains a sandy trail running east-west through a Red Pine forest stand. Both of these habitats were assessed in 2012, when it was determined that Habitat No. 1 was unsuitable, and no Tiger Beetles were observed at Habitat No. 2.

Species of Special Concern

River Redhorse

River Redhorse are designated federally, provincially, and by COSEWIC as being of Special Concern. Gill net surveys were conducted in 2011 at the project site but did not detect any individuals. However, several Redhorse (*Moxostoma*) species have been confirmed within the Petawawa River previously. River Redhorse generally inhabit fast moving, clear-watered riverine systems and spawn in shallow, gravelly areas of streams and rivers.

Snapping Turtle

Snapping Turtles are designated as a species of Special Concern by federal and provincial legislation and COSEWIC. Although the species is still general common, low-recruitment breeding strategy and current knowledge suggest populations are already in decline. Individuals were detected in the project area during 2011 field studies.

Northern Map Turtle

Northern Map Turtles are designated as a species of Special Concern by federal and provincial legislation and COSEWIC. The species suffers primarily from habitat disturbance due to urbanization, shoreline development and high levels of human activity within waterways. The female population relies heavily on molluscs as a food source.

Monarch Butterfly

Monarch butterflies are currently affected by increased predation, increased weather incidences, and decreased breeding habitat. Breeding for this species only occurs when Milkweed plants are available as food for larvae. Monarchs have been confirmed in the project area, although there are no notable occurrences of Milkweed colonies.

2.9.5 Significant Wildlife Habitats

The MNR Site Description Package, provided in Appendix A, identifies one Provincially Significant Wetland (PSW) as being within the vicinity of the Big Eddy site: the Black Bay PSW is located more than 10 km upstream of the proposed facility.

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

The Petawawa Fish Hatchery, Petawawa Fish Hatchery Provincial Nature Reserve, Pembroke Crown Game Preserve and the Petawawa Terrace are also located within 10 km of the project site.

While located in the surrounding area, all of these features are considered outside the project's zone of influence.

2.10 CULTURAL HERITAGE

2.10.1 Archaeological Sites and Assessments

An Archaeological Assessment was conducted on the Provincial and Private lands at the immediate project site in accordance with Ministry of Culture, Tourism and Sport (MTCS) requirements.

No registered archaeological sites were identified in or near the project area during the Stage 1 Archaeological Assessment. A Stage 1 Archaeological Impact Assessment was completed for the proposed project by Woodland Heritage Services Limited (WHSL) to gain an understanding of the cultural heritage of the area. The Stage 1 assessment determined that the project location and the identified zone of inundation contained areas of high archaeological potential. The Stage 1 report recommended an intrusive Stage 2 investigation for those areas with archaeological potential within the overall study area. The Stage 1 Report is appended in Annex V.

The Stage 2 investigation was initiated to further explore the areas of high archaeological potential identified in the Stage 1 Report. These areas of high potential were subject to test pitting. No cultural resources were identified through the Stage 2 investigation, and no further archaeological study was recommended.

Note to Reviewer: Archaeological assessments for access roads will be conducted through the summer of 2013 and the results of these assessments will be incorporated an inform impact assessment for the final environmental report.

2.10.2 Buildings and Structures

There are no buildings or structures in the direct vicinity of the proposed weir site with the exception of the CP Rail Crossing and the pedestrian bridge.

2.11 CURRENT LAND AND WATER USE

2.11.1 Land Use/Land Policies

The project footprint and potential area of impact are located within the Town of Petawawa and will be built on federal, municipal and private lands. The north bank of the Petawawa River and portions of the water intake structure, weir and powerhouse will be located on federal lands owned by CFB Petawawa. The south shore on which the weir extends is owned by H&H Construction. Some upstream areas in which there may be minor water level changes has a mix of ownership between the municipality, and, where shoreline allowances have been purchased, there are privately owned parcels of land. The riverbed is under the jurisdiction of the Province of Ontario.

Agreements with private landowners, required for infrastructure and inundation requirements, are currently a work in progress. Terms of agreements between private land owners and Xeneca are not part of the public record, nor are they required for the EA Report. However, Xeneca recognizes that post EA requirements for Site Release will require evidence of landowner agreement.

Specifically the development area lies across the Crown land area designated for several overlaying land uses. The primary land use is known as the Multiple Natural Resource Use (G396), a 614181 hectare (ha) general use area in MNR's Pembroke district.

There are several existing uses in this area, including: recreational fishing, hiking, cycling, picnicking, whitewater kayaking, rafting, canoeing, snowmobiling, cross country skiing and swimming. Hunting would be generally prohibited in the project area as it falls within a municipal boundary in which firearms discharge would be prohibited. Safety considerations would also preclude other forms of hunting or trapping in the project area.

According to the MNR's Crown Land Use Policy Atlas Report (CLUPA) for this Crown land block, the land use objectives are to maintain a reasonably balanced multiple-use area. Standard management practices combined with the concept of sequential use will enable MNR to take full advantage of the potential of the natural resource, which includes hydroelectric generation.

Commercial activities allowed in the vicinity of Petawawa site include aggregate extraction (generally not permitted in shoreline areas), commercial fishing, bait fishing, commercial fur harvesting, commercial hydro development, timber harvesting, commercial tourism, mineral exploration and development peat extraction and wild rice harvesting. The Crown land can be disposed of for road development and maintenance (MNR, 2006).

Overlay land uses for the general area include Deer yards (G396/DY1), a 21614 ha area containing suitable conifer cover and sources of winter feed that have traditionally supported deer populations throughout the winter season; Conroy Marsh Crown Game Preserve

(G396/CGP5), a 27 ha reserve, and Nopiming Crown Game Reserve (G396/CGP7), a 245 ha reserve. All these areas are managed consistent with the policies for the Multiple Natural Resource General Use Area and no effects from the Big Eddy GS project are expected on these overlaying areas.

2.11.2 Access

Public access to the Petawawa River can be found upstream of the project site in Black Bay PSW. In addition, whitewater recreationalists access the river north of Highway 17 via Rantz Road, and via a trail off Albert Street. Access into Railroad Rapids from Portage Road in Petawawa is via Wilson Ave.

Paquette Road (County Road 55) runs east-west through the northern portion of the inundation area zone and runs within 60 m of the Petawawa River at the top of a meander above the proposed weir location.

Access on the north side of the road is through CFB Petawawa and is restricted. The presence of an artillery range with unexploded ordinances precludes river access. Access is gained through gated access points at Montgomery Road, Petawawa Boulevard and Paquette Road. South of Paquette Road on the north side of the river, the land is federally owned and primarily forested. Trails through the forest are accessed via a road that runs south of and parallel to Paquette Road from the Trillium Trail to Highway 17. This access road is gated to restrict vehicular traffic, but pedestrian access is permitted.

2.11.3 Recreation Use and Commercial Tourism

The Petawawa River, including the area of interest, is enjoyed and utilized by local residents and tourists for a number of general recreational uses. The river is especially popular among canoeing and kayaking enthusiasts for its white water rapids and spectacular views.

Presently, the Emerald Necklace Trail System, which was designed for recreational use and heritage exploration, forms one of the most used locations. It is a series of interpretive and multi-purpose trails introduced as Petawawa's Millennium Partnership Program. There are eight phases to the system that will eventually unite Petawawa – the Millennium trail, the Trillium Trail, the Terrace Trail, the Neighbourhood Paths, the Petawawa River whitewater canoe, kayak and rafting trail, The Ottawa River Waterway, the Soldier's Challenge and the Bike Trail (Municipality of Petawawa, 2013).

Similarly, Petawawa Point, located within the Town of Petawawa on the southeastern shore of the Petawawa River at its convergence with the Ottawa River, is also heavily utilized for various recreational activities. There is a boat dock at the western extent of the beach, and several water crafts (jet-skis, canoes, kayaks, and outboard motor boats) are a common sight in the Ottawa and Petawawa Rivers at this location (Municipality of Petawawa, 2013).

Additionally, the majority of the Petawawa River watershed is located within the Algonquin Provincial Park, the oldest and most popular provincial park in Canada. Algonquin Provincial Park is another popular location for recreationists.

During the August 2012 PIC, Xeneca conducted Petawawa river usage surveys. Based on information gathered through this process, a wide variety of recreational use was illustrated to occur in and around the Petawawa River near the project site. These uses include nature appreciation, picnicking, canoeing and kayaking, camping and training (Figure 3).

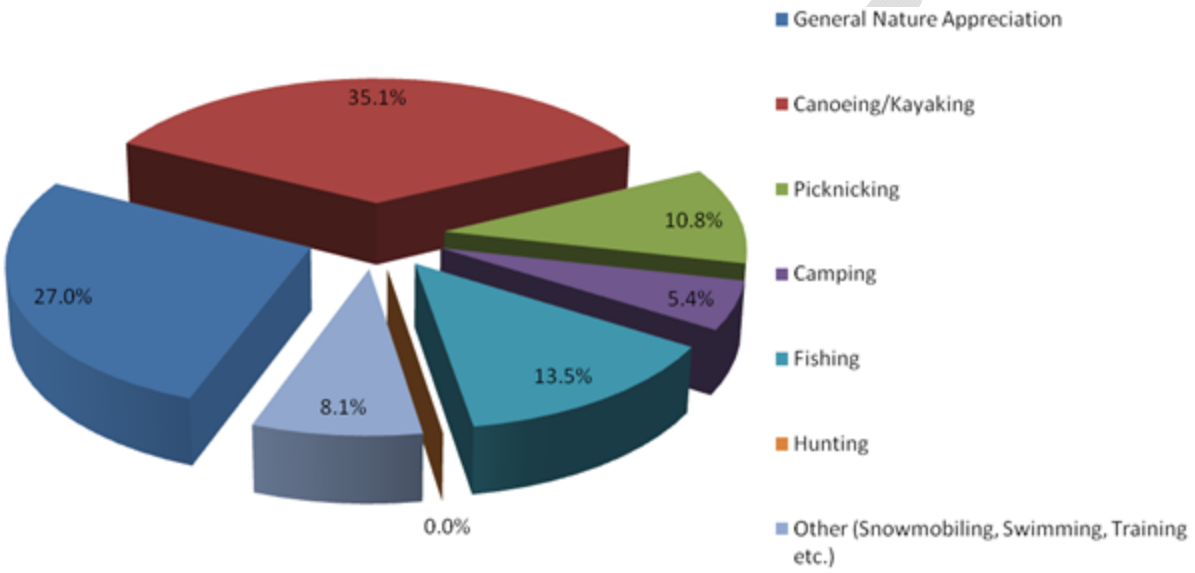


Figure 3: Petawawa River usage by recreational activity

Moreover, the Ottawa Valley Forest Management Plan (FMP) describes how the Forest provides easy access to Crown land for various recreational purposes (both commercial and non-commercial activities) such as bird watching, hiking, camping, fishing, hunting, snowmobiling, ATV touring, recreation camps, mountain biking, cross-country skiing and waterway based activities, such as canoeing, white-water rafting and kayaking (MNR, 2011).

According to information that was available from the Ottawa Valley Tourist Association report in 2006, tourism represents a huge economic benefit to the Ottawa Valley, bringing to the area an estimated $93 million annually. Of that 89% of the expenditures are spend in recreational uses as illustrated in Figure 4.

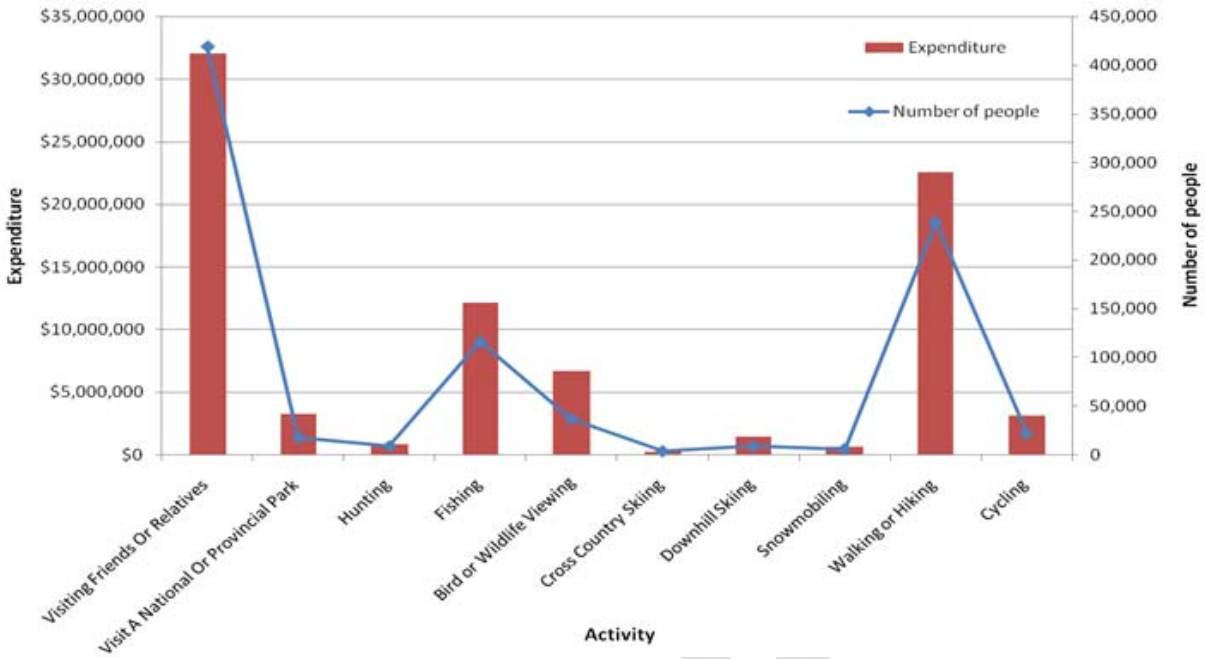


Figure 4: Outdoor recreation expenditure and usage for the Ottawa Valley Forest

Hiking/Swimming

Immediately east of Petawawa Boulevard, the Millennium Trail is a multi-use pathway that runs along the south side of the Petawawa River. It offers recreational uses for walkers, joggers, inline skaters, cyclists, cross-country skiers, and snowshoe enthusiasts. A parking lot is located along Petawawa Boulevard south of the bridge for trail users (Municipality of Petawawa, 2013).

A swimming area, Centennial Park waterfront, is located along the Petawawa River behind the municipal building. Other swimming areas are located on the Ottawa River at Petawawa Point (Municipality of Petawawa, 2013).

Although nature walking and hiking are significant in the Ottawa Valley Forest area as evident in Figure 4, the socioeconomic benefit is difficult to separate between Crown land, private land, and parks. Overall, there are no consistent or reliable methods for quantifying the economic value of these activities. For example, nature walking occurs everywhere and is often without any direct cost or fee (MNR, 2011).

Camping/Cottaging

There are no camping areas designated within the project area. However, based on stakeholder input, camping does occur downstream of the project location. A desktop search revealed two campgrounds, southwest of the project site, into the Town of Petawawa. The closest camp is one kilometre away and therefore not in the immediate vicinity of the Big Eddy GS project (Municipality of Petawawa, 2013).

Based on stakeholder input and a desktop search, there are no cottages in the project area. A residential trailer park downstream of the weir does not have access to the water and is therefore unaffected by the project.

Snowmobiling

The Trillium Trail, a part of the Emerald Necklace trail system, is a motorised and non-motorised public trail and is also a component of the Ontario Federation of Snowmobile Clubs (OFSC) trail system. Also known as the 'TOPS A' interprovincial snowmobile trail, it crosses the Petawawa River on a purpose-built snowmobile bridge, adjacent to the CP rail line in Petawawa. The trail runs parallel to the rail line from Doran Road to Paquette Road, then parallels Paquette Road to the Trans Canada Pipeline right-of-way (ROW) on CFB Petawawa property. The local snowmobile club, Keetna Snowmobile & Recreation has held land use in this area since 2003.

This trail corridor is the main east/west provincial link for OFSC members, forming the only point north of Algonquin Park which has this trail access. As part of the Round Algonquin Park (RAP) Tour, this trail links North Bay to Pembroke on the northern section of the Tour. The RAP is Ontario's premier ranked snowmobile tour and sees a significant amount of winter tourism use as well as a heavy concentration of local snowmobile traffic.

Canoeing/ Kayaking

As seen in Figure 3, the canoeing and kayaking category represents the largest percentage of recreational usage. Usage is further discussed in Section 2.11.4 (Navigation) below.

2.11.4 Navigation

The Petawawa River is considered a managed waterway according to the current definition provided by the Waterpower Class EA. However, there is currently no water management plan for the Petawawa River. The Ottawa River Regulation Planning Board was established to ensure integrated management of the principal reservoirs of the Ottawa River Basin. The goal of this integrated management is to provide protection against flooding and maintain the interests of the various users particularly in hydroelectric energy production (Ottawa River Regulation Planning Board).

The Petawawa River is considered a navigable waterway as defined under the *NWPA*. Local waterway users confirmed that the rapids can be navigated by canoes, kayaks, and rafts. There are presently no official portages bypassing the rapids. The area is heavily used by whitewater kayakers and canoeists for recreational activities and is also used by swimmers. Permanent residences are known to be located in proximity to the proposed project site on the south side of the river, within the Town of Petawawa.

Due to the history, scenic topography, and whitewater present in the area, the Petawawa River is attractive to tourists, especially to white water recreationalists who come to take advantage of the sequence of rapids.

The Petawawa River offers a series of challenging white-water sections with Class 3 and 4 spring-run rapids at various locations along the river. Railroad Rapids is one of the rapids located between Highway 17 upstream and the Ottawa River downstream in the stretch of river known as the "Town Section". It forms one of the most difficult sections of the rapids in the area, sought out by skilled white-water users.

The Petawawa River Rats Kayak Club is one of the volunteer organisations that use the river during the open water part of the year. Commercial white-water rafting companies like Esprit Rafting Adventures, Wilderness Tours, and Owl Rafting also operate in the area.

The Petawawa River recreational usage project was initiated by Xeneca to facilitate the negotiation process between the proponent and the local residents of Petawawa. Since 2011, motion sensing cameras were placed strategically on three locations (Railroad Rapids, Wilson Ave Launch Site, and the Highway 17 Bridge) to monitor the recreational activities throughout the year.

During a monitoring period that spanned April 2011 to November 2011, the cameras captured 868 individuals using the river for a variety of recreational activities on all three sites. The month of May 2011 noted the maximum amount of recreational activity, when a total of 748 individuals were photographed. Of the 748 individuals, the vast majority of the people were recorded on May 7th, 2011 for the annual Petawawa Hell or High Water race. Hell or High Water is one of Canada's leading annual paddle sports festivals which is organized by Petawawa residents and whitewater enthusiasts.

Whitewater kayaking and rafting were characterised as the most prominent recreational activities on the Petawawa River based on the results from the study, as Xeneca monitored a high volume of activity involving individuals with their kayaks or rafts on the river. The second most prominent activity was canoeing followed by hiking, fishing, and swimming. The most common form of canoeing on the Petawawa is recreational flatwater canoeing in the non-rapid sections; however, whitewater canoes do navigate the rapids within the project area.

A breakdown for individuals involved in all recreational activities on a monthly basis is tabulated below in Table 2.

Table 2: Breakdown of individuals involved in all forms of recreational activities in Petawawa River (monthly)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	7	748	0	17	66	26	1	3	0

Figures 5 and 6 illustrate the use of Petawawa River for kayaking and rafting purposes in 2011 following data collection. It could be noted that activity is highest during the spring and early summer (high flows) and little to none for the rest of the monitored time period.

A similar study conducted in 2012 showed similar results with recreational use peaking during high water periods in the spring and then declining throughout the summer (Figures 7 and 8).

Other key aspects of the recreational study with respect to kayaking and rafting were:

Time of Use

Recreational kayaking and rafting use appears to occur primarily during April and May with occasional usage in the summer and fall. No usage appears to occur from November 1 to April 1. Use occurs primarily on weekends from 11 AM to 3 PM (4 hours), and weekdays from 5 PM to 8 PM (3 hours). No night-time navigational use has been documented.

Useful Flows

Recreational use occurs primarily during the spring when flows are high. Use diminishes with receding flow rates. The majority of uses occur at 40 cubic metres per second (m^3/s) to 150 m^3/s.

Number of Uses

Some users appear to favour Railroad Rapids (the most challenging and steepest rapids on this section of river) while others avoid Railroad Rapids. Of the usage recorded at the three locations, recreational rafting and kayaking was observed 765 times in 2011 and 463 times in 2012 (average). The documented use occurred over 11 usage days in 2011 and 28 usage days in 2012.

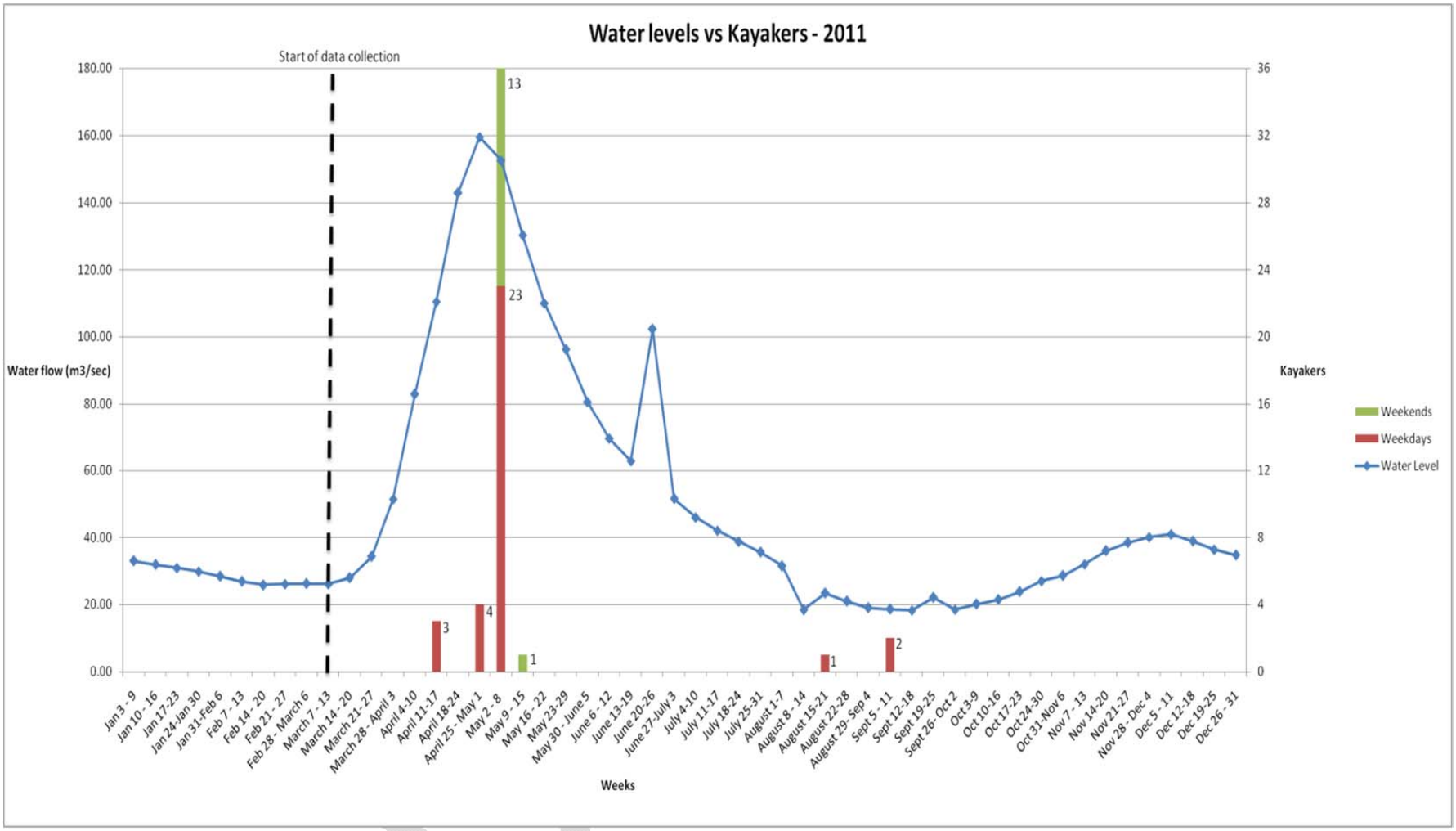


Figure 5: Kayak usage vs. flows on the Petawawa River, 2011

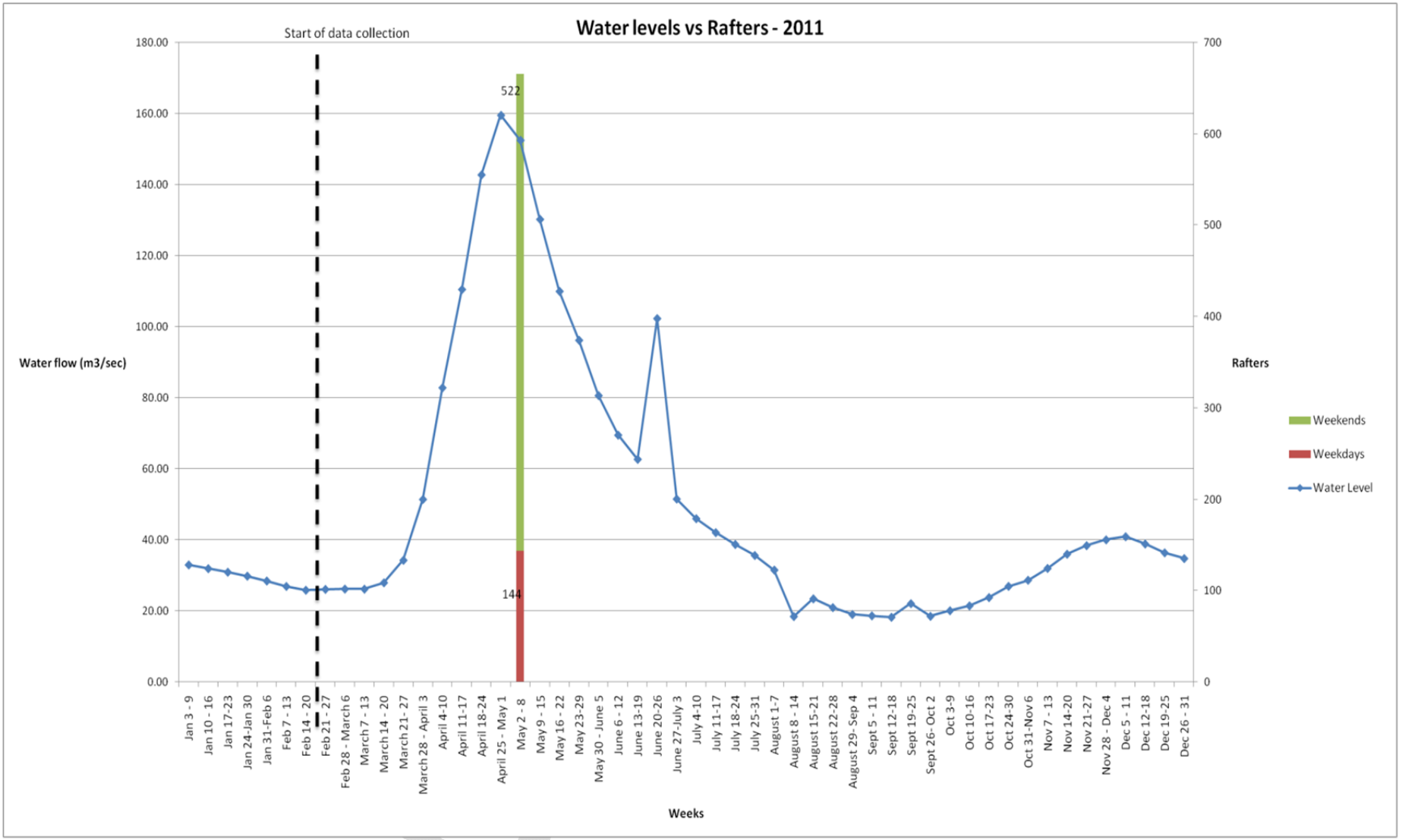


Figure 6: Raft usage vs. flows on the Petawawa River, 2011

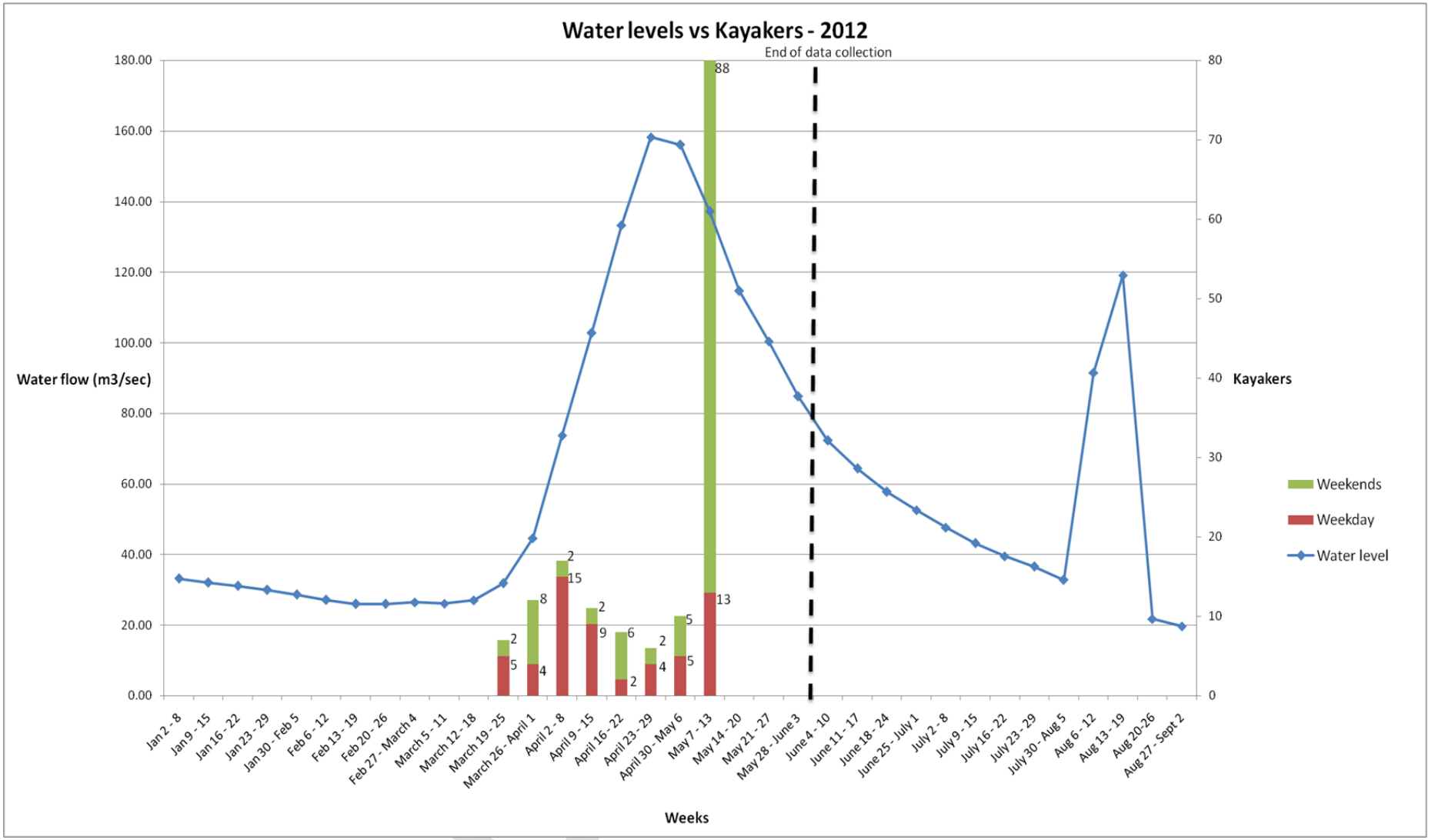


Figure 7: Kayak usage vs. flows on the Petawawa River, 2012

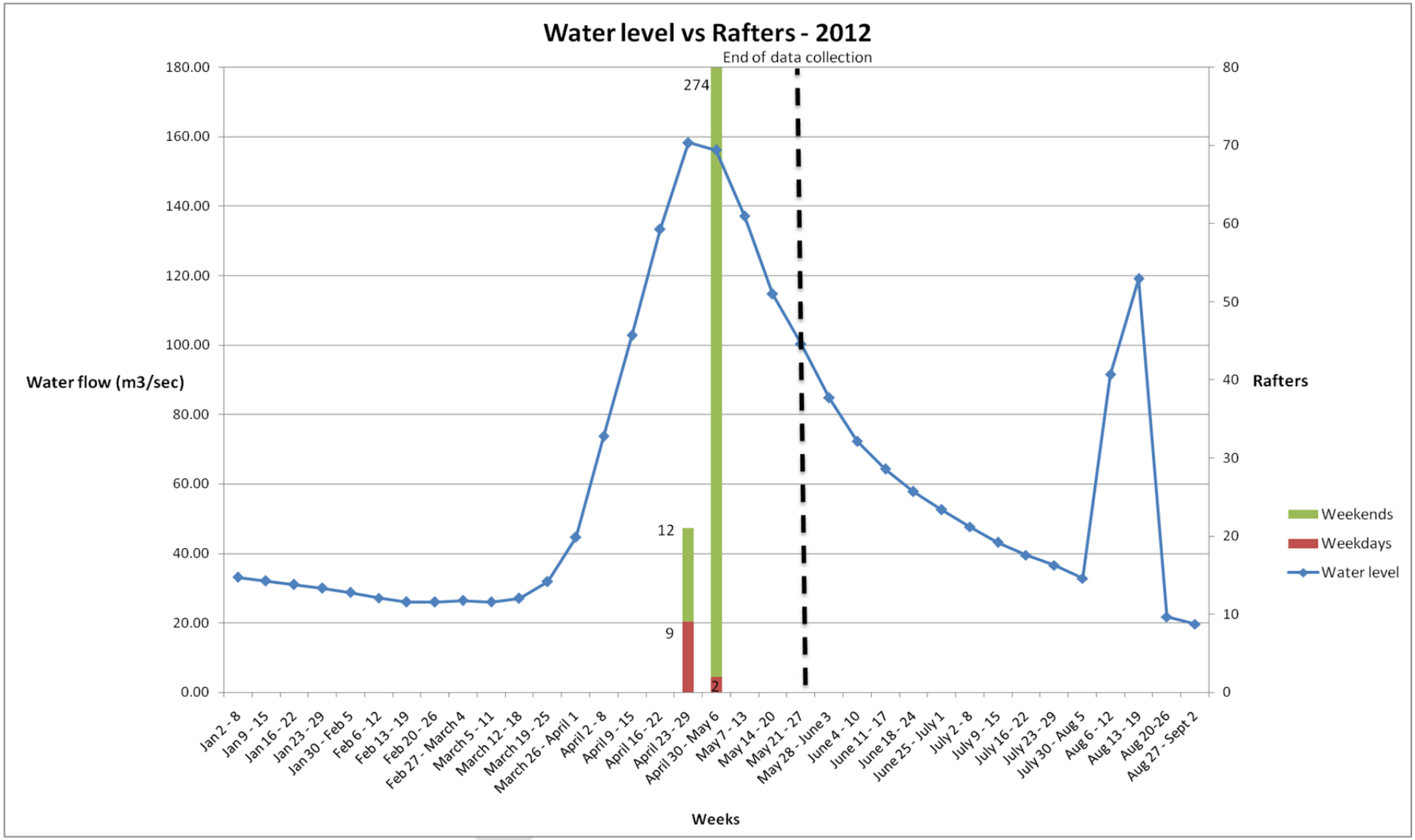


Figure 8: Raft usage vs. flows on the Petawawa River, 2012

2.11.5 Area Aesthetics

Nature appreciation and bird watching are increasingly popular activities throughout Ontario and are closely associated with the natural aesthetics of an area. As evident from the recreational usage surveys and FMP statistics, the general area associated with the Big Eddy GS project is extensively used by residents and visitors of the region for various recreational activities and nature appreciation. The Petawawa River has an aesthetic value with local residents and recreational users of the area who use it to enjoy the visual aspects of the river.

2.11.6 Forestry

The study area is situated within the Ottawa Valley Forest. Under the authority of the Sustainable Forest Licence issued by the MNR, Ottawa Valley Forest Inc. (OVFI) of Pembroke has assumed financial and functional responsibility for forest management planning and the implementation of forest management activities on the Ottawa Valley Forest.

2.11.7 Hunting

The Big Eddy site location is within the Wildlife Management Unit 48. There are no Bear Managements Areas within vicinity of the site as it is surrounded by private and federal land. Moreover, discharge of firearms is prohibited due to safety considerations as the project area falls within a municipal boundary. Thus no hunting exists in the vicinity of the site.

2.11.8 Fishing

The Petawawa River and inline lakes are documented to support a cool/warm water fishery that includes Walleye, Pike, Channel Catfish, Yellow Perch, Smallmouth Bass, Largemouth Bass, Lake Sturgeon, Muskellunge, Rock Bass, Pumpkinseed, White Sucker, Short Head Redhorse, River Redhorse, Brown Bullhead, Log Perch, Blacknose Shiner, Brassy Minnow, Longnose Dace, Fallfish, Central Mud Minnow, Iowa Darter, and Johnny Darter. The potential to support coldwater species exists in many reaches of the Petawawa River as Mottled Sculpin are present throughout and Brook Trout have been documented in the headwater areas in Algonquin Park and in other adjoining tributaries. The Petawawa River is also known to contain historical American Eel habitat and a migration route to other areas within Algonquin Park.

Fishing is a significant recreational activity in the area. The majority of anglers in the general area are local residents fishing both upstream and downstream of the project location. Pickerel (Walleye), Bass and Northern pike are the preferred sport species in the study area according to PIC surveys.

The MNR Site Description Package identifies the Black Bay PSW within the vicinity of the site; however, the wetland is not within the project area. Ice fishing occurs at the Black Bay PSW.

2.11.9 Trapping and Baitfish Harvesting

Trapping and baitfish harvesting are both identified activities within the project area. It does not appear that any trap / baitfish cabins are present within the project's zone of influence. All Crown land open for trapping in the province has a registered trap-line system to control trapping. Each trap-line represents a specific geographical area, in which the holder of the trap-line licence is allowed to conduct trapping activities. Each trap-line is issued a quota for the animals which can be trapped within the area. The quota is specific to each trap-line, being based on past harvest levels, or recent furbearer population surveys. Only one trapper is licensed to trap in each trap-line area. No trapper cabins have been identified in the study area.

There are three licensed MNR trap-lines in the study area (N001, N022, and N024).

The Big Eddy GS site is within the allocated Baitfish Harvest Area PE0123 (10) and adjacent to Harvest Areas PE0124 (6) and PE0125.

2.11.10 Protected Areas

The recommended Barron River Provincial Park is a non-operating waterway park, located 8 km upstream of the site. The majority of the Petawawa River Watershed is located within Algonquin Provincial Park. A popular canoe route passes through the Barron Canyon, and a hiking trail leads to the edge of the Barron Canyon (Wikipedia, 2013). The Barron River joins the Petawawa River at the Black Bay PSW. Beyond the Algonquin Park Boundary, the Barron River is bordered on the north by CFB Petawawa, and to the south by crown land that contains several hunt camps. The river and a strip of land to the south has been designated as a potential Waterway Provincial Park as part of Ontario's Living Legacy.

2.11.11 Mineral Resources

There is no existing mining tenure or claim in the vicinity of the site.

<u>Aggregate</u>

Several aggregate pits are in proximity of the two proposed generators on the Petawawa River, these include:

License #14599 – H&H Construction Inc.: Located 300m SW of the Big Eddy GS
License #16440 – H&H Construction Inc.: Located 2.1 km SW of Big Eddy GS
License #14716 – Bruce Hoffman: Located 3.9 km SW of Big Eddy GS
License #14854 – The Warren Paving and Materials Group: 4.5 km SW of Big Eddy GS
License #15498 – Smiths Construction Company: 4.5 km SW of Big Eddy GS

License #614101 – Black Bay Pit: 5.7 km SW of Big Eddy GS
License #624621 – Newman Pit: 6.3 km SW of Big Eddy GS
License #112145 – Larocque Brothers Pit: 3.7 km SW of Big Eddy GS
License #15505 - R.G.T. CLOUTHIER CONSTRUCTION LTD.: 2.8 km S of Big Eddy GS

As of 2009, the mining rights of the area in Petawawa Township (T-2422), in the Southern Ontario Mining Division, were withdrawn from prospecting, staking out, sale or lease in accordance with the terms of Order No. W-SO-09/09, under Section 35 of the *Mining Act*. The area was withdrawn from mining activities by the MNR for the purpose of the proposed site for the Big Eddy GS project. The site will be subject to long-term waterpower lease agreement via the Public Lands Act.

2.12 Aboriginal Land and Water Use

2.12.1 Reserves and Communities

The identification of Federal Aboriginal Communities for consultation was completed through written direction from TC, with assistance from the DFO, DND and AANDC, to further define communities which may have treaty rights, traditional territories or interests within the project areas by way of correspondence dated October 28, 2011. A copy of this letter can be found in Appendix E. These communities are described below:

- Algonquins of Ontario (AOO)
- MNO
- Algonquin Anishinabeg Nation Tribal Council
- Algonquins of Pikwakanagan

Additionally in November 2008 the MNR released the Site Description Package to Xeneca. This package contained information on Aboriginal Communities which required consultation as part of the Site Release process. These communities are described below:

Algonquins of Ontario

The AOO represent 10 different Algonquin Communities with traditional territories in the Ottawa River Watershed: The Algonquins of Pikwakanagan First Nation, Antoine, Bancroft, Bonnechere, Greater Golden Lake, Mattawa/North Bay, Ottawa, Shabot Obaadjiwan, Snimikobi, and Whitney and Area. A treaty with the AOO has never been formalized, and presently a Land Claim is in negotiation with the Crown as noted in Section 2.12.2 (AANDC, 2012).

Métis Nation of Ontario

The MNO provides a host of services to all Métis individuals in Métis Nation communities and Regions in Ontario.

Algonquin Anishinabeg Nation Tribal Council

The Algonquin Anishinabeg Nation Tribal Council is located in Quebec and represents the First Nations of Abitibiwinni, Eagle Village, Kitigan Zibi, Lac Simon, Long Point, Algonquin Kitcisakik First Nation, and Wahgoshig First Nation. They are responsible for providing assistance and services to their member communities. This community was identified as a federal consultation community, however was not identified provincially (Algonquin Anishinabeg Nation Tribal Council).

2.12.2 Land Claims

There is presently a Comprehensive Land Claim negotiation underway between the Canadian Federal Government and the AOO which represent 10 Algonquin Nations, including the Algonquins of Pikwakanagan. In 2009 a Framework Agreement was signed, which outlines a general process for negotiations. Additionally an agreement on consultation has been established which guides how consultation will occur with the community during the negotiation process.

In December 2012 a Preliminary Draft Comprehensive Land Claim Agreement in Principle was published which outlines the proposed details of the agreement.

2.12.3 Spiritual, Ceremonial, Cultural and Burial Grounds

There is one identified area of spiritual significance that may fall within the Project Area which was identified by an Algonquin Elder. At this time it is believed this area does not fall within an area of impact for the Project, however Xeneca is hopeful that further discussions can occur to obtain further knowledge on this area.

Presently no other areas of Spiritual, ceremonial or cultural significance have been identified within the Project area. Additionally no burial grounds have been identified to date.

Information on the engagement of members of the Aboriginal communities during the project development is provided in Section 6.5.

2.12.4 The American Eel (Kitchisippi Pimisi)

The American Eel (known as Kichisippi Pimisi in the Ottawa River) is a species of cultural and spiritual significance to the Algonquins of Ontario, alongside being both a food source and economic resource. Culturally, the Algonquins of Ontario identify with the adaptability of the

American Eel, and spiritually, the American Eel is considered to be a prayer-carrier due to its ability to travel great distances in a variety of conditions (Algonquins of Ontario, 2012).

The American Eel is now listed as Endangered, with populations in the St. Lawrence basin decreasing by 99% in the last 30 years. The American Eel is close to being extirpated within Algonquin territory, and the Algonquins have released a report stating that it is vital that the American Eel be restored to its historic range in Ontario, including the Petawawa River (Algonquins of Ontario, 2012).

Hydro dams are considered to be a factor in the decline of the American Eel, through physical barriers to passage and turbine mortality. At the proposed project site, these issues will be mitigated through the inclusion of fish passage and trash racks in project design. Preliminary discussions have been held with the MNR, MOE and DFO on eel passage strategies, and are discussed further in Section 6.3.2.

2.13 SOCIAL AND ECONOMIC

The purpose of compiling an economic and a socio-demographic profile is to develop an understanding of the trends, issues and dynamics of the local communities in proximity to Xeneca's projects. The profile also enables Xeneca to identify a sustainable balance between economic growth facilitated by hydropower and socio environmental objectives. This information can be used to create a socioeconomic baseline against which potential project impacts can be compared.

Information used to characterize the socioeconomic environment has been obtained from various sources including government and local documents and websites (e.g. Statistics Canada, Ontario Provincial Park, Forest Management Plan, and CLUPA), agency correspondence, stakeholder input, literature review and field observations. Information obtained at the PIC sessions, held on May 5, 2011 and August 22, 2012, was also incorporated into this section.

2.13.1 Municipal Structure and Community Profile

The proposed project site is situated on federal, municipal and private land, at Petawawa River, in the Township of Petawawa, in Renfrew County. The area is nestled in the Ottawa Valley Area (OVA).

Outside the Town of Petawawa, the closest municipalities to the project site are Pembroke, located approximately 16 km southeast of the site; Laurentian Hills, located approximately 22 km north of the project site; and the Town of Deep River, which is located roughly 32 km northwest of the site. Eganville, a small community also lies about 54 km southeast of the site.

Ottawa Valley Area (OVA)

The Ottawa Valley is a geographic area made up of the valley that has been cut by the Ottawa River which forms part of the border between the provinces of Ontario and Quebec. Geographically it also forms the transition between the highlands of the Canadian Shield and the lowlands of the St. Lawrence River.

While approximately 1.3 million people inhabit the Valley, almost 80% of those live in the City of Ottawa or in the immediate vicinity of it leaving the rest of the region very sparsely populated (Ontario Canada Travel Guide, 2013). The total population for communities in the OVA profile outside of the City of Ottawa is approximately 150,000.

Petawawa

The Town of Petawawa, located in the eastern portion of Southern Ontario, is the largest municipality in the upper OVA with a population of 15,988 people. Of that, 4,130 persons currently reside north of the Petawawa River (Town of Petawawa, 2012) (Table 3).

Approximately 80% of the population in Petawawa speak only English while 18% are bilingual.

Table 3: Outline of the community profile for Petawawa as per the Statistics Canada Census 2001, 2006 and 2011

Canada census – Petawawa (Ontario) Community Profile			
	2011	2006	2001
Population:	15,988	14,651	14,398
Percentage difference	9.10%	1.80%	-5.9%
Land area:	164.68 km^2	164.68 km^2	164.68 km^2
Population density:	97.1 persons /km^2	89.0 persons /km^2	87.4 persons /km^2

Laurentian Hills

The Town of Laurentian Hills, comprising of Chalk River, Meilleurs Bay, Moor Lake, Point Alexander, Rolphton, and Wylie communities, has a population of 2,811 residents as per Statistics Canada 2011 Population Census. This represents a 0.8% increase in the population from 2006 levels and a 1.4% increase since 2001 (Table 4).

Approximately 84% of the population speaks only English in Laurentian Hills while 15% speak both English and French.

Table 4: Outline of the community profile for Laurentian Hills as per the Statistics Canada Census 2001, 2006 and 2011

Canada census – Laurentian Hills (Ontario) Community Profile			
	2011	2006	2001
Population:	2,811	2,789	2,750
Percentage difference	0.80%	1.40%	-1.20%
Land area:	640.48 km^2	640.37 km^2	640.41 km^2
Population density:	4.4 persons /km^2	4.4 persons /km^2	4.3 persons /km^2

Deep River

The Town of Deep River, located 200 km from Ottawa on the Trans-Canada Highway, has a population of 4,193 according to the Statistics Canada 2011 Population Census. This represents a 0.5% decrease in the population from 2006 levels and a 2.4% increase since 2001 (Table 5).

Approximately 83% of the population speaks only English while 16% speak both English and French.

Table 5: Outline of the community profile for Deep River as per the Statistics Canada Census 2001, 2006 and 2011

Canada census – Deep River (Ontario) Community Profile			
	2011	2006	2001
Population:	4,193	4,216	4,135
Percentage difference	-0.5%	2.0%	-7.9%
Land area:	50.90 km^2	50.84 km^2	50.87 km^2
Population density:	82.4 persons /km^2	82.9 persons /km^2	81.3 persons /km^2

Pembroke

Due to recent investment activity in and around the City of Pembroke, according to Statistics Canada, the 2011 population was 14,360. This represents a 3.1% increase in the population from 2006 levels and as 3.3% increase in the population from 2001 levels.

Table 6: Outline of the community profile for Pembroke as per the Statistics Canada Census 2001, 2006 and 2011

Canada census – Pembroke (Ontario) Community Profile			
	2011	2006	2001
Population:	14,360	13,930	13,490
Percentage difference	3.1%	3.3%	-4.8%
Land area:	14.35 km^2	14.35 km^2	14.35 km^2
Population density:	1,000.7 persons /km^2	970.7 persons /km^2	940.1 persons /km^2

In comparison to provincial and national trends, Ontario's population increased 5.7% between the 2006-2011 period; the national average increased 5.9% for the same time period.

2.13.2 Employment & Economic Setting

Petawawa

The original Township of Petawawa was established in 1865 around its military base and availability of natural resources. Ninety-six (96) years later, in 1961, the urban area of Petawawa was incorporated as its own village (the Village of Petawawa). The Township and Village of Petawawa re-amalgamated into the Town of Petawawa in 1997, which to this day remains Renfrew County's largest settlement (Petawawa Heritage Village, 2013).

Historically, Petawawa was perfectly located for the transport of people and goods by way of the Ottawa and Petawawa rivers. Trails along the Petawawa River were integrated as part of the traditional canoe and fur trader's trade routes and in early 19th Century, the Hudson's Bay Trading Company built Fort William across from Petawawa on Quebec's side of the Ottawa River because of the location's strategic benefits (Municipality of Petawawa, 2013).

Though the land was noted not suitable for farming by early settlers, forests, on the other hand, were plentiful and the timber industry created many jobs and opportunities. From the late 19th century until the 1960s, the river was used for log driving of the timber from the forested areas surrounding the river. In 1905 the military bought land from the settlers and converted it into what is now CFB Petawawa, a major employer in the region. Forestry, agriculture and tourism formed the other major employers in the town, although the tourism industry is relatively new to the region. In 1934, Petawawa's main general store and post office (Giesebrecht's Ltd.) became one of the first PEPSI franchises in Canada, and still functions as such to this day.

At present, despite having a small population of less than 16,000, Petawawa has a stable economy based on economic development reports in the area. As mentioned previously, the Town enjoys a unique partnership with CFB Petawawa, the largest commercial customer and a

major economic driver for the upper Ottawa Valley. The military base contributes a $351 million payroll in economic stimulus, and $24 million in maintenance as well as making financial contributions for municipal infrastructure. The base also provides world-class athletic and recreational facilities for its staff and general public (Municipality of Petawawa, 2013).

Laurentian Hills

North of Petawawa, the Town of Laurentian Hills is home to the Nuclear Power Demonstration for the Atomic Energy of Canada (AECL), the area's largest employer, with a workforce of over 3000 people (County of Renfrew, 2013).

According to the Ottawa Valley's Department of Economic Development (OVDED), the AECL and CFB Petawawa are contributing significantly to the growth of the entire region, with an estimated 2,200 new families making their home in the Pembroke/Petawawa/Laurentian Hills/Deep River corridor over the next few years. This, in turn, will help to create more entrepreneurial and investment opportunities in the area as well as increased demand for clean, locally generated electricity.

Deep River

Deep River purportedly derives its name from the fact that the Ottawa River reaches its greatest depth of 402 feet (123 m) just outside Deep River. The Town of Deep River is also known as the research home of AECL and related high technology businesses, the presence of which creates an "extensive research and development capability". According to OVDED, companies and businesses that are located elsewhere are also beginning to look at Deep River as a place to conduct research and development projects because of available expertise, low overheads and local research and development support network (Town of Deep River, 2008).

Pembroke

South of Petawawa, the City of Pembroke is the location of the administrative headquarters of Renfrew County, though the city itself is politically independent. Originally named Miramichi, Pembroke became a police village initially in 1856, followed by its incorporation as a town in 1878 and finally as a city in 1971. Pembroke is named after Sidney Herbert, First Admiral Secretary from 1841 to 1845 and son of George Herbert, 11th Earl of Pembroke.

Pembroke is the largest commercial centre between North Bay and Ottawa. Historically, forestry and farming formed the backbone of the local economy and remain important today. Local timber products include lumber, plywood, veneer, hydro poles and fibreboard. Other local manufacturing operations produce office furniture. Furthermore, continued investment in the Pembroke Regional Hospital, the Superior Court House, Algonquin College, and both the retail and service sectors has meant more employment opportunities in the city (City of Pembroke, 2013).

2.13.3 Water Supply

The Town of Pembroke obtains its water supply from the Ottawa River, via an intake located on the northern periphery of the town. The water supply is outside of the zone of influence of the project, and has no potential to be impacted by the project.

3. DESCRIPTION OF PROPOSED PROJECT

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

The intent and purpose of the EA 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, Aboriginal communities and the general public. During an EA, conceptual design information is presented in addition to data collected through field investigations, desktop studies, and agency consultation 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. Detailed engineering design and specification work is required subsequent to a successful EA outcome, at the permitting and approval stage for construction and operation.

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. The proponent recognizes that any changes to the project that are determined to be significant and which may result in new negative effects to the environment will require an addendum to the Final ER as per the Waterpower Class EA. An addendum to a Final ER will also be subject to mandatory regulatory and public review.

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 identified and resolved 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.

Total Installed Capacity and Annual Energy Output

The approximate installed capacity of this project will be 5.3 MW, generated by one or two turbine units. This will provide approximately 20,000 MWh of renewable energy annually which represents the equivalent of:

- The displacement of 1,920 metric tons of carbon dioxide equivalent; or
- The annual greenhouse gas emissions from 400 passenger vehicles; or
- The sequestering of carbon from nearly 637 hectares of pine or fir forests.

3.1 Description of the Proposed Hydroelectric Facility

Rapids, upstream of the Petawawa Boulevard Bridge, within the Town of Petawawa. The proposed project would have a nominal design head of 9 meters between the upstream intake and the downstream tailrace. The conceptual development for the facility incorporates an overflow weir, an intake channel, a man-made nature-like fishway, powerhouse and tailrace structures. Flows from the river will be directed into the intake channel, which will conduct water into the powerhouse and through one or two turbine units with a total installed capacity of 5.3 MW. The total footprint of all generating station components (regardless of which weir option is selected) will be approximately 15,300 m^2.

3.2 Design Options and Rationale

Water Control Structure

Two options are being considered for the water control structure. Both options involve the construction of a weir, with the difference being that Option 1 has a fixed crest, whereas Option 2 would be equipped with an adjustable Obermeyer gate to better manage the potential inundation impact of flood flows.

A private commercial property is located immediately upstream of the proposed weir location, and would be affected by the inundation created by Option 1 and Option 2. At the time of writing this report, an agreement in principle with the landowner of the commercial property in question was reached.

Under Option 1, involving a fixed crest weir, the shoreline of several waterfront lots would also be affected, especially under flood flow conditions. At this time, no agreement exists with these property owners. Option 2, involving the adjustable Obermeyer gate, provides a viable engineering alternative in the event that an agreement cannot be reached with the owners of these waterfront lots.

Further details on the two weir options are provided in Section 3.3.2.

3.3 GENERATING STATION COMPONENTS

The following is a description of the generating station components. The reader is referred to Annex II 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 regulatory review at the permitting and approvals stage to secure permission to initiate 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 Headworks Structure

As indicated in Section 3.2, two different options for the water control structure are being explored. Both options involve the construction of a control dam structure with an approximate length of 210 m, but the portion of the structure over which water will pass (i.e. the length of the weir) differs for the two options. Option 1 has an overflow weir with a fixed crest, spanning a distance of 110 metres across the channel; mid-way across the channel, the weir will raise normal water levels by approximately 1.5 meters at the weir site. The weir slopes gently in the downstream direction over a distance of 20 metres and returns to the existing water level.

In Option 2, a concrete weir equipped with an Obermeyer gate is proposed, which would span a distance of 133.0 m across the channel. The concrete weir (excluding the Obermeyer gate) has a fixed elevation of 134.20 masl. When the Obermeyer gate is in its fully raised position, the water surface immediately upstream and downstream of the weir would have an elevation of approximately 134.75 and 134.00 masl, respectively, under the normal operating level NOL.

A nature-like fishway will be incorporated into the headworks at the north end of the weir to facilitate upward and downward migration of fish around the weir structure.

An earthen embankment would be required to ensure the protection of the Ottawa Valley railway line. The embankments 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).

3.3.2 Intake and Conveyance System

Water would be directed from the area upstream of the weir through a 5,000 m^2 open channel towards the powerhouse. The intake channel will be constructed using a combination of rock excavation, concrete works and earthfill.

3.3.3 Powerhouse

The powerhouse will have a footprint of approximately 600 m^2. 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.

3.3.4 Turbines

Turbine selection is based on the project site hydraulic 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).

Two options for the turbine selection are being explored for the Big Eddy GS; the specifications for each option, as well as the trash spacing and entrance velocity, are summarized below.

Table 7: Turbine Specifications

	Option 1	Option 2
Type	Kaplan	Kaplan
No. of turbines	1	2
Diameter	2850 mm	2320 mm
RPM, turbine	180	213
No. of blades	4	5
Trash rack gap	48 mm	48 mm
Entrance velocity	0.75 m/s	0.75 m/s

3.3.5 Tailrace

The 16-m wide tailrace will extend approximately 48 m downstream of the powerhouse before the outflow rejoins the natural river channel. The excavation will be to an elevation of approximately 113 masl at the outlet of the powerhouse, and the tailrace channel will taper up towards the end of the canal.

3.3.6 Fishway

A rock channel fishway structure is incorporated into the north end of the proposed weir design, in order to provide upstream passage for fish around the overflow weir where required.

The fishway design will be a nature-like structure that will combine an engineered upstream control structure with a natural channel, to be located on the north side of the river and incorporated into the right weir abutment. A minimum ecological flow of 4 m³/s will be provided to the fishway at all times. Additionally, 30 m³/s will pass through the fishway when water temperatures are appropriate for Walleye spawning (5°C to 12°C) and Sturgeon spawning (9°C to 18°C) in order to facilitate movement during the spawning period.

The upstream end of the fishway will contain a control section that will allow flow to enter the river for downstream fish passage and will be the upstream egress point for upstream fish movement. Sufficient flow will be provided at the control structure to the fishway to allow for fish movement past the weir. When the headpond is at its NOL, flow will enter the fishway at all times. The elevation of the opening will be set below the NOL so that flow enters at all times. The fishway will have an overall slope of 2% with a maximum slope in any area of 3%, and will contain boulder fields and pools, to provide intermittent resting pools and protected areas. The design flow for the fishway will be 30 m³/s which can be distributed between the fishway and weir to provide sufficient flow in the bypass reach to allow for upstream fish movement. Attraction flows to the fishway to be a minimum of 10% of the total flow discharging past the headworks structure.

Key design parameters for the fishway are outlined in the May 9, 2013 technical memo titled, Fish Passage Design Criteria, located in Annex III.

3.3.7 Portage Trail

A portage trail will be added to provide recreational users of the river a route to bypass the weir and powerhouse tailrace. The permanent safety boom will direct users to the portage route which will start just north of the intake canal and will end just beyond the tailrace. Signs will be installed to direct users, and steps and handrails will be installed to allow safe passage in steeper sections.

3.4 Access Roads

The project site will be accessed via a combination of existing residential roads and the construction of new roads. From Gerald Avenue, approximately 150 m of existing road will be upgraded and 200 m of new road will be built to provide temporary access on the south bank of the river during construction. Permanent access will be built to the North shore of the river from Paquette Road. Two options for new road routing from Paquette Road to the powerhouse have been identified and are describe below. Both proposed road options will be approximately 1400m in length, running from the penstock canal at the south end to Paquette Road at the north. Both options include approximately 500 m of new road constructed parallel to the intake canal. In concept, the roadway will be a single lane with buffers along each edge. Both road options can be seen in the General Site Layout drawing in Annex II.

Option 1

Option 1, which is the preferred option, would utilize a recently abandoned CP rail line which provides a natural, pre-disturbed access route linking with Paquette Road at the north end of the site via an established trail. At the south end of the rail line where it intersects with the penstock location, the road would run east along the north side of the newly created intake canal. Using this option will require an easement or lease from CP Rail.

Option 2

In the absence of an easement or lease for use of the CP Rail bed in Option 1, the proposed Option 2 routing will be pursued. Option 2 would construct a single gravel lane along the east side of the Trillium Trail. A buffer beside the trail would allow vehicular traffic to operate without adversely impacting users of the trail. Post-construction, the trail would be paved and a boundary would be delineated to separate the road portion of the trail from the portion being used by pedestrians and cyclists.

Construction of the section of road along the penstock would be easily accomplished using fill and aggregate removed during construction of the canal. Placement of the road on the north side of the canal eliminates the requirement for bridging of the penstock. Vegetation within the proposed east-west section of the road would already be cleared as part of ongoing construction, thereby removing the requirement to clear and/or fill relatively pristine lands. Upon reaching the location of the proposed canal, the new access road will split into two paths; one continuing to the location of the proposed new weir, the other running along the northern side of the canal.

3.5 ANCILLARY WORKS

3.5.1 Connection Line Route

There are currently two proposed transmission line routes for the Big Eddy project. These options follow the two access road options described in Section 3.5 (Access Roads). Option 1 parallels the east side of the CP rail line, which is the preferred option for road access. Option 2 would run parallel to east side of the Trillium Trail and the associated proposed access road.

Further detail can be found in the Distribution Lines and Access Road Summary Report in Annex III.

3.5.2 Electrical Substation

The electrical substation will be located just east of the temporary laydown area, and north of the conveyance channel. It will have a design footprint of 800 m^2. Substation construction will start in Stage 2 of the Construction Phase, once the powerhouse has been constructed to yard grade and the structure backfill is complete. The substation will provide connection to the north, and to the powerhouse situated directly to the southeast. The Construction Management Plan addresses biological concerns related to construction activities in a comprehensive format and can be referenced in Annex II.

The transmission corridor and electrical substation are not being assessed under the Waterpower Class EA planning process. These components will be assessed at a later stage of development (i.e. regulatory approvals during final detailed design) under Ontario's Regulation 334; the MNR's alternative review process.

3.5.3 Other Civil Works

An existing snowmobile trail bridge passes over the Petawawa River between the intake channel and the tailrace outflow. Due to the excavation works required for the construction of the intake channel, a new trail bridge passing over the intake channel will be constructed in order to provide recreational users with uninterrupted access to the entire snowmobile trail. (See also the subsection "Snowmobiling" under Section 2.11.4 for additional information on snowmobile use in the area.)

4. 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 II. 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.

4.1 CONSTRUCTION SCHEDULE

Site preparation activity will commence in mid-2014. Construction of the proposed facility is scheduled to take place between May 2014 and late 2015 with commissioning of the facility anticipated between November 2015 and March 2016. Under the terms of the FIT contract awarded to Xeneca, the facility must be commissioned no later than October, 2015.

Tentative dates for the commencement and completion of various project components are presented in Table 8.

Table 8: Project Component Construction Schedule

Component	Dates	
Engineering	Start	Sept 2013
	Finish	Feb 2014
Construction of roads	Start	May 2014
	Finish	Jun 2014
Construction of dam/weir	Start	Jun 2014
	Finish	Dec 2014
Construction of powerhouse	Start	Jan 2015
	Finish	Dec 2015
Wire-to-wire delivery and installation	Start	Aug 2015
	Finish	Dec 2015
Commissioning	Nov 2015 – Mar 2016	

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

- clearing and grubbing of the right-of-ways;
- clearing of temporary laydown, stockpile and construction areas
- construction of new road access and laydown areas;
- construction of phase 2 cofferdams at tailrace and intake;

- excavation of powerhouse, penstock, intake and tailrace;
- begin construction of substation and connection line;
- connection line right-of-way clearing and line construction;
- construct intake, and 1st spillway section;
- build diversion channel and flood berm/wall;
- begin construction of penstock and powerhouse;
- removal of phase 2 cofferdam and installation of phase 3 cofferdam;
- completion of spillway structure;
- removal of phase 3 cofferdams;
- close intake and diversion works to divert flow over completed spillway;
- complete powerhouse and substation construction;
- electrical and mechanical installation within the powerhouse;
- complete construction of penstock;
- site rehabilitation/reclamation and removal of temporary works.

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 (BMP) 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.

4.2 CONSTRUCTION ACTIVITIES

4.2.1 Clearing and Grubbing

Clearing will be managed in accordance with applicable forestry management guidelines and BMPs. All clearing of timber will conform to the *Crown Forest Sustainability Act*, and the Forest Operations and the Silviculture Manual. Merchantable timber will be decked for removal by the Sustainable Forest Licence (SFL) holder or other party as designated by the MNR.

The environmental concerns associated with vegetation clearing include:

- Erosion of exposed soil by wind and/or water, and deposition of the resulting sediment in water bodies;
- Disturbance, clearing, or accidental removal of trees used by wildlife or by nesting birds, especially during key life cycle periods such as mating, nesting, and/or rearing;
- Blow down or damage of newly exposed trees during high wind events;
- Forest fires associated with loss of control while burning of slash and debris; and
- Entry of cut materials (woody debris) into the waterway.

4.2.2 Aggregate Borrow and Laydown Areas

Granular material will be utilized for the construction of roads, embankments, yards, cofferdams, and concrete structure backfill. The total volume of borrow materials will depend on final Project design. Useable materials excavated from the road will be re-used on site for other construction requirements. Earth borrow material may be excavated from the conveyance channel and powerhouse construction. Overburden materials in the area are mostly sand and gravel and will likely be suitable for use during construction. Some on-site processing of materials may be required (screening or crushing) to improve the engineering characteristics of the in-situ soils.

The site will have a 2000 m^2 temporary laydown area close to the powerhouse. This area will be used for construction materials and equipment storage, construction offices, parking, etc. This area can be reduced post-construction with some area remaining for operations purposes or will be completely reclaimed. An additional 1000 m^2 may be required for stockpiling topsoil, excavated soil material that is unsuitable for construction use, and extra blast rock material.

The weir structure, and possibly the conveyance channel and fishway will consist of a combination of concrete and earthfill. The relative amount of earthfill to concrete will depend on the final Project design, and may vary significantly from the design represented here. Earthfill will be sourced to the extent available on site. The primary borrow locations will include the fishway channel, excavations for the powerhouse, intake and tailrace channels. Development of additional rock borrow areas outside of the construction site area is not contemplated.

4.2.3 Dewatering

Water that accumulates behind the cofferdams will be discharged in accordance with the *Environmental Protection Act*. The Ministry of Environment will confirm the requirements for a Permit to Take Water (Category 2 or 3) and a Certificate of Approval for Sewage Works prior to the initiation of in-water construction activities. Dewatering approvals will require the proponent to submit a Sediment and Erosion Control Plan for regulatory review.

4.2.4 Cofferdams

Temporary cofferdams will be installed in the river during the construction process. At this time, cofferdams are contemplated to be built to manage the 1:20 year flow rate. The cofferdams are used to divert flow first from the powerhouse area, then the weir and fishway area, to allow the construction to occur in dry conditions. Type A cofferdams as presented on the attached Drawing 00-151 will be used for all stages of construction (Annex II – Construction Management Plan). Type A cofferdams consist of cargo bags filled with clean, local granular material and are transported to site in haul trucks or on a tractor trailer bed. They are installed using an excavator and/or a crane to place the bags sequentially in the river. The total footprint of the cofferdams will depend on the elevation of the dam required to prevent overtopping during the 1:20 year flood event, and depth to a suitable base material in the river. This information will be determined once further investigation, design work, and evaluation of a suitable return period flood event are completed.

4.2.5 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 MNR's established timing window for in-stream work. The excavation will be advanced from the powerhouse working towards the watercourse so that flowing water does not infiltrate the cut until the final phase of excavation.

4.2.6 Concrete Production

Concrete will be sources from local ready mix suppliers. There will be no requirement for a concrete batch plant as concrete can be sourced in Petawawa. Following the powerhouse excavation, concrete construction will commence with the placement of a levelling mudslab, followed by successive stages of wood forming, reinforcing, and embedded steel installation and concrete pouring. This work will require a mobile or tower crane set up near the edge of the excavation to move forms, reinforcing steel, and other materials into and out of the work site. Concrete will likely be placed either by pump truck or crane and bucket. The powerhouse construction will likely involve steel erection and installation by crane for the roof and potentially the upper portion of the powerhouse walls.

Construction of the first weir section will commence on the south bank.

4.2.7 Connection Line

Clearing for the transmission line right of way will occur during the development of access roads during the first four to six months of construction. Right-of-ways will be cut 20 m wide, except where the transmission line is situated on a relatively steep side-slope, which would require additional clearing on the upslope side. The first stage of construction will start in early summer

or other suitable time to coordinate with the first in-stream construction window. This will likely be in late summer

4.2.8 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 construction activities will generate waste from various sources, such as packaging from delivered equipment, off-cuts from wood form construction, used formwork, packaging and remains from consumable materials, and organic waste from worker meals.

Waste materials will be shipped to either the Ottawa Valley Waste Recovery Centre in Pembroke, or H & H Concrete.

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*).

4.2.9 Water Crossings

The proposed route for the new access road would not require any water crossings over existing water bodies. While access to the project site would likely require the use of the existing Petawawa Boulevard bridge (approximately 750 m downstream of the proposed dam), modifications to the bridge would not be required. No modifications are proposed to the existing snowmobile bridge as the latter would not be used to access the project site.

4.2.10 Access Roads

It is planned that the majority of this construction will be conducted using excavators, haul trucks, and other earth moving equipment. Some drilling and blasting may be required, depending on the bedrock elevation. Upgrades to existing water crossings and the traveling surface will not be required along these roads. The location of the proposed access roads is illustrated in Figure 9 below, and can also be viewed in the Construction Sequence Plans in the Construction Management Plan (Annex II of this report) and in the lines and roads assessment in Annex III.

5. OPERATION STRATEGY AND EFFECTS MANAGEMENT MEASURES

This section summarizes how the facility will be operated and how the operation will be adapted to maintain key seasonal functions such as aquatic life and recreational use. The proponent's Draft Operating Plan for the proposed Big Eddy GS is presented in Annex I.

The operations strategy is based on the conceptual engineering completed to date, and environmental data collected during the field investigation program. The operations strategy was developed based on data analysis from various studies, including:

- Conceptual Design: drawings of structures as conceptually proposed for the project (Annex II);
- Hydrology Study: an analysis of the natural river flows (Annex I);
- Bathymetric Study: field study of water depths upstream and downstream of the project location and a spot measurement of flows for hydraulic model calibration (Annex I);
- HEC-RAS Study: hydraulic engineering model (i.e. a 1-dimentional HEC-RAS model) run to better understand the various hydraulic parameters to assess operational effects on the environment (Annex I);
- Erosion Survey: desktop analysis completed to identify upstream locations that may be sensitive to shoreline erosion once the project is commissioned (Annex I);
- Environmental field investigations: studies of the natural habitat and key environmental features (Annex III);
- Recreational use study: a study of recreational use in the bypass reach (the results of which are summarized in Section 2.11.4 of this report).

During final engineering design, and/or as additional information becomes available, minor adjustments may be required to the operating plan in order to ensure that the objectives of mitigating and limiting potential impacts outlined in the plan are met.

5.1 HEADPOND INUNDATION

Since the proposed Big Eddy GS is a run-of-river facility, there will be no manipulation of headpond water levels after the initial filling of the headpond.

As indicated in Section 3.2 (Design Option and Rationale), two options are being considered for the water control structure and which would operate at different NOL. Option 1, with the fixed crest weir, has a NOL of approximately 136 masl, whereas Option 2 would have a NOL of 134.75 masl when the adjustable Obermeyer gate is in its fully raised position. Under Option 1, the inundation area would extend 2.7 km upstream of the weir of the weir. Due to Option 2's relatively lower NOL, its inundation area would extend a shorter distance upstream compared to

Option 1, extending less than 2.4 km upstream under long term average flow conditions. The selection of Option 2 for the construction of the weir (with an adjustable Obermeyer gate and a NOL of 134.75 masl) would allow for a certain amount of flood control. Backwater effects during flood events can be minimized by lowering the gate during floods to reduce the hydraulic obstruction caused by the presence of the weir in the waterway.

HEC-RAS modeling, the results of which are presented in Annex I, was undertaken to evaluate the effects associated with the creation and maintenance of a headpond upstream of the proposed Big Eddy GS. These effects would vary depending on the option selected for the construction of the weir. Option 1, in which the weir is constructed with a crest elevation of 135.75 masl, would result in water levels in the headpond immediately upstream of the proposed facility being raised by 0.5 m to 1.7 m. The headpond would extend approximately 2.7 km upstream during long-term annual flow conditions, and 2.8 km upstream during 1:100 year flood events.

HEC-RAS modeling for Option 2 (completed in March 2012) was conducted using the design parameters of the time (a weir crest elevation of 134.5 masl with an Obermeyer gate capable of maintaining water levels at 135.75 masl). The modelling results indicated that, under those earlier design parameters, water levels in the headpond immediately upstream of the weir would increase by 1.3 m compared to pre-construction conditions; it was also estimated that the headpond would extend approximately 2.4 km upstream during long-term annual flow and 1.7 km during 1:100 year flood events.

Under the worst case scenario (Option 1, with the larger headpond), HEC-RAS modeling results indicate that the headpond would not affect water levels at the Highway 17 Bridge, located approximately 2.9 km upstream of the proposed facility.

Given that the proposed Big Eddy GS will operate as a true run-of-river facility, with inflows into the headpond being equal to outflows downstream of the project site, water levels in the headpond will not fluctuate as a result of facility operations. The only manipulation of water levels in the headpond area will occur when the latter is being filled at the end of the construction phase.

Using Option 2 of the proposed weir, the extent of backwater effects during flooding events can be minimized by lowering the Obermeyer gate to reduce the hydraulic obstruction caused by the weir.

The extent of the inundation area for both Option 1 and Option 2 are illustrated in the mapping provided in Annex I of this report. In the two maps dated March 14, 2012, the inundation area is illustrated within a single page for each option. The maps numbered 01-121 to 01-124 and 01-132 to 01-134 illustrate the inundation area under Options 1 and 2, respectively, and include the cross-sections that were used for the HEC-RAS modelling described previously.

5.2 SITE OPERATING STRATEGY

The proposed Big Eddy GS will operate as a true run-of-river facility, meaning that at any given moment, the natural inflows coming from upstream will equal the outflow downstream of the facility. No manipulation of flows downstream of the facility is being proposed.

An overflow weir is proposed immediately upstream of Railway Bridge. This weir would increase water levels to a height that will allow part of the flow to be directed towards the powerhouse intake channel. After passing through the powerhouse and turbine(s), the water would be returned to the Petawawa River at a point approximately 600 m downstream of Railway Bridge. All flows downstream of the tailrace would equal the natural flows upstream of the project site.

The amount of flow that is diverted to the powerhouse would depend on the discharge coming from upstream and the amount of water that must flow into the bypass reach to preserve the ecological integrity and recreational value of that reach. The bypass reach in question is known locally as 'Railway Rapids'. In addition to the creation of the headpond, the most substantial impact on flows would be observed in the bypass reach ('Railroad Rapids'). During much of the year, flows in the bypass reach would be lower than what would have been observed in the absence of the proposed Big Eddy GS, as a portion of the flows in the Petawawa River would be diverted into an intake channel leading to the powerhouse.

A flow equal to or greater than a pre-determined compensatory flow (Q_{comp}) would be spilled over the weir and into the bypass channel at all times. As outlined in Section 5.6, a compensatory flow of at least 4 m^3/s is proposed, with this value increasing to 30 m^3/s during key spawning events in order to facilitate movement during the spawning period for the purpose of fish movement during staging and spawning. Key spawning events are defined to be when water temperatures are appropriate for Walleye spawning (5°C to 12°C) and Sturgeon spawning (9°C to 18°C). A flow greater than Q_{comp} may be passed over the weir if the natural flow in the river falls outside the operating range of the turbine(s). Additionally, a 'recreational flow' may be released into the bypass during rafting/ kayaking hours under a water sharing/accommodation proposal.

One of the main objectives of the operating plan is to achieve shared use of the water, such that electricity generation and recreational uses can co-exist on the river. Based on the findings of a recreational use study conducted by Xeneca in 2011 and 2012, as well as stakeholder reports, the following key considerations in achieving shared use were developed:

1. Time of Use: Recreational kayaking and rafting use appears to occur primarily during April and May with occasional usage in the summer and fall. No usage appears to occur from November 1 to April 1. Use occurs primarily on weekends from 11 AM to 3 PM (4 hours), and weekdays from 5 PM to 8 PM (3 hours). No nighttime navigational use has been documented.
2. Useful Flows: Recreational use occurs primarily during the spring when flows are high. Use diminishes with receding flow rates. Recreational use of Railroad Rapids has been observed at flows as low as 19 m^3/s and as high as 150+ m^3/s. The majority of uses occur at 40 m^3/s to 150 m^3/s.
3. Number of Uses: Some users appear to favor Railroad Rapids (the most challenging and steepest rapids on this section of river) while others avoid Railroad Rapids. Of the usage recorded at 3 locations (Highway 17, Wilson House and Railroad), recreational rafting and kayaking was observed 765 times in 2011 and 463 times in 2012 (average). The documented use occurred over 11 usage days in 2011 and 28 usage days in 2012.
4. Events: An annual 2-day weekend event (Saturday/Sunday), entitled "Hell or High Water" is organized by recreational users every May. The majority of recorded use of Railroad Rapids occurs during this 2-day weekend event.

5.3 VARIABLE FLOW REACH

The Variable Flow Reach spans from the area immediately downstream of the facility to a distance downstream where the variability in flow is attenuated by the presence of a lake or a confluence with a significant tributary. For the proposed Big Eddy GS, the flows downstream of the tailrace, where outflows from the powerhouse join the flows from the bypass channel, will equal flows from upstream at any given moment. Due to the absence of any manipulation of flows, the Variable Flow Reach for the proposed undertaking will encompass the bypass and to the end of the tailrace.

The proposed Big Eddy GS will be operated according to a strictly run-of-river operating regime. As a result, flows in the river downstream of the tailrace would equal flows upstream of the facility at any given time. The only possibility for minor flow variation would occur during start up and shut down of the facility due to any differences in the rates at which flows over the weir change and the facility starts up/shuts down. Should this type of minor flow variation occur, the effects would only last for a short period of time (approximately 5 – 30 minutes) and should neither be significant nor readily perceptible to the downstream environment or recreational users.

5.4 SPILLWAY FLOW ALLOCATION

In addition to increased water levels in the headpond compared to pre-construction conditions, the proposed project's most significant effects on flows would occur in the bypass reach ('Railroad Rapids'). The bypass reach would extend from the proposed weir, located near Railroad Bridge, to a point 600 m downstream where outflows from the powerhouse rejoins the natural river channel. The maximum turbine capacity of the generating station is proposed to be 68 m^3/s, and therefore the amount of flows diverted to the powerhouse will never exceed this rate.

Although the natural habitat within Railroad Rapids is of limited value, the rapids are considered significant for fish passage and for certain benthic invertebrates. The proposed operations at the Big Eddy GS were therefore developed with the aim of:

- Facilitating upstream fish passage during spring spawning events;
- Facilitating downstream fish passage year-round; and
- Ensuring sufficient flow is provided to maintain the productivity of benthic invertebrates in the low flow portion of the channel.

A nature-like fishway will be incorporated into the north end of the overflow weir in order to facilitate upstream and downstream fish passage. As will be discussed in Section 5.6, a flow of at least 4 m^3/s will be provided into the fishway at all times.

Recreational Flows

Based on the observations on recreational use described in Section 2.11.4, it is believed that recreational use in the bypass reach can be satisfactorily accommodated using the following operating commitments:

1. Hell or High Water Event: Electricity generation will be stopped during daylight hours for the **2 days** of the scheduled annual weekend event. All flow will be directed to Railroad Rapids, allowing recreational navigation over the weir and through the fishway, and down Railroad Rapids.
2. Excess Flow: Any flow in excess of the powerhouse capacity (68 m^3/s) is directed down Railroad Rapids. On average, excess flow conditions occur from March 15 to July 1 with average flows during this period of 75 m^3/s. In a typical year, excess flows greater than 60 m^3/s in Railroad Rapids occur **21 days** between March 15 and July 1.
3. On-Demand Flows: Upon the request by users, electricity generation will be stopped during daylight hours for a maximum cumulative total of 100 hours per year on an 'on-demand' basis, and all flow at these times is directed down Railroad Rapids. Assuming 4 hour use days, the on-demand flows provide a further **25 days** of recreational use.

4. Low Flows: No electricity production will occur when flows are less than the minimum turbine capacity and flow will be directed to Railroad Rapids.
5. Ecological Flows: Flows of no less than 4 m^3/s will be provided for ecological compensation (Q_{Comp}) through the fishway at all times (24 hours/7 days a week).
6. Non-impacted Rapids: The facility will be operated as run-of-river, such that the rapids located upstream, between the weir and Highway 17, and the rapids located downstream, between the tailrace and the Ottawa River, remains unaffected by electricity generation.

Under the commitments listed above, there would be 48 days in a typical year where either the full flow rate or an excess flow rate of at least 60 m^3/s would be directed down Railroad Rapids for 4 to 12 hours per day.

5.5 SUMMARY OF HYDRAULIC CHARACTERISTICS

Estimated water levels:

Normal operating headwater level (Option 1)	136 masl
Normal operating headwater level (Option 2)	134.75 masl
1:100 year flood level	137.5 masl
Normal tailwater level downstream of powerhouse	127 masl
Normal operating gross head (Option 1)	9 m
Normal operating gross head (Option 2)	7.75 m
1:100 year flood flow	475.7 m^3/s
1:100 year low flow	2.34 m^3/s
Long-term average flow	47.8 m^3/s
Maximum daily fluctuation in headpond levels	0 m

5.6 OPERATING PARAMETERS FOR WATER CONTROL STRUCTURES

In establishing the operation parameters for the proposed facility, the environmental aspects of the project site and surroundings were considered so as to provide a reasonable balance among operational constraints, environmental features and mitigation of possible impacts.

Operation Parameters

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. Table 9 summarizes the start dates for each season as they relate to the operations of the proposed Big Eddy GS.

Table 9: Seasonal Hydrological Periods

Season	Season start date
Spring	March 15
Summer	July 1
Fall	November 13
Winter	January 1

Table 10 provides a description of the flow 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 10: Big Eddy Flow Parameters

Description	Acronym	Project & Streamflow Conditions (m^3/s)			
		Spring	Summer	Fall	Winter
Streamflow Exceeded 99% of the time	Q_{99}	13.2	5.45	8.44	8.0
Streamflow Exceeded 95% of the time	Q_{95}	19.1	7.5	10.1	12.6
Streamflow Exceeded 80% of the time	Q_{80}	37.7	11.9	17.5	18.1
Streamflow Exceeded 50% of the time	Q_{50}	75.9	21.2	31.6	25.7
Streamflow Exceeded 20% of the time	Q_{20}	136	41.1	55.9	38.2
Minimum compensatory flow in Railroad Rapids [1]	Q_{COMP}	4	4	4	4
Minimum fishway flow	Fishway	4	4	4	4
Maximum turbine flow capacity	Q_{TMAX}	68.0			
Minimum turbine flow capacity	Q_{TMIN}	12			
Long term annual flow	LTAF	48			
Median streamflow value	Q_{MED}	31			
2 year return period 7-day-average-low flow	7Q2	1			
10 year return period 7-day-average-low flow	7Q10	5.9			
20 year return period 7-day-average-low flow	7Q20	4.9			
Streamflow corresponding to the high water mark	Q_{HWM}	170			
High streamflow event; occurrence of 1 in 2 yr	Q1:2	215			
High streamflow event; occurrence of 1 in 100 yr	Q1:100	440			

[1] Note: to facilitate staging and upstream passage during fish spawning events, the minimum compensatory flow in Railroad Rapids will be 30 m^3/s when water temperatures are within 5 to 12°C (during walleye spawning). Similarly, during sturgeon spawning events, the minimum compensatory flow in Railroad Rapids will be 30 m^3/s when water temperatures are within 9 to 18°C, again for the purpose of upstream passage. A minimum of 4 m^3/s will continue to be supplied into the fishway. Any excess flows will be passed over the weir.

Any flow in excess of the maximum turbine flow (Q_{Tmax}, 68 m^3/s) and any flow less than the minimum turbine flow is naturally routed over the weir and the fishway towards Railroad Rapids. Hence the actual flow in Railroad Rapids will either be the amount specifically committed to in Table 10 (Q_{comp}, 4 m^3/s) or a larger amount depending on natural inflow rates. At least the first 4 m^3/s of any compensatory flow for Railroad Rapids will be routed through the fishway structure. As noted in the footnote of Table 10, a flow rate of not less than 30 m^3/s is

required in Railroad Rapids during walleye and sturgeon spawning in order to facilitate upward passage when water temperature fall between 5°C and 18°C in the spring. Of this flow, at least 4 m^3/s would be passed through the fishway, with any excess flow passing over the weir and through the fishway as dictated by upstream water levels.

The frequency with which different flow conditions (flood flow, low flow, etc.) are observed at the location of the proposed Big Eddy GS varies depending on the season, which in turn would affect the volume of water to be allocated between the powerhouse and the Railroad Rapids bypass reach. The occurrence of each type of flow is presented in Table 11.

Table 11: Occurrence of Different Flows by Season

Flow conditions	Spring	Summer	Fall	Winter	Annual
Flood flow spill ($>Q_{TMAX}$)	55%	6%	11%	2%	20%
Compensatory flow ($Q_{Tmin} - Q_{TMAX}$)	38%	72%	82%	93%	69%
Low flow spill ($< Q_{TMIN}$)	4%	22%	7%	5%	11%
	100%	100%	100%	100%	100%

5.7 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 project design will include an Emergency Powerhouse Bypass consisting of an inflatable rubber dam to be used in the case of an emergency shutdown.

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

5.8 COMPLIANCE CONSIDERATIONS

For compliance purposes, the Target Operating Zone will be the legal operating limits as provided in Section 5 of the Draft Operating Plan for the Big Eddy GS. The facility will be considered out of compliance with this Draft Operating Plan if they go outside of these defined operating parameters. Xeneca will be required to submit an Incident Report following standard compliance procedures outlined by MNR whenever the headpond water levels or downstream flow targets deviate outside the Target Operating Zone, with the following exceptions:

During periods of drought or extreme flooding events equipment constraints may prevent water levels or flows from being maintained solely within the Target Operating Zone. Xeneca will not be required to submit an Incident Report whenever the operating parameters deviate outside the Target Operating Zone under these conditions. Xeneca will keep on record the occurrence of these events and resultant conditions.

When flows are above the maximum turbine design capacity (68 m^3/s), Xeneca will have no ability to control water levels, either upstream or downstream of the facility. Water levels and flows will rise and fall in accordance with natural inflows until flow decreases back to or below the design capacities. For compliance purposes, no Incident Report will be required if flows exceed the design capacity of the facility. However, when inflow rates decrease below the facility's design capacity, Xeneca will become subject to the Target Operating Zone Parameters as discussed above.

5.8.1 Compliance Monitoring and Reporting Program

Xeneca will be required to report the following for the facility:

- one instantaneous discharge (flow) reading at 15 minute intervals
- one instantaneous headpond water level reading at 15 minute intervals.

For total instantaneous discharge readings, this would be a combination of gauged/measured flows through the facility and calculated discharge from the spillway.

For the purposes of compliance monitoring, the headpond water level will be monitored from a water level gauge located on the upstream side of the powerhouse.

Water temperature in the headpond will also be monitored on an hourly basis and this data will be reported with the flow and water level reading data.

This information will be reported annually to MNR. The information will be provided in an electronic format that can be graphed as well as in a written format.

An out-of-operating zone situation will require the submission of an Incident Report as noted previously.

5.9 Provisions for Plan Reviews, Amendments and Plan Renewals

Xeneca Power Development has developed an operational plan which describes the water management regime for the proposed Big Eddy GS. As part of development of an operational plan, potentially impacted water users downstream were considered. Since there is no existing Water Management Plan for the Petawawa River, the operational plan does not reference any pre-existing Water Management Plan. Posters on Xeneca's proposed facility's Water Management Planning process were made available at public information centres that took place during the EA planning process.

6. FEDERAL, PROVINCIAL AND MUNICIPAL AGENCY AND STAKEHOLDER CONSULTATIONS

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

6.1 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 any applicable federal legislation. 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 provincial processes (i.e. *Lakes and River Improvement Act*, *Public Lands Act*, etc.) 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 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 agency, public and Aboriginal community consultation undertaken in the planning of this development proposal are provided in Appendices C, D and E, respectively.

6.2 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 is responsible for all procedural aspects of consultation, including but not limited to notification, engagement, and consultation with First Nations and Aboriginal communities. All public consultation events, communications, and advertising with the public at large was coordinated and executed by Xeneca. Public and Aboriginal Community Consultation Plans for the proposed development 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.

It should be noted that many of the early consultation documents for the Big Eddy GS also made reference to a second proposed project on the Petawawa River, the Half Mile GS. During the early stages of the EA planning process, these two proposals were presented jointly due to the proximity of the two project sites. However, this ER, including the summary of consultation efforts presented below, discusses only the proposed Big Eddy GS project.

At the request of the Commanding Officer at CFB Petawawa, Xeneca has deferred plans for development of the Half Mile GS site. At the time of writing of this report, the Federal Priority Permit for site development at Half Mile has lapsed, and there are currently no plans to renew the permit.

6.2.1 General Print and Mailing

General mailing of reports, notices and letters through postal, courier and electronic methods were used to communicate with the community and stakeholders. 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 were specifically requested.

6.2.2 Print Media

Print advertising in support of the undertaking was circulated in the Petawawa Post, the Pembroke Daily Observer, the North Renfrew Times, and the Eganville Leader to ensure broad formal notification of key project milestones and key meeting dates to members of the public.

All Public Information Centres and public meetings were advertised in advance of the meeting dates. Further, Xeneca initiated contact with editorial departments of all area newspapers and generated news articles on several occasions. Copies of the advertisements that were circulated in print media are presented in Appendix D of this report.

6.2.3 Web Media

Xeneca has provided regular project status updates through emailing and through its website throughout the EA process to complement the consultation and engagement program. Key documents (Project Description, etc.) and notifications were provided through emailing and Xeneca's website at www.Xeneca.com; preliminary distribution of Project Description was through the OEL-HydroSys website at www.wesa.ca. In some cases, Xeneca personnel also employed other social media communication tools to garner and provide feedback to the public.

6.2.4 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 6.4.2.

A copy of all notifications of the proposed undertaking provided by the proponent to First Nation and Aboriginal communities is provided in Appendix E.

6.2.5 Public Information Centres (PICs)

In addition to direct correspondence, two (2) public information centres (PIC) were 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 PICs were held on May 31, 2011, and August 22, 2012, both at the Petawawa Civic Centre. Additionally, a Public Information Meeting (PIM) was held on May 5, 2011, at the Petawawa Quality Inn & Suites. The focus of this meeting was on the specific concerns raised by residents regarding the proposed project's potential impacts on recreational use and safety on the Petawawa River. The date and time for the PICs and the PIM was advertised in local publications and notification was sent either electronically or via post to participating members of stakeholder groups and government agencies well in advance of the scheduled date. Members of Xeneca staff as well as key discipline experts from the EA team were on hand to answer public questions and to address concerns related to the project. Attendees were asked to provide their 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 6.4.1.

6.3 GOVERNMENT AND AGENCY CONSULTATION

A record of agency consultation, including meeting minutes is presented in Appendix C.

A summary of agency consultation 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 15 (Identified Issues, Summary of Mitigation, and Potential Residual Effects). The table also identifies the proposed resolution to the issue. Additional measures required at the permitting or operation stage are outlined in Section 5 of this report.

6.3.1 Federal

It is important to remind the reader that the proponent initially approached the EA planning process with a view to presenting one harmonized environmental assessment report document to meet the requirements of both provincial and federal planning processes. Since the enactment of the CEAA 2012 a federal environmental assessment is no longer required for this project. Therefore, the information contained in the following section is based on the preliminary project approach and should therefore be considered in the light of the regulatory setting it was undertaken in despite the current requirements for EA planning. There is merit in recounting the entire planning process accurately so the entire federal consultation record has been included in order to provide a comprehensive account of the planning process. Additional consultation with federal regulators may be required subsequent to the release of this document and prior to authorizations or approvals required under applicable federal legislation.

6.3.1.1 Canadian Environmental Assessment Agency

The CEA Agency was provided with a project overview by Xeneca on July 12, 2010. The CEA Agency confirmed it would be acting at the FEAC for the proposed project. The 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 EC, DFO, HC, Indian and Northern Affairs Canada (now Aboriginal Affairs and Northern Development Canada), NRCan, and TC.

Canadian Environmental Assessment Agency staff met with the proponent on July 29, 2010. The purpose of the meeting was to outline for the proponent the federal and provincial environmental assessment processes and identify regulatory roles in each process. Also participating in the discussion were DFO, MNR and MOE. Meeting minutes are provided in Appendix C.

The Project Description was provided to the FEAC and each of the above referenced federal agencies in November 2011.

An EA Coordination meeting for the proposed project was held in Petawawa on January 18, 2011. The CEA Agency was in attendance via teleconference. The CEA Agency identified TC and DFO as Responsible Authorities (RAs).

The CEA Agency issued a Scoping Document for the proposed undertaking on March 2, 2011 to detail the information that would be required in the EA screening report to constitute the basis for the RAs to render a decision under Section 20 of the *Canadian Environmental Assessment Act.* The Scoping Document (a copy of which is provided in Appendix C) identifies a list of environmental components to be assessed for the proposed undertaking, including:

- Surface geology and soils
- Surface water quality and quantity
- Hydrogeology, groundwater quality and quantity
- Air quality and climate
- Fish and fish habitat
- Vegetation and wetlands
- Wildlife and wildlife habitat (including migratory birds)
- SAR
- Environmental changes resulting in effects on other environmental components

Included in the Scoping Document are requirements to clearly describe public and Aboriginal consultation, including the identification of any concerns raised during consultation with respect to traditional activities being practiced near the project site.

The proponent received an electronic notice from the CEA Agency on August 10, 2012, informing that the CEA Agency is no longer involved in any of the waterpower projects proposed by Xeneca subsequent to the enactment of *CEAA 2012*.

All correspondence received to date from the Canadian Environmental Assessment Agency is provided in Appendix C.

6.3.1.2 Fisheries and Oceans Canada

DFO staff participated in an early data collection teleconference scoping discussion with MNR and members of the EA project team on March 4, 2010. Participants identified field data collection requirements, noted Aboriginal consultation within projects proposed on traditional AOO land, and discussed fish passage requirements and information requirements. With respect to biological field data collection, Xeneca Consultant ORGM was briefed on all agency study requirements and subsequent scoping and work plans addressed each component which is

outlined in ER sections 2.9 and 7.1. Regarding Aboriginal Consultation, Xeneca informed the agencies that, at the request of the AOO, all consultation is to take place through their consultants Jp2g of Pembroke, Ontario. Xeneca has undertaken a robust outreach program that is respectful of the AOO's desire to receive information, meet and otherwise engage on the project. Details are available in ER Section 6.5.

DFO joined the Canadian Environmental Assessment Agency in an EA coordination meeting with the proponent and provincial ministries (i.e. MOE and MNR) representatives on July 29, 2010. The purpose of the meeting was to outline for the proponent the federal and provincial environmental assessment processes and identify regulatory roles in each process.

The DFO's role as a Responsible Authority (RA) under the *Fisheries Act* was confirmed at the EA Coordination meeting on January 18, 2011. DFO listed several key sections of the Fisheries Act that may require Authorizations, include fish passage, Harmful Alteration, Disruption or Destruction (HADD) of fish habitat, screening of intakes, destruction of fish, etc. Correspondence was issued to the proponent on October 5, 2010 detailing the project's possible impacts to fish and fish habitat that would require Authorizations under the legislation. DFO also confirmed that there exist no natural barriers to fish migration on the Petawawa River, and informed the proponent that fish passage should be maintained for American Eel, Lake Sturgeon, Northern Pike, and Walleye. Xeneca concurred with DFO, and, through its consultants at ORMG and with the inputs of various stakeholder groups and regulatory agencies, conducted relevant studies and research leading to the design of a state of the art weir system that will allow fish, eel and recreational kayak and canoe passage. Details on the design and relevant studies can be found in ER Section 3.3.

A letter was issued to the proponent on December 21, 2010 with more detailed information on the required Authorizations for the proposed project, informing the proponent that in most cases the issuance of a *Fisheries Act* authorization is conditional on developing habitat compensation and monitoring plans to ensure there will be no net loss in the productive capacity of fish habitat. Project specific information was requested by the DFO, a copy of the letter is provided in Appendix C. As a result of the Dec. 21, 2010 letter, Xeneca, through its consultants, undertook a rigorous, bathymetric, hydraulic and biological study of the affected reach of river and concluded that only minimal habitat is found to exit in that section. The majority of the affected reach is characterized by high flow velocities combined with bedrock channels and boulder fields that were determined to be unsuitable for spawning or significant foraging. No evidence of spawning was found to occurring with the affected reach, although small area of potential habitat including a riffle area and pool just above the confluence of the bypass and tailrace were identified. Xeneca's research concluded that, with minimum bypass flows of 4 m^3/s, adequate wetted perimeter and flow would be maintained to preserve ecological function (benthics) and allow fish passage through the bypass reach. A monitoring plan is also proposed to confirm study results and an adaptive management plan is in place to adjust to any change from what is

expected to be occurring within the reach during hydroelectric plant operations. Study results and conclusion can be found in Big Eddy Fish Passage Design Criteria Summary, 2013 (Annex III).

Correspondence was jointly issued to the proponent by DFO and TC on October 28, 2011 with respect to consultation with Aboriginal communities for all of Xeneca's proposed waterpower development projects. With respect to the Big Eddy GS project the proponent was advised that in addition to the AOO (including the Algonquins of Pikwàkanagàn), the Algonquin Anishinabeg Tribal Council, and the MNO should be included in the Aboriginal Consultation Plan. Information on consultation outreach by Xeneca is included in section 6.4.

In a letter dated July 12, 2012 the proponent was informed that federal environmental assessments for Xeneca's proposed waterpower projects are no longer required however stating that all other applicable legislative, regulatory, and constitutional requirements must still be fulfilled. Xeneca subsequently met with DFO representatives to better understand the process and was informed that greater detail on DFO engagement and process would be forthcoming. Xeneca and its consultants have relied on input from DFO as well as other agencies to ensure compliance with Federal regulatory requirements is occurring.

A meeting was held between DFO, MNR, Xeneca and the biological consultant for the Big Eddy GS project on July 26, 2012. The purpose of the meeting was to discuss provincial and federal regulatory matters in regards to the preliminary design, engineering and implications with the fish passageway for the proposed generating station. Attendees discussed draft passage design features, flows to maintain passage, the impacts of flow alterations to erosion and geomorphology downstream of project. Facility design with respect to fish impingement and entrainment and possible control measures were also discussed. The reintroduction of American Eel in the Ottawa River and how it may result in a recolonization of species in the Petawawa River was brought up, as was the requirement for the facility design to also address the prevention of eel entrainment and impingement. The continued management for sportfish and the waterway was identified in addition to the requirements under the *Endangered Species Act* and the *Species at Risk Act* (SARA). The proponent was told that the design would have to address attracting the fish to the passageway, and ensuring movement within the feature during key life cycles. Utilizing the expertise of DFO and other agencies as well as best practices identified through available research, the fishway was designed by professional engineers in consultation with aquatic biologists.

The proponent was reminded that flow requirements will also need to satisfy the *NWPA* and that any memorandum of understanding (MOU) between Xeneca and the kayaking community would be subject to DFO review prior to finalization. A follow up meeting to discuss fish passage was held on November 6, 2012. Transport Canada was subsequently provided with a copy of the proposed accommodations for the recreational kayaking and rafting (whitewater) community. Consultation with the whitewater community led to the development of a water sharing proposal. Input was also received from members of the Petawawa Stakeholder Advisory

Committee and presented to the recreational whitewater community. The water sharing proposal is contingent upon agreement with the regulatory agencies.

A representative from the DFO participated in a meeting on September 4, 2012 which included MNR, MOE, the proponent and members of the EA project team. This meeting included discussions on operations, ZOI, Aboriginal consultation, thermal impacts, hydraulic modeling, and fish passage. A review of the aquatic investigations completed in support of the undertaking was presented. The attendees sought confirmation that the project would operate as a run-of river facility, in accordance with the definition of run-of river provided in the Waterpower Class EA. Xeneca confirmed that inflow and outflow would be the same. Concerns with respect to the delineation of the downstream zone of influence were identified by the regulators. Xeneca provided extensive hydrological data and supporting ecological studies as well as geomorphology and temperature assessments that clearly demonstrate compliance with the OWA Class EA requirement to identify immediate and direct impacts of the project. It is also noteworthy that in order to address concerns raised by agency and public stakeholders, the project is now designed as run of river and that impacts do not extend past the tailrace of the project. The proponent was given a list of the data that would be required to support the rationale that the facility's DZOI would not extend beyond the tailrace. Xeneca has agreed to monitoring programs that confirm run of river operation and compliance with constraints on downstream zone of influence. DFO identified that the proponent would have to provide an acceptable rationale as to how the fish passageway design addresses all life cycle stages, and the interaction between both depth and velocity in the passageway. Xeneca, through its consultants, undertook a rigorous, bathymetric, hydraulic and biological study of the affected reach of river and concluded that only minimal habitat is found to exit in that section. The majority of the affected reach is characterized by high flow velocities combined with bedrock channels and boulder fields that were determined to be unsuitable for spawning or significant foraging and that fish passage is likely only occurring during high flow periods. Xeneca's research concluded that, with minimum bypass flows of 4 m^3/s, adequate wetted perimeter and flow would be maintained to preserve ecological function (benthics) and allow fish passage through the bypass reach. A monitoring plan is also proposed to confirm study results and an adaptive management plan is in place to adjust to any change from what is expected to be occurring within the reach during hydroelectric plant operations.

The proponent was asked to produce a map showing the project footprint over federal, provincial, and private lands. Additional discussion on fish passageway requirements followed and a request from regulators with respect to the provision of velocity data in key areas. Velocity, hydraulic and bathymetry data was provided to agencies leading to final design of fish way and eventual consensus on minimum bypass flows.

On November 6, 2012, the proponent and EA team held a meeting with the MNR, DFO and MOE to continue discussions on fish passage and ecological flow. During the meeting, it was

proposed that Xeneca should monitor temperature and rely on temperature triggers to determine the timeframe of walleye and sturgeon staging. DFO and MNR cautioned that there could be riffle spawning habitat near the end of the bypass reach, and that it would need to be provided with adequate flows during egg incubation; Xeneca considered the minimum wetted perimeter when assessing flow rates. DFO also noted a sand bar in the tailrace area, and that erosion of this sand bar is a concern; it was clearly noted by Xeneca that, although suitable habitat exists in the sandbar and riffle area, no evidence of spawning has been found after several years of study. Xeneca has also presented an assessment of the sand bar over the long term and provided mitigation plan if it was found the sandbar was being altered by plant operations. A preliminary discussion was held with regards to suitable approach velocities and trashrack spacings for preventing fish from being entrained in the turbine(s) or impinged against the trashracks. Additionally, Xeneca proposed the installation of an eel slide in the intake canal to allow for safe downstream passage for eel and other fish that approach the intake. Xeneca also proposed the use of light and sound deterrents at the entrance of the intake canal that can be activated during American Eel migration periods. The agencies present at the meeting requested that a habitat impact assessment be conducted, which would provide supplementary documentation and rationale demonstrating that a minimum flow of 4 m^3/s (as opposed to the MNR's previously-suggested 10 m^3/s) in the bypass reach would be adequate for maintaining the basic ecological functions of the reach. (An impact assessment report was prepared and issued to the agencies on March 18, 2013; a copy of the report is included in Annex III of this ER.)

In April 2013, DFO participated in an inter-agency review of an impact assessment report prepared by Xeneca to address the ecological flow and fish passage issues remaining to be discussed. DFO participated in a subsequent inter-agency teleconference call on May 13, 2013, at which time the minimum flow requirement of $4m^3/s$ was confirmed as accepted by regulatory agencies. Details of these meetings are provided under the Ministry of Natural Resources section.

Detailed engineering drawings will be required by the DFO before they can issue a determination under the *Fisheries Act*.

Meeting minutes and DFO correspondence are provided in Appendix C.

6.3.1.3 Transport Canada

Where there is a proposal for new works including dams, booms, and water crossings, the *Navigable Waters Protection Act* (*NWPA*) will be triggered. The *NWPA* prohibits the construction or placement of any "works" in, on, over, under, through or across navigable waters without first obtaining approval. On April 26, 2011, the Navigable Waters Protection division of TC discussed with the project team the requirement for an Approval under the *NWPA* before any works may take place. TC expressed interest in the Public Information Meeting scheduled for May 5, 2011, however that Navigable Waters Protection division were unable to

attend. The project team explained that due to the meeting being in the form of a poster information session, formal meeting minutes would not be recorded, but that a general summary of the event and the concerns expressed by the attendees could be prepared.

On October 28, 2011, in its role as a RA, TC issued the proponent a letter jointly with DFO, regards to Aboriginal consultation. TC noted that, in addition to the Aboriginal communities already listed in the proponent's Project Description, the Algonquin Anishinabeg Nation Tribal Council and the Algonquins of Pikwàkanagàn were also identified by the RAs as being potentially affected by the proposed Big Eddy GS; the proponent was advised to update the consultation plan to include these communities, this was completed. More information on consultation with these communities can be found in Section 6.5.

On October 29, 2012, in response to an inquiry on consultation efforts with local river users, Xeneca provided TC with the minutes from the September 13, 2012, meeting with local kayakers, as well as the proposed water sharing agreement sent to the Petawawa River Rats/Whitewater Ontario.

On February 14, 2013, TC informed Xeneca of the agency's interest in public concerns about the proposed project with regards to navigation, and how Xeneca intends to address these concerns. TC requested to be kept on the contact list in order to obtain information pertinent to their review of the file. In a May 8, 2013 teleconference call between Xeneca and TC, a preliminary discussion was held with regards to navigational use of the Petawawa River in the project area. Xeneca provided a general description of the proposed structures associated with the Big Eddy GS and the consultation efforts with the whitewater community to date. During the call, it was agreed that TC would be included in future multi-agency discussions with regards to the project, and would be provided with all updated documentation (conceptual design, operating plan, etc.) as each became available.

6.3.1.4 Environment Canada

At the January 18, 2011 EA coordination meeting, EC noted their advisory role and interest in terms of water quality (particularly information on methyl mercury), migratory birds, *SARA,* toxics, air quality, and climate change.

The results of the 2010 preliminary surface water quality investigation (Annex IV) were provided to EC on March 14, 2011. EC was also informed of the proponent's timeline for releasing additional supporting documentation, including reports that would encompass hydrology, operations, existing conditions and archaeology. EC reviewed and provided their comments on the report on April 26, 2011 (see Appendix C). In particular, EC offered guidance on the geographical scope of the proposed investigations, the parameters to be measured, and the results to be reported to EC and other regulators.

6.3.1.5 Natural Resources Canada

NRCan participated in the January 18, 2011 EA coordination meeting, the details of which are provided in Appendix C. During this meeting, NRCan identified the agency's ability to provide expert advice on a needed basis.

Electronic correspondence was received from NRCan on August 13, 2012, confirming that NRCan is no longer involved in the undertaking as a result of *CEAA 2012* coming into force.

6.3.1.6 Health Canada

HC was involved in the January 18, 2011 EA coordination meeting, discussion was held concerning the provision of advice on an as-needed basis.

6.3.1.7 Department of National Defence

DND owns land on the north shore of the river both upstream and downstream of the proposed Big Eddy GS project site. On January 12, 2010, the proponent delivered a presentation to CFB Petawawa, briefing Base Command on its proposed waterpower developments on the Petawawa River and the work done with base staff to date. (at the time of the meeting, Big Eddy GS was one of two proposed projects on the river and discussion with the Base on both Big Eddy and Half Mile began in 2007-08). A copy of the January 12, 2010 presentation slides are provided in Appendix C of this report.

CFB Petawawa was provided with a copy of the Stage 1 archaeological assessment report on January 30, 2012.

In the fall of 2012, Woodland Heritage services contacted the DND regarding Stage 2 Archaeological work to be performed on DND lands. The Draft Stage 2 Archaeological report was submitted to the MTCS in February 2013, and has not yet been accepted by MTCS.

DND will review the draft environmental report and determine if federal assessment requirements have been met.

6.3.2 Provincial

Various provincial ministries were provided with a NOC, a revised NOC and the Project Description document. A record of provincial agency consultation is provided in Appendix C.

The following is a synopsis of the consultation undertaken with provincial regulators.

6.3.2.1 Ontario Ministry of Natural Resources

The MNR has a mandate to manage natural resources and to promote renewable energy in the province and has a legislative role in this project with respect to natural heritage, water management planning, and the management of Crown land.

Meetings were held between members of the EA team and the MNR to refine field study work plans and investigation protocols, and confirm reporting requirements. Discussions towards reaching consensus were initiated and will continue beyond the report submission stage for permitting purposes.

The proponent has been working with MNR since February 2009, when a Pre-Screening Meeting was held for the Big Eddy site. The proponent's notification and consultation with the MNR includes the provision of early notification of the project, requests for background/baseline information on natural heritage information and data in the vicinity of the project site, scoping consultation, and application for scientific permits and approvals to complete natural habitat and geotechnical investigations.

MNR staff participated in an early data collection teleconference scoping discussion with members of the EA project team on March 4, 2010. MNR identified field data collection requirements, noted the Aboriginal consultation protocol within projects proposed on traditional AOO land, and discussed fish passage requirements, the American Eel recovery strategy and, project design and information requirements.

On April 23, 2010, members of the EA project team met with MNR biologists to discuss natural habitat assessment requirements in advance of the upcoming field season based on available information and confirmed SAR in the proposed project area. The requirement to maintain existing fish passage for Lake Sturgeon and American Eel was discussed.

The MNR participated in the January 18, 2011 EA coordination meeting, details of which are provided in Appendix C. During this meeting, some of the discussion generated by MNR staff included:

- Consultation protocol for two proposed Xeneca undertakings within the land claim presently being negotiated by AOO and the provincial and federal governments;
- Changes to the thermal regime in the Petawawa River in the vicinity of the proposed projects;
- Discussion on the proposed facility design;
- Effects of riparian rights and the requirement to obtain all land ownership agreements from all impacted property owners;
- Disagreement over the classification of the waterway as 'managed' or 'unmanaged';

- Requirements under the *Endangered Species Act* (*ESA*);
- Recommendations on data collection and public consultation;
- Expectations for permitting requirements for Final ER.

MNR participated in a July 26, 2012 meeting was to discuss the preliminary design, engineering and implications with the fish passageway for the proposed generating station. Attendees discussed draft passage design features, flows to maintain passage, the impacts of flow alterations to erosion and geomorphology downstream of project. Facility design with respect to fish impingement and entrainment and possible control measures were discussed. The reintroduction of American Eel in the Ottawa River and how it may result in a recolonization of species in the Petawawa River was discussed as was the requirement for the facility design to also address the prevention of eel entrainment and impingement. The continued management for sportfish and the waterway was identified in addition to the requirements under the *ESA* and the *SARA*. MNR requested an updated Operating Plan to incorporate some of the meeting discussion on possible mitigation measures to prevent fish injury. MNR staff identified concerns for impacts to the waterway geomorphology, erosion downstream of the tailrace, and increased sediment loading as a result of the project. During 2011 and 2012, Xeneca and high levels of personnel from the MNR, the MOE and, to a limited extent, the DFO, engaged in a series of meetings to determine a reasonable and efficient approach to engaging the review agencies at the regional and district levels. It was hoped that consistency in requirements and review across agency districts could be achieved, such that provincial environmental planning requirements for the Waterpower Class EA process are met within reasonable timeframes, thereby assisting Xeneca in meeting their FIT contract schedule. In 2012, meetings were held on February 8, March 13, April 16, May 4 and June 8. These efforts resulted in a mutually agreed upon approach for the development planning and approval process.

MNR was present during the November 6, 2012 meeting with Xeneca, the EA team, and DFO to discuss ecological flow and fish passage. Among the topics of discussion were mitigation strategies for providing safe downstream passage for American Eel; Xeneca proposed the use of light and sound deterrents to prevent eel and fish from entering the intake canal; the installation of an eel slide in the intake canal was also proposed to allow for safe downstream passage of eel who nonetheless enter the canal. DFO and MNR noted that there is an important riffle spawning habitat near the end of the bypass reach, and that it would need to be provided with adequate flows during egg incubation; Xeneca was therefore to consider the minimum wetted perimeter when assessing flow rates. The agencies present at the meeting requested that a habitat impact assessment be conducted, which would provide supplementary documentation and rationale demonstrating that a minimum flow of 4 m^3/s in the bypass reach would be adequate for maintaining the basic ecological functions of the reach. (An impact assessment report was prepared and issued to the agencies on March 18, 2013; a copy of the report is included in Annex III of this ER. HEC-RAS modeling used to rationalize the 4 m^3/s are

summarized in reports in Annex I of this ER). See also Section 6.3.1.2 for issues raised by the DFO during the meeting.

On April 16, 2013, following their review of the March 18, 2013 impact assessment report for the bypass reach, the MNR (on behalf of the MNR-MOE-DFO agency review team) stated that the use of a minimum flow of 4 m^3/s has not yet been rationalized in a satisfactory manner. A follow-up meeting to discuss the report and the agencies' recommendations was planned for mid-May 2013.

On May 15, 2013, an inter-agency teleconference was held to clarify the ministries' tri-lateral decision to support 4 m^3/s as a minimum bypass flow. This flow was agreed upon by all regulatory agencies (MNR, MOE and DFO) based on additional information provided by Xeneca in the bypass reach impact assessment and supplementary operating plan. Xeneca committed to development of a detailed fisheries compensation and monitoring plan during the permitting and approval phase, post EA. This would include installation of a flow monitoring device downstream of the Big Eddy GS tailrace, as part of Xeneca's reporting and compliance efforts, with the caveat that Xeneca provide more detail on ramping rates, turbine choice, and how project design will provide the flexibility required for achieving run of river flows and any future modifications to ramping.

Xeneca committed to identifying potential sturgeon spawning locations in the bypass reach and ensuring that flows would be adequate in these areas to maintain egg incubation and hatching. Impacts on kayakers and swimmers at the Catwalk would also need to be adequately addressed, through flexible plant design. Tailrace flows, alignment, direction and vectors were discussed with respect to the requirement to ensure the sandbar feature in the tailrace area would be maintained through normal operations. Potential flow differentials downstream of the tailrace were discussed and Xeneca agreed to consider the need for more three dimensional modelling to address the perceived downstream zone of influence issue. With respect to recreational flows, the intent to reach a water sharing agreement that would accommodate recreational needs with kayakers was discussed.

DFO and MNR suggested that the lower section of bypass reach ("Rich's Riffle" section of Railroad Rapids) may be suitable for sturgeon spawning. Xeneca noted that the velocities are somewhat fast and the depths somewhat shallow for sturgeon spawning. Xeneca also noted that no sturgeon spawning or walleye spawning has been confirmed at this location through the biological studies or anecdotally. However, Xeneca committed to ensuring that flows would be provided to maintain egg incubation and hatching if sturgeon spawning is observed in the bypass reach going forward.

ESA permitting requirements were discussed with emphasis placed on ensuring adequate time is afforded for regulatory review of the forms required for submission.

Copies of meeting minutes are provided in Appendix C.

6.3.2.2 Ontario Ministry of the Environment

A project overview and draft NOC was provided to the MOE in July 2010, with subsequent revisions issued on November 13th and December 24th, 2010.

The MOE participated in the January 18th, 2011 EA coordination meeting, details of which are provided in Appendix C. During this meeting, the MOE discussed the following topics:

- Examination of consultation in the case of Part II Order requests
- Shoreline inundation and surface water quality
- Interest in flow regime changes
- Discussion of categorization of waterway under Class EA

A representative from MOE was in attendance at the September 4, 2012 meeting. In addition to the meeting information detailed in the MNR section above (6.3.2.1), MOE stated that flow provision to the kayaking community must also be acceptable under all permits, including the Permit to Take Water. MOE noted that the presently proposed minimum flow seem uncharacteristically low. MOE confirmed that all pertinent hydraulic and hydrology information for the undertaking would be reviewed by MOE staff.

Xeneca outlined its current approach to line and road assessment work in a teleconference held with MOE staff on April 3, 2013, which includes detailed desktop analysis, followed by fieldwork scheduled for the spring of 2013. Woodland Heritage Services was retained to complete Stage 1 and 2 archaeological studies for the lines and roads and is expected to provide their report by the end of June 2013. MOE indicated their acceptance of the robust approach being completed and flagged the requirement for MNR to participate in future meetings related to ensuring that all regulatory requirements under the *Lakes and Rivers Improvement Act* are met.

The MOE participated in the inter-agency teleconference held on May 15, 2013, and confirmed their acceptance of the minimum flow requirements discussed in the MNR section (6.3.2.1).

Over the course of the project, the MOE has received correspondence from concerned stakeholders in relation to the proposed Big Eddy GS. The MOE explained the Waterpower Class EA process to these interested parties, and directed the parties and their concerns to the proponent in order for those concerns to be resolved through the EA public consultation process.

6.3.2.3 Ontario Ministry for Municipal Affairs and Housing

The Ontario Ministry for Municipal Affairs and Housing was provided with a notification of the project. A response has not been received from this Ministry to date.

6.3.2.4 Ontario Ministry of Energy

On June 22, 2010, Xeneca issued a letter of introduction to the ME, informing the ME of its proposed waterpower projects, including the proposed Big Eddy GS. In this letter, Xeneca also requested information on any known issues that may arise as a result of the proposals, and whether the ME intended to comment on any of the projects.

Aside from the issuance of the letter of introduction, no further consultation with the ME occurred.

6.3.2.5 Ontario Ministry of Transportation

At the January 18, 2011 EA coordination meeting, the MTO identified a bridge located at Paquette Road and Highway 17 upstream of the proposed Big Eddy GS, and asked whether it would be affected by the proposed inundation area. Xeneca replied that the localized inundation area of the Big Eddy GS project would not reach that bridge.

No further discussions with the MTO have taken place since the EA coordination meeting.

6.3.2.6 Ontario Ministry of Tourism, Culture and Sport

In a June 10, 2010 letter to the MTCS (previously known as the Ministry of Tourism and Culture), Xeneca notified the MTCS of its various proposed waterpower projects, including the Big Eddy GS, and invited comment and participation as applicable. The MTCS replied on June 24, 2010, informing Xeneca that the file was forwarded to the MTCS' Tourism Industry Advisor for his review.

The Draft Stage 2 Archaeological report was submitted to the MTCS in February 2013, and has not yet been accepted by MTCS.

6.3.2.7 Ontario Ministry of Northern Development and Mines

In correspondence dated January 6, 2011, the MNDM (formerly Ministry of Northern Development, Mines and Forestry) provided a response to the review of Xeneca's project proposals. MNDM suggested that Xeneca should consult with any SFL holders affected by both the project site and access roads. In addition, MNDM stated that there were no mine hazards, mining claims, or withdrawals in place for the proposed Big Eddy GS project site.

Shortly after, it was confirmed that there are no SFL holders associated with the project site as the project site is located within the Town of Petawawa.

6.3.2.8 Ontario Parks

As the Petawawa River is connected to Algonquin Park waterways, a representative from Algonquin Park was present at the January 18, 2011 coordination meeting. At this meeting, it was noted that both Lake Sturgeon and American Eel have been recorded in Algonquin Park and that fish passage would be necessary. Ontario Parks also confirmed an Aboriginal fishery for personal consumption within the Park.

6.3.2.9 Ontario Ministry of Aboriginal Affairs

On June 10, 2010, Xeneca issued a letter and information package to the MAA, introducing its proposed waterpower projects, including the proposed Big Eddy GS. Xeneca requested the MAA provide a list of Aboriginal communities whom the Crown identifies as requiring consultation support for the EA phase of development.

On August 10, 2011, the MAA advised the proponent of Aboriginal communities who may have an interest and/or concerns with the proposed Big Eddy GS, and provided contact information to the Algonquins Consultation Office, the Ottawa Region Métis Council, and the MNO. The MAA also provided the proponent with contacts at Indian and Northern Affairs Canada (now Aboriginal Affairs and Northern Development Canada), whom the proponent can consult for investigating possible land claims in the area.

6.3.3 Municipal

The Council of the Town of Petawawa were informed of the proposed Big Eddy GS since at least 2007. In a letter dated March 6, 2007, the Council stated that they agreed with the project in principle.

On May 3, 2010, the proponent delivered a presentation to the Town of Petawawa introducing its proposed developments on the Petawawa River and their anticipated benefits for the town (at the time of the meeting, the Big Eddy GS was one of two proposed developments on the river. In this meeting, the proponent requested the town's input and support.

On June 16, 2010, Xeneca informed the mayor of Petawawa that the Waterpower Class EA planning process would soon be initiated

In a June 18, 2010 letter, the mayor stated that there was increasing concern among residents about the potential negative impacts of the proposed Big Eddy GS project, and noted the importance of the Petawawa River for recreation and the value of the river to the townspeople. In the letter, the mayor presented the Council's recommendations for Xeneca to consider in planning the proposed project, such as ensuring public safety and continued recreational

enjoyment of the river, and minimizing changes to the natural flow regime of the river. The mayor reiterated that the Town has been quite vocal in their desire not to see any dam or changes to the river.

Xeneca responded to the above letter on July 6, 2010, assuring the mayor that the public's concerns would be given due consideration during the Waterpower Class EA process. In response to the Council's recommendations, Xeneca stated their commitment to ensuring public safety, and clarified that the river would never run dry as a result of operations. Specific flow allocation to the river would be confirmed during the development of the Dam Operating Plan, and that the Town's concerns and recommendations will be taken into consideration during the Waterpower Class EA and the development of the plan.

On December 1, 2010, electronic access to the Project Description for the proposed Big Eddy GS was provided to the following municipalities:

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

After receiving an invitation to attend the EA coordination meeting, the County of Renfrew confirmed in an email on January 13, 2011, that it will be monitoring the progress of the proposed undertaking. The County noted that permits and approvals would be required for access to Paquette Road, as it is a County road, and that the County also maintains a bridge downstream of the proposed project site, on Petawawa Boulevard. Additionally, two sites were being explored for the potential construction of a new bridge crossing the Petawawa River, one of which was in the general vicinity of the proposed Big Eddy GS project site. The County also expressed interest in the project as it relates to economic development and tourism. A representative of the County of Renfrew attended the EA coordination meeting, held on January 18, 2011.

At the EA Coordination meeting on January 18, 2011, the Town of Petawawa informed the proponent that public gatherings in Petawawa had resulted in a presentation to the council outlining concerns of public safety, access, and ecological integrity and public objection to the proposed project. The Town of Petawawa was informed that these concerns would be addressed through upcoming consultation, and that the proposed project would adhere to BMPs and the public safety requirements outlined under the *NWPA*. When asked by the Town of Petawawa about water levels, the proponent clarified that the proposed Big Eddy GS would be operated as a run-of-river facility with no peaking. On March 17, 2011, Xeneca responded to an earlier correspondence (February 15, 2011) from the Mayor, regarding public concern about the project. Xeneca noted they were fully prepared to commit that the proposed Big Eddy GS would operate

as a run-of-river facility, and would not impact recreational activities in the river downstream of the facility's tailrace, including the Catwalk swimming area. Xeneca expressed their willingness to commit in writing that the annual Hell or High Water kayaking event would not be impacted by facility operations, and noted that the water control structure would not present an increased hazard to the community.

Xeneca made a presentation to the Town Council on August 7, 2012, to provide the council with an overview of the proposed Big Eddy GS project and the revisions that were made to earlier project plans in response to public concerns. A summary of biological field studies and survey results to date were also presented. An additional meeting was held with the Town Council on May 8, 2013, the purpose of which was to update the council on the EA and discussions with kayakers, and to discuss how Xeneca can work with the Town.

6.4 PUBLIC CONSULTATION

This section contains a chronological summary of the correspondence and meetings between Xeneca and public stakeholders throughout the course of project design to date. In order to maintain an accurate record of the consultation process, any resolutions that were provided at a later date were not added to the text of this section, and can instead be found in Section 7 (Evaluation of Potential Project Effects) and Table 15 (Identified Issues, Summary of Mitigation, and Potential Residual Effects).

Public consultation was undertaken by the proponent in the form of PICs, PIMs, newsletters, and correspondence via mail and email. The PICs were advertised in local publications at least ten days prior to the event; copies of the advertising undertaken in support of the PICs are provided in Appendix D. Xeneca's public consultation strategy and a record of consultation and correspondence compiled by the proponent are also provided in Appendix D.

Members of the public, including interest groups, local residents, and other stakeholders were added to the public mailing list upon request and sent project information by Xeneca. Stakeholders that have been involved with consultation include, but are not limited to the following:

- Community Alliance to Save the Petawawa (CASP)
- Scouts Canada
- Portage B&B
- Ottawa Riverkeeper
- Riparian landowners
- Pembroke Realty Ltd.
- Black Bay Ratepayers Association (BBRA)

- K. E. Groover Associates
- Binkey Farms
- Algonquin College
- Les amis de la rivière
- CFB Petawawa
- Jerico Inc.
- Deep River Science Academy
- Muldoons Tree Service
- Brookfield Renewable Power Inc.
- Ottawa Valley Tourist Association
- Pembroke Outdoor Sportman's Club (POSC)
- Ontario Federation of Snowmobile Clubs
- Ontario Rivers Alliance
- H & H Aggregates
- Infrastructure, Health and Safety Association
- Ontario Federation of Anglers and Hunters (OFAH)
- Ottawa Valley Tourist Association
- Petawawa Stakeholder Advisory Committee (PSAC)Whitewater Ontario
- Various individual members of the community
- Whitewater paddling interest groups (listed in Section 6.4.4)
- Algonquin Engineering Society

A detailed list of those who have contacted the proponent with respect to this undertaking is provided in the Consultation Log in Appendix D.

The proposed Big Eddy GS has drawn significant public interest within the community of Petawawa and beyond. Key concerns identified through the public consultation initiative include those associated with access, changes to the river's flow regime, navigation, recreational use and public safety. Concerns raised by the paddling community comprise a large portion of the public consultation associated with this project and are presented separately in Section 6.4.4.

One frequently raised issue during consultation was the request for details on proposed ecological (compensatory) flows associated with the undertaking. Since a consensus with various

regulatory bodies on the amount of flow that is required to sustain the ecological health of the Petawawa River system was only recently reached, Xeneca was unable to address this request. The approved ecological flows associated with the undertaking were determined to be 4 m^3/s. A detailed discussion on compensatory flow is provided in Section 5.6.

Another common inquiry raised to the proponent was with respect to the design of the project. This development of the design for the proposed Big Eddy GS has been ongoing, and has changed in response to public input. However, the proponent presented the most current information on the design in response to these design inquiries whenever possible. This report presents the most current conceptual design as discussed in Section 3 and in Annex II.

The concerns raised throughout the consultation process are summarized below. Specific issues and proposed mitigation measures are presented in Table 15.

6.4.1 Public Information Centres

A PIC was originally scheduled for November 16, 2010 at the Quality Inn & Suites in Petawawa, but was later rescheduled, in order to address agency comments and develop further information for the project before being presented.

Public Information Meeting – May 5th, 2011

The first PIM for the project was held on May 5, 2011 at the Petawawa Quality Inn & Suites. Attendance was estimated to be approximately 140-150. Representatives from various regulatory agencies/ministries/departments were in attendance at the PIM.

The open house meetings were held to introduce the proponent and various members of the EA team to the community, and present information on the project available at the time. Concerns raised by attendees included:

- ecological impacts
- effects of project to Petawawa River SAR and fish passage
- effects on angling
- public health and safety, with recreational swimming at the Catwalk in particular
- concern with respect to safety
- recreational use and access
- impacts on tourism
- long-term financial benefits
- long-term job creation

- erosion and sedimentation
- effects of changes in the water regime to ice levels, ice safety on Black Bay for ice fishing and snowmobiling
- noise pollution during construction and dam operation
- riparian rights
- effects on the whitewater paddling season
- how project will affect septic beds downstream
- aesthetic impacts
- effects on the historic value of the river
- danger of debris build up on the river
- safety in the case of flooding
- health impact of water borne bacteria on swimming and drinking
- facility decommissioning
- concerns with the limited formal public review period

Public Information Centre – May 31st, 2011

A PIC was later held at the Petawawa Civic Centre in Petawawa on May 31, 2011 with similar attendance. The May 31, 2011 PIC featured a proposed 'play wave' wave' (a whitewater feature that can occur naturally or that can be man-made; such features allow recreationalists to surf watercrafts on the wave) design for the Big Eddy GS weir which the proponent was affording consideration to as a measure to accommodate recreational paddling use. The play wave design was subsequently rejected by Xeneca in favour of an alternate weir design in order to address safety concerns. During this PIC, an Algonquin Elder raised concerns with proponent regarding how the project would affect American Eel. The Elder expressed concerns not only for this SAR but for other aquatic species and the waterway itself. This Elder later met with the project biologist to share his knowledge of the waterway, and the area flora and fauna. A Petawawa community member present at the PIC also confirmed a recreational occurrence where some individuals body surf through the rapids when water levels are elevated.

Public Information Centre – August 22nd, 2012

Xeneca held another PIC on August 22, 2012 at the Petawawa Civic Centre with approximately 80 attendees present. Representatives from various regulatory agencies/ministries/departments were in attendance at the event. Some attendees expressed support for the project; however, a large group of individuals reiterated concerns they raised at the previous PIC and public meeting, with regards to potential impacts to aquatic and terrestrial habitats, aesthetics, recreational use,

public access and public safety. Many inquiries were made regarding the compensatory flow to be passed into the bypass reach; it was explained at the meeting that compensatory flows would be determined in consultation with regulatory agencies.

6.4.2 Other Meetings

On August 30, 2009, the proponent delivered a presentation to the Black Bay Ratepayers Association at the Annual General Meeting introducing its proposed waterpower developments on the Petawawa River (Big Eddy GS and Half Mile GS). At this meeting, the proponent described the initial project concept and took note of any concerns regarding the proposed Big Eddy GS.

In a presentation on May 4, 2011, Xeneca introduced the proposed project to the Upper Ottawa Valley Chamber of Commerce. Additionally, the presentation included a summary of the anticipated recreational and economic benefits of the proposed project, and a request for input on current recreational use of the river.

On April 15, 2011, the proponent met with the OFAH and presented its various proposed waterpower developments, including the proposed Big Eddy GS. In this meeting, the proponent outlined the process for the development of waterpower projects in the province, and explained the conceptual design of the proposed Big Eddy GS project, the public consultation process, and some preliminary solutions to issues such as impacts to fish passage and recreational use.

On November 1, 2012, Xeneca met with the OFAH. Following this meeting, Xeneca sent a letter to the OFAH providing the Operating Plans for the Big Eddy GS.

6.4.3 Consultation with the Community Alliance to Save the Petawawa (CASP)

CASP has been an active stakeholder in the proposed Big Eddy GS project. CASP also represents the interests of the BBRA. CASP states its purpose as "the united voice of all those who seek to protect the amenity and safe accessibility of the Petawawa River against the threat of aesthetic, environmental, and recreational degradation arising from the proposed hydroelectric dams" (CASP, 2011).

On February 3, 2011, preceding the formal organization of CASP, Mr. Hepburn sent a list of concerns about the proposed Big Eddy GS project to Xeneca. This list included questions about project design and schedule, river classification, safety requirements, operations and flows, failure frequency, fish passage, inundation, and navigation.

On February 22, 2011, CASP formally sent a letter to Xeneca to reiterate concerns about river classification, safety requirements, and navigation. This letter also outlined CASP inquiries concerning the consultation process, the project description, baseline information, SAR, aesthetics, and erosion.

In an April 20, 2011 letter to Xeneca, CASP stated that the planned format for upcoming PICs was not adequate for the number of attendees or the level of interest in the project, and should be revisited.

On September 15, 2011, CASP provided Xeneca with a letter outlining an update to their original concerns with the proposed Big Eddy GS from previous correspondence, based on developments since the initiation of the project. CASP's concerns as they related directly to the project were for public safety, impacts on aquatic species, impacts on recreational use, and impacts on aesthetics. Further concerns involved the Public Consultation process.

On November 15, 2012, Xeneca responded to CASP with a letter providing reassurance that safety would be addressed in regulatory review under LRIA and that access to the river would not be restricted, as only man-made structures would be fenced off. This letter also included a discussion of the most updated information available in terms of flows, design, and operations. Much of this information discussed was in relation to project components that were still under development at that time; current information was shared but it should be noted that some design aspects have since changed.

On January 6, 2013, CASP responded to the proponent's November 15, 2012 correspondence. This letter outlined concerns with regards to the weir design, safety, flows and levels, fish passage, navigability, aesthetics, ZOI, and operations. The proponent responded to this letter on January 29, 2013, directing CASP to the answers previously posted on Xeneca's website, and informing the stakeholder group that further detail in response to several questions would be available in the ER for the project upon its release. CASP replied asking when the numbers for compensatory flow would be available to the public for review and requesting an electronic copy of the ER with searching enabled upon its completion. The proponent replied confirming that the electronic ER would be available on Xeneca's website and could also be sent on CD upon request. CASP requested a CD copy of the report.

On April 12, 2013, Xeneca provided a detailed response to an earlier concern of CASP regarding a hypothetical malfunction of the plant control system. Xeneca outlined the sequence of events that would need to occur for such a malfunction to be triggered, and provided their rationale for concluding that the likelihood of it occurring is extremely remote (letter in Appendix D).

6.4.4 Navigation Concerns from the Whitewater Community

The project's location within a locally, regionally and nationally recognized whitewater feature has gathered interest from the following groups:

- Paddle Canada
- Whitewater Ontario (WO)
- Petawawa River Rats (PRR)

- Esprit Rafting Adventures
- Guelph Kayak Club
- Northern Ontario Paddling Explorers
- Madawaska Kanu Centre
- Ottawa River Runners
- Temagami Outfitters
- Western Kayak Club
- Carleton University Kayak Club
- Hell or High Water
- Mohawk Canoes
- Paddlefoot Natural Adventures
- Kawartha Whitewater Paddlers
- Individuals within the whitewater community

The issues raised by the whitewater community relate largely to the availability of flows for continued use of the Railroad Rapids as a valued whitewater paddling feature. The whitewater community is concerned that the proposed Big Eddy GS will substantially alter the flows of the Petawawa River, and that the resulting flows will negatively impact paddling and whitewater activities. The effects identified by the paddling community include decreased enjoyment of the waterway, interruption to navigation, damage to equipment, the loss of a highlight feature (Railroad Rapids) and the loss of naturally occurring water level fluctuations. Some local paddlers expressed concern that reduced access on this nearby paddling feature will reduce their ability to access the sport entirely.

Since the initiation of the proposed Big Eddy GS project, design has changed from a modified peaking facility to a true run-of-river dam. This has eliminated the impact of the project on flows downstream of the tailrace/bypass confluence; any rapids downstream of the tailrace/bypass confluence will be unaffected.

In a May 5, 2010, letter to the mayor of the Town of Petawawa, PSAC member Joe Kowalski and Operators of Wilderness Adventures whitewater tourism operator provided comments on the proposed Big Eddy GS project, as it was presented to the committee in a May 3, 2010, meeting with the proponent. In the report it was noted that, while the proposed Big Eddy GS project will introduce a new source of income to the town, it risks negatively impacting recreational paddling and the quality of life. They recommended that the town council stress the importance for the proponent to develop a plan that does not create hazards in the river or

negatively impact paddlers' recreational enjoyment of the river. Early stakeholder information has allowed Xeneca to consider impacts on whitewater navigation from early on in the project.

On November 9, 2010, Xeneca provided a letter to Whitewater Ontario with information about the proposed project. Whitewater Ontario responded on January 27, 2011, and expressed interest in setting up a conference call with Xeneca and in attending any PICs.

On February 26, 2011, the Petawawa River Rats Kayak Club contacted Xeneca with an e-mail outlining the club's use of the Petawawa River "Town Section" and the club's concerns about the project in relation to navigability, design, flow, safety, consultation, and access.

In an e-mail dated February 28, 2011, the owner/operator of Esprit Rafting Adventures expressed doubt that a commercial rafting operation and the proposed Big Eddy GS could co-exist, due to the effects of a barrier on the Petawawa River on raft navigation, the impact of losing a highlight feature on Esprit's business, and the environmental impacts on the river corridor.

In response to these concerns, Xeneca outlined that the proposed project is run-of-river that a water control structure is being designed to control passage, and that water flow should not be affected during Esprit's operating season because of required flow rates for the spawning season.

On March 29, 2011, Xeneca made a presentation on the proposed Big Eddy GS project to the Petawawa River Rats, Hell or Highwater, and Paddle Ontario. During this preliminary presentation, Xeneca explained the site choice process and the working conceptual layout for the project that was in use at the time of the meeting. The presentation noted that as a run-of-river project, the flow upstream of the control structure and downstream of the tailrace would be equal at all times.

The Ottawa Valley Tourism Association (OVTA) contacted Xeneca on April 20, 2011 in order to express the importance of the Petawawa River in relation to the Ottawa Valley's reputation as the Whitewater Capital of Canada. The OTVA expressed that the Petawawa River's whitewater is a factor in drawing kayaking enthusiasts to the region, and requested that a Socio-Economic Impact Study be included. A reply was sent on September 9, 2011, explaining that Xeneca has been working with the local paddling community extensively, and that the public consultation required for the Waterpower Class EA addresses socio-economic issues. Xeneca offered to provide the OVTA with a private project briefing in Petawawa/Pembroke in the future.

In early May 2011, Xeneca met with Whitewater Ontario and the Petawawa River Rats to discuss waterway usage by the paddling community, seasonal flows, navigational flows, and potential designs such as a weir with a play wave, a bypass, and on-demand releases. Attending stakeholders estimated that there are approximately 5,000 person trips down the river annually and noted that 25 m^3/s is the lowest flow for whitewater navigation. It was suggested the "play wave" design option include a passage around the wave. The information exchanged at this

meeting allowed Xeneca to move forward with a greater knowledge of the river's recreational use.

On May 20, 2011, Whitewater Ontario sent a letter to the proponent identifying their concern that low flows would render sections of the river unnavigable. The letter also inquired about safety in terms of flow fluctuations, and public access. The president of the organization offered to assist Xeneca in engaging members of Whitewater Ontario to resolve these issues. Xeneca acknowledged the receipt of this letter on May 24, 2011.

In May 2011, Xeneca engaged in a second meeting with whitewater interest groups to resume previous discussions. Additional design options were put forward, as were potential commitments to flow levels and compensation for commercial users. The river usage survey data was discussed with respect to where the cameras had been installed. Those in attendance reiterated their interest in obtaining information on flow levels and design details. During the May 31, 2011 PIC, a proponent team member discussed commercial river usage with the Esprit Rafting manager, pertaining to both raft trips and Swiftwater Rescue Training courses. Intermediate level paddlers expressed concern that the existing natural features used to bypass the more difficult sections of the rapid would be altered by the project, and no longer available to them.

On December 3, 2011, Whitewater Ontario sent a follow-up letter to the aforementioned May 20th correspondence. Xeneca replied to Whitewater Ontario on January 25, 2012. In this letter, Xeneca replied to concerns about water quality studies, public consultation, navigability, public safety, and access.

On January 27, 2013, Xeneca presented to Whitewater Ontario and the Petawawa River Rats with a second draft MOU, outlining the terms and conditions of the proposed water sharing plan. The second MOU addressed concerns over the number of water sharing hours, providing for increases based on demonstrated use and providing shorter use windows. Despite the concessions offered by Xeneca, Whitewater Ontario and the Petawawa River Rats responded on February 27, 2013, stating that they were not prepared to enter into the MOU presented in the January 27, 2013 draft, as it did not meet the needs of the whitewater paddling community. Xeneca informed Whitewater Ontario and the River Rats that they would move forward with the EA planning process without the MOU, but that the following commitments are still being offered pending approval by regulatory agencies:

- The weir will be designed to be safely navigated by paddlers;
- The spring freshet flows between the proposed Big Eddy GS and Railroad Rapids will be shared;
- Unrestricted daytime flows will be provided for the annual, two-day Hell or High Water event;

- 100 hours per year of "on demand" flows will be provided when requested by users through an online registration system to be developed by Xeneca; and
- Minimum flows will be provided in Railroad Rapids in order to maintain the ecological function of the bypass reach.

Whitewater Ontario and the Petawawa River Rats responded on March 27, 2013, in which they noted several of their concerns surrounding the proposed project, the MOU and the river usage study conducted by Xeneca. Both groups expressed concern over the methodology used in the river usage study, and that the actual river usage may have been underestimated. Unfortunately, aside from Xeneca's study, the only other information available is anecdotal observation. Also in dispute was Xeneca's assertion that optimal flows for paddling in the bypass reach would be available for a large proportion of time under normal operating conditions; WO and the PRR maintained that under Xeneca's proposed normal operations, optimal flows would only occur for a few days each year. Additionally, neither Whitewater Ontario nor the Petawawa River Rats believed that the proposed 100 hours of 'on demand' releases would meet the needs of whitewater paddlers. Whitewater Ontario maintained its opposition to the proposed Big Eddy GS project.

6.4.5 Form Letter

Throughout 2011, a form letter containing a series of 17 questions was sent to Xeneca by hundreds of individuals via email. In the form letter, the senders expressed their strong opposition to the proposed Big Eddy GS (as well as the previously-proposed Half Mile GS on the same river). The senders outlined 17 questions about the proposed developments, reproduced here. Please note that due to the large number of form letters received and the identical content of most of the emails, not all the emails received by Xeneca are included in Appendix D:

1. If the public firmly opposes the project, are you willing walk away from the project, or will Xeneca use all available resources to push the project ahead against the wishes of the local community?

2. How will Xeneca protect and maintain the navigability and the quality of the recreational use of the river in the affected reach and the section of river downstream of the powerhouse?

3. What specifically are you doing to enhance the recreational use?

4. How has the recreational community been involved in the planning process?

5. Will Xeneca release water over the weir on a regular basis to permit the current and historic use of the river for navigation? A portage trail – as mentioned in the Project Description – does not meet this criteria as no known trail exists.

6. On what basis was the Notice of Commencement revised to change the status of the waterway from 'unmanaged' to 'managed'? Be specific please, as no management plan is in place for this section of river.

7. Please provide a copy of the public safety requirements that apply to this project, bearing in mind that the area downstream, from the powerhouse is heavily used for recreation.

8. What are the safety standards that must be met? Do they include a project of this style?

9. Please explain in cubic metres / second, the expected variation, and the possible frequency of this variation, in outflow from the powerhouse. Again, please be specific.

10. Provide an explanation that details the difference between "run of river with modified peaking" and "run of river" but that there will be "minor" fluctuation in the flows as you or your staff have indicated on several occasions. If there is a change in flow rates, the project, by definition, if not 'run of river'.

11. How does Xeneca propose to ensure that the public retains the right to access public lands and waters in the area upstream, within, and downstream of the weir and powerhouse?

12. Please provide the minimum residual flow value to be committed to for this project so we have time to carry out our own analysis of the consequences of this number on the recreational use of the river.

13. Please provide an indication of the expected downstream extent of any area where river flow will be, even temporarily, reduced to a value below that of the river flow into the head pond.

14. You indicate that the Big Eddy Project will help increase the reliability of electrical service in periods of blackouts. Can you tell me how many blackouts we have had in the last 2, 3, 5 years, and how many would have been prevented as this seems like valid information in light of your claims.

15. How will the safe passage be maintained for sturgeon, walleye and other sport fish?

16. How did you calculate the economic benefits to the Town of Petawawa, as advertised in local papers? Is there a guarantee of local vendors being chosen for the construction? In addition, how many long-term (post-construction) jobs will be guaranteed to operate the dam and powerhouse?

17. Is Xeneca willing to share the Notice of Inspection and/and or subsequent Environmental Report with those who have requested it within 14 days of completing the report? If not, please explain your reasoning, as this document is considered an important component of the public consultation process.

In a 'Frequently Asked Questions' document dated May 31, 2011, Xeneca provided responses to the 17 questions, as well as responses to 36 other questions they received up to that stage of the EA process. The document was made available for download on the company website, and is included in Appendix D of this report.

6.4.6 Other Correspondence

Many citizens have provided information to Xeneca identifying the community enjoyment of the Petawawa River waterfront in proximity to the project area. Residents have specifically identified concerns with respect to future enjoyment and public safety associated with potential impacts of the project to the Emerald Trail network, Centennial Park, and the Catwalk. Additionally, concerns regarding aesthetic values, community integrity, angling, riparian rights, outdoor education, and access were voiced with the proponent.

On April 22, 2009 and September 10, 2009, Xeneca issued letters to nearby commercial landowners, introducing the proposed Big Eddy GS, welcoming their input into the project and inviting discussions of any concerns they may have.

A NOC for the project was advertised in local publications on July 13, 2010, with subsequent revisions to the NOC advertised on November 13 and December 24, 2011.

In February 2011, Xeneca issued a project newsletter by mail to approximately 5,000 businesses and residences identified by Canada Post as having a Petawawa postal code. The newsletter introduced the proposed project and explained the environmental assessment process. Information on the current design and layout was included, as well as an outline of the anticipated project benefits as they relate to the community of Petawawa. This newsletter also directed interested individuals to Xeneca's website for ongoing project updates.

On March 3, 2011, the Ottawa Riverkeeper sent a letter to Xeneca in response to the Big Eddy GS project description. In this letter, the Ottawa Riverkeeper outlined the organization's concerns in relation to the protection of fisheries and biodiversity, flow conditions, navigation and access, feasibility, public consultation, and project definition. Following these concerns, Ottawa Riverkeeper recommended the formation of a Petawawa River Watershed Management Plan, the assured upstream and downstream passage of fish, and socioeconomic assessment. In an April 20, 2011 letter to Xeneca, the OVTA noted the importance of the rivers in the Ottawa Valley, particularly the Petawawa River, for whitewater rafting, kayaking and canoeing. The OVTA argued that the damming of the river could negatively impact the paddling, fishing and tourism industries in the Town of Petawawa, and requested that a socioeconomic impact study be included as part of the EA for the proposed Big Eddy GS project. In a September 13, 2011 response, Xeneca assured the OVTA that they have and will continue to consult with the local recreational community throughout the course of the EA process, and that the Waterpower Class

EA requires public consultation. Xeneca invited the OVTA to consult project information on the company's website.

On June 21, 2011, the OFSC District 6 sent a letter to the proponent, informing them that a road that was labeled as being a closed road on a conceptual site plan for the proposed Big Eddy GS was not a closed road, but a snowmobile trail that is part of the RAP Tour and acts as a trail link. OFSC expressed concern that the project would reduce accessibility and usage of the trail. Xeneca replied to OFSC on June 28, 2011, assuring the OFSC that the trail would remain open for recreational use and that project engineers would consider how both road and snowmobile access could co-exist in the corridor.

On May 24, 2012, letters were sent to landowners whose properties are located upstream of the proposed weir, and at the very upper limit of the project zone of influence. The landowners were informed of the studies and analyses that were conducted for the river in the vicinity of their property. The modelling results indicated that virtually no significant difference in impact would occur under long term average flow levels, nor under drought conditions, but that a small incremental encroachment up the banks of their property may occur under typical average flood conditions. The landowners were provided with maps and river profiles, and Xeneca offered to provide more extensive explanations about the findings and mitigation measures that could be applied.

A second newsletter was circulated on June 29, 2012, and uploaded on the proponent's website (www.xeneca.com). As with the first newsletter issued in February 2011, the second newsletter was mailed to approximately 5,000 businesses and residences identified by Canada Post as having a Petawawa postal code. The newsletter provided updates on the proposed Big Eddy GS project, including a summary of the studies that were undertaken as part of the environmental assessment process and the improvements and adjustments that were made to the project plans based on public feedback.

On October 1, 2012, the POSC issued a letter to the proponent outlining its concerns surrounding the proposed Big Eddy GS. The POSC noted the Petawawa River's importance for recreation, and argued that the proposed undertaking would have detrimental effects on the migration and spawning activities of aquatic species in the river, such walleye and sturgeon. The POSC also emphasized the need for operating techniques that ensure the safety of swimmers in the river downstream, and suggested that the proponent should offer a commitment in writing to restore the Big Eddy GS site to its original condition in the event that the facility is ultimately abandoned. Xeneca replied to this letter on October 19, 2012, explaining that the proposed Big Eddy GS would comprise of a well-studied state-of-the-art weir. Xeneca also explained that many studies had been done to gain the best possible knowledge of the river and to provide optimal fish passage.

6.5 ABORIGINAL ENGAGEMENT

Xeneca's general approach to Aboriginal engagement and consultation follows:

- the Waterpower Class EA process and best practices adopted from the OPA Consulting with First Nations and Métis Communities: Best Practices, Good Business (OPA, July 2008) document; and
- the Government of Canada's Aboriginal Consultation and Accommodation: Updated Guidelines for Federal Officials to Fulfil the Duty to Consult Guide (AAND 2011).

Using these documents, Xeneca developed an Aboriginal Consultation Plan which contains methods and goals for aboriginal consultations during the Waterpower Class EA period. Highlights of these goals are defined below, a full text of the Aboriginal Consultation Plan can be found in Appendix E.

General Consultation Protocol

Xeneca places great importance on its relationships with potentially affected Aboriginal communities and has created an Aboriginal Relations Liaison position within Xeneca to manage Aboriginal Relations Policy, Guiding Principles and ensure that the consultation requirements of the Waterpower Class EA are satisfied.

To support the Crown's Duty to Consult to the best of its ability. Xeneca proposes to:

- Provide project information to potentially affected communities and to be responsive to questions, concerns and input in a timely manner;
- Through the EA planning process provide all available information and accept from Aboriginal communities all information they wish to share regarding existing and traditional use for those resources and environmental components that might be impacted by the project.
- Ensure that any traditional knowledge shared by a Community is presented in an agreed upon manner to ensure that it remains the property of the Community;
- Afford consideration to any potential adverse impacts to treaty rights in the Waterpower Class EA planning process;
- Clearly outline the EA consultation and engagement process, and potential project related issues to the Communities;
- Maintain records of correspondence and engagement;
- Reflect on input questions and responses in the ER and subsequent processes accurately, respectfully and in a timely manner;

- Seek to have Aboriginal Communities obtain benefits from the projects where reasonably possible;
- Respect an Aboriginal Community's right not to engage; and
- Provide the Crown requested information concerning the proponent's Aboriginal consultant and engagement activities.

Xeneca is committed to carry out engagement with identified Aboriginal Communities and Métis Chapters through written correspondence and direct telephone communications, including follow up on numerous occasions if communities are non-responsive. Upon appropriate direct contact, Xeneca has sought meetings with community leaders or designated lead person(s) in order to introduce Xeneca and the projects which may impact that particular community. Upon receiving an invitation from the host Aboriginal Community, Xeneca will conduct and sponsor community engagement sessions. Xeneca is also prepared, when requested, to provide access to its professional staff and consultants to answer technical questions. Finally, where a request is made Xeneca is committed to providing necessary resources to support meaningful engagement including the retention of external consultants to peer review material presented to the communities.

By meeting these objectives and following the above-noted processes, Xeneca hopes to foster and sustain a mutually respectful relationship with its Aboriginal neighbors beyond the requirement to provide consultation support to the Crown.

The following is a list of methods of communication and engagement approaches employed to seek input from the Aboriginal communities involved with the Big Eddy Project:

- formal engagement letters;
- Follow-up Email(s) and phone call(s);
- Formal invitations to participate in PICs;
- Offer to host information sessions in individual Communities;
- In certain circumstances Xeneca is prepared to provide financial resources, technical staff and consultants to assist in the review of the Draft ER and supporting documents; and
- Where Xeneca has received a protocol from the Aboriginal community that provides details on how the communities are to be consulted with, collaborate with the community to create a mutual understanding on a process to proceed.

<u>Consultation through Site Release</u>

The aboriginal consultation and engagement process began as a component of the Crown Land Site Release Process and has included components of the Waterpower Class EA planning process in parallel. An application was made for this site through the Crown Land Site Release process in

2007. The engagement process as required by the Site Release Process and the Consultation Process as required by the Waterpower Class EA process, were connected and, where possible, completed in parallel.

While Site Release and the Waterpower Class EA consultation processes were connected and completed in parallel, a separate report for the MNR on the status of the consultation process for the Site Release will be completed separately.

Consultation Requirements

The Waterpower Class EA requires that Aboriginal communities be consulted with regards to their rights within treaty and traditional lands and how they may be impacted by project activities. This consultation and engagement is designed to help determine whether the Crown has a legal duty to consult under the Constitution Act of 1982, and is not intended to replace that duty. The Waterpower Class EA requires that Aboriginal engagement includes consultation as required for the general public as well as recommending active engagement to determine if the project activities will impact aboriginal uses and values within the area.

What follows below is a description of the major highlights of engagement and consultation as it relates to the Waterpower Class EA. A full description of all consultation activities, copies of major correspondence, presentations and a log of all correspondence can be found in Appendix E. This description is still in draft and it is expected that it will be updated as the consultation process continues towards a final ER.

Aboriginal Consultation and Engagement Discussion

The ongoing consultation and engagement for the Big Eddy GS Project started in 2010 and continuing to the present has provided the communities involved with notification, as well as relevant information along with the opportunity to provide input and feedback to Xeneca. The presentation of this draft EA, as well as the continuation of the ongoing processes such as dialogue with communities will continue to provide opportunities for input and issues identification which will be addressed in the final version of this document.

It is expected that the aboriginal engagement and consultation section of the ER document will change as the process proceeds and Xeneca enters into official consultation processes with identified communities. It is also anticipated that issues may continue to arise as the construction and operation progresses. Xeneca is committed to adaptive management and establishing protocols within each community for addressing unidentified issues as they arise post construction and for the lifecycle of the projects.

6.5.1 Areas under Land Claim

There is presently a Comprehensive Land Claim negotiation underway between the Canadian Federal Government and the AOO which represent 10 Algonquin Nations, including the Algonquins of Pikwakanagan. In 2009 a Framework Agreement was signed, which outlines a general process for negotiations. Additionally an agreement on consultation has been established which guides how consultation will occur with the community during the negotiation process.

In December 2012, a Preliminary Draft Comprehensive Land Claim Agreement in Principle was published which outlines the proposed details of the agreement. The Big Eddy GS project area does not overlap with an area which is being proposed as a settlement area, however is within the Land Claim area and is therefore subject to the general provisions of the future agreement (MAA, 2013).

The project location is not located within the boundaries of any First Nation reserve lands. Additionally the project is located within the Williams Treaty areas of 1923 but is not anticipated to impact any known rights of those areas.

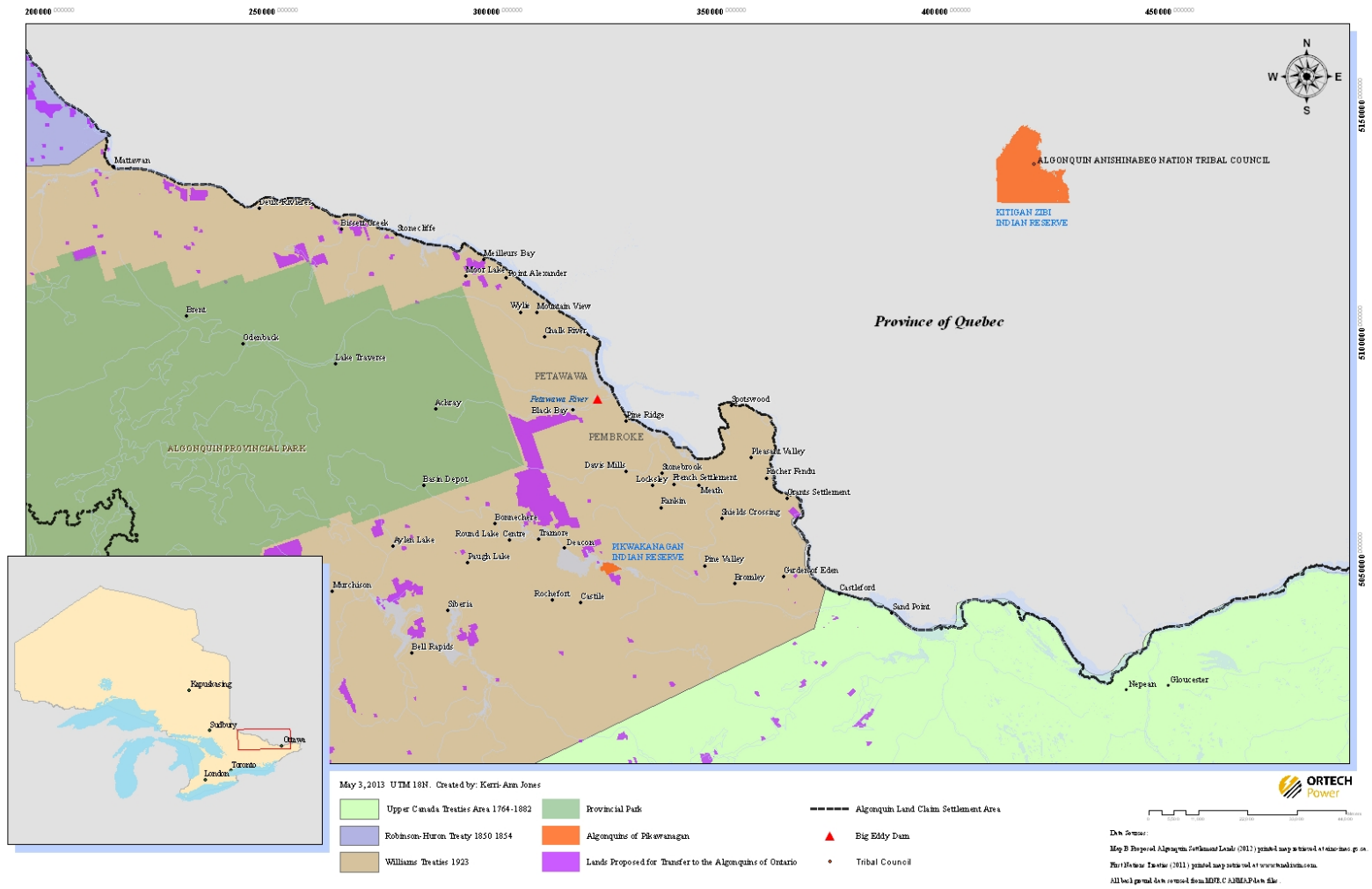


Figure 9: Identified Aboriginal Reserve Lands

6.5.2 Identified Communities

The identification of Federal Aboriginal Communities for consultation was completed through written direction from TC, with assistance from the DFO, DND and AANDC, to further define communities which may have treaty rights, traditional territories or interests within the project areas by way of correspondence dated October 28, 2011. A copy of this letter can be found in Appendix E. These communities are described below:

- Algonquins of Ontario (AOO)
- Metis Nation of Ontario (MNO)
- Algonquin Anishinabeg Nation Tribal Council
- Algonquins of Pikwakanagan

Additionally in November 2008 the MNR released the Site Description Package to Xeneca. This package contained information on Aboriginal Communities which required consultation as part of the Site Release process. These communities are described below:

6.5.2.1 Algonquins of Ontario

The AOO represent 10 different Algonquin Communities with traditional territories in the Ottawa River Watershed: The Algonquins of Pikwakanagan First Nation, Antoine, Bancroft, Bonnechere, Greater Golden Lake, Mattawa/North Bay, Ottawa, Shabot Obaadjiwan, Snimikobi, and Whitney and Area. A treaty with the AOO has never been formalized, and presently a Land Claim is in negotiation with the Crown as noted in Section 6.5.1 above (AANDC, 2012).

The AOO have a consultation protocol in place through their Land Claim negotiation process; they have also delegated Jp2G Consulting as their contact window for the purposes of consultation and engagement with regards to the project development.

Summary of Engagement

The Community was contacted on June 26, 2010 through Jp2G Consulting to notify them the project had obtained a FIT contract and would be begin progressing through the Waterpower Class EA process. This letter included potential timelines for the Waterpower Class EA and expectations for that process.

On December 1, 2010 the Community delivered a letter through Blaney McMurtry Barristers & Solicitors LLP outlining concerns in response to the posting of the NOC on November 13, 2010 for the Project. These concerns included the impacts on the aboriginal rights currently subject to the Land Claim under negotiation, the impact the structure may have on navigation and fish habitat, and the impact of construction works on the environment and aboriginal rights. In

addition the Community requested several items in order to review the project. These concerns and the items requested are detailed in Section 14.

In December, 2010 the Waterpower Class EA began in earnest and Xeneca sent the Community a letter to notify them that this process had begun. This package included copies of the Draft Project Description for the project.

On February 1, 2011 the AOO responded to the Draft Project Description and invited Xeneca to make a presentation to the AOO Energy Committee. A presentation was made to this committee in February 2011. At that time the Community requested several documents to assist in their formal review. This information was provided for their review and an acknowledgement of their receipt was provided on March 15, 2011, on the same date they provided additional comments and issues on these materials for response. Xeneca responded formally to this letter on May 19, 2011, and the issues and concerns along with Xeneca's responses are summarized in Section 14.

In February of 2011 an Elder of the Community provided correspondence regarding issues related to American Eel passage, Lake Sturgeon passage and a sacred site on the Petawawa river watershed. In this correspondence the Elder also identified a need to keep the river free flowing in order to 'honor the spirit of that sacred site'.

On March 24, 2011 the AOO contacted the DFO to notify them that they had special concerns it related to American Eel and Lake Sturgeon as they hold special cultural and spiritual significance to their Community.

On May 11, 2011 Xeneca provided the Community summary reports for the Stage 1 archaeological work that was completed on project sites. The Community responded on May 30, 2011 with a request for funding and to review the terms of reference for the proposed study. On September 6, 2011 a follow up email was sent to the Community which detailed specific aspects of the Stage 2 field work and how the community could participate. In October of 2011 the Community and Xeneca reached mutually agreeable for their participation in the Stage 2 archaeological field work. However due to the Community not supporting an associated facility on the same system they opted not to participate in the field work at that time.

On May 13, 2011 a package of information was sent to the community containing copies of several important project specific documents. The package included copies of all of the NOCs which were filed on three separate occasions, along with past communications, a draft Aboriginal Consultation Plan for the communities review and input, and information regarding the continuing archaeological work.

On May 17, 2011 an email invitation was sent to the community inviting them to a PIC held on May 31, 2011. This email also extended an invitation to host and participate in a meeting within their local community if it was favourable to the Community.

In May 2012 the AOO provided Xeneca with a letter notifying them that they would be unable to support the project. Xeneca responded in June 2012 requesting a meeting which was held on June 18, 2012 during which time they discussed issues related to the spiritual and cultural significance of the waterway as well as concerns as it related to the integrity of the archaeological review. On August 29, 2012 Xeneca provided a follow up letter to the AOO which outlined responses to some concerns. Issues and responses identified during this process are summarized in Section 14.

On August 15, 2012 an email invitation was sent to the Community inviting them to a PIC being held on August 22, 2012. This email also extended an invitation to host and participate in a meeting within their local community if it was favourable to the Community.

In September 2012 Xeneca provided an Aboriginal Consultation Plan for review and comment to the Community.

On September 14, 2012 Xeneca participated in a meeting with the AOO and the MNR liaison in order to develop a strategy to reengage the AOO in the project development. Discussions in this meeting covered issues relating to fish passage, information sharing, project design, issues and responses identified during this process are summarized in Table 15.

In April 2013 Xeneca provided the Stage II archaeological assessment for the community to review and comment on.

Table 12: Algonquins of Ontario ER Milestone Dates Summary

Milestone	Delivery Date	Delivered to
Project Description	December 20, 2010	Jim Hunton Jp2G Consulting
Notice of Commencement	May 13, 2011	Jim Hunton Jp2G Consulting

Current Status of Consultation and Engagement

Throughout the period described above Xeneca has continued to engage with the AOO through a variety of means, including providing materials for review and detailed discussions surrounding methods of consultation and engagement. Presently this consultation is ongoing. A meeting between the AOO and Xeneca occurred in January 2013, during which time Xeneca provided a presentation which updated the Community on the Project. Based on a general understanding of the community's traditional and current use of the area, as well as issues that have been raised

during the engagement, concern for the community are listed in Table 15. This table also addresses items the community has specifically requested throughout the consultation and engagement period to date. It is anticipated that following the Community's review of this draft document and prior to the finalization of this ER document, it will be updated to reflect more comprehensive issues and concerns. Consultation and engagement with this community will continue throughout the Waterpower Class EA process, Site Release Process, construction, and into the lifecycle operations of the project.

6.5.2.2 Métis Nation of Ontario

The MNO provides a host of services to all Métis individuals in Métis Nation communities and Regions in Ontario.

Xeneca is working with the MNO through their Lands, Resources and Consultation Branch collaboratively in order to establish a consultation protocol that will involve regional meetings and will include opportunities for review and input on project developments by representatives from the Ottawa Region, and any other interested Community Councils. The MNO has provided their consultation protocol to Xeneca with the intent that it be used as a model to develop a consultation process and aid in the implementation of an MOU that addresses capacity and accommodation requirements between the two parties.

Summary of Engagement

The MNO was notified about the project in June 2010 when a formal letter was sent introducing the company, notifying the community of the project, the need for a Waterpower Class EA process, and providing information related to the Site Release. This letter provided contact information for Xeneca and contact information for the MNR if any further information was required.

On October 1, 2010 the MNO issued a letter of support to Xeneca, which described the conditions under which the MNO would support the development of the proposed project and process and would be willing to engage with Xeneca on the permitting processes as required.

In October 2010, Xeneca sent a letter inviting the MNO to a preliminary PIC on November 16, 2010. Due to unforeseen circumstances, this PIC was cancelled and a formal letter notifying the community of this change was sent on October 25, 2010.

On May 13, 2011 a package of information was sent to the MNO containing copies of several important project specific documents. The package included copies of all of the NOCs which were filed on three separate occasions, along with past communications, a draft Aboriginal Consultation Plan for the communities review and input, and information regarding the continuing archaeological work.

On June 18, 2011 Xeneca provided the MNO summary reports for the Stage 1 archaeological work that was completed on the project site. This included an offer inviting the community to participate in the Stage II archaeological field work.

On September 26, 2012 Xeneca provided the MNO with two baseline environmental reports on the project for their review and comment.

In April 2013 Xeneca provided the Stage II archaeological assessment for the community to review and comment on.

Table 13: Métis Nation of Ontario ER Milestone Dates Summary

Milestone	Date	Delivered to
Project Description	May 13, 2011	Melanie Paradis
NOC	May 13, 2011	Melanie Paradis

Current Status of Consultation and Engagement

Presently Xeneca is still in negotiations with the MNO, progressing towards a final agreement and MOU. To date the MNO has not tabled any specific concerns related to aboriginal treaty rights, traditional lands or specific community issues. Based on a general understanding of the community's traditional and current use of the area, potential concerns for the community are listed in Table 15. It is anticipated that following the completion of the MOU process, and prior to the finalization of this ER document, it will be updated to reflect more comprehensive issues and concerns. Consultation and engagement with this community will continue throughout the Waterpower Class EA process, Site Release Process, construction, and into the lifecycle operations of the project.

6.5.2.3 Algonquin Anishinabeg Nation Tribal Council

The Algonquin Anishinabeg Nation Tribal Council is located in Quebec and represents the First Nations of Abitibiwinni, Eagle Village, Kitigan Zibi, Lac Simon, Long Point, Algonquin Kitcisakik First Nation, and Wahgoshig First Nation. They are responsible for providing assistance and services to their member communities. This community was identified as a federal consultation community, however was not identified provincially (Algonquin Anishinabeg Nation Tribal Council).

Summary of Engagement

The community was notified of the federal assessment being carried out by CFB Petawawa in April of 2011.

In April 2013 Xeneca provided the Stage II archaeological assessment for the community to review and comment on.

Current Status of Consultation and Engagement

As the federal process has now been withdrawn at the Big Eddy GS site, Xeneca will continue to engage with this community individually, and is preparing a package of materials including past NOCs and PIC information. Moving forward this community will receive all major correspondence and information.

6.5.3 Communities with Minor Consultation

Some communities were consulted in minor ways to gauge their interests or prior to the 2011 MNR letter which identified communities which may have interests in the project. The consultation for these communities is not extensive and as such no attachments are included in the appendices. These communities are described in the sections below.

6.5.3.1 Algonquins of Pikwakianagan

On March 16, 2010 Xeneca notified the Algonquins of Pikwakianagan that it was engaging with Jp2g and the AOO as requested by the MNR with respect to ongoing consultation and engagement on the project. The letter also outlined that a FIT application was in process for the project, and some of the forthcoming requirements of a Waterpower Class EA process should the application be successful.

In September of 2010, Xeneca sent a letter inviting the community to participate in the archaeological studies at the project location.

In October 2010, Xeneca sent a letter inviting the community to a preliminary PIC on November 16, 2010. Due to unforeseen circumstances, this PIC was cancelled and a formal letter notifying the community of this change was sent on October 25, 2010.

Consultation with this community has been folded into the broader consultation with the AOO, as they are a member of the organization. The Algonquins of Pikwakianagan continue to receive notifications and are consulted on project activities through the protocol established with the AOO.

6.5.3.2 Ontario Métis Aboriginal Association

The Ontario Métis Aboriginal Association was notified about the project in June 2010 when a formal letter was sent introducing the company, notifying the Ontario Métis Aboriginal Association of the project, the need for a Waterpower Class EA process, and providing

information related to the Site Release. This letter provided contact information for Xeneca and contact information for the MNR if any further information was required.

In October 2010, Xeneca sent a letter inviting the Ontario Métis Aboriginal Association to a preliminary PIC on November 16, 2010. Due to unforeseen circumstances, this PIC was cancelled and a formal letter notifying the community of this change was sent on October 25, 2010.

On May 13, 2011 a package of information was sent to the Ontario Métis Aboriginal Association containing copies of several important project specific documents. The package included copies of all of the NOCs which were filed on three separate occasions, along with past communications, a draft Aboriginal Consultation Plan for the communities review and input, and information regarding the continuing archaeological work.

The Ontario Métis Aboriginal Association represents the Woodland Métis community in Ontario and has been in receivership since 2007. Consultation with this community has not continued as they were not an identified community for consultation.

7. EVALUATION OF POTENTIAL PROJECT EFFECTS

In the *Class Environmental Assessment for Waterpower Projects* (April 2012), an effect is described as:

"Any change to the environment, positive or negative, that could occur as a result of a project", and which can "include the impact or benefit that a project could potentially have, directly or indirectly, on the environment at any stage in the project life cycle."

Under the Ontario *Environmental Assessment Act*, "environment" means:

(a) air, land or water,
(b) plant and animal life, including human life,
(c) the social, economic and cultural conditions that influence the life of humans or a community,
(d) any building, structure, machine or other device or thing made by humans,
(e) any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities, or
(f) any part or combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario.

The purpose of an EA 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.

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 presented in the following section.

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 15. A discussion of broad categories of effects follows throughout Section 7.

The effects based on changes in water levels in the Petawawa River were estimated through the use of HEC-RAS modeling. Details on the inundation levels created can be found in Section 5.1, and details on the steady state HEC-RAS modeling are presented in Annex I of this report. The proposed daily fluctuations in headpond water levels are presented in graphical form in Annex I.

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 and the Natural Environment Characterization and Impact Assessment report found in Annex III.

7.1 Identified Potential Natural Heritage 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.

Over the course of the assessment process, potential effects to the natural environmental within the project area were identified. For discussion purposes, these effects are grouped into the following categories:

- Water Quality
- Erosion and Sedimentation
- Species at Risk (SAR)
- Terrestrial Wildlife and Habitat
- Aquatic Wildlife and Habitat

Each of these categories is presented with a discussion of effects as they are derived from the inundation, operation strategy, and footprint of the proposed Big Eddy GS. In addition, the general mitigation strategies as they will be applied to these issues are presented.

A summary of Table 15 which details the effects identified and resolutions developed through the assessment is provided in the following sections.

7.1.1 Water Quality

Mercury

Concentrations of mercury in fish tissue can increase rapidly after new lands are inundated for the creation of a headpond, and then decrease and stabilize in subsequent years, as observed in experimental inundation in Ontario and in large hydroelectric projects in Quebec. Methyl mercury may biomagnify within the food chain, posing a potential health concern to humans and wildlife that consume fish. A variety of factors including fish size, diet and trophic position, may influence the rate of mercury accumulation. Site specific factors such as the type of terrain flooded, hydraulic residence time and water level fluctuations, may also play a role in the degree of methyl mercury formation. Potentially elevated levels of methyl mercury in fish tissue as a result of the development of the waterpower facility (flooding of inundation area) may also have a socio-economic impact since recommended fish consumption levels may be impacted.

While mercury levels in relation to hydropower are well studied in large reservoirs, there is relatively little information pertaining to small-scale impoundments. Accurate predictions based on a model are not possible at this time due to the lack of available literature on small waterpower projects and impoundments available for validation.

Although the inundation area for the Big Eddy project is relatively small, there is no way to completely mitigate for mercury creation in the headpond. However, some steps can be taken to minimize the risk of elevated mercury. Inundation will be minimized to the greatest extent possible, and avoid wetlands where possible. In order to further limit any potential impacts associated with the production of mercury, trees currently located within the boundaries of the proposed inundation area would be removed prior to the construction of the proposed Big Eddy GS, thus removing a major potential source of methyl mercury.

A long term monitoring program will be implemented to track methyl mercury in water and fish tissue during the construction and operation phases of the project. Baseline sampling will be utilized to establish a reference condition of the water quality and mercury in fish prior to facility development, which can be used for comparison post-development. Upstream and downstream water quality comparisons will allow facility-related impacts to be addressed. Post-development monitoring will be refined to target the periods of highest sensitivity, providing valuable data to the operator and to the MOE on mercury dynamics in small-scale impoundments.

Any baseline and post-construction data on mercury levels collected for the Petawawa River will contribute towards amassing data in order to create predictive models for future small-scale hydropower projects.

Temperature and Oxygen Levels

The headpond for the Big Eddy GS would have a very small area and short residence times. The average residence time was calculated to be less than 5 hours in average summer months. Appreciable changes to river water temperature would require several days or even weeks of warm air temperature, so it is not believed that an increase of a few hours of residence time in the headpond would result in significant changes to water temperature.

Additionally, water depths in the headpond under long term average flow conditions would increase by less than 1.5 m as a result of the proposed Big Eddy GS project, which is not a sufficiently large increase to result in thermal stratification and significant alterations of the river's thermal regime.

Contamination

Concrete pours will be conducted "in the dry" and efforts shall be made to prevent concrete from contacting the watercourse until it is properly cured. Project personnel will be made aware of safe concrete handling procedures. Cementitious products in concrete mix are very alkali rich (high pH) and are deadly to aquatic life if sufficient quantity comes into contact with a habitable watercourse. Concrete handling will employ watertight forms, spill contingencies, and designated truck clean out pits. Clean out pits and washing areas will be established well away from a watercourse and will be subject to best industry practice and regulatory requirements.

7.1.2 Erosion and Sedimentation

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.

In a study of the erosion potential of the river banks, several locations upstream and downstream of the proposed Big Eddy GS were identified as having the potential for moderate erosion and/or requiring additional analysis (see Annex I). A geomorphological assessment and a hydraulic modeling study were conducted to determine the project's potential impacts on the sediment transport regime of the river. Due to the presence of several lakes and wide sections of river within the first few kilometres upstream of the proposed site for the Big Eddy GS, the amount of sediment being transported downstream is relatively limited under current conditions. Although the construction of a weir would reduce flow velocities upstream, thereby reduce the ability of the current to transport sediment, it was determined that this change would be relatively minor, and that the potential for significant changes to sediment deposition or erosion is low.

It was determined that the change in velocities, and by extension the change in the ability of the flow to transport sediment, as a result of the proposed 1.5 m high weir would be relatively minor.

Sandbar feature at the confluence of the bypass reach and the tailrace

During a meeting with regulatory agencies in November 2012 and in subsequent meetings, the importance of the sandbar feature at the confluence of the bypass reach and the tailrace was noted, as fish may be using it as nursery habitat. Sediment transport in the Petawawa River occurs mostly in the form of suspended sediment, rather than larger bedload sediment. HEC-RAS modeling results suggest that there would be a small decrease in flow velocity in the headpond, but it is not anticipated that this decrease is enough to affect the transport of suspended sediment, and by extension, the supply of sediment to the sandbar feature. In order to confirm that this feature is not being impacted, Xeneca commits to monitoring the size and persistence of the sandbar over time. Should it be observed that the sandbar is shrinking over time, appropriate-sized sediment will be mechanically deposited downstream of the weir in order to re-supply the sandbar with sediment; this commitment was confirmed in writing in an April 25, 2013 letter to the MNR (see Appendix C).

7.1.3 Species at Risk

As discussed previously (Section 2.9.5), Monarch Butterfly, Snapping Turtle and Northern Map Turtle were detected during field studies. Additionally, previous studies in support of other projects have confirmed Lake Sturgeon and River Redhorse on the Petawawa River. Finally, American Eel is known to be present in the Ottawa River, and anecdotal evidence suggests presence upstream and downstream of the project site. Given their importance, Lake Sturgeon, River Redhorse, and American Eel are assumed to be present and have been considered in the development of the project. Potential impacts to these species are discussed below.

7.1.4 Effects on Protected Species

Lake Sturgeon and American Eel

Impacts to Lake Sturgeon and American Eel as a result of the Big Eddy development will largely be related to the construction of the facility and the physical structure affecting their ability safely migrate upstream and downstream past the facility. In order to facilitate passage during staging and spawning events, the bypass will receive 30 m3/s of flow in the spring when temperatures are appropriate for these life events (9°C to 18°C).

The reader is directed to the discussion of fish passage and fish mortality in Section 7.1.4 below.

The potential spawning habitat at the sandbar downstream of the proposed Big Eddy GS has been considered in project development.

Eastern Cougar

The necessary habitat requirements exist in adjacent Algonquin Park for Eastern Cougars, and it is likely that they may inhabit the area. However the Big Eddy GS project would not likely have any significant impact on potential cougar populations due to their large territories and terrestrial nature. General presence/absence surveys were conducted to determine the presence of Eastern Cougar during the course of other field studies. However, Eastern Cougars were not detected during 2011 field surveys at the Big Eddy GS project site.

Western Chorus Frog

Although Western Chorus Frogs were identified as having the potential to be present in the study area, 2011 and 2012 field surveys did not detect any individuals at the project site. A Black Ash swale adjacent to the proposed bypass reach does provide suitable habitat for Western Chorus Frogs, and this site could be impacted by weir development which could result in drying of the swale and a resulting loss of habitat for any Western Chorus Frogs present. Further Western Chorus Frog field surveys were recommended and completed, to determine whether there was potential for them to be impacted, but no frogs were found. No mitigation was recommended.

Northern Barrens Tiger Beetle

Although Northern Barrens Tiger Beetles were not detected during field surveys, suitable habitat for them exists within a sandy pine area along the Trillium Trail. Based on the current project layout, this suitable habitat will potentially be affected if Option 2 for access roads is pursued in the absence of an easement from CP Rail. However, this class of habitat dominates the northern section of the proposed road route, and as a result, little impact predicted to species within this section.

Flooded Jellyskin

The Flooded Jellyskin is a rare lichen that, if present, could be impacted by the project in an area of Black Ash swale located east of the proposed weir site. However no field studies to date have identified the flooded jellyskin as being present, therefore there is currently no known potential impact.

Effects on Species of Special Concern

River Redhorse

River Redhorse could potentially be affected by the proposed weir construction as it presents a barrier to upstream and downstream passage. However, designs which incorporate useable fish passage options for Lake Sturgeon are expected to address River Redhorse passage as well, as Lake Sturgeon are generally larger and less agile fish.

Snapping Turtle

While Snapping Turtles have been identified within the project area, the majority of the affected project footprint is not suitable for this species; construction and inundation are unlikely to negatively impact Snapping Turtles. There is a possibility that overall habitat within the project area will increase as a result of inundation.

Northern Map Turtles

There is little potential for effects to existing Northern Map Turtle habitat, as run-of-river operations will result in minimal water level fluctuations and the proposed bypass is rapids over bedrock substrate, which is not suitable for the species.

Monarch Butterfly

While the Monarch Butterfly has been identified in the project area, no significant larvae-feeding Milkweed colonies, on which the Monarch is dependent, were found within the zone of influence. For this reason, the project is not likely to affect the Monarch Butterfly.

Eastern Wolf

Eastern wolves have been observed on CFB Petawawa lands and as road-kill along Highway 17, however they are unlikely to be impacted adversely by the project since they are mobile, terrestrial, and occupy large territories. Eastern wolves were not detected during 2011 field surveys at the Big Eddy GS project site. Significant rendez-vous and denning sites were not noted within the survey area.

7.1.5 Aquatic Wildlife and Habitat

A discussion of identified potential effects and general mitigation measures can be found in the Environmental Characteristics Reports (ORMG, 2010 and 2011) and Mitigation and Recommendations Report (ORMG, 2013) found in Annex III, and have been summarized in Table 15.

Impacts Associated with Inundation

The construction of the weir and associated headpond will result in an increase in water depth and wetted width upstream of the project site as well as changes in water velocity. These effects will be most pronounced immediately upstream of the facility and will gradually diminish towards the upper extent of the headpond. It should be noted that, due to the relatively small size and capacity of the facility, these effects are anticipated to be minimal.

The creation of the headpond will potentially affect fish and benthic invertebrate habitat upstream of the facility. However, it is expected that existing shallow water habitats will shift

towards new areas following inundation. Similar suitable substrates are present and are also common upstream and downstream of the inundation area.

Impacts Associated with Operation

The proposed Big Eddy GS would operate as a true run-of-river facility, meaning that downstream of the point where the outflow from the powerhouse joins the flows from the bypass channel, flows in the Petawawa River would be equal to what would be observed in the absence of the Big Eddy GS. As such, the variable flow reach would essentially be limited to the length of the bypass channel.

During periods of low flow when the facility is still operating, the minimum ecological flow of 4 m^3/s will be maintained through the bypass. This will result in a decrease in wetted perimeter and depth in the bypass reach compared to natural conditions; however, the bypass itself is largely characterised by fast flowing water over bedrock or cobble which are not considered to be suitable habitat for fish and benthic invertebrates. Shallow water areas will still be present towards the center of the channel and similar substrates are common upstream and downstream of the bypass.

A small gravel riffle is present at the downstream end of the bypass reach and is thought to be suitable for Walleye spawning, though no evidence of spawning has been observed to date. This gravel riffle will remain wetted at the proposed minimum flow. During Walleye spawning in the spring, when water temperatures fall between 5˚C and 12˚C, the bypass will receive $30m^3/s$ in order to provide for the movement of fish during the staging and spawning period. Accordingly, Walleye spawning activity, if present at this location, should not be impacted.

A sandbar located on the eastern portion of the river adjacent to the proposed tailrace location represents potentially significant habitat for fish species such as Smallmouth Bass and Lake Sturgeon, although use by these species has not been confirmed. The tailrace structure and orientation have been designed to ensure this feature will not be eroded. The sandbar will be monitored and maintained by Xeneca in the event that this feature is unexpectedly impacted by operations. Although upriver fish passage is not presumed to be occurring through Railroad Rapids at flows below 30 m^3/s, the natural heritage assessment confirmed that connectivity of the different habitats across the bypass reach will be maintained at the proposed minimum flow of 4 m^3/s (see the Mitigation and Recommendations Report (ORMG, 2013) in Annex III).

Risks of fish stranding due to ramping rates

The proposed Big Eddy GS would operate as a run-of-river facility, and would not result in large, daily fluctuations in flows downstream of the facility. For a limited number of events per year, a portion or the entirety of the flows will be re-directed away from the intake canal and into the bypass reach; these include seasonal low flow conditions, when all flows must be directed into

the bypass reach in order to maintain its ecological integrity, and periods when flows are provided to accommodate recreational use of the bypass reach.

When flows are redirected into the bypass channel during low flow conditions, Xeneca proposes that ramp down (when the Big Eddy GS shuts down) and ramp up (when the Big Eddy GS turns back on) occur gradually over a period of 30 minutes each, to minimize the likelihood of fish becoming stranded when water levels decrease.

Additionally, very few fish have been observed in the bypass reach during field visits, as the bypass reach is characterized by fast-flowing water and a steep and rocky channel. Due to the infrequent ramping events and the low numbers of fish present in the bypass reach, significant impacts as a result of fish stranding are not anticipated to be an issue for the proposed project.

Fish Passage

The creation of a weir and alteration of flows will impact the ability of fish to safely move upstream and downstream past the site. Due to their relatively poor swimming capabilities, passage design requirements have been focused on options for Lake Sturgeon, as designs which incorporate useable fish passage options for Lake Sturgeon will likely address American Eel passage as well as passage requirements for other fish species. A fish passage design committee including representatives from Xeneca, CPL, ORMG, University of Calgary and Ortech staff worked collaboratively to develop feasible alternatives. Proposed designs were reviewed by DFO and MNR personnel during development. Through their work, the passage committee developed a design for a natural ramp structure with boulder fields and pools which mimic natural conditions in the bypass reach and is expected to be able to pass Lake Sturgeon at during low flows (see the Technical Memo, "Big Eddy – Fish Passage Design Criteria", in Annex III).

A post-construction monitoring program will be implemented at the site of the weir, to monitor the success of the natural fishway as a measure to preserve habitat connectivity for these species.

Fish Mortality Due to Impingement and Entrainment

In order to prevent the mortality of American Eel and other fish species as a result of entrainment though the turbine(s), a number of measures have been proposed. The intake canal of the facility will be designed such that water velocities in the canal cannot increase to a level that exceeds the swimming capabilities of fish. This would allow any fish entering the canal to be able to swim against the current and successfully return to the river. Additionally, the intake will be equipped with specialized trashrack to limit fish impingement and, if and when American Eel are confirmed at the site, trashracks with smaller spacing will be installed. In the event fish enter the canal and continue towards the intake, a specialised "slide" will be installed at the facility intake which will pass American Eel (and other fish species) directly to the river below the tailrace, bypassing the turbine(s).

7.1.6 Terrestrial Wildlife and Habitat

Habitat in Area of Proposed Works

The habitat located in the area of the proposed project does not contain any SAR based on the fieldwork performed in 2011 and 2012. The mixedwood forest and the habitat it supports are not rare and have been previously disturbed. Habitat fragmentation will be minimized because the access and transmission routes will be associated with existing infrastructure (Trillium Trail, CP Railway Line). No mitigation is recommended in this habitat area. Key biological concerns include increased stress on wildlife species as a result of noise, traffic and human presence, disturbance of wildlife habitat due to sedimentation, erosion, chemical release, clearing and digging, and disturbance/possible destruction of bird and turtle nests.

Trees cut in the headpond area, inside the transmission line right-of-way and wherever else possible, will have their roots left intact.

Vegetation clearing during bird breeding and nesting season should be avoided. If vegetation clearing is unavoidable during breeding and nesting season, nest surveys shall be undertaken. Tree and vegetation containing nests shall remain in place during the nesting season. Project work should avoid disturbance to the nested vegetation with a designated buffer area. All trees with a diameter greater than 0.05 m located at or below the elevation corresponding to 0.5 m above the proposed Normal Operational Level will be cleared and removed from the headpond.

Headpond clearing is fairly minimal on this project as the headpond area is mostly grassy bays and low sand and gravel banks. Headpond clearing will be completed in a time period that will least impact the river and surrounding environment, which is assumed to be in the winter. This assumption will be confirmed during the EA process and scheduling of the headpond clearing will be finalized as required. Generally the clearing of trees and wood debris will be completed to an elevation 0.5 m above the Normal Operating Level. Before filling the headpond, an inspection of the cleared banks will be carried out and loose woody debris will be removed from the inundation area to prevent a large amount of debris from collecting in the headpond and flowing downstream. Trees cut in the headpond area, inside the transmission line right-of-way and wherever else possible, will have their roots left intact. Merchantable timber will be decked for removal by the Sustainable Forest Licence (SFL) holder or other party as designated by the MNR.

Wetland and Forested Habitat Impacts

The approximate total width of area to be cleared for access roads and transmissions lines for either option will be ~10m in width, and 600m in length, assuming a 3-4m wide roadway plus setbacks and transmission lines (see Section 3.4 and 3.5.1 for details on both options).. This equates to a potential loss of up to 6000m2 of various types of habitat.

Routing the main access road along the abandoned CP Rail line (Option 1) would eliminate large scale clearing, deforestation and vegetation removal across most of the site. Utilizing the already cleared and compressed rail bed would provide a ready-made access route for construction and maintenance traffic with little impact on the surrounding vegetation for the purpose of roads development. Vegetation within the proposed east-west section of the road would already be cleared as part of ongoing construction, thereby removing the requirement to clear and/or fill relatively pristine lands. Location of the road and transmission line along the existing rail bed will eliminate much of the clearing required for access.

The second access road option (Trillium Trail parallel option) has the potential to impact a forested habitat classified as GO55 Tt (Dry to Fresh, Coarse: Aspen – Birch Hardwood) which encompasses much of the central portion of the property which would be impacted by proposed roads, transmission lines, staging areas and the penstock and powerhouse.

Mature hardwood and mixedwood forest habitat, as well as wetland habitats (a 1.5 ha swamp thicket), occur along a large portion of the proposed Option 2 route. Expansion of the existing trail to accommodate vehicular traffic and transmission line poles will require deforestation, removal of ground vegetation, grubbing and infilling of wetland habitat for a 600m stretch of land parallel to the CP Rail line. Loss of this habitat will be irreversible. Disturbance to this area should not significantly impact wildlife species or surrounding habitats. Installation of sediment barriers and establishment of vegetated buffers during construction will minimize impacts and should be sufficient to sustain the sensitive habitats.

Regardless of the access/transmission option selected, best management practices will be adhered to during construction, to minimize extensive impacts to wetland habitats. All clearing and filling will be undertaken outside of the active herpetile and breeding bird seasons, with works occurring between 15 Sept and 15 April. A qualified biologist or wildlife technician should be present during felling of trees to ensure that no key cavity or raptor nest trees are disturbed, and that clearing avoids such sites by providing a buffer of undisturbed vegetation around each tree per MNR guidelines.

General Wildlife Considerations

No trash, litter, or waste materials will be left on or around the work site. Appropriate disposal containers will be available for the prompt disposal of waste. Contractors will be responsible for cleaning up waste materials as soon as possible after they are created and 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.

7.2 IDENTIFIED POTENTIAL SOCIOECONOMIC EFFECTS

7.2.1 Access

During facility operations, the only restrictions to public access would be in the immediate vicinity of man-made structures. No restrictions on access to the river are being proposed. Xeneca commits to maintaining current public access and navigation to the area and restriction will only be placed on areas where it is the interest of public safety (i.e. powerhouse and water intake). Xeneca has gone to great length to design the facility so that the river can continue to be enjoyed by the public. New access to the river and points of interest will be created as part of the project. These include access to the weir structure on the north and south side, and a permanent bridge over the conveyance canal.

Xeneca commits to working with the Town of Petawawa and recreational users to develop amenities in the Big Eddy GS project area, which may include parking and rest areas, launching points for watercrafts and trails.

If Option 2 is selected for access road construction, there could be temporary impacts to use of the Trillium Trail during the construction phase for public safety purposes; any trail closure during construction will temporarily reduce access. Widening of the trail, or construction of a separate adjacent and parallel trail will allow for traditional use of the trail and single lane construction access. There will be timing restrictions for trail improvements and construction access in order to minimize impact to trail users. Localized signage and newspaper notices will be used to advise trail users of any access reductions, and fencing will provide proper demarcation between the trail and the construction access. During operation, there will be appropriate separation of recreational use and road access along the Trillium Trail.

7.2.2 Navigation

Navigation of the Petawawa River has been a primary concern during the course of the Public Consultation process for the Big Eddy GS project, as discussed in Section 6.4.4. Recreational whitewater users have communicated the recreational value of the project area, and as such, the proponent has undertaken several actions to mitigate potential effects to the navigability of the section of the Petawawa known as Railroad Rapids.

Xeneca has met with the paddling community, cottagers and recreational users (including anglers and hunters) to discuss the needs and wants of the community. A PSAC including members of the recreational/commercial paddling community, outdoors clubs and municipality has been providing input since 2009.

<u>Weir Design</u>

The proponent has worked with Northwest Hydraulic Consultants on two weir design options that allow kayaks and canoe to pass over it, though only one option will be pursued.

Regardless of which weir option is selected, watercrafts can bypass the weir by using the fishway. As an ecological flow of at least 4 m^3/s will be provided through the fishway at all times, navigation through the fishway will be possible even at low flows.

Due to its large width and gentle slope in the downstream direction, Option 1 of the weir can be navigated by watercraft under most flow conditions. Navigation over the weir may not be possible under low flow, when most or all of the flow must be directed into the fishway to accommodate fish passage, resulting in an insufficient depth of water passing over the weir. However, as described previously, watercrafts will be able to travel through the fish passage in order to reach the lower sections of the river.

Passage of watercraft directly over Option 2 of the weir would generally only be possible under higher flow conditions, when the Obermeyer gate is lowered. During other flow conditions, the Obermeyer gate would be raised, such that there would be a sudden drop immediately downstream of the structure, making navigation over the weir less practical.

Following consultation with the paddling community, a bypass portage route will be created and maintained to re-establish continuity of access between the areas upstream and downstream of the Project. The route will be properly signed to keep users on the trail. The portage will be sized for non-motorized traffic only.

Overall, the project was setup to help Xeneca attain an enhanced understanding of recreational activities on the Petawawa River which can be essential in making concessions for water sharing to accommodate the whitewater community, the tourist industry and the local residents of Petawawa.

Portage Trail

Additionally, a portage trail, described in Section 3.3.7, will be constructed on the north shore of the project. This will allow the bypass area to be circumvented by users who do not want to navigate Railroad Rapids and by users navigating the Petawawa River when flows within the bypass are below navigable levels.

Water Sharing Agreement

Over the course of the consultation process, the proponent and whitewater stakeholders discussed proposed flow sharing agreements in order for hydroelectric production and recreational enjoyment of Railroad Rapids to co-exist. Although the most recent proposition made by the proponent has been rejected by the paddling community, Xeneca will continue to pursue a successful water sharing proposal with the whitewater community while taking into

account the recreational use survey results from the Petawawa River project. These will be done to mitigate concerns over a reduction in recreational kayaking opportunity. It is possible that with a water sharing agreement that provides predictable, on-demand flows, through the project site, commercial and recreational opportunities may be maintained.

Further it should be noted that Xeneca's commitment to run of river operation and a state-of-the art weir design, kayaking and other recreational activities will not be affected upstream of the generating station, nor will it be affected downstream of the tailrace.

Some impact to the recreational navigation of the Petawawa River within the project area is unavoidable. However, Xeneca has developed multiple mitigative strategies, such as the release of all flows into the bypass reach during daylight hours of the 2-day Hell or High Water event, and the provision of a cumulative total of 100 hours of "on-demand" flows (see the Operating Plan in Annex I). Other mitigative strategies include the maintenance of a portage and other recreational facilities around the site.

In addition to any navigation-related flows, a minimum of 30 m^3/s will be provided to the bypass during Walleye and Lake Sturgeon spring staging and spawning periods, as discussed in Section 5.2 (Site Operating Strategy).

7.2.3 Public Health and Safety

Public safety during construction and operation of the project has been identified as a concern. This section outlines the specific operation safety risks for various areas around the project and considerations for managing risks to the public. Those effects and management strategies associated with the construction and operation of the facility are summarised in the Proposed Operating Plan found in Annex I and in the Construction Management plan found in Annex II.

The proposed Big Eddy project is located in the middle of the Town of Petawawa and readily accessible by the public. In light of extensive recreational use, operational safety of the project is a priority. Concerns about flow ramping, downstream play areas, emergency plant shutdown procedures combined with proximity to recreational trails and fish passage have all created and focused a lot of time, energies and attention on the conceptual design phase of engineering. In addition, the Petawawa site design is intended to offer watercraft passage over the top of a designated area of the weir to allow continued recreational use of the site river reach presents a unique set of public safety concerns as typical power plants intend to limit passage over such control structures.

According to the Ontario Waterpower Association, the overall safety record of such facilities is excellent. However, special operational risks do exist when engineered structures and recreational uses intertwine. Special consideration is being given to public safety in the planning of the facility operation.

The following are the specific locations of special interest to safety planning:

- Construction
- Upstream Inundation Area
- Upstream Intake Channel
- Embankment Dam
- Weir
- Fishway
- Railroad Rapids
- Powerhouse & Tailrace
- Downstream Flows and Levels

Construction

During the construction period, primary potential public health and safety risks are generally related to construction traffic, noise and dust levels and restrictive measures for access to the site construction area. Workers safety is the subject to the requirements of the Ontario Ministry of Labour, Occupational Health and Safety Act O. Reg. 213/91 pertaining to construction sites. This Act includes references to other programs including the NBC & OBC's, (National & Ontario Building Codes), WHMIS (Workplace Hazardous Materials Information System) and MSDS (Material Safety Data sheet) and OSHA guidelines (Occupational Safety and Health Association). First aid equipment will be maintained on site throughout the construction period and workers will be trained to deal with emergency situations.

Public access to the immediate project area will be controlled during construction for the safety of the public and project personnel. A combination of fencing and signage will be used to isolate construction areas from available recreational areas and to alert the public of the area about the dangers of construction and location inaccessibility. Further hazards to the public can also be mitigated by restricting public access to 'at risk' areas of the dam through the use of physical safety measures, including fences, railings, safety booms and buoys.

Accidents or malfunctions during the construction phases of the hydroelectric dam or other project related infrastructure could be hazardous to the public. These accidents vary in severity and could include accidental spills, excessive dust levels or dam failure. The primary protective measure for accidents and equipment malfunctions is the safe design, construction, operation, maintenance, and decommissioning of the Big Eddy GS project and ancillary facilities. Furthermore, contingency planning will be implemented to deal with emergency situations (e.g. the Spill Response Plan to deal with accidental spills of materials followed by adequate spill containment and cleanup materials).

Upstream Inundation Area

Special precaution will be taken during initial filling of the headpond. Filling will occur slowly and a safety-watch person will be in a boat on the river to monitor the shoreline areas for unsuspecting recreational users during the initial filling operation.

During normal operation, the headpond will be operated on "level control" mode. This operation involves monitoring the inflow rates from upstream as well as the water level at the weir. Outflow from the headpond is managed such that the rate of outflow equals the rate of inflow at all times. This level control operation keeps the headpond at a constant level during normal operation, which minimizes the risk of sudden level changes along the shoreline of the headpond and increases safety.

Similar to natural river behavior, headpond levels rise naturally during periods of high inflow rates from upstream. This behavior occurs because water levels in the headpond must rise to allow the greater flow rates to be passed over the weir. For the environmental assessment, flood inundation maps were prepared to illustrate the extent of inundation at various flood flow rates. Although the public is aware of high water levels during flood events, the public may not be aware of the new high water levels that will occur in the headpond area after construction of the project. To this end, an information campaign will be carried out at construction and during first 3 spring freshet events, to make the public aware of the high water level extent in the headpond area. In addition, each property owner and the town engineer's office will be provided with accurate flood inundation maps of the headpond.

Flood inundation is also associated with fast flow rates in the river and headpond area. Flow velocities were calculated for the headpond area for the existing condition and the post-project condition. The calculations show that the flow velocities in the headpond area will be less than the velocities associated with the existing conditions. However, fast flow conditions do occur in the headpond. Recreational users that have visited the headpond during normal flow conditions may not realize that fast flow conditions occur in this otherwise slow flowing section of river. As a result, the information campaign discussed above will also make the public aware of these special risks.

Headpond inundation can also increase drowning risk. The deeper, slower-moving aspects of a headpond may entice recreational users to utilize the headpond for swimming or other water use activities. As a result, the information campaign discussed above will also make the public aware of drowning risks in the headpond and strongly advice against such activities.

For information on Methyl Mercury, see Section 7.1.1 (Water Quality).

Upstream Intake Channel

The intake channel is man-made channel located immediately upstream of the weir on the north side of the river. The intake channel allows water to be diverted from the river into the powerhouse. The potential safety aspects include:

- Fast moving water
- Deep water
- Difficult egress

During the detailed design of the project, the channel will be sized to limit the flow velocities to 0.5 to 1.0 meters per second (0.5 – 1.0 m/s) at the highest design flow rate conditions. Limiting the channel velocity decreases the risk of eddy formation and reduces difficult swimming conditions. However, the water in the channel is deep and flowing towards the powerhouse, thereby creating a drowning and egress risk.

To minimize the risk of inadvertent recreational use by swimmers, a safety boom and warning sign will be located at the river end of the channel. The length of the channel will be fenced on both sides to limit access. At least one, and possibly two bridges will cross the channel. These bridges will also be fenced to minimize the risk falling into the water or being mistaken as a diving platform.

The channel will have steep rock walls, making egress very difficult. A safety ladder will be installed and maintained at the powerhouse location and the bridge to facilitate egress. A one-way gate will be installed near the powerhouse to allow exiting the fenced area. Signage and safety equipment (safety ring and safety pole) will be prominently displayed at the powerhouse in case of emergency. A camera and speaker will be installed on the outside of the powerhouse wall to allow the operator to monitor the area periodically (note, not permanently manned) and communicate if necessary.

The intake to the powerhouse will be equipped with a steel trash-rack grate that will prevent persons from being washed into the powerhouse. The steel grate will have spacing of 48 millimeters (~ 2 inches) and have low entrance velocities (0.5 - 1.0 m/s) to minimize the risk of entrapment of a person in the water against the grate.

Embankment Dam

A short earthen embankment dam will flank either end of the weir. The embankment dam will be accessible to the public, but warning signs will be displayed to caution visitors of the public safety risks in the area and to avoid the area during floods. A fence will be located at the end of the embankment to limit access to the weir and fishway from this location.

The headpond created by the proposed project is relatively small (30,000 cubic meters); however, the sudden release of part or all of this water could cause significant flood risk downstream. As a result, all reasonable effort is made in the engineering design to ensure that the embankment dam and weir structures adhere to strict standards.

Dams, weirs and other in-water structures are engineered in accordance with strict government safety requirements. Special consideration will be given in the detailed design to ensure that all in-water structures meet those requirements. Some of these steps include:

- Selection of qualified engineering design firm with specific experience in the area of in-water design;
- Review and approval of all engineering design drawings by the Ministry of Natural Resources prior to construction; and,
- Preparation and evaluation of a dam-break model to assess consequential downstream impacts of an unplanned failure of the embankment dam or the weir.

Weir

The weir consists of a man-made overflow structure that crosses the river from bank to bank. The weir rises approximately 1.5 meters above the downstream water level. The upstream water level is the headpond level and depends on the natural inflow rate from upstream. Except during high flow and flood conditions, the headpond level is maintained just below the top of the weir with no overflow occurring.

During moderate and low flows, all flow is diverted through the fishway and the powerhouse. The downstream face of the weir is dry under these conditions and may entice persons to climb or explore the weir structure. To discourage use and caution of the risks, signage will be posted as noted above.

Overflow of the weir can occur when headpond water levels rise. This condition does not occur during normal operation and only a limited number of days per year. Headpond levels can change for three reasons and cause the weir to overflow:

- Flood or high flow conditions arriving from upstream for reasons of nature;
- Deliberate shut-down of the powerhouse to facilitate recreational whitewater use in Railroad Rapids; and
- Emergency shut-down of the powerhouse.

In addition to the signage and the public information campaigns outlined earlier, a camera will monitor the weir area. Where a deliberate or emergency shut-down occurs, operating procedures or system will be developed during the detailed design stage to notify persons if present under

these conditions. In addition, calculations will be made to determine the rate of rise under various flow conditions to assess the time available for notification.

Where natural flood or high water conditions occur, control systems will be put into place that alert the operator when a natural flow condition arises that could result in overtopping of the weir. An important aspect of this system is the real-time monitoring of inflow conditions upstream at Highway 17. Similar to the above shut-down scenario, operating procedures or systems will be developed during the detailed design stage to notify persons if present.

Often, natural flood conditions occur progressively over many hours and water levels rise slowly enough to allow impending conditions to be recognized. In many circumstances, flood conditions can be anticipated due to weather forecasting or prevailing weather conditions. Consideration will be given in the detailed design on how to assess these factors and develop appropriate safety procedures in return.

As discussed in other sections of the environmental assessment, the weir will be designed to allow navigation by rafts and kayaks during high flow conditions (i.e. at times when the weir is under water and flow rushes over it). Two weir design options are proposed, depending on property impact constraints and as discussed elsewhere in this document. The two designs and related operational safety considerations are:

- Fixed Weir Option: The fixed weir will be designed so that it will not generate a "re- circulating wave" safety hazard for whitewater users. This design will involve a gradual slope on the downstream face of the weir (20 meters long) as opposed to a traditional weir design involving a sharp drop. The gradual slope prevents the formation of dangerous re-circulating wave conditions. The surface of the weir will be relatively flat with small undulations (i.e. such as natural rock boulders, embedded with grout and sheet piles, and limited rock protrusions at the surface). The fixed weir has no moving parts and requires no operating procedure during use.
- Obermeyer Weir Option: The Obermeyer weir is similar to the fixed weir; however, weir would include embedded steel plates that can be raised or lowered if required. The purpose of the plates is to reduce the weir height, increase the passage rate and avoid upstream shoreline property impacts. Under moderate and low flow, the steel plates would be tilled upwards increasing the weir height by up to 1 meter. Under high flow conditions, some or all of the steel plates would be down (under water with flow overtopping the flat lying steel plates). The remainder of the weir would be similar to the fixed weir described above, including a similar gradual slope on the downstream face of the weir to avoid generating a re-circulating wave hazard. The operating procedure for the Obermeyer weir would involve having at least part of the weir in a completely "down" position when in use to facilitate safe passage for whitewater users.

Regardless of the weir design and interest by whitewater users, it may be legally required to have a safety boom floating upstream of the weir to avoid a safety hazard for inadvertent recreational users and to provide adequate warning of the impending weir. In the detailed design, further consideration will be given to the appropriate balance of facilitated recreational uses, appropriate safety measures and regulatory safety requirements.

Fishway

The north end of the weir contains a nature-like fishway structure that facilitates upward passage of fish during the spring and downward passage for fish all year round. The structure utilizes the naturally sloping shoreline and strategically placed boulders to create conditions suitable for fish passage under various flow conditions. The fishway will pass a minimum of 4 m3/s of flow at all times, regardless of powerhouse operation. The flow rate of 4 m3/s is sufficient to wet approximately 50% of the channel bed in Railroad Rapids at all times (as compared to bank-full flow).

The fishway will be designed in such a manner that during low flow (i.e. 4 m3/s) whitewater users can pass the structure with kayaks and access Railroad Rapids. While this flow rate may not be desirable for whitewater users, the safety design will consider the potential use at this flow rate none-the-less. Under higher flows, the rock boulders will be submerged and the fishway will be navigable with rafts and kayaks so that unobstructed navigation is possible towards Railroad Rapids.

As with any recreational use of whitewater, various risks exist and safety signage or other features may need to be provided to meet regulatory requirements.

Railroad Rapids

Railroad Rapids are a series of natural channel features that are actively used for whitewater recreation. No man-made modification of the channel is proposed as part of the project; however, project operation will affect flows and therefore public safety.

Similar to the conditions affecting the overflow of the weir, the following conditions can result in flow changes in Railroad Rapids:

- Flood or high flow conditions arriving from upstream for reasons of nature;
- Deliberate shut-down of the powerhouse to facilitate recreational whitewater use in Railroad Rapids; and
- Emergency shut-down of the powerhouse.

Safety will be addressed through the development of operating procedure similar to those discussed in the section entitled "Weir" above, including operational monitoring and, if necessary, notification.

Much of the shoreline of Railroad Rapids has steep rocky banks that are difficult to access. Unlike various locations upstream and downstream, public access to Railroad Rapids by foot is limited. The steep channel and whitewater conditions that exist in Railroad Rapids also create public awareness of the inherent dangers of Railroad Rapids. Consideration will be given how this existing awareness can be enhanced through information campaigns and public education.

In addition to the operational safety initiatives outlined above, the powerhouse design includes a special valve that will help avoid rapid increases in flow in Railroad Rapids due to emergency shut-down of the powerhouse.

Powerhouse and Tailrace

The powerhouse is a building located at the east end of the intake channel. The building contains the turbine and generator. A parking lot besides the building will be accessible to the public and a trail will lead to the tailrace area where the public may access the water and fish. A portage access to the river is also provided in this area. The tailrace consists of a short canal where the water exits the powerhouse and re-joins the river. The tailrace water is fast moving and deep.

Special safety consideration will be given to allow good public access while also deterring entry to locations that pose a hazard to the public. The building will be accessible from the north side. A special security door will ensure adequate protection from unauthorized entry. A railing will extend from the east side of the building along the tailrace canal to the shoreline. The railing will allow anglers to access the tailrace for fishing, while providing fall protection into the dangerous water below. A fence will extend from the west side of the building along the intake channel to deter entry to the intake area.

No planned access will be provided to the south side of the powerhouse. A ditch feature exists on the south side of the building that is part of the emergency bypass valve for the powerhouse. This area will be dangerous during emergency shut-downs and must be securely fenced off. Special signage will be provided. Camera monitoring will be installed on all sides of the powerhouse to allow visual surveillance by the operator.

Downstream Flow and Levels

The proposed Big Eddy project will be operated as a true "run-of-river" facility. Under all normal operating conditions, the flow downstream of the powerhouse, where the tailrace flow re-joins the river is always equal to the natural inflow from upstream. No water is stored in the headpond for deferred generation at another time and no modification of flow occurs downstream due to powerhouse operation. However, a number of times per year, conditions

may result in flow downstream being altered temporarily due to shut-down or start-up of the powerhouse.

Powerhouse shut-down or start-up can occur for the following reasons:

- Deliberate shut-down or re-start of the powerhouse to facilitate recreational whitewater use in Railroad Rapids; and
- Emergency shut-down of the powerhouse.

During shut-down of the powerhouse, flow is stopped through the powerhouse and then diverted to Railroad Rapids. A time lag occurs as part of this process. The flow through the turbine stops within less than 60 seconds; however, before powerhouse flow passes down Railroad Rapids, the headpond levels must first rise to overtop the weir. In the initial moment when the powerhouse shuts down, no flow is coming from the powerhouse and no flow is coming down Railroad Rapids, resulting in a temporary drop in flow downstream. The transition process occurs gradually and takes up to several hours to normalize completely.

During start-up of the powerhouse, the reverse process can occur. In this condition, flow is passing down Railroad Rapids. In the initial moment when the powerhouse starts up, flow can occur from both locations (Railroad Rapids and the powerhouse), resulting in a temporary doubling of flows downstream.

To minimize the operational risk of sudden changes in the flow downstream, several features will be incorporate in the final design of the project:

- A powerhouse bypass valve is incorporated into the design to minimize flow fluctuations downstream that could otherwise occur due to powerhouse shut-down or start-up.
- Deliberate powerhouse start-up and shut-down will always occur at minimal turbine flow to minimize flow variations downstream.
- During deliberate start-up or shut-down, the headpond level will be adjusted gradually and an adequate time in advance to gradually adjust the flow in Railroad Rapids and to minimize temporary flow changes at the moment of shut-down or start-up. The powerhouse bypass valve will be used to achieve this operating objective.
- Special consideration will be given to public safety downstream during detailed design including release modeling to predict the magnitude and duration of flow transitions downstream.

The combination of the above operational safety considerations will help to ensure that risk is minimized and flow variations occur gradually and as infrequently as possible.

Public Safety Report

The following quotation comes from the introduction in Xeneca's "General Public Safety Report, December 2011", commissioned from KGS Group, Mississauga, Ontario:

"Dams, control structures and their appurtenances by their very nature may present a number of potential hazards to the public. An important aspect of dam safety management is protecting the public from hazards at dams at every stage of the dam life cycle, from design to decommissioning. Public safety is a most important element of an owner's due diligence in all stages and most importantly in the operational phase of a project. Xeneca has created a Waterway Public Safety Management Guideline (WPSMG) to determine if any potential public safety hazards exist within the area of influence of structures that are owned and operated by Xeneca and to address those that exist.

In developing the WPSMG, the most current dam safety management guidance and practise such as the Canadian Dam Association (CDA) Safety Guidelines (2007) CDA Guidelines for Public Safety Around Dams (2011), Ontario Ministry of Natural Resources (OMNR) Dam Safety Technical Bulletins (2011) and the OMNR Public Safety Guidelines and Best Management Practices (2011). The CDA and OMNR PSG and BMP go beyond 'dam safety' as being primarily concerned with protecting the public from catastrophic failure of the dam brought about by extreme events.

Potential hazards may arise in areas where the dangers posed by structures on the waterway are not well known to the public. This is especially true in the immediate upstream and downstream vicinity of hydroelectric dams and control structures. The risk to the public may increase when rapidly changing flow conditions around dams and hydraulic structures are combined with a general lack of public knowledge about dangers posed. Even relatively low head structures could possibly create submerged hydraulic eddies where overflow water continuously re-circulates, trapping individuals in what are called 'drowning machines'. It is possible that drowning fatalities that have occurred in Canada around dams may have been prevented by application of more rigorous public safety measures, public education and physical warnings directed toward the structures and areas of specific hazards.

Xeneca's corporate Waterway Public Safety Management Plan (WPSMP) is intended to be a living document which can be changed and added to as conditions change and the state of the art evolves."

The General Public Safety Report (KGS Group, 2011) is intended to be a living document which sets the framework for a rigorous public safety plan tailored to each of Xeneca's waterpower sites. The plan includes establishment of governing principals, responsibilities and assumptions and tackles safety in all three primary time frames of a site, design, construction including

installation and commissioning and operation, using the latest available informational guide sources for the same.

The plan outlines basic health and safety process including; hazard identification, risk assessment, control measures, public education and communications plan, incident reporting and the creation of a site specific Waterway Public Safety Management Plan. Systematic and timely follow up review and reassessment is an element of the plan.

A more comprehensive public health and safety assessment will occur during the detailed design stage in accordance with the scope, tenants and responsibilities outlined in Xeneca's WPSMP. As previously noted, communication of this plan to the public is an element of this process.

7.2.4 Civil Structures and Private Property

There is a railway bridge and a roadway bridge downstream of the proposed weir for the Big Eddy GS, in the bypass channel. HEC-RAS model results indicate that water levels at these bridges would not be adversely affected by facility operations, and that these levels would in fact be decreased due to the diversion of flows into the intake channel leading to the powerhouse (see Annex I). Given that these structures would not experience flows any higher than what they have experienced to date under natural conditions, damage due to erosion is not anticipated to occur.

Any significant increase in water levels would end before the gas pipeline crossing and the Highway 17 bridge upstream. Under certain flow conditions, a very minor increase may be observed at the Highway 17 bridge and the pipeline crossing.

Given the run–of-river operation proposed for Big Eddy GS, Xeneca's operations would have no effect on any other waterpower facilities or any water control structures.

7.2.5 Potable Water Supply

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. Currently, the Town of Petawawa obtains its water supply from the Ottawa River.

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, construction industry BMPs 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. A preliminary sediment control plan has been developed and is presented in Annex II. Spill prevention and emergency fuel supply containment measures will be required within the facility throughout the operational period; mitigation measures are described in detail in Table 15.

No impacts to water supply or wastewater treatment facilities are expected as a result of operations at the Big Eddy GS, as none are located within the project's zone of influence (ZOI). While a review of MOE well records did locate wells as being present within 1 km of the project's ZOI, the depths of the water table are such that the project will not likely have an effect on these wells.

7.2.6 Area Aesthetics

Measures for preserving the natural aesthetics of the waterway and surrounding area will be incorporated into the proposed development. The area is popular with recreational paddlers, community members, and other recreationalists. Several permanent residences are also located in proximity to the project site.

Railroad Rapids is heavily treed on both sides. It has steep side slopes and very fast moving water. Based on the proponent's usage survey, it was determined that very few people access this section of river due to the very difficult terrain. Considerable effort has been made to develop a weir design that will look natural and blend into the rocky riverbed landscape. To this end, the design concept for the preferred option of the weir (Option 1) incorporates natural rock rather than concrete, to the greatest extent possible. The proposed powerhouse is designed to blend into the surroundings below the Petawawa Bridge.

To compensate the visual impact in the watercourse, a compensatory flow of at least 4 m^3/s will be maintained in the bypass reach at all times. Even at these low flows, the natural appearance of the river will be preserved. Under the current proposed operations strategy, there would be approximately 48 days/year where either the full flow rate or a flow of at least 60 m^3/s would be flowing in the bypass reach.

Maintaining or enhancing vegetative buffers between the river, roads, and any ancillary works will be a consideration during detailed design to preserve the aesthetic quality of the area; proposed mitigation measures are provided in Table 15.

7.2.7 Noise

Hydroelectric generating stations are largely unobtrusive in terms of impact on the noise environment. Most of the noise that occurs during operations originates inside and is mitigated by the powerhouse structure. The noise associated with this project would occur primarily during the construction phase. Background sound levels within the area will also be created by natural processes such as the falling of water over rocks.

Acoustical analyses of the proposed project were conducted to predict sound emission levels and assess the potential impact of the proposed project. More information is provided in the Initial Environmental Sound Study Big Eddy Hydro-Power Plant, Petawawa, Ontario by Howe Gastmeier Chapnik Limited in Annex I.

In Ontario, guidelines developed by the MOE form a logical basis for an environmental noise assessment. The area surrounding the proposed facility is categorized as a Class 2 environment, due to the proximity to a population centre, and the presence of several significant roadways. For the purposes of this study, the most stringent, "exclusionary minimum" MOE limits from NPC 205 have conservatively been used. For equipment that could operate during both daytime and nighttime hours in a Class 2 environment, the exclusionary minimum limit is 45 decibels (dBA) at any sound sensitive points of reception in the vicinity.

The four closest potential points of reception identified are commercial establishments, which are not considered "sound-sensitive" under MOE noise guidelines. Therefore, in this study, a fifth location has been considered, which consists of a hotel and represents the most potentially impacted sound sensitive point of reception proximate to the facility (these locations are labelled as POR1 through POR5 in Figure 1 of the "Initial Environmental Sound Study", in Annex I of this report).

The only source anticipated to emit sound to the outdoors at the facility, will be a small oil filled transformer with a capacity of approximately 5.18 MW (6.22 MVA), with integral cooling fans. The sound power emission level of the transformer, which is specified as 91 dBA was input into a predictive computer model (Cadna-A version 4.3.143). The model is based on the methods from ISO Standard 9613-2.2 "Acoustics - Attenuation of Sound During Propagation Outdoors", which accounts for the reduction in sound level with distance due to geometrical spreading, air absorption, ground attenuation and acoustical shielding by intervening structures (or by topography and foliage where applicable).

The prediction results presented in Table 14 indicate that sound levels from the proposed Big Eddy GS will be well within the applicable MOE sound level limit at the nearest sound sensitive point of reception, without the need for physical noise control measures. As well, the sound levels at the non-sound-sensitive points of reception are also low, and are not anticipated to have potential for adverse impact. See also the "Initial Environmental Sound Study", in Annex I of this report for the predicted energy-equivalent (LEQ) sound level contours resulting from the sound emissions of the proposed facility.

Table 14: Predicted Equivalent Hourly Sound Levels, L_{EQ} [dBA]

Receptor	MOE Sound Level Limit	L_{EQ}
POR1	Not sound sensitive	41 dBA
POR2	Not sound sensitive	31 dBA
POR3	Not sound sensitive	33 dBA
POR4	Not sound sensitive	30 dBA
POR5	45	30 dBA

A more detailed noise impact assessment will occur during the detailed design stage, as a precursor to the eventual application for an Environmental Compliance Approval(s) (Noise) for the facility under Section 9 of the *Environmental Protection Act*.

7.2.8 Employment & Economic Effects

Construction and operation of the project will generate a positive economic effect due to opportunities for employment of community members and sourcing of construction materials. Similar employment opportunities will also exist for the First Nations and Aboriginal communities as well as the Town of Petawawa.

The proposed Petawawa River Big Eddy GS will have a total installed capacity of approximately 5.3 MW. Waterpower creates jobs, generates revenue for the taxpayers of Ontario, and is the longest lived and most reliable source of renewable electricity, specific benefits include:

- 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 $13 million in the case of this project), in procuring construction labour and materials, consulting and legal services, trucking and other services such as accommodation, food and fuel.
- Direct and indirect job creation (construction) is estimated to be approximately 10,000 person hours of direct work and approximately 15,000 person hours of indirect work supporting the project and personnel.
- A significant return to the people of Ontario paid through Gross Revenue Charges 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.
- The permanence of waterpower: 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 are: nuclear - 40 years, wind 20 - years, solar - 20 years.

7.3 IDENTIFIED ABORIGINAL COMMUNITY CONSIDERATIONS AND CONCERNS

A summary of the specific issues identified during Aboriginal consultation process is presented in tabular format as Table 15. The table identifies how resolution to each identified issue has been or may be resolved, and whether any outstanding issues or concerns remain.

Land Claims

The project location is within a land claim presently being negotiated between the Algonquins of Ontario (AOO) and the Province of Ontario and Canadian federal government, based on a cursory review of the Preliminary Draft Comprehensive Land Claim Agreement in Principle dated

December 2012 (2012 Agreement). It is Xeneca's understanding that the project is not located within any lands scheduled to be set aside as Settlement Lands. The 2012 Agreement (Section 8.1.1 & 8.4.1) notes that there is a right to harvest fish, wildlife, furbearing species and plants for domestic purposes within the Settlement Area. The development of the project will not impede that right as access to these resources will be maintained. Xeneca will continue to engage with the AOO and monitor the agreement to determine what, if any, impacts there may be on the project; as well, ongoing consultation and engagement with the AOO will be undertaken to ensure that Aboriginal rights are protected and maintained.

The project is located within the Williams Treaties Area of 1923 and the project components do not appear to impact any projections of this treaty area at this time. Should it be determined at a later time that the project impacts an area or Community in the Treaty area Xeneca will amend its consultation protocol.

Cultural History

The Petawawa River watershed contains an important, century's old sacred site called Kitchi Mikinac Assin. Based on some initial dialogue, this site appears to be outside the project area and consultation and engagement with regards to this site is still ongoing.

A Stage 2 archaeological assessment of the weir site and inundation area was conducted in the fall of 2012 which targeted areas previously identified in a Stage 1 assessment as having a high potential for the presence of cultural heritage resources. The Stage 2 assessment did not identify cultural resources and no further archaeological assessments were recommended. Copies of the Stage 1 and Stage 2 reports are provided in Annex V. Additionally, these assessments determined that no registered archaeological sites exist in or near the project area.

Note to Reviewer: Archaeological assessments for access roads will be conducted through the summer of 2013 and the results of these assessments will be incorporated an inform impact assessment for the final environmental report.

Access/Navigation

The development of the dam will present a barrier to navigation and may conflict with traditional lifeways of communities. Recreational and traditional users of the Petawawa River will continue to have access to the waterway. A portage route around Railroad Rapids will ensure the river remains accessible by traditional lake canoes.

A portage trail will be added to provide recreational users of the river a route to bypass the weir and powerhouse tailrace. The portage trail will be added during the last phase of construction. The permanent safety boom will direct users to the portage route which will start just north of the intake canal and will end beyond the tailrace. Signs will be installed instructing users of the

portage route at both entrances. The route will utilize steps and handrails to allow safer passage in steep sections.

White-water navigation through the channel is possible under certain flow conditions with appropriate equipment since an ecological flow of at least 4 m^3/s will be provided through the fishway at all times.

Due to its large width and gentle slope in the downstream direction, Option 1 of the weir can be navigated by watercraft under most flow conditions (see also Section 3.3.1 for a more detailed description of the structure). Navigation over the weir may not be possible under low flow, when most or all of the flow must be directed into the fishway to accommodate fish passage, resulting in an insufficient depth of water passing over the weir.

Passage of watercraft directly over Option 2 of the weir would generally only be possible under higher flow conditions, when the Obermeyer gate is lowered. During other flow conditions, the Obermeyer gate would be raised, such that there would be a sudden drop immediately downstream of the structure, making navigation over the weir less practical.

Access around the site will only be restricted during construction and operation as necessary to maintain public health and safety, which could have temporary impacts to access and navigation. A combination of fencing and signage will be used to isolate construction areas from available recreational areas and to alert the public of the area about the dangers of construction and location inaccessibility. During facility operations, the only restrictions to public access would be in the immediate vicinity of man-made structures. No restrictions on access to the river are being proposed.

Concerns about potential impacts to aboriginal tourism operators have been raised. Since there is potential for increased access for angling and kayaking, some tourism values may be enhanced as a result of this project. Xeneca endeavored to design the weir structure in a manner that is functional, aesthetically pleasing and blends into the natural surroundings. The proposed powerhouse is designed to blend into the surroundings below the Petawawa Bridge. Efforts to minimize impacts to the river's tourism values should assist in retaining existing tourism and recreational attributes. See sections 7.2.6 and 7.2.8 for more information.

Traditional Land and Resource Use

Concerns about water quality, clarity and temperature, including methyl mercury effects, have been raised by first nations, members of the public and regulators – these issues are discussed in Sections 7.1.1 and 7.1.2.

Concerns have also been expressed that the installation and operation of the facility will impact migration of culturally important aquatic species such as American Eel and Lake Sturgeon. The proponent is required under the *Fisheries Act* to maintain fish passage. A natural type fishway has

been designed under the guidance of regulators to provide upstream passage of Lake Sturgeon, American Eel, Walleye and other species. Upriver fish passage is being proposed through development of a nature-like fishway as a measure to preserve habitat connectivity for SAR such as the Lake Sturgeon and American Eel, and to preserve important recreational fisheries. The design of the overflow weir was created to safely allow downstream migration and a small fish chute at the powerhouse intake is proposed to provide downstream passage path for fish that do not find the overflow weir or engineered fish passage. A post-construction monitoring program will be implemented at the site of the weir, to monitor the success of the natural fishway. See section 7.1.3 of this report, and Annex III for more detail on these species.

Impacts to important fish species to local aboriginal communities such as: walleye, northern pike, muskellunge, river redhorse and impacts to fish habitat are discussed in Sections 7.1.3 and 7.1.4 above.

A fishway will be incorporated into the project design along the north shore in order to preserve upstream and downstream migration for important fish species. The intake will be designed to minimize the potential for fish mortality as a result of passing through the turbine(s). See section 3.3.6 for details about the fishway.

Development activities, such as the clearing and grubbing of land may impact food bearing plants and impact foraging and harvesting activities of some communities. The clearing and grubbing of land will result in a permanent loss of some vegetation. 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 to avoid any unnecessary loss of vegetation. Areas cleared during construction which are not allocated to associated facilities such as roadways, trails or laydown areas, and, wherever possible, will be repaired, revegetated, and stabilized. Appropriate silviculture treatments will be used to restore and revegetate the work sites and seed mixes and revegetation procedures will meet MNR standards.

Important habitats will be avoided wherever possible and activities will be scheduled to avoid sensitive nesting, rearing, mating, or staging periods, as best possible. Removal of woody vegetation will be conducted outside of the bird breeding period (April 1st – September 1st). Project personnel will be trained and required to use proper care and caution when operating vehicles to avoid collisions with wildlife. Indirect impacts also have potential to occur during active construction and during operation of facility (i.e. noise, human presence and activity).

Development activities may impact the use of the area by waterfowl for foraging and nesting activities. These impacts are considered to be negligible based on communities present in the surrounding landscape.

Furbearing mammals are important to the economies and lifeways of aboriginal communities. Considering the small headpond and inundation area proposed, coupled with the Run-of-River Operation Plan, adverse impacts to furbearers are not believed to have a significant potential. The main river system will still function as feeding and travel habitat for furbearing and other species. Water fluctuations caused by peaking hydroelectric facilities can result in furbearers becoming trapped and drowning in their dens during the winter months; however, due to the Run-of-River operation protocol, no fluctuations in water levels would occur as a result of facility operations. There are no permanent lodges or dens confirmed within the immediate inundation area. The creation of the headpond may increase available feeding habitat for beaver, giving them access to suitable treed areas that are currently out of their "reach".

Based on the Natural Heritage Assessment (Annex III) it is not anticipated that the project will affect deer or moose populations or their habitat. Accordingly, no impacts on First Nation hunting activities are anticipated.

The development of the project may temporarily affect harvesting rights or impede traditional land uses and resource harvesting activities in the immediate project area as a result of clearing and limitations on access during construction. Clearing associated with construction may remove some harvested materials and plants and access may be restricted access to portions of the waterway to maintain public safety. However, following site rehabilitation and into operations, access will only be restricted near the powerhouse, intake and ancillary structures for public safety and facility security. Access past the facility will be maintained. Vegetation will also be re-established in temporary construction areas and access roads.

7.4 Specific Consultation Issues and Resolutions

Discussion on the key issues raised during the consultation process is presented in Section 6. 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 15 (Identified Issues, Summary of Mitigation, and Potential Residual Effects). 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 grouped based on the environmental components which could be affected by the undertaking.

7.5 Consideration of Accidents and Malfunctions

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

As the mitigation measures and BMPs detailed in Table 15 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 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 Big Eddy GS site and along the connection line to minimize the potential for accidents.

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) and the diesel generator will require an Environmental Compliance Approval.

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 downstream. An emergency powerhouse bypass will be built to be used in the event of an emergency shut down at the facility.

7.6 Effects of Environment on the Project

The project team has also considered how the environment may affect 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 connection 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 emergency bypass designed into the facility. This emergency bypass will be designed to accommodate at least the pre-project capacity of the natural rapids. This aspect of the approval process will be dealt with after the EA process is completed, as the detailed engineering design is being finalized.

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 and 5.7.

It should be noted that the facility is not designed 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 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.

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.

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.

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.

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.

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 Western Quebec Seismic Zone, and according to NRCan (http://earthquakescanada.nrcan.gc.ca) this zone was the site of three significant historical seismic events. The closest to the project location was a 1944 earthquake with a magnitude 5.6, located between Cornwall, Ontario and Massena, N.Y. NRCan reports that the area is also shaken by weaker earthquakes felt by the local population from 'time to time'. In 1990, an earthquake of

magnitude 5.0 took place near Mont-Laurier, Quebec; two earthquakes of magnitude 4.4 and 4.3 occurred near Ste-Agathe-des-Monts, Quebec in 1996 and 1997 respectively; in 2010 a 5.0 magnitude earthquake occurred north of Buckingham Quebec and in May of 2013 a 5.2 magnitude earthquake occurred north of Shawville, Quebec. An earthquake occurs in the Western Quebec Seismic Zone every five days on average. The location of the project in this seismic activity area presents a low potential for the facility to be affected by this type of geological event.

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 connection. 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.

Table 15: Identified Issues, Summary of Mitigation, and Potential Residual Effects

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
General Natural Environment					
Air Quality	Noise from operation of electrical generator and transformer at powerhouse and electrical connection	Operation	• design powerhouse to reduce level of noise outside the powerhouse building • a noise impact assessment will be conducted during the detailed design stage of development • proximity to residences will likely require an Environmental Compliance Approval for the facility	Low negative impacts - impacts mitigated or eliminated where ever possible through design	Yes
	Exhaust emissions from equipment and vehicles	Construction & Operation	• 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, Environmental Compliance Approval required	Yes
	Odour	Construction	• 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	No impacts anticipated - proper handling of VOC/organic waste onsite and offsite disposal at an approved disposal location will mitigate potential impacts	Yes
	GHG Offsets	Operation	• N/A	Positive effects due to GHG offsets by building a hydroelectric generating station to generate 20,000 MWh of renewable energy represents the displacement of 1,920 tons of carbon dioxide equivalent	Yes
	Dust emissions from construction activities and vehicles	Construction & Operation	• 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, Environmental Compliance Approval required	Yes

Environmental Component	Issue	Phase of Development	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 access roads	Construction	• 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 and maintain appropriate emergency response measures • implement wet weather restrictions and 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 to maintain a vegetative buffer • 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, use best management practices	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	Construction	• 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;	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; Adhere to all applicable standard best management practices available to the industry.	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Water Quality (surface and groundwater)	Contamination from spills or leaks of hazardous substances	Construction & Operation	• 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 150 m 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 30 m 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 best management practices.	Yes
	Inundation may alter water quality (methyl-mercury and heavy metals) in reservoir	Construction & Operation	• trees and woody debris generally will be removed from the inundation area prior to headpond filling • headpond created in association with the project will be relatively small and have well moving water compared to other hydropower projects where mercury generation has occurred • pre- development monitoring for mercury in fish tissue and surface water has been completed and will be used as baseline information for monitoring programs in the early operational period.	Effects possible but difficult to predict given the available information about the dynamics of mercury generation in small impoundment areas. The proponent has met with regulators and developed suitable programs for surface water and Hg in fish flesh for both pre-op and post-construction period based on the MOE SW Guidance Document (Feb 2012).	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Species at Risk and Habitat (SAR)	Upstream and downstream passage for Lake Sturgeon and American Eel	Construction & Operation	• Upriver fish passage is being proposed through development of a nature-like fishway as a measure to preserve habitat connectivity for Species at Risk (SAR) such as the Lake Sturgeon (*Acipenser fulvescens*) and American Eel (*Anguilla rostrata*) • A post-construction monitoring program will be implemented at the site of the weir, to monitor the success of the natural fishway as a measure to preserve habitat connectivity for these species. • Equip intake with specialized grate to limit fish impingement, if and when American Eel are confirmed, trashracks with smaller spacing will be installed • if American Eel are confirmed, light, sound and flow will be utilised to deter fish from entering the intake canal • A specialised "slide" will be installed at the facility intake which will pass American Eel (and other fish species) directly to the river below the tailrace, bypassing the turbines • velocities within the intake canal will be limited to 1 cms or less through design • A minimum flow of 30 m^3/s will be provided during Lake Sturgeon staging and spawning periods in order to facilitate passage (during the spring when water temperatures range from 5°C to 12°C)	Minimal impact anticipated. The proponent has met with regulators to determine suitable fish passage mitigation methods for Lake Sturgeon and American Eel.	Yes
	Impacts to sandbar located in proximity to facility tailrace (potential Lake Sturgeon habitat)	Construction & Operation	• the construction and alignment of the tailrace has been designed to avoid impacts to this feature • post-construction monitoring will occur to ensure that the sandbar is not being affected by operations	No impacts anticipated - if unforeseen effects are occurring post construction monitoring will inform further management discussions with MNR and DFO	No
Significant Earth or Life Science Features	Black Bay Provincially Significant Wetland in proximity to the Big Eddy project	Construction & Operation	• Black Bay Provincially Significant Wetland is outside of the proposed zone of influence and inundation area, and will not be impacted by run of river operations.	No impacts anticipated	No
	Potential impacts to the Petawawa Fish Hatchery, Petawawa Fish Hatchery Nature Reserve	Construction & Operation	• Identified areas are outside the projects zone of influence and are unlikely to be affected by the project	No impacts anticipated	No

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Terrestrial wildlife (numbers, diversity, distribution)	General disturbance to habitat during construction and maintenance of facility (dam, powerhouse, etc.)	Construction & Operation	• 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	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). Similar vegetation is abundant in the surrounding area and vegetation will re-establish after construction.	Yes
	Access road construction resulting in habitat fragmentation	Construction & Operation	• 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. • No species at risk were found within the area where works are proposed.	Routing will be confirmed with MNR and DND through approvals process	Yes
	Impacts related to the creation of facility and operational headpond	Construction & Operation	• Relative to the areas to be impacted, comparable terrestrial habitats are abundant in the surrounding region	Low negative impacts anticipated - small facility footprint and inundation area and impacts to regional populations will be negligible as similar habitat is abundant in the area.	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Terrestrial wildlife (numbers, diversity, distribution)	Loss of vegetation and terrestrial wildlife during powerhouse construction activities - clearing, grubbing and stockpiling	Construction	• 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.	The clearing and grubbing of land will result in a loss of some vegetation and in turn potential wildlife habitat. Indirect impacts also have potential to occur during active construction (i.e. noise)	Yes
	General disturbance to wildlife	Construction & Operation	• Avoid important habitats, as best possible. • Activities will be scheduled to avoid sensitive nesting, rearing, mating, or staging periods, as best possible. • All food and food waste will be properly stored and disposed of to prevent attracting wildlife. • All Project personnel will be trained and required to use proper care and caution when operating vehicles to avoid collisions with wildlife. • Wildlife are relocated as required during the work.	Construction Management Plan will be updated to include findings from terrestrial studies. Minimize the disturbance to wildlife during the construction and maintenance program.	No
Natural vegetation and habitat linkages	Effects on vegetation and habitat during access roads ROWs construction and maintenance	Construction & Operation	• if an easement/lease is obtained to use the abandoned railroad line, it would eliminate large scale vegetation clearing • if habitat clearing is necessary for ROW construction, a qualified biologist or wildlife technician should be present • 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	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	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Natural vegetation and habitat linkages	Access road - increased potential for forest fires	Construction & Operation	• 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.	No
Soil and sediment quality	Soil compaction in project construction footprint and ROW for access roads	Construction	• schedule construction of temporary access road 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
	Management of excavated materials (blast rock, fill, aggregates, etc.)	Construction	• 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 preliminary Sediment and Erosion Control Plan (Annex II) is provided. If required, an ARD Management Plan will be adhered to.	No

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Significant Natural Heritage Areas and Features	Potential impacts to the Pembroke Crown Game Preserve and the Petawawa Terrace	Construction & Operation	• Identified areas are outside the projects zone of influence and are unlikely to be affected by the project	No impacts anticipated	No
Aquatic and Riparian Ecosystem					
Shoreline Dependent Species	*Shoreline dependant Fish Species - See Fish Habitat Section below*				
Shoreline Dependent Species	Potential impacts on shoreline habitats resulting from construction activities	Construction	• impacts largely limited 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	No
	Disturbance or destruction of existing nests (turtle, bird, fish, etc.)	Construction	• Construction activities will occur outside of timing windows for the protection of fish habitat (Mar 15th-June 1st, July 16th-Sept 15th). • Clearing and grubbing will be performed outside of the breeding bird season where possible (April 1st - Sept 1st). This window will also serve to protect terrestrial turtle activity if present in the construction area.	Low negative impacts anticipated - impacts to regional populations will be negligible as similar habitat is abundant in the area	No
	Furbearing mammals may be impacted by the fluctuating water levels in the headpond during the winter months	Operation	• Small proposed headpond and inundation area; • No permanent lodges or dens confirmed within the immediate inundation area. • Facility operation is Run of River and, following inundation, water level fluctuations will be dependant on natural flows	Given the small headpond and inundation area proposed, coupled with operations as a true Run of River facility, minimal effects as a result of inundation are anticipated.	No
	Furbearing mammals may be impacted by alteration of habitat resulting from inundation	Construction	• Small proposed headpond and inundation area; • No permanent lodges or dens confirmed within the immediate inundation area. • Inundation of the headpond will be timed to avoid trapping denning mammals in their dens	The main river system will still function as feeding and travel habitat for these (and other) species, Flooding may increase available feeding habitat for beaver, giving them access to suitable treed areas that are currently out of their “reach”.	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Wetland Dependant Species	Irreversible loss of wetland habitat (swamp thicket) located along Trillium Trail has potential to be impacted during construction if Option 2 for access road is selected.	Construction	All clearing and filling will be undertaken outside of the active herpetile and breeding bird seasons, with works occurring between 15 Sept and 15 April. A qualified biologist or wildlife technician will be present during felling of trees to ensure that no key cavity or raptor nest trees are disturbed, and that clearing avoids such sites by providing a buffer of undisturbed vegetation around each tree as per MNR guidelines. Sediment barriers will be installed along the boundaries of the wetland to prevent erosion of the wetland during construction.	With selection of Option 2 for access, Low impacts anticipated-loss of wetland habitat for a 600 m stretch along the Trillium Trail (approx. 6000m2 of habitat). Net loss of habitat small in scale; vegetation typical of disturbed areas, no loss of key species of flora or fauna documented in the area.	Yes
Fish Habitat	General impacts of construction activities on fish habitat	Construction	• 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 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
	Effects of lowered water levels in the bypass reach on the movement and staging of walleye at the time of spawning	Operation	• A flow of at least 4 m3/s will be passed through the fishway at all times, in order to facilitate fish passage past the weir. • The minimum flow to be passed into the bypass reach will be 30 m^3/s during walleye spawning, when water temperatures are between 6 and 12°C. • the identified potential walleye habitat within the bypass remains wetted under low flow conditions so typical spring flows will ensure that spawning and eggs are not impacted, should spawning occur at this location.	With the provision of at least 30 m^3/s into the bypass reach during spawning and staging, upstream passage of walleye and lake sturgeon is not anticipated to be significantly compromised. The limited potential habitat within the bypass will remain wetted with appropriate flows to protect spawning and eggs, should spawning occur.	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Fish Habitat	Potential impact on potential walleye spawning in gravel/riffle area at the downstream end of the bypass reach	Operation	• This gravel riffle will remain wetted at the proposed minimum flow.	During Walleye spawning in the spring, when water temperatures fall between 6˚C and 12˚C the bypass will receive a minimum flow of 30 m^3/s. Accordingly, Walleye spawning activity, if present at this location, should not be impacted.	Yes
	Potential effects on habitat and spawning from dewatering activities	Construction	•The cofferdam is anticipated to be constructed in accordance with the appropriate in-water timing window dictated by the Ministry of Natural Resources in order to avoid spawning. • 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. • Dewatering will be done in a controlled manner so as not to discharge turbid water to the receiving watercourse. • The discharge point in the receiving watercourse will be carefully chosen as an area with low scour potential (i.e. bedrock bottom) and will be monitored to ensure that the filtering is effective in removing excess sediment. • 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. • 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 - No confirmed spawning habitats within the construction footprint. 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 benthic invertebrates as a result of inundation and operations	Construction & Operation	• Following inundation, shallow water invertebrate habitat will shift as a result of changes in depth within the inundation area but suitable substrates will remain for benthic species • Suitable habitat for benthic species is abundant both upstream and downstream of the project area • Downriver invertebrate drift will still be possible over the weir • Run of river operational strategy will reduce impacts to benthics associated with water level fluctuations	Low negative effects possible, however suitable habitat is abundant in the surrounding area and habitat functionality will remain within the inundation area	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Fish Habitat	Dewatering of aquatic habitat due to the loss of wetted width within the bypass reach during periods of low flow	Operation	• Habitats present in the bypass are common upstream and downstream of the project site on the Petawawa River • Habitat within the majority of bypass consist of fast or very fast flows over bedrock and is unsuitable aquatic habitat for fish or benthic species • A flow of at least 4 m3/s will be passed through the fishway at all times, in order to facilitate fish passage past the weir. • The minimum flow to be passed into the bypass reach will be 30 m^3/s during walleye spawning, when water temperatures are between 6 and 12°C, and 30 m^3/s during sturgeon spawning, when water temperatures are between 9 and 16°C. • approximately 6m of wetted width will be potentially lost under low flow conditions along the shallow north side of the river just upstream of the railroad bridge, however this habitat consists of pools over bedrock	In some areas of the bypass shallow water habitats will be dried however, channel morphology will allow a shift in shallow water habitats towards the center of the river as water level decrease over gradually sloped channel walls. Overall, shallow water habitat will continue to exist within the bypass reach	Yes
Fish migration	Construction of the dam represents a potential barrier to the upstream movement of fish	Construction & Operation	• upstream fish passage is not always possible under existing conditions due to a combination of channel morphology and flows • a flow of at least 4 m^3/s will be maintained in the fishway and bypass channel at all times; minimum flow requirements will be increased to 30 m^3/s during walleye and sturgeon spawning periods in order to facilitate fish movement • Upriver fish passage is being proposed through development of a nature-like fishway as a measure to preserve habitat connectivity for Species at Risk (SAR) such as the Lake Sturgeon (Acipenser fulvescens) and American Eel (Anguilla rostrata) • A post-construction monitoring program will be implemented at the site of the weir, to monitor the success of the natural fishway as a measure to preserve habitat connectivity for these species.	Minimal impacts anticipated with the implementation of mitigation measures.	Yes
	Downstream fish passage	Construction & Operation	• Downstream fish passage will be maintained over the weir under high flows and down the fishway under low flow conditions • A specialised "slide" will be installed at the facility intake which will pass American Eel (and other fish species) directly to the river below the tailrace, bypassing the turbines • A minimum ecological flow of 4 m^3/s will be passed through/over the facility to allow for the safe descent of fish • Equip intake with specialized grate to limit fish impingement, if and when American Eel are confirmed, trashracks with smaller spacing will be installed	Minimal impacts anticipated with the implementation of mitigation measures.	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Fisheries	Impacts to fisheries within the project zone of influence	Construction & Operation	• Fisheries in the area may be affected by changes in fish habitat and movement within the zone of influence. The reader is referred to the F*ish Habitat*, *Fish Migration* and *Fish Mortality* sections of this table for more information on issue specific mitigation measures • Pre and post-operational monitoring will be conducted to analyze effects on fisheries in the project zone of influence.	Residual effects on fisheries are possible as a result of the project as the creation of a headpond and alteration of flows within the bypass will have effects on fish habitat and movement. However, similar fish habitat is available upstream and downstream of the project and existing habitats will shift to new areas within the zone of influence. Design measures and operational constraints have also been applied to mitigate impacts to both upstream and downstream fish passage. Post construction monitoring will confirm this assessment or indicate if unforeseen effects are occurring.	Yes
Fish Mortality	Fish impingement or entrainment resulting in injury or mortality	Operation	• Engineer facility intake and design velocities to account for fish swimming capabilities to minimise potential for impingement or entrainment through turbine(s) - facility intake canal will have velocities limited to 1cms or less • Equip intake with specialized grate to limit fish impingement • Light and sound deterrents will be installed at entrance to intake canal to further prevent entrainment • a small fish chute/slide at the powerhouse intake is proposed to provide downstream passage path for fish that cannot find the overflow weir or engineered fish passage • Turbine design and selection will minimize fish injury or mortality.	Turbine selection will be discussed with MNR and DFO to address fish injury and mortality. A Kaplan turbine will be used to provide generation efficiency and minimize fish impingement or entrainment.	Yes
	Fish injury or mortality as a result of cofferdam placement and dewatering	Operation	• Placement of the cofferdam will be so as to minimize mortality. Fish salvage will be carried out during all dewatering events by qualified biologist to relocate species.	CMP will consider this potential effect and fish salvage will be carried out during the dewatering operation.	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Fish Mortality	Potential for fish in the bypass reach to become stranded if flows drop too suddenly	Operation	• The Big Eddy GS would operate as a run-of-river facility, and would not result in daily changes to flows in the bypass reach. Flows in the bypass reach would only change rapidly when the facility is turned off to provide all flows to the bypass reach during seasonal low water conditions or to provide flow for recreational uses. During low water conditions, Xeneca proposes a ramp down time and ramp up time of 30 minutes each. • Few fish have been observed in the bypass reach during field visits, due to the fast-flowing water and the steep and rocky nature of the bypass. • Additionally, hydraulic studies have demonstrated that the bypass reach will not be dewatered as a result of operations, even during ramp up and ramp down times.	No impacts anticipated - infrequent ramping events and few fish in the bypass reach	No
Erosion and Sedimentation	Surface water overland flow paths within the construction areas have the potential to carry construction-related sediment to the watercourse.	Construction	• 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.	Adhere to all applicable standard best management practices available to the industry	No
	Increased shoreline erosion, ice scouring and sediment deposition due to inundation and water level fluctuations	Operation	• Facility will operate in true run-of-river mode; therefore water levels in the headpond will not fluctuate as a result of operations • Downstream of the tailrace, where the outflows from the powerhouse join the natural river channel, flows will be the same as those coming from upstream of the intake channel	No negative impact anticipated due to run-of-river operations.	No

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Erosion and Sedimentation	Potential hydraulic impacts on the sandbar feature near the convergence point of the bypass channel and the tailrace (the sandbar is recognized as fish nursery habitat)	Operation	• Sediment transport in the Petawawa River occurs mostly in the form of suspended sediment, rather than bedload sediment. HEC-RAS modeling results suggest that the decrease in flow velocity in the headpond would not be large enough to affect the transport of suspended sediment, which in turn is not expected to affect the supply of sediment to the sandbar. • The outflow from the tailrace will be discharged into the Petawawa River immediately downstream of the sandbar, so it is not anticipated that the sandbar will be impacted by the interaction of flows from the bypass channel and the tailrace outflow. • Following facility construction, the sandbar will be monitored. Should it be observed that the sandbar is shrinking over time, appropriate-sized sediment from upstream of the weir will be mechanically lifted and deposited downstream of the weir in order to re-supply the sandbar with sediment.	No negative impact anticipated, but monitoring and mitigation measures are proposed in the event that impacts are observed. Additionally, large amounts of habitat with a similar potential for use as nursery habitat can be found between the proposed Big Eddy GS site and the Ottawa River.	No
	Potential impacts on current sediment transport regime in the river	Operation	• The amount of sediment currently being transported along the Petawawa River is limited, due to the presence of several lakes and wide sections of river within the first few kilometres upstream of the proposed project site. • The change in sediment transport resulting from the creation of the weir and headpond would be relatively minor, and would not result in significant changes to sediment deposition and/or erosion.	Minor impact anticipated. Sediment transport in the vicinity of the Big Eddy GS site is already limited.	Yes
Drainage, flooding and drought patterns	Alteration from natural patterns	Operation	• Facility will operate as a true run-of-river facility; outside of the zone of influence (from the upstream end of the headpond down to the tailrace of the facility), the Petawawa River will not experience changes in flow patterns compared to pre-development conditions • 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*. • The inclusion of an adjustable Obermeyer gate (Option 2 for the proposed Big Eddy project) will limit the extent of backwater effects during flooding events, and allow for a limited amount of flood control).	Low negative impacts anticipated.	Yes
Water temperature	Alterations of the thermal regime of the river due to impoundment	Operation	• Facility will operate as a true run-of-river facility , the headpond will have a very small area and short residence times • Water depth in the headpond would not be sufficiently large to result in thermal stratification and significant alterations of the river's thermal regime.	The increase in water depth and residence time in the headpond are too small to result in significant changes to water temperature in the river.	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Aboriginal Community					
Spiritual, ceremonial, cultural, archaeological or burial sites	Installation and Operation of the Project will impact migration of culturally important aquatic species at risk such as American eel and Lake Sturgeon	Construction & Operation	• Upriver fish passage is being proposed through development of a nature-like fishway as a measure to preserve habitat connectivity for Species at Risk (SAR) such as the Lake Sturgeon (*Acipenser fulvescens*) and American Eel (*Anguilla rostrata*), and to preserve important recreational fisheries. • A post-construction monitoring program will be implemented at the site of the weir, to monitor the success of the natural fishway as a measure to preserve habitat connectivity for Species At Risk (SAR) such as Lake Sturgeon and American Eel. • Proponent required to maintain fish passage under *Fisheries Act* • natural type fishway was designed under the guidance of regulators to provide upstream passage of sturgeon, American eel, walleye and other species • design of overflow weir was created to safely allow downstream migration • a small fish slide at the powerhouse intake is proposed to provide downstream passage path for fish that cannot find the overflow weir or engineered fish passage • refer to Species at Risk and Habitat, Fish Migration and Fish Mortality	Minimal impact anticipated. The proponent has met with regulators to determine suitable fish passage mitigation methods for Lake Sturgeon and American eel.	Yes
	Impacts to important fish species to local aboriginal communities such as: walleye, northern pike, muskellunge, river redhorse	Construction & Operation	• See *Fish Habitat*, *Fish Migration*, *Fisheries* and *Fish Mortality* sections above.		
	The Petawawa River is a sacred watershed that contains an important sacred site that is many centuries old called Kitchi Mikinac Assin.	Construction & Operation	• It is understood based on some initial dialogue this site is outside the Project Area though additional consultation is required.	Consultation and engagement with regards to this site is still ongoing. Resolution of this issues is difficult given differences in cultural perspectives.	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Spiritual, ceremonial, cultural, archaeological or burial sites	Construction of the dam will present a barrier to navigation and may conflict with traditional lifeways of communities	Construction	• the location of the proposed weir is generally not passable by canoe as it is a major class 3 to 4 rapids, at present, most individuals wishing to pass this area in a canoe would have to portage; • a portage route around the rapids will continue to be accessible. Two options are currently being explored; • either weir option will permit watercraft to bypass the weir using the fishway; • an ecological flow of at least 4 m^3/s will be provided through the fishway at all times, and navigation will be possible through the fishway at all times; • consult with MNR and local users to determine periods of use and potential mitigation strategies; • Recreational and traditional users of the Petawawa River will continue to have access to the waterway. There will be a portage route around the project site.	Consultation on the proposed portage routes is ongoing. Navigation will be affected during construction. Safe navigation passage will be provided for recreational users of the river via the fishway.	Yes
	Quality and clarity of water may be affected by development, which would impact an important cultural and spiritual value for many communities	Construction & Operation	• Implement standard construction best management practises • Contractors will have prepared and will follow a Care of Water plan • Time activities to minimize impact to water quality and clarity, and minimize the duration of activities • isolate cofferdam construction with a silt curtain or equivalent; if unable, then adhere to all applicable standard best management practises • See *Water Quality (surface and groundwater)* section above	Low negative impacts - impacts reduced through mitigation where ever possible	Yes
	Impact of the project on Algonquin history and culture.	Construction & Operation	• No registered archaeological sites exist in or near the project area. • During the Stage 2 Archaeological Assessment, no cultural resources were identified, and no further archaeological study was recommended. • Archaeological investigations for roads will be conducted for the final ER.	No impacts are anticipated as a result of inundation or the facility footprint. Further archaeological assessments of access roads will be conducted to inform impact assessment in the final ER.	Yes
Traditional land or resources used for harvesting activities	Development may restrict aboriginal access to the site, impacting traditional usage of the project area such as hunting, harvesting, foraging, trapping and farming activities.	Construction & Operation	• The proponent is not proposing to restrict access to the river; • Restrictions on access will be limited to those needed to ensure public safety (e.g. in the immediate vicinity of the powerhouse and intake). Xeneca has gone to great lengths to design the facility so that the river can continue to be enjoyed by the public. • New access to the river and points of interest will be created as part of the project. These include access to the weir structure on the north and south side, and a permanent bridge over the conveyance canal. • impacts to specific resources (i.e. fur bearing mammals for trapping) are dealt with in the appropriate natural environment and aquatic and riparian ecosystem sections of this table.	Access will only be restricted for safety purposes during construction and operation. During operation, access will only be restricted where required to ensure public safety. Following construction impacted areas will	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Traditional land or resources used for harvesting activities	Impacts of development on resident trappers and baitfish harvesters.	Construction & Operation	• The proposed Big Eddy site is within MNR allocated Baitfish Harvest Areas PE0123 (10), PE0124 (6) and PE0125 • There are MNR registered Traplines within the proposed project area (N001, N022, N024)	No impact.	No
	Development activities may impact use of the area by waterfowl for foraging and nesting activities which could impact subsistence, harvesting, hunting and cultural activities of communities	Construction & Operation	• 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 • Remove woody vegetation outside of the bird breeding period April 1 - September 1)	Construction Management Plan will be finalized to include instructions and protocols for minimizing the disturbance to wildlife during the construction program. Impacts are considered to be negligible based on communities present in the surrounding landscape	Yes
	Development activities may impact food bearing plants and impact foraging and harvesting activities of some communities	Construction & Operation	• 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. • Any area disturbed during construction will be repaired, revegetated, and stabilized	The clearing and grubbing of land will result in a loss of some vegetation.	Yes
	Development may impact fish habitat resulting in impacts to fish species health and abundance, impacting harvesting and subsistence activities of certain communities during specific times of the year	Construction & Operation	• See *Fish Habitat* section above.		

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Traditional land or resources used for harvesting activities	Habitat changes as a result of development may result in changes in populations of large game such as moose and deer which communities rely on for food and other products	Construction & Operation	• Construction activities will avoid important habitats, as best possible. • Activities will be scheduled to avoid sensitive nesting, rearing, mating, or staging periods, as best possible. • All food and food waste will be properly stored and disposed of to prevent attracting wildlife. • All Project personnel will be trained and required to use proper care and caution when operating vehicles to avoid collisions with wildlife. • Wildlife are relocated as required during the work. • No deer yards or moose feeding areas were encountered in the project area	Construction Management Plan will be updated to include findings from terrestrial studies for lines and roads. Minimize the disturbance to wildlife during the construction and maintenance program. The clearing and grubbing of land will result in a loss of some vegetation and in turn potential wildlife habitat. Indirect impacts also have potential to occur during active construction and during operation of facility (i.e. noise, human presence and activity)	Yes
Employment	Impacts to aboriginal run tourism operators on the waterway	Construction & Operation	• Xeneca has gone to great length to design the weir structure in a manner that is functional, aesthetically pleasing and blends into the natural surroundings. The proposed powerhouse is designed to blend into the surroundings below the Petawawa Bridge. • Xeneca will provide a portage route Upon request from users, Xeneca commits to providing a cumulative total of 100 hours per year during which electricity generation will be halted, and all flows will be directed into the bypass channel; this is in addition to providing all flows into the bypass reach during daylight hours during the 2-day Hell or High Water event. • It was estimated that, even with the diversion of 68 m3/s of flow towards the powerhouse, there would be approximately 21 days between March 15 and July 1 of each year when at least 60 m3/s of excess flows would pass through the bypass reach. As a result, during a typical year, there would be approximately 48 days during which either the full flow rate or a flow of at least 60 m3/s would pass through the bypass reach and over the rapids. • Where flows are low, kayakers will utilize the natural fishway for navigation. In high flow conditions, the Obermeyer dam will be lowered, and will provide safe navigable passage for kayakers. • Xeneca has committed to operational regimes that protect kayaking events held in the Town and further efforts are being made toward water sharing agreements that would be subject to approval by regulatory agencies.	Since there is potential for increased access for angling, kayaking, some tourism values may be enhanced. Efforts to minimize impacts to the river's tourism values should assist in retaining existing tourism and recreational attributes.	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Lands subject to land claims	The project location is within a land claim presently being negotiated between the Algonquins of Ontario and provincial and federal governments	Construction & Operation	• Xeneca understands that the Project is not located within any lands scheduled to be set aside as Settlement Lands based on a review of the *Preliminary Draft Comprehensive Land Claim Agreement in Principle (The Draft Agreement)* dated December 2012.	Xeneca will continue to engage with the Algonquins of Ontario and monitor the agreement to determine what, if any impacts there may be on the project.	No
	Impact of the project on Algonquin aboriginal rights which are currently the subject of Land Claim Treaty Negotiations between the Government of Canada, the Province of Ontario, and the Algonquins of Ontario ("Treaty Negotiations") with respect to the use of traditional waterways without compensation	Construction & Operation	• *The Draft Agreement* (Section 8.1.1 & 8.4.1) notes that there is a right to harvest fish, wildlife, furbearing species and plants for domestic purposes within the Settlement Area. The development of the project will not impede that right as discussed in the aboriginal impact assessment, as access to these resources will be maintained.	Ongoing consultation and engagement with the Algonquins of Ontario is required to ensure that Aboriginal rights are protected and maintained	No
	Project Site located on any First Nations reserve lands or lands allocated to any other aboriginal community.	Construction & Operation	• Memorandums of Understanding with identified local communities are being negotiated, asserted rights to traditional hunting and harvesting will be maintained in treaty areas.	Project Site is not located on any First Nations reserve lands or lands allocated to any other aboriginal community. The Project is located within the Williams Treaty area of 1923.	No
	The Project is located within the Williams Treaties Area of 1923	Construction & Operation	• The Project Components do not appear to impact any projections of these treaties at this time	Xeneca will continue to engage identified communities around the project area	No

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Land and Resource Use					
Access	Effects on public access to waterfront due to fencing/safety concerns	Construction & Operation	• Xeneca is not proposing to restrict access to the river. Restrictions on access will be limited to those needed to ensure public safety (e.g. in the immediate vicinity of the powerhouse and intake). Xeneca has gone to great length to design the facility so that the river can continue to be enjoyed by the public. New access to the river and points of interest will be created as part of the project. These include access to the weir structure on the north and south side, and a permanent bridge over the conveyance canal.	Restrictions to access will be kept to the minimum required to ensure public purposes during construction and operation.	Yes
	If Option 2 (Trillium Trail) is selection for Access, use of Trillium Trail could be impacted especially during Construction Phase.	Construction & Operation	• Widening of trail, or construction of a separate adjacent and parallel trail to allow for traditional use of the trail, as well as single lane construction access. • Timing restrictions for trail improvements and construction access to minimize impact to trail users especially when construction access across the trail is required • Localized signage to advise trail users Fencing to provide proper demarcation between the trail and the construction access where & when necessary Installation of protective measures where appropriate and proper review and rehabilitation of any accidental damage to the trail caused during the construction work period • Newspaper notices prior to and during construction to advise trail users	Option 2 Access will only be used in the case that an easement cannot be obtained from CP Rail for Option 1. In the case that Option 2 is used, access will only be disrupted temporarily.	Yes
Navigation	Impacts of in-water work (e.g. installation of cofferdams) on navigability of the Petawawa River.	Construction	• Xeneca's development will proceed in a manner that will not disrupt use of roads, trails, or the rail bed. Very short term disruption for safety reasons may occur during construction but is not expected to have any significant socio economic impact as advance notice of any disruption will be provided and effects are expected to last only a few hours.	The effects of construction on navigability will be short-term. Any reduced access due to construction activities (such as cofferdams and dewatered areas) will be well marked and will be restored following the completion of in-water work.	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Navigation	Impacts of reduced flows and natural fluctuations in water levels on navigability of Railroad Rapids for whitewater recreationalists.	Operation	• Upon request from users, Xeneca commits to providing a cumulative total of 100 hours per year during which electricity generation will be halted, and all flows will be directed into the bypass channel; this is in addition to providing all flows into the bypass reach during daylight hours during the 2-day Hell or High Water event. • It was estimated that, even with the diversion of 68 m^3/s of flow towards the powerhouse, there would be approximately 21 days between March 15 and July 1 of each year when at least 60 m^3/s of excess flows would pass through the bypass reach. As a result, during a typical year, there would be approximately 48 days during which either the full flow rate or a flow of at least 60 m^3/s would pass through the bypass reach and over the rapids. • Where flows are low, kayakers will utilize the natural fishway for navigation. In high flow conditions, the Obermeyer dam will be lowered, and will provide safe navigable passage for kayakers. • Xeneca has committed to operational regimes that protect kayaking events held in the Town and further efforts are being made toward water sharing agreements that would be subject to approval by regulatory agencies.	It is believed that the vast majority of recreational uses of the bypass reach can be accommodated through the operating constraints outlined in the proposed Operating Plan (Annex I).	Yes
	Concern regarding potential loss of regular access for recreational whitewater users who are unable to travel to out-of-town locations	Operation	• Xeneca's Construction plan includes the creation of road access to the powerhouse and tailrace area. Xeneca has committed to working with the Town of Petawawa and recreational users to develop amenities that may include parking/rest area, launching points and trails. Pending the outcome of those discussions, Xeneca is prepared to work with the community in developing water access and recreational amenities. • Additionally, there would be approximately 48 days in a typical year when either the full flow rate or a flow rate of at least 60 m^3/s would be available in the bypass reach. Users can request the scheduled release of unrestricted flows, for a cumulative total of 100 hours per year.	It is believed that the vast majority of recreational uses of the bypass reach can be accommodated through the operating constraints outlined in the proposed Operating Plan (Annex I).	Yes
	Potential for damage to recreational watercrafts at low flows due to direct passage over the weir	Operation	• Usage surveys and consultation indicate that the existing channel is typically not utilised at flows below 15-20 m^3/s depending on the type of watercraft • In addition warning signs, safety booms, engineering design and an ongoing public relations efforts will provide a conduit for questions and information. In addition, a qualified, third party, independent review of operational safety will be completed during the permitting and approval phase of the project.	No impact - the river at the project site is typically bypassed during low flow conditions	No

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Riparian rights or privileges	Impact on the value of nearby waterfront properties	Operation	• Given the naturalized appearance of the weir structure, the relatively small change in the headpond, run of river operation and the fact that all of the project area is either under lease agreement with the Department of National Defence, the Town of Petawawa or private riparian landowners property, a decline in property values as a result of Xeneca's development and operation of Big Eddy is considered unlikely. Adjacent and backwater property owners have been contacted by Xeneca, and, where the question of property values has been raised, Xeneca has committed to reviewing -- on a case by case basis -- to determine if there is a proven devaluation as a result of its operation of the Big Eddy facility. Should a loss be proven, Xeneca will enter into negotiation with property owner to reach an agreement on restitution.	Low impact - any effects on property value will be mitigated by the proponent through talks with landowners	Yes
	Water levels in Black Bay riparian landowners	Operation	• Black Bay is outside of the zone of influence of the project, being located approximately 10 km upstream of the project site.	No impact - the project will operate as run-of-river and the headpond inundation will no extend to Black Bay	No
Recreational use	Effects on hiking/walking Emerald Trail and Catwalk	Construction & Operation	• Restrictions on access will be limited to those needed to ensure public safety (e.g. in the immediate vicinity of the powerhouse and intake). Xeneca has gone to great length to design the facility so that the river can continue to be enjoyed by the public. To compensate the visual impact in the watercourse, a compensatory flow of at least 4 m^3/s will be maintained in the bypass reach at all times. Even at these low flows, the natural appearance of the river will be preserved.	No impact - access to Emerald Trail and Catwalk will be maintained	No
	Effects on snowmobile trail and bridge within project area	Construction & Operation	• The proponent will work with the local snowmobile club to avoid or minimize any disruption to trail use. Bridging or other suitable crossings will be installed over the intake channel in order to maintain trail usage. Project engineers will consider how both road and snowmobile access can co-exist along the trail corridor during the design process.	Low impact - disruption will be minimized and access will be maintained	Yes
	Effects on Public Swimming at Centennial Park	Construction & Operation	• Centennial Park is located outside of the project's zone of influence, and will not be impacted by the Big Eddy GS	No impacts anticipated.	No
	Effects on Twin Rivers golf course	Operation	• Twin Rivers Golf Course is outside of the ZOI of the facility. Twin Rivers Golf course will be kept informed regarding future construction and operational activities.	None required.	No

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Angling, hunting opportunities	Effects to access of fishing locations	Construction & Operation	• Restrictions on access will be limited to those needed to ensure public safety (e.g. in the immediate vicinity of the powerhouse and intake). No restrictions on overall access to the river are proposed. • The proponent commits to working with the Town of Petawawa and recreational users to develop amenities at the project site, which may include parking and rest areas, launching points for watercrafts, and trails.	Minimal impact anticipated. The majority of the river within the project zone of influence will continue to be accessible to recreational users.	Yes
Trapping	Effects on trapping opportunities in the immediate area of construction	Construction & Operation	• correspondence with MNR identified no traplines within the zone of influence • Xeneca is committed to work with trappers to ensure that traplines along access roads are not disrupted during the construction of the Big Eddy project. • There are MNR registered Traplines within the proposed project area (N001, N022, N024)	Xeneca does not anticipate any significant effect on trapping activities during operation of project	No
Baitfish harvesting activities	The project site is located within MNR Pembroke Baitfish Harvest Area PE-0123 (10), and adjacent to Harvest Areas PE-0124 (6) and PE-0125	Construction & Operation	• Xeneca's consultants have worked with the one known baitfish harvester who is also a member of local First Nations in its assessment of project effects and Xeneca has utilized the traditional and firsthand knowledge of this person. Through consultation, it has been determined that the project will not impact this harvester	No impacts are anticipated.	No
Views or Aesthetics	Potential impacts due to project construction and operation on Petawawa River	Construction & Operation	• Railroad Rapids is heavily treed on both sides. It has steep side slopes and very fast moving water. Based on the proponent's usage study, very few people access this section of river due to the very difficult terrain. Significant effort has been made to come up with a weir design that will look natural and blend into the rocky riverbed landscape. To this end, the design concept for the preferred option of the weir (Option 1) incorporates natural rock rather than concrete, to the greatest extent possible. The proposed powerhouse is designed to blend into the surroundings below the Petawawa Bridge. • To compensate the visual impact in the watercourse, a compensatory flow of at least 4 m^3/s will be maintained in the bypass reach at all times. Even at these low flows, the natural appearance of the river will be preserved. • Under the current proposed operations strategy, there would be approximately 48 days/year where either the full flow rate or a flow of at least 60 m^3/s would be flowing in the bypass reach.	Negative, short-term impacts to aesthetics expected during construction of the proposed facility. A continuous flow will be maintained in the bypass reach during facility operations.	Yes
An existing land or resource management plan	Project effects on existing land or resource management plan(s)	Construction & Operation	• No land resource management plan will be affected as area is surrounded by private and federal land	None required.	No

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Forestry	Effects on forestry operations in the project area	Construction & Operation	• The project is not expected to impact forestry as the area is within municipal boundaries in which commercial harvesting activities do not occur	None required.	No
Mine claims	Effects on mining claims in the project area	Construction & Operation	• There are no mining claims within the vicinity of the project	None required.	No
Cultural Heritage Resources					
Archaeological sites	Disturbance or destruction to archaeological resources within the inundation area or footprint of project components	Construction	• No registered archaeological sites exist in or near the project area. During the Stage 2 Archaeological Assessment, no cultural resources were identified, and no further archaeological study was recommended.	No impacts are anticipated.	No
	Disturbance or destruction to archaeological resources as a result of access road construction	Construction	• Archaeological investigations for roads will be conducted for the final ER.	Archaeological assessment will inform impact assessment for final ER.	Yes
Buildings or structures	Disturbance or destruction to heritage buildings or structures	Construction	• There are no known heritage buildings or structures that will be affected by the project.	No impacts are anticipated.	No
Cultural heritage landscapes	Disturbance or destruction to cultural heritage landscapes	Construction	• No known cultural heritage landscapes will be impacted by the project.	No impacts are anticipated.	No
Social and Economic					
The location of people, businesses, institutions or public facilities	Disruption to traffic local flow patterns during equipment mobilization/ demobilization	Construction	• limit disruptions to traffic flow by maintaining adequate access along travelled routes, and alternate access if required • monitor condition of access roads, and if construction traffic is causing damage, ensure that repairs are undertaken promptly • Avoid sensitive time periods and advise residents of planned activities that may cause access disruption • Construction materials and equipment would be segregated in staging areas during off hours • Apply Best Management Practices and traffic planning to contain construction equipment in designated work areas.	During construction period some short periods of traffic disruptions may be needed; if so, signage will be installed and police notified in advance.	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Community character, enjoyment of property or local amenities	Potential effects on the character of the project area	Construction & Operation	• 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 • Minimize site clearing. Landscape to rehabilitate the construction site. • Apply Best Management Practices and traffic planning to contain construction equipment in designated work areas. • Use natural materials in the new structures wherever practicable. • Use landscaping to rehabilitate the construction area in keeping the surrounding conditions and traditional recreation uses	Low impact - character of the project area will change from current conditions, but will be designed to blend in with surroundings as much as possible	Yes
	Effects of noise pollution from construction activities	Construction	• All vehicles and equipment with combustion engines used during operation or maintenance must use effective exhaust and intake mufflers. • Observe applicable municipal bylaws, the Model Municipal Noise Control By-Law • Limit construction to daylight hours as necessary to limit potential disturbance to wildlife and people	Expected minimal effects for the duration of construction - mitigation will minimize noise disturbances	Yes
	Effects of noise pollution from warning alarm on nearby urban centre	Operation	• Warning device are not contemplated for the Big Eddy site. Ramping rates are such that flow changes in the bypass reach will change over periods of 30 to 60 minutes providing ample time for river users to avoid or adjust to changing flows. In addition warning signs, safety booms, engineering design and an ongoing public relations efforts will provide a conduit for questions and information. In addition, a qualified, third party, independent review of operational safety will be completed during the permitting and approval phase of the project. • proximity to residences will likely require an Environmental Compliance Approval for the facility.	No impacts anticipated	No
	Potential impact to the annual Hell or High Water event	Operation	• Xeneca has committed to providing unrestricted flow at key times and for key recreational events as requested by the whitewater community. This includes unrestricted flows during the daylight hours of the Hell or High Water event.	Potential impacts to the Hell or High Water event will be mitigated through the commitment to halt all electricity generation during the daylight hours of the 2-day event, such that unrestricted flows are provided into the bypass reach.	No

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Local, regional or provincial economies	Potential for lost tourism revenue to the Petawawa community	Construction & Operation	• 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 • Minimize site clearing. Landscape to rehabilitate the construction site. • Apply Best Management Practices and traffic planning to contain construction equipment in designated work areas. • Use natural materials in the new structures wherever practicable. • Use landscaping to rehabilitate the construction area in keeping the surrounding conditions and traditional recreation uses • Operating restrictions and mitigation measures will minimize potential impacts to aquatic habitat, fish passage, local aesthetics and recreation.	Since there is potential for increased access for angling, kayaking as well as commitments to assist the Town of Petawawa in developing its asset base of amenities, some tourism values may be enhanced. Efforts to minimize impacts to the river's tourism values should assist in retaining existing tourism and recreational attributes.	Yes
	Potential for lost tourism revenue to whitewater rafting operators	Construction & Operation	• Xeneca does not anticipate any lost revenue since at no point during construction of the weir will the river be unusable. That is, throughout the entire construction phase, sections of the river will be open and Xeneca will ensure they are safe for recreational use.	While no impacts are expected, Xeneca proposes to compensate operators on a case-to-case basis if it is determined that that they were impacted by the construction of the project.	No
	Activities will support direct and indirect local employment	Operation	• Operation and management of project facilities will lead to one to two full-time positions • Encourage local spending where possible for goods and services like trucking, gas, food and accommodation in sufficient quantity and at competitive cost throughout the duration of the operation phase of the projects.	Positive economic impact	Yes
	Construction of project will involve influx of temporary workers which may increase spending on goods and services within the region	Construction	• Use of local labor force during construction phase will be maximized by utilizing suitable skill sets anticipated to be available in the nearby communities • Create a short-term increase for rental housing in Petawawa, Pembroke and Laurentian Valley area • Potential for additional demand on local public services such as waste disposal, health care, police, housing, food and gas during construction may lead to expansion of services in the general area.	Positive economic impact	Yes
Public health and/or safety	Accidents and malfunctions (Forest fires, equipment failure, accidental spills, etc. caused as a result of project activities)	Construction & Operation	• Project personnel will be prepared and be familiar with the site Emergency Preparedness Plan. Firefighting 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 • 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 • Disposal and storage of waste will be into proper waste containers to prevent fires • Adherence with the Spills Emergency Preparedness and Response Plan for the project site	No impacts anticipated – proper implementation of construction management plan and best management practices will mitigate impacts wherever possible.	No

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Public health and/or safety	Production of waste in and around work site	Construction & Operation	• 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 waste will be collected daily and stored in closed, animal resistant containers until disposed of at an approved waste disposal site • 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
	Impacts associated with facility construction	Construction	• public access to the construction site will be restricted to ensure safety • site access will be maintained as per best management practices (fencing, signage, 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 • Implementation of transportation planning and safety measures during construction • Provide roadside warning and flagmen, road closures, speed restrictions, truck lighting, load restrictions, and equipment inspections as required • Access to construction areas would be limited; presence of construction vehicles will be clearly indicated via appropriate signage	No impacts anticipated - proper implementation of construction management plan and best management practices will mitigate impacts wherever possible.	No
	Danger to recreational users downstream of tailrace during rapid fluctuations	Operation	• The Big Eddy GS would operate as a run-of-river facility, so under normal operations, any changes in flows downstream of the tailrace would be the result of natural changes in flows coming from further upstream. • Some minor variation in flow is possible during start up and shut down of the facility, if the flow over the weir changes more slowly than the rate at which the facility is adjusting its operations. This effect would occur infrequently, and flows would stabilize within approximately 5 to 30 minutes. Changes to the outflow from the powerhouse would occur gradually, and any flow variation under normal operations would not be significant or readily perceptible downstream of the tailrace. • In the unlikely event of an emergency shut-down of the facility, during which flows through the turbines would be suddenly interrupted, a powerhouse bypass valve would automatically be opened in order to provide an alternate outlet for these flows until normal operations resume. The use of an automated powerhouse bypass valve would minimize any sudden changes in flows downstream of the tailrace.	Limited impact during start up and shut down of the facility. In the unlikely event of an emergency shut-down, the activation of the powerhouse bypass valve will limit sudden changes in flows.	Yes

Environmental Component	Issue	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Water supply	Impacts to local water supply	Construction	• The water treatment plant for the Town of Petawawa is located on the north side of the Town. The water source is the Ottawa River upstream of the confluence of the Petawawa and Ottawa Rivers. The wastewater treatment plant for the Town of Petawawa is located on Abbey Lane, on the eastern side of Petawawa, south of the outlet of the Petawawa River to the Ottawa River. • The proposed DS ZOI for the site ends at the bottom of the project tailrace therefore no impact anticipated	There is no potential impact anticipated on the local water/wastewater supply.	No
Civil structures	Impacts of altered flows on bridges and private property	Operation	• The design of the weir will ensure that the inundation area avoids or minimizes impacts to civil structures and private properties located along the Petawawa River. • Landowner agreements will be required by MNR prior to issuance of any work permits • HEC-RAS model results indicate that under the worst-case scenario (Option 1, with the larger inundation area), the headpond will not reach the Highway 17 Bridge, located approx. 2.9 km upstream of the proposed weir. • The railway bridge and recreational trail bridge downstream of the proposed weir would pass over the bypass reach; flows in the bypass reach would be equal to or lower than what has naturally occurred to date, therefore the bridges would not be impacted by increased erosion.	At the time of writing of this report, discussions are being held with a private commercial landowner whose property would be impacted by the inundation area created by Option 1 of the proposed new weir; should landowner agreements not be secured, Option 2 (with a lower Normal Operating Level) will be adopted.	Yes
	Impacts on gas pipeline crossing	Construction & Operation	The gas pipeline crossing is located upstream of the upper limit of the headpond and will therefore not be impacted by the proposed development	No impacts anticipated	No
Energy/Electricity					
Reliability	Voltage support	Operation	• 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	Phase of Development	Mitigation	Resolution / Result	Residual Effect (Yes/No)
Security	Black Start capability	Operation	• 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	Operation	• 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	Operation	• 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

8. RESIDUAL ADVERSE EFFECTS AND SIGNIFICANCE

A summary of the specific issues identified during the regulatory agency and public consultation process is presented in Table 15. Those issues that have been marked as a residual effect in the last column in Table 15 have been carried over to Table 16: Residual Environmental Effects and Significance (found below) for further analysis.

The residual effects of a project are those that are expected to remain despite the application of mitigation measures. Section 4.3.1 of the Class EA for Waterpower Projects (April 2012) provides criteria for assessing significance:

Value of Resource

The value or importance placed on the resource by stakeholders or society at large as determined through consultation and the consideration of overall environmental requirements. The value may be related to the relative abundance of the resource, the interest of participating parties, etc.

High — Value of the resource which will be affected is considered high. The resource has some form of regulatory status or protection, generates a high level of public interest, is considered scarce or is essential to the integrity of the regional economic and/or ecological environment.

Medium — Value of the resource which will be affected is neither high nor low. The resource is acknowledged as an important part of the regional ecological and economic environment, but is not essential. Interest has arisen through consultation but has not been a focus issue.

Low — Value of the resource which will be affected is considered low. The resource is abundant, does not significantly contribute to the regional economy or environment, and no concerns have arisen through consultation.

Magnitude

The magnitude of an effect refers to the extensiveness, scale, degree, or size of that effect. As the assessment of this criterion has a high potential to be subjective/qualitative, and measures of scale vary between effects, each level of magnitude has several specific measures for the means of clear definition. When possible, pre-established quantitative scales of magnitude specific to a given effect should be used and referenced. Mitigation measures and strategies or conditions may affect the magnitude of a residual effect to some degree.

High	Effect will exceed regulatory or guideline criteria and/or remains controversial by the majority of stakeholders and/or is deemed high by expert judgment/historic precedence, and/or exceeds the carrying capacity of the surrounding ecosystem.
Medium	Effect will noticeably change or exceed existing conditions. The change remains - within regulatory or guideline criteria, is capable of being absorbed by the surrounding ecosystem, and is not considered controversial by the majority of stakeholders
Low	Effect will only be evident at or slightly above existing conditions, will be well within the carrying capacity of the surrounding ecosystem, and will have low social impact as shown through public consultation.

Geographic Extent

This criterion defines the geographic area over which the effect would occur. This can relate to either a linear distance (km) or area (km^2), depending on the issue or effect being described.

<1	Effect will be limited to less than a 1 km (distance/area) from the project site
1-10	Effect will be limited to between 1 and 10 km (distance/area) from the project site
11-100	Effect will be limited to between 11 and 100 km (distance/area) from the project site
101-1,000	Effect will be limited to between 101 and 1,000 km (distance/area) from the project site
1,001-10,000	Effect will be limited to between 1,001 and 10,000 km (distance/area) from the project site
>10,000	effect will be extend beyond 10,000 km (distance/area) from the project site

Frequency and Duration

The frequency of when an effect might occur intermittently over a given period of time. Generally, events that occur less frequently or for a more limited period of time are considered less significant.

Frequency:

<11	The effect will occur less than 11 times per year
11-50	The effect will occur between 11 and 50 times per year
51-100	The effect will occur between 51 and 100 times per year
101-200	The effect will occur between 101 and 200 times per year
>200	The effect will occur more than 200 times per year
Continuous	The effect will be occur continuously

Duration:

<1	The effect will occur for less than a month
1-12	The effect will occur for between 1 month and a year
13-36	The effect will occur for between 1 and 3 years
37-72	The effect will occur for between 3 and 6 years
>72	The effect will occur for more than 6 years

Reversibility

Whether or not the effect is reversible if the activity or component of the project which is causing the effect is halted, altered or removed. Irreversible impacts are considered more significant than reversible impacts.

Reversible	Existing conditions would be re-established if the cause of the effect is halted, altered or removed
Irreversible	Existing conditions would not be re-established if the cause of the effect is halted, altered or removed. In the event that reversibility is unknown, the effect should be considered irreversible.

Waterpower facilities typically have a lifespan in excess of 80 years and can be refitted to last decades longer. The longevity of waterpower projects means that once constructed, they are more likely to be upgraded or refitted rather than decommissioned. As a result, when considering the reversibility of residual effects, the physical footprint of the facility and the inundation area are considered as permanent and irreversible. Additionally, those project components or activities that are required for maintenance or public safety are likewise considered permanent

while the facility exists. If these components were to be decommissioned and removed it is conceivable that the environment would return to its natural state but, when compared to the timeframe for other project effects, these effects are not considered reversible. Other activities or effects which could be modified or halted through changes to management or operations or the implementation of further mitigative measures are considered reversible.

Ecological/Social Context

The significance of an effect may be considered more or less significant when considered against an environment that is untouched or has been previously impacted by other activities or issues. The focus during the determination of the significance of the effect is on the change brought about on the existing environment by the project. Therefore, changes to a relatively pristine environment are considered more significant than changes to a previously impacted environment.

Relatively Pristine	The value or resource being affected has not been previously influenced
Previously Impacted	The value or resource being affected has already been influenced by other source(s)

Likelihood of Effect

Some mitigation measures may address the potential of residual effects by reducing the likelihood of their occurrence rather than by reducing the magnitude of the effect.

High	The effect is highly likely to occur
Medium	The effect may occur
Low	The effect is still unlikely to occur

By applying and considering all of the listed criteria, residual effects can be classified as either **Not Significant**, or **Significant** within the context of the project and the environment in which it is proposed. The project may also have residual effects which are considered **Positive** which should be considered and weighed against the potential significant adverse effects.

An assessment of the residual effects (including the positive impacts) of the proposed undertaking are presented in Table 16.

8.1 RESIDUAL NATURAL HERITAGE EFFECTS

Erosion, Air Quality, and Water Quality During Construction

Effects of construction activities such as exhaust, noise, odour, dust emissions, introduction of foreign and organic materials to surface water, increase in sediment suspension and transportation, and contamination from spills and leaks represent residual effects of low significance. These effects are unavoidable components of construction, but mitigation through best management practices will reduce these effects to acceptable levels. These effects are also considered reversible when the construction activity is halted.

Additionally, the projects 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 alteration from natural flow patterns as a result of the operation of the Big Eddy GS project has the potential to have cumulative effects. Low negative impacts are anticipated as dynamic modeling shows that the facility will modify normal flooding patterns but will operate as a run-of-river facility during high and low flow periods. Xeneca is also proposing to monitor the watercourse for the effects of erosion and ice scour following the construction of the facility and, if required, develop management strategies in consultation with regulators to address identified impacts.

Water Quality-Surface and Groundwater

Residual impacts on surface water quality will be reserved primarily to the construction phase along the shoreline of the waterway, at the facility site, and at water crossings along transmission line route and access roads. Many of these impacts will be mitigated through the use of best management practices. Construction and removal of the cofferdam may increase the potential for excess sediment to be suspended and carried downstream by river flow. This will be mitigated by ensuring cofferdam construction and removal is completed during a low flow period and ensuring timing restrictions related to fish spawning are strictly adhered to. Due to the high flow velocities in this section of river, it may not be possible to isolate the cofferdam construction from the channel using a silt curtain. However, all applicable best management practices will be adhered to.

There is a low potential for surface water contamination as a result of spills and leaks of hazardous substances, mainly during the construction phase. This risk can be mitigated by adhering to best management practices related to proper spill prevention, transport, storage and use of hazardous materials.

General Disturbance to Habitat

Habitat disturbance will be primarily observed during the construction phase, with a low potential negative impact. The 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. Indirect impacts also have potential to occur during active construction and during operation of facility (i.e. noise, human presence and activity).

Terrestrial Wildlife, Natural Vegetation and Habitat Linkages

The construction and operation of the Big Eddy GS facility will result in an increase in traffic in local access roads as well as the construction of additional roads and 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. Access road planning to the project site was determined in close consultation with DND with the purpose of incorporating access with existing roads and trails where possible. Accordingly the cumulative impact of new road construction and use in addition to existing uses is not anticipated to be significant.

Given the fact that wildlife in the area is already disturbed through nearby recreational activities and the proximity to the Town of Petawawa, the overall impacts are not anticipated to be significant.

The clearing of terrestrial vegetation along shorelines and headponds is required to mitigate the potential mercury effects and water quality effects associated with inundation. As the inundation associated with the proposed projects affects a very narrow band of vegetation along the headpond, it is not anticipated to have a significant effect on terrestrial species.

Fish Habitat, Migration, Impingement and Entrainment

Due to the diversion of flows towards the intake canal of the facility and the release of these flows to a point approximately 600 m downstream, flows in the bypass reach will inevitably be lower compared to natural conditions. In order to mitigate the impact of decreased flows on staging, and to facilitate upstream passage of Walleye and Sturgeon for spawning, the minimum flow to be released into the bypass channel will be increased from 4 m^3/s to 30 m^3/s during Walleye and Lake Sturgeon spawning periods during the spring, when water temperatures fall between 5°C and 18°C. This increase of flows in the bypass channel, in combination with the continued release of at least 4 m^3/s through the fishway, is expected to keep negative impacts to staging and upstream passage to a minimum.

Placement of the weir may result in residual impacts upon fish migration, however a natural-type fishway was designed under the guidance of regulators to provide upstream passage of Lake Sturgeon, American Eel, Walleye and other species. The overflow weir was also designed to ensure downstream migration would not be impacted. A small fish chute or 'fish slide' will be developed at the powerhouse intake. These measures, combined with assuring minimum flow requirements of 4 m^3/s through the fishway and bypass channel at all times, and the increase of flow to 30 m^3/s to facilitate movement during Walleye and Sturgeon spawning periods, should ensure that appropriate passage is maintained.

The selection of a Kaplan turbine will ensure potential fish entrainment and impingement will be minimized. The facility intake is designed to account for fish swimming capabilities, which will minimize the potential for impingement or entrainment in the turbine(s). If and when American Eel are confirmed at the site, light and sound deterrents at the entrance of the intake canal will be installed to minimize entrainment. These measures will cumulatively address the potential impacts associated with fish entrainment and impingement.

There is potential for fish injury or mortality as a result of cofferdam placement and dewatering. This risk will be mitigated by completing fish salvage by a qualified biologist to relocate species that will be impacted by dewatering events. Impacts are expected to be minimal.

Sediment Transport Regime

The Petawawa River in the project area has very limited sediment transport capabilities, due to the presence of lakes and wide sections of slower-flowing river upstream of the proposed project site, and primarily bedrock and stony substrates in the project area. Potential changes in sediment transport resulting from the creation of the weir and headpond will be relatively minor, and will not result in significant changes to sediment deposition and/or erosion. Xeneca has committed to monitoring the sandbar feature located downstream of the proposed tailrace area, and to mechanical modification of the sandbar if deleterious effects are observed.

Concern was raised during the EA planning process with regards to potential erosion of an important sandbar feature near the project's tailrace, due to its potential use as fish nursery habitat. Due to its location upstream of the confluence between the tailrace and the bypass reach, it would not be impacted by the interaction of flows at that location. This sandbar will nonetheless be monitored, and should it be observed to be steadily shrinking, it will be re-supplied with sediment by mechanically lifting sediment from immediately upstream of the weir and depositing it downstream.

Drainage, flooding and drought patterns

The facility will operate as a true run-of-river facility and there will be no changes in flow patterns observed outside of the zone of influence, compared to pre-development conditions.

Changes in drainage patters from the upstream end of the headpond will end at the tailrace. Facility design will be finalized to ensure flood passage and public safety issues are adequately addressed. If Option 2 of the weir design possibilities is selected, an adjustable Obermeyer gate will limit the extent of backwater effects during flooding events and allow for a limited amount of flood control.

Water Temperature

There may be some residual effects on water temperature due to headpond impoundment. However, in summer, the headpond will have a short residence time, and is limited in size. Water depths are not large enough to result in thermal stratification; therefore significant changes to water temperature are not expected.

Erosion, air quality, and water quality during construction

Effects of construction activities such as exhaust, noise, odour, dust emissions, introduction of foreign and organic materials to surface water, increase in sediment suspension and transportation, and contamination from spills and leaks represent residual effects of low significance. These effects are unavoidable components of construction, but mitigation through BMPs will reduce these effects to acceptable levels. These effects are also considered reversible when the construction activity is halted.

Erosion and water quality during operation

The Big Eddy GS will operate as a true run-of-river facility, so the risks of shoreline erosion associated with daily peaking and rapidly fluctuating water levels in the headpond would not occur for this project. Additionally, sediment transport in the vicinity of the proposed location of the Big Eddy GS is currently low, being mostly in the form of suspended sediment. The installation of a water control structure is not anticipated to lead to sediment starvation and erosion of the downstream reaches. This conclusion was supported by HEC-RAS modelling results, which indicated that the reduction of flow velocity in the headpond would not affect the transport of suspended sediment.

8.2 Residual Socioeconomic Effects

As outlined in Section 7 there are a number of potential residual socio-economic issues and effects associated with the construction and operation of the Big Eddy GS. The proposed site for the facility is in the Town of Petawawa, on a portion of the Petawawa River that is currently popular for recreational use, particularly for whitewater navigation enthusiasts. Over the course of the EA, concern was frequently expressed with regards to public safety on the river as a result of facility operations.

The key residual socioeconomic effects of the project are discussed below.

8.2.1 Access

Xeneca is not proposing to restrict public access to the river and surrounding area. During project construction and operation, fencing and other safety structures would only be installed where necessary to ensure public safety, such as in the immediate vicinity of construction sites and around the intake canal and the powerhouse. As such, only a minimal area will be made off-limits to the public.

Minor disruptions to the navigability of the river may occur due to the presence of cofferdams during construction, but these would be lifted upon the completion of all in-water works.

8.2.2 Navigation

In order to minimize impacts to whitewater recreation on the river, Xeneca commits to providing a cumulative total of 100 hours per year during which the facility will be shut down, and all flows will be directed into the bypass reach. This is in addition to the commitment to shut down the facility during daylight hours during the 2-day Hell or High Water event.

Additionally, all flows in excess of the maximum turbine capacity (68 m^3/s) would automatically be directed into the bypass reach. It was estimated that there would be approximately 21 days in a typical year during which at least 60 m^3/s of water would be flowing in the bypass reach even when the turbine(s) are operating at maximum capacity.

The range of flows at which watercrafts can navigate directly over the weir will depend on the weir option that is ultimately selected. The preferred option (Option 1) is designed to allow passage of watercrafts at most flows; the alternate option can be passed at high flows, when the adjustable Obermeyer gate is lowered. However, the weir (whether Option 1 or 2 is selected) can be bypassed by navigating through the fishway, which will be supplied with at least 4 m^3/s at all times and will be designed to accommodate the safe passage of watercrafts.

With the above commitments, Xeneca believes that significant impacts to whitewater recreation on the Petawawa River can be mitigated.

8.2.3 Recreation Use

One of the road access options (Option 2 in Section 3.4) runs alongside Trillium Trail, which crosses the project area and us currently used for snowmobiling and other recreational activities such as cycling and walking. If this access road option is undertaken, potential impacts to recreational access during construction may occur. Any access reduction would be limited to the construction period. During operation, the access road would run immediately beside the existing trail and would not affect access or usage.

The current bridge crosses the Petawawa River within the proposed bypass reach; flows in the bypass would be equal to or lower than natural flows, so impacts to the stability of the bridge due to erosion are not anticipated.

In order to ensure that the conveyance channel does not sever the continuity of the trail, Xeneca will construct a trail bridge passing over the channel.

If Option 2 for access roads is chosen, some residual effects to the snowmobile/recreational trail and bridge and their use for recreation may occur, although they are not expected to be significant.

8.2.4 Public Health and Safety

The Big Eddy GS will operate as a true run-of-river facility, with no fluctuations in flows and levels either in the headpond or downstream of its tailrace. Under normal operations, variations in flows and levels within the bypass reach may occur during start-up and shut-down of the facility, e.g. when all flows must be directed into the bypass channel for recreational use, or when minimum flows must be increased to 30 m^3/s for fish passage during spawning events. In order to mitigate any potential impacts to public safety due to sudden increases in flow in the bypass, the change in flows will occur gradually over a period of 30 to 60 minutes. Additionally, while minor variations in flows may occur downstream of the confluence between the tailrace and the bypass channel, these would stabilize within 5 to 30 minutes, and would not be significant nor readily perceptible.

In order to mitigate against sudden changes in flows resulting from an emergency shut-down of the facility, an emergency powerhouse bypass will be built to be used in the event of an emergency shut down at the facility.

With the proper implementation of the above mitigation measures, no significant impacts to public safety are anticipated.

8.2.5 Aesthetics

While the construction of the Big Eddy GS will bring unavoidable aesthetic alterations to the project area, those changes will be mitigated by various measures undertaken by the proponent to maintain the natural aesthetics to the greatest extent possible.

The proposed powerhouse is designed to blend into the surroundings below the Petawawa Bridge, and a compensatory flow of at least 4 m^3/s will be maintained in the bypass reach at all times to preserve the natural appearance of the river. Under the current proposed operations strategy, there would be approximately 21 days in a typical year during which at least 60 m^3/s of water would be flowing in the bypass reach even when the turbine(s) are operating at maximum capacity. Together with the commitments for releasing all flows into the bypass reach for

recreational use (see Section 8.2.2), this results in a total of 48 days/year where either the full flow rate or a flow of at least 60 m^3/s would be flowing in the bypass reach.

The proponent also plans to maintain or enhance vegetative buffers between the river, roads, and any ancillary works if possible. As such, while impacts to the area aesthetics will be residual, they are not expected to be significant given the mitigative measures that will be taken.

8.3 Aboriginal Community Considerations and Residual Effects

Concerns regarding impacts to navigation, access, tourism, water quality and clarify, fisheries, fish habitat, and fish migration, impingement and entrainment have been raised by multiple stakeholders, including the Algonquins of Ontario. Discussion about the significance of effects on these subjects can be found in the Residual Natural Heritage Effects and Residual Socioeconomic Effects sections above.

Kitchi Mikinac Assin

It is understood, based on some initial dialogue with the AOO, that the location of the Kitchi Mikinac Ansin sacred site is outside the Zone of Influence of the project. Further consultation with the AOO is planned to confirm the location of this site and determine, if additional mitigation is required to prevent project related impacts

Impact on Algonquin History and Culture

Based on the archaeological investigations and consultation conducted to date, no impacts on Algonquin culture and history related to inundation or the construction of the facility are anticipated. Archaeological investigations are planned for the area traversed by the proposed access roads for the project. The full impact of the project on Algonquin history and culture will be assessed upon the completion of the archaeology report and included prior to the issuance of the final version of the Environmental Report. Further consultation with the Algonquins of Ontario will be conducted based on the results of the archaeological investigation.

Effects on beaver and other aquatic furbearing mammals

No permanent lodges or dens were confirmed within the immediate inundation area during field investigations. Typically, furbearing mammals may be impacted by an increase in water levels when they are overwintering in their dens. No change to the headpond levels related to normal project operation will occur during the winter or ice-over period in order to ensure no mortality due to individuals become trapped. Following inundation, mammals may create new dens along the new shoreline. Given the small headpond and inundation area proposed, minimal effects as a result of inundation are anticipated. Following inundation, the run of river operations strategy will limit water level changes to natural fluctuations so no significant impacts are anticipated.

No adverse impacts are anticipated are anticipated to furbearing mammal feeding and foraging habitat. The main river system will still function as feeding and travel habitat for these (and other) species. Flooding may increase available feeding habitat for beaver, giving them access to suitable treed areas that are currently out of their "reach".

Food-bearing plants and harvesting activities

The loss of vegetation within the construction footprint is an expected and unavoidable effect of the project. This loss is considered to be of low significance as the areas will be carefully planned and clearing will be kept to a minimum. No significant vegetation communities have been identified and the communities that are present will continue to exist along the new shorelines.

It is expected that the appropriate implementation of these measures and mitigative strategies will reduce any residual effects of the project to a not significant level. Additionally, the construction of the Big Eddy facility is expected to have a number of socio-economic benefits, both for local communities and for the Province of Ontario.

Table 16: 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 and electrical connection	Yes	High	Low	< 1	Continuous	Reversible	Relatively Pristine	High	Not Significant
	Exhaust emissions from equipment and vehicles	Yes	High	Low	1-10	13-36	Reversible	Previously Impacted	High	Not Significant
	Odour	Yes	High	Low	< 1	13-36	Reversible	Relatively Pristine	Low	Not Significant
	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
Water Quality (surface and groundwater)	Surface water - general construction activities along shoreline of waterway at facility and water crossings along access roads	Yes	High	Low	1-10	13-36	Reversible	Relatively Pristine	Low	Not Significant
	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	11-100	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

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)	Inundation may alter water quality (methyl-mercury and heavy metals) in reservoir	Yes	High	Medium	1-10	> 72	Reversible	Relatively Pristine	Low	Not Significant
Species at Risk and Habitat (SAR)	Upstream and downstream passage for Lake Sturgeon and American Eel	Yes	High	Medium	< 1	Continuous	Irreversible	Previously Impacted	Low	Not Significant
Terrestrial wildlife (numbers, diversity, distribution)	General disturbance to habitat during construction and maintenance of facility (dam, powerhouse, etc.)	Yes	Medium	Low	11-100	13-36	Reversible	Relatively Pristine	High	Not Significant
	Access road construction resulting in habitat fragmentation	Yes	Low	Low	1-10	Continuous	Irreversible		High	Not Significant
	Impacts related to the creation of facility and operational headpond	Yes	Low	Low	1-10	Continuous	Irreversible	Previously Impacted	High	Not Significant
	Loss of vegetation and terrestrial wildlife during powerhouse construction activities - clearing, grubbing and stockpiling	Yes	Low	Low	< 1	Continuous	Irreversible	Previously Impacted	High	Not Significant
	Effects on vegetation and habitat during access roads ROWs construction and maintenance	Yes	Low	Low	1-10	13-36	Irreversible	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
Aquatic and Riparian Ecosystem										
Shoreline Dependent Species	Furbearing mammals may be impacted by alteration of habitat resulting from inundation	Yes	High	Low	1-10	> 72	Reversible	Relatively Pristine	High	Not Significant
Wetland Dependant Species	Irreversible loss of wetland habitat (swamp thicket) located along Trillium Trail has potential to be impacted during construction if Option 2 for access road is selected.	Yes	Low	Low	< 1	> 72	Reversible	Previously Impacted	High	Not Significant
Fish Habitat	Effects of lowered water levels in the bypass reach on the movement and staging of walleye at the time of spawning	Yes	High	Low	< 1	< 11	Reversible	Relatively Pristine	Low	Not Significant
	Potential impact on potential walleye spawning in gravel/riffle area at the downstream end of the bypass reach	Yes	Medium	Low	< 1	< 11	Reversible	Relatively Pristine	Medium	Not Significant
	Potential effects on benthic invertebrates as a result of inundation and operations	Yes	Medium	Low	1-10	Continuous	Irreversible	Relatively Pristine	High	Not Significant
	Dewatering of aquatic habitat due to the loss of wetted width within the bypass reach during periods of low flow	Yes	Low	Medium	< 1	1-12	Reversible	Relatively Pristine	High	Not Significant
Fish migration	Construction of the dam represents a potential barrier to the upstream movement of fish	Yes	Medium	Low	< 1	Continuous	Irreversible	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
Fish migration	Downstream fish passage	Yes	Medium	Low	< 1			Continuous	Irreversible	Relatively Pristine	Medium	Not Significant
Fisheries	Impacts to fisheries within the project zone of influence	Yes	High	Low	1-10			Continuous	Irreversible	Relatively Pristine	Medium	Not Significant
Fish Mortality	Fish impingement or entrainment resulting in injury or mortality	Yes	High	Low	< 1			Continuous	Irreversible	Relatively Pristine	High	Not Significant
	Fish injury or mortality as a result of cofferdam placement and dewatering	Yes	High	Low	< 1	13-36			Irreversible	Relatively Pristine	Low	Not Significant
Erosion and Sedimentation	Potential impacts on current sediment transport regime in the river	Yes	Low	Low	< 1			Continuous	Reversible	Relatively Pristine	Medium	Not Significant
Drainage, flooding and drought patterns	Alteration from natural patterns	Yes	Medium	Low	< 1			frequency dependant on flood event frequency	Reversible	Relatively Pristine	Low	Not Significant
Water temperature	Alterations of the thermal regime of the river due to impoundment	Yes	Medium	Low	< 1			Continuous	Irreversible	Relatively Pristine	Low	Not Significant
Aboriginal Community												
Spiritual, ceremonial, cultural, archaeological or burial sites	Installation and Operation of the Project will impact migration of culturally important aquatic species at risk such as American eel and Lake Sturgeon	Yes	High	High	< 1	> 72		Continuous	Irreversible	Previously Impacted	Low	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
Spiritual, ceremonial, cultural, archaeological or burial sites	The Petawawa River is a sacred watershed that contains an important sacred site that is many centuries old called Kitchi Mikinac Assin.	Yes								
	Construction of the dam will present a barrier to navigation and may conflict with traditional lifeways of communities	Yes	Medium	Low	1-10	> 72	Irreversible	Relatively Pristine	High	Not Significant
	Quality and clarity of water may be affected by development, which would impact an important cultural and spiritual value for many communities	Yes	High	Low	1-10	Continuous	Irreversible	Relatively Pristine	Medium	Not Significant
	Impact of the project on Algonquin history and culture.	Yes								
Traditional land or resources used for harvesting activities	Development may restrict aboriginal access to the site, impacting traditional usage of the project area such as hunting, harvesting, foraging, trapping and farming activities.	Yes	High	Low	< 1	> 72	Reversible	Relatively Pristine	High	Not Significant
	Development activities may impact use of the area by waterfowl for foraging and nesting activities which could impact subsistence, harvesting, hunting and cultural activities of communities	Yes	High	Low	1-10	Continuous	Irreversible	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
Traditional land or resources used for harvesting activities	Development activities may impact food bearing plants and impact foraging and harvesting activities of some communities	Yes	High	Medium	1-10	Continuous	Irreversible	Relatively Pristine	High	Not Significant
	Habitat changes as a result of development may result in changes in populations of large game such as moose and deer which communities rely on for food and other products	Yes	High	Low	1-10	> 72	Irreversible	Relatively Pristine	High	Not Significant
Employment	Impacts to aboriginal run tourism operators on the waterway	Yes	High	Low	< 1	Continuous	Reversible	Relatively Pristine	Medium	Not Significant
Land and Resource Use										
Access	Effects on public access to waterfront due to fencing/safety concerns	Yes	High	Low	< 1	Continuous	Reversible	Relatively Pristine	High	Not Significant
	If Option 2 (Trillium Trail) is selection for Access, use of Trillium Trail could be impacted especially during Construction Phase.	Yes	High	Low	< 1	13-36	Reversible	Relatively Pristine	High	Not Significant
Navigation	Impacts of in-water work (e.g. installation of cofferdams) on navigability of the Petawawa River.	Yes	High	Low	< 1	1-12	Reversible	Relatively Pristine	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	Impacts of reduced flows and natural fluctuations in water levels on navigability of Railroad Rapids for whitewater recreationalists.	Yes	High	High	< 1	>200	Reversible	Relatively Pristine	High	Not Significant
	Concern regarding potential loss of regular access for recreational whitewater users who are unable to travel to out-of-town locations	Yes	High	Medium	< 1	>200	Reversible	Relatively Pristine	High	Not Significant
Riparian rights or privileges	Impact on the value of nearby waterfront properties	Yes	High	Low	< 1	Continuous	Reversible	Previously Impacted	Low	Not Significant
Recreational use	Effects on snowmobile trail and bridge within project area	Yes	High	Low	< 1	1-12	Reversible	Previously Impacted	Medium	Not Significant
Angling, hunting opportunities	Effects to access of fishing locations	Yes	High	Low	< 1	Continuous	Reversible	Relatively Pristine	Medium	Not Significant
Views or Aesthetics	Potential impacts due to project construction and operation on Petawawa River	Yes	High	Medium	< 1	Continuous	Reversible	Relatively Pristine	High	Not Significant
Cultural Heritage Resources										
Archaeological sites	Disturbance or destruction to archaeological resources as a result of access road construction	Yes								
Social and Economic										
The location of people, businesses, institutions or public facilities	Disruption to traffic local flow patterns during equipment mobilization/ demobilization	Yes	Medium	Medium	< 1	13-36	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
The location of people, businesses, institutions or public facilities	Potential effects on the character of the project area	Yes	High	Medium	< 1	Continuous	Reversible	Previously Impacted	Medium	Not Significant
	Effects of noise pollution from construction activities	Yes	Medium	Medium	< 1	13-36	Reversible	Relatively Pristine	High	Not Significant
Local, regional or provincial economies	Potential for lost tourism revenue to the Petawawa community	Yes	High	Low	< 1	Continuous	Reversible	Previously Impacted	Medium	Not Significant
	Activities will support direct and indirect local employment	Yes	Medium	Medium	< 1	Continuous	Reversible	Previously Impacted	High	Positive
	Construction of project will involve influx of temporary workers which may increase spending on goods and services within the region	Yes	Medium	Medium	< 1	13-36	Reversible	Previously Impacted	High	Positive
Public health and/or safety	Danger to recreational users downstream of tailrace during rapid fluctuations	Yes	High	Low	< 1	>200	Reversible	Relatively Pristine	Medium	Not Significant
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

9. 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 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. Additional insight on potential cumulative effects may emerge during studies typically conducted at the permitting and approvals stage, and will therefore be discussed with the regulating authorities at that time.

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

9.1 IDENTIFICATION OF OTHER PROJECTS AND ACTIVITIES

There are known activities within the area that should be considered along with any residual effects of the Big Eddy GS project in order to undertake an assessment of cumulative effects. These projects or activities are:

- Aggregate operations: A portion of the land currently owned by H&H Construction will be impacted by the headpond of the Big Eddy GS.
- Existing Water control structures in the watershed: although there are no structures manipulating flows on the Petawawa River, small, man-made structures are known to exist along the river and its tributaries.

As discussed in Section 6.2 (Consultation Strategies), a second waterpower project, Half Mile GS, was previously proposed on the Petawawa River. As there are currently no plans to renew the Federal Priority Permit for site development for the Half Mile GS, the EA for the proposed Big Eddy GS proceeded with the assumption that the proposal to develop Half Mile GS will not be pursued. Therefore, the potential cumulative impacts of developing both sites on the Petawawa River are not discussed here.

9.2 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.

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, these impacts are anticipated to be both short term and minor and therefore not significant.

Additionally, as a 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 proposed Big Eddy GS would operate as a true run-of-river facility, such that water levels and flows on the Petawawa River outside of the project's zone of influence would not differ from pre-project conditions. While there exist a number of small man-made structures on the river upstream and downstream of the project site (including tributaries to the Petawawa River upstream of the Big Eddy GS), these are not known to regulate flows and levels. It can therefore be assumed that the presence of these structures on the Petawawa River together with the Big Eddy GS would not likely result in cumulative impacts to flows and levels in the river.

Activities associated with aggregate extraction could potentially result in cumulative impacts with the inundation of new lands from the development of the Big Eddy GS, e.g. from changes to the depth of the water table relative to retention ponds and excavation works. Potential cumulative impacts with aggregate extraction will be avoided either through the purchase of potentially impacted land or by selecting the weir option associated with a smaller headpond (Option 2). The selected approach for mitigating cumulative impacts will be determined through ongoing consultation with H&H Construction.

Disturbance of terrestrial wildlife and vegetation

The construction and operation of the proposed Big Eddy GS 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. Clearing and grubbing for the construction of the access road, connection line, laydown areas and the facility itself will be scheduled between

September 1st and April 1st annually, to allow for the widest possible window for migration, mating and nesting activities for migratory birds.

Energy and electricity reliability, security and distribution

Xeneca's proposed hydroelectric generating facility on the Petawawa River will have an installed capacity of 5.3 MW and will be operated to meet the socioeconomic objective of generating clean energy when it is required by the province. Consultation with Hydro One and adjustments to the regional distribution grid will be required for connection of the projects to the Provincial connection grid. The project will also have black start capability (will be able to restart without input from the external electrical grid), and will be able to contribute to reliable generation capacity.

10. MONITORING & FOLLOW-UP PROGRAMS

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

10.1 CONSTRUCTION MONITORING

Prior to construction, the Construction Management Plan presented in Annex II 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 Construction Management Plan 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 Construction Management Plan and industry/regulator BMPs.
- 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.

10.2 POST-CONSTRUCTION / OPERATION MONITORING

Xeneca has prepared a conceptual post-construction monitoring table detailing various aspects of monitoring that will be necessary following the completion the facility. This table will be prepared based on the suggestions of the project team and the monitoring requirements identified by regulators through the course of the EA. The post-construction monitoring table will be further developed into a comprehensive post-construction monitoring plan through project permitting and approvals following the completion of the EA as detailed design details become available.

Table 17: Post-Construction Monitoring Actions

Environmental Component Parameter		Monitoring Methodology	Monitoring Frequency and Timing	Trigger for Action	Reporting
Aquatic Biota and Habitat	Fish Communities	Fish community sampling to obtain post construction CPUE and relative abundance to compare to pre-construction conditions and determine whether fish community and abundance have changed. Fish community sampling will follow the Riverine Index Netting protocol.	TBD during permitting negotiations	Should the fish community monitoring results reveal changes in the fish community that are of concern for the fisheries management objectives for the river, Xeneca will discuss appropriate mitigation strategies with the Pembroke District MNR.	The results will be submitted to MNR within 3 months of each survey being completed.
	Aquatic Habitat	Monitoring the effectiveness of flow maintenance at 30 m^3/s when water temperature is between 4°C and 18°C, as part of Federal *Fisheries Act* Authorization and *ESA* Permitting, in order to ensure that upstream fish passage is possible within this range,. A lower flow (still TBD) will be maintained for 2 weeks post-18°C to provide sufficient wetted widths for late stage spawning activity (incubation and larval drift).	Annually during spring spawning (4°C-18°C), as part of negotiations for *ESA* Permitting and Federal *Fisheries Act* Authorization	Should results reveal that habitat is not functioning as intended or that identified objectives are not being realized Xeneca will discuss strategies with DFO to ensure that the desired habitat function is achieved and objectives are met.	Annually, timing of reporting TBD after discussion with MNR and DFO.
		Monitoring of Fish Passage – success of the proposed fish passage design will need to be monitored as part of the Federal *Fisheries Act* and potentially as part of *ESA* permitting, to ensure that the passageway is capable of being passed by a predetermined percentage of fishes of particular species.	TBD as part of negotiations for Federal *Fisheries Act* Authorization and *ESA* permitting. Uncertainty regarding existing natural passage makes discussions on passage success percentages and target species critical	Should monitoring reveal that the passageway is not functioning as intended based on discussions with agency experts, or that identified objectives are not being met, Xeneca will discuss strategies with DFO and MNR to ensure that success goals are achieved.	TBD
		Monitoring of size and location of the sandbar feature at the tailrace to ensure that installation of the weir upstream does not adversely impact sediment loading and continued replacement of sediment on the sandbar.	Size and composition of sandbar will be assessed in year 1, 3, 5 and 10 years post construction.	Should monitoring reveal that the sandbar is diminishing in size, or that sediment load is reduced in the downstream reach, Xeneca will determine sediment load requirements and ensure a sufficient amount of sediment is replaced into the reach below the weir for dispersal.	TBD
		Monitoring of potential spawning habitat within the lower end of the bypass reach, to ensure it is wetted during all spawning stages and is functioning as intended.	TBD as part of negotiations for Federal *Fisheries Act* Authorization	Should monitoring reveal that spawning is occurring at this location, Xeneca will discuss strategies with DFO and MNR to ensure that success goals are achieved.	TBD as part of *ESA* Permitting and/or Federal *Fisheries Act* Authorization
		Monitoring of velocity and hydraulics at the tailrace pool to ensure that this pool/ sandbar in the lower portion of the bypass reach is functioning as intended. Required to ensure that predictions with respect to post development depth and velocity at these habitats are accurate and that the habitat continues to function within the preferred depth and velocity ranges for young-of-the-year life cycle stage for this species.	TBD as part of negotiations for *ESA* Permit and Federal *Fisheries Act* Authorization	Should post development monitoring reveal that the habitats are not functioning within the preferred ranges for Sturgeon spawning, discussions with DFO will ensue and the flow is adjusted or alternative compensation is provided.	TBD as part of negotiations for Federal *Fisheries Act* Authorization
	Fish stranding	Monitor for fish stranding in the constructed habitat area in the bypass reach downstream of the weir, especially during ramping	Should occur in spring, summer and fall, during	If stranding is detected, consider rate restrictions on ramping down that would reduce the rate of water level change,	The results will be submitted to OMNR and DFO within 60

		down period when water levels are dropping.	ramping events, to account for seasonal variation in habitat usage by fish. Should occur for two years following construction	thereby providing fish with additional time to move into the natural channel and avoid stranding	days of each survey being completed.
	Fish Entrainment and impingement	Fish mortality from entrainment and impingement, to determine whether entrance velocity and trash rack spacing is adequate to mitigate fish mortality from entrainment and impingement. Subject to American Eel returning to this area in the future, additional racks will be required during American Eel migration periods. These racks will need to be of sufficient size to deter adult eel from entrainment.	Should occur in first year following construction when turbine is operating at maximum capacity	Should intake velocities be outside of predicted ranges to protect fish from entrainment and mortality or should entrainment or impingement be detected modifications to the intake can be made to prevent entrainment and impingement including lighting, electrical barriers, air bubbling and sound barriers	The results will be submitted to OMNR and DFO within 3 months of each survey being completed.

Vegetation and Significant Wildlife Habitat	Headpond Vegetation Surveys	Upstream shoreline vegetation surveys. To determine which, if any, shoreline vegetation communities are establishing in the headpond after weir construction.	Should occur every two years following construction for a period of ten years	Monitoring is for information purposes only and no trigger action applies	The results will be submitted to MNR within 3 months of each survey being completed.
Operation	Water Levels	The head pond water level will be monitored from a water level gauge located on the upstream side of each powerhouse. (See Section 5.8 Compliance Considerations)	At 15 minute intervals for duration of facility lifetime.	Should the head pond water levels deviate outside the Target Operating Zone, an Incident Report following standard compliance procedures outlined by MNR would be submitted.	The results will be submitted to MOE and MNR annually.
	Flow Rates	Total instantaneous discharge readings would be a combination of gauged/measured flows through the facility and calculated discharge from the spillway. Monitoring hardware will be installed below the tailrace, and correlated to the EC gauge upstream of the headpond to ensure commitments to maintain no net change in flow volumes below the tailrace as a result of operations (See Section 5.8 Compliance Considerations)	At 15 minute intervals for duration of facility lifetime.	Should the downstream flow targets deviate outside the, an Incident Report following standard compliance procedures outlined by MNR and MOE would be submitted. Further negotiations on downstream ZOI would be undertaken if the resulting fluctuations are not mitigated by operational alteration.	The results will be submitted to MOE and MNR weekly for the first 12 weeks post operation, and monthly for the remainder of the first year, then annually thereafter.
Surface Water	Surface Water Quality Fish Tissue Mercury Concentrations	Samples will be collected from the upstream reference, and above the impoundment of Big Eddy. Parameters below will be measured: - pH, conductivity, alkalinity; - Total Suspended Solids (TSS) and Total Dissolved Solids (TDS); - cations (Mg, Na, Ca, K); - anions (Cl, SO_4); - Dissolved Organic Carbon (DOC); - total phosphorus; - nitrate, nitrite, ammonia and total Kjeldahl nitrogen (TKN); - Total metals; - low level total mercury (0.1 ng/L detection limit); and, - low level methyl mercury (0.02 ng/L detection limit). Water temperature, dissolved oxygen, pH and conductivity and turbidity will be measured in the field using YSI model 650 TDS multi-meter. (See Surface Water Quality Report Section 4.2 Water Sampling)	Post-development water quality samples will be collected three times a year during the spring freshet, the summer low-flow period and the fall mid-flow periods in years 1, 2 and 3 following development, as recommended by MOE 2012.	Should significant changes happen, the results will be reviewed with MOE to determine if additional sampling or investigation into the source of the changes is necessary.	The results of the post-development monitoring will be compared to pre-construction condition and reported to MOE annually for each monitoring year.
		Fish sampling would be conducted according to the MNR Riverine Index Netting protocol and recommendations of MOE Permit To Take Water Guideline 2012. Large fish: total mercury – 10 samples; methyl mercury – 5 samples, of at least 25 to 55 cm length; Forage fish: total mercury and methyl mercury – 5 composite samples, of 5 to 10 individuals of yearling perch or other cyprinid species.	Sampling will be conducted in years 3, 6 and 9 after development to assess mercury accumulation in fish tissue.	Should significant changes happen, the results will be reviewed with MOE to determine if additional sampling or investigation into the source of the changes is necessary. Data will also be provided to local communities so that community members are aware of any consumption restrictions.	The results of the post-development sampling will be compared to baseline results and reported to MOE annually for each monitoring year.

		Fish will be sampled from the Big Eddy impoundment to assess project impacts. (See the 2012 Baseline Quality and Fish Tissue Mercury report (Section 4.3 Fish Sampling) in Annex IV of this report)			

11. 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 18. Note that at the time of writing of this draft report, amendments to the *Navigable Waters Protection Act* (*NWPA*) were being proposed. The amended act, proposed to be called the *Navigation Protection Act* (*NPA*), would list the major waterways for which regulatory approval is required prior to the placement or construction of a work and expand the list of low risk works that can be pre-approved due to their low potential impact on navigation. The specific requirements of the proposed undertaking with respect to the *NWPA/NPA* may therefore change depending on the amendments that are ultimately incorporated into the Act. Similarly, proposed amendments to the *Fisheries Act* may see a shift in the DFO's focus from reviewing all projects on all waters to those that may have significant impacts on Canadian fisheries. Amendments to Section 35 of the *Fisheries Act* may result in authorizations no longer being required for activities having only temporary effects on fish habitat (Richler, 2012). The amendments that are ultimately adopted into the *Fisheries Act* will determine which activities and works associated with the proposed development of the Big Eddy GS will require authorizations under Section 35.

Table 18: List of Potential Regulatory Approvals

Permit and Legislative Requirement	Agency
Federal	
Authorization for Works and Undertakings Affecting Fish Habitat - *Fisheries Act* [Section 35(2)]	DFO
Authorization for Destruction of Fish by Means other than Fishing - *Fisheries Act* (Section 32)	DFO
Requires fish guards or screens to prevent entrainment of fish at any water diversion or intake – *Fisheries Act* (Section 30)	DFO
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)	DFO
SARA – authorizations, as applicable	DFO; EC
Approval for Construction in Navigable Waters – *Navigable* Waters Protection Act (Section 5)	TC (Marine)
Explosives Act - Temporary Magazine Licence	NRCan

Provincial	
Lakes and Rivers Improvement Act (LRIA) – Section 14 - Location Approval and Plans and Specifications Approval	MNR
Lakes and Rivers Improvement Act (LRIA) – Section 23.1 - Water Management Plan	MNR
Public Lands Act (PLA) – Work Permits (Parts 1-5, as required).	MNR
Public Lands Act (PLA) – Land Use Permit or Licence to Construct	MNR
Public Lands Act (PLA) – Water Power Lease Agreement	MNR
Public Lands Act (PLA) – Grants of Easements (Policy PL 4.11.04)	MNR
Endangered Species Act (ESA) – permits and agreements, as applicable	MNR
Crown Forest and Sustainability Act (CFSA) - Forest Resource Licence and Overlapping Licence Agreement	MNR
Crown Forest and Sustainability Act (CFSA) – Use/maintenance agreement	MNR
Forest Fires Prevention Act (FFPA) - Burn permit on Crown Land	MNR
Aggregate Resources Act (ARA) – Aggregate Permit	MNR
Permit to Take Water – Ontario Water Resources Act (Section 34), Category 2 (construction) and 3 (operation)	MOE
Environmental Compliance Approval (ECA) (*Environmental Protection Act* - Industrial Sewage, Section 53; Air and Noise, Section 9; Waste Generator Registration, Section 18(1), Ontario Regulation 347)	MOE
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

12. COMMITMENTS

The following commitments are made by the proponent, Xeneca 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 BMPs, 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 monitor for the duration of the construction program and through operator training on environmental issues within the operational phase of the project.
- The proponent will apply the mitigation measures for erosion and sedimentation presented in the Preliminary Erosion and Sediment Control Plan (see Annex II). Such mitigation measures include phasing construction to minimize the duration of soil exposure, maximizing the retention of existing vegetation cover, installing silt fences around stockpiles of erodible material, and monitoring the effectiveness of the mitigation measures throughout the construction period. The proponent will further develop the Erosion and Sediment Control Plan (Annex II) before the start of the construction phase for the proposed undertakings.
- The proponent is 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. The format and content of this report will be discussed with local stakeholders and agencies to meet their needs.

Facility Design and Operations

- The identified erosion hazard locations will be monitored during construction and early operation phases by a qualified erosion/sedimentation specialist.
- In order to further minimise the potential for fish mortality a fish slide will be incorporated into the design of the facility to enable fish that enter the intake canal to bypass the turbine(s) and pass directly into the facility tailrace.

- In the event that American Eels are confirmed at the project site, a trashrack with smaller spacing will be installed to during eel migration period to prevent movement through the facility intake. A fish deterrent system (lights) will also be installed to deter fish from entering into intake canal.
- The size and persistence of the sandbar feature at the confluence of the tailrace and the bypass reach will be monitored. Should it be observed that the sandbar is shrinking over time, appropriate-sized sediment will be mechanically deposited downstream of the weir in order to re-supply the sandbar with sediment.
- During walleye and lake sturgeon staging and spawning, the proponent commits to providing 30 m^3/s in the bypass in the spring when water temperatures range from 5°C to 18°C in order to facilitate upstream and downstream passage (see the draft plan in Annex I).
- A post-operational verification assessment will be conducted to confirm the predictions of the hydraulic model for downstream effects on flows and levels.
- Compliance monitoring will be conducted in order to ensure compliance with the water level commitments outlined in the Operating Plan.
- The proponent commits to operating the proposed Big Eddy GS as a true run-of-river facility, with instantaneous in-out water flows.
- Xeneca has committed to providing a flow velocity of 1 m/s or less within the intake canal. This low flow velocity will provide eels and other fish species that enter the canal (despite all preventative efforts) with opportunity to swim back upstream and exit upriver of the weir location.
- An emergency powerhouse bypass will be built to be used in the event of an emergency shut down at the facility.

<u>Consultation</u>

- The proponent is committed to continuing to engage specific community and Aboriginal stakeholders on relevant issues after the issuance of the NOC 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 whitewater community, the recreational angling community, local landowners, and other interested parties to ensure that access, fisheries, tourism values and aesthetics are not negatively affected by the project.
- The proponent will advise the Township of Petawawa when landowner agreements are finalized.

Recreation

- The proponent is committed to maintaining and aiding the annual Hell or High Water whitewater festival on the Petawawa River in order to assure that it is not adversely affected. This will be done through the provision of flows during daylight hours for the duration of the two day event.
- The proponent will ensure that there are no adverse effects on the downstream community recreation area known as "Catwalk".
- The proponent commits to working with the Town of Petawawa and recreational users to develop amenities at the project site, which may include parking and rest areas, launching points for watercrafts, and trails.
- A portage will be constructed and maintained to maintain access around the facility for boaters and canoeists.

Further Investigations

- The proponent will update the Construction Management Plan based on advanced project design to include instructions and protocols for minimizing the disturbance.
- The proponent will document and verify impacts associated with inundation and flow effects within the expanded zone of influence upstream (inundation area) and downstream (variable flow bypass reach) of the facility.
- 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 commits to further develop the post-construction monitoring plans summarized in Section 10.2 during the permitting and approvals stage of development.
- Archaeological investigations will be conducted along access roads in advance of the final ER. Results of these investigations will inform impact assessment.

13. CONCLUSIONS

Xeneca proposes to construct and operate the proposed Big Eddy GS on the Petawawa River. This document describes the 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 and 2 archaeological assessments;
- 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 studies.

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 community 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 and Stage 2 archaeological assessments of the project determined that there were no cultural resources which would be impacted by the project. Further archaeological assessments are being conducted through the spring of 2013 to address the potential for cultural resources to be present along the proposed access roads and transmission lines for the project.

A comprehensive engagement initiative with each community located within, or having traditionally used the project area has been underway since issue of the NOC and will continue beyond NOC and into project implementation.

Throughout this environmental assessment (EA), management strategies were developed and applied to potential impacts in order to avoid, prevent or minimize any identified adverse environmental effects of the project. It is the conclusion of this EA 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.

There are however adverse environmental effects that have been identified that will require further assessment or discussions with regulators through the spring and summer of 2013 before the determination of residual effects and significance can be completed. The results of these studies and discussions will be incorporated into the final environmental report (ER) along with agency draft review comments in advance of the issuance of the ER associated with the Notice of Completion.

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:
    - Job creation during construction both directly and indirectly in the Near North 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 (2) 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 waterpower 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 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.

14. REFERENCES

Aboriginal Affairs and Northern Development Canada. (2012, December 13). Backgrounder - Algonquins of Ontario land claim negotiations. Retrieved from http://www.aadnc-aandc.gc.ca/eng/1355436558998/1355436749970

Algonquin Anishinabeg Nation Tribal Council. (n.d.). AANTC infrastructure. Retrieved from http://www.anishinabenation.ca/eng/infrastructure_en.htm

Algonquins of Ontario, 2012. Returning Kichisippi Pimisi (the American Eel) to the Ottawa River Basin. Retrieved from http://www.tanakiwin.com/AOO_Returning%20Kichisippi%20Pimisi%20to%20the%20Ottawa%20River%20Basin__Dec2012_20121219.pdf

Auer, N. A. 1982. Identification of Larval Fishes of the Great Lakes Basin Emphasis on the Lake Michigan Drainage. Great Lakes Fishery Commission. Ann Arbor, Michigan. Special Publication 82-83. 744pp.

Auer, N. A. 1982. Identification of Larval Fishes of the Great Lakes Basin Emphasis on the Lake Michigan Drainage. Great Lakes Fishery Commission. Ann Arbor, Michigan. Special Publication 82-83. 744pp.

Bird Studies Canada. 2006. Environment Canada's Canadian Wildlife Service, Ontario Nature, Ontario Field Ornithologists and Ontario Ministry of Natural Resources. Ontario Breeding Bird Atlas Database, 31 January 2008. http://www.birdsontario.org/atlas/aboutdata.jsp?lang=en

Bird Studies Canada. 2010. Atlas of the Breeding Birds of Ontario. Square summary sheets and square coverage sheets. Available online at: http://www.birdsontario.org/atlas/squareinfo.jsp?lang=en. Accessed June 8, 2010.

Cada, G. F., C. C. Coutant, and R. R. Whitney. 1997. Development of biological criteria for the design of advanced hydro power turbines. DOE/ID-10578. Prepared for Office of Geothermal Technologies, U.S. DOE, Idaho Falls, ID.

Cada, G.F. and M. Odeh. 2001. Turbulence at hydroelectric power plants and its potential effects on fish. Report to the Bonneville Power Administration, Portland, OR. 31 p.

City of Pembroke, 2013. Economic Development. Retrieved from http://www.pembrokeontario.com/economic-development/ on 24th April 2013

Committee on the Status of Endangered Wildlife In Canada. 2010. Species information. Available at: http://www.cosewic.gc.ca/eng/sct5/index_e.cfm

Community Alliance to Save the Petawawa, 2011. Retrieved from: http://www.liquidlore.com/dam/ on June 11, 2013

Cornell Lab of Ornithology. 2010. Birds of North America Online. Available online at: http://bna.birds.cornell.edu/bna . Accessed Dec. 14, 2010.

County of Renfrew, 2013. Town of Laurentian Hills. Retrieved from http://www.countyofrenfrew.on.ca/municipalities/town-of-laurentian-hills/ on 24th April 2013

Curry, R.A. and D.L.G. Noakes. 1995. Groundwater and the selection of spawning sites by brook trout. Can. J. Fish. Aquat. Sci. 52: 1733-1740.

Debicki, R.L. July 8, 2010. Letter from Ministry of Northern Development, Mines and Forestry to Xeneca Power Development with Attachment 1 Xeneca Power Development Inc.'s Proposals MDNMF Comments-Resident Geologist Program.

Department of Fisheries and Oceans (DFO). 2010. Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff. Available online at: http://www.dfo-mpo.gc.ca/habitat/role/141/1415/14155/risk-risque/page03-eng.asp

Department of Justice Canada. 2002. Species at Risk Act. Available online at: http://laws.justice.gc.ca/en/S-15.3/index.html.

Dobbyn, J.S. 1994. Atlas of the Mammals of Ontario. Federation of Ontario Naturalists.

Environment Canada, 2013. Station Results for Petawawa A. Retrieved from http://climate.weatheroffice.gc.ca/climate_normals/results_e.html?stnID=4352&lang=e&dCode=0&StationName=PETAWAWA&SearchType=Contains&province=ALL&provBut=&month1=0&month2=12

Environment Canada, http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_087406.pdf

Fisheries & Oceans Canada and the Ontario Waterpower Association. 2010. Federal Requirements for Waterpower Development Environmental Assessment Processes in Ontario – Practitioner's Guide, Version 2.0. 91 pp.

Five2nine, 2011. HOHW IV – A HUGE Success. Available online at: http://five2nine.ca/events/about/. Accessed October 23, 2012.

Franke, G.F., D.R. Webb, R.K. Fisher, D.Mathur, P.N Hopping, P.A. March, M.R. Headrick, I.T. Laczo, Y. Ventikos, and F. Sotiropoulios. 1997. "Development of environmentally advanced

hydropower turbine system concepts", Voith Hydro, Inc. Report No.: 2677-0141. Prepared for the USDOE (Idaho) Contract No. DEAC07- 96ID13382.

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.

Government of Ontario. 2007. Endangered Species Act. Available online at: http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_07e06_e.htm.

Harkness, W.J.K. 1923. The rate of growth and the food of the lake sturgeon (*Acipenser rubicundus*). University of Toronto Studies. Publications of the Ontario Fisheries Research Laboratory. 18:15-42.

Harper, D. G. and Blake, R. W. (1990). Fast-start performance of rainbow trout *Salmo gairneri* and northern pike *Esox lucius*. Journal of Experimental Biology, 150, 321-342.

HEC-RAS Hydraulic Reference Manual, Version 4.1. USACE. January 2010.

Hedrick, R. P. 1998. Relationships of the host, pathogen, and environment: implications for diseases of cultured and wild fish populations. J. Aquat. Anim. Health 10: 107-111.

Hogan, T. 2008. Impingement and Entrainment: Biological Efficacy of Intake Alternatives. Presented at the 2008 Desalination Intakes Solutions Workshop. Alden Research Laboratories. Fort Collins, Colorado. Oct. 16 and 17, 2008

Hydrology Review and Flood Frequency Analyses – DRAFT – Ontario South Hydro. Canadian Projects Limited. February 17, 2011.

Hydrology Review for Blanche River Hydropower Sites. Hatch Ltd. October 6, 2009.

Jones, D.R., J.W. Kiceniuk, and O.S. Bamford. 1974. Evaluation of the swimming performance of several fish species from the Mackenzie River. J. Fish. Res. Board Can. 31: 1641 – 1647.

Katopodis, C. and R. Gervais. 1991. Ichthyomechanics. Working Document, Freshwater Institute, Winnipeg, Man. 11 p + appendices.

Métis Nation of Ontario. (2013). About the Métis Nation of Ontario. Retrieved from http://www.metisnation.org/about-the-mno/the-metis-nation-of-ontario

Minister of the Department of Aboriginal Affairs and Northern Development Canada (AAND), (March 2011).Aboriginal Consultation and Accommodation Updated Guidelines for Federal Officials to Fulfill the Duty to Consult (R3-111/2012E-PDF). Retrieved from Government of Canada website: http://www.aadnc-aandc.gc.ca/DAM/DAM-INTER-HQ/STAGING/texte-text/intgui_1100100014665_eng.pdf

Ministry of Natural Resources, 2002. Water Management Planning Guidelines for Waterpower. 79 pp.

Municipality of Petawawa, 2013. Campgrounds. Available online: http://www.petawawa.ca/index.php/campgrounds; retrieved May 27, 2013

Municipality of Petawawa, 2013. History of Petawawa. Retrieved from http://www.petawawa.ca/index.php?option=com_content&task=view&id=461&Itemid=88

Natural Heritage Information Centre (NHIC). 2010. Biodiversity Explorer: Species and Natural Areas Occurrence. Ontario Ministry of Natural Resources, Peterborough, Ontario. Accessed in October 2010. Available http://www.biodiversityexplorer.mnr.gov.on.ca/nhicWEB/nhicIndex.jsp

New York Power Authority. 2005. Cada, G.F. and M. Odeh. 2001. Turbulence at hydroelectric power plants and its potential effects on fish. Report to the Bonneville Power Administration, Portland, OR. 31 p. Available online: http://niagara.nypa.gov/ALP%20working%20documents/finalreports/IS01.pdf.

Newbury, RW, and MN Gaboury. 1993. Stream analysis and fish habitat design: field manual. Newbury Hydraulics Ltd. 256p.

Nichols, S.J., G. Kennedy, E. Crawford, J. Allen, J.I. French, G. Black, M. Blouin, J. Hickey, S. Chernyak, R. Haas and M. Thomas. 2003. Assessment of lake sturgeon (*Acipenser fulvescens*) spawning efforts in the Lower St. Clair River, Michigan. Journal of Great Lakes Research 29: 383-391.

Nowak, A.M. and MacRitchie, I.C. 1984. A study of the Frederick House River, Cochrane District, 1981-1983. MS Report, Ont. Min. of Nat. Res., Cochrane. 99p.

OBBA. 2001. Ontario Breeding Bird Atlas: guide for participants. Available http://www.birdsontario.org/atlas/download/obba_guide_en.pdf

Oldham, M.J. and W.F. Weller. 2000. Ontario Herpetofaunal Atlas. Natural Heritage Information Centre, Ontario Ministry of Natural Resources. Available online at: http://www.mnr.gov.on.ca/MNR/nhic/herps/ohs.html

Ontario Canada Travel Guide. The Ottawa Valley. Retrieved from http://www.ontario-canada-travel.com/ottawa-valley.html#.UXlc-aL9TLU on 4th May 2013

Ontario Ministry of Aboriginal Affairs. (2013, March 22).Algonquin land claim. Retrieved from http://www.aboriginalaffairs.gov.on.ca/english/negotiate/algonquin/algonquin.asp

Ontario Ministry of the Environment, 2012. From Class EA to Permit to Take Water: A Guide to Understanding the Ministry of the Environment's (MOE) Technical Requirements for Waterpower (Draft Document)

Ontario Ministry of Natural Resources (OMNR). 2000a. Significant Wildlife Habitat: Technical Guide. OMNR, October 2000.

Ontario Ministry of Natural Resources (OMNR). 2000b. Addendum to Significant Wildlife Habitat Technical Guide: Appendix G. Accessed July 18, 2011. http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@fw/documents/document/mnr_e001287.pdf.

Ontario Ministry of Natural Resources (OMNR). 2006. Corwn Land Use Policy Atlat Policy Report G396: Multiple Natural Resource Use. Accessed June 25, 2013. http://www.lio.ontario.ca/imf-ows/sites/clupa/xmlReader.jsp?xsl=XML/web-primary.xsl&polid=G396

Ontario Ministry of Natural Resources (OMNR). 2010a. Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005. Second Edition. Toronto: Queen's Printer for Ontario. 248 pp.

Ontario Ministry of Natural Resources Pembroke District, Southern Region. 2011-2021 Forest Management Plan (FMP) for the Ottawa Valley Forest. Retrieved from http://www.appefmp.mnr.gov.on.ca/eFMP/home on 24th April 2013.

Ontario Ministry of Natural Resources. 2009. Ecological Land Classification Field Manual – Operational Draft, April 20, 2009. Ecological Land Classification Working Group, Ontario. Operational Draft.

Ontario Ministry of Natural Resources (OMNR). 2011. Fish Facts. Available online: http://www.mnr.gov.on.ca/en/Business/LetsFish/2ColumnSubPage/STEL02_173221.html.

Ontario Ministry of Natural Resources, 2012.Crown Land Use Policy Atlas. Retrieved from http://www.mnr.gov.on.ca/en/Business/LUEPS/2ColumnSubPage/STDU_137972.html on June 5, 2013

Ontario Ministry of Natural Resources (OMNR). Undated. Site Information Package for Marter Township Water Power Project Site # 2JC16-2JC17, Blanche River

Application Number WSR-2008-22Ontario Ministry of Natural Resources (OMNR). 2000c. Decision Support System (DSS) for the Significant Wildlife Habitat: Technical Guide. Available online: http://www.mnr.gov.on.ca/en/Business/FW/Publication/MNR_E001285P.html

Ontario Ministry of the Environment. From Class EA to Permit to Take Water: A Guide to Understanding the Ministry of the Environment's Technical Requirements for Waterpower. Draft Document, January, 2012.

Ontario Nature. 2010. Ontario's Reptile and Amphibian Atlas. Available on-line at http://www.ontarionature.org/protect/species/reptiles_and_amphibians/index.php (Updated Sept. 15, 2010). Accessed Jan. 4, 2011.

Ontario Power Authority, (July 11, 2008). Consulting with First Nation and Métis Communities: Best Practices, Good Business. Retrieved from website: http://caid.ca/OntPowConPol071108.pdf

Ontario Power Generation (OPG), 2013. *Ontario Power Generation.* Retrieved from http://www.opg.com/index.asp on June 5th, 2013

Ontario Resource Management Group Inc., 2007. 2007 Species at Risk Environmental Study, CFB Petawawa. November 2007. Ontario Resource Management Group, Inc. Unpublished, 438 pp.

Ontario Resource Management Group Inc., 2010 Environmental Characteristics Report, Marter Township Hydroelectric Generating Station, Blanche River, Marter Township, March 17, 2011

Ontario Resource Management Group Inc., 2011 Environmental Characteristics Report, Marter Township Hydroelectric Generating Station, Blanche River, Marter Township, May 2, 2012

Ontario Resource Management Group Inc., DRAFT 2012 Environmental Characteristics Report, Marter Township Hydroelectric Generating Station, Blanche River, Marter Township, July 24, 2012

Ontario Resource Management Group Inc., Marter Township Hydroelectric Generating Station, Mitigation and Recommendations Summary Report, Blanche River, Marter Township, August 10, 2012

Ontario Waterpower Association (OWA). 2012. Class Environmental Assessment for Waterpower Projects. Available online: http://www.owa.ca/assets/files/classea/2012%20Class%20EA%20for%20Watepower%20Projects.pdf

Peake, S., F.W.H. Beamish, R.S. McKinley, C. Katopodis, and D.A. Scruton. 1997. Relating swimming performance of Lake Sturgeon *Acipenser fulvescens*, to fishway design. Can. J. Fish. Aquat. Sci. 54(6): 1361 – 1366.

Peake, S., R.S. McKinley, and D.A. Scruton. 2000. Swimming performance of walleye (*Stizostedion vitreum*). Canadian Journal of Zoology. 78: 1686 – 1690.

Peake, S.J. 2008. Swimming performance and behaviour of fish species endemic to design and water velocity criteria for fishways and culverts. Can. Manuscr. Rep. Fish. Aquat. Sci. 2843: v + 52p.

Petawawa Heritage Village, 2013. Petawawa Timeline. Retrieved from http://www.petawawaheritagevillage.com/history/timeline?page=3

Power, G. 1978. Fish population structure in Arctic Lakes. J. Fish. Res. Board. Can. 35:53-59

Rowe, J.S. 1972. Forest regions of Canada. Dep. Fish and Environ., Can. For. Serv. Pub. 1300. 172pp.

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. Galt House Publications Ltd., Oakville, Ontario. Reprinted in 1998.

Scott, W.B. and E.J. Crossman. 1998. Freshwater Fishes of Canada. Galt House Publications Ltd. Oakville, On.

Scruton, D.A., K.D. Clarke, and L.I Cole. 1998. Water temperature dynamics in small forested headwater streams of Newfoundlancl, Canada: quantification of thermal brook trout habitat to address initial effects of forest harvesting. p. 325-336, In M.K. Brewin and D.M.A. Monita (technical coordinators) Forest-fish conference: land management practices affecting aquatic ecosystems. Proc. Forest-Fish Conf., May 1-4, 1996, Calgary, Alberta. Nat. Resour. Can., Can. For. Serv., North. For. Centre, Edmonton, Alberta. Inf. Rep. NOR-X-356.

Scruton, D.A., K.D. Clarke, and L.I Cole. 1998. Water temperature dynamics in small forested headwater streams of Newfoundlancl, Canada: quantification of thermal brook trout habitat to address initial effects of forest harvesting. p. 325-336, In M.K. Brewin and D.M.A. Monita (technical coordinators) Forest-fish conference: land management practices affecting aquatic ecosystems. Proc. Forest-Fish Conf., May 1-4, 1996, Calgary, Alberta. Nat. Resour. Can., Can. For. Serv., North. For. Centre, Edmonton, Alberta. Inf. Rep. NOR-X-356.

Seyler, J. 1997. Biology of Selected Riverine Fish Species in the Moose River Basin. Northeast Science & Technology (NEST). Information Report IR-024. Ontario Ministry of Natural Resources, Cochrane District. Large River Ecosystem Unit. ISBN 0-7778-5601-8. May 1997.

Species at Risk Public Registry. 2010. Species Profile: Monarch. Available on-line at: http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=294. Accessed January 11, 2011.

Statistics Canada, 2013. Census of Canada. Retrieved from http://www12.statcan.gc.ca/census-recensement/index-eng.cfm on June 5, 2013

Surtees, R.J., 1986. Treaty Research Report: The Williams Treaties. Treaties and Historical Research Center, Indian and Northern Affairs Canada. 36 pp.

Town of Deep River, 2008. Official Plan. Retrieved from http://www.deepriver.ca/userfiles/file/licences-and-forms/DEEP%20RIVER%20OP%20Consolidated.pdf on 19th April 2013

Town of Petawawa, 2012. Parks and Waterfront. Available on-line at: http://www.petawawa.ca/index.php/park-a-recreation/parks-and-waterfront. Accessed October 23, 2012.

Town of Petawawa, 2012. Economic Profile for the Town of Petawawa. Retrieved from http://www.petawawa.ca/images/stories/economic/economic%20profile%20for%20the%20town%20of%20petawawa%202012.pdf on 18th April 2013

Terrapoint #: 2009-161-C; 2009-172-C; and 2009-174-C. Terrapoint. October 1, 2010.

United States Department of Agriculture Forest Service 2000. Edited by Gucinski, H. et al. Accessed July 21, 2011. Available online: http://www.fs.fed.us/eng/road_mgt/science.pdf.

Wester, M., Uhlig, P., and Bakowsky, W. 2010. "Draft Great Lakes St. Lawrence Ecosite Factsheets." Ontario Ministry of Natural Resources: Ontario Forest Research Institute.

Winchell, F., S. Amaral, and D. Dixon. 2000. Hydroelectric turbine entrainment and survival database: an alternative to field studies. In: Hydrovision 2000: New Realities, New Responses. HCI Publications, Kansas City, Missouri.

Wright, D.G., and G.E. Hopky. 1998. Guidelines for the use of explosives in or near Canadian fisheries waters. Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p.