ANNEX III

NATURAL ENVIRONMENTAL CHARACTERIZATION
AND
IMPACT ASSESSMENT REPORT

Wanatango Falls Hydroelectric Development

Natural Environment Characterization & Impact Assessment Report

Prepared for:
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Project No. 1052

Date: September 2011

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Wanatango Falls Hydroelectric Development
Natural Environment Characterization & Impacts Assessment Report

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Report Submitted on September 19, 2011

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1.0 Introduction

Xeneca Power Development Inc. (Xeneca) is currently undertaking a provincial Class Environmental Assessment (EA) for Waterpower Projects (OWA 2008) for the development of a hydroelectric facility. This Class EA was initiated in accordance with Section 8 of the Electricity Project Regulation (Ont. Reg. 116/01) under the provincial *Environmental Assessment Act* . The proposed facility at Wanatango Falls consists of a 4.7 Megawatt (MW) peaking (modified) hydro-electric Generating Station (GS) at Wanatango Falls on the Frederick House River. The site is located approximately 10 km downstream of the existing Frederick House Lake Control Dam operated by Ontario Power Generation (OPG) and approximately 600 m upstream of Zeverley's Road (Figure 1).

In support of the Class EA, Natural Resource Solutions Inc. (NRSI) was retained by Xeneca to characterize existing aquatic, terrestrial and wetland features within the GS study area (Figure 1) and to identify potential impacts on these features as a result of the proposed development of Wanatango Falls GS. Findings of this assessment are summarized in this report, which provides a description of existing ecological features, an analysis of their sensitivity and significance as well as identification of potential impacts from the proposed GS on these features.

1.1 Study Area

The study area is generally defined as the 'zone of influence' (ZOI) plus a 120 perimeter (Figure 1). The ZOI includes the 'area of inundation' plus the downstream 'variable flow reach'. The 'inundation area' is the area upstream of the GS that will be inundated as a result of the construction and operation of the proposed Wanatango GS. The downstream 'variable flow reach' is the downstream reach that is anticipated to experience fluctuations of flows which are characterized by relatively rapid increases and decreases in flow.

Figure 1

Wanatango Falls Hydroelectric Generating Station

Study Area

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 8, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:25,000 (11x17")

494000 495000 496000 497000 498000 499000

5414000 5413000 5412000 5411000 5410000 5409000 5408000 5407000 5406000 5405000

2011 Downstream Limit of Study Area

Zeverley's Bridge

REAUME ESKER RD

Wanatango Falls GS Location

Wanatango Falls

CONNAUGHT EVELYN RD

MANN SOUTH RD

Legend

- Wanatango Falls Hydroelectric Generating Station
- Current Downstream Extent of the Variable Flow Reach
- Preliminary Downstream Extent of the Variable Flow Reach
- Preliminary Extent of Zone of Inundation
- Proposed Wanatango Falls GS Location
- Zone of Inundation
- Flow Direction
- Highway
- Primary Road
- Secondary Road
- Resource / Recreation / Service
- Elevation Contour (10m Interval)

N

0 250 500 750 1,000 Meters

2011 Upstream Limit of Study Area
Frederickhouse Dam

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Fig1_Wanatango_StudyArea_25K_2011_08_08_SWM.mxd

At this point in time, there are two height options presented for the dam, these include what has been described as the 'low dam' and the 'high dam'. Each dam height will result in different inundation areas. The low dam inundation area will extend 0.5km upstream. The high dam inundation area will extend 8.2km upstream. These options have been identified as the land within the upstream inundation area is privately owned, and therefore would require futher approvals. Currently, the low dam height inundation area is contained within approved lands. If landowner approvals are successful, the high dam will be selected and the inundation area will extend 8.2km. For the purposes of this report, the 8.2km high dam inundation area was considered..

The downstream extent of the variable flow reach has changed from what was initially determined. Initially, in the absence of available engineering information, a survey length of 400m was allocated to encompass the extent of the predicted variable flow reach. Currently, Xeneca has now confirmed that the downstream variable flow reach will extend approximately 2.0km downstream of the proposed Wanatango Falls GS site. This was recognized during a formal biological study scoping meeting held on May 2, 2011.

In response to the inclusion of additional length of river within the variable flow reach, Xeneca has committed to having NRSI collect the required natural environment information for the previously unstudied lengths of river in 2011. Furthermore, field work conducted by NRSI in 2010 was based on the preliminary downstream variable reach extent and GS location as field work conducted in the spring of 2011 was carried out based on the current known extent (Figure 1).

1.2 Study Scope

Scoping of natural environment studies and the level of effort of these studies were carried out by NRSI based on the project understanding in the spring of 2010.

As field data gaps were recognized during the 2010 field season, recommendations for additional field work in 2011 were made by NRSI and approved by Xeneca in the spring

of 2011. A summary table of that work is appended to this report (Appendix I). Further consultation on the scope of field studies occurred with the Ontario Ministry of Natural Resources (OMNR) on May 2 and June 15, 2011 during formal biological scoping conference call meetings. Discussions at this meeting contributed to the refinement of the proposed 2011 field surveys.

A summary of field studies completed to date is provided in Table 1 below. Details on the scope of field and desktop studies completed in Table 1 as part of this EA are provided in Sections 2.0, 3.0 and 4.0.

Table 1 Summary of Ecological Field Studies Completed to Date

	Ecological Study	2010	Spring 2011
Aquatic	Fish Community Surveys	√	
	Walleye Spawning Surveys	√	√
	Sturgeon Spawning Surveys		√
	Fish Passage Surveys		√
Terrestrial	Breeding Bird Surveys	√	
	Incidental Wildlife Surveys	√	√
	Vegetation Community Assessments	√	

This report includes findings of the 2010, and spring 2011 field work conducted within the GS study area.

NRSI completed an investigation to identify natural environment features within the preliminary distribution line and access roads study area. Findings of that study are provided in Appendix II.

A separate review is now underway to further develop the route for the distribution line and access roads. KBM Forestry Consultants Ltd. has refined the distribution line and access road alignment analysis conducted by NRSI to minimize overlap with identified

significant natural features. This process also considered construction feasibility, land ownership, as well as consultation with each of the forest management companies which hold crown licenses in the affected areas, etc. Refinement of the distribution lines and access road layouts is ongoing at this time incorporating analysis of flyover mapping and an exercise on assessment of wet lands crossed. The most current version of the distribution line summary by KBM (June 21, 2011) is provided in Annex I of the main EA document , Xeneca 2011a).

As part of the permitting process it is anticipated that the review agencies will require ground truthing of the finalized routes, from a natural environment perspective. This will allow the identification of impacts and associated mitigation measures as they relate to the distribution line and access roads.

In addition, surface water quality as it relates to the proposed undertaking, is also discussed under a separate cover in a study completed by OEL-HydroSys (Annex IV, of the main EA document, Xeneca 2011a).

2.0 Background Secondary Source Records Review

2.1 Methods

A secondary source background records review was conducted for the GS study area as known in 2010 (Figure 1). The review did not include the associated transmission lines and access road corridors. These areas were addressed in a separate desktop study as described in Appendix II. The background review targeted the identification of designated natural areas, significant vegetation communities and habitats, and significant species present within the study area.

The local Cochrane District OMNR office was contacted to provide background information on the natural heritage features known to be in the vicinity of the proposed corridors. In response, a Site Description Package (SDP) summarizing available habitat and species information was provided by the OMNR for the study area (OMNR Undated) (Appendix A, in the main EA document, Xeneca 2011a). An additional meeting with OMNR staff was held on September 24, 2010 to discuss potential presence of Species at Risk (SAR) within the study area.

In addition, various other resources including existing reports, mapping, and occurrence records were reviewed in order to obtain pertinent information to the study areas natural features. Below is a list of secondary sources utilized in the review:

a) OMNR Natural Heritage Information Centre (NHIC) Biodiversity Explorer (NHIC, 2010);
b) Ontario Breeding Bird Atlas (OBBA, Bird Studies Canada 2006);
c) Ontario Herpetofaunal Summary Atlas (Oldham and Weller 2000);
d) Ontario Reptile and Amphibian Atlas (Ontario Nature 2010);
e) Atlas of the Mammals of Ontario (Dobbyn 1994);
f) Air Photos; and
g) Land Information Ontario (LIO)

In searching the NHIC database and the OBBA, the study area was located in square 17MQ91, of the 10km grid system. The results of the records review are provided in section 2.2.

The background review also included other available online and published species information sources, and information provided by the Ontario Waterpower Association (OWA).

2.2 Results

The following sections provide a summary of natural areas, significant vegetation communities and habitats, as well as significant species identified through the background records review.

2.2.1 Designated Natural Areas

The records review has confirmed that there are no designated natural areas overlapping the study area (NHIC 2010). This records review was conducted for a variety of natural area types, such as Areas of Natural and Scientific Interest (ANSI), Provincially Significant Wetlands (PSW), Conservation Reserves, Migratory Bird Sanctuaries, and Provincial Parks.

2.2.2 Significant Vegetation Communities and Habitats

Biodiversity Explorer (NHIC 2010) indicates that there are no known significant vegetation communities present within the study area.

2.2.3 Significant Species

A letter dated July 13, 2010 from Collin Hoag, Policy Advisor for the Ontario Waterpower Association, regarding the proposed Wanatango Falls Hydroelectric GS indicates the following regarding Lake Sturgeon (*Acipenser fulvescens*):

"It is worth noting that there is a Lake Sturgeon occurrence North of MNR Site #4MD02 from 1983 on the Frederick House River, near Frederick Ontario. There is however no known intersection with the Wanatango Falls project."

During a meeting with staff of the OMNR Cochrane District Office (OMNR 2010), Lake Sturgeon was identified as a Valued Ecosystem Component (VEC) for the project. This meeting was held on September 24, 2010 to discuss SAR listed under the Provincial Endangered Species Act (ESA) that may be relevant to the project. The population on the Frederick House River is part of the Southern Hudson Bay – James Bay population, which is listed as a species of Special Concern on the Species at Risk in Ontario (SARO) list under the ESA (OMNR 2010). The Special Concern status does not give a species legal protection. Instead, the ESA requires that the Minister of Natural Resources provide for recovery of Special Concern species through development of management plans specific to each species (Government of Ontario 2010). This population of Lake Sturgeon is considered Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2010). It is not listed on any of the schedules of the federal *Species at Risk Act* (SARA) and so does not have federal legal status. Despite its current listing, Lake Sturgeon is being considered a VEC for the project based on direction from the OMNR Cochrane District Office.

No other SAR or special concern species were documented in background information sources. A summary of the species identified in background review is provided in Table 2.

Table 2 Species at Risk Identified Through Secondary Source Records Review as Possibly Present in Study Area

Scientific Name	Common Name	S-Rank	COSEWIC	SARO	Secondary Source
Fish Species					
Acipenser fulvescens	Lake Sturgeon (Southern Hudson Bay – James Bay)	S3	Special Concern	Special Concern	OWA

2.2.4 Other Species and Habitat Information

The SDP for Wanatango Falls was provided to the team by the Cochrane District OMNR office. Relevant natural heritage information from this package included two background fisheries reports, “A study of the Frederick House River, Cochrane District 1981 – 1983” (Nowak and MacRitchie 1984) and the “Biology of selected riverine fish species in the Moose River Basin” (Seyler 1997). Other specific natural heritage information was not known. The lack of information available was identified as an information gap for wildlife species present and wildlife habitat, provincially significant wetlands, and water quality.

The SDP confirmed that the project area overlaps with two Bear Management Areas (CC-30-011, CC-30-016), one area within one baitfish licence (CO2249), and one trap line (CC033). The specific locations of the trapline and baitfish harvesting area are not known.

Fish occurrence records were provided by the OMNR for the Frederick House River and have been incorporated into Section 3.2.2 Fish Survey Results.

3.0 Aquatic Environment

3.1 Methods

Aquatic resource information was collected over several field trips during the 2010 and 2011 field seasons. These investigations included aquatic habitat characterization and fish surveys, which included Walleye (*Sander vitreus*) and Lake Sturgeon spawning surveys, and fish community surveys. These surveys are discussed further below.

3.1.1 Aquatic Habitat Characterization

Visual surveys of aquatic habitat were conducted throughout the study area and included the entire field study area within 8.5 km upstream and 400 m downstream of Wanatango Falls (Figure 1). Surveys included documenting habitats associated with specific life stages (i.e. spawning, nursery), substrate composition, aquatic vegetation and incidental fish usage of the area. General habitat mapping and photographic documentation was also conducted. Results of the 2010 aquatic habitat characterization are included in Section 3.2.1. Further detailed habitat characterization surveys will be completed in the summer of 2011. These surveys will encompass the additional reaches of the downstream variable flow reach not previously surveyed,

3.1.2 Fish Surveys

Fish surveys included Walleye and Lake Sturgeon spawning surveys, fish community sampling and fish passage sampling. Methods included the use of egg mats, angling, gill netting, Riverine Index Netting (RIN), minnow trapping, electrofishing, external/dart tagging and internal telemetry tagging. These techniques are described below.

3.1.2.1 Fish Community Sampling

Fish community sampling was conducted within the study area from July 24 to July 28, 2010. Sampling in 2010 included Riverine Index Netting (RIN) (Jones and Yunker

2009), electrofishing, and trotlines to determine the biodiversity of the fish community present within the study area.

RIN Netting

Small and large RIN nets with varying mesh sizes were used in order to capture a range of fish species in various sizes. A description of net construction is provided below in Tables 3 and 4.

Table 3 Small RIN Gill Net Construction Parameters (adapted from Jones and Yunker 2009)

Parameter	Panel Construction				
Stretch measure (in)	0.5	0.75	1	1.25	1.5
Stretch measure (mm)	13	19	25	32	38
Mono diameter (mm)	0.1	0.13	0.13	0.15	0.15
Series Order	4	2	5	1	3
Panel length (m)	2.5	2.5	2.5	2.5	2.5
Panel height (m)	0.9	0.9	0.9	0.9	0.9
Monofilament	Clear, double knotted except 13-25 mm are single knot				
Float line	10 mm (3/8 in)				
Lead line	no. 30 (15lbs/300ft)				
Mesh labels	yes (mm)				

Table 4 Large RIN Gill Net Construction Parameters (adapted from Jones and Yunker 2009)

Parameter	Panel Construction							
Stretch measure (in)	1.5	2	2.5	3	3.5	4	4.5	5
Stretch measure (mm)	38	51	64	76	89	102	114	127
Mono diameter (mm)	0.28	0.28	0.28	0.33	0.33	0.33	0.4	0.4
Series Order	5	3	7	1	4	8	2	6
Panel length (m)	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Panel height (m)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Monofilament	Clear, double knotted							
Float line	13 mm (1/2 in)							
Lead line	no. 27 (27lbs/300ft)							
Mesh labels	yes (mm)							

RIN sampling was conducted at 10 stations (RIN-001 to RIN-010) between July 25 and 28, 2010. Small RIN nets were used at RIN-001 and RIN-008 to capture smaller fish,

young-of-the-year and juveniles. Large RIN nets, targeting large-bodied fish, were used at the other eight RIN stations. The sampling objective was to document the diversity of the fish community. As such, the sampling locations were selected in the field using a non-random targeted sampling approach supported, in part, by air photo interpretation. Nets were spaced a minimum of 0.25km apart along the length of the river. Four of the large net sets ranged from 17 to 19 hours in duration. Due to logistical constraints, six of the RIN nets (two small and four large) were set for between 21 and 25 hours. The nets set at stations RIN-009 and RIN-010 were checked periodically in the evening (between 2130hrs and 2300hrs) in the event that Lake Sturgeon were captured early in the set. Fork lengths, total lengths, and weights were measured on each individual fish captured. Refer to Aquatic Assessment Mapping in Appendix III for RIN station locations.

Electrofishing

Electrofishing occurred on July 25 2010 at one station (EMS-001) on the main stem of the river. A Halltech backpack electrofisher was set to a pulse frequency of 60Hz and an electric potential of 300V. Shocking occurred for a total of 914 seconds. A dip net with 3mm mesh was used to collect the shocked fish. Maximum and minimum lengths and bulk weights were measured for each collected fish species. After data collection, all collected fish were live released back into the river. The tributaries were not electrofished due to steep, clay banks that created unsafe conditions. Refer to Aquatic Assessment Mapping in Appendix III for the electrofishing location on the main stem of the river.

Trotlines

Trotlines, also known as baited lead lines, were set at three locations (SLL-007 to SLL-009) on July 26 and 28, 2010. Fork lengths, total lengths, and weights were measured on each individual fish captured. Refer to Aquatic Assessment Mapping in Appendix III for trotline station locations.

3.1.2.2 Sturgeon Spawning Survey

Sturgeon spawning surveys were conducted on May 7, 25, and 26, 2010. Spawning surveys conducted on May 25 and 26 2010 occurred when the water temperature was 24.2°C, well above the preferred temperature range for Lake Sturgeon spawning (8.5°C to 18°C) (Scott and Crossman 1973, Harkness 1923, and Nichols et al 2003). Sampling methods used to determine the presence or absence of spawning Lake Sturgeon consisted of trotlines and egg mats.

Trot Lines

Trotlines were set strategically throughout the study area as a means of capturing Lake Sturgeon to assess sexual maturity, spawning condition, and general spawning area. Each trotline measured 40m in length and had twelve to thirteen 1m long snoods (short lengths line with hooks) attached to the main horizontal line. Snoods were fashioned out of 100lb-test, 0.46mm diameter braided fishing line attached to the lead line at 3m intervals. Size 3-5 hooks were used in a variety of styles and baited with either worms, minnows, or fish flesh. Lead lines were secured at each end to anchors marked with buoys. In total, six trotlines (SLL-001 to SLL-006) were set on May 7 and 25, 2010. Refer to Aquatic Assessment Mapping in Appendix III for trotline stations.

Egg Mats

Egg mats were used as a qualitative method for confirming Lake Sturgeon spawning activities within the study area. Egg mats were not used to determine the relative significance of a given spawning habitat, nor did they allow for the delineation of the specific boundaries of spawning areas. Rather, the presence of one or more Lake Sturgeon eggs in the retrieved mats was considered confirmation of spawning.

The egg mats were constructed using a 38cm x 25cm x 0.06cm piece of steel plating wrapped in furnace filter material and fastened to the plate by four metal clips. The coarse nature of the furnace filter fabric allowed the entrapment of eggs within the fibers. Each mat weighed approximately 7kg. A length of rope was attached to a D-ring on the plate and buoyed by a small piece of foam.

Upon retrieval, the filter fabric was visually scanned for the presence of trapped eggs, with approximately 10 minutes spent searching on each mat. To positively identify the collected eggs, NRSI used egg identification information from Auer (1982). If field identification was not possible, eggs were removed from the filter fabric and placed in a water-filled whirl pack for later identification. Each whirl pack was labelled with the date, time, study reach, station number, and collector's name. Furthermore, as recommended by the Ontario Waterpower Association's Lake Sturgeon Best Management Practices Guide for Waterpower Projects, egg mats were placed in optimal spawning locations include those with cobble or boulder substrates and rapid moving water with depths between 0.3 and 0.6m (OWA 2008).

Three egg mats (EMD-001 to -003) were set on May 7, 2010, and left in place for 18 days. Four egg mats (EMD-004 to -007) were set out on May 25, 2010, and left in place for 21 hours. Refer to Aquatic Assessment Mapping in Appendix III for egg mat station locations.

3.1.2.3 Walleye Spawning Surveys

Walleye spawning surveys were conducted during the spring of 2010 and 2011. Surveys conducted in 2010 took place on April 18. These surveys were completed using angling methods and were used to determine the presence or absence of spawning Walleye. It is important to note that water temperatures in the Frederick House River had already reached above 11°C (upper temperature range for Walleye spawning) (Scott and Crossman 1998) by April 1, 2010 (Chenier, pers. comm. 2010b). As a result, Walleye spawning is believed to have occurred prior to this date. Walleye spawning surveys conducted in 2011 occurred on May 13 to 15 and 21 to 23, 2011. These surveys were completed by settling egg matts with water temperatures ranging from 7-7.5°C and 11-13°C.

<u>Angling</u>

Angling was used to determine presence, sexual maturity (green, ripe, spent) and general location of spawning. Angling was undertaken with conventional rods and reels

using a variety of lures. Angling efforts concentrated on potential spawning habitats to confirm presence/absence. All captured Walleye were measured for weight and total length, sexed using external characteristics, and the spawning condition (green, ripe, or spent) was visually assessed. Spawning condition (sexual maturity) was assessed by running a finger and thumb along the belly of the fish. If no eggs or milt were secreted and the belly felt firm the fish was considered green and not actively spawning. If eggs or milt were secreted the fish was considered ripe and active spawning was already starting or imminent. If the belly felt flaccid and no eggs or milt were secreted, the fish was considered spent and had completed spawning. All fish were marked with a fin clip on the secondary dorsal fin and the caudal fin for the identification of any recaptures. Once Walleye were confirmed within the vicinity of a potential spawning location and stage of the spawn was determined, angling efforts were re-focused to find other potential spawning/staging locations. Incidental catches of non-target species were also recorded.

Angling took place at eight stations (ANG-001 to ANG-008) on April 18, 2010, with a total angling effort of 3 hours and 5 minutes. Refer to Aquatic Assessment Mapping in Appendix III for angling station locations.

Egg Mats

Egg mats were used as a qualitative method for confirming Walleye spawning activities within the study area. Egg mats were not used to determine the relative significance of a given spawning habitat, nor did it allow delineation of the specific boundaries of spawning areas, rather, the results of the egg mats were used to generally confirm or discount spawning in the vicinity. While egg mats cannot be used to generate reliable quantitative data, the presence of one or more Walleye eggs in the retrieved mats was considered to be confirmation of spawning for the purposes of these investigations. Specifications of egg mat construction and methods are consistent with those described in Section 3.1.2.2. Furthermore, NRSI biologists attempted to place egg mats according to Scott and Crossman's (1973) optimal Walleye spawning conditions including: those with rapids flowing over rocky substrates (usually below impassable barriers), with water temperatures between 6.7 and 8.9°C.

Nineteen egg mats were set on the Frederick House River between 7 and 13°C in 2011. Eleven (EMD008-EMD018) were set downstream of the proposed dam site and nine (EMD019 to EMD 026) were set upstream of the proposed dam site. Of the eleven downstream egg mats, nine (EMD008 to EMD016) were placed between Zeverly's Bridge (natural potential barrier) and Wanatango Falls and the remaining two egg mats (EMD017 and EMD018) were placed below the natural potential barrier at Zeverly's Bridge. Ten of these eleven egg mats (EMD008-EMD017) were set on May 13 2011, reset in the same locations on May 14, 15 and removed on the 16. The remaining egg mat (EMD018) was set on May 14 2011, reset on the 15 and removed on the 16.

Nine egg mats (EMD-019 to EMD-026) were set upstream of Wanatango Falls on May 14 and removed on May 15. Three egg mats (EMD-019, EMD-020 and EMC-026) were replaced in their locations on May 15 and were then removed on May 21 due unsafe high water levels prior. Two mats (EMD - 020 and EMD - 026) were replaced on May 21 and removed on May 23. Egg mats were generally left between 17 and 28.5hrs with the exception of the upstream egg mats being left 6 days due to high flows.

Refer to Aquatic Assessment Mapping in Appendix III for egg mat station locations and to Appendix IV for egg mat deployment details.

3.1.3 Fish Passage Study

The reach of the Fredrick House River within the location of the proposed dam site was studied to examine existing fish passage use. This study employed two approaches to track movement of fish within the reach. These approaches included a mark and recapture study method via external/dart tags and netting as well as radio telemetry tracking of the movements of surgically implanted Walleye and/or Sauger (*Sander Canadensis*), with radio via active and passive radio receivers.

Fish Collection

In order to obtain a sufficient number of Walleye for surgical implantation, 27 Large mesh Riverine Index Netting (RIN) gill nets (RIN011 to RIN038) and 10 Fyke nets (FND001 to FND010) were set below Zeverley's Bridge on May 4 - 6 and 22 - 23, 2011. Specifications for these large mesh RIN nets are included in Table 4 of this report. These nets were placed specifically to target Walleye and Sauger for telemetry tagging and therefore the net locations and durations did not follow the RIN protocol. Nets were set during the day for an average of 1-2 hours with a maximum of 2.45 hours. The purpose of short duration net sets was to effectively minimize the risk of mortality to captured species, and greatly increase their overall likelihood of survival following surgery and release. All 10 Fyke net sets (FND001D - FND010D) occurred in proximity to the island downstream of Zeverley's Bridge on May 4 - 6 and 22 - 23, 2011 and were left for a minimum of 6 and maximum of 24 hours. All fish caught were sampled for total and fork length (mm) as well as weight (g).

Radio Telemetry Study

I conjunction with an ongoing OMNR telemetry study focused on Lake Sturgeon, mature Walleye and/or Sauger were also implemented with a Lotek radio transmitter (3V Micro coded fish transmitter, 12 x 53mm, 10g, external antenna, frequency of 149.190 with a burst rate of 5s). These surgeries were planned to occur two weeks prior to spawning in order to minimize/avoid any impacts on natural migration and spawning behaviour; however NRSI biologist conducted surgeries during and after the Walleye/Sauger spawning period between May 4 and May 23, 2011 due to manufacturer's availability of tags, accessibility of the site and unsafe flow conditions. As a result it is possible that some adverse effects on natural migration and spawning behavior resulted from the netting, surgeries or external tagging such as a delay or failure of individuals to spawn.

Walleye and/or Sauger surgeries were conducted by two trained and practiced NRSI Biologists and followed the OMNR Aquatic Research and Development Section Animal Health Care Committee's Animal Use Protocol. The first step to implementing intracoelomic radio transmitters required anesthetizing the fish in a bath of tricaine methanesulfonate (MS-222) (Knights et al. 2002; Sutton et al. 2004) until stage 4 (an

immobile stage of anesthesia) was achieved (Summerfelt and Smith 1990). During surgery, the fish's gills were continually flushed with anesthetizing water of a much lower concentration than the initial bath (see Figure 2). A small incision was made on the *linea alba*, anterior to the pelvic girdle (see Figure 3) and the smooth transmitter inserted. The incision was then closed with interrupted sutures using absorbable monofilament suture material (see Figure 4). Fish were then placed in a holding tank of fresh water or a holding pen in the river and allowed to fully recover prior to release. All equipment used was properly sterilized using iodine prior to surgery.

Figure 2 Gill Flushing

Figure 3 Making Incision

Figure 4 Sutures

Radio tagged fish movements were tracked using both passive and active methods, providing the greatest likelihood of fish detection. In collaboration with NRSI, the Cochrane District of OMNR established three radio receiving base stations (Lotek SRX Receiver/Datalogger Units) in close proximity to the proposed dam site at Wanatango Falls. As seen in Appendix III all three stations (SRX1, SRX2 and SRX3) are located on the East bank of the Frederick House River and were strategically placed by the MNR to enable accurate interpretation of fish movements across the features under question. In addition, NRSI Biologists actively searched for tagged fish downstream of Zeverley's Bridge and upstream to station 3 (SRX3) using Lotek's handheld Yagi antenna in an attempt to detect additional fish and refine location information.

Mark – Recapture Study

All fish collected were given an external/dart tag (excluding sturgeon), located on the left side of the body, below the dorsal fin. In an attempt to recapture these tagged fish, a total of four-teen mesh RIN gill nets were set between May 21 and 23, 2011. Twelve of which (RIN-039-042 and 045-052) were set between the proposed dam site at Wanatango Falls and the nearest fast water feature approximately 0.5km upstream in an attempt to recapture fish possibly using this area as a passageway. The remaining two nets (RIN-043-044) set approximately 2km downstream of the Fredrick House Lake Dam approximately 8.0km above Wanatango Falls for the same reason close to the upstream section of the Fredrick House Dam. In addition to the NRSI collections, external tags

provided contact details for recreational anglers to report any collections of these marked fish. Specific details on the radio temelmetry and external tagging program being conducyted by MNR was detailed in signage that was placed by MNR in numerous angler access locations as well as being directly provided to local groups and outfitters as part of the program awareness.

3.2 Results

3.2.1 Aquatic Habitat Characterization

The Frederick House River originates in Night Hawk Lake and flows northerly approximately 9km to Frederick House Lake. The Frederick House Dam (High Falls Dam) is located at the outlet of the Frederick House Lake. From Frederick House Lake, the river continues to flow north until it joins the Abitibi River. The Wanatango Falls project area is a short distance downstream of the Frederick House Lake and associated dam, with the upstream limit of its conceptual inundation area separated from the existing dam by approximately 1km.

The Frederick House River flows over the Northern Clay belt which results in muddy turbid water because of fine suspended clay particles (Seyler 1997a). The river channel is contained within a well-defined, narrow flood plain. Bottom substrates consist predominately of sand and clay. Aquatic vegetation in main channels is sparse, often consisting of a narrow fringe less than one meter in width along the river bank. This is due to steep-sided channel morphology, turbidity and annual water level fluctuations that range from two to three meters. The mean annual flow of the Frederick House River is 35.34m^3/s based on simulated natural daily flow data from 1975-1999 (25 yrs of data) (OMNR 2010c). Bedrock outcrops located along significant faults are present within the Frederick House River; however the overall the gradient is more consistent than rivers located on the Canadian Shield.

3.2.1.1 Upstream of Proposed GS Site

Upstream of the proposed dam location the river is relatively uniform and low gradient flowing through the Northern Clay Belt. Two relatively high gradient bedrock features features are present, the first of which is located on the west side of a small island. Flow from the river passes over the bedrock through a number of small braided chutes. During periods of higher water levels, flow passes over the entire width of the bedrock lined channel. Directly below this bedrock feature a plunge-pool has been created through years of scouring. A narrow channel approximately 5m wide was observed along the east side of the island. Good riffle habitat is created by water flowing over broken bedrock, boulder, and cobble substrates along this side of the island. During periods of higher water levels, the channel depth and velocities increase significantly. Small pockets of water are present along the east channel as a result of large boulders and small back eddies. Directly downstream of these features a second small bedrock island is present and the majority of the river flow is directed toward the west side of the river. During periods of higher water levels flow passes over the small bedrock island. A large back water eddy Iis also present along the east side downstream of the bedrock chutes. The substrates along the banks of the back water eddy consist mainly of boulders and cobble. A large, deep pool is located between the proposed dam site and the above-mentioned islands.

The second significant gradient change is located beginning approximately 600 m upstream of the proposed dam facilitywhere a series of three riffles are present. Bedrock is the predominant shoreline feature through this series of riffles. However the bedrock is overlaid in sections with substrates consisting of boulder, cobble, and gravel. Channel widths (5m to 20m) and depth (0.25m to 0.75m) vary at each riffle location however fish migration is not impeded. Between riffle sections large deep pools are present with depths up to 4.8m in some pools. Within one deep pool, woody habitat is present as a result bank slumping along the outside bend.

The remainder of the river is relatively uniform with substrates consisting of sands, clays and fine material through a relatively straight channel. Channel width is also consistent throughout these sections of river averaging approximately 55m to 60m wide. Sandy

shorelines contain a small band (1.0m wide) of emergent aquatic vegetation including common arrowhead (*Sagittaria latifolia*.), curly white water crowfoot (*Ranunculus longirostris*) and green-fruited bur-reed (*Sparganium emersum*). A small back-bay wetland is present along the west side of the river which has limited connectivity to the river via a small narrow channel. This wetland was classified as a mineral shallow marsh during 2010 surveys. Two additional marshes were identified in close proximity along the east shoreline. These two marshes were classified as a mineral shallow marsh and a mineral meadow marsh. The marshes with connectivity to the river provide spawning habitat for fish species that spawn in submersed vegetation. The deep water habitat throughout the upstream area may be important to resident fish for winter and summer refuge.

3.2.1.2 Proposed GS Site

The proposed dam site is located along a large island where flow is directed along both the east and west sides. Along the east side of the island a narrow channel with steep bedrock shorelines is present. Within the channel a high gradient riffle with turbulent water flows through exposed substrates dominated by large boulders and broken bedrock. Cobble and gravel substrates are present in isolated pockets created by obstructions such as boulders. The channel width ranges from 2.75m to 5.0m and experiences only minor changes to its wetted width during periods of high flow due to the steep bedrock shorelines. Water depth and flow can vary greatly between periods of low and high water. During the summer site investigations water depths ranged from 0.25m to 0.75m, although the high water mark suggests that depth can increase by up to 2.0 m through this section of river.

The west side of the island has a much lower gradient than observed along the east side. A “ponding” or backwatering effect takes place along the west channel as a result of a bedrock chute at the downstream end. The bedrock chute has a significant drop in elevation with a small vertical face (approximately 1.5m). Directly upstream of the bedrock chute is a series of two small pools and riffles with bedrock substrates. Isolated broken bedrock and cobble substrates with limited habitat value were also observed

through these riffles. The pools were approximately 15m long and 18m wide during the summer site investigations. The shorelines of the west channel are dominated by bedrock. No aquatic vegetation was observed. Upstream of the riffles, a wide low gradient section of river occurs where substrates are dominated by fine material such as sand and clay. Channel width ranged from 25m to 60m in the ponded section and 7m to 10m in the riffle section.

3.2.1.3 Downstream of Proposed GS Site

Immediately downstream of the island and dam site, a scoured bedrock pool is present where the west and east channels converge. Pool depths ranged from 0.5m to 1.5m during the summer sampling observations. While the pool depth was greater during the spring investigations; channel widths remained relatively constant due to steep nature of the banks. Substrates within the pool are dominated by bedrock along the west side of the river with bedrock and broken boulders along the east side.

Downstream of the pool, there is a run with a channel width of approximately 15m and observed water depths ranging from 0.25m to 0.75m. Channel substrates throughout the run remained relatively consistent with that of the pool and were dominated by bedrock with isolated boulders. Due to the change in elevation upstream and periodic high water velocities observed throughout this section, channel substrates are limited to bedrock and large material such as boulders. This run extends approximately 150m downstream of the island.

Smaller material such as cobble and gravel have been deposited downstream of the run to create a wide shallow section of river approximately 50m in length. During the spring investigations this area was submerged, however during the fish community sampling program (2010), a large portion of this cobble riffle was exposed along the west bank. The wetted width at the tail-out of the run was approximately 15m wide while the wetted width of the riffle was approximately 5m wide along the east bank leaving a large portion of the riffle exposed (May 25, 2010).

Downstream of the riffle a long run is present with bedrock shorelines. Habitat throughout the run is provided by isolated boulders and slack water. Some cobble and boulders are present near the tail-out of this run before it flows out over the scoured bedrock of Zeverley's Landing under the Reaume Esker Road Bridge.

Immediately downstream of the scoured bedrock of Zeverley's landing, a deep pool/run is present. The wetted width of the pool was approximately 100m to 125m wide in spring conditions (2011). An island is also present downstream, in which smaller material such as gravel and sand has been deposited. The west side of the island has a high abundance of aquatic vegetation which may provide spawning potential for some fish species. Continuing north the remainder of the river is relatively uniform with substrates consisting of sands, clays, and fine material through a relatively straight channel. An additional marsh was identified downstream of Zeverley's landing in close proximity to the east shoreline. The marsh has connectivity to the river and may provide spawning habitat for fish species that spawn in submersed vegetation.

3.2.1.4 Associated Tributaries

There are a number of tributary streams entering the Frederick House River within the proposed inundation area; however there are no tributaries located within the immediate vicinity of the proposed dam site or 100m downstream. All of the tributaries within the study area are relatively small first or second order streams originating from surface run-off or wetlands. Two tributaries located along the west side of the Frederick House River originate from a series of lakes and ponds approximately 1.5km to 2.0km west of the river. Channel substrates observed within the tributaries are relatively uniform consisting of fine material such as sands and clays. Evidence of beaver activity was observed in a number of these tributaries including active beaver dams and lodges. As with the connected marsh habitats, the habitat in the tributaries may provide spawning habitat for fish species that spawn in submersed vegetation.

3.2.2 Fish Survey Results

3.2.2.1 Fish Community Sampling

During the 2010 fish community sampling in the study area, 10 RIN net sets collected 183 fish and 20 fish species. These species are summarized in Table 5 below. Only one of the fish species, Lake Sturgeon, is listed as a Species at Risk both provincially and nationally. The remaining 19 fish species are considered common and widely distributed throughout Ontario.

Table 5 Fish Species Observed in Study Area by NRSI in 2010

Scientific Name	Common Name	S-Rank	National Status (COSEWIC)	Provincial Status (SARO)
Acipenser fulvescens Pop.2	Lake Sturgeon (Southern Hudson Bay - James Bay population)	S3	Special Concern	Special Concern
Catostomus catostomus	Longnose Sucker	S5	No status	No status
Catostomus commersoni	White Sucker	S5	No status	No status
Coregonus artedi	Cisco	S5	No status	No status
*Coregonus clupeaformis**	Lake Whitefish*	S5	No status	No status
Cottus bairdi	Mottled Sculpin	S5	No status	No status
*Culaea inconstans**	Brook Stickleback*	S5	No status	No status
Esox lucius	Northern Pike	S5	No status	No Status
Hiodon alosoides	Goldeye	S3	No status	No status
Lota lota	Burbot	S5	No status	No status
Moxostoma macrolepidotum	Shorthead Redhorse	S5	No status	No status
Notropis atherinoides	Emerald Shiner	S5	No status	No status
Notropis hudsonius	Spottail Shiner	S5	No status	No status
Perca flavescens	Yellow Perch	S5	No status	No status
Percina caprodes	Logperch	S5	No status	No status
Rhinichthys cataractae	Longnose Dace	S5	No status	No status
Sander canadensis	Sauger	S4	No status	No status
*Sander canadensis x Sander vitreus**	Saugeye*	S5	No status	No status
Sander vitreus	Walleye	S5	No status	No status
Semotilus atromaculatus	Creek Chub	S5	No status	No status

S-Rank (Provincial Rank) (Source: NHIC 2010)

SNA- Not Applicable: A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

COSEWIC - Committee on the Status of Endangered and Threatened Species
SARO – Species at Risk Ontario (ONMR)
S1- Critically Imperiled
S2- Imperiled
S3- Vulnerable
S4- Apparently Secure
S5- Secure
* Additional species sampled during 2011 fish passage surveys

The majority of the 2010 RIN protocol fish sampling occurred upstream of Wanatango Falls and below the Frederick House (High Falls) Dam. Although the fish community documented during the 2010 sampling are representative of the section of river above the proposed dam site it should be noted that similar communities were sampled below Zeverley's Bridge during the 2011 fish passage surveying. During this sampling event three additional species were documented, below Zeverley's Bridge: Saugeye (*Sander canadensis x Sander vitreus*), Lake Whitefish (*Coregonus clupeaformis*) and Brook Stickleback *(Culaea inconstans)* neither of which have a national or provincial Species at Risk status.

For the study area as a whole, the documented fish community to date includes 20 fish species representing eight families. The families are Catostomidae (suckers), Salmonidae – subfamily Coregoninae (whitefish), Cottidae (sculpins), Hiodontidae (mooneyes), Gadidae (cods), Gasterosteidae (Sticklebacks), Cyprinidae (minnows), and Percidae (perches). The presence of 20 species is indicative of a diverse fish community, as evidenced by their respective life history requirements, as well as trophic status and physical morphology. The species composition varies widely in relative size at maturity and utilizes the full range of feeding environments present within the study area (benthic, benthopelagic, and pelagic). The species composition also represents multiple trophic classes (herbivore, planktivore, invertivore and carnivore) as well as a range of temperature preferences (warm, cool, and cold). In addition to demonstrating diversity, this varied species composition demonstrates that a complete range of trophic levels and ecological niches are currently being are filled, providing habitat for all life stages and functions. The habitat and feeding characteristics are summarized in Table 6.

Table 6 Habitats and Feeding Characteristics of Observed Fish Species

Scientific Name	Common Name	Adult Size Range - Total Length (cm)*	Environment*	Trophic Status*	Thermal Regime*
Acipenser fulvescens Pop.2	Lake Sturgeon (Southern Hudson Bay - James Bay population)	76.2 – 142.5	Benthic	Invertivore/Herbivore	Coolwater
Catostomus catostomus	Longnose Sucker	30.5 - 45.7	Benthic	Invertivore	Coldwater
Catostomus commersoni	White Sucker	25.4- 50.8	Benthic	Invertivore/Detritivore	Coolwater
Semotilus atromaculatus	Cisco	22.1 – 37.6	Pelagic	Planktivore/Invertivore	Coldwater
Coregonus artedi	Lake Whitefish	38.1-74.9	Benthic	Invertivore/Carnivore	Coldwater
Coregonus clupeaformis	MottledSculpin	7.6 – 10.2	Benthic	Invertivore	Coldwater
Esox lucius	Northern Pike	45.7 – 100.2	Benthopelagic	Carnivore	Coolwater
Culaea inconstans	Brook Sticklback	3.8-6.9	Benthopelagic	Planktivore/Invertivore	Coolwater
Cottus bairdi	Goldeye	25.9 – 40.6	Pelagic	Invertivore	Coolwater
Hiodon alosoides	Burbot	38.1 – 83.8	Benthic	Invertivore/Carnivore	Coldwater
Lota lota	Shorthead Redhorse	35.6 – 52.7	Benthic	Invertivore	Warmwater
Moxostoma macrolepidotum	Emerald Shiner	6.4 – 10.2	Benthopelagic	Planktivore	Coolwater
Notropis atherinoides	Spottail Shiner	5.8 – 12.7	Benthopelagic	Invertivore/Planktivore	Coolwater
Notropis hudsonius	Yellow Perch	11.4 – 30.5	Benthopelagic	Invertivore/Carnivore	Coolwater
Perca flavescens	Logperch	7.6 – 14.7	Benthic	Invertivore	Warmwater
Rhinichthys cataractae	Longnose Dace	6.4 – 11.4	Benthic	Invertivore	Coolwater
Sander canadensis	Sauger	23.0 – 52.3	Benthopelagic	Invertivore/Carnivore	Coolwater
Sander canadensis x Sander vitreus	Saugeye	33 – 40.6	Benthopelagic	Invertivore/Carnivore	Coolwater
Sander vitreus	Walleye	30.5 – 76.2	Benthopelagic	Invertivore/Carnivore	Coolwater
Semotilus atromaculatus	Creek Chub	7.6 – 20.3	Benthopelagic	Invertivore/Carnivore	Coolwater

In addition to the 20 fish species captured in 2010, an additional nine species are known from the study area based on the background information provided by the OMNR Cochrane District Office. A study by MacRitchie (1983) documented: Mooneye (*Hiodon tergisus*), Brown Bullhead (*Ameiurus nebulosus*), and Rock Bass (*Ambloplites rupestris*). Another study by Nowak and MacRitchie (1984) documents an additional four species. These include Golden Shiner (*Notemigonus crysoleucas*), Blacknose Shiner (*Notropis heterolepis*), Trout-perch (*Percopsis omiscomaycus*), and Johnny Darter (*Etheostoma nigrum*). A report titled *Biology of Selected Riverine Fish Species in the Moose River Basin* by Seyler (1997) indicates that all of these species occur in the Frederick House River, plus two additional species: Iowa Darter (*Etheostoma exile*) and Brook Trout (*Salvelinus fontinalis*). These nine additional fish species, listed in Table 7, have potential to occur within the study area despite their absence in fish sampling by NRSI in 2010 and 2011. All of these additional fish species are relatively common and widely distributed in Ontario.

Table 7 Additional Fish Species Known to Occur in the Frederick House River

Scientific Name	Common Name	S-Rank	National Status (COSEWIC)	Provincial Status (SARO)
Ambloplites rupestris	Rock Bass	S5	No status	No status
Ameiurus nebulosis	Brown Bullhead	S5	No status	No status
Etheostoma exile	Iowa Darter	S5	No status	No status
Etheostoma nigrum	Johnny Darter	S5	No status	No status
Hiodon tergisus	Mooneye	S4	No status	No status
Notemigonus crysoleucas	Golden Shiner	S5	No status	No status
Notropis heterolepis	Blacknose Shiner	S5	No status	No status
Percopsis omiscomaycus	Trout-perch	S5	No status	No status
Salvelinus fontinalis	Brook Trout	S5	No status	No status

S-Rank (Provincial Rank) (Source: NHIC 2010)

SNA- Not Applicable: A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

COSEWIC - Committee on the Status of Endangered and Threatened Species
SARO – Species at Risk Ontario (ONMR)
S4- Apparently Secure
S5- Secure

3.2.2.2 Lake Sturgeon Spawning Survey

Lake Sturgeon spawning surveys were conducted in the spring of 2010. Sampling methods included use of trotlines and egg mats. No fish were caught during trotline sampling. Egg mat deployment surveys resulted in the capture of eggs from non-target species. On May 7, 2010, three eggs were collected at EMD-002, and seven eggs were collected at EMD-003. The species consisted of one Goldeye (*Hiodon alosoides*) egg at EMD-002, and the remaining eggs were identified as Redhorse Sucker Silver (*Moxostoma anisurum*) or Redhorse Sucker Shorthead (*Moxostoma macrolepidotum*). On May 25, 2010, a single Redhorse Sucker (Silver or Shorthead) egg was found at EMD-007. No Lake Sturgeon eggs were observed during these spawning surveys. Detailed results from the Lake Sturgeon spawning surveys are provided in Appendix IV.

3.2.2.3 Walleye Spawning Survey

During the spring of 2010 no fish were captured during the Walleye spawning angling surveys. As previously mentioned, water temperatures in the Frederick House River had already reached 11°C on April 1, 2010 (Chenier, pers. comm. 2010a) resulting in the Walleye spawn likely occurring prior to the date of angling on April 18, 2010.

Walleye spawning surveys conducted in the spring of 2011 occurred between May 13 and May 23 between water temperatures of 7.0 and 13°C. Over the course of the study two eggs were found. One egg was located below Zeverley's bridge on EMD-017, on May 14 2010, and was identified as Walleye/Sauger. The second egg was also identified as Walleye/Sauger and was located on EMD-020 above Wanatango falls on May 21 2011 (see Figure 5 below).

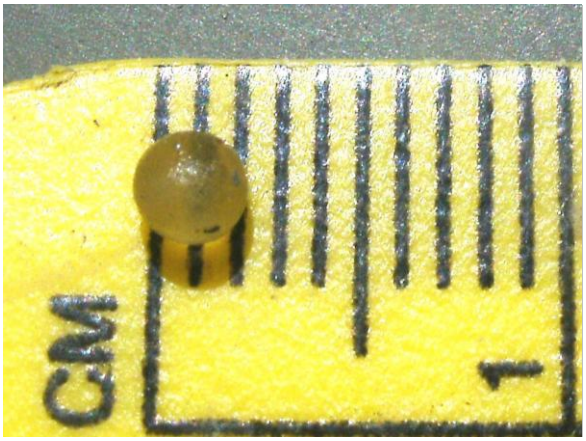

Figure 5 Walleye/Sauger Egg from EMD-020

Detailed results from the Walleye spawning surveys are provided in Appendix IV.

3.2.3 Fish Passage Study

RIN and Fyke nets set below Zeverley's Bridge captured 14 species and 463 individual fish in total (300 from RIN nets and 163 from Fyke nets). Of the 463 collected fish, 265 were externally dart tagged including: 134 Goldeye, 76 Northern Pike, 17 Walleye, 10 White Suckers, nine Sauger, eight Shorthead Redhorse, four Longnose Sucker, three Yellow Perch and three Lake Whitefish. Table 8 below provides a summary of the number of fish dart tagged using RIN versus Fyke nets; for further detail please see Fish Passage in Appendix IV.

Water temperatures within the river measured 3.5°C at the beginning of the study and increased to 13°C at the end of the study.

Table 8 Numbers of Fish Dart Tagged During Fish Passage Netting

Scientific Name	Common Name	Number of Fish Dart Tagged from 2011 RIN Nets	Number of Fish Dart Tagged from Fyke Nets	Total Number of Fish Dart Tagged
Catostomus catostomus	Longnose Sucker	4	0	4
Catostomus commersoni	White Sucker	2	8	10
Coregonus artedi	Lake Whitefish	3	0	3
Cottus bairdi	Goldeye	134	0	134
Esox lucius	Northern Pike	50	26	76
Lota lota	Shorthead Redhorse	2	6	8
Notropis hudsonius	Yellow Perch	3	0	3
Sander canadensis	Sauger	8	1	9
*Sander canadensis x Sander vitreus**	Saugeye	0	1	1
Sander vitreus	Walleye	14	3	17
Total				**265**

Mark – Recapture Study Results

Of the 265 individuals tagged, no marked fish were re-captured within the area of the proposed dam location as well as upstream. As part of the re-capture sampling efforts upstream of the proposed hydroelectric facility, 10 fish were collected; seven Goldeye, one Sauger, one White Sucker and one Cisco sp. None of these fish were tagged however five of the individuals were too small to have been tagged and therefore it cannot be confirmed whether they moved upstream from below Zeverley's Bridge.

Recreational anglers reported the collection of three externally marked fish including one Goldeye (external tag #172), one implanted Walleye (external tag#133) and one Sauger (external tag #198). All fish were angled downstream of Zeverley Bridge near the site of their initial collection and release.

Radio Telemetry Study Results

Of the 24 Sauger, Saugeye (Sauger & Walleye hybrid) and Walleye caught, 19 were surgically implanted with telemetry tags (TEL-100-118). Average total lengths and weights of these fish were 364mm and 650g, respectively. Walleye and Sauger deemed too small were not selected for surgical implantation of telemetry tags .. Table 9 below provides specifics on the 19 telemetry implanted fish.

Table 9 Telemetry Tagged Target Fish, 2011

Number of Target Fish Tagged	Station	Date & Time Retrieved (month/day/year)	Water Temperature (°C)	Species	Length (mm)		Weight (g)	Sex	Maturity	Dart Tag Number	Telemetry Tag Number
					Total	Fork					
1	RIN-011	5/5/11 13:55	3.50	Sauger	321	303	480	M	UK	35	100
2	RIN-015	5/6/11 13:45	3.75	Walleye	336	315	720	M	ripe	80	106
3	RIN-016	5/6/11 15:40	3.75	Sauger	306	306	480	M	ripe	99	105
4	RIN-020	5/9/11 12:25	4.50	Walleye	440	412	1960	M	ripe	147	110
5	RIN-020	5/9/11 12:25	4.50	Sauger	320	301	610	F	green	126	107
6	RIN-022	5/9/11 15:05	4.50	Walleye	389	365	1230	UK	UK	133	111
7	RIN-023	5/9/11 1605	4.50	Walleye	393	367	1190	F	green	131	102
8	RIN-027	5/21/11 1614	11.50	Walleye	355	334	454	UK	spent	194	117
9	RIN-028	5/21/11 17:45	11.50	Walleye	350	328	425	M	ripe	110	109
10	FND-006	5/22/11 13:05	12.00	Walleye	388	365	567	F	ripe	121	116
11	RIN-029	5/22/11 14:25	12.00	Walleye	337	311	360	M	ripe	118	115
12	RIN-031	5/22/11 16:47	12.00	Walleye	322	303	270	UK	UK	139	101
13	RIN-031	5/22/11 16:47	12.00	Walleye	374	351	490	UK	UK	171	103
14	FND-008	5/23/11 11:20	12.00	Saugeye	341	318	240	UK	UK	247	108
15	FND-008	5/23/11 11:20	12.00	Walleye	465	438	970	UK	UK	225	113
16	FND-008	5/23/11 11:20	12.00	Walleye	347	320	390	UK	spent	228	104
17	RIN-036	5/23/11 17:10	13.00	Walleye	393	365	470	UK	spent	223	118
18	RIN-032	5/23/11 12:55	13.00	Walleye	374	351	490	UK	UK	171	114
19	RIN-034	5/23/11 15:04	13.00	Walleye	376	353	570	UK	spent	250	112

UK- Unknown

Active tracking of these fish by NRSI biologists between station SRX3 and downstream of Zeverley's Bridge produced the identification of nine tag signals: TEL-103, TEL-104, TEL-108, TEL-109, TEL-110, TEL-111, TEL-112, TEL-116 and TEL-255 between May 21 and 23, 2011. All signals were located below Zeverley's Bridge and were identified as NRSI tags except TEL-255 which remains unidentified. In addition, MNR staff also tracked TEL-118 approximately 10km downstream Zeverley's Bridge on June 17 2011 and above Zeverley's Bridge on June 26, 2011. They also tracked signals TEL-104 and TEL-106 below Zeverley's Bridge on June 26, 2011 (Chenier, pers. comm. 2011b). See Appendix III for specific locations of the strongest signal received for each of these tagged fish.

Information on the passive tracking of telemetry tagged fish was collected by MNR between May 10 and June 26, 2011 and provided to NRSI. See Appendix III for SMX station locations. In total six NRSI tagged fish (Walleye and Sauger) and one MNR tagged fish (Lake Sturgeon) were recorded between these dates. Table 10 below provides the specific details of the signals received by individual station.

Table 10 Telemetry Station Signal Details

Date	Telemetry Tag #	SMX3 (downstream)	SMX2 (Wanatago Falls)	SMX1 (Upstream)
May 14, 2011	002*			√
May 21-23, 2011	111*	√		
	112	√		
	115	√		
	117	√		
	109	√		
May 24, 2011	118		√	
May 26, 2011	118	√		
June 11, 2011	109		√	√
June 25, 2011	109			√

Note: the Walleye implanted with TEL #111 was caught and kept by an angler below Zeverley Bridge on May 27, 2011 and #002 was an MNR tagged Lake Sturgeon.

It should be noted station SMX3 was having some technical difficulties around June 4 but was soon repaired by MNR staff (Chenier, pers comm. 2011c).

In summarizing this information it appears that six NRSI tagged fish were logged at station SMX3 located below the proposed dam location, two fish logged at station two (SMX2) proposed control dam with obermeyer gate and one fish logged at station one (SMX1) upstream of Wanatango Falls. This data suggests Walleye, Sauger and Saugeye are capable of traveling from below Zeverley's Bridge to station SMX1 and therefore above the location of the proposed Wanatango Falls dam.

4.0 Terrestrial Environment

Comprehensive site investigations to document the existing terrestrial and wetland characteristics of the study area were undertaken in 2010 and 2011. These site-specific field investigations focused on vegetation community mapping and wildlife usage. A summary of field investigation methods is found below.

4.1 Methods

Terrestrial resource information was collected over two trips during the 2010 field seasons. In 2010, these trips were conducted on June 18 and July 9. These investigations included vegetation community mapping and wildlife surveys. These surveys are discussed further below.

Any evidence of wildlife was documented during all fieldwork programs including aquatic surveys.

4.1.1 Vegetation Community Mapping

Vegetation community mapping was completed using a combination of aerial photograph interpretation and site-specific field investigations. All communities were described to the ecosite level, using the ELC Field Manual (OMNR 2009), and associated Draft Boreal Ecosite Factsheets (Banton and Racey 2009). During these site investigations, NRSI biologists conducted vegetation mapping of all features within the study area, and compiled a detailed plant list within each vegetation community. Detailed results of the vegetation community mapping are included in Section 4.2.1 Vegetation Communities. Mapping has been provided in Appendix V.

4.1.2 Breeding Bird Surveys

Breeding bird surveys were conducted over two field visits, following the protocol described by the Ontario Breeding Bird Atlas (OBBA 2001). The surveys were conducted on June 18 and July 9, 2010. These surveys were designed to focus on

breeding bird activity within the study area. All visits were conducted during early morning hours, with at least 10 days between visits. During each site visit, NRSI biologists conducted area searches throughout the study area and recorded all bird species observed within each general habitat type. Breeding evidence for each species was recorded using standard breeding evidence codes recognized by the OBBA. In addition to these specific area searches, all bird species observed during other site visits were recorded as incidental observations and have been included in the final species list. Results from the bird surveys are included in Section 4.2.2 Birds.

4.1.3 Snake Cover Boards

To characterize the snake species present in the vicinity of the study area, NRSI biologists strategically placed 12 cover boards throughout the study area based on habitat availability (SNK-001 to SNK-012). Six cover boards were placed along the north side of the river and six along the south side of the river. All of the snake cover boards were placed along the shoreline of the Frederick House River from the proposed dam location upstream to the end of the proposed inundation area. The exact location of the cover boards are shown in Appendix V. Each cover board was made of spruce plywood, approximately two feet by four feet in size, with the upper surface painted with black latex paint to increase the absorption of radiant heat. Boards were placed out on May 29, 2010, and were checked on June 18 and July 9, 2010. Results from the snake cover board surveys are discussed in Section 4.2.3 Herpetofauna.

4.1.4 Other Wildlife

Incidental observations of all other wildlife, including mammals, herpetofauna, butterflies, and dragonflies, were documented during all field visits. This included direct observations of individuals, as well as signs of animal presence (tracks, scat, etc.). Other wildlife observed by NRSI biologists is presented in Sections 4.2.4 Mammals and 4.2.5 Other Incidental Wildlife Observations.

4.2 Results

4.2.1 Vegetation Communities

The study area is comprised of a black spruce forest community, interspersed with a few tributary related wetlands. Four vegetation communities have been identified as per the Ecological Land Classification within approximately 120m of the proposed development activities and the resulting inundation area. All of the vegetation communities represent natural communities, with little signs of disturbance. The vegetation communities are described in Section 4.2.1 below, and are shown on Vegetation Communities and Cover Board Locations Maps in Appendix V.

In addition to the broad-scale vegetation mapping, NRSI biologists have also conducted site-specific floral inventories of each vegetation communities. A vegetation inventory was conducted within each vegetation community, and is provided for the entire project area in Appendix VI. No significant vegetation species have been identified through background review, OMNR correspondence, or site specific investigations conducted by NRSI biologists.

Four ecosite types were identified within 120m of proposed development activities and resulting inundation area. These ecosite types represent one forest and three wetland communities. Dominant species, species associations, and other habitat characteristics were recorded for all habitats, and are discussed in more detail below.

<u>B114 Black Spruce-Pine Conifer-Moist, Fine</u>

This community covers the east and west side of the river throughout the entire inundation area, including the islands at the dam site. It is a heavily-forested community; the canopy is dominated by black spruce (*Picea mariana*), with some balsam fir (*Abies balsamea*), trembling aspen (*Populus tremuloides*), and balsam poplar (*Populus balsamifera ssp. balsamifera*). The understory is dominated by dwarf raspberry (*Rubus pubescens*) and bush honeysuckle (*Diervilla lonicera*), with lesser amounts of beaked hazel (*Corylus cornuta ssp. cornuta*), mountain maple (*Acer spicatum*), red-osier dogwood (*Cornus stolonifera*), and speckled alder (*Alnus incana spp. rugosa*). The herb

layer includes bunchberry (*Cornus canadensis*), bluebead lily (*Clintonia borealis*), large-leaved aster (*Eurybia macrophylla*), goldthread (*Coptis trifolia*), wild sarsaparilla (*Aralia nudicaulis*), creeping snowberry (*Gaultheria hispidula*), Canada mayflower (*Maianthemum canadense*), and running club moss (*Lycopodium clavatum*).

B134S Mineral Thicket Swamp

This community is found in a tributary floodplain on the west bank of the river. It is a shrub dominant community; the canopy is sparsely treed with black spruce, balsam poplar and tamarack (*Larix laricina*), with some trembling aspen. The understory is dominated by speckled alder and red-osier dogwood, with dwarf raspberry and alder-leaved buckthorn (*Rhamnus alnifolia*). The herb layer includes blue-flag iris (*Iris versicolor*), joe-pye-weed (*Eupatorium maculatum ssp. maculatum*), tall meadow-rue (*Thalictrum pubescens*), spike rush (*Eleocharis sp*.), Canada anemone (*Anemone canadensis*), marsh marigold *(Caltha palustris*), and nodding trillium (*Trillium cernuum*).

B142N Mineral Meadow Marsh

This community is found on the east side of the river directly adjacent to the mineral shallow marsh further inland. It is a shrub-dominated community with a substantial herb component and some open aquatic areas. The canopy is sparsely treed with occasional black spruce. The understory is dominated by red-osier dogwood and speckled alder, and the herb layer includes river bulrush (*Bolboschoenus fluviatilis*), spike rush, joe-pye-weed, water horsetail (*Equisetum fluviatile*), Canada anemone, and prickly wild rose (*Rosa acicularis ssp. sayi*).

B148N Mineral Shallow Marsh

These communities are found in two locations: the first is inland from the east side of the river adjacent to the mineral meadow marsh community, and the second site is found to the north of the first, on the west side of the river. These communities are dominated by herbs with a surrounding shrub community. The shrub area is dominated by red-osier dogwood and speckled alder, and the herb layer included blue flag iris, broad-leaved cattail (*Typha latifolia*), horsetail, joe-pye-weed, Canada anemone, and spike rush.

4.2.2 Birds

A combined species list of NRSI observations and results from the 2nd Ontario Breeding Bird Atlas (OBBA 2001) indicate that a total of 80 bird species have the potential to regularly occur and/or breed within the vicinity of the Wanatango Falls project area. A comprehensive bird species list, including field observations from NRSI and background information from the Ontario Breeding Bird Atlas (Bird Studies Canada 2006) are included in Appendix VII. Although breeding bird surveys were conducted by polygon in the project area, this report summarizes the highest breeding bird evidence observed for each species within the entire project area.

A total of 61 bird species were observed during morning breeding bird surveys on June 18 and July 9, 2010. Of these species, 35 species demonstrated possible breeding evidence, while 19 species demonstrated probable breeding evidence. Only four species demonstrated confirmed breeding evidence: American robin (*Turdus migratorius*), spotted sandpiper (*Actitis macularia*), bald eagle (*Haliaeetus leucocephalus*), and hooded merganser (*Lophodytes cucullatus*). Three species, turkey vulture (*Cathartes aura*), herring gull (*Larus argentatus*) and ring-billed gull (*Larus delawarensis*), were observed without any breeding evidence.

Two Species at Risk birds were observed by NRSI biologists during 2010 field surveys: bald eagle and Canada warbler (*Wilsonia canadensis*). An adult bald eagle was observed entering a nest, and a male Canada warbler was observed singing in the study area. Seven additional Species at Risk birds are flagged below as having the potential to occur within the study area based on breeding ranges determined by the Ontario Breeding Bird Atlas (2007) these include: olive-sided flycatcher, chimney swift, peregrine falcon, short-eared owl, common nighthawk, bobolink, and rusty blackbird. The status of these species, along with their preferred habitat is discussed further in Section 5.1.2 Species at Risk.

4.2.3 Herpetofauna

Review of both the Ontario Herpetofauna Summary Atlas (Oldham and Weller 2000) and Ontario's Reptile and Amphibian Atlas (Ontario Nature 2010) identified seven species of herpetofauna (reptiles and amphibians) that could occur within the vicinity of the study area. There are no Species at Risk herpetofauna known from the study area.

During spring and summer work, NRSI biologists observed one species of snake and three species of frogs and toads: eastern garter snake (*Thamnophis sirtalis sirtalis*), American toad (*Bufo americanus*), spring peeper (*Pseudacris crucifer*) and wood frog (*Rana sylvatica*). No species at risk were observed. Snakes are difficult to survey due to their secretive nature. However, NRSI has had success attracting snakes and observing them using snake boards, in the past. Twelve snake cover boards were placed in the study site in habitat conducive to snakes. Refer to Vegetation Communities and Cover Board Locations Maps (Appendix VI) for the location of the snake boards. Using these boards, two eastern garter snakes were found.

A herpetofauna species list consisting of field observations from NRSI biologists and species identified by the two Herpetofaunal Atlases are included in Appendix VIII.

4.2.4 Mammals

A total of 38 mammal species have been identified as being potentially present within the project area. NRSI biologists incidentally observed evidence of nine species during site visits. All of these species represent common species with secure populations within Ontario, including black bear (*Ursus americanus*), moose (*Alces alces*), and beaver (*Castor canadensis*) (Dobbyn 1994).

A review of the Ontario Mammal Atlas has identified the presence of one significant species that may be present within the Wanatango Falls project area: the northern long-eared bat (*Myotis septentrionalis*). This species is discussed further in Section 5.1.2. No other significant mammal species have been identified within the project area, through a review of Biodiversity Explorer (NHIC 2010). No significant mammals were

observed by NRSI biologists during site investigations. A detailed list of mammal species observed within the study area and known from the Mammal Atlas is presented in Appendix IX.

4.2.5 Other Incidental Wildlife Observations

No other incidental wildlife observations were made.

5.0 Significant and Sensitive Habitats and Species

Several wildlife species identified through this study are significant based on conservation concerns, legal status, and/or socioeconomic value. In addition, certain habitats are of significance to these and other species. These species and their habitats have been discussed in detail in the report thus far. They are summarized and discussed below as a means of identifying their significance and sensitivity prior to conducting an impact assessment for the proposed development of the Wanatango Falls GS.

5.1 Species at Risk and of Special Concern

The following species are those considered to be Endangered, Threatened, or Special Concern in either the Species at Risk in Ontario or the Species at Risk in Canada lists, or have a conservation status (S-Rank) of below 4, indicating that it has a population that is critically imperiled, imperiled, or vulnerable (NHIC 2010). This list is comprised of species known from the study area through the background review, as well as those observed by NRSI biologists during field surveys.

Table 11 Species at Risk and Species of Special Concern Known to Occur in the Study Area

Scientific Name	Common Name	S-Rank	COSEWIC	SARO	Preferred Habitat	Suitable Habitat in Study Area?	Observed by NRSI during EA field studies?	Discussed Further In SWH, VEC, and Impact Sections
Chordeiles minor	Common Nighthawk	S4B	T	SC	open ground; clearings in dense forests; ploughed fields; gravel beaches or barren areas with rocky soils; open woodlands; flat gravel roofs[1]	Yes	No	Yes
Falco peregrinus anatum/tundrius	Peregrine Falcon	S3B	SC	THR	rock cliffs, crags, especially situated near water; tall buildings in urban centres[1]	No	No	No
Chaetura pelagica	Chimney Swift	S4B	T	THR	commonly found in urban areas near buildings; nests in hollow trees, crevices of rock cliffs, chimneys[1]	Yes	No	Yes

Scientific Name	Common Name	S-Rank	COSEWIC	SARO	Preferred Habitat	Suitable Habitat in Study Area?	Observed by NRSI during EA field studies?	Discussed Further In SWH, VEC, and Impact Sections
Dolichonyx oryzivorus	Bobolink	S4B	T	THR	prefer large tracts of grassland or similar open habitats greater then 50ha in size[1]	No	No	No
Contopus cooperi	Olive-sided Flycatcher	S4B	T	SC	semi-open, conifer forest, prefers spruce; near pond, lake or river; treed wetlands for nesting[1]	Yes	No	Yes
Haliaeetus leucocephalus	Bald Eagle	S4B	Not at Risk	SC	requires large areas with continuous deciduous or mixed forests found on large lakes or rivers. Tall dead trees within 400m of the nest site are required for perching[1]	Yes	Yes	Yes
Wilsonia canadensis	Canada Warbler	S4B	T	SC	an interior forest species; dense, mixed coniferous, deciduous forests with closed canopy, wet bottomlands of cedar or alder; shrubby undergrowth in cool moist mature woodlands; riparian habitat; usually requires at least 30ha[1]	Yes	Yes	Yes
Acipenser fulvescens	Lake Sturgeon (Southern Hudson Bay – James Bay)	S3	SC	SC	larger rivers and lakes, usually less than 30 feet deep, coldwater[2]	Yes	Yes	Yes

[1] OMNR 2010

[2] OMNR 2011

5.1.1 Valued Ecosystem Components (VEC's)

The term Valued Ecosystem Component (VEC) is being utilized to identify species that are not considered Species at Risk (SAR) and are of importance for reasons such as recreation, sustenance or sensitivity. Within the Wanatango Falls study area, VEC's are limited to fish species.

Walleye, Sauger, Northern Pike and Lake Whitefish are widely sought as a target species in recreational fisheries, and therefore have also been included as VEC's.

Brook Trout have also been identified as being present in the Frederick House River (Seyler 1997) and have potential to be considered VECs. However, none of these have been captured in the study area. Furthermore, the record of Brook Trout in Seyler (1997) indicates that its distribution is mainly in tributary streams with occasional residence in the main channel.

At this time it is the opinion of the project team that Walleye, Sauger, Northern Pike and Lake Whitefish are considered the primary VECs (with regards to fish community) in the study area. The following discussion of each of these species, therefore, includes information on the biology, habitat requirements, distribution in the Frederick House River, occurrence in the study area, and their relationship to the habitat in the study area.

5.1.1.1 Walleye

Walleye on the Frederick House River represent a VEC as they are a targeted species for recreational and subsistence fishing. NRSI biologists captured Walleye in the study area in the main stem of the Frederick House River both upstream and downstream of the proposed dam site.

Scott and Crossman (1973) notes that Walleye habitat preference islarge, shallow lakes or large, turbid, slow-flowing rivers. In turbid water, Walleye are often more active during the day, as it provides good shelter from the daylight. They will also utilize shallower areas if there is a sufficient amount of aquatic vegetation, downed trees, or large boulder shoals. The habitat characteristics that Walleye prefer to reside in are present throughout the project area. Walleye spawn at night in areas of fast moving water or rapids over boulder/cobble/gravel areas which are widely available within the project area. Walleye are active throughout the winter months and reside in the deeper pools away from fast flowing water. The area from Zeverley's Landing to Wanatango Falls contains three areas of boulder/cobble/gravel that represent potential spawning habitat. Additional areas of potential spawning habitat are present in the proposed inundation area upstream of Wanatango Falls.

5.1.1.2 Sauger

Sauger on the Frederick House River represent a VEC as they are a targeted species for recreational and subsistence fishing. During field studies by NRSI in the summer of 2010, Sauger were captured upstream of Wanatango Falls and are also known from further downstream on the Frederick House River (Nowak and MacRitchie 1984).

Saugers are similar to Walleye in that their habitat preference seems to be for large, shallow lakes or large, turbid, slow-flowing rivers (Scott and Crossman 1973). They tend to do well only if water temperatures allow them to utilize the entire depth range. They often feed on the same shoals as Walleye, and spawning habitat may also be the same. An important distinction is the timing of spawning, which is during a 2-week period in the spring, often immediately following the Walleye spawn. Nevertheless, Sauger and Walleye are known to hybridize in natural settings (Scott and Crossman 1973). The area from Zeverley's Landing to Wanatango Falls contains three areas of boulder/cobble/gravel that represent potential spawning habitat. Additional areas of potential spawning habitat are present in the proposed inundation area upstream of Wanatango Falls.

5.1.1.3 Northern Pike

Northern Pike on the Frederick House River represent a VEC as they are a targeted species for recreational and subsistence fishing. During field studies in the Spring of 2011, NRSI biologists captured Northern Pike downstream of the proposed dam site. Northern Pike live in riverine and lacustrine habitats throughout North America. Within riverine systems, Pike seem to prefer clear, meandering, warm and heavily vegetated areas (Scott and Crossman 1973). Northern Pike spawn in the spring over aquatic vegetation and seasonally inundated vegetation such as the marshes and wetland found throughout the project area (both upstream and downstream of the proposed dam location). The west side of the island immediately downstream of Zeverly's landing is another potential spawning area for Northern Pike.

5.1.1.4 Lake Whitefish

Lake Whitefish on the Frederick House River represent a VEC as they are a targeted species for recreational and subsistence fishing. During field studies in the Spring of 2011, NRSI biologists captured Lake Whitefish downstream of the proposed dam site, Lake Whitefish is widely distributed in North American fresh waters. They are a coolwater species that prefer deeper waters of lakes and large rivers. These fish move from deep water to shoals in early spring and back to deep water in the summer months. Spawning occurs in the fall in fast flowing shallow water at depths of less than 25 feet, and takes place over hard or stoney substrates (Scott and Crossman 1973). The area from Zeverley's Landing to Wanatango Falls contains three areas of boulder/cobble/gravel that represent potential spawning habitat for Lake Whitefish. Additional areas of potential spawning habitat are present in the proposed inundation area upstream of Wanatango Falls.

5.2 Significant Wildlife Habitat

Significant Wildlife Habitat is designated following criteria identified in the Significant Wildlife Habitat Technical Guide (SWHTG) (OMNR 2000b). The SWHTG divides habitat types into four broad categories (Seasonal Concentration Areas of Animals, Rare Vegetation Communities or Specialized Habitat for Wildlife, Habitat for Species of Conservation Concern, and Animal Movement Corridors), the first three of which correspond to Tables 1, 2 and 3, respectively of Appendix X:

- Seasonal Concentration Areas;
- Rare vegetation communities or specialized habitats for wildlife; and
- Habitats of species of conservation concern, excluding the habitats of endangered and threatened species.

Species listed as Special Concern under the Species at Risk in Ontario list are considered species of conservation concern. Additionally, species identified as nationally Endangered or Threatened by the Committee on the Status of Endangered Wildlife in Canada, which are not protected in regulation under the *Endangered Species Act*, 2007, are considered species of conservation concern. Habitat for these species

are therefore considered Significant Wildlife Habitat under the Provincial Policy Statement, 2005.

NRSI conducted a screening exercise that utilized general evaluation criteria set out in the SWH Technical Guide as well as OMNR's Decision Support System (DSS) to identify the presence of candidate SWH within the GS study area. NRSI used the results of the 2010 vegetation mapping (ELC) and new 2011 aerial photography of the study area to inform this process. Under the OMNR's Natural Heritage Assessment process (OMNR 2010), the candidate SWH identified using the DSS would trigger specific field surveys. The outcomes of those surveys would be assessed for significance using specific tools that exist for Ecoregion 3E, the study area's Ecoregion.

For SWH criteria that were determined to be present within the study area, NRSI conducted further assessment at this stage to determine the regional importance of those habitats on the surrounding landscape in relation to what was present within the study area. Following this broader level of assessment, SWH was classified as candidate or not present within the study area. Candidate and confirmed (by OMNR) SWH resulting from this screening are further described in Sections 5.2.1 and 5.2.2.

It is important to note that some SWH types are lacking criteria in the SWH Technical Guide for determined significance, and the relevance or importance of certain wildlife habitat types to this region of the province are not outlined. In the absence of these criteria, NRSI biologists have used their professional judgment in determining the significance or relevance of wildlife habitats for the study site. A summary of findings from the SWH screening exercise is provided in Appendix X in the form of Tables 1-3, for Seasonal Concentration Areas, Specialized Wildlife Habitat, and Habitat for Species of Conservation Concern, respectively. Confirmed SWH is also shown on the terrestrial maps provided in Appendix V.

Recommendations for additional field surveys have also been identified where candidate SWH cannot be determined based on available information.

5.2.1 Candidate Significant Wildlife Habitats

5.2.1.1 Denning Sites for Mink, Otter, Gray Wolf, Eastern Wolf, Canada Lynx, Marten, Fisher, Black Bear

The study area features relatively undisturbed shoreline habitats of coniferous forest, with areas of downed woody debris in localized areas. These habitat features coupled with a productive fish community in the Frederick House River, make the study area a potentially significant habitat for mink and otters. Further, the surrounding forest is large (>100ha in size) and contiguous, making it potentially important habitat for martens and fishers. Localized areas of deadfalls, log piles and shrubby areas within the study area may also provide suitable habitat for otters and lynx. However, while river otters and a black bear were observed, observations or evidence of mink, martens, lynx, wolves or fishers were not documented. As well, similar habitat (e.g. water bodies surrounded by large relatively contiguous forest) does occur in the broader surrounding landscape, although the productivity of these waters for fish has not been assessed. Additional work is required to determine the significance of the study area for large weasel denning. Overall, this SWH type is listed as a candidate SWH for the study area.

5.2.1.2 Common Nighthawk Nesting and Foraging Habitat

Common nighthawk is listed as of Special Concern provincially and threatened nationally, rendering it a species of conservation concern whose habitat is considered to be Significant Wildlife Habitat under the PPS (OMNR 2010). As a species of conservation concern, the common nighthawk is not afforded protection under the ESA.

This species nests on open ground; in clearings in dense forests created by logging or fire, ploughed fields, gravel beaches or barren areas with rocky soils, in open woodlands and on flat gravel roofs (OMNR 2000b). Suitable habitat for this species exists within the study area, while this habitat is also abundant on the surrounding landscape. NRSI biologists did not observe common nighthawk within the study area during any of the field investigations undertaken in 2010 or 2011.

5.2.1.3 Olive-sided Flycatcher Nesting and Foraging Habitat

Olive-sided flycatcher is listed as of Special Concern provincially and threatened nationally, rendering it a species of conservation concern whose habitat is considered to be Significant Wildlife Habitat under the PPS (OMNR 2010). As a species of conservation concern, the common nighthawk is not afforded protection under the ESA.

They prefer semi-open, conifer forests near water bodies with treed wetlands for nesting (OMNR 2000b). Due to the large tracts of conifer forest and the Frederickn House River found within the project area, it is possible that olive-sided flycatchers would be found breeding within the project area. This habitat is also abundant in the surrounding landscape. NRSI biologists did not observe olive-sided flycatcher within the study area during any of the field investigations undertaken in 2010 or 2011.

5.2.1.4 Northern Long-eared Bat Habitat

Review of the Ontario Mammal Atlas has identified one significant mammal species that may be present within the Wanatango Falls study area. The northern long-eared bat is listed as provincially rare (S-Rank S3? – Vulnerable, with uncertainty). Consequently it is considered to be of conservation concern, and its habitat is considered to be Significant Wildlife Habitat under the PPS (OMNR 2010). It is not afforded protection under either the federal SARA or the provincial ESA.

Northern long-eared bat hibernates during winter in mines or caves. During summer, males roost alone and females form maternity colonies of up to 60 adults in manmade structures, hollow trees or under loose bark (OMNR 2000b). Based on habitat requirements, it is possible that this species could be present within the project area. However, this habitat is also abundant in the surrounding landscape. NRSI biologists did not observe northern long-eared bat within the study area during any of the field investigations undertaken in 2010 or 2011.

5.2.2 Confirmed Significant Wildlife Habitat

5.2.2.1 Bald Eagle Nesting and Foraging Habitat

The bald eagle is designated as Special Concern provincially, rendering it a species of conservation concern whose habitat is considered to be Significant Wildlife Habitat under the PPS (OMNR 2010). As such, this species is not afforded protection by the ESA. Bald eagle is designated nationally as Not at Risk, and is not afforded protection under SARA.

The bald eagle requires large areas with continuous deciduous or mixed forests found on large lakes or rivers. Tall dead trees within 400m of the nest site are required for perching (OMNR 2000b). This habitat is abundant in the surrounding area. NRSI biologists did observe an adult bald eagle entering a nest, confirming breeding, within the study area during field investigations undertaken in spring 2010. This tree is not expected to be affected by the inundation.

5.2.2.2 Canada Warbler Nesting and Foraging Habitat

Canada warbler is listed as being of Special Concern provincially, rendering it a species of conservation concern whose habitat is considered to be Significant Wildlife Habitat under the PPS (OMNR 2010). As a species of conservation concern, the Canada warbler is not afforded protection under the ESA. This species is designated as Threatened nationally, and is listed on Schedule 1 of SARA, affording it protection on federal, private and provincial crown land under the Act.

The Canada warbler breeds in interior forest habitats with a dense, well developed shrub and vegetation understory, often along riparian zones in excess of 30ha (OMNR 2000b). Interior and riparian forest habitat is abundant within the study area, as it is on the surrounding landscape. NRSI biologists observed a singing male individual of this species in spring 2010, indicating potential breeding. However, due to the presence and size of the appropriate breeding habitat, it is quite likely that Canada warbler is breeding

within the study area. Therefore, canada warbler nesting and foraging habitat is considered confirmed SWH for the study area.

6.0 Impact Assessment and Mitigation

The impact assessment on terrestrial, wetland, fisheries and aquatic habitat for this project has been based on the engineering details, reports and plans that have been provided to date to NRSI by Xeneca. The information provided to NRSI at the time of this report includes:

1) conceptual engineering drawings provided by Canadian Project Limited (CPL) (Annex II, of the main EA document, Xeneca 2011a);
2) inundation mapping provided by Xeneca (Annex I, of the main EA document, Xeneca 2011a);
3) draft operating flows and levels plan provided by Xeneca (Annex I, of the main EA document, Xeneca 2011a);
4) extent of variable flow reach downstream (pers. comm. Ed Laratta Xeneca);
5) construction sequence plan (Annex II, of the main EA document, Xeneca 2011a); and
6) construction management plan completed by CPL (Annex II, of the main EA document, Xeneca 2011a)

6.1 Impact Assessment Methods

6.1.1 Terrestrial Methods

The assessment of impacts on existing terrestrial resources is based on a combination of the relative level of terrestrial disturbance proposed, and the relative significance and sensitivity of the species present, that species' habitat or a designated natural area. Disturbance to terrestrial habitat as part of the proposed Wanatango GS is typcially associated with the removal of existing habitat (e.g. associated with the construction of the Wanatango GS and the resulting inundation area).

6.1.2 Aquatic Methods

The outcome of the fisheries and aquatic habitat impact assessment is based primarily on the resilience of the identified habitat and the species relying on the function of that habitat, to withstand predicted disturbances caused by construction and/or operation of the project. In this manner, both the significance and sensitivity to disturbance of localized areas, both directly in the project footprint and the greater study area are considered. Similar to the approach outlined in DFO's Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff (Fisheries and Oceans Canada 2010), this process will follow a hierarchical approach to fish habitat protection. Avoidance and re-design has, and will continue to be, applied toward the selection of the preferred alternative, construction and future operations of the facility. Where avoidance and design modifications cannot be achieved, impacts associated with the construction of the facility, as well as operation of the GS will be assessed based on the predicted interactions between the design and the existing fish and fish habitat sensitivities.

As part of the federal government's commitment to modernizing and streamlining regulatory approvals in Canada, Fisheries and Oceans Canada (DFO) developed the Environmental Process Modernization Plan (EPMP). A key element of the EPMP is the Risk Management Framework (RMF).

The RMF Matrix is designed to evaluate the relative risk associated with the residual effects of a project identified using a Pathways of Effect (PoE) approach. It assesses the severity of the residual effects in combination with the sensitivity of the species and habitat at the site. The relative risk is categorized as low, medium, or high, representing an increasing scale of anticipated negative effect. Projects components identified as low risk are typically managed by DFO through recommendations for mitigation and best management practices, while medium and high risk category projects are usually managed through individual *Fisheries Act* authorizations at the permitting stage of a project. Due to the nature of hydroelectric GS projects, the risk category can be assumed to be high, further requiring authorization under the *Fisheries Act*. At this time, engineering design for this project is not sufficiently advanced to allow for a complete and accurate assessment of the potential impacts to fish and fish habitat and

consequently to develop appropriate mitigation and compensation strategies to advance any federal *Fisheries Act* approvals. As soon as detailed engineering plans are provided, application of the DFO PoE and RMF Matrix to assess project impacts that may result in the Harmful Alteration, Disruption, and Destruction (HADD) of fish habitat will be carried out.

Of particular interest to this assessment, will be the potential for impacts to interfere with sensitive life history stages of VEC fish such as Walleye, Northern Pike, Sauger, and Lake Whitefish as well as SAR species like Lake Sturgeon. Further to this, the potential for impacts to the spawning habitat of these species, such as may be encountered in the reaches downstream of Wanatango Falls within the variable flow reach, will also be identified and assessed. By following this approach, a clear understanding of potential aquatic impacts can be demonstrated and an assessment of residual effects can be undertaken.

6.2 Evaluation of the Proposed Undertaking

The following sections identify potential impacts associated with the proposed undertaking based on the current conceptual design. The associated potential impacts are based on natural environment characterization results of the 2010 and spring 2011 field programs.

Potential impacts have been identified as they relate to the design footprint, construction, and operation of the proposed facility and are discussed in following sections.

6.2.1 Design Footprint

The preliminary engineering details of the proposed GS structure components include a dam with adjustable gate spillway, stoplog spillway, headrace, powerhouse, overflow dam, and tailrace (Annex II, of the main EA document, Xeneca 2011a). Details of these features are discussed below. Impacts on terrestrial, wetland and aquatic function as a

result of the design footprint are discussed in Sections 6.2.1.1 and 6.2.1.2. Table 11 presents estimated design footprint areas as provided by Xeneca (Xeneca 2011b).

Table 12 Summary of GS Component Footprint Areas

Structure	Estimated Footprint Area in m^2
Adjustable Gate Spillway	300
Dam	800
Headrace	1600
Overflow Dam	300
Powerhouse	400
Stoplog Spillway	250
Tailrace	400
TOTAL AREA	**2450**

Dam, Water Intake Structure, and Powerhouse

Based on review of preliminary layouts provided in Annex II of the main EA document (Xeneca 2011a) it is understood that aquatic and terrestrial habitats will be affected by the dam, powerhouse and intake structure. As part of the proposed development, a headrace or 'intake channel' to route water from upstream reaches of the Frederick House River into the water intake structure will be constructed (Annex II, of the main EA document, Xeneca 2011a). According to the construction sequencing details (Annex II, of the main EA document, Xeneca 2011a), cofferdams will also be required for the construction of the headrace.

Overflow Dam

An overflow dam will be constructed on the island adjacent to the dam (Annex II, of the main EA document, Xeneca 2011a). This will be constructed entirely on land.

Spillway

A spillway to route water downstream will be constructed (Annex II, of the main EA document,). The proposed spillway will require the excavation of bedrock. The spillway is contained entirely within the existing riverbed. According to the construction

sequencing details (Annex II, of the main EA document), a cofferdam will also be required to complete the stoplog spillway and adjustable gate spillway construction.

Tailrace

A tailrace channel to route water downstream and away from the turbine will be constructed (Annex II, of the main EA document, Xeneca 2011a). The proposed tailrace channel will require the excavation of river substrates and bedrock. According to the construction sequencing details (Annex II, of the mainain EA document, Xeneca 2011a), a cofferdam will also be required to complete the tailrace construction.

6.2.1.1 Terrestrial Impacts

The dam with adjustable gate spillway, stoplog spillway, headrace, powerhouse, overflow dam, and tailrace will result in direct impacts to terrestrial habitat in the form of localized clearing and grubbing of existing riparian vegetation. The spillways will not result in any impacts to terrestrial habitats as they are contained within the existing riverbed. The forest community that would be affected is B114 Black Spruce-Pine Conifer-Moist, Fine.

The Frederick House River, where it runs through the study area, was confirmed as a SWH supporting bald eagle and Canada warbler foraging and perching activity. A bald eagle was observed entering a nest, and a Canada warbler was observed singing during spring 2010 field investigations. An area of existing riparian Spruce-Pine forest (B114) habitat will be cleared for construction of the GS. However, the area to be cleared is very small in relation to the abundance of this habitat type on the surrounding landscape outside the study area. Consequently, construction of the GS will likely have a negligible impact on bald eagle in the vicinity of the project area.

All of the ELC polygons that will be affected by footprint impacts may also provide habitat for three other species of conservation concern that may occur in the study area (common nighthawk, olive-sided flycatcher, and northern long-eared bat) and one SAR that may occur in the study area (chimney swift). However, due to the small area

covered by the GS footprint in relation to the abundance of these species' habitat types on the surrounding landscape, any loss of habitat for these species would likely have a negligible effect on their overall regional populations.

As a SAR, chimney swift and its habitat is protected under the *Endangered Species Act* (ESA) 2007. Any impact to known chimney swift habitat due to construction of the Wanatango Falls GS will require a permit under Section 17(2)C of the ESA and a strategy to provide overall benefit to the species. Once operation commences, an Agreement for Operation and monitoring protocols under the ESA will be required by the OMNR. Various construction practices can be employed to limit impacts on chimney swift. These include:

- Clearly delineating the area for clearing/grubbing to ensure that only required areas are cleared;
- Removing woody vegetation outside the breeding period (April 15-August 8, inclusive); and,
- Retaining an avian biologist to conduct nest searches ahead of tree removal, if trees must be removed during the breeding period.

Implementation of these construction practices will mitigate impacts on local chimney swift populations, and will result in an anticipated low negative impact for the species within the project area.

Other terrestrial wildlife species that are not of conservation concern may use habitat within the footprint of the Wanatango Falls GS. However, as described above, the overall impacts on these species on a landscape scale will likely be negligible given the abundance of appropriate habitat that exists on the surrounding landscape.

It is anticipated that the bear management areas will likely have minimal impacts from habitat loss or disturbance as the affected habitat is in negligible in proportion to the surrounding available habitat. Information about the location of traplines was not available from the OMNR; however, if they are in the area of project influence, it is

anticipated that they will also have minimal impacts as the affected habitat is in negligible in proportion to the surrounding available habitat.

6.2.1.2 Aquatic Impacts

The construction of the dam will result in the loss of aquatic habitat due to the permanent covering and infilling of the river channel within the footprint area.

The construction of the headrace (intake channel), spillway, and tailrace involves the permanent alteration of habitat due to the re-structuring of the riverbed to form smooth re-graded concrete channels. This alteration will result in the loss of existing natural substrates, aquatic vegetation and morphological habitat features (i.e. riffle, pool, etc.) and furthermore, will considerably limit function and productive capacity of habitat within these areas.

The construction of all in-water structures will take place in isolation from the river flow through the use of cofferdams. Temporary disturbance to fish habitat is anticipated within the cofferdam footprint as well as from associated dewatering activities. Potential impacts associated with the construction of the Wanatango Falls GS are discussed further in Section 6.2.6.

In addition, it is anticipated that existing downstream habitat will be affected by the creation of the dam due to changes in flow pattern (direction and rates). Potential effects may include downstream river bank erosion, sedimentation, and scouring of the riverbed. River morphology will be altered downstream, changing existing habitats (i.e. substrate composition, water depth, flow rate, wetted width etc.). Operational related impacts to changes in flow (increases and decreases) are discussed in Section 6.2.3., as it relates to the downstream variable flow reach.

Aquatic habitat within the GS footprint area is present on both the west and east side of a large island. The east side of the island is characterized as a high gradient riffle with turbulent water flows dominanted by large boulder and broken bedrock substrate.

Cobble and gravel are also present in isolated pockets created by obstructions such as boulders. The channel is narrow through this section with steep bedrock shorelines. The water depth and flow through this riffle section can vary greatly between periods of low and high water.

The west side of the island has a lower gradient than the east side and experiences a backwatering effect as a result of a bedrock chute at the downstream end. Located downstream of the proposed dam location is a pool-riffle-pool sequence, ending with a bedrock chute that has a significant elevation drop. The construction of the dam and spillway will result in the loss in a section of the pool habitat and alteration to the pool and riffle sequence.

The construction of the dam, GS and spillway will result in the alteration of habitat on both sides of the island. The quiter backwater parts of these habitats have the potential to provide cover, refuge and rearing habitat for cyprinidis. In the faster water sections, with larger substrates, there is potential for spawning of Walleye, Sauger, and Lake Sturgeon.

The creation of the headrace (intake channel) will result in the alteration of aquatic shoreline upstream of the proposed dam location. This shoreline is presently made up of broken bedrock and boulder substrates. Within the channel is a riffle feature that will be permantly altered throughout this process.

The creation of the tailrace will result in the alteration of a run and aquatic shoreline downstream of the bypass reach. The shoreline is currently composed of bedrock and large boulders and the run has a channel width of approximately 15m. The substrates throughout the run are dominated by bedrock and large boulders. Smaller materials such as cobble as gravel have been deposited approximately 20m downstream from the current tailrace location. This cobble riffle shows good spawning potential for Walleye, Sauger, and Lake sturgeon.

The placement of the dam may potentially create a barrier to upstream fish passage. Upstream movement/migration/passage of fish past Wanatango Falls was studied in the spring of 2011 (see Section 3.2.3.). This study primarily targeted Walleye, Sauger and Saugeye to determine if these species are moving from downstream, through the proposed dam location to upstream reaches. Preliminary findings from this survey indicate that in at least one case during the study period, a walleye transitioned through the proposed dam location into the upstream reaches of the Frederick House River. In addition to these recent findings,, movement of an individual Sauger had been documented during a study of fish production at Neeland's Rapids in the Frederick House River. During this study by MacRitchie (1983a), a Sauger that had been captured and tagged downstream of Zeverley's Landing and was later recaptured in the vicinity of the Frederick House (High Falls) Dam. This collection history indicates that this individual fish had successfully passed both Zeverley's Landing and Wanatango Falls in an upstream direction (MacRitchie 1983a). Through personal communications with OMNR Cochrane District Office it was noted that upstream migration over these falls by Sauger has been observed previously through telemetry studies, indicating that some upstream migration over Zeverley's and Wanatango Falls does occur (OMNR 2010a). As such, it is anticipated that the creation of the dam will impede passage of Walleye and Sauger as well as other species. Consideration for structures (i.e fish ladders) that allow for the maintenance of upstream and downstream passage should be discussed with local OMNR.

Mitigation strategies to offset potential impacts during construction will include implementation of construction best management practices (BMPs) as provided in Section 6.2.6.

The proposed compensation for anticipated impacts related to the construction of the GS will need to be developed and discussed with DFO once the engineering details for the project have been advanced during the permitting phase of the project. Effectiveness goals will need to be discussed with OMNR and DFO to ensure the compensation will be effective. It is expected that the replacement of any spawning habitats that the effectivenss and intended function of the compensation habitat can be demonstrated. .

Similarily, any fish passage facilities that are built will need to be monitored for performance. The Fisheries Act Authorization will be discussed and resolved with DFO and MNR in 2012. Xeneca will develop a compliance program for this Authorization and provide it to affected Agencies.

6.2.2 Inundation Area

The construction and operation of the proposed Wanatango GS will result in a backwater effect upstream of the proposed dam location, increasing water depths and newly inundating adjacent riparian lands. Based on hydrological information provided to NRSI in 2011 (Annex II, of the main EA document, Xeneca 2011a), the inundated area will have an overall surface area of either 7.8ha, or if landowner approvals are successful, 64.8ha. The upstream limit of the inundation area is expected to extend approximately 0.5km or 8.2km (with landowner approval) upstream of proposed dam site (Figure 1). Impacts were considered for the further reach for this report. It is anticipated that existing water levels in the river will experience the greatest increase at the dam location, decreasing in increased water level when moving further upstream of the dam.

6.2.2.1 Terrestrial Impacts

Damming of the Frederick House River will result in direct impacts in the form of clearing of existing riparian forest within the area proposed for inundation. Based on the 2010 field investigations, the proposed 8.2km inundation area includes four different ELC communities:

- B114 Black Spruce-Pine Conifer-Moist, Fine
- B134S Mineral Thicket Swamp
- B142N Mineral Meadow Marsh
- B148N Mineral Shallow Marsh

The dominant vegetation community within the study area is B114 Black Spruce-Pine Conifer – Moist, Fine. Where the inundation area overlaps with these communities, all vegetation will be cleared and the habitat will be converted from terrestrial to aquatic.

The Frederick House River, where it runs through the study area, was confirmed as a SWH supporting bald eagle and Canada warbler foraging and perching activity. A bald eagle was observed entering a nest, and a Canada warbler was observed singing during spring 2010 field investigations. An area of existing riparian Spruce-Pine forest (B114) habitat will be cleared for construction of the GS. However, the area to be cleared is very small in relation to the abundance of this habitat type on the surrounding landscape outside the study area. Consequently, construction of the GS will likely have a negligible impact on bald eagle in the vicinity of the project area.

All of the ELC polygons that will be affected by footprint impacts may also provide habitat for three other species of conservation concern that may occur in the study area (common nighthawk, olive-sided flycatcher, and northern long-eared bat) and one SAR that may occur in the study area (chimney swift). However, due to the small area covered by the GS footprint in relation to the abundance of these species' habitat types on the surrounding landscape, any loss of habitat for these species would likely have a negligible effect on their overall regional populations.

As a SAR, chimney swift and its habitat is protected under the *Endangered Species Act* (ESA) 2007. Any impact to known chimney swift habitat due to construction of the Wanatango Falls GS will require a permit under Section 17(2)C of the ESA and a strategy to provide overall benefit to the species. Once operation commences, an Agreement for Operation and monitoring protocols under the ESA will be required by the OMNR. Various construction practices can be employed to limit impacts on chimney swift. These include:

- Clearly delineating the area for clearing/grubbing to ensure that only required areas are cleared;
- Removing woody vegetation outside the breeding period (April 15-August 8, inclusive); and,
- Retaining an avian biologist to conduct nest searches ahead of tree removal, if trees must be removed during the breeding period.

Implementation of these construction practices will mitigate impacts on local chimney swift populations, and will result in an anticipated low negative impact for the species within the project area.

Measures can be taken to minimize impacts on aquatic, shoreline-dependent mammals (e.g. beavers, otters) during the initial inundating of lands. Specifically, the area should not be initially filled during the winter or ice-over period as this could cause direct mortality by drowning mammals in their dens. It is anticipated that proper construction sequencing and operations planning will mitigate impacts to aquatic mammal species, such that minimal impacts are anticipated.

Impacts to wetland areas within the inundation zone can be mitigated through adherence to measures such as the following:

- Restrict construction vehicles to existing access routes and staging areas
- Minimize access
- Retain vegetation to the extent possible
- During clearing, trees will be felled into the proposed site wherever possible
- Clearing will comply with the requirements of all applicable permits and approvals, the Crown Forest Sustainability Act, and the Forest Operations and Silviculture Manual
- Trees will not be felled into the water
- Wildlife trees, culturally modified trees and other significant trees will be marked for protection; marked trees will only be removed if they are safety concerns that cannot be addressed in other practical ways
- Brush will be disposed of by burning or chipping. When burning is carried out, it will be under permit with the OMNR and according to the Forest Fires Prevention Act.

It is anticipated that proper construction and operations planning will mitigate impacts to aquatic mammal species, such that no impacts are anticipated.

Other terrestrial wildlife species that are not of conservation concern may use habitat within the footprint of the Wanatango Falls GS. However, as described above, the overall impacts on these species on a landscape scale will likely be negligible given the abundance of appropriate habitat that exists on the surrounding landscape.

It is anticipated that the bear management areas will likely have minimal impacts from habitat loss or disturbance as the affected habitat is in negligible in proportion to the surrounding available habitat. Information about the location of traplines was not available from the OMNR; however, if they are in the area of project influence, it is anticipated that they will also have minimal impacts as the affected habitat is in negligible in proportion to the surrounding available habitat.

6.2.2.2 Aquatic Impacts

As a result of inundation, two fastwater habitats as identified in Section 3.2.1.1. will be permanently altered. These changes will result in an increase in depth and wetted width of these habitats and associated reductions in velocity. Generally speaking, due ot channel gradient, these impacts are of greater magnitude nearer to the dam and decrease in magnitude approaching the upstream extent of inundation. As both of these habitats are located in close proximity to the dam site these habitats will be subjected to the full extent of inundation and will cease to function as fastwater habitats.

It will be necessary to understand the nature of these habitats in order that appropriate compensation habitats can be created which mimic the physical habitat characteristics and associated ecological function of the altered habitats. It will be necessary to understand the required depths, velocities and wetted widths required at the new habitat areas in order to replicate ecological function.

This assessment will be accompliased with additional HEC RAS modeling for these specific areas.

6.2.1 Water Level Fluctuations

The proposed modified run-of-river operation will result in a fluctuation of water levels within the inundation area (Annex II, of the main EA document, Xeneca 2011a). This fluctuation is expected to vary water levels by 1m in depth. This depth will range from the normal operating level of 257.5m ASL and be drawn down to 256.5m ASL. This fluctuation is expected to occur from one to several times daily. The degree of water level fluctuation will be greatest at the dam site (1m) and will gradually decrease, moving in an upstream direction, due to river gradient.

6.2.1.1.1 Terrestrial Impacts

The impact of fluctuating water levels in the inundation area during intermittent operations is that emergent vegetation is not expected to re-establish along the shoreline. This is due to the fact that riparian and emergent plant species will not tolerate water level fluctuations of 1.0m on a one to several times daily. As a result, much of the shoreline and nearshore area will remain as bare substrate. This essentially represents a loss of habitat within this zone of water level fluctuation, for emergent vegetation. However, vegetation that is lost as a result of intermittent water level fluctuation within the inundation area is abundant on the surrounding landscape, such as upstream along the Frederick House River outside of the project area. Therefore, any impacts on emergent plant species will likely be negligible in the context of the broad surrounding landscape.

6.2.1.1 Aquatic Impacts

Since the two existing fastwater habitats will be permanently altered when inundated, subsequent fluctuations will not impact further on these habitats. However any new fastwater habitats will need to be designed so as to minimize the exposure of these habitats to rapid and frequent fluctuations. Therefore, it is recommended that these habitats be placed upstream of the zone of inundation and therefore outside of any fluctuations caused by operation.

6.2.2 By-Pass Reach

The approximately 350m section of the Frederick House River along the east side of the island and the approximately 210m section along the west side of the island between the proposed dam location and the tailrace are considered the by-pass reach. As discussed in Section 3.2.1.2, the section along the east side of the island includes a high gradient, turbulent riffle section comprised of large boulders and broken bedrock. Cobble and gravel are present in isolated pockets created by obstructions such as boulders. The section along the west side of the island has a lower gradient and has a pool-riffle-pool sequence, ending with a bedrock chute that has a significant elevation drop. Immediately downstream of the island and dam location, where the east and the west channels converge, a scoured bedrock pool is present. Downstream of the pool, there is a run with substrates are dominated by bedrock and large boulders. This entire bypass section affords suitable cover and feeding habitat for Walleye and other species as well as suitable spawning substrates and spring flow conditions for Walleye, White Sucker, Sauger, and other species. In addition, sections of this area would provide for benthic invertebrate productions as well as contributing to dissolved oxygen levels.

To mitigate the potential for negative impacts on this habitat during operations it is expected that suitable minimum ecological flow will maintained through this reach during the calendar year. The Operating Plan for this facility has indicated the compensatory bypass flow to be 1.0 m^3/s for the spring and 0.5 m^3/s for the rest of the year. It is expected that these values will be further discussed with OMNR to ensure that these quantities will meet their management objectives.

6.2.3 Downstream Variable Flow Reach

The operation of the GS will result in changes to the flow regime downstream of the facility, relative to the existing conditions. These changes come about based on the capacity of the operation to store water upstream of the dam during periods of low power demand, and release that water, through the turbines, during periods of higher power demand. This can result in a fluctuation of flows which are characterized by relatively rapid increases and decreases in flow, an increase in the frequency of flow changes and

associated changes in the wetted width, depths, and velocities in downstream habitat areas.

The confirmed Walleye spawning habitat identified 375m downstream of Wanatango Falls GS will be maintained as it is not located within the dam, powerhouse and tailrace construction footprint. White Sucker, Sauger, and Lake Sturgeon have been sampled within the Frederick House River downstream of the Wanatango Falls GS. Due to the presence of these species and suitable spawning habitat, it has been assumed that spawning does occur within riffles and tail outs downstream. As such, it will be necessary to ensure that adequate flow is maintained over this habitat to ensure that it continues to function effectively for multiple species spawning and egg incubation. The proposed operating plan indicates that there will be no intermittent flow during the spring of the year and will operate as a run-of-river facility. The maximum turbine flow of the facility will be 15m^3/s (Xeneca 2011b). Currently, the long term median flow during the spring spawning season is estimated to be in the range of 27m^3/s. It may be necessary to extend the period of run of the river operation in order to accommodate the later spawning periods of the Lake Sturgeon. This will have to be negotiated with MNR and DFO.

In order to predict the required flows necessary to protect the spawning function of the fish species present , it will be necessary to undertake modeling studies to determine the depth, velocity and wetted width of that habitat under a range of flows. This will require surveying of cross sections in the spawning habitat. By comparing these results to known preferences for the various species spawning it will be possible to predict the flow that is required to adequately protect habitat spawning and egg incubation function. Xeneca is committed to undertaking this modeling exercise. In subsequent operations of the GS, it may be possible to adjust this required flow downwards, based on actual observations of flow over the habitat during the spawning period.

6.2.4 Entrainment and Impingement

The potential for fish entrainment and impingement at the intake of a hydroelectric facility exists and is well studied with regards to hydroelectricity projects (New York Power Authority 2005). Entrainment occurs when fish enter into a facility through intake flows and continue passing through the turbines and other components. Similarly, impingement occurs when fish become pressed up against the trash racks by intake flows. Entrainment and/or impingement are influenced by the intake velocity relative to the swimming ability of the species, the individual fish's stage of development (i.e. larval, juvenile or adult), as well as sickness or disease.

A detailed assessment of the potential for entrainment and/or impingement of fish at the intake of the proposed Wanatango Falls GS project will ultimately take into account four sport fish species and one species of special concern known to inhabit the Frederick House River upstream of the proposed facility. These species include Walleye, Sauger, Northern Pike, Lake Whitefish and Lake Sturgeon. .

It is important that the proposed intake structure will be intentionally designed for low velocities in order to avoid/mitigate the potential risk of entrainment and impingement. Trash racks will also be implemented as both a visual and physical deterrent for fish becoming entrained and/or impinged although specific details of the size and spacing have yet to be developed. It is expected that engineering design will determine the intake velocities which can then be compared to swimming speeds to determine the potential for entrainment or impingement.

6.2.4.1 Evaluation of Swimming Capabilities

This section details the swimming capabilities of the five VEC's that are found within the study area in anticipation of the future analysis required for this project.

Swimming speed is often discussed in terms of the speed at which a fish can swim over prolonged periods. This speed is typically referred to as the U Critical speed (Ucrit) (Peake 2008). If the length of time that the fish can sustain the Ucrit speed is known,

this is cited as part of the speed value (e.g. $Ucrit_{10}$ is the U critical speed sustained over ten minutes). Where time is not specified, values greater than 20 minutes are most common (Peake 2008).

Further to Ucrit speeds, fish are also capable of burst swimming speeds which exceed their Ucrit values, often by a significant amount. For example, Peake (2004) demonstrated that velocity criteria based on Ucrit values underestimated, by at least 50%, the maximum velocity that could be negotiated by free swimming smallmouth bass. Also, in general, the larger a fish gets the higher its Ucrit speed will be (Peake 2004). Therefore, using a U Critical speed for a juvenile fish is a very conservative way of estimating a species' ability to avoid certain intake velocities at a hydroelectric station, because juvenile fish have lower swimming speeds and Ucrit values are less than burst swimming capabilities.

Lake Whitefish

The critical swimming speeds for Lake Whitefish were assessed by Bernatchez and Dodson (1985) as influenced by temperature and current speed. Fish were tested at three different acclimated temperatures; 5.0, 12.0, and 17.0°C. It was determined that the critical swimming speed of a 364g Lake Whitefish at 5.0°C is 0.63m/sec ± 6.0, at 12.0°C is 0.75m/sec ± 9.5, and at 17.0°C is 0.67 m/sec ± 4.4. The results determined during this study were notably higher than those identified by Jones *et al.* (1974) who identified a Ucrit speed of 0.54 m/sec for Lake Whitefish. However, the study conducted by Bernatchez and Dodson (1985) used fish that had been 'trained' to swim against the current while Jones *et al.* conducted their study on wild fish.

Northern Pike

A study completed by Peake (2008) is considered one of the most comprehensive sources of information available on the swimming speeds of Northern Pike. This document is a literature review that was developed for the purpose of establishing design and water velocity criteria for culverts and fish ways. For juvenile Northern Pike (< 35cm fork length) the calculated Ucrit value is considered to be 0.15m/sec to 0.35m/sec however, no burst speed capabilities were noted.). However, by taking the

Ucrit values cited above for juvenile Northern Pike (15 to 35cm/s and applying the factor cited by Peake (2004), it is estimated that juvenile Northern Pike may be capable of burst speeds of between 0.2m/s and 0.5m/s. For larger Pike, the Ucrit upper limit recommendation ranges from 0.38m/sec to 2.80m/sec. A second study by Harper and Blake (1990) also measured burst swimming speeds of between 1.1m/sec and 2.20m/sec for adult Northern Pike.

Walleye

The development of a regression equation used to accurately predict the Ucrit swimming capabilities of Walleye was established by Scruton et al. (1998), and was based on laboratory swim trials. Results of this study found that sustained Ucrit values of 0.5m/sec were observed in juvenile Walleye with a fork length of 0.15m. Further to this, Jones (1974) determined a similar sustained swimming speed of 0.4m/sec for Walleye. Scruton et al (1998) also predicted that a juvenile Walleye is capable of burst swimming speeds of 1.60m/sec and Peake et al, (2000) note burst swimming speeds of 1.6m/sec to 2.6m/sec in adult Walleye for short periods of time (15-20 seconds).

Sauger

A limited amount of information is available for Sauger in regards to the swimming capabilities. The Loup Power District prepared a report titled the Loup River Hydroelectric Project (2010). Within this report it lists the estimated critical swimming speed (Ucrit) and burst swimming speed estimates (Uburst). The critical swimming performance trials were for a 10 minute duration. The estimated Ucrit for adult Sauger is 0.79m/sec and the Uburst was undetermined. The Uburst was unable to be determined through literature review, but assumed similar to Walleye due to close relation of species and the ability to hybridize.

Lake Sturgeon

The swimming performance of Lake Sturgeon was assessed by Peake *et al.* (1997) in order to determine critical swimming speeds in relation to both body size and temperature. Small (<15cm), intermediate (23 to 55cm), and large (>100cm) sturgeon were tested at 7.0°C, 14.0°C, and 21.0°C. It was ultimately determined that critical

speed increased with fish length, from 0.27m/sec for small (15cm) sturgeon, up to 0.98m/sec for large sturgeon (120cm) at 14°C. Critical speed also increased with water temperature, from 0.36m/sec at 7.0°C, to 0.42m/sec at 21.0°C for intermediate sturgeon (35cm).

Summary

The results of the literature review will be compared against the proposed design velocities at the intake of the GS (at the trash racks), to determine the relative risk of the juvenile and adult VEC fish species of being entrained or impinged. Should the ultimate intake design not allow for intake velocities lower than burst swimming capabilities of the various species of concern there are numerous other potential modifications that can be made at the intake to prevent entrainment an impingement. These include lighting, electrical barriers, air bubbling and sound barriers (Hogan 2008).

6.2.5 Turbine Mortality

The overall risk of juvenile and adult fish becoming entrained or impinged on the trash racks is unknown at this time based on the lack of intake velocities although specific details of swimming abilities, intake velocities and preferred habitat associations of the local fish community. For these reasons, discussions related to turbine mortality of entrained or impinged fish will primarily be focused on those individuals that do not have the ability to escape (i.e. larval fish) or fish that are in a weakened state (i.e. wounded or diseased fish). In these cases, some small fish (larval fish and some juveniles) as well as adults (diseased or in weakened state) will enter the intake channel and become entrained, passing through the turbines and into the tailrace channel.

Currently, one or more Kaplan turbines coupled to a generator is proposed (Xeneca 2011b). Although, specific turbine information such as diameter, number of blades, operational speed (r/min) and hydraulic capacity ranges (m^3/s) is required for determining turbine mortality. The hydraulic head to be captured is approximately 9.0m.

The study of turbine injury and/or mortality on fish is a well-studied topic (Cada and Odeh 2001), the mechanisms of which have been extensively explored in the literature. One study noted that fish survival through turbines is generally more dependent on the size of the fish being entrained rather than specific species, with higher survival being documented in small fishes (New York Power Authority 2005). Furthermore, a study conducted by Amaral (2001), noted that the mechanisms by which fish are injured or killed through turbine passage can be grouped in four categories. Those being:

1) Pressure (rapid changes in pressure from intake to tailrace)
    - Sudden pressure changes can cause physiological changes in fish (i.e. swim bladders may expand or rupture).
2) Shear and turbulence (high-velocity turbulent flow)
    - Rapid changes in the velocity of flow within the turbine components (i.e. acceleration and deceleration) can occur resulting in shear stress to fish.
3) Cavitation
    - Rapid changes in turbulence and cavitation's' as a result of gas bubble formation and collapse may result in injury to entrained fish as well as disorientation.
4) Mechanical
    - Direct contact or strike with turbine blades or turbine components. This may also include contact with other objects being passed through the turbines at the same time.
    - Abrasion or grinding of fish may also occur as fish are drawn into tight spacing with little clearance for passage.
    - The effects of direct and indirect stress may result in the fish being passed through the tailrace of the facility in a weakened or disoriented state leaving them more vulnerable to disease and predation.

With regards to pressure stress at low head hydroelectric facilities, a publication by Franke et al. (1997), observed that probable pressure-related injuries to fish are unlikely to occur at facilities with less 18m of hydraulic head. Therefore there is potential for pressure related injury or mortality of fish to occur at the proposed Wanatango Falls generating station, which has a proposed head of 9.0m. Further to this, in regards to shear and turbulence stress, some applicable studies investigating injuries related to high-velocity jets have observed little or no injury/mortality in fish at velocities up to 18m/sec (Franke *et al.* 1997).

If high velocity gradients can be shown to be minimized within the turbines at the Four Slide Falls generating station, injuries and mortality of fish related to shear and turbulence will likely be minimal. Impacts related to cavitation at the Four Slide Falls generating station are also anticipated to be minimal because of the selection of the turbines which can operate at a high rate of generation efficiency under a wide variety of flows). As cavitation is minimized through operations running at peak efficiency, concerns regarding fish injury and mortality related to cavitation will be minimized through turbine design.

Franke et al. (1997) noted that the primary cause of fish injury and mortality during turbine passage at low head facilities is the mechanical impacts related to direct strike, abrasion, grinding and disorientation. In developing the basis for "fish friendly" design criteria, Frank et al. (1997) conducted extensive evaluations of turbine survival studies and concluded that up to 40% of the variability in turbine passage survival can be attributed to mechanical attributes of the turbines such as wicket gate openings, blade speeds and comparative fish lengths. Other publications by Hedrick (1998) and Winchell et al. (2000) found that in axial flow turbines, specifications such as the number of blades, runner rotational speed and comparative fish lengths were negatively correlated to fish survival.

Further case study research related to field and laboratory studies conducted by Cada et al. (1997) listed the following criteria for minimizing the risks associated with strike related injury and fish mortality.

- Minimize the number of blades or amount of blade leading edge.
- Maximize the open space between blades and other structures.
- Use blunt leading edges instead of sharp ones.
- Minimize runner speed.
- Direct fish toward the runner hub and not the runner periphery.
- Minimize gaps between fixed and moving parts.

When assessing the influence of the proposed Wanatango Falls GS, turbine design once it is possible, the survival of entrained fish will be determined following the predictive model developed by Hedrick (1998) for axial flow turbines.

S= 109.2 – 0.027(l) – 1.038(b) – 0.045(r)

*where S is the estimate of turbine survival, l is fish length, b is the number of turbine blades, and r is the runner rotational speed in rpm.

This model equation will be used to estimate survival rates for fish of five lengths (100 to 500 mm) passing through the turbine(s) of the Four Slide Falls generating station.

6.2.6 General Construction Related Impacts and Associated Best Management Practices

The following section has been prepared to identify potential construction related impacts and associated mitigation strategies to offset these effects. Additional details regarding construction activities and associated mitigation measures has been prepared under separate cover by Canadian Projects Limited (2011) and are included in Annex II of the main EA document (Xeneca 2011a).

6.2.6.1 Construction Details

The following provides a summary of construction details as indicated in the Construction Sequencing Plan (Annex II, of the main EA document, Xeneca 2011a) and the Construction Management Plan (Annex II, of the main EA document, Xeneca 2011a).

Two 1000m^2 laydown areas have been identified on either side of the river to service the primary worksites of the intake/powerhouse and the spillway (Annex II, of the main EA document, Xeneca 2011a). The construction office will be located in the east laydown area. Additional areas of up to 5000m^2 may be required for stockpiling topsoil, excavated soil material that is unsuitable for construction use and extra blast rock

material if it cannot all be incorporated into the construction (Annex II, of the main EA document, Xeneca 2011a).

A temporary area for parking of vehicles and construction machinery will be located on the east side of the river and will cover an area of 200m^2 (Annex II, of the main EA document, Xeneca 2011a). Temporary vehicle access roads will also be required to allow for construction equipment into the GS site, these are shown along with the temporary parking area in Annex II of the main EA document (Xeneca 2011a).

A sub-station will be constructed on-site; it will have a footprint of 500m^2

Due to the nature of the proposed works, blasting of local bedrock can be expected in isolated locations such as with the creation of the spillway and tailrace. Blasting will result in the removal of bedrock to allow for required depth and grading necessary for the GS construction. Specifics on blasting activities were not known at the time of the completion of this report.

To allow for in-water work in the Frederick House River to occur in the dry, cofferdams will be temporarily installed to isolate work areas within the river (Annex II, of the main EA document, Xeneca 2011a). Water within the isolated work areas of the river will then require removal. It is not known at this time if groundwater pumping is required for localized draw down of the water table to allow work to occur in the dry (i.e. excavations). In general, specific details on dewatering are not known at this time and would be determined during the detail design phase of the project.

A total of two Type A and two Type B cofferdams are proposed. A summary of cofferdam footprint areas was provided by Xeneca and is shown in Table 12.

Table 13 Summary of Cofferdam Footprint Areas

Dewatered Areas	TYPE A	TYPE B
PHASE 1	400	3900
PHASE 2	600	5000

6.2.6.2 Erosion and Sedimentation Control

Overland flow paths within the construction areas have the potential to carry construction-related sediment to the watercourse or to open water areas of wetlands which may result in water quality impairment by altering primary productivity due to turbidity or nutrient inputs, affecting aquatic habitat by siltation of critical areas or, directly affecting fish by gill abrasion or covering/ smothering of eggs. Overland surface water flow may also impact terrestrial features by depositing construction-related sediments and other potential contaminants onto low-lying vegetation within flow paths. This may result in damage or death of vegetation within affected areas due to smothering. The loss of which may affect wildlife that use those species for foraging or other habitat purposes; however, there is no shortage of foraging areas in the vicinity .

Erosion control is the preferred method of erosion and sediment control mitigation, i.e. preventing the soil from eroding initially. This includes phasing the construction properly to minimize exposed soils and use of geotextiles or plantings to prevent erosion. Sediment barriers are placed around the construction site perimeters to prevent the migration of construction related material from leaving the site or entering a watercourse.

Erosion and sediment control is discussed in the CMP. Sediment and erosion control measures identified in this plan will be installed prior to construction and maintained diligently throughout the construction operations. The installed measures will be routinely inspected to ensure that they are maintained and functioning as designed. Erosion control devices will be left intact following construction until such time as vegetative cover is sufficiently established.

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. 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.

6.2.6.3 Blasting

Given the bedrock nature of the local topography and river bottom, in-water or near shore blasting is anticipated during construction. The use of chemical explosives in or near water produces post detonation high-energy shock waves followed by a rapid decay to below ambient hydrostatic pressure. This pressure decay causes impacts on fish. The effects of sudden changes of hydrostatic pressure may result in trauma and death of fish (particularly those with swim bladders). Injuries sustained by fish include ruptured swim bladders and haemorrhaging in the colonic and pericardial cavities. Liver, kidney, spleen, or sinus venous injuries may also occur (Wright and Hopky 1998). Fish eggs and larvae may also be killed or damaged.

The use of explosives in and near fish habitat may also result in the physical and/or chemical alteration to that habitat such as sedimentation resulting from the explosive to cover spawning areas or reduce or eliminate bottom dwelling life forms that fish use for food. Use of explosives will be controlled to minimize any such activity near fish habitats.

Any such activity will need to follow the process outlined in the publication entitled “Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters” (Wright and Hopky 1998).

If in-water blasting is required, the following permits and approvals may be required:

- Section 32 Authorization to destroy fish by means other than fishing (DFO). The blasting program should be designed with the "Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters” in mind, incorporating the mitigation measures, or others as appropriate, to prevent the destruction of fish. If, after all reasonable mitigation methods have been considered, there still exists the likelihood of killing fish; the proponent will then be required to apply for a Section 32 Authorization.

- Permit under the *Navigable Waters Protection Act* or a letter of exemption (Transport Canada).

- *Canadian Environmental Assessment Act* screening and approval, since the DFO and perhaps Transport Canada need to issue approvals.

The minimum requirements associated with DFO blasting guidelines include:

- Restriction on instantaneous pressure increases in the open water. These restrictions influence the weight of explosive and how far it needs to be buried.
- Restrictions on types of explosives (e.g. no ammonium nitrate).
- Confined explosives are generally required as opposed to unconfined.
- OMNR in water timing window restrictions for construction for spring spawning fish species (typically April 1 to June 15). Specific timing windows should be agreed to with the local OMNR as part of the permitting process.

If blasting occurs, it is not expected to have any permanent terrestrial impacts as the blasting will occur in-water or at the near shore. Any impacts as a result of noise or dust on wildlife and vegetation are expected to be minimal, localized, and temporary. Where possible, however, blasting should occur outside of known breeding periods (i.e., April-July) to limit disruption to those species.

Possible mitigating measures to avoid/reduce impacts include the use of bubble curtains or blast mats to block shock waves and contain debris, removal of fish prior to blasting, and the use of smaller charges and staggering of blasts.

6.2.6.4 Use of Cofferdams

Cofferdams are constructed to isolate any in-water work area from a water body for the purpose of enabling work under dry conditions. They are temporary structures that form an impermeable dyked enclosure which also prevent escape of debris and sediment to the exterior water body. Cofferdam material can include sandbags, sheet piling, rock fill, wood sheeting and rock filled timber cribs, depending on the size of the project and duration the cofferdam will be in place.

Temporary disturbance to additional aquatic habitat areas is anticipated during the construction of a cofferdam required to complete the dam, intake and powerhouse and tailrace construction in the dry. Impacts to aquatic habitat and biota associated with cofferdams include the potential for excess sediment to be suspended and carried downstream by river flow during the installation and removal of the dam. Depending on the size and type of cofferdam utilized the structure will have direct impacts on the substrates and habitat for which is has been placed, and has potential to strand fish within the enclosure.

Currently, the cofferdams proposed to facilitate the construction of the dam and powerhouse are Type A and Type B (see CPL drawings and construction details). Cofferdams will be designed to prevent overtopping during a 1:20 year flood event (Annex II, of the main EA document, Xeneca 2011a). It is acknowledged that the most significant potential impact during construction and removal of the cofferdam is the potential for excess sediment to be suspended and carried downstream by river flow. Due to the velocities present in this section of river, it may not possible to isolate the cofferdam construction from the channel using a silt curtain or equivalent. For these reasons the following employment of construction Best Management Practices are recommended during construction.

- Ensure that all rock materials placed into the river have been prewashed.
- Construct and remove the cofferdam during an appropriate low flow period (generally during the summer months).
- Ensure that weather forecast does not predict significant rains during the cofferdam installation or removal time 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 spring spawning fish species (typically

April 1 to June 15). Specific timing windows should be agreed to with the local OMNR as part of the permitting process.

6.2.6.5 Dewatering Operations

When cofferdams are first completed there is often a considerable amount of water retained inside of the cofferdam, in the area where work is to occur. Often fish can become stranded within the cofferdam with no access to the watercourse. If these fish are not removed prior to dewatering the isolated work area fish may not survive. In these cases, removal of the stranded fish and standing water is usually necessary before construction can proceed. A scientific collector's permit is required from the OMNR before a fish salvage can be completed.

Depending on the amount of suspended sediment in the pumped water there is the potential to impact water quality of the receiving watercourse by increasing the suspended solids loading in the watercourse above background levels. This has the potential to result in sedimentation of critical aquatic habitat such as spawning areas. It also has the potential to interfere with native fish by causing gill abrasion or interfering with foraging activities of site feeding fish.

If dewatering is required, the following permits and approvals may be required from DFO:

- Section 35 Authorization to harmfully alter, disrupt or destroy fish habitat (DFO). This requires a compensation package to address disrupted habitat.
- Section 32 Authorization to destroy fish by means other than fishing (DFO).

Dewatering activities will be done in a controlled manner so as not to discharge turbid water to the receiving watercourse. Materials such as filter bags, straw bales, filter fabric, and page-wire fencing will be on site to create a dewatering corral for waste water as a contingency plan in the event that groundwater is encountered and additional filtering properties are required. Suitable containment/treatment areas will be identified

by the Contract Administrator. The ultimate discharge point to the receiving watercourse will be monitored to ensure that the filtering is effective in removing excess sediment. The discharge point in the receiving watercourse will be carefully chosen as an area with low scour potential (i.e. bedrock bottom). If scour potential does exist, the contractor will use energy dissipation in the form of a splash pad or rock protection for the stream bottom. As mentioned above, it will also be necessary for qualified professionals under permit from the OMNR to complete a fish salvage operation from the area to be dewatered.

6.2.6.6 Clearing, Grubbing and Stockpiling

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. 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.

Travel paths, stockpile areas, and staging areas will be carefully planned and followed. Every reasonable attempt will be made to minimize the construction-related disturbance to natural features.

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.

The construction operations will include the repair and stabilization of any area disturbed during construction. This includes, but is not limited to, application of sod, topsoil, seed erosion control mats, or other suitable slope treatments.

Other Best Management Practices that can be employed to minimize impacts on terrestrial wildlife include the following:

- Limit use of machinery in and around watercourses and sensitive terrestrial areas.
- 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.
- Limit removal of vegetation during construction/maintenance to maintain habitat connectivity.
- Schedule activities to avoid migratory nesting periods.
- 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.

Lands within the construction zone reserved for laydown areas, stockpile areas and temporary construction camps will be cleared of vegetation, representing a loss of wildlife habitat within those areas. The particular locations of these areas have yet to be finalized. However, due to the relatively small size of the areas to be cleared in relation to the large extent of similar habitat on the surrounding landscape, impacts on wildlife as a result of these habitat losses is expected to be minimal to negligible.

6.2.6.7 Hazardous Material Management

Proper hazardous materials management is the first line of defense against spills occurring. In this regard, no refuelling of machinery will occur within 30m of the watercourse, and all refueling will occur on impermeable pads or pans to contain any spills. Drip pans will also be installed on equipment to capture any minor leaks. All hydraulic systems on equipment will be inspected prior to use in and around water to ensure that no spills of hydraulic oil occur into the watercourse. Any other hazardous materials, such as construction chemicals, will be stored in a designated, secure area

well away from the watercourse and other sensitive environmental features. Impervious liners or dykes will be constructed around oil, fuel, or chemical storage areas to prevent leakage into surrounding aquatic or terrestrial features. All fuels, oils and lubricants will be stored in a secondary containment area. In-water work will be halted during periods of heavy precipitation.

Appropriate types and amount of sorbent materials, oil booms, etc. will be kept on site to deal with the type and amount of chemicals which may be on site at any given time. The contractor's staff should be properly trained in the use of such materials.

In the unlikely event of a spill of hazardous materials, construction will cease immediately and all effort will be directed to the containment and clean-up of the spill. Environmental incidents will be recorded, including mitigation measures taken, and any spills reported to the Ministry of Environment Spills Action Centre. An Emergency Preparedness and Response pPlan will be prepared prior to construction, as part of this plan will include a Spill Response Plan (SRP).

7.0 Summary and Conclusions

Natural Resource Solutions Inc. was retained by Xeneca Power Development Inc*.* to complete a Natural Environmental Characterization and Impact Assessment Report for the proposed Wanatango Falls GS on the Frederick House River.

The proposed Wanatango Falls GS site is located on the Frederick House River, situated approximately 26km northwest of Iroquois Falls and 22km south of Cochrane. The site is approximately 10km downstream of the existing Frederick House Lake dam and approximately 600m upstream of Zeverley's Road. The Frederick House River originates in Night Hawk Lake and flows northerly approximately 9km to Frederick House Lake. From Frederick House Lake, the river continues to flow north until it joins the Abitibi River. The Frederick House River is a large and turbid watercourse that is contained within a well-defined, narrow floodplain. The bottom substrates consist predominately of sand and clay. Three bedrock features exist within the river project area, the middle being Wanatango Falls. This natural riffle and chute feature is the location of the proposed GS site. Aquatic studies completed by NRSI in 2010 and 2011 indicate the presence of 20 fish species within the study area reach of the river. Suitable spawning habitat for several of these species, including Lake Sturgeon and Walleye was also identified.

The surrounding landscape is composed of a black spruce forest community, interspersed with a few tributary related wetlands. There is little overall disturbance to this vegetation within the study area. Vegetation communities identified within the study area represent one forest and three wetland communities. No designated natural areas or significant vegetation species or communities exist in the study area. Wildlife studies conducted by NRSI in 2010 indicated that a variety of wildlife was found to be using the study area.

Based on a review of background information, communication with the OMNR, and NRSI's field surveys, significant and/or sensitive species have been identified within the study area. These include species such as Walleye, Sauger, Northern Pike, and Lake

Whitefish which have been acknowledged as Valued Ecosystem Components (VEC's). Three SAR may be present within the study area, but were not observed by NRSI biologists during 2010 or 2011 field visits. These species include the peregrine falcon, chimney swift, and bobolink. Candidate Significant Wildlife Habitat was identified within the study area for denning sites for mink, otter, gray wolf, eastern wolf, Canada lynx, marten, fisher, and black bear. common nighthawk nesting and foraging. olive-sided flycatcher nesting and foraging, and northern long-eared bat roosts and nurseries.

Confirmed Significant Wildlife Habitat was also identified within the study area for bald eagle nesting and foraging and Canada warbler nesting and foraging.

Based on current conceptual design provided by Xeneca and construction management planning as well as knowledge of the existing natural environmental and significance and sensitivity of species identified as occurring within the study area, impact assessments were completed.

Habitat loss will be the primary terrestrial impact to occur within the project area as a result of the GS footprint, flooding of the inundation area, and other related construction activities. Minor portions of riparian habitat that may include areas of significant wildlife habitat for bald eagle and Canada warbler nesting, foraging and breeding, as well as chimney shift habitat (SAR) and all other wildlife species will be newly inundated in the vicinity of the Frederick House River, although, new habitats will be created along the new shorelines of the inundation area that will provide similar ecological functions. Consequently, loss of habitat will likely have a negligible long-term impact on these species in the vicinity of the project area. Intermittent water level fluctuation within the inundation area will inhibit growth of emergent vegetation along shorelines, removing a source of food for area species, such as moose.

Moreover, the total area of impact represents a small proportion of these species' habitat types relative to that which exists on the surrounding landscape outside the study area. Therefore, we anticipate that impacts to the terrestrial features within the study area will have minimal to negligible impacts on these species in the broad landscape context.

Specific mitigation measures have been developed to further limit impacts on wildlife and their habitats. These include specific measures to mitigate impacts on chimney swift populations within the study area, as well as measures to limit impacts on all wildlife and vegetation communities as a result of general construction activities. Mitigation measures have also been proposed to limit impacts on shoreline-based mammals (e.g. beavers, otters) and on wetland habitats and their dependent wildlife. It is anticipated that implementation of these mitigation measures will result in low levels of impacts to terrestrial wildlife and habitats within the study area.

Various components of the facility including the dam, spillway, GS and tailrace may result in the permanent loss of fish habitat. Similarly, permanent alteration of fastwater habitats upstream of the dam will occur due to inundation. In these cases, it will be necessary to design compensation habitats which are acceptable to DFO.

Results of fish passage studies indicate that movement of Walleye, Sauger and Saugeye is possible through the proposed Wanatango Falls GS dam location site. As such, it is anticipated that the creation of the dam will impede passage of these species as well as other species. Consideration for structures (i.e fish ladders) that allow for the maintenance of upstream and downstream passage should be discussed with local OMNR.

Impacts associated with the upstream water level fluctuations are anticipated to be very limited and include reduced spawning function for those fish utilizing the shallow riparian areas where daily fluctuations will be most pronounced. Shoreline erosion is another impact that is anticipated to have limited potential due to the upstream water level fluctuations. In winter months, movement of ice on the water's surface may result in sediment scouring, sediment movement or turbidity along the shoreline.
Although impacts associated with the upstream water level functions are deemed to be limited, once operating if an impact occurs, Xeneca may need to make adjustments to their operating plan to mitigate any observed impacts.

The operation of the power facility will result in changes to the flow regime downstream of the facility, relative to the existing conditions within the by-pass reach and the downstream variable flow reach. Changes in flow have potential to alter existing habitat that affords cover , and suitable spawning habitat for Walleye, Lake Sturgeon, Lake Whitefish, Sauger, and other species, benthic invertebrate production as well as contributes to dissolved oxygen concentrations. As such, it will be necessary to ensure that adequate flow is maintained. In order to predict the required flows necessary to protect the function of this habitat, it will be necessary to undertake HEC RAS modeling studies to determine the depth, velocity and wetted width of that habitat under a range of flows.

Impacts associated with entrainment and impingement will be determined through comparison of swim velocity literature review results with the proposed design velocities at the intake of the GS (at the trash racks), to determine the relative risk of juvenile and adult fish species of being entrained or impinged. Should the ultimate intake design not allow for intake velocities lower than burst swimming capabilities of the various species of concern there are numerous other potential modifications that can be made at the intake to prevent entrainment an impingement.

Mitigation strategies will include implementation of construction best management practices (BMPs). The proposed compensation for anticipated impacts related to the construction of the GS will be developed and discussed with DFO and MNR once the engineering details for the project have been advanced during the permitting phase of the project.

There is potential for pressure related injury or mortality of fish to occur at the proposed Wanatango Falls GS. If high velocity gradients can be shown to be minimized within the turbines at the Wanatango Falls generating station, injuries and mortality of fish related to shear and turbulence will likely be minimal. Impacts related to cavitation at the Wanatango Falls generating station are also anticipated to be minimal because of the selection of the turbines which can operate at a high rate of generation efficiency under a wide variety of flows). As cavitation is minimized through operations running at peak

efficiency, concerns regarding fish injury and mortality related to cavitation will be minimized through turbine design.

In summary, biological studies have been completed to date to document existing aquatic, terrestrial and wetland conditions. Potential impacts on these features have been identified based on conceptual design details, proposed operational plans and construction details. Mitigation strategies to offset these impacts have been provided. Appropriate compensation for impacts that cannot be mitigated will be determined in the detailed design phase of the project. Specific biological studies may be required at that time to inform permit applications with the relevant agencies such as DFO and the MNR. Monitoring will also be necessary during and post construction to ensure compliance with permit conditions and to guide adaptive management decision making.

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APPENDIX I

2011 XENECA APPROVED FIELD WORK PLAN

Wanatango Falls 2011 Field Investigations Work Plan

Field Work Component	Rationale for Undertaking	General Description of Methods
Spring Walleye and Sauger Spawning Surveys (angling, netting, visual surveys and egg matting)	Sampling is intended to further document spawning activity and suitable Walleye and Sauger spawning habitats at Wanatango and Zeverley's Falls and at other potential spawning locations in the 2.0km Variable Flow Reach as well as the 8.5km inundation area.	• Egg matting will be conducted in all known critical spawning habitats including potential tributaries • Visual spotlighting to document walleye spawning activity • Netting and angling will be utilized to collect walleye confirming their presence in the vicinity of spawning habitats and their spawning condition.
Summer Fish Community Sampling and Habitat Characterization of tributaries	Sample tributaries within the 2.0km Variable Flow Reach (6 minor) and the 8.5km inundation zone (10 minor) to determine fish communities	• Electrofishing and minnow trap deployments in tributaries. • Document habitat characteristics of the tributaries for a distance of 250m upstream from the confluence with the Frederickhouse River • Collect general water quality information on tributaries (dissolved oxygen, pH, conductivity, water temperature)
Summer Fish Community Sampling and Habitat Characterization in the Main Stem of the Ivanhoe River	Sampling is intended to provide an understanding of the fish community (species diversity) and associated habitats present in the main stem of the Frederickhouse River in the 2.0km Variable Flow Reach and the 8.5km inundation area. This information is required in order to predict impacts and develop mitigation strategies.	• Gill netting, hoop/trap netting, trot lines and angling will be employed to sample fish from Frederickhouse River • Some of the fish specimens collected during this program will be sacrificed for Methyl Mercury analysis (fish tissue) • Document the aquatic habitat features with particular focus on critical spawning and nursery habitats for key species • Collect specific habitat measurements to quantify critical habitats and determine relative significance
Invertebrate Sampling	Sampling is intended to provide a general representation of the baseline benthic invertebrate communities found in critical habitat areas as well as to better understand the relative abundance of benthic invertebrates. This data is being provided in response to MNR requests for all projects. This will include samples from the 2.0km Variable Flow Reach and the 8.5km inundation area.	• Collection of benthic invertebrates from riffle areas within main stem of the Frederickhouse River • We have assumed that a maximum number of 15 benthic invertebrate stations will be sampled.
Methyl Mercury (fish tissue)	This sampling and fish tissue analysis is an EA requirement of MOE. Please note that the majority of fish will be collected during the summer fish community sampling within the 2.0km Variable Flow Reach and the 8.5km inundation area.	• Gill netting, hoop/trap netting, trot lines and angling will be employed to sample fish from Frederickhouse River • The majority of fish tissue will be collected during the summer sampling programs but additional time has been provided to ensure the collection of sufficient numbers and species of fish. • Tissue sample collection and preservation. • Delivery of samples to lab in required time frames

APPENDIX II

XENECA POWER HYDROELECTRIC DEVELOPMENTS TRANSMISSION LINE AND ACCESS ROAD NATURAL ENVIRONMENT PRELIMINARY ANALYSIS (NRSI)

Xeneca Power Hydroelectric Developments
Transmission Line and Access Road
Natural Environment Preliminary Analysis

Upper Vermillion
Wabagishik
Allan & Struthers
Wanatango Falls
The Chutes
Third Falls
McCarthy Chutes
Four Slide Falls

Prepared for:
Xeneca Power Development Inc.
5160 Yonge Street, Suite 520
Toronto, Ontario
M2N 6L9

Project No. 1016D

Date: March 11, 2011

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Xeneca Power Hydroelectric Developments
Transmission Line and Access Road
Natural Environment Preliminary Analysis

Project Team:

Staff	Role
Dan Gibson	Aquatic Biologist
Brett Woodman	Terrestrial and Wetland Biologist
Robin Boles	Terrestrial and Wetland Biologist
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Shawn MacDonald	GIS Technician

Report submitted on March 11, 2011

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1.0 Preliminary Analysis Overview

Natural Resource Solutions Inc. (NRSI) was retained by Xeneca Power Development Inc. (Xeneca) to complete a preliminary analysis of the natural environment associated with the proposed transmission line and access road corridors for several Hydroelectric Generating Station projects in Northern Ontario. The proposed Hydroelectric Generating Stations are identified in Table 1, below. Mapping for each of the sites is provided in Appendix I.

Table 1. Proposed Hydroelectric Generating Stations

Proposed Hydroelectric Generating Station	River
Upper Vermillion (McPherson Falls, Cascade Falls & Soo Crossing)	Vermillion
Wabagishik	Vermillion
Allan & Struthers	Wanapitei
Wanatango Falls	Frederickhouse
The Chutes	Ivanhoe
Third Falls	Ivanhoe
McCarthy Chutes	Serpent
Four Slide Falls	Serpent

This preliminary analysis was conducted in conjunction with NRSI's work on the 2010/2011 Natural Environment Characterization and Impact Assessment Reports for each of these sites, and is informed by the results of the Natural Environment Characterization.

The investigations were conducted on the transmission line and access road routes provided by Xeneca on January 26, 2011. The study area was considered to extend 250m on each side of the proposed routes, resulting in the investigation of 500m-wide corridors.

The investigation into the corridors included a background review, air photo interpretation, and GIS analysis. The background review included an analysis of designated natural areas, significant vegetation communities and habitats, and significant species. To complete the background review, NRSI consulted the Ministry of Natural Resources (MNR) Natural Heritage Information Centre (NHIC) Biodiversity

Explorer mapping tool and information database (NHIC 2010), the Ontario Breeding Bird Atlas (OBBA, Cadman *et al*. 2007), the Ontario Herpetofauna Atlas (Oldham and Weller 2000), the Ontario Reptile and Amphibian Atlas (Ontario Nature 2010) and the Atlas of the Mammals of Ontario (Dobbyn 1994). In searching the NHIC database and the OBBA, the study areas were located within a 10km grid. NHIC results are returned collectively for all relevant grid squares, while OBBA data are provided for each separate square.

Local district MNR offices were contacted to provide background information on the natural heritage features known to be in the vicinity of the proposed corridors. At the time this report was prepared, MNR responses had not been issued for all sites. Where applicable, Site Information Packages and associated MNR Values Resource Mapping provided by the MNR for the inundation area associated with the proposed developments have been incorporated into this preliminary analysis, along with any other background information collected as part of the inundation reporting.

Air photo interpretation was used to identify potential watercourse crossings along the proposed routes as well as potential wetlands within the study area. Air photo interpretation was conducted on 1:10,000 scale satellite imagery. Results from the air photo interpretation were incorporated into NRSI's GIS, and were used to analyze the potential effects of the proposed routes.

Selected natural resource feature data, such as moose aquatic feeding areas and bird nesting areas, were obtained from Land Information Ontario. These data were overlaid onto satellite imagery for further analysis.

A summary of the results of the preliminary analysis are provided in Table 2, below. Mapping for each site is provided in Appendix I – VIII. Details regarding each watercourse crossing and background information results for OBBA and NHIC data are provided in Appendix IX – XVI. Based upon the background review, air photo interpretation, and GIS analysis, points of concern regarding the routes have been identified for each site and are discussed below.

Table 2. Preliminary Analysis of Transmission Line and Access Road Routes

Site	Surficial Geology	Corridor Length (km) (Transmission Line/Access Road)	Number of Stream Crossings	Number of Wetland Crossings	Linear km of Wetlands Crossed	Known Significant Natural Features Crossed	NHIC Background Review Search Results (Federal/Provincial Status is provided for first occurrence)	Significant Species Identified in Agency Correspondence	Significant Species Identified in Background Review
Upper Vermillion	Till Veneer	20.5/10.5	15/4	15/5	1.2/0.64	None	Peregrine Falcon (*Falco peregrines*, SC/THR), Eastern Milksnake (*Lampropeltis t. triangulum*, SC/SC), Large Water-starwort (*Callitriche heterophylla*, none/provincially rare)	None	Short-eared Owl (*Asio flammeus*, SC/SC), Peregrine Falcon, Common Nighthawk (*Chordeiles minor*, T Sch 1/SC), Whip-poor-will (*Caprimulgus vociferous*, T No Sch/THR), Chimney Swift (*Chaetura pelagic*, T Sch 1/THR), Olive-sided Flycatcher (*Contopus cooperi*, T Sch 1/SC), Golden-winged Warbler (*Vermivora chrysoptera*, T Sch 1/SC), Canada Warbler (*Wilsonia canadensis*, T Sch 1/SC), Bobolink (*Dolichonyx oryzivorus*, T No Sch/THR), Common Snapping Turtle (*Chelydra s. serpentine*, SC/SC), Blanding's Turtle (*Emydoidea blandingii*, T/THR), Eastern Milksnake, Eastern Massasauga Rattlesnake (*Sistrurus c. catenatus*, T/THR), Northern Long-eared Bat (*Myotis septentrionalis*, none/provincially rare)
Wabagishik	Coarse Grained, Till Veneer	10.6/3.8	10/2	6/1	1.2/0.065	None	Blanding's Turtle, Eastern Milksnake, Purplish Copper (*Lycaena helloides*, none/provincially rare)	Lake Sturgeon (*Acipenser fulvescens*, Great Lakes – Upper St. Lawrence pop., T No Sch/THR)	Common Nighthawk, Whip-poor-will, Chimney Swift, Olive-sided Flycatcher, Canada Warbler, Bobolink, Common Snapping Turtle, Blanding's Turtle, Eastern Milksnake, Northern Long-eared Bat
Allan & Struthers	Till Veneer, Undivided	14.4/4.3	22/3	23/1	1.4/0.022	Moose Aquatic Feeding Areas: 2/0	Blanding's Turtle, Northern Map Turtle (*Graptemys geographica*, SC/SC), Eastern Milksnake, Eastern Massasauga Rattlesnake, Purplish Copper	Lake Sturgeon (Great Lakes – Upper St. Lawrence pop.), Blanding's Turtle, Eastern Massasauga Rattlesnake, Manitoba Elk (*Cervus elaphus manitobensis,* none/none)	Olive-sided Flycatcher, Canada Warbler, Blue-/Golden-winged Warbler, Bobolink, Common Snapping Turtle, Blanding's Turtle, Northern Map Turtle, Eastern Milksnake, Eastern Hog-nosed Snake (*Heterodon platirhinos*, T/THR), Eastern Massasauga Rattlesnake, Northern Long-eared Bat
Wanatango Falls	Till Blanket, Organic Deposit, Fluvial	42.0/0.67	17/0	9/0	0.68/0	Moose Aquatic Feeding Areas: 1/0	None	Lake Sturgeon (Southern Hudson Bay – James Bay pop., SC/SC)	Common Nighthawk, Bobolink, Rusty Blackbird (*Euphagus carolinus*, SC/NAR), Northern Long-eared Bat
The Chutes	Till Blanket	41.8/0.08	25/0	15/0	1.9/0	Moose Aquatic Feeding Areas: 5/0 Nesting Sites: 1/0 Fish Spawning Sites: 2(Walleye)/0	Vimy Lake Uplands Conservation Reserve, Groundhog River Waterway Provincial Park	Lake Sturgeon (Southern Hudson Bay – James Bay pop.)	None
Third Falls	Till Blanket	57.1/0.5	30/0	26/0	6.2/0	Moose Aquatic Feeding Areas: 10/0	Lake Sturgeon (Southern Hudson Bay – James Bay pop.), Nova Township Clay Plain Peatlands, Groundhog River Waterway Provincial Park	Lake Sturgeon (Southern Hudson Bay – James Bay pop.)	Olive-sided Flycatcher, Rusty Blackbird
McCarthy Chutes	Till Veneer	11.7/0.33	10/0	9/0	0.53/0	None	Lake Sturgeon (Great Lakes – Upper St. Lawrence pop.), Eastern Milksnake, Enhanced Management Area - Serpent River, Recreation	Peregrine Falcon, Bald Eagle (*Haliaeetus leucocephalus*, NAR/SC), Blanding's Turtle, Eastern Milksnake, Eastern Cougar (*Puma concolor*, none/END), Monarch (*Danaus plexippus*, SC/SC)	Olive-sided Flycatcher, Common Nighthawk, Canada Warbler, Bobolink, Rusty Blackbird, Common Snapping Turtle, Wood Turtle (*Glyptemys insculpta*, T/END), Blanding's Turtle, Northern Map Turtle, Eastern Milksnake, Northern Long-eared Bat
Four Slide Falls	Undivided, Till Veneer	11.8/5.0	8/4	5/2	0.63/0.15	None	Lake Sturgeon (Great Lakes – Upper St. Lawrence pop.), Eastern Milksnake, Enhanced Management Area - Serpent River, Recreation	Peregrine Falcon, Bald Eagle, Blanding's Turtle, Eastern Milksnake, Eastern Cougar, Monarch	Whip-poor-will, Canada Warbler, Common Snapping Turtle, Wood Turtle, Blanding's Turtle, Northern Map Turtle, Eastern Milksnake, Northern Long-eared Bat

Table 2. cont'd.

Legend	
Provincially Rare	Provincial SRank S1 (Critically Imperilled), S2 (Imperilled), or S3 (Vulnerable)
NAR	Not at Risk
SC	Special Concern
T	Nationally Threatened
THR	Provincially Threatened, and afforded protection under the Endangered Species Act (ESA, MNR 2007)
END	Provincially Endangered, and afforded protection under the ESA
No Sch	Species does not appear on Schedule 1 of the Species at Risk Act (SARA, Department of Justice 2002), and thus is not afforded SARA protection
Sch 1	Species appears on Schedule 1 of SARA, and is thus afforded SARA protection on private and provincial crown land

2.0 Points of Concern

2.1 Upper Vermillion

Table 3. Areas of Concern for the Upper Vermillion Site.

Area of Concern	Type	Mitigation Recommended	Proposed Route Change on Map
1	Wetland crossing	Avoid	Yes
2	Creek and wetland crossing	Avoid	Yes
3	Creek and wetland crossing	Avoid	Yes
4	Wetland crossing	Avoid	Yes
5	Creek and wetland crossing	Avoid	Yes
6	Wetland crossing	Avoid	Yes
7	Wetland crossing	Avoid	Yes
8	Wetland crossing	Avoid by following proposed access road	Yes
9	Wetland crossing	Avoid	Yes

2.2 Wabagishik

Table 4. Areas of Concern for the Wabagishik Site.

Area of Concern	Type	Mitigation Recommended	Proposed Route Change on Map
1	Creek and wetland crossing	Avoid widest section, crossing further west	Yes
2	Wetland crossing	Avoid	Yes

2.3 Allan & Struthers

Table 5. Areas of Concern for the Allan & Struthers Site.

Area of Concern	Type	Mitigation Recommended	Proposed Route Change on Map
1	Wetland crossing	Avoid wetland, crossing further south	Yes
2	Creek and wetland crossing	Avoid wetland, crossing further north	Yes
3	Creek and wetland crossing	Avoid wetland, crossing further north	Yes
4	Creek and wetland crossing	Avoid wetland, crossing further north	Yes
5	Creek and wetland crossing	Avoid eastern edge of wetland by crossing further south	Yes
6	Wetland crossing	Avoid wetland, crossing further north	Yes
7	Wetland crossing	Avoid wetland, crossing further	Yes

		north	
8	Creek and wetland crossing	Avoid widest section, crossing further north	Yes
9	Creek and wetland crossing	Avoid	Yes
10	Wetland crossing	Avoid	Yes
11	Creek crossing	Avoid	Yes
12	Creek crossing	Avoid	Yes

2.4 Wanatango Falls

Table 6. Areas of Concern for the Wanatango Falls Site.

Area of Concern	Type	Mitigation Recommended	**Proposed Route Change on Map**
1	Forest	Avoid by following road	Yes
2	Creek and wetland crossing	Avoid by following road	Yes
3	Forest	Avoid by following road	Yes
4	Wetland crossing	Avoid by following road	Yes
5	Creek crossing	Avoid widest section, crossing further north along road	Yes

2.5 The Chutes

Table 7. Areas of Concern for The Chutes Site.

Area of Concern	Type	Mitigation Recommended	Proposed Route Change on Map
1	Wetland crossing	Avoid by following road	Yes
2	Creek and wetland crossing	Avoid by following road	Yes
3	Wetland crossing	Avoid by following road	Yes
4	Wetland crossing	Avoid by following road	Yes
5	Creek and wetland crossing	Avoid by following road	Yes
6	Creek and wetland crossing	Avoid by following road	Yes
7	Wetland crossing	Avoid by following road	Yes
8	Wetland crossing	Avoid by following road	Yes
9	Aquatic feeding area	Avoid by following road	Yes
10	Wetland crossing	Avoid by following road	Yes
11	Wetland crossing	Avoid by following road	Yes
12	Wetland crossing	Avoid by following road	Yes
13	Spawning area	Avoid by following road	Yes
14	Wetland crossing	Avoid by following road	Yes
15	Spawning area	Avoid by following road	Yes
16	Wetland crossing	Avoid by following road	Yes
17	Creek and	Avoid by following road	Yes

	wetland crossing		
18	Spawning area	Avoid by following road	Yes
19	Wetland crossing	Avoid by following road	Yes

2.6 Third Falls

Table 8. Areas of Concern for the Third Falls Site.

Area of Concern	Type	Mitigation Recommended	**Proposed Route Change on Map**
1	Creek crossing	Avoid	Yes
2	Wetland crossing	Avoid by following road	Yes
3	Wetland crossing	Avoid by following road	Yes
4	Wetland crossing	Avoid by following road	Yes
5	Conservation reserve	Avoid by following road	Yes
6	Creek crossing	Avoid by following road	Yes
7	Creek crossing	Avoid by following road	Yes
8	Wetland crossing	Avoid	Yes
9	Wetland crossing	Avoid	Yes
10	Wetland crossing	Avoid by following road	Yes
11	Wetland crossing	Avoid	Yes
12	Wetland crossing	Avoid by following road	Yes
13	Wetland crossing	Avoid	Yes
14	Wetland crossing	Avoid	Yes
15	Creek crossing	Avoid two crossings by crossing further north	Yes
16	Creek and wetland crossing	Avoid wider section by crossing further north	Yes
17	Wetland crossing	Avoid by crossing further north	Yes
18	Wetland crossing	Avoid by crossing further north	Yes
19	Wetland crossing	Avoid by crossing further north	Yes

2.7 McCarthy Chutes

Table 9. Areas of Concern for the McCarthy Chutes Site.

Area of Concern	Type	Mitigation Recommended	**Proposed Route Change on Map**
1	Wetland crossing	Avoid widest section, crossing further south	Yes
2	Creek and wetland crossing	Avoid	Yes
3	Creek and wetland crossing	Avoid	Yes
4	Wetland crossing	Avoid	Yes
5	Creek crossing	Avoid widest section, crossing further south	Yes
6	Creek and wetland crossing	Avoid	Yes

7	Wetland crossing	Avoid by following road	Yes
8	Creek crossing	Avoid by following road	Yes

2.8 Four Slide Falls

Table 10. Areas of Concern for the Four Slide Falls Site.

Area of Concern	Type	Mitigation Recommended	**Proposed Route Change on Map**
1	Wetland crossing	Avoid	Yes
2	Creek and wetland crossing	Avoid by following road	Yes
3	Wetland crossing	Avoid by following road	Yes
4	Wetland crossing	Avoid by following road	Yes
5	Creek and wetland crossing	Avoid majority of wetland by following existing trail where possible	Yes

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Wanatango Falls

Key Map

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

March 2, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:95,000 (11x17")

Wanatango Falls

CONC 5 & 6 NEWMARKET

CONC 2 & 3 NEWMARKET

WILSON LAKE RD

Frederick House Lake

CAMP BICKELL RD

HWY 67

CONNAUGHT RD

HWY 610

DUGALL RD

CARRIGAN RD

HWY 803

Legend

- Study Area
- Site Location
- Point of Connection (PC)
- Point of Common Coupling (PCC)
- 28kV Line
- Access Road
- Railway
- Primary Road
- Secondary Road
- Tertiary Road
- Watercourse
- Waterbody
- Wetland Area
- Elevation Contour (10m Interval)

Kilometers
0 1 2 3 4 5

488000 490000 492000 494000 496000 498000 500000 502000 504000 506000 508000 510000

5412000 5410000 5408000 5406000 5404000 5402000 5400000 5398000 5396000 5394000 5392000 5390000 5388000 5386000 5384000 5382000 5380000 5378000 5376000

NRSI_1052_Wanatango_KeyMap_95K_2011_03_02_SWM

Map - 1

Wanatango Falls

Transmission Line and Access Road
Natural Environment Preliminary Analysis

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

February 23, 2011
Project: 1016D
NAD83 - UTM Zone 17
Scale:1:10,000 (11x17")

N

494000 495000 496000

5412000 5411000 5410000 5409000

Wanatango Falls
CKC-001
CKC-002
WCR-001
WCR-002
CONNAUGHT EVELYN RD

Legend

- Creek Crossing (CKC)
- Site Location
- Point of Connection (PC)
- Point of Common Coupling (PCC)
- 28kV Line
- Access Road
- Primary Road
- Secondary Road
- Tertiary Road
- Watercourse
- Waterbody
- Wetland Area
- Tourism Establishment Area
- Aquatic Feeding Area
- Wetlands (NRSI)
- Elevation Contour (10m Interval)

0 200 400 600 Meters

Map - 2

Wanatango Falls

Transmission Line and Access Road
Natural Environment Preliminary Analysis

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

February 23, 2011
Project: 1016D
NAD83 - UTM Zone 17
Scale:1:10,000 (11x17")

N

495000
496000
5409000
5408000
5407000
5406000

WCR-003
WCR-004
CKC-003
CKC-004
WCR-005
WCR-006
CKC-005
WCR-007
WCR-008
CONNAUGHT EVELYN RD

Legend

- Creek Crossing (CKC)
- 28kV Line
- Primary Road
- Secondary Road
- Tertiary Road
- Watercourse
- Waterbody
- Wetland Area
- Wetlands (NRSI)
- Elevation Contour (10m Interval)

Meters
0 200 400 600

NRSI_1052_Wanatango_KeyMap2_2011_02_18_GCS

Map - 3

Wanatango Falls

Transmission Line and Access Road
Natural Environment Preliminary Analysis

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

February 23, 2011
Project: 1016D
NAD83 - UTM Zone 17
Scale:1:10,000 (11x17")

N

495000 496000 497000

5405000 5404000 5403000 5402000

WCR-009

WCR-0010

WCR-011

1

Legend

- Possible Alternative
- 28kV Line
- Primary Road
- Secondary Road
- Tertiary Road
- Watercourse
- Waterbody
- Wetland Area
- Aquatic Feeding Area
- Area of Concern
- Wetlands (NRSI)
- Elevation Contour (10m Interval)

Meters
0 200 400 600

NRSI_1052_Wanatango_KeyMap3_2011_02_18_GCS

Map - 4

Wanatango Falls

Transmission Line and Access Road
Natural Environment Preliminary Analysis

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

February 23, 2011
Project: 1016D
NAD83 - UTM Zone 17
Scale:1:10,000 (11x17")

N

496000 497000

5401000 5400000 5399000 5398000

WCR-011
CKC-006
WCR-012
WCR-013
2
CKC-007
WCR-015
CKC-008
WCR-014
WCR-016
CKC-009

Legend

- Creek Crossing (CKC)
- Possible Alternative
- 28kV Line
- Primary Road
- Secondary Road
- Tertiary Road
- Watercourse
- Waterbody
- Wetland Area
- Aquatic Feeding Area
- Area of Concern
- Wetlands (NRSI)
- Elevation Contour (10m Interval)

Meters
0 200 400 600

NRSI_1052_Wanatango_KeyMap4_2011_02_18_GCS

Map - 5

Wanatango Falls

Transmission Line and Access Road
Natural Environment Preliminary Analysis

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

February 23, 2011
Project: 1016D
NAD83 - UTM Zone 17
Scale:1:10,000 (11x17")

N

496000 497000

5397000 5396000 5395000 5394000

3

WCR-017

Legend

- Recreation Point
- Possible Alternative
- 28kV Line
- Primary Road
- Secondary Road
- Tertiary Road
- Watercourse
- Waterbody
- Wetland Area
- Aquatic Feeding Area
- Area of Concern
- Wetlands (NRSI)
- Elevation Contour (10m Interval)

Produced using information provided by Xeneca Power Development and base data provided under license by the Ministry of Natural Resources, copyright the Queen's Printer of Ontario. Satellie Imagery provided by MapMart

0 200 400 600 Meters

NRSI_1052_Wanatango_KeyMap5_2011_02_18_GCS

Map - 6

Wanatango Falls

Transmission Line and Access Road
Natural Environment Preliminary Analysis

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

February 23, 2011
Project: 1016D
NAD83 - UTM Zone 17
Scale:1:10,000 (11x17")

N

498000
499000
5394000
5393000
5392000
5391000

ICE CHEST LK RD
SUMMER RD

WCR-018
WCR-019
WCR-020
WCR-021
4

Legend

- Recreation Point
- Possible Alternative
- 28kV Line
- Primary Road
- Secondary Road
- Tertiary Road
- Watercourse
- Waterbody
- Wetland Area
- Waste Disposal Site
- Cottage Residential Site
- Cottage Residential Area
- Camp Recreation
- Aquatic Feeding Area
- Area of Concern
- Wetlands (NRSI)
- Elevation Contour (10m Interval)

Meters
0 200 400 600

NRSI_1052_Wanatango_KeyMap6_2011_02_18_GCS

Map - 7

Wanatango Falls

Transmission Line and Access Road
Natural Environment Preliminary Analysis

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

February 23, 2011
Project: 1016D
NAD83 - UTM Zone 17
Scale:1:10,000 (11x17")

N

499000 500000 501000

5390000 5389000 5388000 5387000

WCR-022
CKC-010
CKC-011
WCR-023
WCR-024

Legend

- Creek Crossing (CKC)
- Possible Alternative
- 28kV Line
- Primary Road
- Secondary Road
- Tertiary Road
- Watercourse
- Waterbody
- Wetland Area
- Aquatic Feeding Area
- Wetlands (NRSI)
- Elevation Contour (10m Interval)

0 200 400 600 Meters

NRSI_1052_Wanatango_KeyMap7_2011_02_18_GCS

Map - 8

Wanatango Falls

Transmission Line and Access Road
Natural Environment Preliminary Analysis

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

February 23, 2011
Project: 1016D
NAD83 - UTM Zone 17
Scale:1:10,000 (11x17")

N

CKC-011
WCR-023
WCR-024
CKC-012
WCR-025

499000
500000
501000
5387000
5386000
5385000
5384000

Legend

- Creek Crossing (CKC)
- Possible Alternative
- 28kV Line
- Primary Road
- Secondary Road
- Tertiary Road
- Watercourse
- Waterbody
- Wetland Area
- Wild Rice Stand
- Aquatic Feeding Area
- Wetlands (NRSI)
- Elevation Contour (10m Interval)

Meters
0 200 400 600

NRSI_1052_Wanatango_KeyMap8_2011_02_18_GCS

Map - 9

Wanatango Falls

Transmission Line and Access Road
Natural Environment Preliminary Analysis

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

February 23, 2011
Project: 1016D
NAD83 - UTM Zone 17
Scale:1:10,000 (11x17")

N

499000 500000 501000

5383000 5382000 5381000 5380000

WCR-026

WCR-027

HWY 610

DUGALL RD

CARRIGAN RD

Legend

- Possible Alternative
- 28kV Line
- Railway
- Primary Road
- Secondary Road
- Tertiary Road
- Watercourse
- Waterbody
- Wetland Area
- Work Camp
- Nesting Site
- Wild Rice Stand
- Aquatic Feeding Area
- Wetlands (NRSI)
- Elevation Contour (10m Interval)

Meters
0 200 400 600

NRSI_1052_Wanatango_KeyMap9_2011_02_18_GCS

Map - 10

Wanatango Falls

Transmission Line and Access Road
Natural Environment Preliminary Analysis

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

February 23, 2011
Project: 1016D
NAD83 - UTM Zone 17
Scale:1:10,000 (11x17")

498000
499000
5380000
5379000
5378000
5377000

HWY 610
LITTLE RD
CARRIGAN RD
WCR-027
WCR-028
CKC-013
HWY 101

Legend

- Creek Crossing (CKC)
- Possible Alternative
- 28kV Line
- Railway
- Primary Road
- Secondary Road
- Tertiary Road
- Watercourse
- Waterbody
- Wetland Area
- Nesting Site
- Aquatic Feeding Area
- Wetlands (NRSI)
- Elevation Contour (10m Interval)

N

Meters
0 200 400 600

NRSI_1052_Wanatango_KeyMap10_2011_02_18_GCS

Map - 11

Wanatango Falls

Transmission Line and Access Road
Natural Environment Preliminary Analysis

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

February 23, 2011
Project: 1016D
NAD83 - UTM Zone 17
Scale:1:10,000 (11x17")

494000 495000 496000 497000

5377000

5376000

HWY 610

HWY 101

CKC-014

CKC-015

5

CKC-016

CKC-017

WCR-029

Legend

- Creek Crossing (CKC)
- Possible Alternative
- Point of Connection (PC)
- Point of Common Coupling (PCC)
- 28kV Line
- Railway
- Primary Road
- Secondary Road
- Tertiary Road
- Watercourse
- Aquatic Feeding Area
- Area of Concern
- Wetlands (NRSI)
- Waterbody
- Wetland Area
- Elevation Contour (10m Interval)

N

Meters
0 200 400 600

NRSI_1052_Wanatango_KeyMap11_2011_02_18_GCS

APPENDIX III

AQUATIC ASSESSMENT MAPPING

Figure 1

Wanatango Falls Hydroelectric Generating Station

Key Map

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 3, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:25,000 (11x17")

494000 495000 496000 497000 498000 499000

5414000 5413000 5412000 5411000 5410000 5409000 5408000 5407000 5406000 5405000

Downstream Limit of Study

Zeverley's Bridge

Map 1

REAUME ESKER RD

Wanatango Falls

Map 2

CONNAUGHT EVELYN RD

Map 3

Map 4

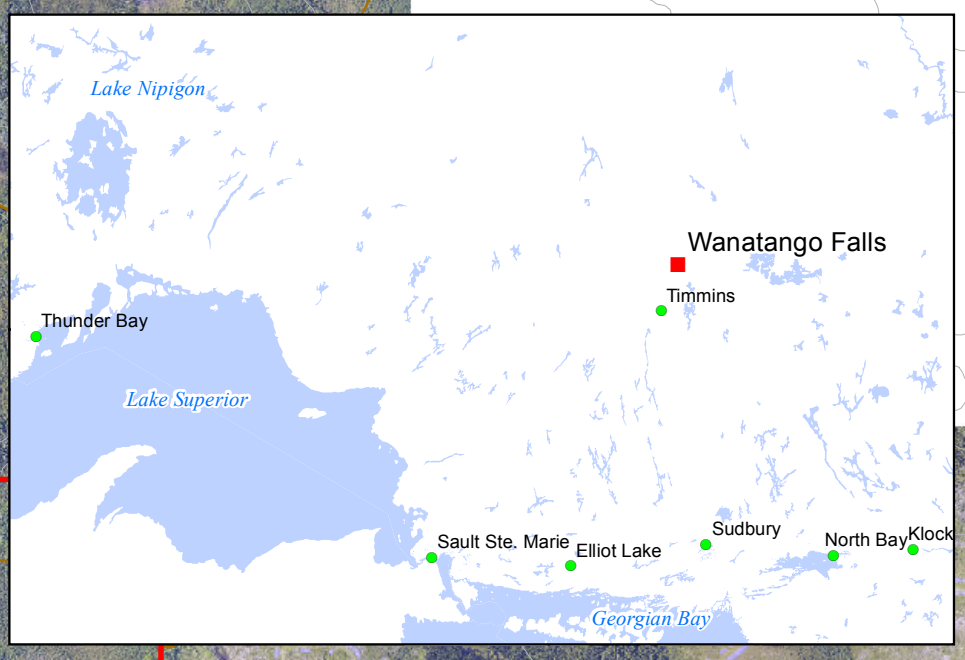
Map 5

Map 6

Map 7

MANN SOUTH RD

Frederickhouse Dam
Upstream Limit of Study



Legend

- Wanatango Falls Hydroelectric Generating Station
- Flow Direction
- Highway
- Primary Road
- Secondary Road
- Resource / Recreation / Service
- Elevation Contour (10m Interval)

N

0 250 500 750 1,000 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Fig1_Wanatango_KeyMap_25K_2011_08_03_SWM.mxd

Wanatango Falls Hydropower Development

Aquatic Assessments - Map 1

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

Downstream Limit of Study

MAP 2

RIN-010

RIN-009

REAUME ESKER RD

N

Meters
0 100 200 300

Legend

- (RIN) RIN Station
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

494750 495000 495250 495500 495750 496000

5414250 5414000 5413750 5413500 5413250 5413000 5412750 5412500

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango1_AquaticStations_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Aquatic Assessments - Map 2

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

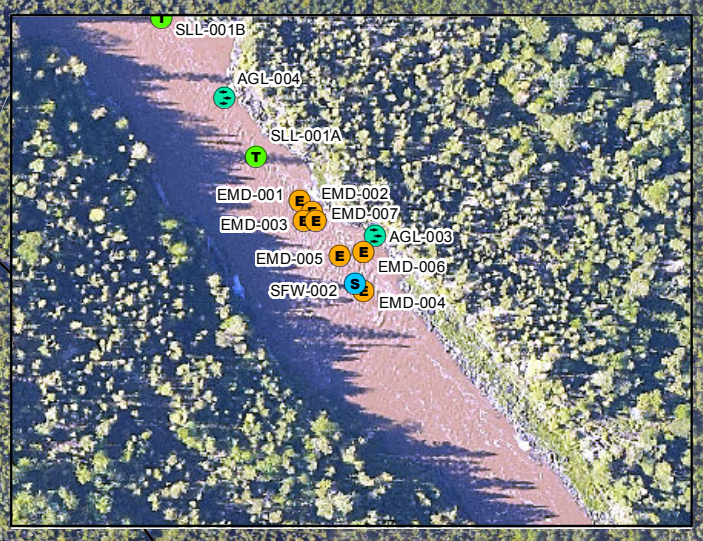
August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

494500 494750 495000 495250 495500

5412750 5412500 5412250 5412000 5411750 5411500 5411250 5411000

MAP 1

RIN-010
RIN-009
SLL-009
SFW-003
SFW-004
Zeverley's Bridge
EMD-017
EMD-018
CONNAUGHT EVELYN RD
EMD-008
EMD-010
AGL-001
AGL-002
EMD-009
EMD-011
EMD-012
EMD-013
EMD-014
EMD-015
EMD-016
Proposed Spillway
SLL-007
Proposed Control Dam with Obermeyer Gate
AGL-008
AGL-007
Wanatango Falls
EMD-026
EMD-021
EMD-025
EMD-022
EMD-023
EMD-019
EMD-020
AGL-005
EMD-024
AGL-006
EMS-001
SLL-008
MAP 3



Legend

- (AGL) Angling Effort Station
- (EMS) Electrofishing Monitoring Station
- (SFW) Surface Water Monitoring
- (RIN) RIN Station
- (EMD) Egg Mat Deployment Station
- (GND) Gill Net Deployment Station
- (SLL) Trot Line Deployment Station
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango2_AquaticStations_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Aquatic Assessments - Map 3

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

494500 494750 495000 495250 495500

5411000 5410750 5410500 5410250 5410000 5409750 5409500 5409250

SLL-008 SLL-008

RIN-008B
RIN-008A

RIN-007B
RIN-007A

RIN-005B
RIN-005A

MAP 2

MAP 4

CONNAUGHT EVELYN RD

Legend

- (RIN) RIN Station
- (SLL) Trot Line Deployment Station
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango3_AquaticStations_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Aquatic Assessments - Map 4

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

494750 495000 495250 495500 495750

5409250 5409000 5408750 5408500 5408250 5408000 5407750 5407500

MAP 3

CONNAUGHT EVELYN RD

RIN-004

RIN-003

MAP 5

Legend

- (RIN) RIN Station
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango4_AquaticStations_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Aquatic Assessments - Map 5

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

495500 495750 496000 496250 496500

5407500 5407250 5407000 5406750 5406500 5406250 5406000 5405750

RIN-003

MAP 4

RIN-006B

RIN-006A

RIN-002

MAP 6

RIN-001

Legend

- (RIN) RIN Station
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

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N

Meters
0 100 200 300

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango5_AquaticStations_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Aquatic Assessments - Map 6

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

496250 496500 496750 497000 497250 497500 497750 498000

5406000 5405750 5405500 5405250 5405000

MAP 5

RIN-001

SFW-001

SFW-005

MAP 7

Legend

- (SFW) Surface Water Monitoring
- (RIN) RIN Station
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

Meters
0 100 200 300

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango6_AquaticStations_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Aquatic Assessments - Map 7

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

SFW-005

MAP 6

Frederickhouse Dam
Upstream Limit of Study

Legend

- (SFW) Surface Water Monitoring
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

497750 498000 498250 498500 498750 499000 499250 499500 499750

5405500 5405250 5405000 5404750 5404500

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango7_AquaticStations_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Critical Aquatic Habitat - Map 1

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

Downstream Limit of Study

MAP 2

REAUME ESKER RD

N

Meters
0 100 200 300

Legend

- Aquatic Vegetation
- Cobble/Boulder/Gravel
- Deep Pool
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

494750 495000 495250 495500 495750 496000

5414250 5414000 5413750 5413500 5413250 5413000 5412750 5412500

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango1_CritialHabitat_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Critical Aquatic Habitat - Map 2

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

494500 494750 495000 495250 495500

5412750 5412500 5412250 5412000 5411750 5411500 5411250 5411000

MAP 1

MAP 3

REAUME ESKER RD

CONNAUGHT EVELYN RD

Legend

- Vertical Drop
- Aquatic Vegetation
- Cobble/Boulder/Gravel
- Deep Pool
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango2_CritialHabitat_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Critical Aquatic Habitat - Map 3

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

494500 494750 495000 495250 495500

5411000 5410750 5410500 5410250 5410000 5409750 5409500 5409250

MAP 2

MAP 4

CONNAUGHT EVELYN RD

Legend

- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango3_CritialHabitat_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Critical Aquatic Habitat - Map 4

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 3, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

494750 495000 495250 495500 495750

5409250 5409000 5408750 5408500 5408250 5408000 5407750 5407500

MAP 3

MAP 5

CONNAUGHT EVELYN RD


1


2


3

Legend

- Photo Location
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

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N

0 100 200 300 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango4_CritialHabitat_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Critical Aquatic Habitat - Map 5

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

MAP 4

MAP 6

Legend

- Photo Location
- Aquatic Vegetation
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

Meters
0 100 200 300

495750 496000 496250 496500 496750

5407000 5406750 5406500 5406250 5406000 5405750 5405500 5405250

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango5_CritialHabitat_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Critical Aquatic Habitat - Map 6

Natural Resource Solutions Inc.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

MAP 5

MAP 7

Legend

- Photo Location
- Aquatic Vegetation
- Cobble/Boulder/Gravel
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

496750 497000 497250 497500 497750 498000 498250 498500

5406000 5405750 5405500 5405250 5405000

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango6_CritialHabitat_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Critical Aquatic Habitat - Map 7

Natural Resource Solutions Inc.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

MAP 6

Frederickhouse Dam
Upstream Limit of Study

497750 498000 498250 498500 498750 499000 499250 499500

5405250 5405000 5404750 5404500 5404250

Legend

- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango7_CritialHabitat_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Fish Passage - Map 1

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

Downstream Limit of Study

TEL-110
TEL-103
RIN-021
RIN-017
RIN-015
FND-002/3
RIN-013
RIN-011
TEL-104
FND-001
FND-006/8/10
RIN-019
MAP 1
REAUME ESKER RD

494750 495000 495250 495500 495750 496000
5414250 5414000 5413750 5413500 5413250 5413000 5412750 5412500 5412250

Legend

- (FND) Fyke Net Location
- (TEL) Fish Telemetry Tag ID Logged
- (RIN) Non-RIN Protocol RIN Station
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango1_FishPassage_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Fish Passage - Map 2

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

494500 494750 495000 495250 495500

5412750 5412500 5412250 5412000 5411750 5411500 5411250 5411000

MAP 1

RIN-017
RIN-015
RIN-013
FND-002/3
RIN-011
TEL-104
FND-005/7/9
FND-001
FND-006/8/10
TEL-109
FND-004
RIN-019
TEL-112
RIN-022
RIN-025
RIN-018
RIN-014
RIN-024
RIN-027
RIN-016
TEL-108/111/116/255
Zeverley's Bridge
CONNAUGHT

RIN-020
RIN-033
RIN-037
RIN-023
RIN-030
RIN-028
RIN-026
RIN-029
RIN-038
RIN-012
RIN-035
RIN-032
RIN-031
RIN-036
RIN-034

REAUME ESKER RD

TEL Fish Tag ID Logged:
109, 111, 112, 115, 117, 118

SRX1

TEL Fish Tag ID Logged:
109, 118

SRX2

Proposed Spillway

Proposed Control Dam
with Obermeyer Gate

RIN-051
RIN-049
RIN-047
RIN-048
RIN-046
RIN-041
RIN-045
RIN-042
RIN-050
RIN-040
RIN-052
RIN-039

TEL Fish Tag ID Logged:
109

SRX3

Wanatango Falls

MAP 3

Legend

- SRX Receiver/Data Logger Unit
- (FND) Fyke Net Location
- (TEL) Fish Telemetry Tag ID Logged
- (RIN) Non-RIN Protocol RIN Station
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango2_FishPassage_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Fish Passage - Map 3

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

494500 494750 495000 495250 495500

5411000 5410750 5410500 5410250 5410000 5409750 5409500 5409250

MAP 2

MAP 4

CONNAUGHT EVELYN RD

Legend

- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango3_FishPassage_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Fish Passage - Map 4

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

MAP 3

MAP 5

CONNAUGHT EVELYN RD

494750 495000 495250 495500 495750

5409250 5409000 5408750 5408500 5408250 5408000 5407750 5407500

Legend

- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango4_FishPassage_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Fish Passage - Map 5

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

MAP 4

MAP 6

Legend

- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

Meters
0 100 200 300

495500 495750 496000 496250 496500

5407500 5407250 5407000 5406750 5406500 5406250 5406000 5405750

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango5_FishPassage_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Fish Passage - Map 6

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

MAP 5

MAP 7

RIN-043

RIN-044

Legend

- (RIN) Non-RIN Protocol RIN Station
- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

496250 496500 496750 497000 497250 497500 497750 498000

5406000 5405750 5405500 5405250 5405000

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango6_FishPassage_5K_2011_08_05_SWM.mxd

Wanatango Falls Hydropower Development

Fish Passage - Map 7

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

August 5, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

497750 498000 498250 498500 498750 499000 499250 499500 499750

5405500 5405250 5405000 5404750 5404500

MAP 6

Frederickhouse Dam
Upstream Limit of Study

Legend

- Flow Direction
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango7_FishPassage_5K_2011_08_05_SWM.mxd

APPENDIX IV

AQUATIC ASSESSMENT DETAILS

1052 Wanatango Falls Hydro-Electric Development

2011 Sturgeon Survey - Trot Line Results

Station	Date	Time Deployed	Time Retrieved	Elapsed Time (hr)	Water Temp (°C)	Line Length (m)	Hook Interval (m)	Water Depth (point A/point B/point C) (m)	Net Orientation	Species	Species Code	Length (mm)		Weight (g)	Tally	Condition
												Fork	Total			
SLL-001	7-May-10	17:19	20:05	2:46	11	40	3	1.22/1.83	across current	(no catch)	n/a	n/a	n/a	n/a	-	
SLL-002	7-May-10	18:27	20:30	2:03	11	40	3	1.83/2.44	across current	(no catch)	n/a	n/a	n/a	n/a	-	
SLL-003	25-May-10	15:13	19:42	4:29	24.2	40	3	1.28/1.95	with current	(no catch)	n/a	n/a	n/a	n/a	-	
SLL-004	25-May-10	15:20	19:53	4:33	24.2	40	3	1.55/1.74	with current	(no catch)	n/a	n/a	n/a	n/a	-	
SLL-005	25-May-10	5/25/10 20:25	5/26/10 12:35	16:10	24.2	40	3	1.21/1.21	with current	(no catch)	n/a	n/a	n/a	n/a	-	
SLL-006	25-May-10	5/25/10 20:35	5/26/10 12:05	15:30	24.2	40	3	2.13/2.43	with current	(no catch)	n/a	n/a	n/a	n/a	-	
SLL-007	26-Jul-10	13:50	20:00	6:10	n/a	40	3	5.49/4.88	across current	(no catch)	n/a	n/a	n/a	n/a	-	
SLL-008	26-Jul-10	14:30	21:00	6:30	n/a	40	3	3.05/3.96	across current	Walleye	334	261	280	180	1	
SLL-008	26-Jul-10	14:30	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Goldeye	151	312	340	360	1	
SLL-009	28-Jul-10	9:45	13:45	4:00	22	40	3	3.05/3.05	across current	(no catch)	n/a	n/a	n/a	n/a	-	

n/a = not available

1052 Wanatango Falls Hydro-Electric Development

2010 Summer Fish Survey - RIN Results

Station	Date & Time Deployed	Date & Time Retrieved	Elapsed Time (hr)	Water Temp (°C)	Start Depth (m)	End Depth (m)	Net Size (Jones and Yunker 2009)	Mesh Size (mm)	Species	Species Code	Fish Number	Length (mm)		Weight (g)	Sex	Maturity	Aging Structure	Comments
												Total	Fork					
RIN-001	7/25/10 16:15	7/26/10 15:30	23:15:00	21.60	7	15.0	Small RIN	32	Goldeye	151	1	360	330	420	UK	UK	scales	
								32	Goldeye	151	2	335	310	380	UK	UK	n/a	
								19	Emerald Shiner	196	3	80	75	7	UK	UK	n/a	
								19	Goldeye	151	4	321	305	300	UK	UK	n/a	
								19	Goldeye	151	5	361	335	460	UK	UK	n/a	
								19	Sauger	332	6	277	271	180	UK	UK	n/a	
								38	Goldeye	151	7	386	355	620	UK	UK	n/a	
								13	Emerald Shiner	196	8-11	90	82	25	UK	UK	n/a	Average lengths and bulk weight
								25	Goldeye	151	12	371	355	420	UK	UK	n/a	
								25	Goldeye	151	13	331	306	300	UK	UK	n/a	
RIN-002	7/25/10 16:30	7/26/10 16:30	24:00:00	21.60	15	10.0	Large RIN	102	Goldeye	151	1	324	293	280	UK	UK	scales	
								102	White Sucker	163	2	294	278	260	UK	UK	scales	
								12	Goldeye	151	3	341	309	340	UK	UK	scales	
								64	Goldeye	151	4	372	336	720	UK	UK	scales	
								64	Goldeye	151	5	343	319	340	UK	UK	scales	
								64	Goldeye	151	6	341	319	380	UK	UK	scales	
								64	Goldeye	151	7	297	275	220	UK	UK	scales	
								64	White Sucker	163	8	315	302	320	UK	UK	n/a	
								64	White Sucker	163	9	314	293	300	UK	UK	n/a	
								64	Shorthead Redhorse	171	10	283	262	160	UK	UK	n/a	
								64	Shorthead Redhorse	171	11	392	372	700	UK	UK	n/a	
								38	Sauger	332	12	197	212	60	UK	UK	scales	
								38	Sauger	332	13	210	200	60	UK	UK	scales	
								38	Yellow Perch	331	14	140	135	40	UK	UK	scales	
								38	Goldeye	151	15	191	175	40	UK	UK	scales	
								89	White Sucker	163	16	396	365	960	UK	UK	scales	
								89	Goldeye	151	17	359	327	420	UK	UK	scales	
								89	Goldeye	151	18	350	341	420	UK	UK	scales	
								89	Goldeye	151	19	336	302	340	UK	UK	scales	
								51	Goldeye	151	20	311	280	110	UK	UK	n/a	
								51	Goldeye	151	21	210	191	110	UK	UK	n/a	
								51	Goldeye	151	22	192	170	210	UK	UK	n/a	
								51	Walleye	334	23	321	310	190	UK	UK	scales	
								51	Goldeye	151	24	180	175	320	UK	UK	n/a	
								51	Shorthead Redhorse	171	25	331	315	180	UK	UK	n/a	
								76	Goldeye	151	26	374	336	300	UK	UK	n/a	
								76	Goldeye	151	27	366	332	280	UK	UK	n/a	
								76	Goldeye	151	28	374	335	300	UK	UK	n/a	
								76	Goldeye	151	29	381	350	340	UK	UK	n/a	
								76	Goldeye	151	30	365	336	330	UK	UK	n/a	
								76	Shorthead Redhorse	171	31	321	281	320	UK	UK	n/a	
RIN-003	7/25/2010 17:30	7/26/10 18:30	25:00:00	21.00	12	14.0	Large RIN	102	White Sucker	163	1	360	340	500	UK	UK	n/a	
								38	Goldeye	151	2	340	308	380	UK	UK	n/a	
								89	White Sucker	163	3	410	387	720	UK	UK	n/a	
								89	Goldeye	151	4	346	310	220	UK	UK	n/a	
								89	White Sucker	163	5	395	366	580	UK	UK	n/a	
								89	Goldeye	151	6	429	395	800	UK	UK	n/a	
								51	Goldeye	151	7	330	305	340	UK	UK	n/a	
								76	Goldeye	151	8	341	312	340	UK	UK	n/a	
								76	Shorthead Redhorse	171	9	382	340	520	UK	UK	n/a	
RIN-004	7/25/2010 17:45	7/26/10 11:25	17:40:00	21.60	10	10.5	Large RIN	76	Goldeye	151	1	750	450	460	UK	UK	scales	
								76	Goldeye	151	2	322	294	300	UK	UK	scales	
								76	Goldeye	151	3	366	347	440	UK	UK	scales	
								51	Longnose Sucker	162	4	277	265	200	UK	UK	scales	
								51	Walleye	334	5	294	277	240	UK	UK	scales	
								51	White Sucker	163	6	225	215	100	UK	UK	scales	
								89	Goldeye	151	7	380	352	480	UK	UK	scales	
								89	Goldeye	151	8	336	328	380	UK	UK	scales	
								89	Goldeye	151	9	338	312	340	UK	UK	scales	
								38	Goldeye	151	10	189	177	60	UK	UK	scales	
								38	Unknown	n/a	11	169	155	60	UK	UK	n/a	
								38	Sauger	332	12	195	187	40	UK	UK	scales	
								127	Goldeye	151	13	326	291	340	UK	UK	scales	
								127	White Sucker	163	14	309	295	380	UK	UK	scales	
RIN-005	7/26/2010 13:10	7/27/10 11:27	22:17:00	24.00	7	8.0	Large RIN	76	Walleye	334	1	397	370	480	UK	UK	n/a	

Station	Date & Time Deployed	Date & Time Retrieved	Elapsed Time (hr)	Water Temp (°C)	Start Depth (m)	End Depth (m)	Net Size (Jones and Yunker 2009)	Mesh Size (mm)	Species	Species Code	Fish Number	Length (mm)		Weight (g)	Sex	Maturity	Aging Structure	Comments
												Total	Fork					
								76	White Sucker	163	2	375	350	520	UK	UK	n/a	
								76	White Sucker	163	3	331	312	440	UK	UK	n/a	
								51	Goldeye	151	4	330	304	360	UK	UK	n/a	
								51	Goldeye	151	5	284	261	220	UK	UK	n/a	
								51	Goldeye	151	6	348	316	380	UK	UK	n/a	
								51	Goldeye	151	7	334	309	380	UK	UK	n/a	
								51	Goldeye	151	8	334	305	360	UK	UK	n/a	
								51	Goldeye	151	9	336	308	300	UK	UK	n/a	
								51	Goldeye	151	10	313	295	280	UK	UK	n/a	
								51	Goldeye	151	11	241	230	100	UK	UK	n/a	
								89	Goldeye	151	12	361	335	460	UK	UK	n/a	
								89	Goldeye	151	13	390	363	480	UK	UK	n/a	
								89	Shorthead Redhorse	171	14	394	357	600	UK	UK	n/a	
								38	Goldeye	151	15	354	327	400	UK	UK	n/a	
								127	Shorthead Redhorse	171	16	285	255	220	UK	UK	n/a	
								127	White Sucker	163	17	284	265	172	UK	UK	n/a	
								64	White Sucker	163	18	286	268	275	UK	UK	n/a	
								64	Goldeye	151	19	340	313	350	UK	UK	n/a	
								64	Goldeye	151	20	300	273	260	UK	UK	n/a	
								64	Goldeye	151	21	276	250	162	UK	UK	n/a	
RIN-006	7/26/2010 18:10	7/27/10 15:15	21:05:00	22.00	10	9.0	Large RIN	76	White Sucker	163	1	312	292	381	UK	UK	n/a	
								76	Shorthead Redhorse	171	2	398	364	623	UK	UK	n/a	
								76	Goldeye	151	3	336	304	369	UK	UK	n/a	
								114	Goldeye	151	4	345	325	366	UK	UK	n/a	
								114	Goldeye	151	5	356	323	403	UK	UK	n/a	
								114	Goldeye	151	6	405	372	700	UK	UK	n/a	
								51	Goldeye	151	7	263	238	180	UK	UK	n/a	
								51	Goldeye	151	8	275	250	204	UK	UK	n/a	
								51	Goldeye	151	9	236	220	100	UK	UK	n/a	
								51	Goldeye	151	10	213	195	79	UK	UK	n/a	
								51	Goldeye	151	11	198	180	61	UK	UK	n/a	
								51	Goldeye	151	12	249	228	122	UK	UK	n/a	
								51	Goldeye	151	13	200	181	64	UK	UK	n/a	
								51	Goldeye	151	14	197	182	60	UK	UK	n/a	
								51	Goldeye	151	15	345	322	116	UK	UK	n/a	
								51	Goldeye	151	16	226	207	92	UK	UK	n/a	
								89	Goldeye	151	17	359	250	385	UK	UK	n/a	
								89	Goldeye	151	18	330	250	319	UK	UK	n/a	
								89	Shorthead Redhorse	171	19	376	341	551	UK	UK	n/a	
								89	Goldeye	151	20	396	365	560	UK	UK	n/a	
								38	Goldeye	151	21	322	386	64	UK	UK	n/a	
								38	Goldeye	151	22	204	185	64	UK	UK	n/a	
								38	Goldeye	151	23	212	193	74	UK	UK	n/a	
								38	Goldeye	151	24	169	155	38	UK	UK	n/a	
								64	Goldeye	151	25	337	306	316	UK	UK	n/a	
								64	Goldeye	151	26	323	305	280	UK	UK	n/a	
								64	White Sucker	163	27	341	320	500	UK	UK	n/a	
								64	Goldeye	151	28	315	294	284	UK	UK	n/a	
								64	Shorthead Redhorse	171	29	361	320	452	UK	UK	n/a	
								64	Goldeye	151	30	304	282	257	UK	UK	n/a	
								64	Goldeye	151	31	331	300	309	UK	UK	n/a	
RIN-007	7/26/2010 19:40	7/27/10 12:43	17:03:00	22.00	12	9.0	Large RIN	64	Goldeye	151	1	330	303	308	UK	UK	n/a	
								64	Walleye	163	2	401	380	430	UK	UK	scales	
								38	Cisco	93	3	176	158	52	UK	UK	n/a	
								89	Goldeye	151	4	356	324	400	UK	UK	n/a	
								51	Goldeye	151	5	246	225	124	UK	UK	n/a	
								51	Goldeye	151	6	284	265	194	UK	UK	n/a	
								76	Goldeye	151	7	498	424	380	UK	UK	n/a	
								76	Goldeye	151	8	373	345	420	UK	UK	n/a	
RIN-008	7/26/2010 20:00	7/27/10 17:00	21:00:00	22.00	9	11.0	Small RIN	32	Goldeye	151	1	250	230	129	UK	UK	n/a	
								32	Walleye	334	2	260	242	120	UK	UK	scales	
								19	Goldeye	151	3	368	334	460	UK	UK	n/a	
								19	White Sucker	163	4	230	215	135	UK	UK	n/a	
								38	Goldeye	151	5	356	305	355	UK	UK	n/a	
								38	Goldeye	151	6	380	335	453	UK	UK	n/a	
								38	Goldeye	151	7	340	308	340	UK	UK	n/a	
								38	White Sucker	163	8	231	219	138	UK	UK	n/a	
								19	Goldeye	151	9	266	243	194	UK	UK	n/a	
								19	Emerald Shiner	196	10-25	70	65	36	UK	UK	n/a	Average lengths and bulk weight

Station	Date & Time Deployed	Date & Time Retrieved	Elapsed Time (hr)	Water Temp (°C)	Start Depth (m)	End Depth (m)	Net Size (Jones and Yunker 2009)	Mesh Size (mm)	Species	Species Code	Fish Number	Length (mm)		Weight (g)	Sex	Maturity	Aging Structure	Comments
												Total	Fork					
								19	Emerald Shiner	196	26-38	70	65	20	UK	UK	n/a	
								19	Spottail Shiner	201	39-46	71	64	18	UK	UK	n/a	
								25	Goldeye	151	47	355	321	416	UK	UK	n/a	
								25	Goldeye	151	48	350	320	385	UK	UK	n/a	
RIN-009	7/27/2010 15:30	7/28/10 10:00	18:30:00	22.00	7	8.5	Large RIN	76	Shorthead Redhorse	171	1	355	325	520	UK	UK	scales	
								76	Walleye	334	2	457	434	860	UK	UK	n/a	
								114	Goldeye	151	3	254	230	160	UK	UK	n/a	
								114	Goldeye	151	4	256	235	160	UK	UK	n/a	
								52	Goldeye	151	5	227	209	100	UK	UK	n/a	
								89	Shorthead Redhorse	171	6	374	342	620	UK	UK	n/a	
								127	Goldeye	151	7	250	224	160	UK	UK	n/a	
								64	Walleye	334	8	400	374	620	UK	UK	n/a	
								102	Shorthead Redhorse	171	9	397	352	720	UK	UK	n/a	
								89	Lake Sturgeon	31	10	810	730	6000	UK	UK	n/a	approximate weight
RIN-010	7/27/2010 16:00	7/28/10 11:00	19:00:00	22.00	9	14.0	Large RIN	89	Longnose Sucker	162	1	359	357	540	UK	UK	n/a	

n/a = not available, UK=unknown

Notes: For full RIN net construction details, refer to: Jones, NE and G Yunker. 2009. Riverine Index Netting Manual of Instructions V.2. Ontario Ministry of Natural Resources, River and Stream Ecology Laboratory. 36 pp.

1052 Wanatango Falls Hydro-Electric Development

2010 Summer Fish Survey - Electrofishing Results

Station	Date	Pulsating Frequency (Hz)	Voltage	Start Time	End Time	Shocking Seconds	Area Shocked (m2)	Net Size (m)	Species	Species Code	Min. Total Length (mm)	Max. Total Length (mm)	Weight (g) - bulk if multiple collected	Number Collected	Fish condition/ Additional details
EMS-001	25-Jul-10	60	300	17:45	19:00	914	n/a	0.16	Logperch	342	80	142	32.2	5	-
									Burbot	271	n/a	212	50.3	1	-
									Longnose Dace	211	35	97	69.02	16	2 collected as YOY
									Mottled Sculpin	281	n/a	75	72.9	11	-
									Creek Chub	212	n/a	92	8.4	1	-
									White Sucker	163	n/a	36	0.5	1	YOY
									Sauger	332	n/a	108	7.3	1	Juvenile

n/a = not available

1052 Wanatango Falls Hydro-Electric Development

2010 Sturgeon Spawning Survey - Egg Mat Results

Station	Deployment Date	Water Depth (m)	Bottom Substrate	Water Temp (°C)	Duration (hrs)	Mat Condition	Number of Eggs	Species	Species Code
EMD-001	7-May-10	n/a	n/a	24.2	24 days 19hrs	n/a	0	not applicable	not applicable
EMD-002	7-May-10	n/a	n/a	24.2	24 days 19hrs	n/a	3	Redhorse (Silver or Shorthead)	(168 or 171)
EMD-003	7-May-10	n/a	n/a	24.2	24 days 19hrs	n/a	7	Goldeye and Redhorse (Silver or Shorthead)	151, (168 or 171)
EMD-004	25-May-10	0.3	boulders	23	21hrs	n/a	0	not applicable	not applicable
EMD-005	25-May-10	0.75	boulders	23	21hrs	n/a	0	not applicable	not applicable
EMD-006	25-May-10	0.4	boulders	23	21hrs	n/a	0	not applicable	not applicable
EMD-007	25-May-10	1.2	boulders	23	21hrs	n/a	1	Redhorse (Silver or Shorthead)	(168 or 171)

n/a = not available

1052 Wanatango Falls Hydro-Electric Development

2010 Walleye Spawning Survey - Angling Results

Station	Date	Number of Anglers	Start Time	End Time	Elapsed Time (min)	Species	Spawning Condition						Total
							Green		Ripe		Spent		
							M	F	M	F	M	F	
AGL-001	18-Apr-10	1	14:30	14:50	0:20	(no catch)	UK	UK	UK	UK	UK	UK	0
AGL-002	18-Apr-10	1	14:20	14:50	0:30	(no catch)	UK	UK	UK	UK	UK	UK	0
AGL-003	18-Apr-10	1	15:20	15:40	0:20	(no catch)	UK	UK	UK	UK	UK	UK	0
AGL-004	18-Apr-10	1	15:40	16:00	0:20	(no catch)	UK	UK	UK	UK	UK	UK	0
AGL-005	18-Apr-10	1	17:50	18:10	0:20	(no catch)	UK	UK	UK	UK	UK	UK	0
AGL-006	18-Apr-10	1	17:50	18:15	0:25	(no catch)	UK	UK	UK	UK	UK	UK	0
AGL-007	18-Apr-10	1	18:15	18:45	0:30	(no catch)	UK	UK	UK	UK	UK	UK	0
AGL-008	18-Apr-10	1	18:20	18:40	0:20	(no catch)	UK	UK	UK	UK	UK	UK	0

UK=Unknown

1052 Wanatango Falls Hydro-Electric Development

2011 Walleye Spawning Survey - Egg Mat Results

Station	Deployment Date	Water Depth (m)	Bottom Substrate	Water Temperature at time of Deployment (°C)	Duration (hrs)	Mat Condition	Number of Eggs	Species	Species Code
EMD-008	13-May-11	n/a	n/a	7.5	22	n/a	0	not applicable	not applicable
EMD-009	13-May-11	n/a	n/a	7.5	22	n/a	0	not applicable	not applicable
EMD-010	13-May-11	n/a	n/a	7.5	21	n/a	0	not applicable	not applicable
EMD-011	13-May-11	n/a	n/a	7.5	21	n/a	0	not applicable	not applicable
EMD-012	13-May-11	n/a	n/a	7.5	21	n/a	0	not applicable	not applicable
EMD-013	13-May-11	n/a	n/a	7.5	21	n/a	0	not applicable	not applicable
EMD-014	13-May-11	n/a	n/a	7.5	22	n/a	0	not applicable	not applicable
EMD-015	13-May-11	n/a	n/a	7.5	22	n/a	0	not applicable	not applicable
EMD-016	13-May-11	n/a	n/a	7.5	22	n/a	0	not applicable	not applicable
EMD-017	13-May-11	n/a	n/a	7.5	17	n/a	1	Walleye/Sauger	334/332
EMD-008	14-May-11	n/a	n/a	7	12	n/a	0	not applicable	not applicable
EMD-009	14-May-11	n/a	n/a	7	25	n/a	0	not applicable	not applicable
EMD-010	14-May-11	n/a	n/a	7	26	n/a	0	not applicable	not applicable
EMD-011	14-May-11	n/a	n/a	7	24	n/a	0	not applicable	not applicable
EMD-012	14-May-11	n/a	n/a	7	23	n/a	0	not applicable	not applicable
EMD-014	14-May-11	n/a	n/a	7	22	n/a	0	not applicable	not applicable
EMD-015	14-May-11	n/a	n/a	7	22	n/a	0	not applicable	not applicable
EMD-016	14-May-11	n/a	n/a	7	22	n/a	0	not applicable	not applicable
EMD-018	14-May-11	n/a	n/a	7	28	n/a	0	not applicable	not applicable
EMD-019	14-May-11	n/a	n/a	7	20	n/a	0	not applicable	not applicable
EMD-020	14-May-11	n/a	n/a	7	19	n/a	0	not applicable	not applicable
EMD-021	14-May-11	n/a	n/a	7	19	n/a	0	not applicable	not applicable
EMD-022	14-May-11	n/a	n/a	7	19	n/a	0	not applicable	not applicable
EMD-023	14-May-11	n/a	n/a	7	19	n/a	0	not applicable	not applicable
EMD-024	14-May-11	n/a	n/a	7	18	n/a	0	not applicable	not applicable
EMD-025	14-May-11	n/a	n/a	7	19	n/a	0	not applicable	not applicable
EMD-026	14-May-11	n/a	n/a	7	19	n/a	0	not applicable	not applicable
EMD-019	15-May-11	n/a	n/a	6	149	n/a	0	not applicable	not applicable
EMD-020	15-May-11	n/a	n/a	6	146	n/a	1	Walleye/Sauger	334/332
EMD-026	15-May-11	n/a	n/a	6	146	n/a	0	not applicable	not applicable
EMD-020	21-May-11	n/a	n/a	11.5	45	n/a	0	not applicable	not applicable
EMD-026	21-May-11	n/a	n/a	11.5	50	n/a	0	not applicable	not applicable

n/a = not available

1052 Wanatango Falls Hydro-Electric Development

2011 Fish Passage Fyke Net Results

Net Length	Net Height	Net Orientation	Species	Species Code	Number of Fish	Length (mm)		Weight (g)	Sex	Maturity	Aging Structure	Dart Tag Number	Recapture	Telemetry Tag Number	Comments
						Total	Fork								
1- 25' central lead wing & 2 -10' side lead wings	2' x 3' front frames & 4 - 24" hoops	Perpendicular to shore	No Fish Collected												
1- 25' central lead wing & 2 -10' side lead wings	2' x 3' front frames & 4 - 24" hoops	Perpendicular to shore	Northern Pike	131	1	470	500	1630	M	ripe	none	47	no	not applicable	none
			Northern Pike	131	2	482	508	1870	M	ripe	none	50	no	not applicable	none
			Northern Pike	131	3	437	465	1210	M	spent	none	33	no	not applicable	none
			Northern Pike	131	4	364	385	740	M	ripe	none	46	no	not applicable	none
			Northern Pike	131	5	385	410	830	M	ripe	none	26	no	not applicable	none
			Northern Pike	131	6	314	333	610	M	spent	none	39	no	not applicable	none
			Northern Pike	131	7	387	412	790	M	ripe	none	36	no	not applicable	none
			Northern Pike	131	8	387	412	830	M	ripe	none	57	no	not applicable	none
			Northern Pike	131	9	336	359	630	M	spent	none	48	no	not applicable	none
			Northern Pike	131	10	465	495	1270	M	ripe	none	28	no	not applicable	none
			Northern Pike	131	11	419	443	1210	F	ripe	none	49	no	not applicable	none
			Northern Pike	131	12	377	390	830	UK	spent	none	34	no	not applicable	none
			Northern Pike	131	13	324	342	550	M	ripe	none	none	no	not applicable	none
			Northern Pike	131	14	392	420	1010	M	ripe	none	37	no	not applicable	none
			Northern Pike	131	15	338	361	610	M	spent	none	41	no	not applicable	none
			Northern Pike	131	16	359	380	760	M	spent	none	88	no	not applicable	none
			White Sucker	163	17	189	204	190	M	ripe	none	none	no	not applicable	none
			Yellow Perch	331	18	75	79	n/a	n/a	yoy	none	none	UK	not applicable	Died
			Shiner sp.		19	n/a	n/a	n/a	n/a	n/a	none	none	no	not applicable	Died (half eaten)
			Yellow Perch	331	20	67	70	n/a	n/a	yoy	none	none	UK	not applicable	Died (half eaten)
			Yellow Perch	331	21	n/a	n/a	n/a	n/a	yoy	none	none	UK	not applicable	Died (half eaten)
			Shiner sp.		22	n/a	n/a	n/a	n/a	n/a	none	none	no	not applicable	Died (half eaten)
			Yellow Perch	331	23	68	70	n/a	n/a	yoy	none	none	UK	not applicable	none
			Emerald Shiner	196	24	66	71	n/a	n/a	n/a	none	none	no	not applicable	Sample taken
1- 25' central lead wing & 2 -10' side lead wings	2' x 3' front frames & 4 - 24" hoops	Perpendicular to shore	Emerald Shiner	196	1	85	92	n/a	UK	UK	none	none	no	not applicable	none
			Emerald Shiner	196	2	46	51	n/a	UK	UK	none	none	no	not applicable	none
			Emerald Shiner	196	3	n/a	31	n/a	UK	UK	none	none	no	not applicable	Partially eaten
			Emerald Shiner	196	4	51	57	n/a	UK	UK	none	none	no	not applicable	none
			Emerald Shiner	196	5	42	45	n/a	UK	UK	none	none	no	not applicable	none
			Emerald Shiner	196	6	52	57	n/a	UK	UK	none	none	no	not applicable	none
			Emerald Shiner	196	7	70	75	n/a	UK	UK	none	none	no	not applicable	none
			Emerald Shiner	196	8	55	60	n/a	UK	UK	none	none	no	not applicable	none
			Emerald Shiner	196	9	53	56	n/a	UK	UK	none	none	no	not applicable	none
			Emerald Shiner	196	10	51	55	n/a	UK	UK	none	none	no	not applicable	none
1- 25' central lead wing & 2 -10' side lead wings	2' x 3' front frames & 4 - 24" hoops	Perpendicular to shore	Northern Pike	131	1	420	453	520	M	ripe	none	74	no	not applicable	none
			Northern Pike	131	2	359	380	130	M	ripe	none	42	no	not applicable	none
			Northern Pike	131	3	394	415	390	M	ripe	none	20	no	not applicable	none
			Northern Pike	131	4	357	382	220	M	ripe	none	10	no	not applicable	none
			Northern Pike	131	5	362	385	300	M	spent	none	58	no	not applicable	none
			Northern Pike	131	6	323	343	n/a	UK	UK	none	none	no	not applicable	Too small to tag
			Brook Stickleback	281	7	n/a	56	n/a	UK	UK	none	none	no	not applicable	Too small to tag
1- 25' central lead wing & 2 -10' side lead wings	2' x 3' front frames & 4 - 24" hoops	Fairly perpendicular to shore (angled slightly towards downstream)	Yellow Perch	331	1	180	172	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	2	184	176	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	3	256	246	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	4	232	220	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	5	250	238	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	6	264	255	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	7	252	242	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	8	223	215	n/a	M	ripe	none	none	UK	not applicable	none

Net Length	Net Height	Net Orientation	Species	Species Code	Number of Fish	Length (mm)		Weight (g)	Sex	Maturity	Aging Structure	Dart Tag Number	Recapture	Telemetry Tag Number	Comments
						Total	Fork								
			Yellow Perch	331	9	227	222	n/a	UK	spent	none	none	UK	not applicable	none
			Yellow Perch	331	10	165	157	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	11	183	176	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	12	215	205	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	13	232	223	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	14	251	243	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	15	196	187	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	16	188	180	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	17	184	178	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	18	215	207	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	19	166	159	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	20	199	179	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	21	193	187	n/a	M	ripe	none	none	UK	not applicable	none
			Northern Pike	131	22	412	385	397	M	ripe	none	177	no	not applicable	none
			Yellow Perch	331	23	189	183	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	24	160	152	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	25	153	147	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	26	190	184	n/a	UK	spent	none	none	UK	not applicable	none
			Yellow Perch	331	27	160	155	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	28	166	162	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	29	179	175	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	30	202	196	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	31	196	190	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	32	230	221	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	33	194	191	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	34	210	200	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	35	196	189	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	36	188	177	n/a	M	ripe	none	none	UK	not applicable	none
			White Sucker	163	37	379	340	n/a	UK	spent	none	none	no	not applicable	none
			Yellow Perch	331	38	185	179	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	39	161	179	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	40	175	167	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	41	153	143	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	42	169	162	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	43	198	188	n/a	F	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	44	172	168	n/a	M	ripe	none	none	UK	not applicable	none
			Shorthead Redhorse	171	45	321	281	283	UK	UK	none	none	no	not applicable	none
			Northern Pike	131	46	419	384	340	M	ripe	none	none	no	not applicable	none
			Yellow Perch	331	47	190	184	n/a	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	48	166	161	n/a	M	ripe	none	none	UK	not applicable	none
1- 25' central lead wing & 2 -10' side lead wings	2' x 3' front frames & 4 - 24" hoops	Perpendicular to shore	Shorthead Redhorse	171	1	410	365	680	UK	UK	none	173	yes	not applicable	none
			Northern Pike	131	2							137	yes	not applicable	none
			Northern Pike	131	3							49	no	not applicable	none
			Northern Pike	131	4	445	420	510	UK	spent	none	147	no	not applicable	none
			Shorthead Redhorse	171	5	391	360	680	UK	UK	none	151	no	not applicable	none
			White Sucker	163	6	385	362	680	F	ripe	none	163	no	not applicable	none
			White Sucker	163	7	320	299	340	UK	UK	none	157	no	not applicable	none
			Burbot	271	8	260	n/a	170	UK	UK	none	none	no	not applicable	none
			White Sucker	163	9	283	264	283	UK	spent	none	none	no	not applicable	none
			Northern Pike	131	10	527	500	566	UK	UK	none	165	no	not applicable	none
			Walleye	332	11	388	365	567	F	ripe	none	121	no	116	none
1- 25' central lead wing & 2 -10' side lead wings	2' x 3' front frames & 4 - 24" hoops	Fairly perpendicular to shore (angled slightly towards downstream)	Yellow Perch	331	1	216	210	60	UK	spent	none	none	UK	not applicable	Too small to tag
			Yellow Perch	331	2	210	205	50	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	3	211	201	110	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	4	191	182	100	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	5	222	213	150	UK	spent	none	none	UK	not applicable	none
			Yellow Perch	331	6	208	199	120	M	ripe	none	none	UK	not applicable	none

Net Length	Net Height	Net Orientation	Species	Species Code	Number of Fish	Length (mm)		Weight (g)	Sex	Maturity	Aging Structure	Dart Tag Number	Recapture	Telemetry Tag Number	Comments
						Total	Fork								
			Yellow Perch	331	7	221	213	150	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	8	191	182	120	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	9	202	194	150	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	10	195	187	110	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	11	171	164	60	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	12	225	215	200	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	13	226	216	210	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	14	194	185	150	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	15	191	183	150	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	16	175	167	130	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	17	182	175	130	M	ripe	none	none	UK	not applicable	none
			White Sucker	163	18	311	289	420	UK	UK	none	232	no	not applicable	One eye
			White Sucker	163	19	435	401	940	UK	UK	none	233	no	not applicable	none
			Northern Pike	131	20	380	353	440	F	ripe	none	none	no	not applicable	died
			Northern Pike	131	21	426	400	550	UK	UK	none	217	no	not applicable	none
			Yellow Perch	331	22	156	149	50	UK	UK	none	none	UK	not applicable	Too small to tag
			Yellow Perch	331	23	156	150	50	UK	UK	none	none	UK	not applicable	none
1- 25' central lead wing & 2 -10' side lead wings	2' x 3' front frames & 4 - 24" hoops	Fairly perpendicular to shore (angled slightly towards downstream)	Shorthead Redhorse	171	1	391	347	630	UK	UK	none	155	no	not applicable	none
			Saugeye	751	2	341	318	240	UK	UK	none	247	no	108	none
			Walleye	332	3	465	438	970	UK	UK	none	225	no	113	none
			Shorthead Redhorse	171	4	294	262	220	UK	UK	none	236	no	not applicable	none
			Northern Pike	131	5	399	376	470	UK	spent	none	244	no	not applicable	none
			White Sucker	163	6	403	376	660	UK	spent	none	242	no	not applicable	none
			White Sucker	163	7	377	351	580	UK	spent	none	241	no	not applicable	none
			White Sucker	163	8	398	369	760	UK	UK	none	237	no	not applicable	none
			Shorthead Redhorse	171	9	299	368	250	UK	UK	none	226	no	not applicable	none
			Walleye	332	10	246	201	110	UK	UK	none	none	no	none	none
			White Sucker	163	11	253	325	490	F	ripe	none	211	no	none	none
			Walleye	332	12	347	320	390	UK	spent	none	228	no	104	none
1- 25' central lead wing & 2 -10' side lead wings	2' x 3' front frames & 4 - 24" hoops	Fairly perpendicular to shore (angled slightly towards downstream)	Yellow Perch	331	1	226	217	120	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	2	249	239	150	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	3	230	219	150	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	4	215	205	140	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	5	218	208	140	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	6	227	218	140	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	7	216	208	130	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	8	202	194	80	UK	UK	none	none	UK	not applicable	none
			Yellow Perch	331	9	202	191	90	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	10	200	190	80	UK	UK	none	none	UK	not applicable	none
			Yellow Perch	331	11	222	210	120	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	12	187	178	90	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	13	186	177	90	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	14	186	178	80	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	15	217	207	100	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	16	217	199	150	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	17	173	165	70	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	18	170	164	60	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	19	186	179	70	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	20	171	163	50	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	21	189	179	60	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	22	189	180	70	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	23	175	166	50	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	24	191	182	60	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	25	157	149	30	M	ripe	none	none	UK	not applicable	none
			Yellow Perch	331	26	186	179	80	M	ripe	none	none	UK	not applicable	none
			Shorthead Redhorse	171	27	324	286	380	UK	UK	none	256	no	not applicable	none
			Sauger	334	28	275	266	180	UK	spent	none	264	no	none	none

Net Length	Net Height	Net Orientation	Species	Species Code	Number of Fish	Length (mm)		Weight (g)	Sex	Maturity	Aging Structure	Dart Tag Number	Recapture	Telemetry Tag Number	Comments
						Total	Fork								
1- 25' central lead wing & 2 -10' side lead wings	2' x 3' front frames & 4 - 24" hoops	Fairly perpendicular to shore (angled slightly towards downstream)	Northern Pike	131	1	375	353	110	UK	UK	none	251	no	not applicable	none
			Yelllow Perch	331	2	200	190	UK	M	ripe	none	none	UK	not applicable	none

1052 Wanatango Falls Hydro-Electric Development

2011 Fish Passage - RIN sets (not using official RIN protocol)

Station	Date & Time Deployed	Date & Time Retrieved	Elapsed Time (hr)	Water Temp (°C)	Start Depth (m)	End Depth (m)	Net Size (Jones and Yunker 2009)	Mesh Size (mm)	Species	Species Code	Fish Number	Length (mm)		Weight (g)	Sex	Maturity	Aging Structure	Dart Tag Number	Recapture	Telemetry Tag Number	Comments
RIN-011	5/5/11 11:55	5/5/11 13:55	2:00:00	3.5	n/a	n/a	Large RIN	n/a	Northern Pike	131	1	755	718	6300	F	UK	none	95	no	not applicable	none
								n/a	Northern Pike	131	2	633	599	2970	F	UK	none	90	no	not applicable	none
								n/a	Northern Pike	131	3	402	376	720	UK	UK	none	45	no	not applicable	none
								n/a	Northern Pike	131	4	322	303	330	UK	UK	none	45	no	not applicable	none
								n/a	Northern Pike	131	5	415	390	790	M	UK	none	61	no	not applicable	none
								n/a	Sauger	332	6	321	303	480	M	UK	none	35	no	100	none
RIN-012	5/5/11 12:55	5/5/11 15:05	2:10:00	3.5	n/a	n/a	Large RIN	n/a	White Sucker	163	1	406	375	1670	M	ripe	none	56	no	not applicable	none
RIN-013	5/6/11 9:25	5/6/11 11:25	2:00	3.75	n/a	n/a	Large RIN	No Fish Collected													
RIN-014	5/6/11 10:20	5/6/11 12:20	2:00	3.75	n/a	n/a	Large RIN	n/a	Northern Pike	131	1	674	640	4800	F	spent	none	55	no	not applicable	none
								n/a	Goldeye	151	2	365	339	990	UK	UK	none	30	no	not applicable	none
								n/a	Goldeye	151	3	354	326	1010	UK	UK	none	44	no	not applicable	none
								n/a	Goldeye	151	4	382	343	1270	F	ripe	none	19	no	not applicable	none
								n/a	Goldeye	151	5	417	376	1560	F	ripe	none	24	no	not applicable	none
								n/a	Goldeye	151	6	410	367	1370	F	ripe	none	2	no	not applicable	none
								n/a	Goldeye	151	7	361	328	880	UK	UK	none	27	no	not applicable	none
								n/a	Goldeye	151	8	363	328	880	UK	spent	none	3	no	not applicable	none
								n/a	Goldeye	151	9	365	341	830	F	ripe	none	66	no	not applicable	none
								n/a	Goldeye	151	10	394	357	660	F	ripe	none	35	no	not applicable	none
								n/a	Goldeye	151	11	402	370	1250	F	ripe	none	12	no	not applicable	none
								n/a	Goldeye	151	12	356	323	790	M	spent	none	6	no	not applicable	none
								n/a	Goldeye	151	13	360	327	920	UK	spent	none	14	no	not applicable	none
								n/a	Goldeye	151	14	341	314	920	UK	spent	none	85	no	not applicable	none
								n/a	Goldeye	151	15	387	349	1300	UK	spent	none	9	no	not applicable	none
								n/a	Goldeye	151	16	399	360	1250	F	ripe	none	5	no	not applicable	none
								n/a	Sauger	332	17	268	250	220	M	ripe	none	22	no	none	too small for tellemetry tag
								n/a	Northern Pike	131	18	591	560	2330	M	ripe	none	21	no	not applicable	none
								n/a	Northern Pike	131	19	410	386	790	M	ripe	none	25	no	not applicable	none
								n/a	Northern Pike	131	20	511	480	1960	M	ripe	none	100	no	not applicable	none
								n/a	Northern Pike	131	21	460	432	1250	M	ripe	none	1	no	not applicable	none
RIN-015	5/6/11 11:30	5/6/11 13:45	2:15	3.75	n/a	n/a	Large RIN	n/a	Goldeye	151	1	360	324	700	UK	spent	none	94	no	not applicable	none
								n/a	Goldeye	151	2	345	315	660	UK	spent	none	98	no	not applicable	none
								n/a	Goldeye	151	3	390	355	1140	F	ripe	none	83	no	not applicable	none
								n/a	Goldeye	151	4	342	307	650	UK	spent	none	77	no	not applicable	none
								n/a	Goldeye	151	5	390	351	940	F	ripe	none	78	no	not applicable	none
								n/a	Goldeye	151	6	340	312	740	UK	spent	none	87	no	not applicable	none
								n/a	Goldeye	151	7	436	394	1690	F	ripe	none	81	no	not applicable	none
								n/a	Yellow Perch	331	8	210	203	260	M	ripe	none	97	no	not applicable	none
								n/a	Northern Pike	131	9	440	416	940	M	ripe	none	91	no	not applicable	none
								n/a	Northern Pike	131	10	393	367	630	M	ripe	none	89	no	not applicable	none
								n/a	Northern Pike	131	11	398	374	740	M	ripe	none	86	no	not applicable	none
								n/a	Walleye	334	12	336	315	720	M	ripe	none	80	no	106	none
RIN-016	5/6/11 13:35	5/6/11 15:40	2:05	3.75	n/a	n/a	Large RIN	n/a	Goldeye	151	1	416	373	1410	F	ripe	none	92	no	not applicable	none
								n/a	Goldeye	151	2	425	392	1580	F	ripe	none	79	no	not applicable	none
								n/a	Northern Pike	131	3	555	517	2020	M	ripe	none	82	no	not applicable	none
								n/a	Northern Pike	131	4	449	419	1160	M	ripe	none	96	no	not applicable	none
								n/a	Northern Pike	131	5	350	332	520	M	ripe	none	4	no	not applicable	none
								n/a	Northern Pike	131	6	560	528	2090	UK	spent	none	23	no	not applicable	none
								n/a	Northern Pike	131	7	620	582	3480	UK	spent	none	17	no	not applicable	none
								n/a	Yellow Perch	331	8	220	213	190	UK	spent	none	11	no	not applicable	none
								n/a	Sauger	332	9	326	306	480	M	ripe	none	99	no	105	none
RIN-017	5/7/11 10:25	5/7/11 12:40	2:40	4.5	n/a	n/a	Large RIN	n/a	Goldeye	151	1	369	331	880	F	ripe	none	8	no	not applicable	none
								n/a	Goldeye	151	2	413	367	1470	F	ripe	none	84	no	not applicable	none
								n/a	Goldeye	151	3	372	340	1140	F	ripe	none	51	no	not applicable	none
								n/a	Yellow Perch	331	4	170	161	40	M	ripe	none	none	no	not applicable	none
								n/a	Northern Pike	131	5	503	470	1360	M	ripe	none	200	no	not applicable	none
								n/a	Northern Pike	131	6	485	557	1250	F	ripe	none	62	no	not applicable	none
								n/a	Northern Pike	131	7	461	432	1050	UK	spent	none	75	no	not applicable	none
								n/a	Northern Pike	131								100	yes	not applicable	none
								n/a	Northern Pike	131	9	510	474	1300	M	ripe	none	15	no	not applicable	none
								n/a	Northern Pike	131	10	500	469	1410	UK	spent	none	13	no	not applicable	none
								n/a	Northern Pike	131	11	654	617	4070	UK	spent	none	18	no	not applicable	none
RIN-018	5/9/11 9:05	5/9/11 10:10	1:05	4.5	n/a	n/a	Large RIN	n/a	Goldeye	151	1	340	312	460	UK	spent	none	73	no	not applicable	none
								n/a	Goldeye	151	2	388	363	940	F	ripe	none	31	no	not applicable	none
								n/a	Goldeye	151	3	352	321	370	UK	spent	none	53	no	not applicable	none
								n/a	Goldeye	151	4	358	321	590	UK	spent	none	69	no	not applicable	none
								n/a	Goldeye	151	5	369	332	530	UK	spent	none	29	no	not applicable	none
								n/a	Goldeye	151	6	375	340	740	UK	spent	none	93	no	not applicable	none
								n/a	Goldeye	151	7	376	n/a	570	UK	spent	none	none	no	not applicable	none
								n/a	Goldeye	151	8	384	345	630	UK	spent	none	71	no	not applicable	none
								n/a	Goldeye	151	9	348	318	370	UK	spent	none	40	no	not applicable	none
								n/a	Goldeye	151	10	346	314	500	F	ripe	none	68	no	not applicable	none
								n/a	Goldeye	151	11	369	335	570	F	ripe	none	72	no	not applicable	none
								n/a	Goldeye	151	12	420	380	1430	F	ripe	none	59	no	not applicable	none
								n/a	Goldeye	151	13	390	360	1030	F	ripe	none	43	no	not applicable	none
								n/a	Northern Pike	131	14	435	407	770	M	ripe	none	67	no	not applicable	none

Station	Date & Time Deployed	Date & Time Retrieved	Elapsed Time (hr)	Water Temp (°C)	Start Depth (m)	End Depth (m)	Net Size (Jones and Yunker 2009)	Mesh Size (mm)	Species	Species Code	Fish Number	Length (mm)		Weight (g)	Sex	Maturity	Aging Structure	Dart Tag Number	Recapture	Telemetry Tag Number	Comments
								n/a	Northern Pike	131	15	604	575	2310	F	ripe	none	16	no	not applicable	none
								n/a	Northern Pike	131	16	503	470	1270	F	ripe	none	64	no	not applicable	none
								n/a	Northern Pike	131	17	337	305	220	M	ripe	none	none	no	not applicable	too small to dart tag
								n/a	Northern Pike	131	18	355	335	330	M	ripe	none	none	no	not applicable	too small to dart tag
								n/a	Yellow Perch	331	19	229	222	n/a	F	ripe	none	none	no	not applicable	too small to dart tag
RIN-019	5/9/11 9:10	5/9/11 11:15	2:05	4.5	n/a	n/a	Large RIN	n/a	Northern Pike	131	1	780	741	7360	F	spent	none	52	no	not applicable	Scar on pelvic area
								n/a	Northern Pike	131	2	469	439	1450	M	ripe	none	60	no	not applicable	none
								n/a	Northern Pike	131	3	380	353	740	M	ripe	none	70	no	not applicable	none
RIN-020	5/9/11 10:20	5/9/11 12:25	2:55	4.5	n/a	n/a	Large RIN	n/a	Goldeye	151	1							73	yes	not applicable	none
								n/a	Goldeye	151	2							81	yes	not applicable	none
								n/a	Northern Pike	131	3	507	474	1520	F	ripe	none	54	no	not applicable	none
								n/a	Northern Pike	131	4	370	345	720	M	ripe	none	63	no	not applicable	none
								n/a	Northern Pike	131	5	485	455	1270	M	ripe	none	137	no	not applicable	none
								n/a	Northern Pike	131	6	354	329	610	M	ripe	none	149	no	not applicable	none
								n/a	Northern Pike	131	7	430	403	1080	M	ripe	none	134	no	not applicable	none
								n/a	Walleye	334	8	440	412	1960	M	ripe	none	147	no	110	none
								n/a	Sauger	332	9	300	284	460	UK	spent	none	65	no	none	too small
								n/a	Sauger	332	10	320	301	610	F	green	none	126	no	107	none
RIN-021	5/9/11 11:25	5/9/11 13:40	2:15	4.5	n/a	n/a	Large RIN	n/a	Northern Pike	131	1	413	388	940	M	ripe	none	145	no	not applicable	none
RIN-022	5/9/11 13:55	5/9/11 15:05	1:10	4.5	n/a	n/a	Large RIN	n/a	Goldeye	151	1	428	395	1650	F	ripe	none	132	no	not applicable	none
								n/a	Goldeye	151	2	356	321	720	UK	spent	none	128	no	not applicable	none
								n/a	Northern Pike	131	3	572	540	2490	F	ripe	none	76	no	not applicable	none
								n/a	Northern Pike	131	4	535	505	1940	UK	spent	none	138	no	not applicable	none
								n/a	Yellow Perch	331	5	256	425	500	UK	spent	none	127	no	not applicable	fish lice on tail
								n/a	Yellow Perch	331	6	181	175	n/a	M	ripe	none	none	no	not applicable	to small to tag
								n/a	Longnose Sucker	162	7	423	394	1760	UK	UK	none	178	no	not applicable	believed to be male
								n/a	Longnose Sucker	162	8	389	360	1380	UK	UK	none	148	no	not applicable	believed to be male
								n/a	Walleye	334	9	389	365	1230	UK	UK	none	133	no	111	fish lice on tail
RIN-023	5/9/11 14:05	5/9/11 1605	2:00	4.5	n/a	n/a	Large RIN	n/a	Northern Pike	131	1	510	482	1630	UK	UK	none	144	no	not applicable	none
								n/a	Northern Pike	131	2	621	587	3500	UK	UK	none	150	no	not applicable	none
								n/a	Northern Pike	131	3	465	437	1250	M	ripe	none	146	no	not applicable	none
								n/a	Walleye	334	4	393	367	1190	F	green	none	131	no	102	fish lice on tail
RIN-024	5/15/11 13:30	5/15/11 14:34	1:04	6.0	n/a	n/a	Large RIN	n/a	Northern Pike	131	1	495	462	358	M	ripe	none	136	no	not applicable	none
								n/a	Northern Pike	131	2	383	365	200	F	ripe	none	141	no	not applicable	none
								n/a	Northern Pike	131	3	384	359	145	M	ripe	none	135	no	not applicable	none
								n/a	Longnose Sucker	162	4	401	372	335	UK	UK	none	38	no	not applicable	red stripe & breeding tubercles present
RIN-025	5/21/11 11:53	5/21/11 13:53	2:00	11.5	n/a	n/a	Large RIN	n/a	Northern Pike	131	1						none	95	yes	not applicable	none
								n/a	Goldeye	151	2	343	315	367	F	ripe	none	187	no	not applicable	none
								n/a	Goldeye	151	3	401	367	482	F	ripe	none	190	no	not applicable	none
								n/a	Goldeye	151	4	394	356	567	F	ripe	none	123	no	not applicable	none
								n/a	Goldeye	151	5	370	330	425	UK	UK	none	188	no	not applicable	none
								n/a	Goldeye	151	6	400	360	567	F	ripe	none	101	no	not applicable	none
								n/a	Goldeye	151	7	341	307	312	UK	spent	none	115	no	not applicable	none
								n/a	Goldeye	151	8	395	363	567	F	ripe	none	176	no	not applicable	Left eye squished
								n/a	Goldeye	151	9	333	300	312	UK	spent	none	195	no	not applicable	none
								n/a	Goldeye	151	10	352	322	397	F	ripe	none	182	no	not applicable	none
								n/a	Goldeye	151	11	336	306	312	UK	spent	none	191	no	not applicable	none
								n/a	Goldeye	151	12	394	360	595	F	ripe	none	none	no	not applicable	Died
								n/a	Goldeye	151	13	320	292	283	UK	spent	none	none	no	not applicable	Too small to tag
								n/a	Goldeye	151	14	362	327	369	M	spent	none	152	no	not applicable	none
								n/a	Walleye	334	15	262	244	113	UK	UK	none	none	no	not applicable	Too small to tag
								n/a	Goldeye	151	16	416	381	652	F	ripe	none	none	no	not applicable	Died
								n/a	Goldeye	151	17	341	317	397	F	ripe	none	178	no	not applicable	none
								n/a	Goldeye	151	18	430	389	680	UK	spent	none	none	no	not applicable	Died
								n/a	Goldeye	151	19	341	308	283	UK	spent	none	192	no	not applicable	none
								n/a	Goldeye	151	20	400	362	539	UK	spent	none	none	no	not applicable	Body in rough condition
								n/a	Goldeye	151	21	372	341	482	F	ripe	none	none	no	not applicable	Died
								n/a	Goldeye	151	22	379	342	652	UK	UK	none	none	no	not applicable	Died
RIN-026	5/21/11 13:37	5/21/11 15:33	2:00	11.5	n/a	n/a	Large RIN	n/a	Walleye	334	1	290	270	198	UK	UK	none	142	no	none	Too small for tellemetry tag
								n/a	Northern Pike	131	2	709	673	2410	UK	spent	none	117	no	not applicable	none
								n/a	Sauger	332	3	286	269	227	F	spent	none	198	no	none	Too small for tellemetry tag/fish lice on tail
								n/a	Goldeye	151	4	425	390	624	UK	spent	none	186	no	not applicable	none
								n/a	Goldeye	151	5	417	379	567	UK	spent	none	185	no	not applicable	none
								n/a	Goldeye	151	6	36	337	425	UK	spent	none	none	no	not applicable	Died
								n/a	Goldeye	151	7	390	355	510	UK	spent	none	189	no	not applicable	none
								n/a	Goldeye	151	8	380	345	539	UK	spent	none	193	no	not applicable	none
								n/a	Yellow Perch	331	9	235	225	n/a	F	spent	none	none	no	not applicable	Too small to tag
								n/a	Sauger	332	10	260	245	n/a	UK	UK	none	none	no	none	Too small to tag
RIN-027	5/21/11 14:11	5/21/11 1614	2:03	11.5	n/a	n/a	Large RIN	n/a	White Sucker	163	1	280	262	227	UK	UK	none	196	no	not applicable	none
								n/a	Goldeye	151	2	364	330	624	UK	spent	none	184	no	not applicable	none
								n/a	Goldeye	151	3	360	327	425	F	ripe	none	140	no	not applicable	none
								n/a	Goldeye	151	4	436	395	709	M	spent	none	183	no	not applicable	none
								n/a	Goldeye	151	5	427	386	624	F	ripe	none	180	no	not applicable	none
								n/a	Goldeye	151	6	403	365	567	UK	spent	none	179	no	not applicable	none
								n/a	Goldeye	151	7	373	344	425	UK	spent	none	none	no	not applicable	Died
								n/a	Walleye	334	8	250	234	none	UK	UK	none	none	no	not applicable	Died
								n/a	Walleye	334	9	355	334	454	UK	spent	none	194	no	117	none
RIN-028	5/21/11 15:37	5/21/11 17:45	2:08	11.5	n/a	n/a	Large RIN	n/a	Goldeye	151	1	382	350	539	UK	UK	none	167	no	not applicable	none
								n/a	Goldeye	151	2	346	325	340	UK	spent	none	112	no	not applicable	none

Station	Date & Time Deployed	Date & Time Retrieved	Elapsed Time (hr)	Water Temp (°C)	Start Depth (m)	End Depth (m)	Net Size (Jones and Yunker 2009)	Mesh Size (mm)	Species	Species Code	Fish Number	Length (mm)		Weight (g)	Sex	Maturity	Aging Structure	Dart Tag Number	Recapture	Telemetry Tag Number	Comments
								n/a	Goldeye	151	3	364	329	340	UK	spent	none	111	no	not applicable	none
								n/a	Goldeye	151	4	380	345	482	F	ripe	none	122	no	not applicable	none
								n/a	Goldeye	151	5	330	295	283	UK	spent	none	103	no	not applicable	none
								n/a	Goldeye	151	6	390	355	454	UK	spent	none	105	no	not applicable	none
								n/a	Northern Pike	131	7	465	435	482	UK	spent	none	116	no	not applicable	none
								n/a	Sauger	332	8	276	260	n/a	M	ripe	none	none	no	not applicable	none
								n/a	Walleye	334	9	240	223	n/a	UK	UK	none	none	no	none	Too small to tag
								n/a	Yellow Perch	331	10	260	250	198	UK	spent	none	none	no	not applicable	none
								n/a	Northern Pike	131	11	474	451	397	UK	UK	none	199	no	not applicable	none
								n/a	Yellow Perch	331	12	225	217	255	UK	spent	none	none	no	not applicable	none
								n/a	Walleye	334	13	287	270	255	UK	spent	none	none	no	none	Too small to tag
								n/a	Walleye	334	14	350	328	425	M	ripe	none	110	no	109	none
RIN-029	5/22/11 11:57	5/22/11 14:25	2:28	12	n/a	n/a	Large RIN	n/a	Lake Sturgeon	31	1	765	665	2280	UK	UK	none	none	no	not applicable	none
								n/a	Northern Pike	131	2						none	90	yes	not applicable	none
								n/a	Shorthead Redhorse	171	3	307	275	300	UK	UK	none	162	no	not applicable	none
								n/a	Goldeye	151	4	375	343	410	UK	spent	none	none	no	not applicable	died
								n/a	Goldeye	151	5	352	322	380	UK	spent	none	none	no	not applicable	Died
								n/a	Walleye	334	6	213	200	n/a	M	ripe	none	none	no	none	Died
								n/a	Goldeye	151	7	435	393	82	F	ripe	none	175	no	not applicable	none
								n/a	Goldeye	151	8	404	368	510	F	ripe	none	166	no	not applicable	none
								n/a	Goldeye	151	9	363	331	410	UK	spent	none	200	no	not applicable	none
								n/a	Goldeye	151	10	424	392	610	UK	spent	none	none	no	not applicable	Died
								n/a	Goldeye	151	11	350	311	370	UK	spent	none	159	no	not applicable	none
								n/a	Goldeye	151	12	398	362	520	F	ripe	none	156	no	not applicable	none
								n/a	Longnose Sucker	162	13	435	410	910	UK	UK	none	168	no	not applicable	none
								n/a	Sauger	332	14	309	286	280	UK	spent	none	181	no	none	Too small to tellemetry tag
								n/a	Walleye	334	15	270	255	190	M	ripe	none	none	no	none	Too small to tellemetry tag
								n/a	Walleye	334	16	337	311	360	M	ripe	none	118	no	115	none
RIN-030	5/22/11 13:00	5/22/11 15:45	2:45	12	n/a	n/a	Large RIN	n/a	Goldeye	151	1	353	319	380	UK	spent	none	161	no	not applicable	none
								n/a	Goldeye	151	2	399	360	700	F	spent	none	none	no	not applicable	none
								n/a	Goldeye	151	3	407	364	510	UK	spent	none	104	no	not applicable	none
								n/a	Goldeye	151	4	384	349	580	F	spent	none	120	no	not applicable	none
								n/a	Goldeye	151	5	399	361	580	F	ripe	none	153	no	not applicable	none
								n/a	Goldeye	151	6	380	345	450	M	ripe	none	108	no	not applicable	none
								n/a	Goldeye	151	7	379	359	420	UK	spent	none	none	no	not applicable	Missing top of tail
								n/a	Goldeye	151	8	353	325	430	UK	spent	none	119	no	not applicable	none
								n/a	Goldeye	151	9	364	334	460	F	ripe	none	114	no	not applicable	none
								n/a	Goldeye	151	10	351	315	400	UK	spent	none	none	no	not applicable	Died
								n/a	Goldeye	151	11	347	319	370	UK	spent	none	113	no	not applicable	none
								n/a	Goldeye	151	12	356	328	400	UK	spent	none	none	no	not applicable	Died
								n/a	Goldeye	151	13	328	300	270	UK	spent	none	102	no	not applicable	none
								n/a	Goldeye	151	14	311	284	250	UK	spent	none	none	no	not applicable	Died
								n/a	Goldeye	151	15	400	360	520	F	ripe	none	none	no	not applicable	Died
								n/a	Goldeye	151	16	345	312	310	F	ripe	none	none	no	not applicable	Died
								n/a	Sauger	332	17	223	210	100	UK	UK	none	none	no	none	Too small to tag
RIN-031	5/22/11 15:33	5/22/11 16:47	1:14	12	n/a	n/a	Large RIN	n/a	Goldeye	151	1	370	335	430	F	ripe	none	172	no	not applicable	none
								n/a	Goldeye	151	2	394	359	540	F	ripe	none	124	no	not applicable	none
								n/a	Goldeye	151	3	380	346	470	UK	spent	none	none	no	not applicable	none
								n/a	Goldeye	151	4	360	329	480	UK	spent	none	174	no	not applicable	none
								n/a	Yellow Perch	331	5	222	215	160	M	spent	none	none	no	not applicable	Too small to tag
								n/a	Walleye	332	6	198	187	n/a	UK	UK	none	none	no	none	Too small to tag
								n/a	Walleye	332	7	276	258	180	UK	UK	none	none	no	none	Too small to tag
								n/a	Goldeye	151	8	394	358	550	UK	spent	none	170	no	not applicable	none
								n/a	Goldeye	151	9	384	349	580	F	ripe	none	none	no	not applicable	none
								n/a	Lake Whitefish	91	10	394	353	590	UK	UK	none	154	no	not applicable	none
								n/a	Walleye	332	11	312	295	300	UK	UK	none	125	no	none	Too small to tag
								n/a	Sauger	334	12	233	220	n/a	UK	UK	none	none	no	none	Too small to tag
								n/a	Walleye	332	13	272	253	170	UK	UK	none	none	no	none	Too small to tag
								n/a	Walleye	332	14	270	251	190	M	ripe	none	none	no	none	Too small to tag
								n/a	Walleye	332	15	322	303	270	UK	UK	none	139	no	101	none
								n/a	Walleye	332	16	374	351	490	UK	UK	none	171	no	103	none
RIN-032	5/23/11 10:24	5/23/11 12:55	2:55	13	n/a	n/a	Large RIN	n/a	Goldeye	151	1							179	yes	not applicable	none
								n/a	Goldeye	151	2							153	yes	not applicable	none
								n/a	Northern Pike	131	3							54	yes	not applicable	none
								n/a	Walleye	332	4	279	256	110	UK	UK	none	none	no	none	Died
								n/a	Lake Whitefish	91	5	334	297	250	UK	UK	none	205	no	not applicable	none
								n/a	Goldeye	151	6	344	310	270	UK	spent	none	246	no	not applicable	none
								n/a	Goldeye	151	7	350	310	310	UK	spent	none	248	no	not applicable	none
								n/a	Walleye	332	8	281	260	140	UK	spent	none	none	no	none	Died
								n/a	Walleye	332	9	273	258	140	UK	spent	none	227	no	none	none
								n/a	Walleye	332	10	339	315	320	M	ripe	none	234	no	114	none
RIN-033	5/23/11 10:28	5/23/11 12:57	2:29	13	n/a	n/a	Large RIN	n/a	Goldeye	151	1	430	404	710	F	ripe	none	245	yes	not applicable	Lost previous tag so it was re-tagged
								n/a	Goldeye	151	2	308	281	200	UK	UK	none	231	no	not applicable	none
								n/a	Goldeye	151	3	373	340	370	UK	UK	none	240	no	not applicable	none
								n/a	Goldeye	151	4	376	340	470	F	spent	none	229	no	not applicable	none
								n/a	Goldeye	151	5	391	352	480	F	ripe	none	107	no	not applicable	none
								n/a	Goldeye	151	6	382	341	500	F	ripe	none	239	no	not applicable	none
								n/a	Goldeye	151	7	342	310	340	UK	spent	none	109	no	not applicable	none
								n/a	Goldeye	151	8	406	370	610	F	ripe	none	106	no	not applicable	none

Station	Date & Time Deployed	Date & Time Retrieved	Elapsed Time (hr)	Water Temp (°C)	Start Depth (m)	End Depth (m)	Net Size (Jones and Yunker 2009)	Mesh Size (mm)	Species	Species Code	Fish Number	Length (mm)		Weight (g)	Sex	Maturity	Aging Structure	Dart Tag Number	Recapture	Telemetry Tag Number	Comments
								n/a	Goldeye	151	9	377	344	500	F	ripe	none	243	no	not applicable	none
								n/a	Goldeye	151	10	353	314	340	UK	spent	none	none	no	not applicable	Died
								n/a	Goldeye	151	11	344	311	310	UK	spent	none	209	no	not applicable	none
								n/a	Goldeye	151	12	251	227	70	UK	UK	none	none	no	not applicable	Too small to tag
								n/a	Goldeye	151	13	379	345	430	UK	UK	none	206	no	not applicable	none
								n/a	White Sucker	163	14	276	259	180	UK	spent	none	none	no	not applicable	To small to tag
								n/a	Walleye	332	15	305	283	200	UK	UK	none	none	no	not applicable	Died
								n/a	Northern Pike	131	16	489	461	660	M	spent	none	238	no	not applicable	none
								n/a	Goldeye	151	17	371	337	450	F	ripe	none	none	no	not applicable	Died
								n/a	Goldeye	151	18	401	370	470	F	ripe	none	none	no	not applicable	Died
								n/a	Sauger	334	19	242	326	150	UK	UK	none	none	no	not applicable	Too small to tag
RIN-034	5/23/11 12:59	5/23/11 15:04	2:05	13	n/a	n/a	Large RIN	n/a	Goldeye	151	1							243	yes	not applicable	none
								n/a	Goldeye	151	2	390	352	490	UK	spent	none	none	no	not applicable	Died
								n/a	Goldeye	151	3	383	345	480	UK	spent	none	230	no	not applicable	none
								n/a	Goldeye	151	4	379	348	510	UK	spent	none	212	no	not applicable	none
								n/a	Sauger	334	5	220	205	90	M	ripe	none	none	no	none	Died
								n/a	Northern Pike	131	6	419	392	400	M	ripe	none	215	no	not applicable	none
								n/a	Walleye	332	7	376	353	570	UK	spent	none	250	no	112	none
								n/a	Walleye	332	8	361	340	460	UK	spent	none	none	no	none	Died
RIN-035	5/23/11 13:51	5/23/11 16:00	2:09	13	n/a	n/a	Large RIN	n/a	Northern Pike	131	1	780	745	2830	UK	UK	none	221	no	not applicable	Rough shape from net
								n/a	Goldeye	151	2	381	347	400	F	ripe	none	204	no	not applicable	none
								n/a	Goldeye	151	3	333	302	230	F	ripe	none	207	no	not applicable	none
								n/a	Goldeye	151	4	343	312	280	UK	spent	none	201	no	not applicable	none
								n/a	Goldeye	151	5	449	410	800	F	spent	none	222	no	not applicable	none
								n/a	Goldeye	151	6	432	397	700	F	ripe	none	213	no	not applicable	Missing part of tail
								n/a	Goldeye	151	7	327	300	250	UK	spent	none	203	no	not applicable	none
								n/a	Goldeye	151	8	356	325	300	UK	spent	none	249	no	not applicable	none
								n/a	Goldeye	151	9	387	348	420	UK	spent	none	224	no	not applicable	none
								n/a	Goldeye	151	10	374	339	320	UK	spent	none	297	no	not applicable	none
								n/a	Goldeye	151	11	339	305	250	UK	spent	none	202	no	not applicable	none
								n/a	Goldeye	151	12	390	350	510	F	ripe	none	220	no	not applicable	none
								n/a	Longnose Sucker	162	13	489	453	1290	F	ripe	none	214	no	not applicable	Lip cut from net
								n/a	Sauger	334	14	323	302	140	M	ripe	none	none	no	none	died
								n/a	Sauger	334	15	266	250	90	UK	UK	none	none	no	none	Died (fish lice)
RIN-036	5/23/11 15:13	5/23/11 17:10	1:57	13	n/a	n/a	Large RIN	n/a	Goldeye	151	1							53	yes	not applicable	none
								n/a	Goldeye	151	2	415	375	580	UK	spent	none	254	no	not applicable	none
								n/a	Goldeye	151	3	376	373	420	F	spent	none	218	no	not applicable	none
								n/a	Walleye	332	4	393	365	470	UK	spent	none	223	no	118	none
RIN-037	5/23/11 1610	5/23/11 18:27	2:17	13	n/a	n/a	Large RIN	n/a	Goldeye	151	1	437	401	460	F	ripe	none	266	no	not applicable	none
								n/a	Goldeye	151	2	380	343	340	UK	spent	none	261	no	not applicable	none
								n/a	Goldeye	151	3	414	373	570	F	ripe	none	253	no	not applicable	none
								n/a	Goldeye	151	4	356	323	300	UK	spent	none	216	no	not applicable	none
								n/a	Goldeye	151	5	360	323	310	UK	spent	none	257	no	not applicable	none
								n/a	Goldeye	151	6	344	307	440	M	spent	none	208	no	not applicable	none
								n/a	Goldeye	151	7	380	343	390	UK	spent	none	238	no	not applicable	none
								n/a	Goldeye	151	8	355	320	270	UK	spent	none	288	no	not applicable	none
								n/a	Shorthead Redhorse	171	9	423	385	810	F	ripe	none	262	no	not applicable	none
								n/a	Sauger	334	10	264	250	90	UK	UK	none	none	no	none	Too small to tag
								n/a	Sauger	334	11	229	205	50	UK	UK	none	none	no	none	Too small to tag
								n/a	Sauger	334	12	285	268	110	M	ripe	none	none	no	none	Died
								n/a	Sauger	334	13	265	250	100	UK	UK	none	none	no	none	Died
								n/a	Walleye	332	14	272	254	150	UK	UK	none	none	no	none	Too small
RIN-038	5/23/11 17:15	5/23/11 18:45	1:30	13	n/a	n/a	Large RIN	n/a	Goldeye	151	1	432	391	590	UK	spent	none	265	no	not applicable	none
								n/a	Goldeye	151	2	389	346	340	UK	spent	none	274	no	not applicable	none
								n/a	Goldeye	151	3	351	321	310	F	spent	none	268	no	not applicable	none
								n/a	Goldeye	151	4	376	344	340	UK	n/a	none	210	no	not applicable	none
								n/a	Goldeye	151	5	331	300	240	UK	UK	none	none	no	not applicable	none
								n/a	Walleye	332	6	255	239	160	UK	UK	none	none	no	none	Too small to tag
								n/a	Goldeye	151	7	337	301	280	UK	UK	none	283	no	not applicable	none
								n/a	Goldeye	151	8	342	311	270	M	spent	none	260	no	not applicable	none
								n/a	Sauger	334	9	235	220	n/a	UK	UK	none	none	no	not applicable	none
								n/a	Goldeye	151	10	352	315	350	UK	UK	none	272	no	not applicable	none
								n/a	Goldeye	151	11	419	372	560	UK	UK	none	255	no	not applicable	none
								n/a	Sauger	334	12	280	261	80	UK	UK	none	none	no	none	none
								n/a	Saugeye	751	13	259	242	80	UK	UK	none	none	no	none	Too small to tag
								n/a	Walleye	332	14	313	293	140	UK	UK	none	none	no	none	Died
								n/a	Goldeye	151	15	352	325	230	UK	UK	none	none	no	not applicable	none
								n/a	Sauger	334	16	225	207	70	UK	UK	none	none	no	none	Died
RIN-039	5/21/11 12:20	5/21/11 13:28	1:08	11	2.6	2.8	Large RIN	No Fish Collected													
RIN-040	5/21/11 12:30	5/21/11 14:15	1:45	11	1.8	3.3	Large RIN	No Fish Collected													
RIN-041	5/21/11 13:40	5/21/11 15:41	1:31	11	3	4.5	Large RIN	38	Goldeye	151	1	225	210	UK	UK	UK	none	none	UK	not applicable	too small to have been tagged, photographs taken
RIN-042	5/21/11 14:25	5/21/11 16:30	2:05	11	3.5	4.5	Large RIN	64	Goldeye	151	1	355	325	UK	UK	UK	none	none	no	not applicable	photographs taken
								38	Goldeye	151	2	405	357	UK	UK	UK	none	none	no	not applicable	none
								38	Goldeye	151	3	355	320	UK	UK	UK	none	none	no	not applicable	none
								51	Goldeye	151	4	210	190	UK	UK	UK	none	none	UK	not applicable	possibly too small to have been tagged
RIN-043	5/22/11 15:15	5/22/11 16:25	1:10	12	5	3	Large RIN	38	Goldeye	151	1	200	185	UK	UK	UK	none	none	uk	not applicable	possibley too small to have been tagged
RIN-044	5/22/11 15:50	5/22/11 16:40	0:50	12	3	9.4	Large RIN	No Fish Collected													
RIN-045	5/23/11 11:24	5/23/11 12:32	1:08	12.5	2.8	5.5	Large RIN	No Fish Collected													
RIN-046	5/23/11 11:35	5/23/11 13:00	1:25	12.5	2.5	7.7	Large RIN	38	White Sucker	163	1	168	155	UK	UK	UK	none	none	UK	not applicable	too small to have been tagged

Station	Date & Time Deployed	Date & Time Retrieved	Elapsed Time (hr)	Water Temp (°C)	Start Depth (m)	End Depth (m)	Net Size (Jones and Yunker 2009)	Mesh Size (mm)	Species	Species Code	Fish Number	Length (mm)		Weight (g)	Sex	Maturity	Aging Structure	Dart Tag Number	Recapture	Telemetry Tag Number	Comments
								51	Herring sp (Cisco)	106	2	205	180	UK	UK	UK	none	none	no	not applicable	none
RIN-047	5/23/11 12:40	5/23/11 13:54	1:14	12.5	3.5	4	Large RIN	51	Sauger	334	1	233	215	UK	UK	UK	none	none	UK	none	This fish would have been too small to tag
RIN-048	5/23/11 13:00	5/23/11 14:12	1:12	12.5	4	9.5	Large RIN	76	Goldeye	151	1	350	320	UK	UK	UK	none	none	no	not applicable	none
RIN-049	5/23/11 13:50	5/23/11 15:20	1:30	12.5	3	4	Large RIN	No Fish Collected													
RIN-050	5/23/11 14:20	5/23/11 15:30	1:10	12.5	3.5	4	Large RIN	No Fish Collected													
RIN-051	5/23/11 15:25	5/23/11 16:45	1:20	12.5	3	3	Large RIN	No Fish Collected													
RIN-052	5/23/11 15:45	5/23/11 17:10	1:25	12.5	3	2	Large RIN	No Fish Collected													

1052 Wanatango Falls Hydro-Electric Development

2010 Surface Water Sampling

			YSI Multi meter Data					Ferrous Iron	General			
Sample #	**Duplicate**	**Date**	**Time**	**pH**	**Conductivity (µs/cm)**	**Temp (°C)**	**DO (%)**	**Results (mg/L)**	**Water Level**	**Water Current**	**Water Colour**	**Water Odour**
SWF-001	No	27-Jul-10	14:30	8.69	228	23.2	99.1	0.07	low	slow	Turbid/brown	none
SWF-002	No	29-May-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	fast	Turbid/brown	none
SWF-003	No	27-Jul-10	18:50	8.85	231	23	98.7	0.04	low	moderate	Turbid/brown	none
SWF-004	yes	27-Jul-10	18:50	8.85	231	23	98.7	0.03	low	moderate	Turbid/brown	none
SWF-005	No	29-May-10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	fast	Turbid/brown	none

n/a = not available

APPENDIX V

TERRESTRIAL ASSESSMENT MAPPING

Wanatango Falls Hydropower Development

Vegetation Communities & Cover Board Locations - Map 1

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

July 26, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

494750 495000 495250 495500 495750

5411500 5411250 5411000 5410750 5410500 5410250 5410000 5409750

B114
CONNAUGHT EVELYN RD
SB10
SB9
B114
B114
SB8
MAP 2

Legend

- Snake Board Location
- Zone of Inundation
- Flow Direction
- Significant Wildlife Habitat for Bald Eagle Nesting and Perching
- Significant Wildlife Habitat for Canada Warbler
- Ecological Land Classification

(B114) Moist, Fine: Pine - Black Spruce Conifer

- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

Meters
0 100 200 300

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango1_ELC_5K_2011_07_26_SWM.mxd

Wanatango Falls Hydropower Development

Vegetation Communities & Cover Board Locations - Map 2

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

July 26, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

MAP 1

B134

B114

B114

MAP 3

Legend

- Zone of Inundation
- Flow Direction
- Significant Wildlife Habitat for Bald Eagle Nesting and Perching
- Significant Wildlife Habitat for Canada Warbler
- Ecological Land Classification
- (B114) Moist, Fine: Pine - Black Spruce Conifer
- (B134) Mineral Thicket Swamp
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

494500 494750 495000 495250 495500

5409000 5408750 5408500 5408250 5408000 5407750 5407500 5407250

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango2_ELC_5K_2011_07_26_SWM.mxd

Wanatango Falls Hydropower Development

Vegetation Communities & Cover Board Locations - Map 3

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

July 26, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

496000 496250 496500 496750 497000

5406750 5406500 5406250 5406000 5405750 5405500 5405250 5405000

MAP 2

B114

SB6

B148

SB5

B142

B148

B114

B114

MAP 4

N

0 100 200 300 Meters

Legend

- Snake Board Location
- Zone of Inundation
- Flow Direction
- Significant Wildlife Habitat for Bald Eagle Nesting and Perching
- Significant Wildlife Habitat for Bald Eagle Foraging
- Significant Wildlife Habitat for Canada Warbler
- Ecological Land Classification

(B114) Moist, Fine: Pine - Black Spruce Conifer

(B142) Mineral Meadow Marsh

(B148) Mineral Shallow Marsh

- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango3_ELC_5K_2011_07_26_SWM.mxd

Wanatango Falls Hydropower Development

Vegetation Communities & Cover Board Locations - Map 4

Natural Resource Solutions Inc.
Aquatic, Terrestrial and Wetland Biologists

July 26, 2011
Project: 1052
NAD83 - UTM Zone 17
Scale:1:5,000 (11x17")

496750 497000 497250 497500 497750 498000 498250 498500

5406000 5405750 5405500 5405250 5405000

MAP 3

SB5 SB4 SB3 SB2 SB1

B148 B142 B114

Legend

- Snake Board Location
- Zone of Inundation
- Flow Direction
- Significant Wildlife Habitat for Bald Eagle Nesting and Perching
- Significant Wildlife Habitat for Bald Eagle Foraging
- Significant Wildlife Habitat for Canada Warbler
- Ecological Land Classification
- (B114) Moist, Fine: Pine - Black Spruce Conifer
- (B142) Mineral Meadow Marsh
- (B148) Mineral Shallow Marsh
- Primary Road
- Secondary Road
- Tertiary Road
- Elevation Contour (10m Interval)

N

0 100 200 300 Meters

Path: X:\1016_XenecaPower\Wanatango\NRSI_1052_Wanatango4_ELC_5K_2011_07_26_SWM.mxd

APPENDIX VI

VEGETATION INVENTORY

Wanatango Hydroelectric Generation Station

Vegetation Species Observed in the Study Area

BOTANICAL NAME	COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	PROVINCIAL STATUS	OMNR STATUS	COSEWIC STATUS	GLOBAL STATUS
	SOURCE:	OLDHAM ET AL	OLDHAM ET AL	OLDHAM ET AL	MNR RARE 4th Ed. 2009	SARO List	SARA Registry	MNR RARE 4th Ed. 2009
PTERIDOPHYTES	**FERNS & ALLIES**							
Dryopteridaceae	**Wood Fern Family**							
Athyrium filix-femina var. angustum	Northern Lady Fern	4	0		S5			G5T5
Gymnocarpium dryopteris	Oak Fern	7	0		S5			G5
Matteuccia struthiopteris var. pensylvanica	Ostrich Fern	5	-3		S5			G5
Equisetaceae	**Horsetail Family**							
Equisetum sp.	Horsetail sp.							
Equisetum arvense	Field Horsetail	0	0		S5			G5
Equisetum fluviatile	Water Horsetail	7	-5		S5			G5
Equisetum sylvaticum	Wood Horsetail	7	-3		S5			G5
Lycopodiaceae	**Clubmoss Family**							
Lycopodium annotinum	Bristly Club-moss	7	0		S5			G5
Lycopodium clavatum	Running Club-moss	6	0		S5			G5
Polypodiaceae	**Polypody Family**							
Polypodium virginianum	Rock Polypody Fern	6	5		S5			G5
GYMNOSPERMS	**CONIFERS**							
Cupressaceae	**Cedar Family**							
Juniperus communis	Common Juniper	4	3		S5			G5
Thuja occidentalis	Eastern White Cedar	4	-3		S5			G5
Pinaceae	**Pine Family**							
Abies balsamea	Balsam Fir	5	-3		S5			G5
Larix laricina	Tamarack	7	-3		S5			G5
Picea glauca	White Spruce	6	3		S5			G5
Picea mariana	Black Spruce	8	-3		S5			G5
Pinus resinosa	Red Pine	8	3		S5			G5
DICOTYLEDONS	**DICOTS**							
Aceraceae	**Maple Family**							
Acer spicatum	Mountain Maple	6	3		S5			G5
Apiaceae	**Carrot or Parsley Family**							
Sium suave	Hemlock Water-parsnip	4	-5		S5			G5
Apocynaceae	**Dogbane Family**							
Apocynum androsaemifolium ssp. Androsaemifolium	Spreading Dogbane	3	5		S5			G5T?
Araliaceae	**Ginseng Family**							
Aralia elata	Sarsaparilla		5	-1	SE1			G?
Aralia nudicaulis	Wild Sarsaparilla	4	3		S5			G5
Asclepiadaceae	**Milkweed Family**							
Asclepias incarnata ssp. Incarnata	Swamp Milkweed	6	-5		S5			G5T5
Asclepias syriaca	Common Milkweed	0	5		S5			G5

BOTANICAL NAME	COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	PROVINCIAL STATUS	OMNR STATUS	COSEWIC STATUS	GLOBAL STATUS
Asteraceae	**Composite or Aster Family**							
Achillea millefolium ssp. Lanulosa	Woolly Yarrow	0	3		S5			G5T5
Bidens sp.	Bur-marigold species							
Cirsium arvense	Canada Thistle		3	-1	SE5			G?
Cirsium muticum	Swamp Thistle	8	-5		S5			G5
Erigeron annus	Daisy Fleabane	0	1		S5			G5
Erigeron philadelphicus ssp. Philadelphicus	Philadelphia Fleabane	1	-3		S5			G5T?
Erigeron strigosus	Daisy Fleabane	0	1		S5			G5
Eupatorium maculatum ssp. Maculatum	Spotted Joe-pye-weed	3	-5		S5			G5T5
Eurybia macrophylla	Large-leaved Aster	5	5		S5			G5
Hieracium aurantiacum	Devil's Paintbrush		5	-2	SE5			G?
Leucanthemum vulgare	Ox-eye Daisy		5	-1	SE5			G?
Oclemena nemoralis	Bog Aster	10	-5		S5			G5
Petasites frigidus	Palmate-leaf Sweet-coltsfoot	8	-3		S5			G5
Taraxacum officinale	Common Dandelion		3	-2	SE5			G5
Balsaminaceae	**Touch-me-not Family**							
Impatiens capensis	Spotted Touch-me-not	4	-3		S5			G5
Betulaceae	**Birch Family**							
Alnus incana spp. Rugosa	Speckled Alder	6	-5		S5			G5T5
Betula papyrifera	White Birch		2		S5			G5
Corylus cornuta ssp. Cornuta	Beaked Hazel	5	5		S5			G5T
Boraginaceae	**Borage Family**							
Mertensia paniculata	Tall Lungwort				S5			G5
Brassicaceae	**Mustard Family**							
Cardamine pensylvanica	Pensylvania Bitter-cress	6	-4		S5			G5
Caprifoliaceae	**Honeysuckle Family**							
Diervilla lonicera	Bush Honeysuckle	5	5		S5			G5
Lonicera canadensis	American Fly Honeysuckle	6	3		S5			G5
Lonicera xylosteum	Fly Honeysuckle		5	-2	SE2			G?
Viburnum trilobum	High Bush Cranberry	5	-3		S5			G5T5
Caryophyllaceae	**Pink Family**							
Cerastium sp.	Chickweed sp.							
Cerastium fontanum	Larger Mouse-ear Chickweed		3	-1	SE5			G?
Cornaceae	**Dogwood Family**							
Cornus canadensis	Bunchberry	7	0		S5			G5
Cornus stolonifera	Red-osier Dogwood	2	-3		S5			G5
Ericaceae	**Heath Family**							
Gaultheria hispidula	Creeping Snowberry	8	-3		S5			G5
Gaultheria procumbens	Wintergreen	6	3		S5			G5
Ledum groenlandicum	Labrador-tea	9	-5		S5			G5
Vaccinium angustifolium	Low Sweet Blueberry	6	3		S5			G5
Fabaceae	**Pea Family**							
Lotus corniculatus	Bird's-foot Trefoil		1	-2	SE5			G?
Trifolium hybridum ssp. Elegans	Alsike Clover		1	-1	SE5			
Trifolium pratense	Red Clover		2	-2	SE5			G?
Vicia cracca	Tufted Vetch		5	-1	SE5			G?
Grossulariaceae	**Currant Family**							
Ribes lacustre	Swamp Black Currant	7	-3		S5			G5
Guttiferae	**St. John's-wort Family**							
Hypericum mutilum ssp. Mutilum	Dwarf St. John's-wort	6	-3		S4			G5T
Triadenum virginicum	Swamp St. John's-wort	10	-5		S4			G5

BOTANICAL NAME	COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	PROVINCIAL STATUS	OMNR STATUS	COSEWIC STATUS	GLOBAL STATUS
Lamiaceae	**Mint Family**							
Lycopus uniflorus	Northern Water-horehound	5	-5		S5			G5
Mentha arvensis ssp. Borealis	American Wild Mint	3	-3		S5			
Prunella vulgaris ssp. Vulgaris	Common Heal-all		0	-1	SE3			G5T?
Scutellaria galericulata	Hooded Skullcap	6	-5		S5			G5
Monotropaceae	**Indian Pipe Family**							
Monotropa uniflora	Indian-pipe	6	3		S5			G5
Myricaceae	**Wax-myrtle Family**							
Myrica gale	Sweet Gale	6	-5		S5			G5
Oleaceae	**Olive Family**							
Fraxinus nigra	Black Ash	7	-4		S5			G5
Onagraceae	**Evening-primrose Family**							
Circaea alpina	Smaller Enchanter's Nightshade	6	-3		S5			G5
Chamerion angustifolium spp. Angustifolium	Fireweed	3	0		S5			G5
Epilobium species	Willow-herb speices							
Epilobium ciliatum ssp. Ciliatum	Ciliate Willow-herb	3	3		S5			G5T?
Plantaginaceae	**Plantain Family**							
Plantago lanceolata	Ribgrass		0	-1	SE5			G5
Polygonaceae	**Smartweed Family**							
Persicaria amphibia	Water Smartweed	5	-5		S5			G5
Polygonum cilinode	Fringed Black Bindweed	2	5		S5			G5
Rumex acetosella ssp. Acetosella	Sheep Sorrel		0	-2	SEU			G5T
Rumex crispus	Curly-leaf Dock		-1	-2	SE5			G?
Rumex orbiculatus	Great Water Dock	6	-5		S4S5			G5
Primulaceae	**Primrose Family**							
Lysimachia terrestris	Swamp Loosestrife	6	-5		S5			G5
Trientalis borealis ssp. Borealis	Star-flower	6	-1		S5			G5T?
Pyrolaceae	**Wintergreen Family**							
Moneses uniflora	One-flowered Wintergreen	10	0		S5			G5
Ranunculaceae	**Buttercup Family**							
Anemone canadensis	Canada Anemone	3	-3		S5			G5
Anemone quinquefolia var. quinquefolia	Wood Anemone	7	0		S5			G5
Caltha palustris	Marsh-marigold	5	-5		S5			G5
Coptis trifolia	Goldthread	7	-3		S5			G5T5
Ranunculus acris	Tall Buttercup			-2	SE5			G5
Ranunculus hispidus var. nitidus	Swamp Buttercup				SNR			G5T5
Ranunculus repens	Creeping Buttercup		-1	-1	SE5			G?
Thalictrum dioicum	Early Meadow-rue	5	2		S5			G5
Thalictrum pubescens	Tall Meadow-rue	5	-2		S5			G5
Rhamnaceae	**Buckthorn Family**							
Rhamnus alnifolia	Alder-leaved Buckthorn	7	-5		S5			G5
Rosaceae	**Rose Family**							
Amelanchier arborea	Downy Juneberry		3		S5			G5
Comarum palustre	Marsh Cinquefoil	7	-5		S5			G5
Dasiphora fruticosa ssp. floribunda	Shrubby Cinquefoil	9	-3		S5			G5T
Fragaria vesca ssp. Americana	Woodland Strawberry	4	4		S5			G5T?
Prunus virginiana ssp. Virginiana	Choke Cherry	2	1		S5			G5T?
Rosa acicularis ssp. Sayi	Prickly Rose	7	3		S5			G5TU
Rubus idaeus ssp. Melanolasius	Wild Red Raspberry	0	-2		S5			G5T
Rubus pubescens	Dwarf Raspberry	4	-4		S5			G5
Sorbus decora	Showy Mountain-ash	8	3		S5			G4G5
Spiraea alba	Narrow-leaved Meadow-sweet	3	-4		S5			G5
Waldsteinia fragarioides	Barren Strawberry	5	5		S5			G5

BOTANICAL NAME	COMMON NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	PROVINCIAL STATUS	OMNR STATUS	COSEWIC STATUS	GLOBAL STATUS
Rubiaceae	**Madder Family**							
Galium asprellum	Rough Bedstraw	6	-5		S5			G5
Galium boreale	Northern Bedstraw	7	0		S5			G5
Galium palustre	Marsh Bedstraw	5	-5		S5			G5
Galium triflorum	Sweet-scented Bedstraw	4	2		S5			G5
Salicaceae	**Willow Family**							
Populus balsamifera ssp. Balsamifera	Balsam Poplar	4	-3		S5			G5T?
Populus tremuloides	Trembling Aspen	2	0		S5			G5
Salix discolor	Pussy Willow	3	-3		S5			G5
Salix lucida	Shining Willow	5	-4		S5			G5
Scrophulariaceae	**Figwort Family**							
Mimulus ringens	Square-stemmed Monkey-flower	6	-5		S5			G5
Violaceae	**Violet Family**							
Viola renifolia	Kidney-leaved Violet	7	-3		S5			G5
Viola sororia	Woolly Blue Violet	4	1		S5			G5
MONOCOTYLEDONS	**MONOCOTS**							
Alismataceae	**Water-plantain Family**							
Alisma plantago-aquatica	Common Water-plantain	3	-5		S5			G5
Sagittaria latifolia	Broad-leaved Arrowhead	4	-5		S5			G5
Cyperaceae	**Sedge Family**							
Carex sp.	Sedge species							
Bolboschoenus fluviatilis	River Bulrush	7	-5		S4S5			G5
Carex retrorsa	Retrorse Sedge	5	-5		S5			G5
Carex rostrata	Beaked Sedge				SU			G5
Eleocharis sp.	Spike-rush species							
Eriophorum sp.	Cotton-grass species							
Rhynchospora capillacea	Capillary Beaked-rush	10	-5		S4?			G5
Schoenoplectus acutus	Hard-stemmed Bulrush	6	-5		S5			G5
Schoenoplectus tabernaemontani	American Great Bulrush	5	-5		S5			G?
Scirpus sp.	Bulrush species							
Iridaceae	**Iris Family**							
Iris versicolor	Multi-coloured Blue-flag	5	-5		S5			G5
Lemnaceae	**Duckweed Family**							
Lemna minor	Lesser Duckweed	2	-5		S5			G5
Liliaceae	**Lily Family**							
Clintonia borealis	Bluebead-lily	7	-1		S5			G5
Maianthemum canadense	Wild Lily-of-the-valley	5	0		S5			G5
Maianthemum stellatum	Star-flowered Solomon's Seal	6	1		S5			G5
Polygonatum biflorum	Hairy Solomon's Seal	8	3		S4			G5
Streptopus roseus	Rose Twisted-stalk	7	0		S5			G5
Trillium cernuum	Nodding Trillium	8	0		S5			G5
Orchidaceae	**Orchid Family**							
Goodyera pubescens	Downy Rattlesnake-plantain	8	0		S4			G5
Poaceae	**Grass Family**							
Agrostis gigantea	Red-top		0	-2	SE5			G4G5
Pontederiaceae	**Pickerel-weed Family**							
Pontederia cordata	Heart-leaved Pickerel-weed	7	-5		S5			G5
Potamogetonaceae	**Pondweed Family**							
Potamogeton sp.	Pondweed species							
Potamogeton richardsonii	Richardson's Pondweed	5	-5		S5			G5
Sparganiaceae	**Bur-reed Family**							
Sparganium emersum ssp. Emersum	Green-fruited Bur-reed	5	-5		S5			
Typhaceae	**Cattail Family**							
Typha angustifolia	Narrow-leaved Cattail	3	-5		S5			G5
Typha latifolia	Broad-leaved Cattail	3	-5		S5			G5

APPENDIX VII

BIRD SPECIES LIST

Wanatango Hydroelectric Generation Station

Birds Observed and Known From the Study Area

Highest Breeding Evidence - NRSI Breeding Bird Surveys	Scientific Name	Common Name	GRANK	SRANK	COSEWIC	SARO	Highest Breeding Evidence (2nd OBBA - 17MQ90)	Highest Breeding Evidence (2nd OBBA - 17MQ91)
		Ducks, Geese & Swans						
H	*Branta canadensis*	Canada Goose	G5	S5				
H	*Aix sponsa*	Wood Duck	G5	S5				
FY	*Lophodytes cucullatus*	Hooded Merganser	G5	S5B, S5N				
H	*Mergus merganser*	Common Merganser	G5	S5B, S5N				
		LOONS						
	Gavia immer	Common Loon	G5	S5B, S5N	NAR	NAR	P	NE
		CORMORANTS						
H	*Phalacrocorax auritus*	Double-crested Cormorant	G5	S5B	NAR	NAR		
		HERONS & BITTERNS						
H	*Ardea herodias*	Great Blue Heron	G5	S5				
		VULTURES						
X	*Cathartes aura*	Turkey Vulture	G5	S5B				
		HAWKS, KITES & EAGLES						
AE	*Haliaeetus leucocephalus*	Bald Eagle	G4	S1S2N, S4B	NAR	SC		
H	*Buteo platypterus*	Broad-winged Hawk	G5	S5B				
		CARACARAS & FALCONS						
H	*Falco columbarius*	Merlin	G5	S5B	NAR	NAR		
		CRANES						
H	*Grus canadensis*	Sandhill Crane	G5	S5B				
		SANDPIPERS & PHALAROPES						
FY	*Actitis macularia*	Spotted Sandpiper	G5	S5				
H	*Tringa flavipes*	Lesser Yellowlegs	G5	S4B, S4N				
		GULLS, TERNS & SKIMMERS						
X	*Larus delawarensis*	Ring-billed Gull	G5	S5B, S4N				
X	*Larus argentatus*	Herring Gull	G5	S5B, S5N				
		KINGFISHERS						
H	*Ceryle alcyon*	Belted Kingfisher	G5	S4B			S	
		WOODPECKERS						
H	*Sphyrapicus varius*	Yellow-bellied Sapsucker	G5	S5B			P	
H	*Picoides pubescens*	Downy Woodpecker	G5	S5				
T	*Picoides villosus*	Hairy Woodpecker	G5	S5				
H	*Colaptes auratus*	Northern Flicker	G5	S4B			S	
H	*Dryocopus pileatus*	Pileated Woodpecker	G5	S5				
		TYRANT FLYCATCHERS						
T	*Empidonax flaviventris*	Yellow-bellied Flycatcher	G5	S5B			T	
T	*Empidonax alnorum*	Alder Flycatcher	G5	S5B			S	
H	*Empidonax minimus*	Least Flycatcher	G5	S4B			S	
		VIREOS						
	Vireo solitarius	Blue-headed Vireo	G5	S5B			S	
T	*Vireo olivaceus*	Red-eyed Vireo	G5	S5B			S	
		CROWS & JAYS						
H	*Perisoreus canadensis*	Gray Jay	G5	S5				
H	*Cyanocitta cristata*	Blue Jay	G5	S5				
H	*Corvus brachyrhynchos*	American Crow	G5	S5B				
H	*Corvus corax*	Common Raven	G5	S5				
		SWALLOWS						
	Tachycineta bicolor	Tree Swallow	S5	S4B			S	
		CHICKADEES & TITMICE						
T	*Poecile atricapillus*	Black-capped Chickadee	G5	S5			S	
S	*Poecile hudsonicus*	Boreal Chickadee	G5	S5				
		NUTHATCHES						
T	*Sitta canadensis*	Red-breasted Nuthatch	G5	S5			S	

Highest Breeding Evidence - NRSI Breeding Bird Surveys	Scientific Name	Common Name	GRANK	SRANK	COSEWIC	SARO	Highest Breeding Evidence (2nd OBBA - 17MQ90)	Highest Breeding Evidence (2nd OBBA - 17MQ91)
		WRENS						
T	*Troglodytes troglodytes*	Winter Wren	G5	S5B			T	
		KINGLETS						
	Regulus satrapa	Golden-crowned Kinglet	G5	S5B			S	
	Regulus calendula	Ruby-crowned Kinglet	G5	S4B			T	
		THRUSHES						
S	*Catharus fuscescens*	Veery	G5	S4B			S	
T	*Catharus ustulatus*	Swainson's Thrush	G5	S4B			S	
S	*Catharus guttatus*	Hermit Thrush	G5	S5B			T	
FY	*Turdus migratorius*	American Robin	G5	S5B			T	
		MOCKINGBIRDS & THRASHERS						
S	*Dumetella carolinensis*	Gray Catbird	G5	S4B				
		WAXWINGS						
T	*Bombycilla cedrorum*	Cedar Waxwing	G5	S5B			S	
		WOOD-WARBLERS						
S	*Vermivora peregrina*	Tennessee Warbler	G5	S5B				
S	*Vermivora ruficapilla*	Nashville Warbler	G5	S5B			T	
T	*Parula americana*	Northern Parula	G5	S4B				
S	*Dendroica petechia*	Yellow Warbler	G5	S5B				
T	*Dendroica pensylvanica*	Chestnut-sided Warbler	G5	S5B			T	
S	*Dendroica magnolia*	Magnolia Warbler	G5	S5B			S	
S	*Dendroica tigrina*	Cape May Warbler	G5	S5B				
S	*Dendroica caerulescens*	Black-throated Blue Warbler	G5	S5B			S	
T	*Dendroica coronata*	Yellow-rumped Warbler	G5	S5B				
T	*Dendroica virens*	Black-throated Green Warbler	G5	S5B			S	
T	*Dendroica fusca*	Blackburnian Warbler	G5	S5B			S	
S	*Dendroica palmarum*	Palm Warbler	G5	SNRB				
S	*Dendroica castanea*	Bay-breasted Warbler	G5	S5B			S	
T	*Mniotilta varia*	Black-and-white Warbler	G5	S5B			T	
T	*Setophaga ruticilla*	American Redstart	G5	S5B			T	
T	*Seiurus aurocapillus*	Ovenbird	G5	S4B			T	
S	*Seiurus noveboracensis*	Northern Waterthrush	G5	S5B				
S	*Wilsonia canadensis*	Canada Warbler	G5	S4B	T	SC		
		SPARROWS						
	Spizella passerina	Chipping Sparrow	G5	S5B			S	
S	*Melospiza melodia*	Song Sparrow	G5	S5B				
S	*Melospiza georgiana*	Swamp Sparrow	G5	S5B			T	
T	*Zonotrichia albicollis*	White-throated Sparrow	G5	S5B			T	
	Junco hyemalis	Dark-eyed Junco	G5	S5B			S	
		CARDINALS & ALLIES						
P	*Pheucticus ludovicianus*	Rose-breasted Grosbeak	G5	S4B				
		BLACKBIRDS						
	Agelaius phoeniceus	Red-winged Blackbird	G5	S5			P	
	Quiscalus quiscula	Common Grackle	G5	S5B			H	
		FINCHES						
	Carpodacus purpureus	Purple Finch	G5	S4B			H	

APPENDIX VIII

HERPETOFAUNA SPECIES LIST

Wanatango Hydroelectric Generation Station

Herpetofaunal Species Observed and Known From the Study Area

Ontario Herpetofaunal Atlases (Oldham and Weller 2000, Ontario Nature 2010)	**NRSI Observations**	**SCIENTIFIC NAME**	**COMMON NAME**	**GRANK**	**SRANK**	**COSEWIC** (**BOLD** indicates change in status as of 2008)	**OMNR** (**BOLD** indicates change in status as of 2008/9)
		Snakes					
X	X	*Thamnophis sirtalis sirtalis*	Eastern Gartersnake	G5T?	S5		
		Toads and Frogs					
X	X	*Bufo americanus*	American Toad	G5	S5		
X	X	*Pseudarcris crucifer crucifer*	Northern Spring Peeper	G5	S5		
X		*Rana pipiens*	Northern Leopard Frog	G5	S5	NAR	NAR
X		*Rana septentrionalis*	Mink Frog	G5	S5		
X	X	*Rana sylvatica*	Wood Frog	G5	S5		
		Salamander					
X		*Ambystoma laterale*	Blue-spotted Salamander	G5	S4		

APPENDIX IX

MAMMAL SPECIES LIST

Wanatango Hydroelectric Generation Station

Mammals Observed and Known From the Study Area

Ontario Mammal Atlas	NRSI Observations	Scientific Name	Common Name	GRANK	SRANK	COSEWIC	OMNR
X	X	*Alces alces*	Moose	G5	S5		
X	X	*Blarina brevicauda*	Northern Short-tailed Shrew	G5	S5		
X		*Canis latrans*	Coyote	G5	S5		
X	X	*Canis lupus*	Gray Wolf	G4	S4		NAR
X	X	*Castor canadensis*	Beaver	G5	S5		
X		*Cervus elaphus*	Eastern Elk (Wapiti)	G5	SXC		EXT
X		*Clethrionomys gapperi*	Southern Red-backed Vole	G5	S5		
X		*Condylura cristata*	Star-nosed Mole	G5	S5		
X		*Erethizon dorsatum*	Porcupine	G5	S5		
X		*Lepus americanus*	Snowshoe Hare	G5	S5		
X	X	*Lutra canadensis*	River Otter	G5	S5		
X		*Lynx canadensis*	Lynx	G5	S5	NAR	NAR
X		*Marmota monax*	Woodchuck	G5	S5		
X		*Martes americana*	Marten	G5	S5		
X		*Martes pennanti*	Fisher	G5	S5		
X		*Mephitis mephitis*	Striped Skunk	G5	S5		
X		*Microtus pennsylvanicus*	Meadow Vole	G5	S5		
X		*Mustela frenata*	Long-tailed Weasel	G5	S4		
X		*Mustela vison*	Mink	G5	S5		
X		*Myotis lucifuga*	Little Brown Bat	G5	S5		
X		*Myotis septentrionalis*	Northern Long-eared Bat	G4	S3?		
X		*Odocoileus virginianus*	White-tailed Deer	G5	S5		
X	X	*Ondatra zibethicus*	Muskrat	G5	S5		
X		*Peromyscus maniculatus*	Deer Mouse	G5	S5		
X	X	*Procyon lotor*	Raccoon	G5	S5		
X		*Sciurus carolinensis*	Gray Squirrel Black Morph	G5	S5		
X		*Sorex cinereus*	Masked (Common) Shrew	G5	S5		
X		*Tamias mimumus*	Least Chipmunk	G5	S5		
X		*Tamias striatus*	Eastern Chipmunk	G5	S5		
X	X	*Tamiasciurus hudsonicus*	Red Squirrel	G5	S5		
X	X	*Ursus americanus*	Black Bear	G5	S5	NAR	NAR
X		*Vulpes vulpes*	Red Fox	G5	S5		

APPENDIX X

SIGNIFICANT WILDLIFE HABITAT (SWH) SCREENING

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 3E.

Wildlife Species[1]	Candidate SWH		Confirmed SWH	Wanatango Falls
	ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Moose Late Winter Cover				
Moose	B036 - 038, B049-053, B065-068 B081-087 B098-102 B114-117 More common on deeper soils with dense conifer cover and vegetation in the understory for browse.	Late winter moose habitat is characterized by dense conifer cover with greater than 60% canopy closure and >6m in height. Upland sites are preferred [cxcv]. Snow depth in excess of 70cm restrict moose movement during winter, however late winter thermal refuge is important in relieving heat stress. These habitats are extensively used by moose during late spring and summer due to the shade provided [cxcv]. Conifer stands >50ha [cxcv], dominated by tall trees >6m, on gentle to moderately rugged sites with deep soils. Areas identified as rating 3 or 4 [cxcv] for late winter moose habitat are Candidate SWH. <u>Information Sources</u> • OMNR Forester, Ecologist or Biologist may be aware of locations. • The Selected Wildlife and habitat Inventory Manual (1998)[cxcv] outlines the inventory method for Late Winter Moose Habitat.	Field Studies will confirm the use of these areas as late winter habitat by moose during the months of March and April. Moose are very difficult to observe in late winter habitat, therefore any number of moose observed or moose tracks and trails observed in the habitat confirm this habitat as a SWH. The area of the SWH is the area of treed ecosites associated with the winter cover area plus 300 m surrounding the site [cxlviii]. The relative importance of the site to the surrounding landscape should be considered. Significant sites may be only one of few in the area [cxlviii]. SWHDSS [cxlix] Index #24 provides development effects and mitigation measures for aquatic feeding areas, similar effects and mitigation can be used for late winter habitat.	Moist, Fine: Pine-Black Spruce Conifer forest (B114) present in study area. Late Winter Habitat not identified by MNR. **Not SWH**

Wildlife Habitat: Waterfowl Stopover and Staging Areas (Terrestrial)				
American Black Duck Wood Duck Green-winged Teal Blue-winged Teal Mallard Northern Pintail Northern Shoveler American Wigeon Gadwall	Focus on sites that have appropriate vegetation and highest likelihood of seasonal water accumulation B060-062 B077-079 B093-095 B109-111 Plus evidence of annual spring flooding from melt water or run-off within identified Ecosites.	Fields with sheet water during Spring (mid March to May). • Fields flooding during spring melt and run-off provide important invertebrate foraging habitat for migrating waterfowl. • Flood plains (flooded river banks) • Cultivated fields with waste grains are commonly used by waterfowl, these are not considered SWH. <u>Information Sources</u> • Anecdotal information from the landowner, adjacent landowners or local naturalist clubs may be good information in determining occurrence. • EIS Reports • Sites documented through waterfowl planning processes (eg. EHJV implementation plan) • Naturalist Clubs • Ducks Unlimited Canada • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	Studies carried out and verified presence of an annual concentration of any listed species, evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi]. • Any mixed species aggregations of 100[í] or more individuals required. • The area of the flooded field ecosite habitat plus a 100-300m radius buffer dependant on local site conditions and adjacent land use is the significant wildlife habitat [cxlviii]. • Annual use of habitat is documented from information sources or field studies (annual use can be based on studies or determined by past surveys with species numbers and dates). • SWHDSS [cxlix] Index #7 provides development effects and mitigation measures.	Appropriate habitat not present within the study area **Not SWH**

Wildlife Habitat: Waterfowl Stopover and Staging Areas (Aquatic)				
Canada Goose Cackling Goose Snow Goose American Black Duck Northern Pintail Northern Shoveler American Wigeon Gadwall Green-winged Teal Blue-winged Teal Hooded Merganser Common Merganser Lesser Scaup Greater Scaup Long-tailed Duck Surf Scoter White-winged Scoter Black Scoter Ring-necked Duck Common Goldeneye Bufflehead Redhead Ruddy Duck Red-breasted Merganser Brant Canvasback Tundra Swan Trumpeter Swan	B142-152	• Ponds, marshes, lakes, bays, coastal inlets, and watercourses used during migration. Sewage treatment ponds and storm water ponds do not qualify as a SWH, however a reservoir managed as a large wetland or pond/lake does qualify. • These habitats have an abundant food supply (mostly aquatic invertebrates and vegetation in shallow water); <u>Information Sources</u> • OMNR District staff. • Canadian Wildlife Service staff know the larger, most significant sites. Check website: http://wildspace.ec.gc.ca • Naturalist clubs often are aware of staging/stopover areas. • OMNR Wetland Evaluations indicate presence of locally and regionally significant waterfowl staging. • Sites documented through waterfowl planning processes (eg. EHJV implementation plan) • Ducks Unlimited projects • Element occurrence specification on NatureServe Explorer: http://www.natureserve.org • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	Studies carried out and verified presence of: • Aggregations of 100Í or more individuals of listed species for 7 daysÍ, results in > 700 waterfowl use days. • Areas with annual staging of ruddy ducks, canvasbacks, redheads and trumpeter swans are SWH [cxlix] • The combined area of the ELC ecosites and a 100m radius area is the SWH [cxlviii] • Wetland area and shorelines associated with sites identified within the SWHTG [cxlviii] Appendix K [cxlix] are significant wildlife habitat. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi] • Annual Use of Habitat is Documented from Information Sources or Field Studies (Annual can be based on completed studies or determined from past surveys with species numbers and dates recorded). • SWHDSS [cxlix] Index #7 provides development effects	Mineral Meadow Marsh (B142), Mineral Shallow Marsh (B148) present in study area. Wetlands not very large (4.47ha) relative to wetlands on the surrounding landscape. No species of concern identified. **Not SWH**

			and mitigation measures.	
Wildlife Habitat: Shorebird Migratory Stopover Area				
Greater Yellowlegs Lesser Yellowlegs Marbled Godwit Hudsonian Godwit Black-bellied Plover American Golden-Plover Semipalmated Plover Solitary Sandpiper Spotted Sandpiper Semipalmated Sandpiper Pectoral Sandpiper White-rumped Sandpiper Baird's Sandpiper Least Sandpiper Stilt Sandpiper Short-billed Dowitcher Red-necked Phalarope Wilson's Phalarope Whimbrel Ruddy Turnstone Sanderling Dunlin Wilson's Snipe	B005-006 B160-162 B170-172 B176-178 B186-188 B204 B207	Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats. Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid-June and early July to October. Storm water retention ponds and sewage lagoons are not considered SWH. <u>Information Sources</u> • Western hemisphere shorebird reserve network. • Canadian Wildlife Service (CWS) Ontario Shorebird Survey. • Bird Studies Canada • Ontario Nature • Local birders and naturalist clubs. • Temiskaming Birds: http://timbirds.info/ • NHIC Shorebird Migratory Concentration Area	Studies confirming: • Presence of 3 or more of listed species and > 1000[Í] shorebird use days during spring or fall migration period. (shorebird use days are the accumulated number of shorebirds counted per day over the course of the fall or spring migration period) • Sites used for multiple years are more significant. • The area of significant shorebird habitat includes the mapped ELC ecosites plus a 100m radius area [cxlviii] • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi] • SWHDSS [cxlix] Index #8 provides development effects and mitigation measures.	Appropriate habitat not present within the study area. **Not SWH**

Wildlife Habitat: Bat Winter Hibernacula				
Big Brown Bat Little Brown Myotis Tri-coloured Bat/Eastern Pipistrelle Northern Myotis Eastern Small-footed Myotis	Hibernacula may be found in abandoned caves, mine shafts, underground foundations (Karsts) and these ecosites: B158-159 B164-165 B174-175 B180-181 Caves and mine shafts are the important features. Commonly associated as components of either Cliff or Rock Barren ecosites. Once feature is identified the substrate classification can be used to identify characteristics and potential/suitability of identified or suspected hibernacula.	• Hibernacula may be found in abandoned caves, mine shafts, underground foundations and karsts. The locations and site characteristics of bat hibernacula are relatively poorly known. • Primary criteria is identification of known feature • Buildings are not considered to be SWH) <u>Information Sources</u> • OMNR for possible locations and contact for local experts • NHIC Bat Hibernaculum/Nursery. • Ministry of Northern Development and Mines and NRVIS for location of mine shafts and mine locations. • Clubs that explore caves (e.g. Caving Canada (http://www.cancaver.ca/) Sierra Club) • University Biology Departments with bat experts.	• All sites with confirmed hibernating bats are SWH [cxlviii, ccvii,]. • The area includes 1000m radius around the entrance of the hibernaculum [cxlviii, ccvii,]. • Studies are to be conducted during the peak swarming period (Aug. – Sept.). Surveys should be conducted following methods outlined in the "Guideline for Wind Power Projects Potential Impacts to Bats and Bat Habitats" [ccv]. • SWHDSS [cxlix] Index #1 provides development effects and mitigation measures.	No cliffs/caves present. No hibernacula identified by MNR. **Not SWH**

Wildlife Habitat: Bat Maternity Colonies				
Big Brown Bat Little Brown Myotis Silver-haired Bat Northern Myotis	Maternity colonies considered SWH are found in treed Ecosites. B015-019 B023-028 B039-043 B054-059 B069-076 B087-092 B103-108 B118-125 Aspen is an important feature in Ecoregion 3E, primarily the presence of larger diameter trees in older mixed-wood stands.	Maternity colonies can be found in tree cavities, vegetation and often in buildings [xxii, xxv, xxvi, xxvii, xxxi] (buildings are not considered to be SWH). Maternity roosts are not found in caves and mines in Ontario [xxii]. • Maternity colonies located in Mature (dominant trees > 80yrs old) deciduous or mixed forest stands [ccix, ccx] with >10/ha large diameter (>25cm dbh) wildlife trees [ccvii]. • Female Bats prefer wildlife trees (snags) of decay class 1 or 2 [ccxii] or class 2-4 [ccxiv], can be living or with bark mostly intact. • Northern Myotis prefer contiguous tracts of older forest cover for foraging and roosting in snags and trees [ccix] • Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags/ha are preferred [ccx] <u>Information Sources</u> • OMNR for possible locations and contact for local experts • University Biology Departments with bat experts.	• All Maternity Colonies are considered SWH • The area of the habitat includes the entire woodland or the forest stand ELC Ecosite containing the maternity colony[Í]. • Evaluation methods for maternity colonies should be conducted following methods outlined in the "Guideline for Wind Power Projects Potential Impacts to Bats and Bat Habitats" [ccv]. • SWHDSS [cxlix] Index #1 provides development effects and mitigation measures.	Moist, Fine: Pine-Black Spruce Conifer forest (B114) present in study area. Old trees along river may provide suitable maternity roosts, although this habitat is likely abundant outside project area. **Not SWH**

Wildlife Habitat: Bat Migratory Stopover Area				
Hoary Bat Eastern Red Bat Silver-haired Bat	No specific ELC types.	Long distance migratory bats typically migrate during late summer and early fall from summer breeding habitats throughout Ontario to southern wintering areas. Their annual fall migrations concentrate these species of bats at stopover areas. The location and characteristics of stopover habitats are generally unknown. <u>Information Sources</u> • OMNR for possible locations and contact for local experts • University Biology Departments with bat experts.	• The confirmation criteria and habitat areas for this SWH are still being determined • SWHDSS [cxlix] Index #38 provides development effects and mitigation measures	Criteria unavailable to assess significance of habitat in study area.

Wildlife Habitat: Turtle-Wintering Areas				
Painted Turtle **<u>Special Concern:</u>** Snapping Turtle	B128-142 B145-152	For most turtles, wintering areas are in the same general area as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates. • Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen. [cix], [cx], [cxi], [cxviii] • Year-round persistence of standing or flowing water to depth, or presence of springs to prevent freezing is key. <u>Information Sources</u> • Reports and other information available from CAs. • Local naturalists and experts, as well as university herpetologists may also know where to find some of these sites. • OMNR ecologist or biologist may be aware of locations of wintering turtles • NHIC, Ontario Herpetofaunal Summary Atlas, Ontario Herpetofaunal Atlas.	• Presence of one or more over-wintering Painted Turtles is significant[Í]. • One or more Snapping Turtle over-wintering within a wetland is significant[Í]. • The mapped ELC ecosite area with the over wintering turtles is the SWH. If the hibernation site is within a stream or river, the deep-water pool where the turtles are over wintering is the SWH. • Over wintering areas may be identified by searching for congregations (Basking Areas) of turtles on warm, sunny days during the fall (Aug. – Sept.) or spring (Apr. - May). Congregation of turtles is more common where wintering areas are limited and therefore significant [cix, cx, cxi, cxii]. • SWHDSS [cxlix] Index #28 provides development effects and mitigation measures for turtle wintering habitat.	Mineral Meadow Marsh (B142), Mineral Shallow Marsh (B148) present in study area. Wetlands may function as overwintering habitat but wetlands of equal or greater size occur on the surrounding landscape. No turtle species were recorded. **Not SWH**

Wildlife Habitat: Reptile Hibernacula				
Snakes: Gartersnake Smooth Green Snake Northern Ringneck Snake Northern Redbelly Snake	For all snakes, habitat may be found in any forested ecosite in northern Ontario. Talus, rock barren, crevice and caves are more typically related to these habitats. Many suitable conditions also observed in the very shallow ecosites particularly on fractured bedrock and lower veg cover Open and Sparse Tall/Low Treed or Shrub Systems. B008-028 B128-139 B158-159 B164-165 B167-172 B174-175 B180-181 B183-188	For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural locations. Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line [xliv, li, cxii]. Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover. Observation of congregating snakes on sunny warm days in the spring or fall is a good indicator. The existence of rock piles or slopes, stone fences, and crumbling foundations. <u>Information Sources</u> • In spring, local residents or landowners have observed the emergence of snakes on their property (e.g. old dug wells). • Reports and other information available from CAs. • Local naturalists and experts, as well as university herpetologists may also know where to find some of these sites. • OMNR ecologist or biologist. • NHIC.	Studies confirming: • Presence of snake hibernacula used by a minimum of five individuals of a snake sp. <u>or</u>; individuals of two or more snake spp. • Congregations of a minimum of five individuals of a snake sp. <u>or</u>; individuals of two or more snake spp. near potential hibernacula (e.g. foundation or rocky slope) on sunny warm days in Spring (Apr/May) and Fall (Sept/Oct)[Í]. • <u>Note</u>: Sites for hibernation possess specific habitat parameters (e.g. temperature, humidity, etc.) and consequently are used annually, often by many of the same individuals of a local population. Other critical life processes (e.g. mating) often take place in close proximity to hibernacula. As such, the feature in which the hibernacula is located plus a 30 m radius buffer is the SWH[Í] • SWHDSS [cxlix] Index #13 provides development effects and mitigation measures for snake	Mineral Thicket Swamp (B134) present in study area. No species of conservation concern observed in the study area. No cliffs or broken rock. Hibernaculum habitat is not prevalent within the project area. **Not SWH**

			hibernacula.	
Wildlife Habitat: Colonially-Nesting Bird Breeding Habitat (Bank and Cliff)				
Bank Swallow Cliff Swallow	Eroding banks, sandy hills, borrow pits, steep slopes, and sand piles (Bank Swallow). Cliff faces, bridge abutments, silos, barns (Cliff Swallows). Habitat may be found in, but not limited to the following ecosites: B001-004 B157-159 B173-175	• Any site or areas with exposed soil banks, undisturbed or naturally eroding that is not a licensed/permitted aggregate area. • Does not include man-made structures (bridges or buildings) or recently (2 years) disturbed soil areas, such as berms, embankments, and soil or aggregate stockpiles. • Does not include a licensed/permitted Mineral Aggregate Operation. <u>Information Sources</u> • Reports and other information available from CAs. • Ontario Breeding Bird Atlas. • Bird Studies Canada; *NatureCounts* http://www.birdscanada.org/birdmon/ • Naturalist Clubs.	Studies confirming: • Presence of 1 or more nesting sites with 8[cxlvix] or more cliff swallow pairs or 50[Í] bank swallow during the breeding season. • A colony identified as SWH will include a 50m radius habitat area from the peripheral nests [ccvii] • Field surveys to observe and count swallow nests are to be completed during the breeding season (May-July). Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi] • SWHDSS [cxlix] Index #4 provides development effects and mitigation measures.	No cliffs or banks. No species of concern observed. **Not SWH**

Wildlife Habitat: Colonially-Nesting Bird Breeding Habitat (Tree/Shrubs)				
Great Blue Heron Bonaparte's Gull Double-crested Cormorant	May include a wide variety of tall treed ecosites. Habitat selection based on close proximity to water body or on island: B045-059 B064-076 B081-092 B097-108 B113-137 B161-162 B177-178	• Great Blue Herons nest in live or dead standing trees in wetlands, lakeshores, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used. • Most nests in trees are 11 to 15 m from ground, near the top of the tree. • Bonaparte's Gulls nest in coniferous trees (preferably spruce-fir) near fens, bogs, swamps, ponds or lakes. • Double-crested Cormorants prefer to nest in trees but will nest on the ground as well where trees are limited or have died and fallen [(OBBA)]. <u>Information Sources</u> • Ontario Breeding Bird Atlas, colonial nest records. • Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNR). • NHIC Mixed Wader Nesting Colony • Aerial photographs can help identify large heronries. • Reports and other information available from CAs • OMNR District Offices. • Local naturalist clubs. • NRVIS	Studies confirming: • Presence of 4 or more active nests of Great Blue Heron or 10 or more nests of Bonaparte's Gull [cxlviii]. • For Great Blue Heron: the edge of the colony and a minimum 300m radius area of habitat or extent of the ELC ecosite containing the colony or any island <15.0ha with a colony is the SWH [cc, ccvii]. • For Bonaparte's Gull: the edge of the colony and a minimum 150m radius area of habitat surrounding the colony is the SWH [ccvii]. • For Double-crested Cormorants: OMNR District offices will identify significance of colony and mitigation measures. • Confirmation of active colonies must be achieved through site visits conducted during the nesting season (April to August) or by evidence such as the presence of fresh whitewash, dead young and/or eggshells • SWHDSS [cxlix] Index #5 provides development effects and mitigation measures.	Moist, Fine: Pine-Black Spruce Conifer forest (B114), Mineral Thicket Swamp (B134) present in the study area in close proximity to open water (Fredrickhouse River and Mineral Shallow Marsh (B148)). Great Blue Heron observed in suitable breeding habitat. However, relevant species not observed in high abundances. No heronry observed. **Not SWH**

Wildlife Habitat: Colonially -Nesting Bird Breeding Habitat (Ground)				
Herring Gull Ring-billed Gull Common Tern Double-crested Cormorant Brewer's Blackbird	Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1;50,000 NTS map). B160-165 B169-172 B176-181 B185-188 Close proximity to watercourses in open fields or pastures with scattered trees or shrubs (Brewer's Blackbird). B008 B020-021 B030-031 B045-046 B061-062 B078-079 B094-095 B110-111 B142-144	• Nesting colonies of gulls and terns are on islands or peninsulas (natural or artificial) associated with open water or in marshy areas, lakes or large rivers (two-lined on a 1:50,000 NTS map). • Brewers Blackbird colonies are found loosely on the ground or in low bushes in close proximity to streams and irrigation ditches within farmlands. • Double-crested Cormorants prefer to nest in trees but will nest on the ground as well where trees are limited or have died and fallen [(OBBA)]. <u>Information Sources</u> • Ontario Breeding Bird Atlas, rare/colonial species records. • Canadian Wildlife Service • Reports and other information available from CAs • OMNR District Offices. • Local naturalist clubs. • NHIC Colonial Waterbird Nesting Area	Studies confirming: • Presence of > 25 active nests for Herring Gulls or Ring-billed Gulls, >5 active nests for Common Tern [Í]. • Presence of 5 or more pairs for Brewer's Blackbird[Í]. • The edge of the colony and a minimum 150m area of habitat, or the extent of the ELC ecosites containing the colony or any island <3.0ha with a colony is the SWH [cc, ccvii] • For Double-crested Cormorants: OMNR District offices will identify significance of colony and mitigation measures. • Studies would be done during May/June when actively nesting. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi] • SWHDSS [cxlix] Index #6 provides development effects and mitigation measures.	Species present: Double-crested cormorant (observed in suitable habitat), Ring-billed Gull, Herring Gull. No suitable breeding habitat observed. No breeding colonies observed. **Not SWH**

1: Ontario Ministry of Natural Resources (OMNR). 2011. Significant Wildlife Habitat Ecoregion 3E Criterion Schedule. June 2011. 47pp.

Table 2. Characteristics of Specialized Wildlife Habitat for Ecoregion 3E

Wildlife Species[1]	Candidate SWH		Confirmed SWH	Wanatango Falls
	ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Waterfowl Nesting Area				
American Black Duck Northern Pintail Northern Shoveler Gadwall Blue-winged Teal Green-winged Teal Wood Duck Hooded Merganser Common Merganser Red-breasted Merganser Mallard Canada Goose American Widgeon Bufflehead Common Goldeneye	All upland habitats located adjacent to ELC ecosites; B129-135 B140-152 B224 are Candidate SWH: **Note: includes adjacency to provincially Significant Wetlands**	A waterfowl nesting area extends 120 m [cxlix] from a wetland (> 0.5 ha) or a cluster of 3 or more small (<0.5 ha) wetlands within 120 m of each individual wetland where waterfowl nesting is known to occur [cxlix]. • Upland areas should be at least 120 m wide so that predators such as raccoons, skunks, and foxes have difficulty finding nests. • Wood Ducks, Bufflehead, Common Goldeneye and Hooded Mergansers utilize large diameter trees in woodlands for cavity nest sites. <u>Information Sources</u> • Ducks Unlimited staff may know the locations of particularly productive nesting sites. • OMNR District Staff • OMNR Wetland Evaluations for indication of significant waterfowl nesting habitat. • Reports and other information available from CAs.	Studies confirmed: • Presence of 3 or more nesting pairs for listed species excluding Mallards[Í], or; • Presence of 10 or more nesting pairs for listed species including Mallards[Í]. • Nesting studies should be completed during the spring breeding season (April - July). Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi] • A field study confirming waterfowl nesting habitat will determine the boundary of the waterfowl nesting habitat for the SWH, this may be greater or less than 120 m [cxlviii] from the wetland and will provide enough habitat for waterfowl to successfully nest. • SWHDSS [cxlix] Index #25 provides development effects and mitigation measures.	Upland habitat extending >120 m from wetlands (Mineral Thicket Swamp (B134), Mineral Meadow Marsh (B142), Mineral Shallow Marsh (B148)) occurs within the project area. Upland areas are pine-black spruce dominated forest surrounding wetlands (B114). Mineral meadow marsh and mineral shallow marsh both shrub dominated. Understorey species in both marshes are red-osier dogwood and speckled alder. Species: Wood Duck in suitable breeding habitat; Hooded Merganser with fledged young. Low number of species and individuals observed. Larger wetlands occur on the surrounding landscape. **Not SWH**

Wildlife Habitat: Bald Eagle and Osprey Nesting Habitat				
Osprey **Special Concern** Bald Eagle	Treed communities directly adjacent to riparian areas – rivers, lakes, ponds and wetlands	Nests are associated with lakes, ponds, rivers or wetlands along treed shorelines, islands, or on structures over water. Osprey nests are usually at the top of a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree's canopy. Nests located on man-made objects such as telephone or hydro poles will not normally be considered as SWH, however the OMNR District retains discretion regarding significance of constructed nesting platforms. <u>Information Sources</u> • NHIC compiles all known nesting sites for Bald Eagles in Ontario. • OMNR values information (LIO/NRVIS) will list known nesting locations • Nature Counts, Ontario Nest Records Scheme data. • OMNR Ecologist or Biologist may be aware of locations of nesting raptors. In addition, these staff may know local naturalists that may be aware of the locations of raptor nests. • Sustainable Forestry Licence (SFL) companies will identify additional nesting locations through field operations. • Ontario Breeding Bird Atlas or Rare Breeding Birds in Ontario for species documented • Reports and other information available from CAs. • Local naturalists may know of other locations. • Use maps and aerial photographs to	Studies confirm: • One or more active Osprey or Bald Eagle nests in an area. • Considered SWH if the nest has been used or suspected of use within the past 5 years; unless documented that the nest and other associated nests in the nesting area have been unoccupied within the past 3 consecutive years by Osprey or Bald Eagle [cxlviii, ccvii]. • Some species have more than one nest in a given area and priority is given to the primary nest with alternate nests included within the area of the SWH. • For an Osprey, the active nest and a 300 m radius around the nest is the SWH [ccvii] • For a Bald Eagle the active nest and a 400-800 m radius around the nest is the SWH. [cvi, ccvii] Area of the habitat from 400-800m is dependant on site lines from the nest to the development and inclusion of perching and foraging habitat [cvi] • SWHDSS [cxlix] Index #26 provides development effects and mitigation measures • Evaluation methods to	Large coniferous forest occurs adjacent to the Fredrickhouse River within the study area. No Ospreys observed. NRSI biologists observed an adult Bald Eagle entering a nest, confirming breeding, within the study area during field investigations undertaken in spring 2010. **SWH**

		identify forests with few roads that tend to have less human disturbance.	follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]	
Wildlife Habitat: Woodland Raptor Nesting Habitat				
Red-tailed Hawk Great Horned Owl: Broad-winged Hawk Sharp-shinned Hawk Merlin Coopers Hawk Northern Goshawk Great gray Owl Long-eared Owl Common Raven ---------- Cavity Nesters/users: Saw-whet Owl Boreal Owl Barred Owl Northern Hawk Owl American Kestrel (Northern Flying Squirrel use cavities as roosting sites in winter)	May be found in all forested ELC Ecosites.	All natural or conifer plantation woodland/forest stands [lxxxviiii, lxxxix, xc, xci, xciii, xciv, xcv,xcvi, cxxxiii]. • Stick nests found in a variety of intermediate-aged to mature conifer, deciduous or mixed forests within tops or crotches of trees. Species such as Merlin or Coopers Hawk nest along forest edges sometimes on peninsulas or small off-shore islands. • Some woodland raptors rely on cavity trees for nesting. They do not excavate their own cavities, but rely on natural cavities of sufficient size and those excavated by Pileated Woodpeckers. Larger diameter trees are used most frequently, with nest cavities most often found in trembling aspen. • Nests may be used again, or a new nest may be in close proximity to old nest. <u>Information Sources</u> • OMNR Ecologist or Biologist may be aware of locations of nesting raptors. • Sustainable Forestry Licence (SFL) companies will identify additional nesting locations through field operations. • Ontario Breeding Bird Atlas or Rare Breeding Birds in Ontario for species documented. • Check data from Bird Studies Canada. • Reports and other information available from CAs.	Studies confirm: • Presence of 1 or more occupied nests from species list is considered significant [cxlviii]. • Northern Goshawk – A 400m radius around the nest or 28 ha of suitable habitat is the SWH [ccvii]. • Barred Owl – A 200m radius around the nest is the SWH [ccvii]. • Broad-winged Hawk, Coopers Hawk, Great Horned Owl, Red-tailed Hawk, Long-eared Owl – A 100m radius around the nest is the SWH [ccvii]. • Merlin and Sharp-Shinned Hawk – A 50m radius around the nest is the SWH [ccvii]. • Conduct field investigations from mid-March to end of May. The use of call broadcasts can help in locating territorial (courting/nesting) raptors and facilitate the discovery of nests by narrowing down the search area. • SWHDSS [cxlix] Index #27 provides development effects and mitigation measures.	Coniferous forest; mainly closed canopy. However, habitat type is abundant on the surrounding landscape. No nests of relevant species observed. **Not SWH**

		• Use maps and aerial photographs to identify forests with few roads that tend to have less human disturbance.		
Wildlife Habitat: Turtle Nesting Areas				
Painted Turtle <u>Special Concern Species</u> Snapping Turtle	B003 B006-007 B031 B171-172 B187-188	• Best nesting habitat for turtles are close to water and away from roads and sites less prone to loss of eggs by predation from skunks, raccoons or other animals. • For an area to function as a turtle-nesting area, it must provide sand and gravel that turtles are able to dig in and are located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH. • Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes, and rivers are most frequently used. <u>Information Sources</u> • Use Ontario Soil Survey reports and maps to help find suitable substrate for nesting turtles (well-drained sands and fine gravels). • Ontario Herpetofaunal Summary Atlas records or other similar atlases for uncommon turtles; location information may help to find potential nesting habitat for them. • Ontario Reptile and Amphibian Atlas (Ontario Nature). • NHIC • Use aerial photographs and maps to narrow the search for prime nesting areas including shoreline beaches located near weedy areas of wetlands, lake and river shorelines, road embankments near turtle habitat, and stream	Studies confirm: • One or more Turtle nest is a SWH[Í]. • The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30-100m around the nesting area dependant on slope, riparian vegetation and adjacent land use is the SWH [cxlviii]. • Travel routes from wetland to nesting area are to be considered within the SWH [cxlix]. • Field investigations should be conducted in prime nesting season typically late spring to early summer. • SWHDSS [cxlix] Index #28 provides development effects and mitigation measures for turtle nesting habitat	Appropriate turtle nesting habitat was not observed within the project area. No turtle species observed. **Not SWH**

		crossings/culverts. • Reports and other information available from CAs. • Sightings by local Naturalist groups		
Wildlife Habitat: Seeps and Springs				
Selected wildlife species that utilize this feature: Ruffed Grouse Moose White-tailed Deer Black bear Northern two-lined Salamander.	Seeps/Springs are areas where ground water comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a stream could have seeps/springs.	Any forested area (with <25% meadow/field/pasture) within the headwaters of a stream or river system [cxlvii, cxlix]. • Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species [cxx, cxxii, cxiv]. <u>Information Sources</u> • Topographical Map. • Thermography. • Hydrological surveys conducted by CAs and MOE. • Local naturalists and landowners may know some locations. • Municipalities and Conservation Authorities may have drainage maps and headwater areas mapped.	Field Studies confirm: • Presence of a site with 2 or more[í] seeps/springs should be considered SWH. • The area of ELC ecosite containing the seeps/springs is the SWH. The protection of the function of the feature considering the slope, vegetation, height of trees and groundwater condition need to be considered in delineation the habitat [cxlviii]. • SWHDSS [cxlix] Index #30 provides development effects and mitigation measures	Not a headwater area. **Not SWH**

Wildlife Habitat: Aquatic Feeding Habitat				
Moose	Habitat may be found in all forested ecosites adjacent to water.	• OMNR maps these locations on Crown land and rate the site on a scale of 1 – 4, with 4 having the greatest potential. Feeding sites classed 3 or 4 are candidate significant areas[Í]. • Identification of Moose Aquatic Feeding Areas should follow the method outlined in OMNR's Selected Wildlife and Habitat Features: Inventory Manual [cxcv] o Wetlands and isolated embayments in rivers or lakes which provide an abundance of submerged aquatic vegetation such as pondweeds, water milfoil and yellow water lily are preferred sites. Adjacent stands of lowland conifer or mixed woods will provide cover and shade [cxlviii]. <u>Information Sources</u> • Local naturalists and landowners may know some locations. • OMNR values information (NRVIS) may list known locations • OMNR Biologist may be aware of locations. • Sustainable Forestry Licence (SFL) companies may identify additional MAFA locations through field operations. • Topographical Maps together with aerial photographs will help locate potential sites.	• Moose Aquatic Feeding Habitat identified and ranked 3 or 4 by OMNR are considered SWH. • The area of the habitat includes the ELC ecosite area and adjacent stands (120m) of mixed or conifer forest, particularly those that provide thermal cover and/or travel corridors to other habitat features are considered significant [cxcvii]. • Surveys should be conducted from mid June to end of July when submergent aquatic vegetation has peaked [cxcv]. • Surveys should confirm the use of the site by moose or other species through observation of animal presence, tracks, etc. • If a SWH is determined for Aquatic Feeding Habitat then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule • SWHDSS [cxlix] Index #24 provides development effects and mitigation measures.	Mineral Meadow Marsh and Mineral Shallow Marsh are present adjacent to coniferous forest on the banks of the river. Dominant vegetation not noted to be key moose feeding species. OMNR has not identified any moose aquatic feeding areas. Moose observed in study area. **Not SWH**

Wildlife Habitat: Mineral Licks				
Moose Porcupine	Habitat may be found in all treed ecosites.	This habitat component is found in upwelling groundwater and the soil around these seepage areas. It typically occurs in areas of sedimentary and volcanic bedrock. In areas of granitic bedrock, the site is usually overlain with calcareous glacial till [cxlviii]. <u>Information Sources</u> • Local naturalists and landowners may know some locations. • OMNR values information (NRVIS) may list known locations • OMNR Ecologist or Biologist may be aware of locations. • Sustainable Forestry Licence (SFL) companies may identify additional locations through field operations.	• The area of the habitat is the wetland, seep or spring containing the mineral lick and 120m of undisturbed contiguous forest around the site dependant on level of disturbance in the area [cxlviii]. • Field investigations should be conducted in early spring prior to leaf out. Since sites will be very difficult to locate, consider using a small aircraft. • SWHDSS [cxlix] Index #29 provides development effects and mitigation measures.	Not a seepage area. Mineral lick not identified. **Not SWH**

Wildlife Habitat: Denning Sites for Mink, Otter, Gray Wolf, Eastern Wolf, Canada Lynx, Marten, Fisher, Black Bear				
Mink Otter Gray Wolf Canada Lynx **Special Concern** Eastern Wolf **Cavity Users** Marten Fisher	Habitat may be found in all treed ecosites.	Mink prefer shorelines dominated by coniferous or mixed forests with dens usually underground. Mink will often use old muskrat lodges [cxlviii]. Mink may den in root masses along shorelines of water bodies. Otters prefer undisturbed shorelines along water bodies that support productive fish populations with abundant shrubby vegetation and downed woody debris for denning. They often use old beaver lodges or log jams and crevices in rock piles [cxlviii]. Marten and fisher share the same general habitat, requiring large tracts of coniferous or mixed forests of mature or older age classes. Denning sites are often in cavities in large trees or under large downed woody debris [cxlviii]. Wolves prefer a more interior forest condition for locating their den sites. Wolves require sandy ground, sloped for excavation (esker areas should be examined as potentially key sites). Lynx den sites are most often associated with the presence of downed woody debris. Black bears, particularly sub-adults, will often den in the base of hollow trees. In 3E such trees are rare and primarily consist of large diameter cedar or sometimes large white spruce. <u>Information Sources</u> • Local naturalists and landowners may know some locations. • OMNR values information (NRVIS) may list known locations. • OMNR Ecologist or Biologist may be	• Wolf den sites (gray or eastern) and a 200m radius will be considered significant [ccvii]. • Any known active denning site and a 100 m radius around it with the remaining listed species is considered to be significant [cxlviii]. • Extensive searches for denning sites are not recommended as they are very difficult to locate but protection of appropriate habitat should be considered during planning. • SWHDSS [cxlix] Index #31 provides development effects and mitigation measures.	Undisturbed river shorelines heavily vegetated with large coniferous forest and providing a source of fish - suitable for Mink, otters, Marten, Fisher Presence of localized deadfalls, logs within the project area. Shrubby areas present. Provides suitable denning habitat for otters, lynx. River Otter and Black Bear observed. **Candidate SWH**

		aware of locations. • Sustainable Forestry Licence (SFL) companies may identify additional denning sites through field operations. • Topographical Maps together with aerial photographs will help locate potential sites. • Local trappers may know the location of prime denning sites.		
Wildlife Habitat: Wolf Rendezvous Sites				
Gray Wolf **<u>Special Concern</u>** Eastern Wolf	Isolated open areas including bogs, fens, meadows, clearcuts.	• Rendezvous sites may be found in a variety of habitats such as open bogs, burns, clearcuts, beaver meadows, and open forest [ccvii]. • Rendezvous sites are often used by wolf packs during multiple years [ccvii]. • Areas used as rendezvous sites one year may be used as den sites in a subsequent year [ccvii]. • Wolves in remote areas, or where prone to harvest by humans, appear to have a low tolerance for human activity near rendezvous sites [ccvii].	The identified rendezvous site and a 200 m radius from the site are considered the SWH [ccvii].	Appropriate habitat not present within the study area. **Not SWH**

Wildlife Habitat: Amphibian Breeding Habitat (Wetlands)				
Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Boreal Chorus Frog Northern Leopard Frog Green Frog Mink Frog Wood Frog Spring Peeper	Rich swamps and thickets, vernal/seasonal pooling, riparian and variety of wetland interiors and margins B128-135 B141-152 B223-224	• Wetlands and pools (including vernal pools) >500m^2 (about 25m diameter) [ccvii] supporting high species diversity are significant; some small or ephemeral habitats may not be identified on OMNR mapping and could be important amphibian breeding habitats [clxxxiv]. • Wetlands and pools need to persist until mid-July [cxlviii] • Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators. <u>Information Sources</u> • Ontario Herpetofaunal Summary Atlas • Ontario Reptile and Amphibian Atlas (Ontario Nature). • Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count. • OMNR Ecologist or Biologist may know of populations, wetland evaluations may be a good source of information.. • Use maps or aerial photography to locate marsh habitat. • Reports and other information available from CAs.	Studies confirm: • Presence of breeding population of 1or more of the listed salamander species or 3 or more of the listed frog or toad species with at least 20 breeding individuals (adults, juveniles, eggs/larval masses) [lxxi, lxxiii] • The ELC ecosite area and the shoreline are the SWH. • Surveys to confirm breeding to be completed during spring (Apr to June) when amphibians are migrating, calling and breeding within the wetland habitats. • If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWHDSS [cxlix] Index #15 provides development effects and mitigation measures.	Mineral Thicket Swamp (B134), Mineral Meadow Marsh (B142), Mineral Shallow Marsh (B148) present in study area. Species present: American Toad Spring Peeper Wood Frog Not likely an important area for wetland breeding habitat relative to surrounding landscape. **Not SWH**

Wildlife Habitat: Amphibian Breeding Habitat (Woodland).				
Eastern Newt Blue-spotted Salamander Spotted Salamander Four-toed Salamander Spring Peeper Wood Frog American Toad	All treed upland ecosites, however more likely on fine textured moist ecosites (e.g., B119-125) The wetland breeding ponds (including vernal pools) may be permanent or seasonal, large or small in size and could be located within or adjacent to the woodland [lxxii].	• Presence of a wetland, lake or pond of area >500m^2 (about 25m diameter) [ccvii] within or adjacent (within 120m) to a woodland (no minimum size) [clxxxii, lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx]. The wetland, lake or pond and surrounding forest, would be the Candidate SWH. Some small wetlands may not be mapped and may be important breeding pools for amphibians. • Pools need to be present until mid-July. • Breeding pools within the woodland or the shortest distance from forest habitat are more significant because of reduced risk to migrating amphibians and more likely to be used. • Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat [cxlviii]. <u>Information Sources</u> • Ontario Herpetofaunal Summary Atlas for historical records • Ontario Reptile and Amphibian Atlas (Ontario Nature). • Local landowners may also provide assistance as they may hear spring-time choruses of amphibians on their property. • Contact local OMNR Ecologist or Biologist and wetland evaluations. • Local field naturalist clubs • Canadian Wildlife Service Amphibian Road Call Survey information. • Ontario Vernal Pool Association (http://www.ontariovernalpools.org/)	Studies confirm; • Presence of 1 or more of the listed salamander species; or 2 or more of the frogs or toads with at least 100 individuals (adults, juveniles, eggs/larval masses) [lxxi] is significant. • The habitat is the wetland and treed area or adjacent ELC treed ecosites. The amount of area protected is dependant on slope, riparian vegetation, high water mark, density and height of trees and ground/surface water condition [cxlviii]. • A study to determine this SWH will be required during the spring when amphibians are migrating or are concentrated around suitable breeding habitat within the woodland. • SWHDSS [cxlix] Index #14 provides development effects and mitigation measures	No woodland ponds observed. Species present: American Toad Spring Peeper Wood Frog Not likely an important area for woodland breeding habitat relative to surrounding landscape. **Not SWH**

Wildlife Habitat: Mast Producing Areas				
Examples of wildlife species utilizing this habitat: Black Bear White-tailed deer Ruffed Grouse	All shrub and treed ecosites capable of producing mast.	Significant tree species include mountain ash and pin cherry. Significant shrub species include blueberries, raspberries, beaked hazel and choke cherry [cxlviii]. Some Oak or other hard-mast producing species may be present in 3E and its' significance should be evaluated as encountered because of its importance as a food source for various wildlife species. Recently disturbed sites (fire or logging), large bedrock outcroppings, forest openings or utility corridors >1 ha provide excellent sites for mast producing shrubs [cxlviii]. Permanent open sites providing long-term food sources are more significant [cxlviii]. <u>Information Sources</u> • OMNR Ecologists, Biologists or Foresters may know of important feeding sites or areas with high composition of mast producing trees through OMNR Wildlife Food Surveys. • FRI maps to locate stands with mast producing trees. • SFL companies may know of areas through regular forest inventory work. • Local naturalists clubs or hunters may be aware of important locations. • Aerial photography will assist in locating forest openings and bedrock outcrops.	•Natural open sites with abundant (50% ground cover) Í mast producing shrubs (e.g. Raspberry, Blueberry and Beaked hazel) species are considered significant [cxlix]. •Anthropogenic disturbances (logging or otherwise) may be considered significant at the discretion of OMNR. •Area of the early successional habitat or treed ELC ecosite with mast-producing trees or shrubs is the SWH. •Surveys should be conducted from June to August when plants are actively growing to determine presence. •SWHDSS [cxlix] Index #3 provides development effects and mitigation measures	Forests do not contain beech or oak trees, no mast-producing trees. Shrub community does not contain large patches of berry-producing shrubs. Lack of large areas of stable food source. **Not SWH**

Wildlife Habitat: Sharp-tailed Grouse Leks				
Sharp-tailed Grouse	B029-031 B044-046 B060-062 B077-079 B093-095 B109-111 B126 B136-141	The lek or dancing ground consists of bare, grassy area as the core of the lekking area, and may contain some sparse shrubland. There is often a knoll or slightly elevated rise in topography associated with the site [ccxix]. This is a better drained site less likely to collect water. Leks are typically a grassy field/meadow separated by >15ha from adjacent shrublands and >30ha from adjacent treed areas. Field/meadows are to be >15ha when adjacent to shrubland and >30ha when adjacent to deciduous stands [ccxix]. Field/meadows are to be as undisturbed as possible with low intensities of agriculture (light grazing or late haying) Leks will be used annually if not destroyed by cultivation or invasion by woody plants or tree planting [ccxix] <u>Information Sources</u> ▪ OMNR district office ▪ Bird watching clubs ▪ Local landowners ▪ Ontario Breeding Bird Atlas	Studies confirming lek habitat are to be completed from March to June. Any site confirmed with sharp-tailed grouse courtship activities is considered significant[1] The ELC ecosite plus a 200 meter area with shrub or deciduous trees is the lek habitat[1]	Appropriate habitat not present in the study area. **Not SWH**

1: Ontario Ministry of Natural Resources (OMNR). 2011. Significant Wildlife Habitat Ecoregion 3E Criterion Schedule. June 2011. 47pp.

Table 3. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 3E

Wildlife Species	Candidate SWH		Confirmed SWH	Wanatango Falls
	ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Wildlife Habitat: Marsh Bird Breeding Habitat				
American Bittern Sora Red-necked Grebe Pied-billed Grebe Ring-necked Duck Lesser Scaup Ruddy Duck American Coot Sandhill Crane Virginia Rail Trumpeter Swan **Special Concern**: Yellow Rail Black Tern	Ecosites: B134-B152[1]	• Nesting occurs in wetlands. • All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present [cxxiv]. <u>Information Sources</u> • Contact OMNR, wetland evaluations are a good source of information. • Local naturalist clubs • NHIC Records. • Reports and other information available from CAs. • Ontario Breeding Bird Atlas [ccv].[1]	Studies confirm: • Presence of any combination of 5 or more of the listed species Í. • Presence of one or more breeding pair of trumpeter swans is significant. • Note: any wetland with breeding of 1 or more Black Terns or Yellow Rail is SWH Í. • Area of the ELC ecosite is the SWH. • Breeding surveys should be done in May-July when these species are actively nesting in wetland habitats. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi] • SWHDSS [cxlix] Index #35 provides development effects and mitigation measures[1]	Mineral Thicket Swamp (B134), Mineral Meadow Marsh (B142), Mineral Shallow Marsh (B148) present in study area. Marshes are not large in relation to marshes on the surrounding landscape. Sandhill Crane observed in suitable breeding habitat. No species of conservation concern observed. **Not SWH**

Wildlife Habitat: Open Country Bird Breeding Habitat				
Indicator Spp: Vesper Sparrow Le Conte's Sparrow Eastern Meadowlark Common Spp: American Kestrel Northern Harrier Savannah Sparrow **Special Concern** Short-eared Owl	All Field, Meadow and Sparse Shrub ecosites B08-09 B20-21 B29-31 B44-46 B60-62 B77-79 B93-95 B109-111[1]	Large field/meadow areas (includes natural and cultural fields and meadows) >30 ha [clx, clxi, clxii, clxiii, clxiv, clxv, clxvi, clxvii, clxviii, clxix]. Field/meadow not Class 1 or 2 agricultural lands, and not being actively used for farming (i.e. no row cropping or intensive hay or livestock pasturing in the last 5 years) Í. Field/meadow sites considered significant should have a history of longevity, either abandoned fields, mature hayfields and pasturelands that are at least 5 years or older. The Indicator bird species are area sensitive requiring larger Field/meadow areas than the common Field/meadow species. Information Sources • Use Agricultural land classification maps with aerial photographs to determine the potential Fields/meadows that might be candidate sites. • Ask local birders for location of Fields/meadows that support abundant and species rich populations of area-sensitive species. • Reports and other information available from CAs. • Ontario Breeding Bird Atlas.[1]	Field Studies confirm: • Presence of nesting or breeding of 2 or more Indicator species and at least 1 of the common species.Í • A field with 1 or more breeding Short-eared Owls is to be considered SWH. • The area of SWH is the contiguous ELC ecosite field areas. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi] • SWHDSS [cxlix] Index #32 provides development effects and mitigation measures[1]	Habitat does not occur within the project area. **Not SWH**

Wildlife Habitat: Shrub/Early Successional Bird Breeding Habitat				
Clay-colored Sparrow Field Sparrow Ruffed Grouse Eastern Kingbird	All sparse shrub and shrub ecosites B09-10 B21-22 B31-32 B46-47 B62-63 B79-80 B95-96 B111-112 B134-135[1]	Large natural field areas succeeding to shrub and thicket habitats>30 ha in size. Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (i.e. no row-cropping, haying or live-stock pasturing in the last 5 years) [Í]. Larger shrub thicket habitats (>30 ha) are most likely to support and sustain a diversity of these species [clxxiii]. Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands. <u>Information Sources</u> • Use agricultural land classification maps and recent aerial photographs to determine the amount of potential shrub and thicket habitats. • Ask local birders for location of shrub and thicket habitats that support abundant and species rich populations of area-sensitive species. • Reports and other information available from CAs. • Ontario Breeding Bird Atlas.[1]	Field Studies confirm: • Presence of nesting or breeding of 2 or more of species listed [Í]. • The area of the SWH is the contiguous ELC ecosite area. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi] • SWHDSS [cxlix] Index #33 provides development effects and mitigation measures.[1]	Habitat does not occur within the project area. **Not SWH**

Wildlife Habitat: Canada Warbler Nesting and Foraging Habitat				
		Usually moist, mixed deciduous-coniferous forests with a well-developed understory and often near water. In the Great Lakes basin, commonly found in eastern hemlock-white pine-red pine forests with a maple-birch-American beech component.[2]	Canada Warbler habitat is considered Significant Wildlife Habitat if nesting or foraging activity is confirmed.	Canada Warbler is a species of Special Concern in Ontario. Consequently, confirmed habitat is considered Significant Wildlife Habitat. NRSI biologists observed one Canada warbler singing in suitable breeding habitat within the study area in spring 2010. This observation, and an abundance of suitable habitat, suggest likely breeding within the study area. **SWH**
Wildlife Habitat: Common Nighthawk Nesting and Foraging Habitat				
		Prefers open ground, clearings in dense forests, ploughed fields, gravel beaches or barren areas with rocky soils, open woodlands, and flat gravel roofs[2]	Common Nighthawk habitat is considered Significant Wildlife Habitat if nesting or foraging activity is confirmed.	Common Nighthawk is a species of Special Concern in Ontario. Consequently, confirmed habitat is considered Significant Wildlife Habitat. NRSI biologists did not observe this species within the study area, but it was identified in the OBBA as potentially occurring in the project area. **Candidate SWH**

Wildlife Habitat: Olive-sided Flycatcher Nesting and Foraging Habitat				
		Prefers semi-open, conifer forest near ponds, lakes, or rivers, as well as treed wetlands for nesting[2]	Olive-sided Flycatcher habitat is considered Significant Wildlife Habitat if nesting or foraging activity is confirmed.	Olive-sided Flycatcher is a species of Special Concern in Ontario. Consequently, confirmed habitat is considered Significant Wildlife Habitat. NRSI biologists did not observe this species within the study area, but it was identified in the OBBA as potentially occurring in the project area. **Candidate SWH**
Wildlife Habitat: Northern Long-eared Bat Habitat				
		Hibernates during winter in mines or caves. During summer, males roost alone and females form maternity colonies of up to 60 adults in manmade structures, hollow trees or under loose bark[2]	Confirmed use of a habitat by Northern Long-eared Bat for its life cycle requirements is considered Significant Wildlife Habitat	Northern Long-eared Bat is a species of Special Concern in Ontario. Consequently, confirmed habitat is considered Significant Wildlife Habitat. NRSI biologists did not observe this species within the study area, but it was identified by the OMNR as potentially occurring in the project area. **Candidate SWH**

1: Ontario Ministry of Natural Resources (OMNR). 2011. Significant Wildlife Habitat Ecoregion 3E Criterion Schedule. June 2011. 47pp.
2: OMNR Significant Wildlife Habitat Technical Guide and Appendices (2000)