

Annex II

**Bonnechere River – Proposed Thomas Low Waterpower Project –Environmental
Impact Assessment, Version 1.0, December 2011, Revised February 2012**

**Butternut Health Assessment Report, Raglan St. South Property, Renfrew Lot 13 Concession 2,
August 6, 2009**

**BONNECHERE RIVER
PROPOSED
THOMAS LOW
WATERPOWER PROJECT**

Environmental Impact Assessment

Version 1.0

Prepared for:
OEL-HydroSys Inc.

Prepared by:
Bowfin Environmental Consulting

**December 2011
(Revised February 2012)**

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1.0 INTRODUCTION

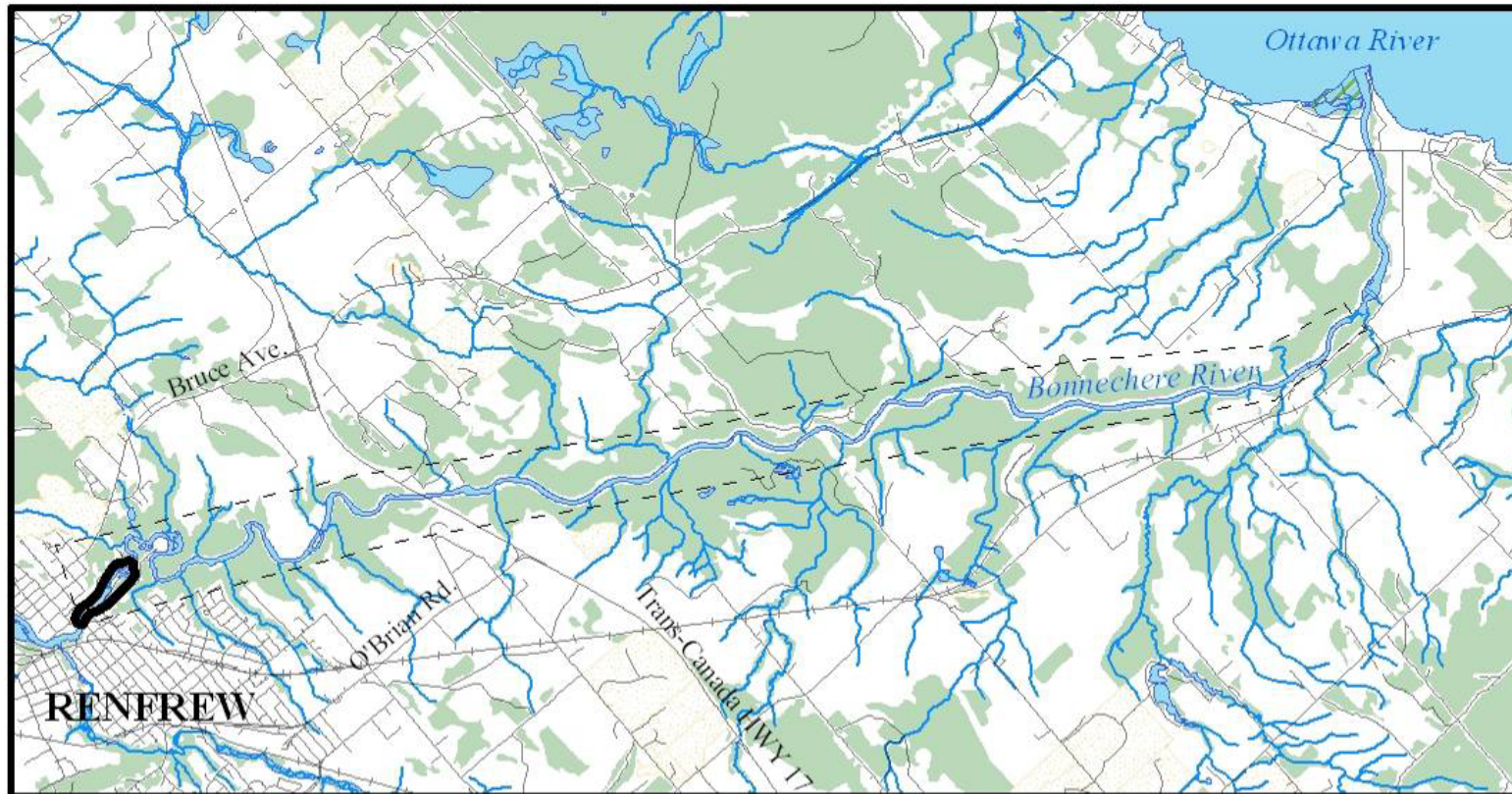
Renfrew Power Generation Inc. (RPG) currently operates two small waterpower facilities on the Bonnechere River within the Town of Renfrew. These existing facilities are referred to as the Upper and Lower Plants and are located approximately 400 m apart. The tailrace of the Upper Plant is located upstream of the intake of the Lower Plant allowing the two plants to run in succession generating up to 2.0 MW. At this time RPG is proposing the construction of a new small waterpower generating facility, named the Thomas Low Generating Station (TLGS).

The TLGS project would consist of building a new small waterpower facility adjacent to, and slightly downstream of the Lower Plant (Figure 1). The intake for the Thomas Low GS would be located within the existing intake canal for the Upper Plant. The flow would be channeled from the canal through a water conveyance structure to the TLGS, located approximately 425 m downstream from the intake. The water conveyance structure will consist of a combination of a pipeline and a double penstock, both will be buried. A new tailrace would be created which would join to the existing Lower Plant tailrace immediately upstream of the small island. There are no changes proposed to the water levels upstream of the Upper Plant (located at Bridge Avenue). The proposed TLGS would house two Kaplan turbines and be designed to generate up to 4.0 MW. RPG is proposing to initiate construction in spring of 2012.

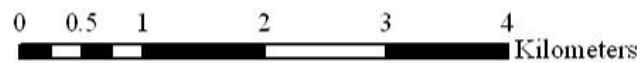
OEL-HydroSys Inc. (a member of WESA Group Inc., WGI) is overseeing the environmental assessment and engineering design of the proposed undertaking, and will provide technical support during the construction of the project, if approved. The environmental consultant is Bowfin Environmental Consulting (Bowfin).

This report provides a summary of the background data and existing conditions at the proposed project site, and an assessment of the potential effects on the natural environment for the TLGS. The potential impacts associated with the rehabilitation of Dams #1 and #2 and the Upper Plant intake canal are also addressed within this document.



Figure 1 Location of Project Area and Larger Inventory Study Area



(Basemap created from OBM)



Legend

-  Study Area
-  Inventory Study Area



*Bowfin Environmental Consulting Inc.
December 17, 2009*

1.1 Project Area Description

The project area is located on the Bonnechere River in the Town of Renfrew, Ontario. The Bonnechere River watershed is approximately 2400 km². The headwaters of the Bonnechere are located in Algonquin Park at McKaskill Lake, from where the Bonnechere travels approximately 145 km downstream to the Ottawa River. There are 4 waterpower facilities, and 8 water control structures located on the Bonnechere River as well as several structures on the Ottawa River, resulting in the Bonnechere River being regulated from Round Lake to its confluence with the Ottawa River. Waterpower facilities on the Bonnechere River consist of both peaking and run-of-river systems. Fish movements into and out of the project area is restricted by the existing dams located at RPG's Renfrew facility and by the waterfalls at First Chute. The project area is located in what is referred to as Reaches 2 and 3 of the Bonnechere River. Reach 2 extends from Renfrew Dam #2 to First Chute and Reach 3 extends from Douglas to Renfrew Dam #2.

2.0 METHODOLOGY

The data presented within this report was collected from two areas; the project area and the inventory study area (Figure 1). The project area includes the potential zone of impact for works discussed within this report and is located between Renfrew Dam #1 to approximately 0.68 km downstream. The second area is identified as the "inventory study area" on Figure 1, and comprises data that was collected between Dam #1 and First Chute, a distance of approximately 14 km, as part of investigations for a separate project.

The terrestrial and aquatic habitats descriptions and the search for SAR and species of conservation concern and their habitats were completed within the project area. The information on the fauna (bird, fish and reptile) collected in the project area was supplemented with data collected from the inventory study area as there are no barriers to movement between Dam #2 and First Chute (downstream end of inventory study area).

2.1 Review of Background Information

A review of available background information was conducted in order to identify potential environmental concerns and to supplement the data gathered by Bowfin. This included identifying natural heritage features within the project area. The natural heritage features which were examined were: the habitat of endangered or threatened species, significant wetlands, fish habitat, significant areas of natural and scientific interest, significant woodlands, and significant wildlife habitat. Background information was requested from the Pembroke District of the Ontario Ministry of Natural Resources (MNR). Databases related to natural features were searched and analyzed, including: Natural Heritage Information Centre (NHIC), Land Information Ontario (LIO), Ontario Crown Land Use Atlas, Ontario Renewable Resource Atlas, Conservation Ontario and *Ontario Breeding Bird Atlas* (OBBA) (2005). The *Ontario Breeding Bird Atlas* (OBBA) (2005) database was referenced for a list of possible, probable and confirmed breeding bird species in the general area. Note that there is no Conservation Authority for the project area.

2.2 Aquatic Habitat Description

The project area includes the aquatic habitats from Dam #1 to approximately 0.68 km downstream (Figure 2). The general channel morphology was described using the point observation technique along transects within the project area. Transects were completed by foot and were typically spaced every 20 m. The data which was collected included: depth, substrate size, morphological units and in-stream cover. Wetted width, water temperature and shoreline vegetation information was also recorded. The information was then combined to create a schematic drawing of the existing aquatic habitats within the project area.

2.3 Terrestrial Habitat Description

The terrestrial habitats were described based on the *Ecological Land Classification for Southern Ontario* (ELC). In addition to the habitat descriptions, a list of dominant plant species was compiled. The terrestrial habitats were studied in July 2009. A community description was provided for communities occupying a minimum area of 0.5 ha. A description of smaller habitats was provided only when they contained rare vegetation communities or significant functions.

The botanical fieldwork consisted of systematically cruising the project area to ensure a thorough survey of plant species and vegetation communities. The field work was completed on August 31, 2007 and was updated on July 10, 2009. Sufficient level of detail was collected in order to provide a general habitat description and identify the presence/absence of any of the natural environmental features. Representative plant species were recorded within the communities and a running list of plants observed within the study area was kept. Specific attention was paid to locating SAR and species of conservation concern¹ listed as potentially occurring within the study area. Any individuals found was photographed and its coordinates were recorded on a hand held GPS using NAD83. Plants that could not be identified in the field were collected for a more detailed examination in the laboratory. Nomenclature used in this report follows the Southern Ontario Plant List (Bradley, 2007) for both common and scientific names which are based on Newmaster *et al.* (1998). Authorities for scientific names are given in Newmaster *et al.* (1998).

2.4 Fish Community Sampling

Fish community sampling was performed in order to supplement data obtained during the background review and to document the use of the available habitat by fish during different seasons. The methodologies were chosen during a preliminary meeting with MNR and DFO. Sampling was completed using backpack electrofishing, and gill netting. Seine netting was also completed within the inventory study area. The seine netting data was not summarized in Section 3.4 as there were no sites within the study area; however the species were included in the list of species present of Table 11.

¹ "Species of conservation concern" are those species listed as S1-S3 (but are not listed as Endangered or Threatened provincially or federally) and those listed as Special Concern (provincially or federally)

Backpack Electrofishing

Backpack electrofishing was completed at nine sites on the Bonnechere River during August 2006 and July and September 2007. No sampling could be completed within the mainstem during April through June owing to the fast flow associated with the spring water levels. Five of the sampling sites are located within the project area and the results from these sites are summarized in Section 3.4 (Figure 2). The fish were identified, counted, measured and released. The transect length, approximate width, volts, current and shock time were also recorded.

Gill Netting

At the request of MNR, gill netting following the *River Index Netting Manual of Instructions* (Jones and Yunker 2007) was completed. A total of 17 sites were sampled within the inventory study area in August 2007. An 18th net was set however this net was stolen and the data lost. Of these sites, one is located within the project area and these results are presented in Section 3.4 (Figure 2). Note that the timing of this survey was delayed due to an extreme rain event. The gill nets were set perpendicular to the water flow over a 16 to 20 hour period. The fish were identified, counted, measured and those that were healthy were released. The remaining fish were frozen for disposal at the Renfrew landfill. Photographs of the head, dorsal, tail and lips of the redhorses were taken for field identification verification by Erling Holm (ROM) and Robert Jenkins.

2.5 Reptile Survey

A total of 23 trips were completed on the Bonnechere River from Renfrew to First Chute between July 2006 and September 2007. Visual observations of reptiles were noted during each event. Particular attention was paid to possible nesting sites and turtle basking sites.

2.6 Bird Survey

Bird surveys were completed within the inventory study area on May 3 and June 13, 2007, by Bernie Muncaster and Michelle Lavioitre. Additional survey information was collected on July 10, 2009 within the project area. Birds were identified by sound and/or sight. Bird surveys were conducted from 0600 hours terminating before the afternoon (in response to the decrease in the amount of singing). The surveys were completed on days with little wind, comprising the area between Renfrew Dams and First Chute. The surveys were completed by travelling through the area by foot and by boat and stopping for periods of 5 minutes to listen and observe. All species observed along the river were considered to potentially occur within the project area. The May 3rd visit occurred prior to leaf-out, and included a search for raptor nests or evidence of nesting (such as stick nests, food caches, whitewashing of branches and foliage, accumulation of feathers/fur or prey remains on the ground or in shrubs as per the *Significant Wildlife Habitat Technical Guide* (SWHTG - Appendix O) as well as the raptors themselves. Any incidental sightings during the field program were also recorded throughout the numerous field visits.

2.7 Species at Risk and Species of Conservation Concern

The presence/absence of both Species at Risk (SAR) and species of conservation concern was assessed. SAR species include any species listed as Endangered or Threatened provincially or federally. These species are protected by the provincial *Endangered Species Act* (ESA) and the federal *Species at Risk Act* (SARA), respectively. Since no federal lands or federal funding is involved in the proposed undertaking, federal jurisdiction extends only the bird (*Migratory Birds Act*) and fish species (*Fisheries Act*) within the study area.

Species of conservation concern are those listed as Special Concern provincially or have a provincial SRank of S1-S3 and are not listed as Endangered or Threatened (provincially). They also include any Federal Endangered or Threatened species not protected federally or provincially as SAR within the study area. Information on SAR or species of conservation concern was obtained from MNR Pembroke, the NHIC database, the Environment Canada SAR website and the OBBA.

Inventories were completed to determine whether flora SAR or species of conservation concern were located within the project area. The flora survey was undertaken on August 31, 2007 and was updated on July 10, 2009. The location of any SAR or species of conservation concern was recorded using a hand held GPS and photographs were taken. Butternuts were assessed following the butternut health assessment protocol by a Butternut Health Assessor (Butternut Health Assess #117). The butternut assessment was adjusted following the outcome of the audit which was completed on August 28, 2009.

The potential for fauna SAR or species of conservation concern to occur was established based on the available habitat and/or sightings. The potential for impact to the species is discussed within this report.

2.8 Incidental Wildlife Observations

During all site visits any wildlife observations were recorded. Incidental observations included observations of an individual, its tracks, burrows, nesting sites, feces and/or kill sights.

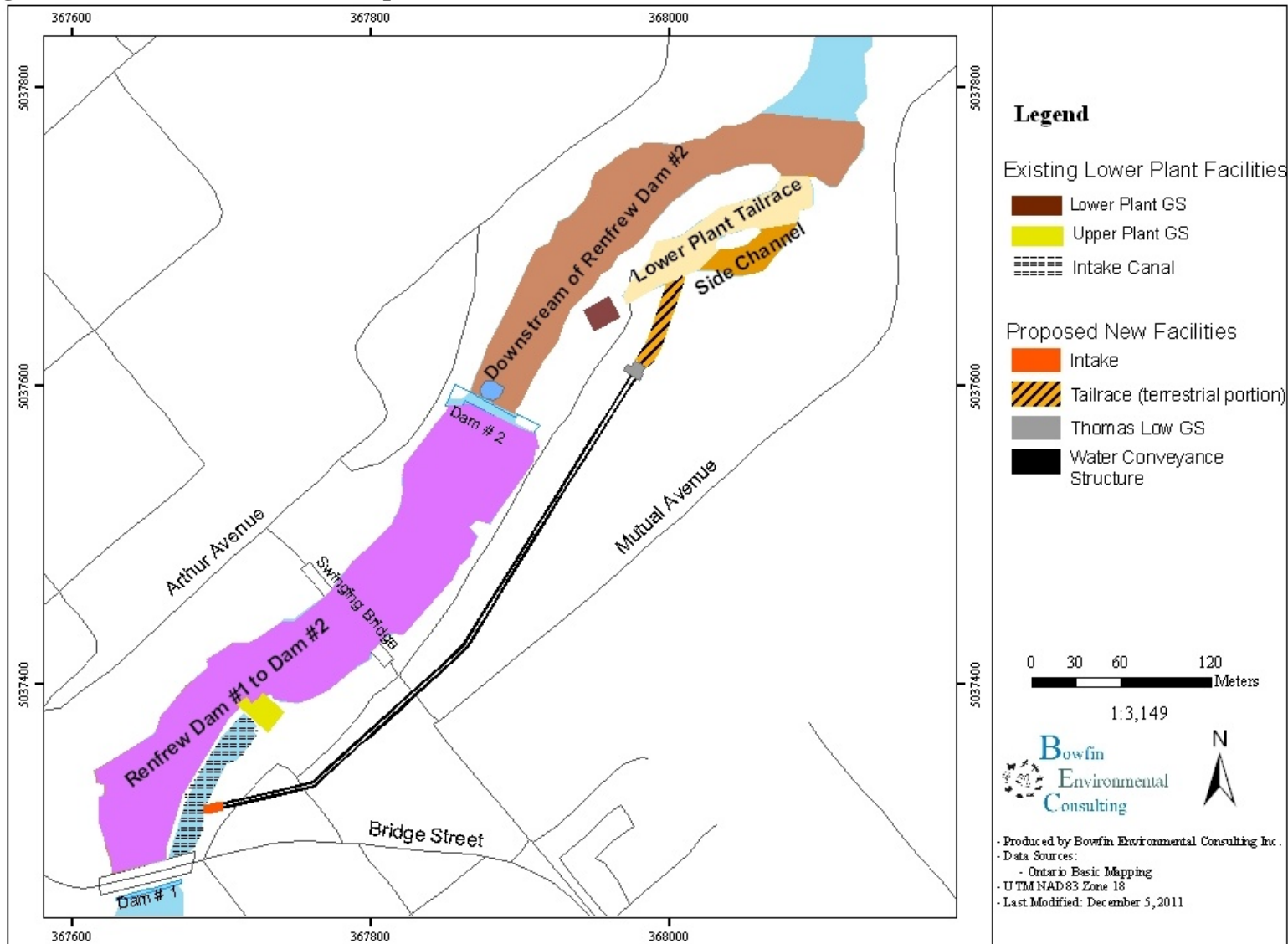
3.0 EXISTING CONDITIONS

3.1 Aquatic Environment

The Bonnechere River between Renfrew Dam #1, extending to approximately 680 m downstream was characterized during the summer of 2007 using transects. There were no tributaries located within the project area. The project area was divided into four sections (Figure 2):

1. Renfrew Dam #1 to Renfrew Dam #2;
2. “Mainstem” (downstream of Renfrew Dam #2);
3. The existing Lower Plant tailrace; and
4. Side channel located along the south bank, south of the Lower Plant tailrace.

Figure 2 Location of Habitat Description Sites



Dam 1 to Dam 2

This section is approximately 375 m long and consists of two distinct areas. The first is located between Dam #1 and the headpond and is approximately 150 m long (Photo 1). The upstream section could only be accessed when the flow was fully diverted (with the exception of the leakage through the logs which represents the existing residual flow). The channel width and wetted widths above the headpond were approximately 60 m and 37 m, respectively, on July 10, 2009. The upstream section contained fractured bedrock and large boulders. The morphological unit consisted of white water or runs and pools depending on the flow. The in-stream cover consisted primarily of boulders and the edges of the bedrock outcrops as well as occasional pool habitat.

The second area is the headpond which is approximately 225 m long (Photos 2 & 3). The channel width of the headpond is approximately 63 m. The water depth varies from approximately 1.8 m near the powerhouse to 3.0 m under the swinging bridge and 3.6 m at the old dam. The old dam is approximately 68 m upstream from Dam #2 and can be located by the cement piers that are still visible along the shoreline. There is a steep drop immediately downstream of the old dam and the maximum water depth is approximately 7.5 m. A smallmouth bass habitat enhancement project is located along the north shoreline between the Swinging Bridge and Dam #2. The enhancement consists of two tree trunks which were anchored into the riverbank within the past 5 years (pers. comm. Peter Boldt).



Photo 1 Looking downstream from Dam #1, July 10, 2009.

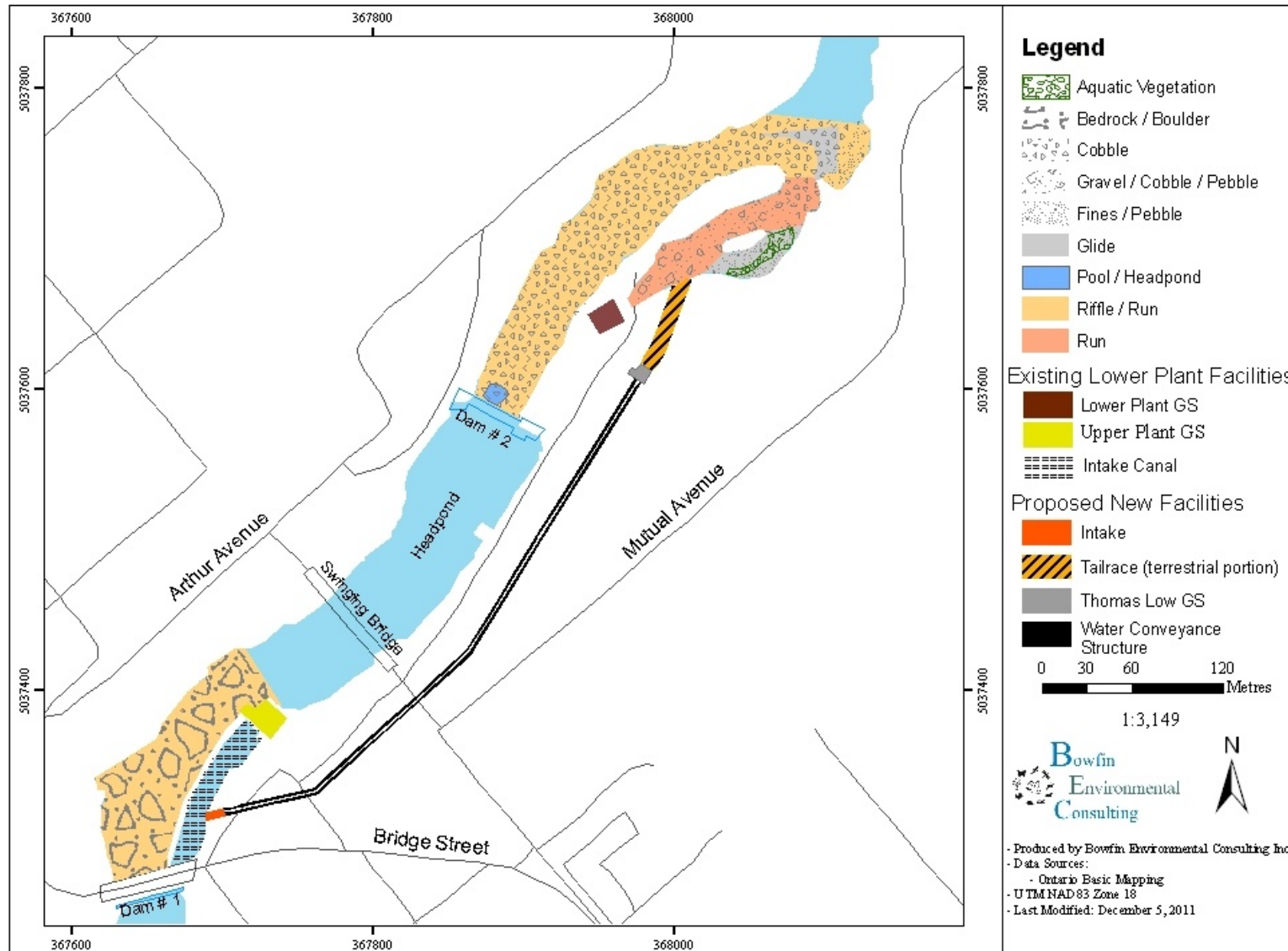


Photo 2 Looking upstream from the Swinging Bridge, July 10, 2009.



Photo 3 Looking downstream from the Swinging Bridge, July 10, 2009.

Figure 3 Aquatic Habitat Mapping Depicting Dominant Habitat and Substrate Types (Summer 2007)



Downstream of Dam 2

The site was characterized on July 16, 2007 (Photo 4). The site length was 205 m. The average wetted width was 33.6 m. The average water depth was 18 cm (range 0 – 70 cm). The morphological unites consisted of glide (57%), run (29%), riffle (8%), and pool (6%). The substrate was composed of cobble (56%), boulder (15%), gravel (12%), fines (10%), and pebble (7%). In-stream cover was provided at 42% of the points. The in-stream cover consisted of rocks (92%), and aquatic vegetation (12%). Aquatic vegetation was dominated by purple loosestrife followed by spotted jewel-weed. Banks were protected by boulders and cobble.



Photo 4 Looking downstream from Dam 2, July 10, 2009.

Lower Plant Tailrace

This site was described on July 17, 2007 (Photo 5). The site length was 144 m. The average wetted width was 23 m. The average water depth was 37 cm (range 6 – 92 cm). The morphological unites consisted of glide (56%), run (22%), and riffle (22%). The substrate was composed of gravel (41%), cobble (21%), pebble (21%), and fines (17%). In-stream cover was provided at 29% of the points. The in-stream cover consisted of rocks (86%), and aquatic vegetation (29%). Aquatic vegetation was dominated by pondweed species. Banks were protected by boulders and cobble.



Photo 5 Looking upstream at the tailrace, August 31, 2007.

Side Channel

Site was described on July 10, 2009 (Photo 6). The site length was 36 m. The average wetted width was 15 m. The average water depth was 49 cm (range 13 – 96 cm). The habitat types consisted of primarily of glide. The substrate was composed of fines (43%), pebble (40%), gravel (13%), and cobble (4%). In-stream cover was provided at 20% of the points. The in-stream cover consisted of aquatic vegetation (67%), rocks (17%), and overhanging vegetation (17%). Aquatic vegetation was dominated by tapegrass followed by small pondweed, and Canada waterweed.



Photo 6 Looking upstream from the downstream end, July 10, 2009.

3.2 Terrestrial Habitat

The terrestrial habitat was classified into three categories: meadow, parkland, and mixed forest (Figure 4). The meadow consisted of an area at the top of the hill that was recently disturbed by utility work. The site was dominated by blueweed, white sweet clover and black medick (Photo 7). Other species included viper's bugloss, white clover, wild mint, common plantain and common mullein.



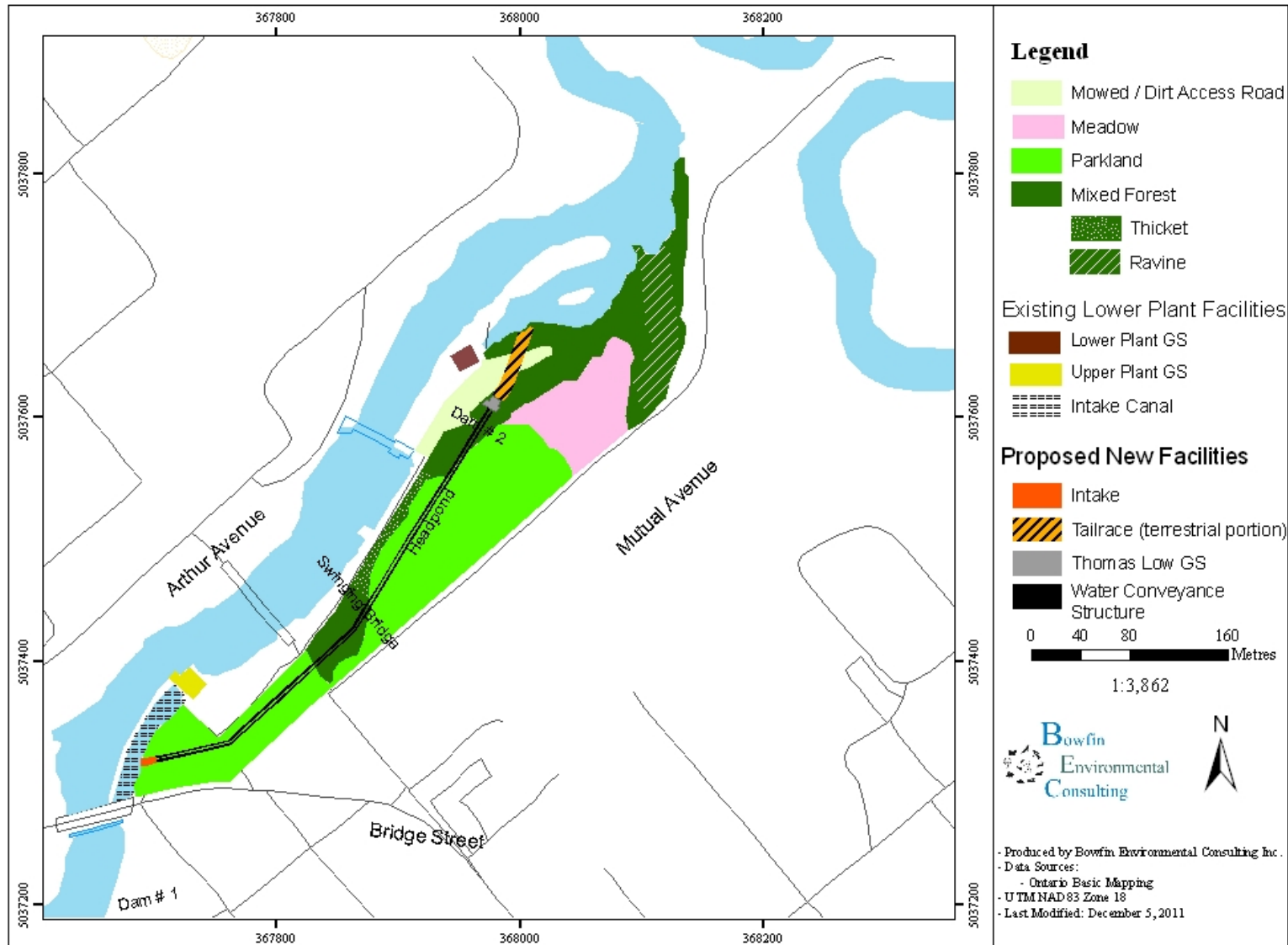
Photo 7 Meadow in foreground, deciduous windrow in background, July 10, 2009.

The parkland consisted of manicured grass with white cedars and deciduous windrows (Photo 8) as well as a mowed area near Lower Plant. The species located within the windrow was dominated by staghorn sumac, Manitoba maple and white ash. Other species included American elm and riverbank grape.



Photo 8 Parkland with planted white cedars and deciduous windrow along the top of bank, July 10, 2009.

Figure 4 Terrestrial Habitat Mapping



The forested area consisted of remnant mixed forest with a thicket inclusion and was located along: the hill, the ravine and the shoreline. The area along the hill is subjected to frequent disturbance from tree cutting for the maintenance of the two transmission lines which are located along the bottom and the top of the hill. These areas were similar in terms of their dominant flora species, with some differences in the order of abundance. The canopy was dominated by eastern white cedar, white ash, white pine and basswood. The canopy was 10-25 m in height and provided 50% cover. The sub-canopy was dominated by common buckthorn, staghorn sumac, white ash, American elm, and Manitoba maple. The sub-canopy was 2-10 m in height and provided 90% cover. The understory varied within the different forest areas but in general was 1-2 m in height and provided between 25-60% cover. Dominant species included buckthorn, white ash, American elm, ironwood, gray dogwood, thimbleberry, and common buckthorn. The ground layer was sparse. Where present it included: spotted jewelweed, white sweet clover, bull thistle, and poison ivy. There was also abundant Virginia creeper and riverbank grape which extended into the canopy. It should be noted that Butternut was found within the forest polygon.

The thicket inclusion was located along the side of the hill adjacent to the Lower Plant access road (Figure 4). This area included young and regenerating Manitoba maple, sugar maple, American elm, eastern white cedar and butternut as well as wild red raspberry, prickly ash, staghorn sumac, poison ivy, milkweed, yarrow, Philadelphia fleabane, white sweet clover and cow vetch. Butternut was also located within this section of the polygon.

3.3 Plants

Appendix A lists the plant species that were recorded within the project area. A total of 92 species were identified of which 72% were native and all but one was ranked at a value higher than S4. The butternut is a S3? ranked species and is also listed as an Endangered species both provincially and federally. The question mark signifies that MNR considers the ranking uncertain. The Co-efficient of Conservatism (CC) of the species recorded provides information on the species' tolerance to disturbance; those species with a high CC (maximum of 10) are highly sensitive. The average CC for this site was 3.7 which signifies a higher tolerance to disturbance. The majority of the species had a CC value of low or moderate (91%). The butternut is further discussed in Section 4.1 of this report.

3.4 Fish Community Results

3.4.1 Background Information

Background information on the potential fish species occurring within Reaches 2 and 3 on the Bonnechere River was obtained from the Bonnechere River Water Management Plan (BRWMP) (2009). The list contained 30 common warm to cool water fish species (Appendix B). MNR Pembroke requested that the American eel (Endangered, END), river redhorse (SC), and lake sturgeon (SC) be included as potential SAR (END) or species of conservation concern (SC), as applicable. Information on these species is provided in Sections 4.1 and 4.4 of this report.

The local Conservation Officer (Mark Lamant) and bait fish operator (Alan Roetterg) were contacted in order to obtain additional information on the fish community. No members of the Fish and Game Club who fished in this area were available. Mr. Lamant indicated that he had checked the catch from fishermen near the dams. Their catch consisted primarily of bass and none had walleye. Mr. Lamant had never observed any fishermen at Highway 17 (though access would be an issue at this location).

Mr. Roetterg indicated that he had not fished within this section and that the previous permit holder this section of the river had informed him that he had caught very few minnows in this area.

It is noted that the shorelines of the Bonnechere River are all privately owned and very steep. Algonquins of Ontario were contacted for information through Jacqueline Oblak. No information was available (with the exception of information on historical presence of American eels downstream of First Chute which was provided during a meeting with AOO).

3.4.2 Fish Community Sampling Results

Backpack Electrofishing

The backpack electrofishing Sites A to E are located within the project area; these were sampled in August 2006, July 2007 and September 2007 and are summarized below based on their location within the study area (Figure 5).

Dam #1 to Dam #2

Site A was located between the two existing dams; the site length was 150 m. This site was visited twice; July 2007 and July 2008. Only 10 fish were captured on the first visit of July 11, 2007. This visit occurred a few days after the start of low flow conditions. The low number of fish captured prompted a second visit the following year. The second visit was conducted on July 23rd, 2008 which was the same day that the water levels were lowered, allowing sampling to occur while fish remained within the site.

A total of seventy-eight fish representing eleven species were captured during the two sampling periods: white sucker, redhorse sp., rosyface shiner, blacknose dace, longnose dace, creek chub, banded killifish, rock bass, smallmouth bass, johnny darter, and logperch (Table 1). Young-of-the-year (YOY) redhorse (likely shorthead), white suckers, rock bass and smallmouth bass were captured. Yearly results are provided in Appendix C.

Table 1 Site A Total Catch (July 11, 2007 and July 23, 2008)

Species name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
white sucker	<i>Catostomus commersoni</i>	insectivore / omnivore	cool	4	37-80
redhorse sp.	<i>Moxostoma sp.</i>			5	22-37
rosyface shiner	<i>Notropis rubellus</i>	Insectivore	warm	13	61-71
blacknose dace	<i>Rhinichthys atratulus</i>	insectivore / generalist	cool	5	30-63
longnose dace	<i>Rhinichthys cataractae</i>	Insectivore	cool	31	28-121
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	1	45
banded killifish	<i>Fundulus diaphanus</i>	Insectivore	cool	1	27
rock bass	<i>Ambloplites rupestris</i>	insectivore / piscivore	cool	6	25-158
smallmouth bass	<i>Micropterus dolomieu</i>	insectivore / piscivore	warm	8	35-115
johnny darter	<i>Etheostoma nigrum</i>	Insectivore	cool	1	45
Logperch	<i>Percina caprodes</i>	Insectivore	cool / warm	3	80-99
Total				78	

(Coker et al., 2001; MTO, 2006)

Downstream of Dam #2

Site B was 215 m long and located downstream of Dam #2. The site was sampled twice, July 10 and September 6, 2007. Individual results are provided in Appendix C. A total of ninety-one fish representing five species were captured: longnose dace, rock bass, smallmouth bass, johnny darter, and logperch (Table 2). YOY smallmouth bass were included in the catch.

Table 2 Site B Total Catch (August 24, 2006, July 10, 2007, and September 6, 2007)

Species name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
longnose dace	<i>Rhinichthys cataractae</i>	Insectivore	cool	22	31-104
rock bass	<i>Ambloplites rupestris</i>	insectivore / piscivore	cool	2	69-129
smallmouth bass	<i>Micropterus dolomieu</i>	insectivore / piscivore	warm	50	40-133
johnny darter	<i>Etheostoma nigrum</i>	Insectivore	cool	2	55-69
logperch	<i>Percina caprodes</i>	Insectivore	cool / warm	15	101-136
Total				91	

(Coker et al., 2001; MTO, 2006)

Lower Plant Tailrace

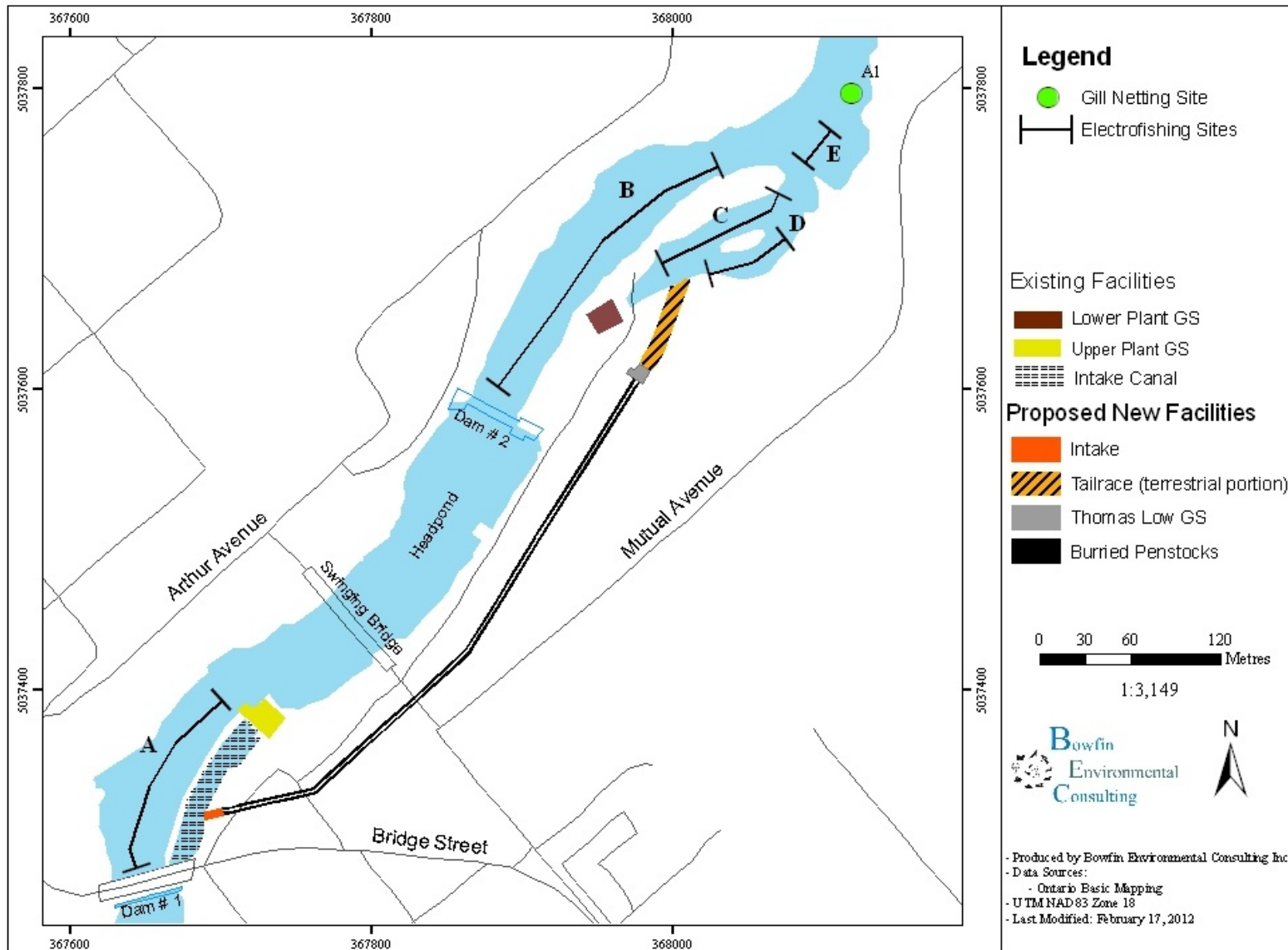
Site C was located within the Lower Plant tailrace and sampled once on September 6, 2007. The site length was 90 m and electrofishing time was 619 seconds. A total of twenty-one fish representing seven species were captured: bluntnose minnow, brown bullhead, rock bass, pumpkinseed, smallmouth bass, johnny darter, and logperch (Table 3). YOY smallmouth bass formed part of the catch.

Table 3 Site C (September 6, 2007)

Species name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
bluntnose minnow	<i>Pimephales notatus</i>	Omnivore	warm	4	56-72
brown bullhead	<i>Ameiurus nebulosus</i>	Insectivore	warm	1	133
rock bass	<i>Ambloplites rupestris</i>	insectivore / piscivore	cool	1	85
Pumpkinseed	<i>Lepomis gibbosus</i>	Insectivore	warm	1	84
smallmouth bass	<i>Micropterus dolomieu</i>	insectivore / piscivore	warm	11	65-107
johnny darter	<i>Etheostoma nigrum</i>	Insectivore	cool	2	50-53
Logperch	<i>Percina caprodes</i>	Insectivore	cool / warm	1	117
Total				21	

(Coker et al., 2001; MTO, 2006)

Figure 5 Location of Sampling Sites



Side Channel

Site D was located within the side channel and sampled three times: August 24, 2006, July 10, 2007 and September 6, 2007. Individual results are provided in Appendix C. A total of twenty-seven fish were captured representing six species: bluntnose minnow, brown bullhead, banded killifish, rock bass, pumpkinseed, and johnny darter (Table 4). YOY rock bass and pumpkinseed were captured.

Table 4 Site D (July 10, 2007 and September 6, 2007)

Species name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
bluntnose minnow	<i>Pimephales notatus</i>	Omnivore	warm	6	49-61
brown bullhead	<i>Ameiurus nebulosus</i>	Insectivore	warm	1	249
banded killifish	<i>Fundulus diaphanus</i>	Insectivore	cool	1	65
rock bass	<i>Ambloplites rupestris</i>	insectivore / piscivore	cool	11	30-120
pumpkinseed	<i>Lepomis gibbosus</i>	Insectivore	warm	3	40-85
johnny darter	<i>Etheostoma nigrum</i>	Insectivore	cool	5	49-57
Total				27	

(Coker et al., 2001; MTO, 2006)

Downstream of Small Island

Site E was located in the main channel, downstream of the small island. This site was sampled twice (July 10th and September 6, 2007). A total of twenty-seven fish representing five species were captured: bluntnose minnow, longnose dace, rock bass, smallmouth bass, and johnny darter (Table 5).

Table 5 Site E Total Catch (July 10, 2007 and September 6, 2007)

Species name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
bluntnose minnow	<i>Pimephales notatus</i>	omnivore	warm	1	48
longnose dace	<i>Rhinichthys cataractae</i>	insectivore	cool	12	30-100
rock bass	<i>Ambloplites rupestris</i>	insectivore / piscivore	cool	1	54

Species name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
smallmouth bass	<i>Micropterus dolomieu</i>	insectivore / piscivore	warm	4	30-103
johnny darter	<i>Etheostoma nigrum</i>	insectivore	cool	9	26-66
Total				27	

(Coker et al., 2001; MTO, 2006)

River Index Netting (RIN)

One gill net was located immediately downstream of the project area, Net A1. Net A1 was set on August 20th 2007 over a period of 21 hours and 51 minutes. Four fish, two rock bass and two smallmouth bass, were captured (Table 6). The catch did not include any YOY.

Table 6 RIN Site A1 (August 21, 2007)

Species name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
rock bass	<i>Ambloplites rupestris</i>	insectivore / piscivore	cool	2	130-185
smallmouth bass	<i>Micropterus dolomieu</i>	insectivore / piscivore	warm	2	259-260
Total				4	

(Coker et al., 2001; MTO, 2006)

3.5 Reptiles

The available background information for reptile species within the project area pertained to SAR and species of conservation concern and is presented in Sections 4.1 and 4.4 of this report. A total of 23 trips were made down the Bonnechere River within the study inventory area between July 2006 and September 2007. No turtles were observed basking and no nest sites were seen.

While MNR indicated that the northern map turtle has been observed downstream of First Chute (pers. comm. MNR), none were observed or have been documented within the study inventory area.

3.6 Birds

3.6.1 Background Information

The available background information for bird species within the project area included the OBBA results and information pertaining to SAR or species of conservation concern (presented in Sections 4.1 and 4.4 of this report). A list of potential breeding birds for the general area was obtained from the OBBA square 18UR63 (Appendix D). The OBBA lists a total of one hundred and eleven (111) birds; forty-three (43) confirmed breeding bird species, forty-nine (49) possible breeding bird species and nineteen (19) probable breeding bird species. Only one species, the Olive-sided flycatcher is listed provincially as a species of Special Concern (SC) and federally as Threatened (THR). The olive-sided flycatcher is found in openings with tall snags or trees, and is highly vocal and conspicuous (Cheskey 2007) making it easy to observe and document. The olive-sided flycatcher was not heard or observed during any of the site visits.

MNR indicated that Bald eagles have been observed near Phillip Shrive Memorial Bridge (approximately 2.6 km to the west). Discussion regarding this species is found on Section 4.4 of this report.

3.6.2 Survey Results

A total of 48 bird species were identified in the study inventory area during field investigations, those that were observed within the project area are listed in bold script. All were common species with S4 to S5 ranking (Table 7). No raptor nests or nesting activities were observed within the project area.

Table 7 List of Bird Species Observed in the Study Inventory Area

COMMON NAME	SCIENTIFIC NAME	SRANK	Provincial Status (SARO)	Federal Status (SARA)
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	S5B		
Great Blue Heron	<i>Ardea herodias</i>	S4		
Turkey Vulture	<i>Cathartes aura</i>	S5B		
Mallard	<i>Anas platyrhynchos</i>	S5		
Red-tailed Hawk	<i>Buteo jamaicensis</i>	S5		
Killdeer	<i>Charadrius vociferus</i>	S5B, S5N		
Spotted Sandpiper	<i>Actitis macularia</i>	S5		
Ring-billed Gull	<i>Larus delawarensis</i>	S5B, S4N		
Mourning Dove	<i>Zenaida macroura</i>	S5		
Belted Kingfisher	<i>Ceryle alcyon</i>	S4B		
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	S5B		
Downy Woodpecker	<i>Picoides pubescens</i>	S5		
Northern Flicker	<i>Colaptes auratus</i>	S4B		
Eastern Wood-Pewee	<i>Contopus virens</i>	S4B		
Alder Flycatcher	<i>Empidonax alnorum</i>	S5B		
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	S4B		

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COMMON NAME	SCIENTIFIC NAME	SRANK	Provincial Status (SARO)	Federal Status (SARA)
Eastern Kingbird	<i>Tyrannus tyrannus</i>	S4B		
Warbling Vireo	<i>Vireo gilvus</i>	S5B		
Red-eyed Vireo	<i>Vireo olivaceus</i>	S5B		
Blue Jay	<i>Cyanocitta cristata</i>	S5		
American Crow	<i>Corvus brachyrhynchos</i>	S5B		
Tree Swallow	<i>Tachycineta bicolor</i>	S4B		
Barn Swallow	<i>Hirundo rustica</i>	S4B	THR	
Black-capped Chickadee	<i>Poecile atricapilla</i>	S5		
White-breasted Nuthatch	<i>Sitta carolinensis</i>	S5		
House Wren	<i>Troglodytes aedon</i>	S5B		
Veery	<i>Catharus fuscescens</i>	S4B		
Wood Thrush	<i>Hylocichla mustelina</i>	S4B		
American Robin	<i>Turdus migratorius</i>	S5B		
Gray Catbird	<i>Dumetella carolinensis</i>	S4B		
European Starling	<i>Sturnus vulgaris</i>	SNA		
Cedar Waxwing	<i>Bombycilla cedrorum</i>	S5B		
Yellow Warbler	<i>Dendroica petechia</i>	S5B		
Black-and-white Warbler	<i>Mniotilta varia</i>	S5B		
American Redstart	<i>Setophaga ruticilla</i>	S5B		
Ovenbird	<i>Seiurus aurocapillus</i>	S4B		
Common Yellowthroat	<i>Geothlypis trichas</i>	S5B		
Chipping Sparrow	<i>Spizella passerina</i>	S5B		
Savannah Sparrow	<i>Passerculus sandwichensis</i>	S4B		
Song Sparrow	<i>Melospiza melodia</i>	S5B		
White-throated Sparrow	<i>Zonotrichia albicollis</i>	S5B		
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	S4B		
Bobolink	<i>Dolichonyx oryzivorus</i>	S4B	THR	
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	S4		
Eastern Meadowlark	<i>Sturnella magna</i>	S5	THR	
Common Grackle	<i>Quiscalus quiscula</i>	S5B		
Brown-headed Cowbird	<i>Molothrus ater</i>	S4B		
Baltimore Oriole	<i>Icterus galbula</i>	S4B		
American Goldfinch	<i>Carduelis tristis</i>	S5B		

Ranking updated February 22, 2012

SRANK DEFINITIONS

S4 Apparently Secure, Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 Secure, Common, widespread, and abundant in the nation or state/province.

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

S#S# Range Rank, A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

SAB Breeding accidental.

SAN Non-breeding accidental.

SZB Breeding migrants/vagrants.

SZN Non-breeding migrants/vagrants.

SARO STATUS DEFINITIONS

THR Threatened: A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.

SC Special Concern: A species with characteristics that make it sensitive to human activities or natural events.

SARA STATUS DEFINITIONS

SC Special Concern: a wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

3.7 Incidental Fauna Observations

A list of incidental wildlife observations for the inventory study area is provided in Table 8. All but the grey squirrel were recorded outside of the project area. The list includes an additional twelve species: 1 butterfly, 2 dragonflies, 5 amphibians, and 5 mammals. All species observed are considered to be commonly observed species, including the monarch butterfly despite it being listed as a SC. No monarchs or large concentrations of milkweeds were observed within the project area.

Table 8 List of Fauna Observed in the Study Inventory Area

COMMON NAME	SCIENTIFIC NAME	SRANK	Provincial Status (SARO)	Federal Status (SARA)
BUTTERFLIES				
Monarch	<i>Danaus plexippus</i>	S2N, S4B	SC	SC
DRAGONFLIES				
Black-Shouldered Spinyleg	<i>Dromogomphus spinosus</i>	S5		
Common Whitetail	<i>Libellula Lydia</i>	S5		
AMPHIBIANS				
American Toad	<i>Bufo americanus</i>	S5		
Western Chorus Frog	<i>Pseudacris triseriata</i>	S4		
Bullfrog	<i>Rana catesbeiana</i>	S4		
Green Frog	<i>Rana clamitans</i>	S5		
Northern Leopard Frog	<i>Rana pipiens</i>	S5		
MAMMALS				
Grey Squirrel	<i>Sciurus carolinensis</i>	S5		
Red Squirrel	<i>Tamiasciurus hudsonicus</i>	S5		
Beaver	<i>Castor canadensis</i>	S5		
Muskrat	<i>Ondatra zibethicus</i>	S5		
Porcupine	<i>Erethizon dorsatum</i>	S5		
Raccoon	<i>Procyon lotor</i>	S5		
White-tailed Deer	<i>Odocoileus virginianus</i>	S5		

Ranking updated February 22, 2012

SRANK DEFINITIONS

S4 Apparently Secure, Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 Secure, Common, widespread, and abundant in the nation or state/province.

SAB Breeding accidental.

SAN Non-breeding accidental.

SARO STATUS DEFINITIONS

SC Special Concern: A species with characteristics that make it sensitive to human activities or natural events.

SARA STATUS DEFINITIONS

SC Special Concern: a wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

4.0 SIGNIFICANT NATURAL FEATURES

4.1 Habitat of Species at Risk

This section contains information on those species that are listed as Endangered or Threatened by the provincial and/or the federal governments². The available background information for the project area indicated list two SAR as potentially occurring in the general area; barn owl and Blanding's turtle.

During the preliminary discussion, MNR requested that the species list be widened to include all SAR identified as occurring in the County of Renfrew. This added another eighteen species for a total of twenty potential species: lake sturgeon, American eel, eastern sand darter, stinkpot turtle, Blanding's turtle, spiny softshell, least bittern, golden eagle, peregrine falcon, barn owl, loggerhead shrike, olive-sided flycatcher, barn swallow, Kirtland's warbler, eastern meadowlark, pale-bellied frost lichen, flooded jellyskin, American ginseng, butternut and Ogden's pondweed (Table 9).

A search was made for the plant SAR to confirm their presence/absence within the project area, only butternuts were found.

In the following table, those species that were documented as occurring within the area of impact are highlighted in bold and those species that may be present based on habitat are listed in regular type. Fauna species whose habitat was not found within the zone of impact (direct or indirect), and the flora species that were found to be absent during the search are listed in gray type. The species listed in regular or bold type and have been observed within the past 30 years are further discussed below and in Section 5.2 of this report.

² Note that only aquatic species and migratory birds listed as Endangered or Threatened on Schedule 1 are included as this is private land and no federal funding was sought.

Table 9 List of Potentially Occurring Species at Risk within the Project Area

Common Name	Scientific Name	SRANK	Provincial Status	Federal Status	Preferred Habitat	Last Observed	Reference
FISH							
Lake Sturgeon	<i>Acipenser fulvescens</i>	S2	THR		Bottoms of lakes and large rivers.	22/05/2001	COSEWIC 2000
American Eel	<i>Anguilla rostrata</i>	S1?	END		Near cover over muddy, silty bottoms of lakes, rivers and creeks.		COSEWIC 2006
Eastern Sand Darter	<i>Ammocrypta pellucida</i>	S2	END	THR	Sandy bottoms of large creeks and small to medium rivers, and sandy shoals of lakes.	1953	COSEWIC 2009
REPTILES							
Stinkpot	<i>Sternotherus odoratus</i>	S3	THR	THR	Shallow slow moving water with a soft substrate.	07/1992	Edmonds 2002
Blanding's Turtle	<i>Emydoidea blandingii</i>	S3	THR	THR	Shallow water, large marshes, shallow lakes or similar such water bodies.	02/06/2004	COSEWIC 2005
Spiny Softshell	<i>Apalone spinifera</i>	S3	THR	THR	Swallow water with soft substrate	07/1986	Fletcher 2002
BIRDS							
Least Bittern	<i>Ixobrychus exilis</i>	S4B	THR	THR	Freshwater marshes, ditches, creeks, rivers and lakes with tall emergent vegetation	06/06/2001	COSEWIC 2009
Golden Eagle	<i>Aquila chrysaetos</i>	S2B	END		Open country, near mountains and lakeshores.	1953	Peterson 1980

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Common Name	Scientific Name	SRANK	Provincial Status	Federal Status	Preferred Habitat	Last Observed	Reference
Peregrine Falcon	<i>Falco peregrinus anatum</i>	S3B	THR		Requires steep cliffs or high rises for nesting and open habitat for foraging.	2005	COSEWIC 2007
Barn Owl	<i>Tyto alba</i>	S1	END	END	Agricultural areas, orchards, pastures, marshes and meadows	01/01/2005	Ontario Barn Owl Recovery Team 2010
Loggerhead Shrike	<i>Lanius ludovicianus</i>	S2B	END	END	Pastures, marginal farmland, and wetlands.	16/06/2008	Environment Canada 2010
Olive-sided Flycatcher	<i>Contopus cooperi</i>	S4B	SC	THR	Open areas containing tall trees or snags for perching.		COSEWIC 2007
Barn Swallow	<i>Hirundo rustica</i>	S4B	THR		Open or semi-open lands: farms, field, marshes.		Peterson 1980
Kirtland's Warbler	<i>Dendroica kirtlandii</i>	S1B	END	END	Requires large stands of young Jack pine.	08/2008	James 1999
Eastern Meadowlark	<i>Sturnella magna</i>	S4B	THR		Fields, meadows and prairies.		Peterson 1980
PLANTS							
Pale-bellied Frost Lichen	<i>Physconia subpallida</i>	S1	END		Epiphyte on hardwood trees.	12/05/2009	COSEWIC 2009
Flooded Jellyskin	<i>Leptogium rivulare</i>	S1	THR	THR	Periodically inundated bases of trees.	2003-2004	COSEWIC 2004
American Ginseng	<i>Panax quinquefolius</i>	S2	END	END	Rich, moist habitat and is associated with sugar maple forests.		COSEWIC 2000
Butternut	<i>Juglans cinerea</i>	S3?	END	END	Variety of sites, grows best on	2009 (by Bowfin)	COSEWIC 2003

Common Name	Scientific Name	SRANK	Provincial Status	Federal Status	Preferred Habitat	Last Observed	Reference
					well-drained fertile soils in shallow valleys and on gradual slopes		
Ogden's Pondweed	<i>Potamogeton ogdenii</i>	SH	END	END	Clear slow-moving streams, beaver ponds, and lakes.	15/07/1873	COSEWIC 2007

Ranking and status updated: February 22, 2012

- S1 – Critically Imperiled
- S2 – Imperiled
- S3 – Vulnerable
- S4 – Apparently Secure
- S5 - Secure
- SC – Special Concern (formerly Vulnerable)
- SNA – Not Applicable
- SZ – Not of practical conservation concern
- SZB – Breeding migrants/vagrants
- SZN – non-breeding migrants/vagrants
- THR – Threatened
- END – Endangered

Fish

Lake Sturgeon

Lake sturgeon is listed as a Threatened species provincially. It is not listed federally. Lake sturgeon spawn in fast flowing water such as rapids. The adults are typically captured on shoals in depths of 4.6-9.2 m and the young on gravelly or sandy shoals at the mouths of rivers (Scott and Crossman 1979). Lake sturgeon have been documented to occur downstream of First Chute by MNR. Within the project area, the area downstream of Dam #2 provides suitable lake sturgeon spawning habitat however it is unlikely that this species occurs upstream of First Chute due to the barrier to movement created by the chute, the drifting and fragile nature of lake sturgeon larvae, and the absence of sturgeon captured during sampling.

Lake sturgeon are poor jumpers. The smaller lower lobed tail, the presence of scutes (which create drag) and the species' inability to produce high burst speeds reduces the sturgeon's ability to jump and to thrust through obstacles (Peake *et al* 1997). In order for lake sturgeon to travel up First Chute, the operations of both Renfrew Dams and the Chat's Falls Dam on the Ottawa River would need to occur in such a way as to produce a significant back up of water downstream of the First Chute thereby reducing the height and distance that fish would be required to travel (Photo 9). The presence of cedars along the rock face of the Chute suggests that the water does not typically rise much higher than shown in Photo 10. Furthermore, a noticeable increase in

water elevation would likely result in effects to downstream landowners and would have been noted.

If the migration of lake sturgeon over the First Chute was possible there are several suitable spawning areas within this section of the river, including the area below Dam #2. Even if the sturgeon spawned as far away from First Chute as Dam #2, the majority of the larvae would not be expected to survive. The larvae are very vulnerable until they reach a total length of about 400 mm, at which time their scutes begin to develop (Auer and Baker 2002). At twenty days old, larvae are on average 22 mm (Benson et al. 2005, Auer and Baker 2002). With the high velocities experienced in the Bonnechere River during the larvae drift period, any larvae that were present in the main channel would be washed over First Chute within less than a day (based on flow modeling exercise results). The white water and turbid conditions of First Chute would be detrimental to their survival.

Furthermore, if lake sturgeon were moving up First Chute to spawn, one would expect some of the YOY to settle upstream of First Chute creating a population between Dam #2 and First Chute. Gill netting is a technique that is commonly used for sampling sturgeon (Cochner 2002, Cooke *et al.* 2002, Dewayne *et al.* 2002, Haxton 2002, Peterson *et al.* 2002, Rien and North 2002, Smith *et al.* 2002). The Bonnechere River was sampled between Renfrew Dam #2 and First Chute with gill nets during August 2007 (Table 10). A total of 17 nets were processed. No lake sturgeon were captured.

Table 10 Gill Netting Summary (between Renfrew Dam #1 and First Chute)

Species Name	Scientific Name	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
northern pike	<i>Esox lucius</i>	piscivore	cool	1	454
white sucker	<i>Catostomus commersoni</i>	insectivore / omnivore	cool	130	208-479
shorthead redhorse	<i>Moxostoma macrolepidotum</i>	insectivore	warm	49	170-705
minnow species				1	140
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	2	164-170
brown bullhead	<i>Ameiurus nebulosus</i>	insectivore	warm	3	251-275
rock bass	<i>Ambloplites rupestris</i>	insectivore / piscivore	cool	45	52-185
pumpkinseed	<i>Lepomis gibbosus</i>	insectivore	warm	3	88-103
smallmouth bass	<i>Micropterus dolomieu</i>	insectivore / piscivore	warm	88	136-346
walleye	<i>Stizostedion vitreum vitreum</i>	piscivore	cool	2	155-361
Total Catch				324	



Photo 9 Looking downstream from the top of First Chute, April 26, 2007.



Photo 10 Looking at the cedars along the rock face at First Chute, April 26, 2007.

American Eel

The American eel is listed as Endangered provincially; the species is not listed federally. The American eel breeds in the Sargasso Sea and matures in freshwater rivers in North America (including the Ottawa River) (Becker 1983, DFO 2008, OMNR 2007, Scott and Crossman 1998). The freshwater eel population within Ontario has been declining since the 1980s (OMNR 2007). The eels migrate to the Ottawa River during the spring and migrate downstream during the fall, spending 5 to 20 years in freshwater (Becker 1983, DFO 2008, OMNR 2007, Scott and Crossman 1998). This portion of the Bonnechere River does not provide suitable over-wintering sites as they prefer larger and calmer river tributaries as overwintering habitat (pers. comm. Kirby Punt).

American eels have been reported in the Ottawa River at Chat's Falls, and in the downstream reach of the Bonnechere River (Haxton and Chubbuck 2002). Anecdotal information places eels immediately downstream of the Renfrew Dams (pers. comm. Kirby Punt MNR). As such, there is a potential for the American eel to occur within the project area. A meeting was held on-site between federal and provincial regulators, the proponent, and members of the project team to discuss eel passage in the summer of 2009. An American eel monitoring program drafted by the MNR is presently underway and a memo discussing this issue is located in Appendix E.

Turtles

Blanding's Turtle

Blanding's turtle is currently listed as Threatened provincially and federally. The Blanding's turtle is associated with a variety of shallow slow aquatic habitats with submergent and emergent plants. This turtle requires basking sites near water such as exposed rocks or partially submerged logs. The nesting sites are found within areas of loose substrates varying from sand to cobblestone and may occur along roadways as far as 400 m away. Marsh habitat is important for the juveniles for protection from predators. The species overwinters within permanent water bodies (COSEWIC 2005).

The habitat for the Blanding's Turtle within the project area is marginal due to the presence of fast flowing water and varying water levels which would limit basking areas during high flows. There is one small isolated section within the project area that may provide suitable habitat. This area is located within the side channel between the existing tailrace of the Lower Plant and the location of the proposed TLGS tailrace. This is the only area within the project area that contained soft sediment and aquatic vegetation and is not always subjected to high flow conditions however no sightings were made during multiple field visits. It is considered unlikely that this species is found within the project area.

Spiny Softshell

The spiny softshell is listed as a Threatened species both provincially and federally. The spiny softshell is a turtle which spends much of its time in the water. This species prefers areas with soft substrate that allows it to bury (COSEWIC 2002). The nesting sites are found close to the water but above the summer high water mark and can be found on a variety of substrate types; other habitat requirements include deep pools and basking sites (COSEWIC 2002).

As with the other turtle species, the habitat for the spiny softshell is marginal at best within the project area due to the presence of fast flowing water and varying water levels which would limit basking areas during high flows. There is one small isolated section of the project area that may provide habitat. This area is located within the side channel between the existing tailrace of the Lower Plant and the location of the proposed TLGS tailrace. This is the only area within the project area that contained soft sediment and aquatic vegetation and while not subjected to the same high velocities as the main stem, still contained moderate to high flows. No sightings were made during the multiple field visits. It is considered unlikely that this species is found within the project area.

Birds

Peregrine Falcon

The Peregrine Falcon is listed as Threatened provincially. The Peregrine Falcon is a small bird of prey that is found in areas that have cliffs or high rises or other tall man-made structures which the species utilizes for nesting. This species was threatened by the presence of organochlorine pesticides and polybrominated diphenyl ethers which negatively impacted its nesting success (COSEWIC 2007).

No nests were observed during the spring nesting survey conducted in 2007. No Peregrine Falcons were observed during any of the field visits despite this being considered a very vocal and visible bird during courtship (Armstrong 2007). A search of the OBBA indicated that no Peregrine Falcons are recorded within the general project area. The Peregrine Falcon is not considered to be found within the project area.

Plants

Butternut

Butternut is listed as an Endangered species both provincially and federally signifying that it is at risk of becoming extinct or extirpated in Ontario and in Canada. Butternut is a shade intolerant species that is often found along edge habitats on rich, moist, well-drained loams or well-drained gravels (COESWIC 2003). The butternut is threatened by a canker for which there is no known control (COESWIC 2003).

A total of 15 Butternuts (including 3 potential hybrids) were observed during a survey conducted in August 31st, 2007, updated on July 10, 2009, and audited on August 28, 2009. A planting and monitoring plan to secure authorization to harvest butternut trees was submitted to, and approved by MNR. Further details are provided in Section 5.2.2 of this report.

4.2 Fish Habitat

In general, the project area consists of rocky substrate with fast flow. There are no tributaries located within the project area. The project area was divided into four sections: the area between Dams #1 and #2, downstream of Dam #2, Lower Plant tailrace and the side channel. The available habitat within the first two areas is affected by the operation of the Dams # 1 and #2. During periods of low flow the only water available downstream of the dams is that which flows as a result of leakage (residual flow). This flow is demonstrated in Photographs 5 and 8; this condition was observed during a July 10, 2009 site visit with DFO and MNR.

The habitat located between the two dams consisted of a steep boulder and bedrock area followed by a deep headwater pond. This area is isolated on both sides by the existing dams, though it is likely that some fish unwillingly enter the area by falling over Dam #1 and exit over Dam #2. For safety reason, the upper section was sampled once most of the flow was diverted through the Upper Plant. There was a significant change in the number of fish captured between 2007 and 2008. During the July 2007 catch, only 10 fish were captured and the dominant species was longnose dace (70%). During the July 2008 catch, 61 fish were captured and the dominant species was longnose dace (28%) and rosyface shiner (21%) (Appendix C). The rosyface shiners were observed to be in poor condition. The larger diversity and numbers of fish captured in 2008 may have been because the site was sampled on the same day that all but the residual flow was diverted into the Upper Plant whereas the 2007 sampling event occurred a few days after the diversion. During periods of residual flow, the upper section provides habitat for small benthic fish species within the deeper pool habitat where the fish are out of reach of foraging birds. The upper section provides good spawning habitat for longnose dace which is supported by their dominance. The steeper slope and high spring time flows within this section may limit potential spring spawners to the downstream edge. The headpond provides year round habitat and is thought to support spawning habitat for smallmouth bass.

The majority of the habitat located on the downstream side of the project area (downstream of Dam #2 and the Lower Plant tailrace) consists of fast flowing runs over rocky substrate. The habitat within the side channel (glide over fines and pebbles) was the exception. The side channel was also the only section with submergent vegetation.

Both dams pose permanent barriers to fish movement. Fish can freely move in and out on the downstream end of the project area up to the next barrier located at First Chute, 14 km downstream. As discussed in Section 4.1 First Chute likely restricts upstream fish movement with the exception of American eels as this species can move on land if needed.

Overall, the fish community downstream of Dam #2 and at the Lower Plant tailrace was dominated by longnose dace and smallmouth bass. It was noted that bluntnose minnow was relatively abundant below the Lower Plant tailrace in the rocky section.

The side channel was dominated by rock bass, pumpkinseed and bluntnose minnow however there were very few fish captured at any one time.

No seasonal changes in the community were observed.

In addition to the species captured within the immediate study area, those captured in the gill nets and during seine netting downstream are considered as potential users of this site. The gill net catch was dominated by white suckers (40%), smallmouth bass (27%), shorthead redhorses (15%) and rock bass (14%). It also included several other species that are of interest to fish managers including northern pike, brown bullhead, pumpkinseed and walleye however each of these species represented less than 1% of the total catch. There were twelve seine netting sites within the inventory area. A total of 222 fish were captured during seine netting representing eleven species: white sucker (15%), blackchin shiner (1%), common shiner (1%), sand/mimic shiner (35%), bluntnose minnow (11%), creek chub (<1%), brown bullhead (1%), banded killifish (<1%), brook stickleback (2%), rock bass (6%), pumpkinseed (3%), smallmouth bass (1%), johnny darter (19%) and logperch (3%).

Based on the type of habitat and the fish species captured during sampling, the areas downstream of Dam #2 and the Lower Plant tailrace are best suited as spawning habitat for white suckers, shorthead redhorses, longnose dace, bluntnose minnow, rock bass, pumpkinseed, smallmouth bass and Johnny darters. These areas also provides foraging, nursery and overwintering habitat.

As the preferred walleye spawning velocity suggested by the MNR Percid Synthesis Review (1997) is between 0.20-0.30 m/s, the project area does not provide optimal spawning habitat. The velocities of the Mainstem (the area downstream of Dam #2) are in the range of 0.72-1.62 m/s during April and 0.65-1.32 m/s during May. While the Lower Plant tailrace is slower, it is also higher than preferred during peak operation (at 14 cms the velocities are between 0.66 and 0.86 m/s). These velocities will not prevent walleye from spawning along the shorelines or in protected areas. In order for the spawn to be successful, the larvae must have suitable nursery habitat.

There is a lack of embayments and refuge areas for YOY walleye within the entire 14 km reach between Dam #2 and First Chute. The lack of embayments and areas of calm water between the spawning grounds and First Chute are important in this situation as walleye larvae are very weak swimmers and flow with the current during yolk absorption. Based on calculations, completed by OEL-Hydrosys, the larvae would reach First Chute within 1 day of hatching unless they could settle out in a refuge area before hand. The white water habitat of First Chute would be detrimental to the larvae survival. This may explain the low number of walleye (only 2 individual were captured, no YOY were captured) and the high number of suckers captured during sampling (seine netting, gill netting, backpack electrofishing). [Note that white suckers larvae remain in the substrate for a longer period prior to drifting, allowing them to become stronger swimmers upon hatching].

No brook trout were captured within the inventory study area (including the tributaries) and no groundwater upwelling was observed. Fall spawning brook trout are not anticipated to occur within the project area.

The following table combines the species list from the background review with those species captured during the field surveys on the Bonnechere River within the inventory study area. The table provides a summary of each species' trophic class, thermal regime, preferred habitat, reproductive guild, spawning period and spawning temperatures. The species listed in bold type were captured within the project area by Bowfin; species listed in regular type were captured in the inventory study area (Table 11). Individual results sites per visit in Appendix C.

Table 11 List of Fish Species Found within the Bonnechere River between Renfrew Dam #1 and First Chute and their Preferred Habitats

Species Name	Latin Name	Trophic Class*	Thermal Regime	General Habitat (Adult)	Reproductive Guild*	Spawning Period/ Habitat	Spawning Temp (°C)
nothern pike	<i>Esox lucius</i>	piscivore	Cool	Clear, slow moving water with dense aquatic vegetation. Preferred water temp 17-21°C.	A.1.5 Non-guarder. Open substrate spawner. Scatters eggs onto submerged live or dead aquatic plants or recently flooded live terrestrial plants. Occasionally on wood. Adapted to low oxygen concentrations.	Early spring	5-11°C
white sucker	<i>Catostomus commersoni</i>	insectivore/ omnivore	Cool	Slow moving water, pools.	A.1.3 Non-guarder. Open substrate spawner. Rock and gravel spawners with benthic larvae.	Spring (April-May)	10-20°C
shorthead redhorse	<i>Moxostoma macropelidotum</i>	insectivore	Warm	Clear water, sandy to gravel substrate. Preferred water temp 26-27.5°C.	A.1.3 Non-guarder. Open substrate spawner. Scatters eggs on rock and gravel substrate. Benthic larvae	Spring	10-18°C
emerald shiner	<i>Notropis atherinoides</i>	insectivore	Cool	Prefers pool and run habitat in rivers and lakes with sand or gravel substrates. Preferred water temperature is 9-23°C.	A.1.1 Non-guarder. Pelagic spawners. Buoyant eggs.	Summer	20-24°C
common shiner	<i>Luxilus cornutus</i>	insectivore	Cool	Stream dweller, prefers pools located below faster water. Bottom velocities of 0.1-0.5 m/s.	B.2.3 Nest builder with high parental care. Eggs deposited on cleaned rocks or in dug gravel pits.	Spring	16-26°C

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Species Name	Latin Name	Trophic Class*	Thermal Regime	General Habitat (Adult)	Reproductive Guild*	Spawning Period/Habitat	Spawning Temp (°C)
blackchin shiner	<i>Notropis heterodon</i>	insectivore	cool/warm	Clear water with aquatic vegetation and slow velocities.	Categorized as A.1.5 in MTO 2006, however little is known of its spawning behaviour. A.1.5 Non-guarder. Open substrate spawner. Scatter or deposit adhesive eggs onto submerged live or dead aquatic plants or recently flooded live terrestrial vegetation.	Spring - summer	
rosyface shiner	<i>Notropis rubellus</i>	insectivore	Warm	Intolerant of sediment. Prefers streams and rivers. Prefers sand and gravel and water temp of 26.8°C.	A.1.3 Non-guarder. Open substrate spawner. Scatters eggs on rock and gravel substrate. Benthic larvae	Spring - summer	20-27°C
mimic shiner	<i>Notropis volucellus</i>	insectivore	Warm	Prefers waters with little flow. Prefers sandy substrate.	Categorized as A.1.4 in MTO 2006 but little is known of spawning behaviour. Is assumed to broadcast its eggs over vegetation. Non-guarder. Open substrate spawner. Deposits eggs in clear water on submerged plants or debris.	Summer?	
bluntnose minnow	<i>Pimephales notatus</i>	omnivore	Warm	Variety of habitats. Prefers water temp of 29°C.	B.2.7 Nest spawner. High parental care. Deposits eggs underneath flat stones (occasionally uses logs).	Late spring - summer	19-26°C
fathead minnow	<i>Pimephales promelas</i>	omnivore	Warm	Variety of quiet habitats.	B.2.7 Nest spawner with high parental care. Eggs attached to underside of cavities.	Spring	14-29°C
blacknose dace	<i>Rhinichthys atratulus</i>	insectivore/generalist	cool/warm	Inhabits runs and pools with clear water. Typically in fast flowing water with gravel.	A.1.3 Non guarder, open substratum spawner. Spawns within gravelly bottoms.	Spring	15-22°C

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Species Name	Latin Name	Trophic Class*	Thermal Regime	General Habitat (Adult)	Reproductive Guild*	Spawning Period/ Habitat	Spawning Temp (°C)
longnose dace	<i>Rhinichthys cataractae</i>	insectivore	Cool	Fast flowing water with rocky substrate. Prefers depths <30 cm deep and surface velocities over 0.45 m/s. Prefers water temp of 13-21°C.	A.1.3 Non-guarder. Open substrate spawner. Scatters eggs on rock and gravel substrate. Benthic larvae	Spring - summer	11-23°C
creek chub	<i>Semotilus atromaculatus</i>	insectivore/ generalist	Cool	Variable habitats, typically found in small streams <12 m wide. Prefer velocities lower than 0.3 m/s but have been found in velocities up to 0.6 m/s.	A.2.3 non-guarder. Buries eggs in gravel nests. Cleans rock. Areas with fast flowing water or springs required.	Spring	12-17°C
brown bullhead	<i>Ameiurus nebulosus</i>	insectivore	Warm	Shallow, slow moving water with abundant aquatic vegetation.	B.2.7 Nest spawner. High parental care. Nests in natural or constructed holes and cavities such as the underneath of flat stones.	Late spring - summer	14-25°C
stonecat	<i>Noturus flavus</i>	insectivore	Warm	Riffle, run or rapids with large loose rocks as substrate.	B.2.7 Nest guarder. Adhesive eggs are deposited underneath or rocks.	Summer	25-29°C
banded killifish	<i>Fundulus diaphanus</i>	insectivore	Cool	Quiet shallows with sand or gravel substrate and aquatic vegetation.	A.1.5 Non guarder, open substratum spawner. Adhesive eggs that stick to live or dead vegetation.	Summer	21-25°C
rock bass	<i>Ambloplites rupestris</i>	insectivore/ piscivore	Cool	Rocky areas in lakes and streams. Prefers water temp of 25-29°C.	B.2.3 Nest guarder. Rock and gravel nester.	Late spring - early summer	16-23°C

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Species Name	Latin Name	Trophic Class*	Thermal Regime	General Habitat (Adult)	Reproductive Guild*	Spawning Period/ Habitat	Spawning Temp (°C)
pumpkinseed	<i>lepomis gibbosus</i>	insectivore	Warm	Prefers slow moving water with aquatic vegetation or small woody debris. Prefers water temp of 22-30°C.	B.2.2 Nest guarder. Shallow depressions created in areas with aquatic vegetation. May occur within a variety of substrates. Adhesive eggs.	Late spring - early summer	16-23°C
smallmouth bass	<i>Micropterus dolomieu</i>	insectivore/ piscivore	Warm	Clear water with rocky or sandy substrate. Prefers water temperatures of 20-26°C.	B.2.2 Nest builder with high parental care. Various substrates, prefers rocky. Adhesive eggs.	Late Spring	13-20°C
walleye	<i>Sander vitreus</i>	piscivore	Cool	Prefer shallow turbid lakes or deep rivers. Prefers water temperatures of 19-23°C.	A.1.2. Non-guarders. Open substrate spawners. Rock and gravel spawners with pelagic larvae.	Early spring	5-11°C
johnny darter	<i>Etheostoma nigrum</i>	insectivore	Cool	Variety of habitats but prefers areas with moderate to no current over sandy or mixed substrate. Prefers water temperatures of 22.8°C.	B.2.7 Nest builder with high parental care. Deposits eggs underneath rock or ledge.	Spring	12-21°C
logperch	<i>Percine caprodes</i>	insectivore	cool/warm	Rocky or sandy habitats in lakes or streams.	A.1.6 Non-guarders. Spawn over sand. Eggs are adhesive.	Spring	10-18°C
mottled sculpin	<i>Cottus bairdi</i>	insectivore	Cold	Cool streams and lakes often associated with sandy substrate in streams.	B.2.7 Nest builder with high parental care. Deposits eggs underneath rock or ledge.	Spring	5-16°C

(Balon 1981, Coker *et al.* 2001, Cooke and Bunt 1999, Edwards *et al.* 1983, Edwards and Schreck 1983, Krieger *et al.* 1983, McMahon 1982, Scott and Crossman 1973, Twomey *et al.* 1984, Trial *et al.* 1983, Trial *et al.* 1984)

4.3 Areas of Scientific or Natural Interest

A review of the available background information indicated that there are no Ontario Living Legacy Sites, provincially significant wetlands, Areas of Natural Scientific Interest, significant vegetation communities, or provincial parks within or adjacent to the project area. The nearest wetland, a non-provincially significant wetland, is located approximately 700 m downstream of the proposed TLGS. MNR Pembroke did not identify any natural areas within the project area.

4.4 Significant Wildlife/Habitats of Species of Conservation Concern

Communications from MNR Pembroke requested that species of conservation concern listed for the entire County of Renfrew be considered as occurring within the project area. Species of conservation concern include those species listed as S1, S2 or S3 and/or as SC, provincially or federally and are not already protected by provincial legislation. The resulting list contained 55 species (Table 12). A search was made for the plant species of conservation concern to confirm their presence/absence within the project area.

In the following table, those species that may be present based on habitat are listed in regular type. All others are listed in gray type due to a lack of habitat within the zone of impact (direct or indirect), lack of sightings for over thirty years or in the case of the plant species, the absence of presence. This analysis left the potential for the following eight species: harpoon clubtail (dragonfly), monarch (butterfly), greater redhorse and river redhorse (fish), milksnake, bald eagle, northern long-eared bat and eastern small-footed bat.

No species of conservation concern was documented as occurring within the project area during any of the site visits or within the available background information.

Table 12 List of Potentially Occurring Species of Conservation Concern within the Project Area

Common Name	Scientific Name	SRANK	Provincial Status	Federal Status	Preferred Habitat	Last Observed	Reference
INSECTS							
Harlequin Darner	<i>Gomphaeschna furcillata</i>	S3			Bogs, and alder or cedar swamps.		Dunkle 2000
Mottled Darner	<i>Aeshna clepsydra</i>	S3			Found within small lakes or in bays of large rivers that have marsh or bog habitat along the shoreline. Often associated with water lilies and clear soft water.	10/09/2000	Dunkle 2000
Beaverpond Clubtail	<i>Gomphus borealis</i>	S2			Slow moving streams and lakes with pools with fine substrate.	06/07/2000	Dunkle 2000
Harpoon Clubtail	<i>Gomphus descriptus</i>	S3			Clear, fast flowing, rocky streams and rivers with pools	21/06/1999	Dunkle 2000

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Common Name	Scientific Name	SRANK	Provincial Status	Federal Status	Preferred Habitat	Last Observed	Reference
					with fines.		
Cobra Clubtail	<i>Gomphus vastus</i>	S1			Medium to fast flowing rivers also can sometimes be found in large lakes and rivers.	1941	Dunkle 2000
Arrow Clubtail	<i>Stylurus spiniceps</i>	S2			Typically found in large rivers with sandy substrate. Substrate may also consist of silt or gravel.	30/06/1935	Dunkle 2000
Elusive Clubtail	<i>Stylurus notatus</i>	S2			Occur along streams or shores of large lakes	12/10/1954	Dunkle 2000
Horned Clubtail	<i>Arigomphus cornutus</i>	S3			Ponds or watercourses with no noticeable flow. Frequently with marsh or bog habitat along the shoreline.	10/07/2002	Dunkle 2000
Lilypad Clubtail	<i>Arigomphus furcifer</i>	S3			Marshy lakes.		Dunkle 2000
Extra-striped Snaketail	<i>Ophiogomphus anomalus</i>	S3			Clear. Fast flowing medium to large rivers.	18/06/2001	Dunkle 2000
Riffle Snaketail	<i>Ophiogomphus carolus</i>	S2S3			Cold water stream with rocks and riffles	21/06/1999	Dunkle 2000
Arrowhead Spiketail	<i>Cordulegaster obliqua</i>	S2			Spring-fed, headwaters with substrate consisting of muck.	17/06/1999	Dunkle 2000
Canada Whiteface	<i>Leucorrhinia patricia</i>	S2S3			Bogs, fens and lakes.	03/06/1972	Dunkle 2000
Amber-winged Spreadwing	<i>Lestes eurinus</i>	S3			Ponds, bogs and lakes.		Lam 2004
Monarch	<i>Danaus plexippus</i>	S4B, S2N	SC	SC	Old fields, meadows, roadsides confined to places where milkweed sp. grow.		COSEWIC 2010
Sleepy Duskywing	<i>Erynnis brizo</i>	S1			Oak woods.	16/06/1996	Layberry et al. 1998
FISH							
Greater Redhorse	<i>Moxostoma valenciennesi</i>	S3			Little is known. Spawns in fast flowing waters. After spawn can be found in shallow slow moving areas.		Scott & Crossman 1998
River Redhorse	<i>Moxostoma carinatum</i>	S2	SC	SC	Little is known.	28/08/1992	COSEWIC 2006
REPTILES							
Northern Map Turtle	<i>Graptemys geographica</i>	S3	SC	SC	Large waterbodies with slow velocities, soft substrate and dense aquatic vegetation	24/07/1996	COSEWIC 2002
Eastern Ribbonsnake	<i>Thamnophis sauritus</i>	S3	SC	SC	Prefers meadows or forest edge, often around permanent slow moving, waterbodies	02/09/1993	COSEWIC 2002
Milksnake	<i>Lampropeltis triangulum</i>	S3	SC	SC	Found within open forest, forest edges, meadows, and cultivated areas.	19/08/1992	Fischer 2002

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Common Name	Scientific Name	SRANK	Provincial Status	Federal Status	Preferred Habitat	Last Observed	Reference
BIRDS							
Bald Eagle	<i>Haliaeetus leucocephalus</i>	S2N, S4B	SC		Associated with large lakes and rivers. Frequently observed on dead branches overlooking water.	2008	Peterson 1980
Black Tern	<i>Chlidonias niger</i>	S3B	SC		Breed in freshwater marshes	12/06/1990	Peterson 1980
Short-eared Owl	<i>Asio flammeus</i>	S2N, S4B	SC	SC	Open areas.		COSEWIC 2008
Prairie Warbler	<i>Dendroica discolor</i>	S3B			Brush habitat such as areas that have been slashed, pastures and low pines.	22/06/1989	Peterson 1980
MAMMALS							
Northern Long-eared Bat	<i>Myotis septentrionalis</i>	S3			Found in treed or shrubby habitats near water.	20/11/1988	Eder 2002
Eastern Small-footed Bat	<i>Myotis leibii</i>	S2S3			Found within deciduous or coniferous forests in hilly areas.	13/08/1991	Eder 2002
Eastern Pipistrelle	<i>Pipistrellus subflavus</i>	S3?			Prefers shrub habitat or open woodland near water.	18/01/1976	Eder 2002
PLANTS							
A Liverwort	<i>Frullania selwyniana</i>	S1S2			Bark of <i>Thuja occidentalis</i> .	20/08/1989	Conard 1979
A Lichen	<i>Diplotomma epipolium</i>	S1S2			Calcareous rocks.	21/09/1973	Hale 1979
A Lichen	<i>Lecidea plebeja</i>	S1S2			Old hardened wood of conifer stumps.	20/08/1986	Hale 1979
A Lichen	<i>Sarcosagium campestre</i>	S1S2			Nutrient-poor soil and dry and warm habitats on rocks	20/08/1986	Hale 1979
Knothole Moss	<i>Anacamptodon splachnoides</i>	S2			On knotholes or rotting wood. Prefers beech but can also be found on oak.		Conard 1979
A Moss	<i>Brachythecium calcareum</i>	S2			Thin soil or humus over calcareous rocks.	13/04/1969	Conard 1979
Spatulate Moonwort	<i>Botrychium spathulatum</i>	S1			Sand dunes, old fields, and grassy railroads.	21/06/2010	Voss 1985
Purple-stemmed Cliffbrake	<i>Pellaea atropurpurea</i>	S3			Found along limestone-rich cliffs and outcroppings.	22/06/2010	Voss 1985
Prickly Hornwort	<i>Ceratophyllum echinatum</i>	S3?			Freshwater lakes, ponds, marshes, swamps. Prefers cool, clear, and oligotrophic water. Can also be found in more ephemeral sites, such as shrub swamps and beaver ponds.	20/09/2000	Voss 1985
Bluets	<i>Hedyotis caerulea</i>	SH			Meadows.	18/06/1969	Voss 1985
Woolly Beach-heath	<i>Hudsonia tomentosa</i>	S3			Sandy habitat such as sand dunes, sandy pine wood and	21/06/2010	Voss 1985

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Common Name	Scientific Name	SRANK	Provincial Status	Federal Status	Preferred Habitat	Last Observed	Reference
					clearings.		
American Waterwort	<i>Elatine americana</i>	S3			Muddy shores of pond, tidal rivers, and tributaries.	11/08/1984	Voss 1985
Spurge	<i>Euphorbia commutata</i>	S1			Associated with shady slopes along watercourses, in moist woods, and on calcareous rocks and outcrops.	22/06/2010	Voss 1985
Cooper's Milkvetch	<i>Astragalus neglectus</i>	S3			In semi-shaded to open habitats along lakeshores, stream banks, or ravines. Rarely on limestone cliff ledges, limestone barrens, or on steep, eroding shale slopes.	01/08/1990	Voss 1985
Giant Pinedrops	<i>Pterospora andromedea</i>	S2			Associated with dry woods containing conifers and a well-developed needle duff.	21/06/2010	Voss 1985
Horn-leaved Riverweed	<i>Podostemum ceratophyllum</i>	S2			On rock in fast flowing stream.	18/07/1982	Voss 1985
Field Sedge	<i>Carex conoidea</i>	S3			From moist to open situations including fens, wet prairies, meadows, borders, usually in calcareous or neutral substrates	16/06/1964	Voss 1985
Northern Long Sedge	<i>Carex folliculata</i>	S3			Along shorelines, wetlands.	28/07/1975	Voss 1985
Schweinitz's Flatsedge	<i>Cyperus schweinitzii</i>	S3			Prefers sandy and loamy soils with moist or wet soils. Shade intolerant.		Voss 1985
Houghton's Umbrella-Sedge	<i>Cyperus houghtonii</i>	S3			Sandy usually disturbed sites (i.e. dunes, shores, trails and roads in jack pine, oak, or aspen woodland.	31/08/1970	Voss 1985
Clinton's bulrush	<i>Scirpus clintonii</i>	S2			Open, dry to mesic prairies, meadows, riverbanks, rocky outcrops, and on lime-rich substrates.	10/06/1976	Voss 1985
Woodland Bulrush	<i>Scirpus expansus</i>	S1			Swamps, bogs and streamside.	2000	Voss 1985
Thread-like Naiad	<i>Najas gracillima</i>	S2			Submerged plant associated with sandy or gravel substrates, usually inhabiting soft-water lakes and pools. Intolerant to pollution	25/08/1984	Voss 1985
Ram's-head Lady's Slipper	<i>Cypripedium arietinum</i>	S3			Dunes, along shores, or inland under Jake pine and oak and also in coniferous swamps.	04/07/2001	Voss 1985

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Common Name	Scientific Name	SRANK	Provincial Status	Federal Status	Preferred Habitat	Last Observed	Reference
Auricled Twayblade	<i>Listera auriculata</i>	S3			Sandy and acidic habitats (i.e. sandy banks, outwash along streams and swamps adjacent to large lakes). Also reported in much, sphagnum bogs, and calcareous soils. Associated with speckled alder thickets. Shade tolerant.	07/07/1968	Voss 1985
Pale Green Orchid	<i>Platanthera flava</i> var. <i>herbiola</i>	S3			Shoreline of lakes, rivers, and ponds, and in moist meadows, or prairies.	20/09/2000	Voss 1985
Northern Dropseed	<i>Sporobolus heterolepis</i>	S3			On sandy, loamy soils in open areas with dry to moderate moisture. Typically in prairies.	03/07/1993	Voss 1985

Ranking and status was updated: February 22, 2012

SRANK DEFINITIONS

SH Possibly Extirpated (Historical), Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.

S1 Critically Imperiled, Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.

S2 Imperiled, Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.

S3 Vulnerable, Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4 Apparently Secure, Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S#S# Range Rank, A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

SAB Breeding accidental.

SAN Non-breeding accidental.

SZB Breeding migrants/vagrants.

SZN Non-breeding migrants/vagrants.

SARO STATUS DEFINITIONS

SC Special Concern: A species with characteristics that make it sensitive to human activities or natural events.

SARA STATUS DEFINITIONS

SC Special Concern: a wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

5.0 POTENTIAL IMPACTS AND MITIGATIONS

The proposed project has the potential to impact the terrestrial and aquatic habitats during the construction, operation and decommissioning phases. The significance of the potential impacts is measured using three different criteria: area affected, duration of impacts and magnitude. The area affected may be local in extent signifying that the impacts will be localized within the project area or regional signifying that the impacts may extend beyond the immediate project area. The duration of the impact was rated as short term (construction phase, 1-1.5 years), medium term (2-4 years) or long term (>4 years). The magnitude of the impact may be negligible signifying that the impact is not noticeable, minor signifying that the project's impacts are perceivable and require mitigation, moderate signifying that the project's impacts are perceivable and require mitigation as well as monitoring and/or compensation, and major signifying that the project's impacts would destroy the environmental component within the project area.

The potential impacts associated with the construction and operation of the proposed projects is discussed in the following four sub-sections. The first sub-section provides a summary of the zone of impact, for all project activities (the construction of the TLGS and the rehabilitation of Dam #1 and Upper Plant intake canal wall). The second deals exclusively with the construction phase beginning with outlines of the construction activities and potential impacts followed by a discussion of the potential impacts, mitigation measures and residual level of impact. The third analyses is provided for the operation phase of TLGS beginning with descriptions of the existing and proposed operating regimes. These descriptions discuss where and when flow is currently diverted and what changes are anticipated under the proposed operating regime. This is followed by the outline of the potential operational impacts followed by a discussion of the potential impacts, mitigation measures and residual level of impact. The fourth and final sub-section discusses the potential cumulative effects of the proposed undertaking.

5.1 Zone of Potential Impacts

The following provides a summary of the potential zone of impacts. Further information on the activities and impacts is presented in Section 5.2. Additional detail on the construction methodology and operation are presented in *Preliminary Planning Summary Report* prepared by OEL-Hydrosys.

5.1.1 Thomas Low

The TLGS project has the potential to impact both the terrestrial (construction phase) and aquatic environments (construction and operation phases). The construction would involve: the building of a new intake within the existing Upper Plant canal, the construction of a new water conveyance structure, a new powerhouse, transformer, improvements to the existing access road, and excavation of the new tailrace. The excavation of the new tailrace would include excavation on land (terrestrial) and in-water. The amount of in-water excavation has not been finalized and as such a worst case scenario will be used for this assessment.

Note the minimum and maximum operational capacities for TLGS are approximately 2.5 and 23 cms, respectively. These numbers are subject to change based on final engineering design.

5.1.2 Rehabilitation of Dam #1 and Upper Plant Intake Canal Wall

The works associated with the dam rehabilitation and repairs to the Upper Plant canal include the removal of existing concrete and pouring of new cement, and construction of gabion baskets. There will be no alterations of terrestrial habitat associated with this phase only the aquatic environment has the potential to be impacted. The canal wall will not be increased in height, only repaired where it is failing.

5.1.3 Rehabilitation of Dam #2

Dam #2 requires rehabilitation of the sill for erosion protection. This work will consist of concrete repairs along the existing structure and will not result in any changes to the footprint of the dam.

5.2 Construction Phase Outline of Activities

The construction phase of the project would consist of: the construction of TLGS and the rehabilitation of Dam #1 and the Upper Plant intake canal. A summary of the construction methods and area of impact are summarized in the following paragraphs.

5.2.1 Construction of TLGS

The construction of TLGS could consist of the following (note that the construction sequence is subject to changes proposed by the selected contractor):

1. New intake within the existing intake canal (in-water work – non-fish habitat);
 - Installation of watertight steel crib in order to de-water the area in front of the intake;
 - Excavation within the isolated work area;
 - Installation of a silt fence at the toe of the downstream face of the existing wall;
 - Repairs to the downstream face of the existing canal wall;
 - Construction of new gabion wall within the existing canal;
 - Retaining wall repairs (upstream side);
 - Construction of intake structure; and
 - Installation of intake gate.
2. New powerhouse (approximately 120 m², area of disturbance for construction of powerhouse and terrestrial portion of tailrace is approximately 0.88 ha- all located in upland habitat)
 - Clearing of terrestrial vegetation;
 - Excavation within terrestrial habitat;
 - Construction of powerhouse;
 - Installation of 2 Kaplan turbines; and
 - Backfilling within terrestrial habitat.
3. New tailrace [upland (approximately 670 m²) and in-water work (up to 0.35 ha within existing Lower Plant tailrace)]
 - Clearing of terrestrial vegetation;

- Installation of temporary cofferdam (sand bags or earth fill);
 - De-fishing of areas behind cofferdams by a qualified biologist;
 - Excavation within shoreline and aquatic habitats (within isolated work area);
 - Installation of erosion control measures (rip rap) as required; and
 - Removal of temporary cofferdam.
4. Repairs to the outer wall of the existing canal (in-water – non-fish habitat)
5. New retaining walls on both sides of intake at the canal (in-water non-fish habitat)
- Dewatering canal using maintenance gate in canal entrance to isolate work area; and
 - Construction of concrete walls (in the dry).
6. Improvements to the existing access road
- Minor grading and leveling of existing dirt road and topping with gravel in order to support construction vehicles.
7. New buried water conveyance structure (length of structure is approximately 425 m and the area of disturbance would be approximately 0.65 ha, all impacts are located in upland habitat)
- Clearing of terrestrial vegetation;
 - Excavation within terrestrial habitat; and
 - Backfilling within terrestrial habitat.
8. New transformer [area of disturbance approximately 185m² - to be located within the upland habitat (meadow)]
- Clearing of terrestrial vegetation;
 - Excavation within terrestrial habitat;
 - Backfilling within terrestrial habitat.
- Installation of hydro poles (2-3)

5.2.2 Rehabilitation of Dam #1

1. Repairs to Dam #1
- Underwater installation of maintenance grooves upstream of old piers
 - Installation of cofferdam gate (one sluiceway at a time)
 - Concrete repair works (one sluiceway at a time)

The construction of the new intake and the repairs to the canal would be completed in the dry and would take up to 5 months to complete. It is noted that the canal walls will not be increased in height and will keep their same shape. This section of the riverbed is usually dry allowing construction to occur without the use of cofferdams. The canal would be dewatered by placing maintenance logs within the existing grooves at the canal intake. Note that it is the proponent's intention to only de-water the canal once. As such the intake and the outside of the canal would be completed at the same time.

During Item 2 the canal would be in operation and as much water as possible would be diverted around Dam #1 through the canal. Depending on the amount of flow in the river, the work on the dam would be completed in one or two bays at a time. A metal sheet would be used to isolate the sluiceways; cribs would be used to isolate the wing walls. There would be a minor increase in the footprint within the River along the north side of the canal wall. This increase would only occur where needed to stabilize the canal structure and the width would be minimized. The increase size of the footprint would be no more than 27 m² (based 90 m long by a maximum width increase of 0.30 m).

5.2.3 Rehabilitation of Dam #2

1. Repair of face of sill
 - o Pouring of concrete (work to be completed in the dry during the low flow period)

5.3 Potential Impacts during Construction Phase Outline

This section examines the potential impacts during construction for the proposed TLGS and the rehabilitation of Dams #1 and #2 and the intake canal. Construction related impacts to the environment may occur as a result of the following activities: de-watering, clearing, excavation, concrete removal, cement pouring, contouring and backfilling.

The potential impacts associated with these activities are:

1. Decrease in surface water quality
 - a. Re-suspension of sediments during clearing, hoe-ramming and/or excavation;
 - b. Introduction of concrete particles during removal of old concrete; and
 - c. Introduction of cement during pouring.
2. Terrestrial Habitat and Species
 - a. Disruption to wildlife and bird populations as a result of the increase in noise and light pollution during construction;
 - b. Impacts to terrestrial SAR (Endangered or Threatened, provincially and/or migratory birds listed federally); and
 - c. Impacts to terrestrial species of conservation concern (SC, S1-S3).
3. Aquatic Habitat and Species
 - a. Alteration, disruption and/or destruction to fish habitat through excavation for the new tailrace;
 - b. Impacts to aquatic SAR (Provincially and/or Federally Listed as Endangered, Threatened); and
 - c. Impacts to aquatic species of conservation concern (SC, S1-S3).
4. Increased noise pollution
 - a. Increased noise pollution as a result of construction operations

5. Accidents or malfunctions
 - a. Spills from project machines during construction activities; and
 - b. Spread of invasive species.

Several of these potential impacts may be reduced or eliminated through the use of mitigation measures. These mitigation measures are described below and are summarized in Table 13.

5.3.1 Surface Water Quality

Summary and Potential Impact Analysis

Water quality may be impacted during the construction of TLGS as the result of clearing, backfilling, contouring, and excavation. Additionally, the rehabilitation works at Dams #1 and 2 and the intake canal may result in water quality impacts from the removal of existing concrete and the pouring of new cement. As noted in the dam rehabilitation outline, some of the in-water work would occur underwater. The remaining activities would occur within isolated areas. Isolation of the work area would be completed using steel sheets (sluiceways), crib walls (wing walls) or cofferdams (TLGS tailrace). Prior to mitigation, the impacts associated with a decrease in surface water quality would be local, short term in duration and minor in magnitude.

Mitigation Measures

- The orientation of the tailrace for Thomas Low has been chosen so as to prevent the need to excavate within the side channel (where fines are present);
- Should machinery need to work within the creek bed, this work will occur in the dry;
- During the construction activities mitigation measures would be installed to prevent the movement of suspended sediments and concrete outside of the work area.
 - Turbidity curtains within the water and sediment fencing along the shoreline should be used to contain any particles which may enter the water.
 - During concrete removal above the water line, tarps should be used to contain dust particles. It is noted that given the humid nature of concrete on dams, it is expected that little dust would be created (pers. comm. Sébastien Vittecoq).
 - Turbidity curtains would be utilized behind the cofferdams during the construction of the new tailrace as well as immediately downstream of any removal of concrete or pouring of cement as a contingency measure.
 - Work on Dam #2 will be completed in the dry and should be completed during the low flow period when most of the water can be diverted through the waterpower stations.
 - The sediment control measures would be put in place prior to any removal of shoreline vegetation or any in-water works.
 - A sediment control plan would be submitted for regulatory approval prior to permitting. Included within the plan would be the methods and measures which would be put in place during the removal of the old concrete and pouring of new cement for the rehabilitation work.
- Isolated work areas would be dewatered using appropriate pumps; the water would be discharged over an appropriately sized vegetated area or to a sediment containment

feature. A variety of methods are available to ensure that the water removed during dewatering does not create erosion or introduce suspended sediments upon its re-entry into the natural system. These include sediment bags at the end of the pump, rock check dams, straw bale settling ponds or allowing the water to pass through a fully vegetated area.

- The contractor would be responsible to ensure that the water re-entering the system is clean and does not cause erosion or the re-suspension of sediments. An appropriate sediment monitoring program is recommended.
- Any removal of riparian vegetation should be minimized and removal should be completed using small machinery.
- Bank erosion may be reduced by leaving a minimum of 60 cm stump in place from trees removed along the shoreline, whenever possible.
- Any stock piles of soil or fill material would be stored at least 30 m from the river and protected by silt fencing.
- Additional materials (*i.e.* rip rap, filter cloth and silt fencing) should be readily available in case they are needed promptly for erosion and/or sediment control.
- The sediment fencing would not be removed until the terrestrial vegetation has become re-established.
- The removal of the cofferdams would be completed prior to the removal of the silt curtain. The silt curtain would then be removed carefully.
- Both sediment fencing and the silt curtains would require maintenance.
- Monitoring of sedimentation outside of the sediment fencing and silt curtains should occur throughout the day.

Net Impact Analysis

Following the proper implementation of the mitigation measures, it is anticipated that the impacts to the surface water quality would be local, short term in duration and negligible in magnitude.

5.3.2 Terrestrial Habitat and Species (including SAR and Species of Conservation Concern)

Summary and Potential Impact Analysis

Terrestrial Habitat

No loss of vegetation (aquatic or terrestrial) is anticipated for the rehabilitation of Dams #1, #2 or the rehabilitation of the Upper Plant canal. Loss of terrestrial vegetation would occur during construction of the following Thomas Low components: intake canal, water conveyance structure, new powerhouse and tailrace. The habitat within the project area is primarily parkland and existing disturbed areas such as the existing dirt access road to the Lower Plant. The surrounding land uses are residential and existing infrastructure including transmission lines, two waterpower facilities, and the new wastewater treatment facility downstream of the project site.

Prior to mitigation, the impacts associated with the terrestrial vegetation would be local, long-term to permanent and minor.

The water conveyance structure will be buried and the area revegetated. Grass species and/or native meadow species will be planted otop of this structure. The following table provides information on the approximate area of the habitat within the study site and area to be cleared during construction.

Table 13 Summary of Estimated Area to be Cleared

Community Type	Total Area within Thomas Low Project Area (ha)	Area to be Cleared during Construction (ha)
Mixed forest	1.7	0.41
Mowed	0.3	0.16
Meadow	0.6	0.05
Parkland	2.1	0.91
Total		1.53

Terrestrial Flora

With the exception of the removal of retainable butternuts, no SAR or species of conservation concern were found within the habitat to be impacted during construction. Prior to mitigation, the impact of the removal of the woody vegetation would be local, long-term to permanent, and moderate in magnitude.

Terrestrial Fauna

The majority of the construction activities would occur within an area that is already disturbed. Most impacts associated with the wildlife species are related to the change in habitat or through increased noise and light pollution during construction. No SAR or species of conservation concern were observed within the project area and sensitive habitats such as hibernacula, wetlands, colonial nesting sites or overwintering areas will not be impacted. Prior to mitigation, the potential impacts associated with wildlife would be local, short term to permanent, and minor in magnitude.

Mitigation Measures

The following mitigation measures as well as those listed for surface water quality, should be adhered to in order to minimize impacts to terrestrial habitat, flora and wildlife:

- The areas where the vegetation would be removed should be minimized and clearly delineated (i.e. snow fencing).
- Butternuts not intended for removal and that are within 50 m of the construction area shall be protected by placing snow fencing outside of their drip lines.
- Small equipment should be utilized in order to prevent harming woody vegetation not intended for removal.
- If possible the stumps (60 cm of trunk) should be left in place to maintain erosion control from any tree proposed to be removed from the banks and the top of the cliff.

- Where possible, re-vegetate with native vegetation following the completion of the construction phase.
- Removal of woody vegetation would not occur during the breeding bird season from April 15th to July 31st inclusive, unless a qualified biologist has searched the site for nests and concluded that no nests are present, no more than 5 days prior to clearing.
- When possible work should be completed during daylight.
- Vehicles and equipment should have the appropriate mufflers installed.
- Do not remove any vegetation along or within 30 m of the shoreline until appropriate erosion control measures have been erected
- Follow erosion control mitigation measures outlined above.

Compensation Measure for SAR

Butternuts can be exempt from the ESA under O. Reg 242/08. The regulation stipulates the following:

“Clause 9(1) (a) of the Act does not apply to a person who kills a butternut tree that occurred naturally if, in the opinion of a person or member of a class of persons designated by the Minister, the butternut tree is affected by butternut canker to such a degree that it is not necessary to retain the tree at its current location to support the protection or recovery of butternut”.

The butternut trees were assessed by a Butternut Health Assessor and the assessment was confirmed during an audit by MNR. Under section 5 (5) of the ESA, the Act does not apply if no more than 10 retainable butternut trees will be killed, harmed, or taken. This exception is conditional to Ministry approval of a planting and monitoring plan. The proponent has received approval by MNR. A summary of the plans requirements is listed below: Total of 25 butternut seedlings are to be planted;

- Seedlings should be no closer than 25 m from the water conveyance structure or any area that may need to be disturbed for maintenance (*i.e.* clearing, filling, digging);
- Seedlings should be spaced no closer than 3 m apart;
- Seedlings would be planted within the designated areas on RPG land;
- Seedlings would be monitored for survival over a period of 5 years, additional seedling would be planted should more than 50% of the seedlings die within this time period; and
- Seedlings would be protected from animals, and vegetation competition.

Net Impact

Following the proper implementation of the mitigation measures, compensation for the loss of butternuts and the application best practises during construction, the impacts to terrestrial habitat and species are considered to be local, short to permanent and negligible.

5.3.3 Aquatic Habitat and Species

Summary and Potential Impact Analysis

Thomas Low has the potential to impact the aquatic environment during the construction of the tailrace. Little to no loss of aquatic vegetation is anticipated as part of the construction of Thomas Low. The rehabilitation projects have the potential to impact the aquatic environment during the removal of concrete and the pouring of new cement.

Tailrace Construction

The tailrace construction involves the creation of approximately 670 m² new aquatic habitat and excavation within the existing Lower Plant tailrace. The new habitat would provide a similar value as the existing tailrace area at the Lower Plant (Dam #2) (fast flowing run over rocky substrate). The value of the new habitat would vary depending on the flows and corresponding velocities.

As mentioned previously, the amount of excavation in the existing tailrace has yet to be determined and as such a worst case scenario is presented here. The purpose of the excavation is to increase the water depth and thereby decrease the water velocity and potential to cause erosion within both the study area and further downstream. The reduction of the potential to cause erosion is considered to be a benefit to the fish habitat. This excavation will also result in the removal of the existing rock weir located within this same tailrace. The removal of the weir will also be beneficial in that it will reduce the potential of fish stranding during operations (this will be discussed further in Section 5.3.2).

The excavation will occur in the dry during the appropriate in water period. Prior to excavation the area consists of a fast flowing run over rocky habitat. No excavation of the fines within the side channel will occur. The maximum area of excavation would be up to 0.35 ha. The resulting change in habitat will be a deepening; the substrate will remain the same (if necessary, some of the substrate will be returned to ensure that the area continues to provide rocky run habitat). As an enhancement measure, larger boulders would be strategically placed to provide resting areas for fish.

As discussed under the surface water section, the design of the tailrace has taken into the account of the potential to cause erosion. The potential to cause erosion or flush fines will be mitigated through proper orientation of the new tailrace, deepening of the existing tailrace and, where required, the addition of rip rap to protect the banks.

During the in-water works, a cofferdam would be used to isolate the work area causing a temporary loss of fish habitat during the in-water timing window (July 1st to September 30th).

Dam Rehabilitations

Much of the work would focus along the edge of the existing Upper Plant intake canal and the dams. These areas provide little to no direct habitat during periods of low flow. The entire dam rehabilitation phase would require 3 to 8 months of construction and the work would be phased. Depending on the end footprint of the work along the canal wall, there could be a loss of up to a maximum of 27 m² along the canal wall for its reinforcement (Photo 11). No change would occur to the wall height or design. The repairs to the sill of Dam #2 would not result in any changes to the in-water footprint.



Photo 11 Looking east at the canal wall, July 11, 2007

Fish Community and Aquatic Species at Risk

The project and inventory study areas provide habitat for a variety of common warm and cool water fish species including shorthead redhorse, white sucker, rock bass, pumpkinseed, and smallmouth bass. No SAR or species of conservation concern were captured. It is considered unlikely that any of the SAR or species of conservation concern occur within the project area with the possible exception of the American eel. Regardless, the construction activities associated with the proposed project will result in little change to the aquatic environment provided that the mitigation measures are properly implemented and the work will occur within the in-water timing window (July 1 to September 30th). Note that the proponent is currently working with MNR on a solution for the passage of American eel and a memo regarding the potential to impact eels and suggestions for passage options is located in Appendix E. No measurable impacts to aquatic fauna, including any potential SAR or species of conservation concern, are anticipated with the construction phase. Prior to mitigation, the impacts would be local and permanent.

Mitigation Measures

Mitigation measures described under the surface water and vegetation sections of this report also apply in the protection of the aquatic habitat. In addition to those items, the following mitigation measures are recommended:

- The construction activities would occur during the MNR in-water timing window (July 1st to September 30th, inclusive).
- Locations of sensitive areas (areas with fine sediments in Side Channel and downstream of the small island) should be clearly identified on final construction drawings.
- Pumping of isolated work areas should be completed using pumps that are no larger than 3 inches in diameter. If larger pumps are required, then the pump should be placed in a box with 13 mm mesh screening, in addition to the installation of fish screen on the pump itself, to prevent impingement.
- A qualified fish biologist would be on-site during the de-watering process in order to remove any stranded fish.
- Should water from the river overtop isolated areas, these would be dewatered following the above procedures.
- No blasting in water is anticipated. Should this change, the *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters* (Wright and Hopky 1998) should be followed.

Net Impact

The overall impacts would be local, permanent term and would include a net gain / enhancement. The gain would be in the new habitat created within the tailrace and the enhancement would consist of the placement of boulders within the Lower Plant tailrace. Note that the new habitat will serve as refuge and foraging areas.

5.3.4 Noise

The potential impacts associated with noise pollution would be local, short term and negligible. All project vehicles should ensure that they have appropriate mufflers installed. Local noise by-laws would be followed.

5.3.5 Accidents and malfunctions

Although the likelihood of accidents and malfunctions occurring would be minimized by following the mitigation measures outlined below, should accidents and/or malfunctions occur they have the possibility of presenting serious impacts and require consideration.

All equipment working in or near the water should be well maintained, clean and free of leaks. Maintenance on construction equipment such as refueling, oil changes or lubrication would only

be permitted in designated area located at a minimum of 30 m from the shoreline in an area where sediment erosion control measures and all precautions have been made to prevent oil, grease, antifreeze or other materials from inadvertently entering the ground or the surface water flow. If machinery was recently used in another waterbody, then the equipment should be thoroughly cleaned to prevent the potential spread of invasive species. Machinery that will be working in or around the river should utilize biodegradable hydraulic fluids.

On-shore maintenance of construction equipment such as refueling, oil changes or lubrications would only be permitted within a staging area located at a minimum of 30 m from the shoreline where control measures would be installed or applied to prevent oil, grease, antifreeze or other materials from inadvertently entering the ground or the surface water flow.

Emergency spill kits would be located on site. The crew would be fully trained on the use of clean-up materials in order to minimize impacts of any accidental spills. The area would be monitored for leakage and in the unlikely event of a minor spillage the project manager would halt the activity and corrective measures would be implemented. Any spills would be immediately reported to the MOE Spills Action Centre (1800 268-6060).

Table 14– Environmental Effects Analysis during Construction

Environmental Component	Potential Project – Environmental Interactions	Mitigation Measures	Net Effect
<p>Surface Water Quality</p>	<ul style="list-style-type: none"> • Introduction of sediment from the construction activities • Re-suspension of sediments during excavation • Introduction of concrete debris 	<p>Sediment and concrete particle control strategies would be implemented. These may include the use of tarps, keyed in sediment fencing and silt curtains.</p> <p>Repairs of the sill at Dam #2 will be completed in the dry and should be completed during the low flow period.</p> <p>Cofferdam would be put in place to isolate any in-water work areas.</p> <p>Water pumped from isolated work areas would be allowed to settle prior to re-entering the watercourse.</p> <p>Prior to the removal of the cofferdams, the work area will be cleaned of sediment.</p> <p>Minimize the removal of riparian vegetation.</p> <p>When possible, leave 60 cm stumps on any trees removed from the banks.</p> <p>With the exception of on top of the buried water conveyance structure; revegetate any disturbed areas with native shrub and tree species.</p>	<p>Local Short term Negligible</p>

Environmental Component	Potential Project – Environmental Interactions	Mitigation Measures	Net Effect
		<p>As a minimum, the turbidity created by the project activities must conform to the Ministry of Natural Resources turbidity criteria (i.e. maximum suspended sediment concentration should not decrease the secchi disc reading by more than 10%).</p> <p>Shorelines will be protected with large boulders to prevent erosion, where needed.</p>	
<p>Terrestrial Habitat and Species</p>	<ul style="list-style-type: none"> • Loss of riparian vegetation • Loss of terrestrial woody vegetation • Disruption of wildlife as a result of the increased noise and light from the project activities • Disruption or harm to SAR or species of conservation concern • Increased noise 	<p>Minimize the removal of riparian vegetation.</p> <p>Use small machinery for the removal of woody vegetation.</p> <p>Clearly delineate the area for clearing/grubbing with snow fencing</p> <p>When possible, leave 60 cm stumps on any trees removed from the banks.</p> <p>Woody vegetation would be removed outside of the breeding bird period, April 15th to July 31st inclusive</p> <p>Avoid running heavy machinery and lights during night</p> <p>Appropriate mufflers on all machinery.</p>	<p>Local Short Term to Permanent Negligible</p>

Environmental Component	Potential Project – Environmental Interactions	Mitigation Measures	Net Effect
		<p>Butternuts were identified as occurring within the project area. All other species were considered unlikely to occur within the area of impact.</p> <p>An exemption for the removal of the butternuts is available under O. Reg. 242/08. A planting and monitoring plan has been submitted to MNR.</p> <p>All other butternuts should be protected with snow fencing installed outside of their drip line.</p>	
<p>Aquatic Habitat and Species</p>	<ul style="list-style-type: none"> • Loss of aquatic habitat during construction • Loss of fish during in-water works • Temporary loss of in-water habitat within cofferdam. 	<p>Project includes the deepening of the existing Lower Plant tailrace. The proponent will ensure that similar rocky substrate present prior to excavation is present on the new creek bed. Large boulders will be placed as refuge within this section of the river.</p> <p>Sensitive areas with fine sediment (located in the Side Channel and downstream of the small island) will be clearly marked on final construction drawings.</p> <p>Project also includes the creation of approximately 670 m² new aquatic habitat. This habitat will provide refuge and foraging areas.</p> <p>Removal of the trees and shrubs located adjacent to the tailrace area will be minimized.</p>	<p>Local Permanent Net gain / Enhancement</p>

Environmental Component	Potential Project – Environmental Interactions	Mitigation Measures	Net Effect
		<p>Removal of riparian vegetation will be minimized and when woody vegetation must be removed a 60 cm stump will be left in place, wherever possible.</p> <p>Where possible, the disturbed riparian area will be revegetated with native trees and shrubs.</p> <p>Cofferdams will be erected to prevent impacts to the fish habitat outside of the construction area and to clearly delineate the in-water work area.</p> <p>Work will occur within the MNR in-water window (July 1st to September 30th, inclusive).</p> <p>Fish salvage will be completed by a qualified fish biologist prior to excavation in the tailrace.</p> <p>Sediment control strategies will be put in place and site will be monitored for suspended sediments.</p> <p>The tailrace substrate will include cobbles and strategically placed boulders.</p> <p>Disturbed shorelines will be protected with large boulders to prevent erosion.</p>	

Environmental Component	Potential Project – Environmental Interactions	Mitigation Measures	Net Effect
Noise	<ul style="list-style-type: none"> Increased noise from construction activities 	<p>Appropriate mufflers on all machinery.</p> <p>Follow local noise by-laws.</p>	<p>Local Short term Negligible</p>
Accidents or Malfunctions	<ul style="list-style-type: none"> Introduction of exotic species Spills from project machinery 	<p>Ensure that any machinery entering the riverbed is cleaned.</p> <p>In-water machinery would be of good working order, clean and free of leaks.</p> <p>In-water works should be avoided during periods of high precipitation.</p> <p>Maintenance of equipment, machinery would occur at a minimum of 30 m from the shoreline.</p> <p>Fueling and maintenance activities would occur within an area where sediment erosion control measures and all precautions have been made to prevent oil, grease, antifreeze or other materials from inadvertently entering the ground or the surface water flow.</p> <p>Biodegradable hydraulic fuel should be used on machinery working within the water.</p> <p>Monitor area for leakage, in the unlikely event of spillage the supervising engineer would halt all construction activities and corrective measures</p>	<p>In the unlikely event that an accident or malfunction occurs the impacts maybe Local/ regional Long term Moderate/ Major</p>

Environmental Component	Potential Project – Environmental Interactions	Mitigation Measures	Net Effect
		would be implemented. Any spills would be immediately reported to the MOE Spills Action Centre (1.800. 268.6060)	

5.4 Operation Phase

In order to be able to predict the potential impacts associated with the operation of the proposed TLGS, an understanding of the existing and proposed regime is required. The individual potential impacts and recommended mitigation measures are offered following the operating regime discussion.

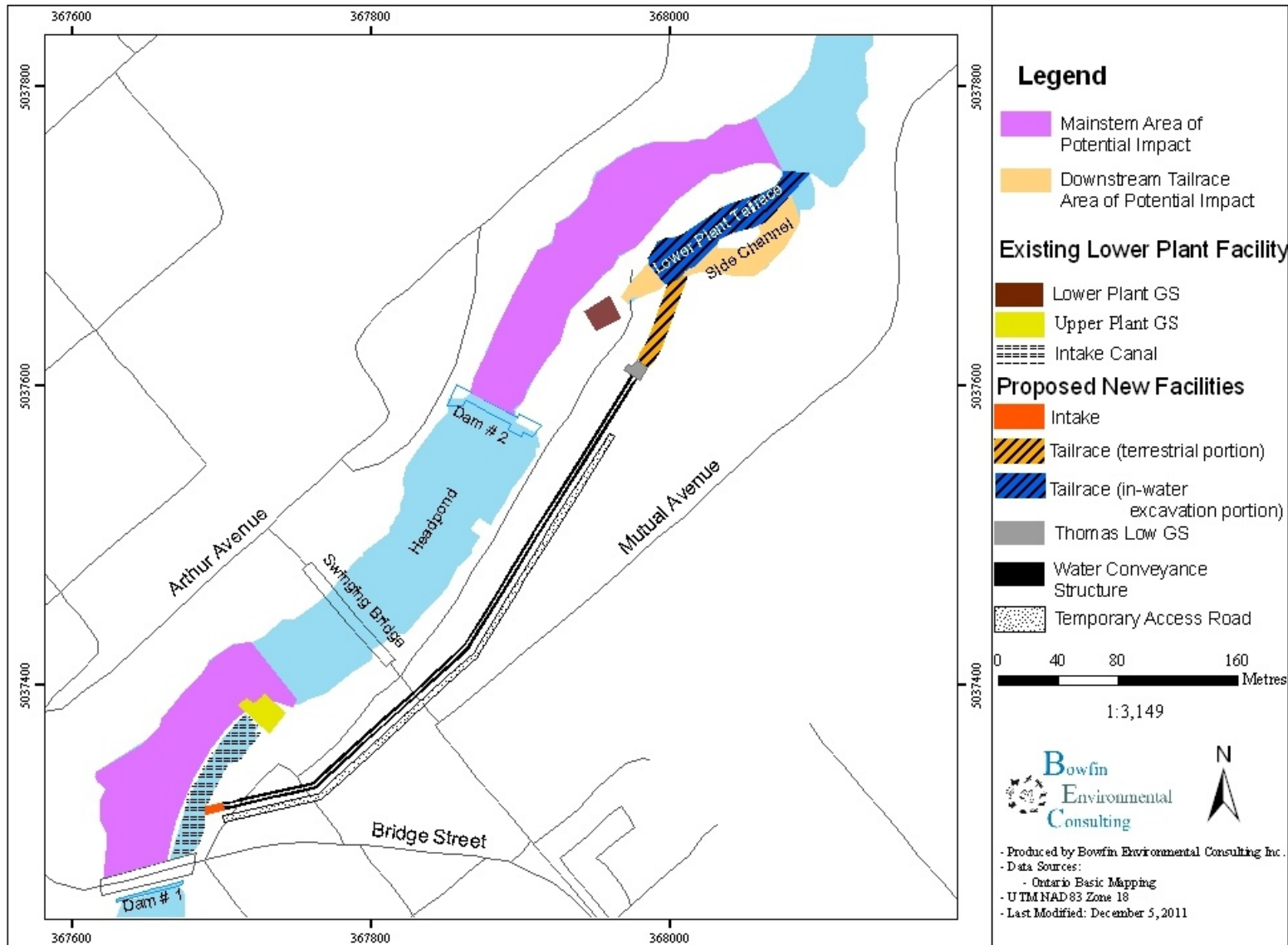
5.4.1 Operating Regime

Existing Operational Regime

There are currently two waterpower generating facilities operating within the project area, the Upper Plant, and the Lower Plant. The Upper Plant has a total of three turbines; two are rated for 4.1 cms and one for 5.8 cms for a total capacity of 14.0 cms. The Lower Plant has two turbines both rated at 7 cms, for a total capacity of 14.0 cms. The tailrace of the Upper Plant flows into the headpond for the Lower Plant. The tailrace for the Lower Plant is located downstream of Dam # 2 to the south of the “mainstem” (Figure 6). The powerhouses are located about 400 m apart and run successively with a maximum of 14 cms being diverted twice, once around the area upstream of the headpond and once around the mainstem below Dam #2. There is currently an estimated 0.5 cms residual flow between Dam #1 and the headpond and downstream of Dam #2. These residual levels were based on calculations made by OEL-Hydrosys on the amount of water presently leaking through the stop logs. As this residual flow is the only inflow to both channels, it has become necessary to allow the residual in order to maintain the aquatic habitat. It is anticipated that minimum flows will be determined as part of this project. At levels above 14.5 cms (max. capacity of 14 cms + residual flow of 0.5 cms), the extra flow falls over Dams #1 and 2 into the main channels. One of the recommendations put forward in the BRWMP was that a minimum flow be established at this site.

The numerical value of the minimum flow has not been confirmed and on-going discussions will be required with MNR during the permitting process. The use of 0.5 cms will be used in this report in order to facilitate discussion. The proponent will commit to continuing to allow water to pass below both dams in such a way as to mimic the existing conditions. It is proposed that the residual flows be established based on what was observed on July 10, 2009 during an on-site meeting with MNR and DFO at which time all parties agreed that this was an appropriate amount of water. A minimum flow release will be designed which will ensure that the water follows the desired path through the river and provides the accepted flow. An adaptive management approach will be utilized during the first year to fine tune and finalize the monitoring requirement for this item. The purpose of this approach would be to provide the opportunity to ensure and if needed, to adjust the system in order to meet these two criteria (numerical flow value and flow pattern). Following the first year, a report will be provided to MNR for their review. The report will detail the final option chosen for the design of the residual flow release and the monitoring which will be adhered to by the proponent.

Figure 6 Location of Potential Areas of Impact



Proposed Operational Regime

The proposed operational regime would see the Thomas Low Generating Station become the primary waterpower generating station at RPG's Renfrew facility. The older facilities would primarily be operated when the river flow exceeds the TLGS maximum operating capacity or when there are periods of extended maintenance/repair required on Thomas Low. In terms of potential impacts to the natural environment, the worst case scenario would be that all three plants are in operation. The following information is important to keep in mind while reviewing this section of the report:

- Minimum capacity for Thomas Low of 2.0 cms;
- Maximum capacity for Thomas Low of up to 23 cms;
- Maximum capacity for Upper and Lower Plants 14 cms;
- Thomas Low is operated at the primary facility;
- Existing residual flow conditions below both dams is estimated at 0.5 cms. This value represents residual flows unless otherwise indicated; and
- Worst case scenario would only occur when there is 37.5 cms or more of water in the system.

As noted previously, the numbers above are estimated and are subject to change based on final engineering design.

Since the Thomas Low intake would be constructed to connect to the Upper Plant canal, this would result in residual conditions in the Mainstem when the river flow is between 2.5 cms (min. capacity TLGS + 0.5 cms residual) and 37.5 cms (based on the max. capacity of the Upper and Lower Plants + max. capacity of TLGS). Under this circumstance, there would be an increase in the maximum amount of flow in the Lower Plant tailrace area from 14 cms up to a maximum of 37 cms.

There would be no change to the water level within the headpond at anytime.

Note that under the current and proposed operating regimes, the Upper Plant operates at 1 cms during periods of extreme low flow in order to prevent the drying out of the system. This is accomplished by using the storage capacities of the lakes located upstream, and outside of the study area, to maintain a level of 1.5 cms (1 cms used for generating and 0.5 cms residual).

Where conditions exceed 37.5 cms, all additional flow would be routed to the Mainstem. The following table details the proposed operational regimes under various flow conditions.

Table 15 Diversion of Flow between the Existing and New Generating Stations

Range of flow in river (cms)	Bonnechere River at various flow conditions (cms)	Overflow Dam #1 (residual) (cms)	Q Upper plant (cms)	Q Thomas Low GS (cms)	Overflow Dam #2 (residual) (cms)	Q Lower plant (cms)
0 to 2.50	0 to 2.0** (minimum of 1 cms)	0 to 1.5**	1	0*	1.0 plus leakage **	0*
2.51 to 23.5	2.51 10	0.5 0.5	0 0	2.0 9.5	0.5 0.5	0 0
23.51 to 37.50	27 37.5	0.5 0.5	4 14	23 23	0.5 0.5	4 23
37.51 and above	40 65	3 28	14 14	23 23	3 28	14 14
* Shutdown of Lower Plant and Thomas Low						
** values are approximate and subject to change at final engineering design stage						

(Table provided by OEL-Hydrosys)

The Bonnechere River Water Management Plan governs the management of water levels and flows on the waterway. Water storage elsewhere on the system will remain unchanged from the operation of the Thomas Low GS (pers. comm. Peter Boldt).

5.4.2 Discussion of Potential Impacts

Potential Impacts during Operation Outline

During the operation of the new powerhouse there is a potential for impacts to occur as a result in a change to the distribution of water flow and accidents and/or malfunctions.

The potential impacts to the natural environment associated with these activities are:

1. Decrease in surface water quality / erosion
 - a. Increase in flow through Lower Plant tailrace
2. Aquatic habitat and species
 - a. Alteration, disruption and/or destruction of fish habitat
 - i. Changes to water levels and flows
 - ii. Turbine mortality
 - b. Impacts to SAR and Species of Conservation Concern
 - i. Changes to water levels and flows
3. Noise
 - a. Impacts to wildlife from noise as a result of the addition of the powerhouse
4. Accidents or malfunctions
 - a. Spills from machinery during maintenance activities.

Surface Water Quality / Erosion

Summary and Potential Impact Analysis

Water quality may be impacted during the operation of TLGS as the result of the increase in flow through the existing Lower Plant tailrace. Prior to mitigation, the impacts associated with a decrease in surface water quality would be local, repetitive and, depending on the extent, could have a high magnitude. Do to the potential for an increased level of impact, the engineering team is finalizing the engineering for the tailrace design which will reduce water velocities at the tailrace outlet and mitigate erosion effects along the shorelines where required. Possible mitigation being considered in the engineering design of the tailrace is presented below.

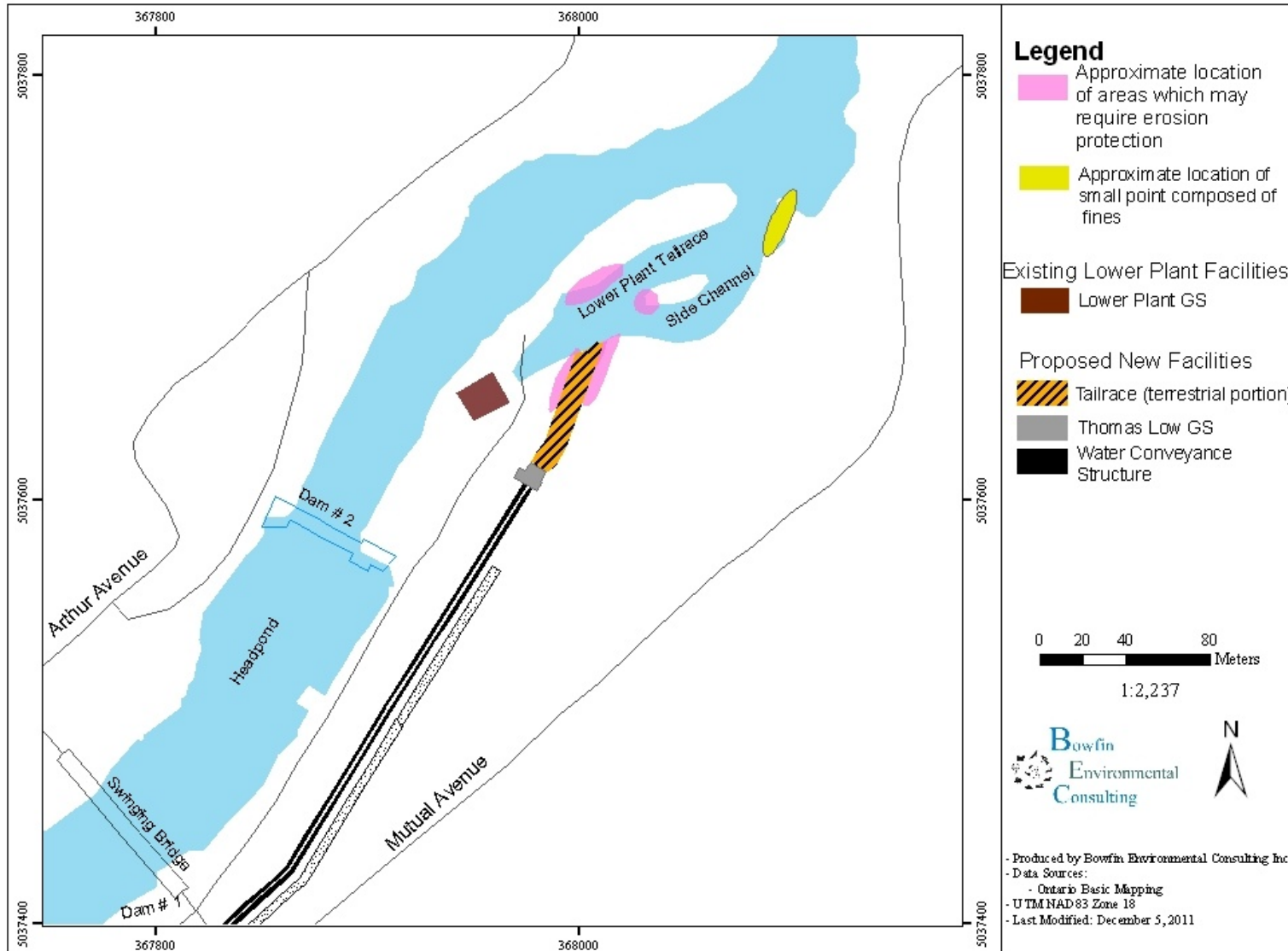
Mitigation Measures

- The feasibility of increasing the water depth within the existing Lower Plant tailrace is being examined. This would result in a decrease in velocity, thereby reducing the potential for erosion downstream of the tailrace. Velocities leaving the tailrace will be lowered as much as possible;
- The orientation of the tailrace for Thomas Low will be designed so as to prevent erosion of the shorelines, the small island, the fines in the side channel, and of the small point located approximately 30 m downstream of the island (Figure 7);
- Depending on the success of the engineering design to achieve the required velocity reduction, key areas may require enhanced erosion protection. This would be achieved through the installation of rip rap. These areas are identified on Figure 7.

Net Impact Analysis

Following the proper design, it is anticipated that the impacts to the surface water quality from erosion would be local, short term in duration and negligible in magnitude. The potential for the undertaking to result in erosion will be subject to regulatory review and approval during the permitting phase of the project.

Figure 7 Location of Areas Requiring Erosion Protection



Aquatic Habitat and Species

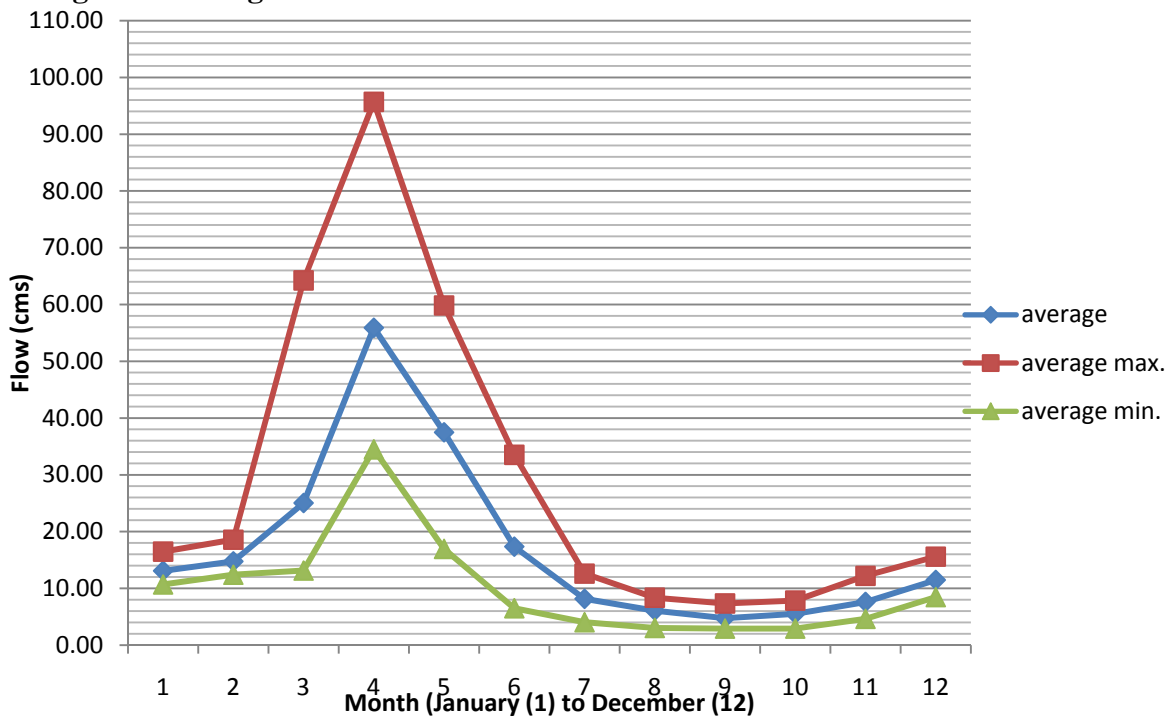
Summary and Potential Impact Analysis

The proposed operation of TLGS would affect the amount of flow present in the different sections of the river during different months. This in turn could impact available aquatic habitat and individuals present. The operation of a new waterpower facility also has the potential to increase fish mortality. Prior to mitigation, these impacts could be local to regional (may affect fish populations from Dam #2 to First Chute), permanent but variable (would fluctuate on a daily, monthly and yearly basis), and minor.

The mitigation of fish mortality will be addressed through project design which will incorporate a low approach intake velocity and trash rack to account for fish swimming capabilities to minimize entrainment (see *Environmental Report* OEL-HydroSys Inc.). This item will be further addressed during discussion with MNR and AOO regarding eel migrations and during the permitting process with DFO.

The following provides a comparison of the effect of the existing and proposed operational regimes on flows in the mainstem and the downstream tailrace areas. The minimum, maximum and average³ flow values were tabulated from data ranging from 1978 to 2007 by OEL. Average monthly values are presented in Figure 8. Existing residual flow conditions are shown in Photographs 5 and 8.

Figure 8 Average Flow Rates at Renfrew 1978-2007



³ Note that the median value (midpoint of the values) was used as the average in order to eliminate the affect of unusually high or low values.

The changes in flow conditions between the existing and proposed operating regimes would vary within the Mainstem and the Lower Plant tailrace. The mainstem includes an area of approximately 1.0 ha. When there is less water within the mainstem, there will be more water within the Lower Plant tailrace which encompasses an area of 0.35 ha. Since these two areas will be experiencing opposite impacts they will first be discussed in isolation.

Note that a summary of all impacts to all habitats during all phases is presented in Section 6.0.

The design of the Thomas Low tailrace has been engineered so that no increased flow occurs along the side channel. As such this area will not be impacted by the proposed changes to the operation regime.

Changes in Flow in the Mainstem

Since the development of the Thomas Low GS results in the ability to increase the maximum amount of flow that is diverted from 14.0 to 37.0 cms; the primary change will be an increased duration when only the residual flow would be expected within the Mainstem. Impacts to fish habitat and the fish population are dependent on what habitats are changed, how they are being changed, and during which months the changes are occurring. In order to understand how this increased capacity would affect fish, a comparison of the timing of residual flows within the mainstem during the existing and the proposed operational regimes is presented in Table 16.

As flow conditions fluctuate on a daily basis, the average minimum, average maximum and the average flow values (Figure 8) were used to determine the duration of residual flow in the mainstem on a monthly basis. The timing was determined by comparing the average monthly river flow values to the maximum total capacity under each operating regime.

For instance, if an average flow of 25 cms is present, then the flow within the mainstem during the existing regime would be 11 cms (the maximum capacity of 14 cms is diverted and all remaining flow remains in the mainstem). Under the same scenario in the proposed regime the flow in the mainstem would be 0.5 cms [while there remains the capacity to divert all of the flow (up to 37 cms), the minimum residual flow for the mainstem is maintained].

The terms used for duration are qualified as:

- Residual flow would be anticipated to ALWAYS be present IF the average, minimum and maximum flows < maximum capacity;
- Residual flow would USUALLY be present IF the average and minimum flows < maximum capacity;
- Residual flow would SOMETIMES be present IF only the minimum flow < maximum capacity; and
- Rarely = there would be MORE than the Residual flow IF no flow values were below the maximum capacity.

Table 16 Comparison of the Provision of Residual Flow in the Mainstem under Existing and Proposed Operating Regimes

Operational Regime	Residual Flow of 0.5 cms is Present			
	Always	Usually	Sometimes	Rarely
Existing Regime (based on max. capacity of 14cms)	July to November	January	Feb-March June	April May
Proposed Regime (based on max. capacity of 14 cms for Upper and Lower Plants + max. capacity of 37 cms)	June to February	March	April May	-

The mainstem fish habitat will be impacted to some degree throughout the year (Table 16). Under the existing operating regime, the residual flow is always present between July and November, is usually present during January, sometimes present between March and June, and rarely occurs during April and May. The proposed changes would result in the residual flow always occurring between July and February, usually present during March and sometimes during April and May. The level of impact to fish varies with the time of year.

Fall /Winter

The change between January and March would likely not result in a noticeable impact to the fish community since it would occur during the winter when little activity is occurring; this same level of negligible effect also applies to the beginning of the month of April.

Spring

The change in flow during the later part of April and the month of May presents the potential for the most significant level of impact. This is due to the possible use of the Mainstem area by spring spawners. Typical early spring spawners associated with this type of habitat include walleye, white suckers and redhorses. While very few walleye (only 2 captured during gill netting; none during seine netting or backpack electrofishing) were captured within the system during the sampling events there remains a potential for this area to be utilized by walleye. It is noted that suitable spawning habitat for these species is also present downstream near the sewage treatment plant, near HWY 17, and at two additional locations further downstream.

The significance of the potential to affect early spring spawners was assessed using data compiled during HEC RAS modeling completed for the existing and proposed operating regimes. The details are provided in a Technical Note issued by OEL on October 19, 2011. As discussed previously, the HEC RAS modeling demonstrates that under the existing operating regime, much of the habitat in this area is faster than the preferred walleye spawning conditions (Table 17). The preferred walleye spawning velocity suggested by the MNR Percid Synthesis Review (1997) is between 0.20-0.30 m/s. The average velocities during the existing regime are significantly higher - the lowest value starts at 0.65m/s (Table 17). It should be noted that despite the higher than preferred velocities under the both regimes, it is reasonable to assume that walleye could spawn especially along the edges. While the Mainstem habitat does not currently provide optimal potential for walleye spawning, under the new regime it will provide better spawning habitat in terms of velocities and depth. This is a positive impact and net gain.

It is however recommended that the minimum residual flow be augmented to approximately 2.0 cms during mid-April-May. This will result in a minimum average depth of approximately 0.32 to 0.54 m and average velocities between 0.23 m/s and 0.59 m/s (Technical Note, October 19, 2011). The residual flow is dependent on the natural conditions (i.e. more than 2 cms must be naturally present in the system for this target to be met; the storage capacity of the upstream lakes would not be used to artificially create these conditions). It is noted that when more than 39 cms is present in the system, the residual flow will be higher than 2 cms.

Table 17 Comparison of Early Spring Depths and Velocities under the Existing and Proposed Operating Regime in the Mainstem

Operational Regime	April		May	
	Depth (m)	Velocity (m/s)	Depth (m)	Velocity (m/s)
Existing Regime max. capacity 14.0cms	1.18-1.69	0.72-1.62	0.87-1.46	0.65-1.32
Proposed Regime max. capacity 37.0 cms	0.96-1.49	0.49-0.86	0.68-1.49	0.26-0.64

Summer

As noted in Table 16, the existing conditions consist of residual water levels during the summer months. This will not change. As such no impacts are expected during the summer months.

Changes in Flow in the Lower Plant Tailrace Area

As mentioned above, the impact to the Lower Plant tailrace is the opposite of that experienced in the Mainstem. Here, the change comes from an increase in flow from a maximum of 14 cms in the existing operation to a maximum of 37 cms in the proposed. As such, the impacts would occur during periods of high flow. Under existing conditions, the maximum amount of flow usually occurs between February and June and always during April and May (Figure 8, Table 18). Based on historical levels there is no month when the proposed operating regime would be anticipated to always occur. On average, the flows in the Lower Plant tailrace would be higher than the existing conditions during February through June (Table 18). The maximum flow of 37 cms could occur between March and May. No to very little change would be seen between July and January (Table 18).

Table 18 Changes in Average Flow within Lower Plant Tailrace

Month	Average Flow (cms) (min-max)	Average Flows (cms)	
		Existing	Proposed
January	13.0 (10.7-16.5)		12.5
February	14.8 (12.4-18.6)	14	14.3
March	25.0 (13.1-64.2)	14	24.5
April	55.9 (34.5-95.7)	14	37.0
May	37.5 (17.0-59.8)	14	35.5
June	17.9 (6.5-33.5)	14	17.4
July	8.2 (4.0-12.6)		7.7
August	6.1 (3.0-8.4)		5.6
September	4.8 (3.0-7.3)		4.3
October	5.5 (2.9-7.9)		5.0
November	7.6 (4.6-12.2)		7.1
December	11.5 (8.5-15.6)		11.0

Fall /Winter

There is little change expected between September and February. The change during March would likely not result in a noticeable impact to the fish community since it would occur during the winter when little activity is occurring; this same level of negligible effect also applies to the beginning of the month of April.

Spring

The higher flows during mid April and May could affect the potential fish production for walleye and other early spawners such as redhorses and suckers. As mentioned in the surface water / erosion discussion, velocities at the outlet of the tailrace will be minimized by increasing the depth of the tailrace. Despite the increase in depth, the water velocities are estimated to be approximately twice as fast as the maximums experienced during the existing conditions (Table 19). Large boulders will be strategically placed within this area to provide refuge to help alleviate this impact.

Table 19 Comparison of Early Spring Depths and Velocities under the Existing and Proposed Operating Regime in the Lower Plant Tailrace (between small island and peninsula)

Operational Regime	Channel Depth (m)	Velocity (m/s)
Existing Regime max. capacity 14 .0cms	1.63-2.13	0.66-0.86
Proposed Regime max. capacity 37.0 cms	2.05-2.55	1.28-1.53

Summer

No change is expected over the summer months.

Mainstem and Lower Plant Tailrace Summary

While the water velocities are above optimal in both locations, it is expected that the Lower Plant tailrace would provide better spawning habitat for walleye than the Mainstem under the existing regime. It is likely that should walleye spawning occur in the Mainstem, that it would be restricted to the shorelines. The opposite is expected to occur under the proposed operating regime. Since the potential spawning bed in the Mainstem is much larger (1.0 ha) than that of the Lower Plant tailrace (0.35 ha), the overall impact would be a gain over the existing conditions.

Fish Community and Aquatic Species at Risk

The project area and inventory study area provide habitat for a variety of common warm and cool water fish species. YOY redhorse, white sucker, rock bass, pumpkinseed, and smallmouth bass were captured. No aquatic SAR or species of conservation concern were captured. It is considered unlikely that any of the SAR or species of conservation concern occur within the

project area with the possible exception of the American eel. Discussions regarding the final design for American eel passage at both Dam #1 and #2 are ongoing between the proponent and regulators.

Mitigation Measures for Fish Habitat

- In order to maximize the benefits during the spring spawn, a residual flow downstream of Dam #2 of 2.0 cms is recommended within the mainstem between mid-April and the end of May thus ensuring the provision of spawning habitat. [Note that a minimum of 2.0 cms must be present in the natural system to meet this requirement and that when flows are above 39 cms, the minimum flow in the Mainstem will be higher than 2 cms]
- The additional of boulders in the deeper Lower Plant tailrace will create an enhancement by increasing resting areas.

Net Impact

Following the proper implementation of mitigations measures it is anticipated that the potential impacts resulting from the proposed operating regime would be local, permanent (and variable) and positive in magnitude. The gain in productivity would be the result of reduced velocities during early spring in the Mainstem (an area of 1.0 ha) [which will offset any loss of spawning opportunities in the Lower Plant tailrace (an area of 0.35 ha)].

Noise

The potential impacts associated with noise pollution to wildlife are local, permanent and negligible. From a wildlife perspective, there site already has a high background level of noise (i.e. fast flowing river, roads and existing power plants). It is anticipated that the construction of the additional powerhouse would not provide any additional impacts to the wildlife. It is also noted that the Thomas Low would be the primary generating station most of the time, that the Upper Plant would be powered down during winter months and that all three generating stations would only be in use at the same time during periods of high flows when the noise level from the river is also higher.

Accidents and malfunctions

Although the likelihood of accidents and malfunctions occurring would be minimized by following the mitigation measures outlined below, should accidents and/or malfunctions occur they have the possibility of being serious and need to be considered before they happen.

All maintenance equipment working in or near the water should be well maintained, clean and free of leaks. Spill kits would be located on site. The crew would be fully trained on the use of clean-up materials in order to minimize impacts of any accidental spills. The area would be monitored for residual and in the unlikely event of a minor spillage the project manager would halt the activity and corrective measures would be implemented. Any spills would be immediately reported to the MOEE Spills Action Centre (1800 268-6060).

Table 20 Environmental Effects Analysis during Operations

Environmental Component	Potential Project – Environmental Interactions	Mitigation Measures	Net Effect
Surface Water Quality / Erosion	<ul style="list-style-type: none"> Increase in flow within the Lower Plant tailrace could cause erosion of the shorelines or bed of the river within and / or downstream of the project area 	<p>New tailrace will be oriented to ensure that the fines in the side channel are not affected.</p> <p>The existing Lower Plant tailrace will be deepened to decrease the velocity within the tailrace.</p> <p>If needed, shoreline protection consisting of rip rap will be installed.</p>	Local Permanent Negligible
Aquatic Habitat and Species	<ul style="list-style-type: none"> Change in flow 	Residual flow of a minimum of 2.0 cms is recommended downstream of Dam #2 during mid-April to end of May (when feasible)	Local Permanent term Potential net gain
Noise	<ul style="list-style-type: none"> Increased noise from construction of TLGS 	The proponent will be required to secure a Certificate of Approval for Air Emissions (Noise) for the operation of the powerhouse. Additionally, only one facility would be operating except in periods of exceptional flows (whereas two are presently in operation).	Local Long term Negligible
Accidents or Malfunctions	<ul style="list-style-type: none"> Spills during repairs and maintenance 	Monitor area for leakage, in the unlikely event of spillage the supervising engineer would halt all construction activities and corrective measures would be implemented. Any spills would be immediately reported to the MOE Spills Action Centre (1.800. 268.6060)	In the unlikely event that an accident or malfunction occurs the impacts maybe Local/ regional Long term Moderate/ Major

5.4 Decommissioning Phase

At this time, it is anticipated that the decommissioning of the powerhouse would consist of abandonment and salvaging of equipment.

5.5 Cumulative Effects

This project will not result in any impacts upstream of Renfrew Dam #1 or downstream of the proposed location of the Thomas Low tailrace. The project area is located on a privately owned parcel of land that has been used for waterpower generation for several decades. This project will not affect the operation of the new wastewater treatment facility, as the river will return to

normal flows immediately downstream of the proposed tailrace. Any cumulative effects would be restricted to additional projects within the river near the dams, and these would be subject to a separate evaluation of their potential impacts.

6.0 SUMMARY OF POTENTIAL IMPACTS (all phases)

This project has the potential to impact both the terrestrial and aquatic habitats. The terrestrial habitat within the project area would only be affected by the construction phase. This area is already disturbed and the only significant feature was the presence of butternuts. A planting and monitoring plan for the loss of the fewer than 10 butternuts is being approved by MNR. All other impacts to the terrestrial environment are well understood and easily mitigated through best management practices.

The aquatic environment may be impacted during the construction phase. The anticipated impacts are well understood and can be mitigated through the use of in-water timing windows, working in the dry (where possible) and implementing known best management practices, and monitoring their integrity and effectiveness.

While the potential impacts to the natural environment as a result of the proposed operating regime are restricted to the aquatic environment, these impacts are more complex in nature and differ based on the location and the time of year. The final engineering design of the tailrace (subject to regulatory approval) will result in no effects downstream of the zone of influence. The concerns in the downstream areas are the potential for erosion and sedimentation. The final design will mitigate the increase in water velocity in the existing Lower Plant tailrace through deepening of the channel. Where required, bank stabilization through the installation of rip rap will be undertaken. The final engineering design and required additional mitigation measures will ensure that no erosion impacts are experienced within the study area or further downstream.

Within the study area, there are three main areas that will be impacted as a result of the proposed project: between Dam #1 and the headpond, downstream of Dam #2 and downstream of the Lower Plant tailrace. Of these areas, there will be no significant residual effects between Dam #1 and the headpond. The two remaining areas are similar in terms of the substrate and morphology type; fast flowing runs over rocky substrate. This type of habitat is not limited within the area; the Mainstem (downstream of Dam #2) includes 1.0 ha and the Lower Plant tailrace 0.35 ha. The area immediately downstream of the peninsula also consists of run habitat over rocky substrate and there are additional areas further downstream.

The Mainstem will be impacted by an increase in the period of residual flow conversely the Lower Plant tailrace will have a longer period of high flows. The highest level of impact from these changes of flows would occur during the spring when early spawners are in the area. Based on modeling, the velocities and depths in the Mainstem will be reduced and will be near the optimal conditions for walleye and will provide similar conditions to later spawners. This will be an enhancement of the available spawning habitat for walleye.

The Lower Plant tailrace may experience some reduction in spawning potential as a result of changes in velocities. The addition of boulders in the redesigned Lower Plant tailrace will create refuge areas for fish.

Overall, it is anticipated that a minimum residual flow of 2.0 cms, when possible, below Dam #2 during the early spring spawning window will result in an improvement of the amount of available spawning habitat and an increase in fish productivity since the size of the Mainstem is three times the size of the Lower Plant tailrace.

During the summer months, the available habitat downstream of Dam #2 would remain similar, experiencing a longer period of residual flow in the Mainstem and a longer period of high flow below the Lower Plant tailrace. The Mainstem will continue to provide refuge habitat for such species as smallmouth bass as it does now. The velocities in the Lower Plant tailrace were already high and as such this may have little impact (note that few were captured at any one time in this location).

7.0 COMMITMENTS

RPG commits to providing satisfactory calculations for the determination numerical value for the approved residual flow. A monitoring plan will be implemented during year 1 to ensure that the required volume of water to maintain ecological function is passed below both dams, and that this flow follows the preferred paths of the river (as decided during the July 10, 2009 site visit with regulators).

RPG also commits to continue to work with MNR and AOO in the development of upstream and downstream American eel passage at both existing facilities.

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Personal communications

Peter Boldt. Refrew Power Corporation Inc.

Sébastien Vittecoq. P. Eng OEL-Hydrosys.

Appendix A List of Plant Species Observed within Thomas Low Project Area

Common Name	Scientific Name	Srank	Provincial Status (SARO)	Federal Status (SARA)
PLANTS				
Northern Lady Fern	<i>Athyrium filix-femina var. angustum</i>	S5		
Sensitive Fern	<i>Onoclea sensibilis</i>	S5		
Field Horsetail	<i>Equisetum arvense</i>	S5		
Eastern White Cedar	<i>Thuja occidentalis</i>	S5		
Balsam Fir	<i>Abies balsamea</i>	S5		
White Spruce	<i>Picea glauca</i>	S5		
White Pine	<i>Pinus strobus</i>	S5		
American Yew	<i>Taxus canadensis</i>	S4		
Manitoba Maple	<i>Acer negundo</i>	S5		
Red Maple	<i>Acer rubrum</i>	S5		
Sugar Maple	<i>Acer saccharum</i>	S5		
Western Poison-ivy	<i>Rhus radicans ssp. rydbergii</i>	S5		
Staghorn Sumac	<i>Rhus typhina</i>	S5		
Swamp Milkweed	<i>Asclepias incarnata ssp. incarnata</i>	S5		
Common Milkweed	<i>Asclepias syriaca</i>	S5		
Common Yarrow	<i>Achillea millefolium ssp. millefolium</i>	SNA		
Common Burdock	<i>Arctium minus ssp. minus</i>	SNA		
Ox-eye Daisy	<i>Chrysanthemum leucanthemum</i>	SNA		
Bull Thistle	<i>Cirsium vulgare</i>	SNA		
Philadelphia Fleabane	<i>Erigeron philadelphicus ssp. philadelphicus</i>	S5		
Spotted Joe-pye-weed	<i>Eupatorium maculatum ssp. maculatum</i>	S5		
Black-eyed Susan	<i>Rudbeckia hirta</i>	S5		
Early Goldenrod	<i>Solidago juncea</i>	S5		
Common Dandelion	<i>Taraxacum officinale</i>	SNA		
Coltsfoot	<i>Tussilago farfara</i>	SNA		
Spotted Jewel-weed	<i>Impatiens capensis</i>	S5		
White Birch	<i>Betula papyrifera</i>	S5		
Ironwood	<i>Ostrya virginiana</i>	S5		
Viper's Bugloss	<i>Echium vulgare</i>	SNA		
Creeping Bellflower	<i>Campanula rapunculoides</i>	SNA		
American Fly Honeysuckle	<i>Lonicera canadensis</i>	S5		
Tartarian Honeysuckle	<i>Lonicera tatarica</i>	SNA		
Maple-leaved Viburnum	<i>Viburnum acerifolium</i>	S5		
Nannyberry	<i>Viburnum lentago</i>	S5		
Bladder Champion	<i>Silene latifolia</i>	SNA		
Gray Dogwood	<i>Cornus foemina ssp. racemosa</i>	S5		
Red-osier Dogwood	<i>Cornus stolonifera</i>	S5		
Hog Peanut	<i>Amphicarpaea bracteata</i>	S5		

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Common Name	Scientific Name	Srank	Provincial Status (SARO)	Federal Status (SARA)
Trailing Crown-vetch	<i>Coronilla varia</i>	SNA		
Bird's-foot Trefoil	<i>Lotus corniculatus</i>	SNA		
Black Medick	<i>Medicago lupulina</i>	SNA		
White Sweet-clover	<i>Melilotus alba</i>	SNA		
Red Clover	<i>Trifolium pratense</i>	SNA		
White Clover	<i>Trifolium repens</i>	SNA		
Cow Vetch	<i>Vicia cracca</i>	SNA		
White Oak	<i>Quercus alba</i>	S5		
Red Oak	<i>Quercus rubra</i>	S5		
Wild Black Currant	<i>Ribes americanum</i>	S5		
Butternut	<i>Juglans cinerea</i>	S3?	END	END
Black Walnut	<i>Juglans nigra</i>	S4		
Canada Enchanter's Nightshade	<i>Circaea lutetiana ssp. canadensis</i>	S5		
Common Plantain	<i>Plantago major</i>	SNA		
Tufted Loosestrife	<i>Lysimachia thysiflora</i>	S5		
Canada Anemone	<i>Anemone canadensis</i>	S5		
Tall Buttercup	<i>Ranunculus acris</i>	SNA		
Common Buckthorn	<i>Rhamnus cathartica</i>	SNA		
Common Strawberry	<i>Fragaria virginiana ssp. virginiana</i>	S5		
White Avens	<i>Geum canadense</i>	S5		
Shrubby Cinquefoil	<i>Potentilla fruticosa ssp. floribunda</i>	S5		
Rough-fruited Cinquefoil	<i>Potentilla recta</i>	SNA		
Choke Cherry	<i>Prunus virginiana ssp. virginiana</i>	S5		
Wild Red Raspberry	<i>Rubus idaeus ssp. strigosus</i>	S5		
Purple Flowering Raspberry	<i>Rubus odoratus</i>	S5		
Fragrant Bedstraw	<i>Galium triflorum</i>	S5		
Prickly-ash	<i>Zanthoxylum americanum</i>	S5		
Largetooth Aspen	<i>Populus grandidentata</i>	S5		
Trembling Aspen	<i>Populus tremuloides</i>	S5		
Crack Willow	<i>Salix fragilis</i>	SNA		
Common Mullein	<i>Verbascum thapsus</i>	SNA		
American Basswood	<i>Tilia americana</i>	S5		
American Elm	<i>Ulmus americana</i>	S5		
Virginia Creeper	<i>Parthenocissus inserta</i>	S5		
Riverbank Grape	<i>Vitis riparia</i>	S5		
Bebb's Sedge	<i>Carex bebbii</i>	S5		
Fringed Sedge	<i>Carex crinita</i>	S5		
Lakebank Sedge	<i>Carex lacustris</i>	S5		
Awl-fruited Sedge	<i>Carex stipata</i>	S5		
Greenish Sedge	<i>Carex viridula</i>	S5		
Black Bulrush	<i>Scirpus atrovirens</i>	S5		
Softstem Bulrush	<i>Scirpus validus</i>	S5		
Canada Waterweed	<i>Elodea canadensis</i>	S5		
Tapegrass	<i>Vallisneria americana</i>	S5		
Soft Rush	<i>Juncus effusus ssp. solutus</i>	S5		

Common Name	Scientific Name	Srank	Provincial Status (SARO)	Federal Status (SARA)
Tiger Lily	<i>Lilium lancifolium</i>	SNA		
False Solomon's Seal	<i>Maianthemum racemosum ssp. racemosum</i>	S5		
Rattlesnake Grass	<i>Glyceria canadensis</i>	S4S5		
Reed Canary Grass	<i>Phalaris arundinacea</i>	S5		
Timothy	<i>Phleum pratense</i>	SNA		
Small Pondweed	<i>Potamogeton pusillus</i>	S4S5		
Giant Bur-reed	<i>Sparganium eurycarpum</i>	S5		
Narrow-leaved Cattail	<i>Typha angustifolia</i>	SNA		

Updated: February 22, 2012

SRANK DEFINITIONS

S4 Apparently Secure, Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 Secure, Common, widespread, and abundant in the nation or state/province.

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

S#S# Range Rank, A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

SZB Breeding migrants/vagrants.

SARO STATUS DEFINITIONS

END Endangered: A species facing imminent extinction or extirpation in Ontario which is a candidate for

SARA STATUS DEFINITIONS

END Endangered, a wildlife species facing imminent extirpation or extinction.

Appendix B Historical Fish Species BRWMP

Species Name	Latin Name	Trophic Class*	Thermal Regime	OMNR Status (SRANK)	Federal Status
brook trout	<i>Salvelinus fontinalis</i>	piscivore	cold	(S5)	
northern pike	<i>Esox lucius</i>	piscivore	cool	(S5)	
central mudminnow	<i>Umbra limi</i>	insectivore/ omnivore	cool/ warm	(S5)	
white sucker	<i>Catostomus commersoni</i>	insectivore/ omnivore	cool	(S5)	
shorthead redhorse	<i>Moxostoma macrolepidotum</i>	insectivore	warm	(S5)	
greater redhorse	<i>Moxostoma valenciennesi</i>	insectivore	cool/ warm	(S3)	
brassy minnow	<i>Hybognathus hankinsoni</i>	omnivore/ herbivore	cool	(S5)	
golden shiner	<i>Notemigonus crysoleucas</i>	omnivore	cool	(S5)	
emerald shiner	<i>Notropis atherinoides</i>	insectivore	cool	(S5)	
common shiner	<i>Luxilus cornutus</i>	insectivore	cool	(S5)	
blackchin shiner	<i>Notropis heterodon</i>	insectivore	cool/ warm	(S4)	
blacknose shiner	<i>Notropis heterolepis</i>	insectivore	cool/ warm	(S5)	
spottail shiner	<i>Notropis hudsonius</i>	insectivore	cool	(S5)	
rosyface shiner	<i>Notropis rubellus</i>	insectivore	warm	(S4)	
mimic shiner	<i>Notropis volucellus</i>	insectivore	warm	(S5)	
bluntnose minnow	<i>Pimephales notatus</i>	omnivore	warm	(S5)	
longnose dace	<i>Rhinichthys cataractae</i>	insectivore	cool	(S5)	
creek chub	<i>Semotilus atromaculatus</i>	insectivore/ generalist	cool	(S5)	
fallfish	<i>Semotilus corporalis</i>	insectivore	cool	(S4)	
brown bullhead	<i>Ameiurus nebulosus</i>	insectivore	warm	(S5)	
American eel	<i>Anguilla rostrata</i>	insectivore/ piscivore	cool	END (S1?)	
rock bass	<i>Ambloplites rupestris</i>	insectivore/ piscivore	cool	(S5)	

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Species Name	Latin Name	Trophic Class*	Thermal Regime	OMNR Status (SRANK)	Federal Status
pumpkinseed	<i>Lepomis gibbosus</i>	insectivore	warm	(S5)	
smallmouth bass	<i>Micropterus dolomieu</i>	insectivore/ piscivore	warm	(S5)	
largemouth bass	<i>Micropterus salmoides</i>	insectivore/piscivore	warm	(S5)	
yellow perch	<i>Perca flavescens</i>	insectivore/piscivore	cool	(S5)	
walleye	<i>Sander vitreus vitreus</i>	piscivore	cool	(S5)	
Iowa darter	<i>Etheostoma exile</i>	insectivore	cool	(S5)	
johnny darter	<i>Etheostoma nigrum</i>	insectivore	cool	(S5)	
logperch	<i>Percina caprodes</i>	insectivore	cool/warm	(S5)	

(Balon 1981, Coker et al 2001, Scott and Crossman 1973)

Appendix C Detailed Fish Sampling Results

Site A (July 11, 2007)

The site length was 150 m. The shock time was 778 seconds. A total of ten fish representing three species were captured: white sucker, longnose dace, and logperch (Table A). This catch was dominated by longnose dace (70%).

Table A Site A (July 11, 2007)

Species Name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
white sucker	<i>Catostomus commersoni</i>	insectivore / omnivore	cool	2	37-39
longnose dace	<i>Rhinichthys cataractae</i>	insectivore	cool	7	29-89
Logperch	<i>Percina caprodes</i>	insectivore	cool / warm	1	99
Total				10	

(Coker et al., 2001; MTO, 2006)

Site A (July 23, 2008)

The site length was 150 m. The shock time was 1210 seconds. A total of sixty one fish representing eleven species were captured: redhorse species, white sucker, rosyface shiner, longnose dace, creek chub, banded killifish, rock bass, smallmouth bass, johnny darter, and logperch (Table B). This catch was dominated by longnose dace (28%) followed by rosyface shiners (21%).

Table B Site A (July 23, 2008)

Species Name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
redhorse sp.				5	22-37
white sucker	<i>Catostomus commersoni</i>	insectivore / omnivore	cool	2	73-80
rosyface shiner	<i>Notropis rubellus</i>	insectivore	warm	13	61-71
blacknose dace	<i>Rhinichthys atratulus</i>	insectivore / generalist	cool	5	30-63
longnose dace	<i>Rhinichthys cataractae</i>	insectivore	cool	17	28-121
creek chub	<i>Semotilus atromaculatus</i>	insectivore / generalist	cool	1	45
banded killifish	<i>Fundulus diaphanus</i>	insectivore	cool	1	27
rock bass	<i>Ambloplites rupestris</i>	insectivore / piscivore	cool	6	25-158
smallmouth bass	<i>Micropterus dolomieu</i>	insectivore / piscivore	warm	8	35-115

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Species Name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
johnny darter	<i>Etheostoma nigrum</i>	insectivore	cool	1	45
logperch	<i>Percina caprodes</i>	insectivore	cool / warm	2	80-82
Total				61	

(Coker et al., 2001; MTO, 2006)

Site B (July 10, 2007)

The site length was 200 m. The shock time was 906 seconds. A total of thirty three fish representing five species were captured: longnose dace, rock bass, smallmouth bass, johnny darter, and logperch (Table C). This catch was dominated by longnose dace (%) followed by smallmouth bass (%).

Table C Site B (July 10, 2007)

Species Name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
longnose dace	<i>Rhinichthys cataractae</i>	insectivore	cool	18	31-104
rock bass	<i>Ambloplites rupestris</i>	insectivore / piscivore	cool	1	69
smallmouth bass	<i>Micropterus dolomieu</i>	insectivore / piscivore	warm	10	40-115
johnny darter	<i>Etheostoma nigrum</i>	insectivore	cool	2	55-69
logperch	<i>Percina caprodes</i>	insectivore	cool / warm	2	114-128
Total				33	

(Coker et al., 2001; MTO, 2006)

Site B (September 6, 2007)

The site length was 200 m. The shock time was 599 seconds. A total of fifty eight fish representing five species were captured: longnose dace, rock bass, smallmouth bass, and logperch (Table D). This site was dominated by smallmouth bass (69%) followed by logperch (22%).

Table D Site B (September 6, 2007)

Species Name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
longnose dace	<i>Rhinichthys cataractae</i>	Insectivore	cool	4	54-89
rock bass	<i>Ambloplites rupestris</i>	insectivore / piscivore	cool	1	129
smallmouth bass	<i>Micropterus dolomieu</i>	insectivore / piscivore	warm	40	63-133
logperch	<i>Percina caprodes</i>	insectivore	cool / warm	13	101-136
Total				58	

(Coker et al., 2001; MTO, 2006)

Site C (September 6, 2007)

The site length was 90 m. The shock time was 619 seconds. A total of twenty one fish representing seven species were captured: bluntnose minnow, brown bullhead, rock bass, pumpkinseed, smallmouth bass, johnny darter, and logperch (Table E). This catch was dominated by smallmouth bass (%) followed by bluntnose minnow (%).

Table E Site C (September 6, 2007)

Species Name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
bluntnose minnow	<i>Pimephales notatus</i>	Omnivore	warm	4	56-72
brown bullhead	<i>Ameiurus nebulosus</i>	Insectivore	warm	1	133
rock bass	<i>Ambloplites rupestris</i>	insectivore / piscivore	cool	1	85
pumpkinseed	<i>Lepomis gibbosus</i>	Insectivore	warm	1	84
smallmouth bass	<i>Micropterus dolomieu</i>	insectivore / piscivore	warm	11	65-107
johnny darter	<i>Etheostoma nigrum</i>	Insectivore	cool	2	50-53
logperch	<i>Percina caprodes</i>	Insectivore	cool / warm	1	117
Total				21	

(Coker et al., 2001; MTO, 2006)

Site D (August 24, 2006)

The shock time was 247 seconds. A total of fourteen fish representing four species were captured: brown bullhead, rock bass, pumpkinseed, and johnny darter (Table F). This catch was dominated by rock bass (%) followed by pumpkinseed (%).

Table F Site D (August 24, 2006)

Species Name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
brown bullhead	<i>Ameiurus nebulosus</i>	insectivore	warm	1	249
rock bass	<i>Ambloplites rupestris</i>	insectivore / piscivore	cool	8	30-83
pumpkinseed	<i>Lepomis gibbosus</i>	insectivore	warm	3	40-85
johnny darter	<i>Etheostoma nigrum</i>	insectivore	cool	2	49-55
Total				14	

(Coker et al., 2001; MTO, 2006)

Site D (July 10, 2007)

The site length was 50 m. The shock time was 343 seconds. A total of nine fish representing four species were captured: bluntnose minnow, banded killifish, rock bass, and johnny darter (Table G). This catch was dominated by bluntnose minnow (%) and rock bass (%).

Table G Site D (July 10, 2007)

Species Name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
bluntnose minnow	<i>Pimephales notatus</i>	omnivore	warm	4	49-58
banded killifish	<i>Fundulus diaphanus</i>	insectivore	cool	1	65
rock bass	<i>Ambloplites rupestris</i>	insectivore / piscivore	cool	3	78-120
johnny darter	<i>Etheostoma nigrum</i>	insectivore	cool	1	52
Total				9	

(Coker et al., 2001; MTO, 2006)

Site D (September 6, 2007)

The site length was 50 m and the average wetted width and depths were 1330 cm and 30 cm, respectively. The area fished was 665 m² and the shock time was 257 seconds. A total of four fish representing two species were captured: bluntnose minnow, and johnny darter (Table H). The catch was evenly represented by the two species.

Table H Site D (September 6, 2007)

Species Name	Latin Names	Trophic Class	Thermal Regime	Number Caught	Size Range (FK mm)
bluntnose minnow	<i>Pimephales notatus</i>	omnivore	warm	2	57-61
johnny darter	<i>Etheostoma nigrum</i>	insectivore	cool	2	56-57
Total				4	

(Coker et al., 2001; MTO, 2006)

Appendix D List of Breeding Bird Species, OBBA

Common Name	Scientific Name	OBBA Category	Federal Status	Provincial Status	SRank
Common Loon	<i>Gavia immer</i>	confirmed			S5B, S5N
Great Blue Heron	<i>Ardea herodias</i>	confirmed			S4
Green Heron	<i>Butorides virescens</i>	confirmed			S4B
American Bittern	<i>Botaurus lentiginosus</i>	possible			S4B
Canada Goose	<i>Branta canadensis</i>	possible			S5
Mallard	<i>Anas platyrhynchos</i>	possible			S5
Wood Duck	<i>Aix sponsa</i>	possible			S5
Turkey Vulture	<i>Cathartes aura</i>	possible			S5B
Red-tailed Hawk	<i>Buteo jamaicensis</i>	possible			S5
Red-shouldered Hawk	<i>Buteo lineatus</i>	probable	SC		S5B
Broad-winged Hawk	<i>Buteo platypterus</i>	probable			S5B
Northern Harrier	<i>Circus cyaneus</i>	possible			S4B
Merlin	<i>Falco columbarius</i>	probable			S5B
American Kestrel	<i>Falco sparverius</i>	possible			S4
Ruffed Grouse	<i>Bonasa umbellus</i>	confirmed			S4
Wild Turkey	<i>Meleagris gallopava</i>	probable			S5
Sora	<i>Porzana carolina</i>	possible			S4B
Killdeer	<i>Charadrius vociferus</i>	probable			S5B, S5N
Upland Sandpiper	<i>Bartramia longicauda</i>	possible			S4B
American Woodcock	<i>Scolopax minor</i>	confirmed			S4B
Common Snipe	<i>Gallinago delicata</i>	possible			S5B
Rock Pigeon	<i>Columba livia</i>	confirmed			SNA
Mourning Dove	<i>Zenaida macroura</i>	probable			S5
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	confirmed			S5B
Barred Owl	<i>Strix varia</i>	possible			S5
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	confirmed			S5B
Belted Kingfisher	<i>Ceryle alcyon</i>	probable			S4B
Northern Flicker	<i>Colaptes auratus</i>	confirmed			S4B
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	confirmed			S5B
Hairy Woodpecker	<i>Picoides villosus</i>	probable			S5
Downy Woodpecker	<i>Picoides pubescens</i>	possible			S5
Pileated Woodpecker	<i>Dryocopus pileatus</i>	probable			S5
Eastern Kingbird	<i>Tyrannus tyrannus</i>	confirmed			S4B
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	confirmed			S4B
Eastern Phoebe	<i>Sayornis phoebe</i>	probable			S5B
Alder Flycatcher	<i>Empidonax alnorum</i>	possible			S5B
Least Flycatcher	<i>Empidonax minimus</i>	probable			S4B
Eastern Wood-Pewee	<i>Contopus virens</i>	probable			S4B
Olive-sided Flycatcher	<i>Contopus cooperi</i>	probable	THR	SC	S4B

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Common Name	Scientific Name	OBBA Category	Federal Status	Provincial Status	SRank
Tree Swallow	<i>Tachycineta bicolor</i>	possible			S4B
Bank Swallow	<i>Riparia riparia</i>	confirmed			S4B
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	confirmed			S4B
Barn Swallow	<i>Hirundo rustica</i>	confirmed		THR	S4B
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	possible			S4B
Purple Martin	<i>Progne subis</i>	possible			S4B
Blue Jay	<i>Cyanocitta cristata</i>	probable			S5
Common Raven	<i>Corvus corax</i>	probable			S5
American Crow	<i>Corvus brachyrhynchos</i>	confirmed			S5B
Black-capped Chickadee	<i>Poecile atricapilla</i>	confirmed			S5
White-breasted Nuthatch	<i>Sitta carolinensis</i>	probable			S5
Red-breasted Nuthatch	<i>Sitta canadensis</i>	probable			S5
Brown Creeper	<i>Certhia familiaris</i>	probable			S5B
House Wren	<i>Troglodytes aedon</i>	possible			S5B
Winter Wren	<i>Troglodytes troglodytes</i>	probable			S5B
Gray Catbird	<i>Dumetella carolinensis</i>	possible			S4B
Brown Thrasher	<i>Toxostoma rufum</i>	confirmed			S4B
American Robin	<i>Turdus migratorius</i>	confirmed			S5B
Wood Thrush	<i>Hylocichla mustelina</i>	probable			S4B
Hermit Thrush	<i>Catharus guttatus</i>	probable			S5B
Veery	<i>Catharus fuscescens</i>	confirmed			S4B
Eastern Bluebird	<i>Sialia sialis</i>	probable			S5B
Cedar Waxwing	<i>Bombycilla cedrorum</i>	probable			S5B
European Starling	<i>Sturnus vulgaris</i>	confirmed			SNA
Blue-headed Vireo	<i>Vireo solitarius</i>	probable			S5B
Red-eyed Vireo	<i>Vireo olivaceus</i>	probable			S5B
Warbling Vireo	<i>Vireo gilvus</i>	probable			S5B
Black-and-white Warbler	<i>Mniotilta varia</i>	probable			S5B
Nashville Warbler	<i>Vermivora ruficapilla</i>	probable			S5B
Yellow Warbler	<i>Dendroica petechia</i>	probable			S5B
Magnolia Warbler	<i>Dendroica magnolia</i>	probable			S5B
Cape May Warbler	<i>Dendroica tigrina</i>	possible			S5B
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>	possible			S5B
Yellow-rumped Warbler	<i>Dendroica coronata</i>	possible			S5B
Black-throated Green Warbler	<i>Dendroica virens</i>	probable			S5B
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	confirmed			S5B
Bay-breasted Warbler	<i>Dendroica castanea</i>	observed			S5B
Pine Warbler	<i>Dendroica pinus</i>	probable			S5B
Ovenbird	<i>Seiurus aurocapillus</i>	probable			S4B
Mourning Warbler	<i>Oporornis philadelphia</i>	probable			S4B
Common Yellowthroat	<i>Geothlypis trichas</i>	confirmed			S5B

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Common Name	Scientific Name	OBBA Category	Federal Status	Provincial Status	SRank
American Redstart	Setophaga ruticilla	probable			S5B
House Sparrow	Passer domesticus	confirmed			SNA
Bobolink	Dolichonyx oryzivorus	confirmed		THR	S4B
Eastern Meadowlark	Sturnella magna	probable		THR	S4B
Red-winged Blackbird	Agelaius phoeniceus	confirmed			S4
Baltimore Oriole	Icterus galbula	confirmed			S4B
Common Grackle	Quiscalus quiscula	confirmed			S5B
Brown-headed Cowbird	Molothrus ater	probable			S4B
Scarlet Tanager	Piranga olivacea	probable			S4B
Northern Cardinal	Cardinalis cardinalis	possible			S5
Rose-breasted Grosbeak	Pheucticus ludovicianus	confirmed			S4B
Indigo Bunting	Passerina cyanea	probable			S4B
Evening Grosbeak	Coccothraustes vespertinus	confirmed			S4B
Purple Finch	Carpodacus purpureus	confirmed			S4B
American Goldfinch	Carduelis tristis	confirmed			S5B
Savannah Sparrow	Passerculus sandwichensis	possible			S4B
Grasshopper Sparrow	Ammodramus savannarum	possible			S4B
Vesper Sparrow	Pooecetes gramineus	possible			S4B
Chipping Sparrow	Spizella passerina	confirmed			S5B
Field Sparrow	Spizella pusilla	possible			S4B
White-throated Sparrow	Zonotrichia albicollis	confirmed			S5B
Swamp Sparrow	Melospiza georgiana	confirmed			S5B
Song Sparrow	Melospiza melodia	confirmed			S5B

Ranking Updated February 22, 2012

SRANK DEFINITIONS

S4 Apparently Secure, Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 Secure, Common, widespread, and abundant in the nation or state/province.

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

S#S# Range Rank, A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

SAB Breeding accidental.

SAN Non-breeding accidental.

SZB Breeding migrants/vagrants.

SZN Non-breeding migrants/vagrants.

SARO STATUS DEFINITIONS

THR Threatened: A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.

SC Special Concern: A species with characteristics that make it sensitive to human activities or natural events.

SARA STATUS DEFINITIONS

THR Threatened, a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

SC Special Concern, a wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

Appendix E Eel Memo (November 29, 2011)

MEMO

Date: November 29, 2011
To: Tami Sugarman
From: Michelle Lavictoire
Regarding: American eel and Renfrew Dams

Tami,

As per our discussion stemming from our visit with the Algonquins of Ontario (AoO), I offer the comments below on the American eel as it pertains to downstream and upstream bypasses at Renfrew Power Generation (RPG). This information is based on a literature search of this species' general biology as it relates to movement and provides a summary of mitigation measures which have been implemented in North America and Europe. The European eel has been included in this discussion as is a relative abundance of scientific papers relating to them. Furthermore, this species has been used by others in the development of management practices for American eels (Jessop 1987). The discussion below begins with eel movement, followed by mitigations measures and recommendations for RPG's Renfrew facility.

Eel Movement

The following provides a summary of existing information on timing and duration of eel movement, and the potential environmental triggers for migration followed by a discussion of eel behaviour at waterpower facilities and / or their bypasses.

Timing and Duration of Movement

Our knowledge of eel migrations in Ontario stems primary of from data collected from the upper St. Lawrence River. The analysis of eel passage on ladders indicates that downstream and upstream migration on the St. Lawrence River in Cornwall may occur anywhere between June and October (pers. comm. Alastair Mathers, EPRI 2001). This timing window is currently being applied across Ontario. However it is important to note that data collected with respect to migration patterns in the St. Lawrence may not necessarily be directly applicable to eel migration patterns in the Bonnechere River as indicated in the following.

The upstream movement of the species on a tributary to the Hudson River in New York was documented between May 15 and September (Schmidt et al. 2009). Winter et al. (2006) reported that downstream movement may occur between February and June; the downstream movement

of European eel is typically much shorter (between late October and early November). Data collected on smaller systems, including the Nive River in France (80 km long, flow range 6-300 cms) indicates much narrower downstream migration periods occur. Gosset et al. (2005) described the downstream passage for European eels as containing several runs lasting a maximum of 4 days, between which there is little movement. The peak movement occurred over a two week period (Gosset et al. 2005). Acou et al. (2008) indicated that European eels migrated between August and April with 90% of the population migrating over a 2 week period. Carr and Whoriskey (2008) reported that American eel migration on the Magaguadavic River in New Brunswick (river length to the estuary is 96 km) occurred over a three month period in autumn, with peak migration lasting 4 weeks. It therefore appears that migration can occur over extended timeframes however most studies concluded that peak movement tends to occur over a narrower (2-4 weeks) window. The longer migration periods, especially within the larger systems such as the St. Lawrence River, may be reflective of several groups of eels migrating from, and to, smaller watersheds and sub-watersheds. An interesting side note on movement from Jessop (1987) is that smaller females and males of all sizes migrate upstream earlier than larger females and that this movement occurs prior to peak movement.

While available scientific data provides some insight into migration patterns, the application of traditional knowledge is also valuable. Discussions with RPG's Peter Boldt have indicated that eels were witnessed moving upstream under the wood slave penstock at the Lower Plant GS as late as the 1950s. Water loss from the wood penstock would have served as an indicator to the eels that an upstream passage was available. Documentation of eels travelling on land is widely available. The particular movement pattern witnessed at Renfrew also suggests that the species can be attracted to very little water and low water velocities. Aboriginal Traditional Knowledge (ATK) recently provided from participants in a meeting held between the project team and Algonquin Nations Representatives indicated that eels were known to accumulate below First Chute during the early spring spawning season, specifically during the sucker spawn. Depending on whether the suckers in question were white suckers or redhorses this may indicate that the eels were accumulating as early as April (white suckers) or later in May after the spring floods had receded (redhorses). The potential for eels to be congregating at First Chute may merit investigation

Potential Environmental Triggers to Movement

Several studies have targeted or provided comment on possible environmental factors that trigger eel migration. The most commonly cited significant triggers are:

- Lunar cycle / dark nights (Durif et al. 2002, EPRI 2001, Hildebrand 2005, McCarthy et al. 2008 Schmidt et al. 2009);
- Periods of high flow (Durif et al. 2002, EPRI 2001, Hildebrand 2005, McCarthy et al. 2008, Schmidt et al. 2009); and

- Storm events / heavy rainfall events (Durif et al 2002, McCarthy et al. 2008).

A review of these studies presents conflicting data. Durif et al. (2002) found that the downstream migration of eels did not relate to the moon phase but rather to a rapid drop in water temperature from 15°C to 10°C. This correlates somewhat with the discussion presented in EPRI (2001) that identifies downstream movement occurring when water temperature is between 3-18°C, with peak movement occurring between 9-12°C however peak movements have been documented on the St. Lawrence River at water temperatures over 20°C. While not statistically significant, Schmidt et al. (2009) noted that upstream American eel movement occurred only when water temperatures were above 12°C, with 20°C corresponding to the peak movement period. McCarthy et al. (2008) found that the lunar effect was secondary to the affect of spillage as a trigger for migration.

Other factors which have previously been examined include barometric pressure and local precipitation by Hildebrand (2005), and turbidity and conductivity increases and decrease in air pressure by Durif et al. (2002); these were concluded to be insignificant by the authors.

Eel Behaviour at Waterpower Facilities and their Bypasses

Two key items were identified as affecting eel behaviour at waterpower facilities during the literature search, the first being the location of eels within the water column during migration, and second, the effects of intake approach velocities and trash racks. The location of the bypass and its hydraulics (i.e. velocities, depth, turbulence, etc.) at the entrance are the key factors in determining bypass success (Amaral 2003). Some research has been conducted comparing the effects of bypass entrances sited at the top of, versus bottom of the dam (USFWS, Gosset et al. 2005). Studies completed by both Durif et al. (2002) and Gosset et al. 2005) indicate that eels appear to be more attracted to bottom bypass channels. When given an option, European eels also appeared to choose the bottom bypass. The cost of a bottom bypass channel can be significant since it requires the regulation of higher velocities at the bottom, and it is not always possible at existing infrastructure (Gosset et al. 2005). The authors also reported that top bypasses have proven successful and are easier to maintain (Gosset *et al.* 2005). It was hypothesized that the preference for bottom bypasses was a result of the eels migrating in the bottom of the water column. Russon et al. (2010) found during experimental work conducted with European eels, the species typically moved along the edge of the walls or the bottom of the channel floor (or a combination of both). In the wild, American eels have been described as poor swimmers preferring to move upstream along areas with low-current, for example along banks (Cairns et al. 2004). While eels have been documented as being able to scale vertical walls, it must be noted that this applies only to individuals measuring less than 11 cm (much smaller than those which would be found in the Bonnechere River). Longer specimens require some level of incline to travel upstream (Cairns et al. 2004).

Russon et al. (2010) completed experiments with European eels to determine trash rack angle and to document the effect of angle on eel movement patterns. The study utilized the standard European trash rack design (with a gap of 12 mm). It was determined that angles $<45^\circ$ performed the best to prevent impingement (Russon et al. 2010). The authors also reported that eels were able to escape impingement / entrainment from racks with approach velocities of up to 0.9 m/s (Russon et al. 2010). A separate study published by Gosset et al. (2005) recommended that trash rack bars be spaced to provide approximately 20 mm gaps, and that an approach velocity of approximately 0.3m/s be provided since the closer the spacing, the slower the approach velocity required to prevent impingement. Other research suggests that impingement occurs at velocities greater than 0.5 m/s to 0.6 m/s (EPRI 2001, Verrault and Therrien). EPRI (2001) research indicates that faster approach velocities can be mitigated through the use of wedge-wire screens, commenting that impingement during downstream migration is likely a factor of the size and health of the individuals.

Lighting has been used as a method to direct the eels away from turbines and towards bypasses. Eels are reportedly repelled by light, particularly by the blue-green end of the spectrum (EPRI 2001). The lights appear to work best when they are directed downward at approximately 35° to the current, and have a candle power ranging from 0.25 to 5.3 cp (EPRI 2001). However as this method tends to function best in clear, shallow water (max. depth 1.3 m) with slow to moderate currents (up to 0.76 m/s) (EPRI 2001, Verreault and Therrien) it is not recommended for Renfrew due to the high turbidity and water depth at the dams.

Mitigation Measures and Recommendations for Renfrew

In order to prevent eel mortality at waterpower facilities, a system that deters eels from entering turbines needs to be coupled with one that attracts the eels to an alternative path over or through the dam, a bypass. Some success in repelling eels has been obtained with trash racks or wedge-wired screens as well as lights. Other methods such as electricity and noise have so far been unsuccessful (EPRI 2001).

Based on the information obtained from the literature review and the ATK (summarized above), it is possible that eel movement into and from the Bonnechere River could occur anytime between April and October. The duration of the peak migration windows is unknown, but it is anticipated that once the population becomes re-established (through the implementation of the provincial recovery strategy) the ability to predict the timing of migration will improve. This will also lead to the identification of a narrower migration window.

It is proposed that eels be repelled from the intakes at the Renfrew facility using an inclined trash rack. This trash rack should be in place between June and October (as the reported earlier

migration was associated with upstream movement only). The dimensions of the trash rack should be based on the recommendations provided by Gosset et al. (2005) set at an incline of 25° with bar spacing of 20-30 mm. The literature review indicates that the approach velocity should be between 0.3 m/s and 0.9 m/s. Currently the European Union recommends 0.5 m/s however Russon et al. (2010) suggests that this is too modest. Since the Renfrew facility includes existing infrastructure, it is recommended that an approach velocity of no more than 0.6 m/s be included in the engineering design of the Thomas Low GS with a slower velocity being preferred. It is anticipated that these proposed measures will be sufficient to minimize or eliminate eel mortality through impingement and entrainment.

The following considerations are for eel movement downstream and upstream of the two dams. Note that RPG and MNR are presently conducting research on the numbers of eels trying to migrate over Dam #2.

Possible methods for the downstream and upstream eel passage have to date been discussed with the MNR and DFO. Subsequent to a recent discussion with the AoO it is anticipated that the sharing of ATK towards the location and design of these measures will be possible. The following is presented for discussion purposes only.

Based on the literature review and consultation with the AoO and RPG staff, there are several possible alternatives which may be used to provide eel passage for downstream and upstream migration, or both. These include: spillage slides, culverts around the dam, culvert through Dam #1 and grassy swales. It is noted that the following includes new and previously discussed alternatives.

Spillage Slides

Studies suggest that the majority of the downstream movement of European eels occurs during periods of spillage. As such, this “natural” tendency could be encouraged by allowing eels to spill over using a slide with a downstream plunge pool, where required. A spillage slide could be added at two locations, at the dams and/or at the canal. In essence, the idea is to provide safe passage from the top of the dam / canal and ending in a plunge pool. Eels could be attracted to the slides through the creation of areas of high turbulence at the upstream end (eels actively search for areas with the highest discharge and turbulence Russon et al. 2010). The possible addition of a ramp on the upstream side of the slides leading to the dams could encourage the use of this area since the literature indicates that eels tend to move along the bottom. It is recognized that should a slide be provided at the canal, additional trash rack monitoring may be required to ensure that the rack, velocities and the eel’s urge to move upstream are sufficient to prevent impingement / entrainment.

Culvert around Dam #2

One of the original options discussed with regulators for upstream movement at Dam #2 is a narrow culvert with cobbles or cement knobs cemented in place to help the eels move up the incline. The culvert would be wetted and could be designed for both upstream and downstream passage.

Culvert through Dam #1

A culvert through Dam #1 is a viable option since significant repairs to the dam are required, creating an opportunity to place a culvert through one of the sluices (away from the intake canal). This culvert would also be knobbed and be wetted.

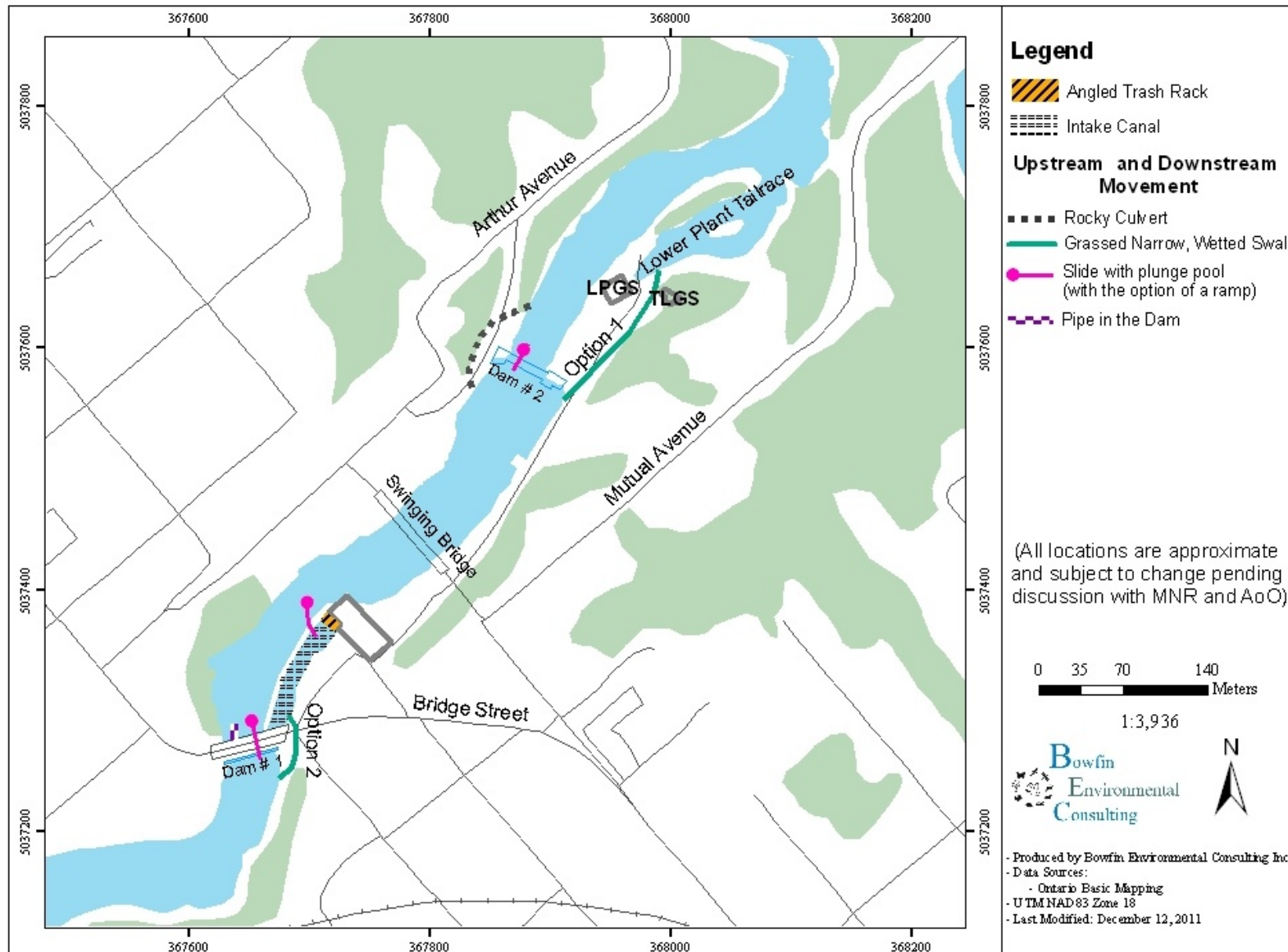
Grassy Swales

The creation of grassy swales is presently the preferred alternative for the provision of upstream and downstream passage at both Renfrew dams. Not only is this alternative economically viable but the swales would also mimic past eel migration patterns observed at the Renfrew facility during the 1950s. The passage around Dam #2 would mimic the historical migration route as understood by the current operator (below the former wood stave penstock). This route would extend from the Lower Plant tailrace or the mainstem, under the existing Lower Plant penstocks and exit at the headwater pond. The eels would then have to find their way to the next upstream passage. The second option is a passage that would connect the headpond to upstream of Dam #1. The swales may require berming or short concrete barriers to guide the eels to their destination. This alternative may also potentially require fencing or other method of protection to prevent poaching of the eels. Another possible solution might be to involve volunteers to act as spotters during the migration period. It is noted that the grassy swale around Dam #2 would need to be installed on the same side as the intake for the Lower Plant. This could result in a targeted seasonal shut down of the Lower Plant or possibly the installation of an angled trash rack. Since TLGS would be the primary generating station, the seasonal shutdown of the Lower Plant remains a feasible option.

Concluding Remarks

The American eel population within the Bonnechere River is presently thought to be quite low which will make the identification of migration timing and patterns difficult. This will also present a challenge for monitoring the effectiveness of the selected bypass features. The low population however affords time for discussion, and for the gathering and inclusion of ATK towards determining the best course of action. This may result in the identification of additional alternatives that may be identified through ATK and on-going research, ultimately resulting in the creation of successful bypasses thereby contributing to the recovery of the species within the Ottawa River watershed.

Eel Passage Alternatives



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Personal Communications

Alastair Mathers, Biologist with Lake Ontario Management Unit. Telephone 613.476.3255.

BHA #117
Michelle Lavictoire
4590 Chapel Rd RR#1
Martintown, ON K0C 1S0

Date: August 6, 2009

Proponent:

Renfrew Power Generation Inc.
32 Bridge Ave.
Renfrew, ON K7V 3R2
Attn: Mr. Peter Boldt

Re: Raglan St. South Property, Renfrew Lot 13 Concession 2.

Dear Mr. Boldt:

This letter is in regard to my assessment of the butternut trees on your property and is being copied to the Species at Risk Biologist of the Ontario Ministry of Natural Resources (MNR) Pembroke District Office. An inventory of the butternut trees located within and adjacent to the area which would be disturbed for the proposed construction of Clear Point Hydroelectric Facility was made. While twelve Butternuts and four potential Butternut hybrids were inventories, only those trees which may be impacted by the proposed construction were assessed (#1-#6 and #12, H1 and H2).

MNR may contact you regarding the need for audit of my assessment within 3 weeks of receiving a copy of this letter. It is requested that no trees (including those assessed to be non-retainable) be harmed or removed for 3 weeks to allow MNR a chance to notify you about a potential audit on the assessment.

As a qualified Butternut Health Assessor (BHA), I am providing the following comments about the Butternut trees I located and assessed at the above noted property during the site visit on August 5, 2009.

These trees were numbered sequentially with white paint on the larger specimens and pink flagging tape with numbers on the smaller specimens. Those marked as H before the number signified that they were suspected hybrids.

Non-retainable tree(s)

There were no non-retainable trees assessed within the area to be disturbed.

Hybrid tree(s)

The following tree(s): H1, H2, H3 and H4 are likely hybrid Butternut trees based on the thickness of the pith in 2 year old twigs. Photographs of the twigs of H1 and H2 are attached at the end of this letter. H1 and H2 are located under the power lines at the top of the cliff. H1 and H2 were assessed. H3 and H4 were located on the cliff and adjacent to Butternut Tree #3 and were not flagged nor were they assessed. These two specimens are located at UTM 367860E 5033757N (they are located within one meter of each other). Both specimens were less than 2 m tall and their crown was 100% live. Note that an active ground hornet nest is present at this site.

If OMNR confirms that these trees are hybrids, then they are not afforded protection under the Endangered Species Act, 2007. Hybrid trees can be removed if desired. If OMNR determines that these species are pure butternuts, then all four be considered retainable.

Retainable tree(s)

All of the Butternut trees inventories are considered retainable and meet the retention criteria and are ***protected from killing or harm*** under the ESA 2007. A protective buffer of 25m radius from the bole of the Butternut is required to prevent root disturbance. In this buffer area, operations such as excavating or paving that would remove or significantly compact the roots and soil, and cause direct harm to the tree are not permitted. Removal of other vegetation and careful logging practices within this radius are permitted.

Other butternut not located during this assessment:

Please be advised that butternut trees other than noted here, that are located or are naturally regenerating on this property must also be assessed by a BHA if their removal is being considered.

Permits may be issued by the MNR for the removal of **retainable trees**. **In order to apply for a permit for the removal of retainable trees you must contact your local district MNR Species at Risk Biologist to discuss this matter further.**

Please retain this letter as proof of a Butternut Health Assessment performed on the above noted property and any other documentation you may receive from the MNR should an audit of the assessment occur.

If you have any questions, please do not hesitate to contact the undersigned Butternut Health Assessor, or the MNR District Species at Risk Biologist. www.mnr.gov.on.ca

See the attached information sheet for more information on Butternut and the Endangered Species Act (ESA, 2007).

Sincerely,

A handwritten signature in blue ink that reads "Michelle Lavictoire". The signature is written in a cursive style and is placed on a small, light-colored rectangular piece of paper.

Michelle Lavictoire #117
Tel: 613.528.1303



Photo 1 Looking at the pith of H1



Photo 2 Looking at the pith of H2