PROPOSED RANNEY FALLS GENERATING STATION G3 EXPANSION PROJECT

DETAILED ENVIRONMENTAL IMPACT ANALYSIS REPORT

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EXECUTIVE SUMMARY

Ontario Power Generation Inc. (OPG) is proposing to expand the capacity of its Ranney Falls Generating Station (GS) located on the Trent-Severn Waterway (TSW) in the Municipality of Trent Hills. There are two powerhouses on site. The main powerhouse has the G1 and G2 turbine units, each operating at approximately 5 MW during maximum flows. A secondary powerhouse, referred to as the "Pup", contains the 0.72 MW G3 unit that ceased operations in June 2014.

Based on a Feasibility Study for the proposed Ranney Falls GS G3 Expansion Project (Ranney Falls G3 Project or Project), it was determined that a new G3 unit of up to 10 MW could be installed at the Ranney Falls GS site. This would increase total station capacity to approximately 20 MW. The "Pup" powerhouse would be decommissioned but the building will be left in place.

The proposed Ranney Falls G3 Project is being undertaken by OPG to improve the efficient use of the available hydroelectric potential at the site, to reduce greenhouse gas emissions and to increase the amount of clean renewable energy from OPG's Central Operations (COs). The Panel on the Future of the Trent-Severn Waterway (PFTSW, 2008) concluded that the development of renewable energy resources is a sound public policy goal and supported a vigorous effort to pursue green energy generating potential along the TSW. The proposed Project is consistent with the Provincial Policy Statement, which recommends that the use of existing infrastructure and public service facilities should be optimized, whenever feasible, before consideration is given to developing new infrastructure and public service facilities (OMMAH, 2014). OPG will operate the proposed expanded Ranney site within historical water levels (since 1951) and existing water management practices with a flow up to 171 cms at the Ranney site. There will be no increase in water levels operating the proposed site.

Spillway discharge capacity for flood control at Dam 10 (Ranney Falls) is the sole responsibility of the Trent-Severn Waterway (Parks Canada). Installation and operation of a new spillway to be built between the existing and new powerhouse to bypass powerhouse flows in the event of an emergency shutdown of the unit is the responsibility of OPG. The Spillway operation will minimize wave surge and mitigate any rapid increase in water level associated with unplanned station shutdown. The design for the new spillway will be developed during the next stage of development (Interim Licence) whereby General Construction Plans are prepared for the review and approval by the Parks Canada Agency.

This Detailed Environmental Impact Analysis (DIA) Report was prepared to fulfill federal department obligations to the *Canadian Environmental Assessment Act, 2012 CEAA,* section 67*.* Parks Canada's legal accountability under CEAA 2012 is to ensure that project activities undertaken on the lands it manages do not result in significant adverse effects (Section 67 CEAA 2012). Parks Canada has jurisdiction over the bed of the canal at Ranney Falls. The DIA Report provides a description of the proposed undertaking, summarizes the overall

environmental setting and anticipated environmental effects, recommends appropriate mitigation measures to minimize or obviate these effects, and describes public, agency and Aboriginal consultation. More detailed information on the environmental setting, anticipated environmental effects and recommended mitigation measures is provided in four Technical Support Documents (TSDs) addressing the aquatic environment, terrestrial environment, land use and socio-economic environment, and cultural heritage resources. Two additional TSDs provide a more detailed description of outcomes of public and government agency, as well as First Nation and Métis Nation of Ontario, consultation and engagement.

An Open House was held on the project on June 17, 2015 and over twenty-four individuals attended that meeting. No individuals indicated an opposition to the proposed Project and several people indicated support for it. However, a number of questions were asked about the Project and a few local residents raised questions with respect to traffic, noise and potentially other nuisance effects. Responses were provided to them and OPG takes the position that it is always willing to listen to concerns and issues and address them wherever possible.

Based on assessment of the available baseline information and potential effects, as well as the implementation of the recommended mitigation measures, it is concluded that effects due to construction activities associated with the proposed Project will be minimal, localized and short-term. It is anticipated that substantial economic benefits will be realized by Campbellford and other local communities due to the supply of required goods and services during the construction phase.

Based on assessment of the available baseline information and potential effects, as well as the implementation of the recommended mitigation measures, it is concluded that the operation of the proposed Project will have negligible effects on the environment.

1.0 INTRODUCTION

This Detailed Environmental Impact Analysis (DIA) Report was prepared to fulfill federal department obligations to the *Canadian Environmental Assessment Act, 2012 CEAA,* section 67*.* Parks Canada's legal accountability under CEAA 2012 is to ensure that project activities undertaken on the lands it manages do not result in significant adverse effects (Section 67 CEAA 2012).

As the proposed Ranney Falls G3 Project is on a federal waterway and subject to the federal *Dominion Water Power Act* administered by Parks Canada, it is not subject to the Ontario *Environmental Assessment Act (EA Act)*. The proposed Project is also exempt from the Lower Trent Conservation (LTC) Permit for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses under Ontario Regulation 163/06 of the *Conservation Authorities Act* (M. Lovejoy, LTC, 2012, pers. comm.).

As part of the federal government plan for Responsible Resource Development, which seeks to modernize the regulatory system for project reviews, *Canadian Environmental Assessment Act* (S.C. 1992, c. 37) was recently repealed when the *Canadian Environmental Assessment Act, 2012* (*CEAA 2012*) came into force. For projects on federal lands that are not designated projects, *CEAA 2012* requires that before federal authorities make any decision that would allow a project to proceed, they must determine whether a project is likely to cause significant adverse environmental effects. As *CEAA 2012* does not establish a process for determining whether the undertaking of a non-designated project is likely to cause significant adverse environmental effects, the involved federal departments, e.g., Parks Canada, Department of Fisheries and Oceans (DFO), Environment Canada, Transport Canada, must establish their own (or conduct joint efforts) for the environmental effects review process. Parks Canada has jurisdiction over the bed of the canal at Ranney Falls.

As the proposed Ranney Falls G3 Project occurs within a Parks Canada protected heritage area, the Trent-Severn Waterway National Historic Site of Canada, Parks Canada – Ontario Waterways, Trent-Severn Waterway (Parks Canada – TSW) is responsible for review of the draft DIA Report, determination of significance of effects, and approval of the Project with conditions, or rejection with explanation.

The DIA Report together with Technical Support Documents (TSDs) provides the requisite information to enable the involved federal departments to undertake the environmental effects review process.

This DIA Report follows the guidance provided within the Terms of Reference (ToR) for the proposed Ranney Falls G3 Project (SENES, 2015), which was finalized based on review by the Federal Review Team which included Parks Canada – TSW, DFO, Environment Canada and Transport Canada. The draft ToR was also reviewed by the Ontario Ministry of Environment and Climate Change (MOECC) and Ontario Ministry of Natural Resources and Forestry

(MNRF). The final ToR forms the basis for the environmental effects review process for the proposed Project. This DIA Report and TSDs were prepared by OPG for review by the Federal Review Team, MOECC and MNRF.

Based on technical information provided by OPG, DFO has determined that the proposed Project "is not likely to result in impacts to fish and fish habitat provided that additional mitigation measures are applied" (see Section 4.1.4.8). Based on the Letter of Advice (LOA) dated July 17, 2012, a formal approval from DFO is not required (C. Strand, DFO, 2012, pers. comm. and follow-up DFO Fisheries Protection email dated July 31, 2014).

Environment Canada, Canadian Wildlife Service (CWS), has approved the "Turtle Nesting Habitat Mitigation Plan" prepared by OPG to create and enhance access and nesting habitat for Northern Map Turtle (*Graptemys geographica*) and Eastern Snapping Turtle (*Chelydra serpentina serpentina*), both designated as Special Concern federally and provincially (K-A. Fagan, Environment Canada, 2012, pers. comm.) (see Section 4.1.3). An In-water and Shoreline Work Permit Application was submitted to Parks Canada – TSW on December 9, 2014 to obtain approval for implementation of the Plan under the Historic Canals Regulations pursuant to the *Department of Transport Act*.

As the Trent River/Canal from Rice Lake to Lake Ontario is included in the *Navigation Protection Act* (*NPA*) List of Scheduled Waters, an application (Notice of Works Form) for approval of the proposed Project was submitted by OPG to Transport Canada on December 19, 2014. OPG subsequently received a letter dated December 30, 2014 from Transport Canada indicating that the information provided by OPG was complete for the purpose of commencing agency review.

2.0 PROJECT

2.1 SCOPE OF PROJECT

The Ranney Falls Generating Station (GS) site was formerly leased by the Federal Government to the Seymour Power Company. With its purchase of the Seymour Power Company on March 9, 1916, ownership rights to the site were acquired by the Province. Ranney Falls GS G1 and G2 units were commissioned in August 22, 1922 and September 2, 1922, respectively. Unit G3, which started operation in 1926, was acquired by the Hydro-Electric Power Commission of Ontario from the Quinte and Trent Valley Power Company in 1937. Ranney Falls GS was transferred to OPG on April 1, 1999, and is managed by OPG's Central Operations (COs) with remote operation from its North Bay Control Centre and maintained by its Campbellford Service Centre.

OPG is proposing to expand the capacity of its Ranney Falls GS that is located on the Trent-Severn Waterway (TSW) within the community of Campbellford in the Municipality of Trent Hills (Trent Hills), Northumberland County (Figure 2.1). There are two powerhouses on site (Figure 2.2). The main powerhouse has the G1 and G2 turbine units, each operating at approximately 5 MW during maximum flows. A secondary powerhouse, referred to as the "Pup", contains the 0.72 MW G3 unit that ceased operations in June 2014.

Ranney Falls GS was first identified by Ontario Hydro (1992) to be within the scope of the Small Hydroelectric Assessment and Retrofit Program (SHARP) for assessment of its long-term viability as a generating resource. The SHARP was established as a formalized approach to address operational optimization of the 33 existing small and ageing hydroelectric stations within the hydraulic generation system. Based on the criteria for age, capacity and operating condition, the SHARP identified Ranney Falls GS as a potential opportunity for renewal and improvement.

As a result, a Concept Phase Study for the Ranney Falls GS was undertaken by KST Hydroelectric Engineers (KST, 1992) to review all available project options and recommend a preferred alternative, as well as to identify the detailed engineering and environmental studies and their associated costs for the Definition Phase. Due to the cancellation of the SHARP, further work associated with the redevelopment of Ranney Falls GS was terminated.

Figure 2.1 Project Location

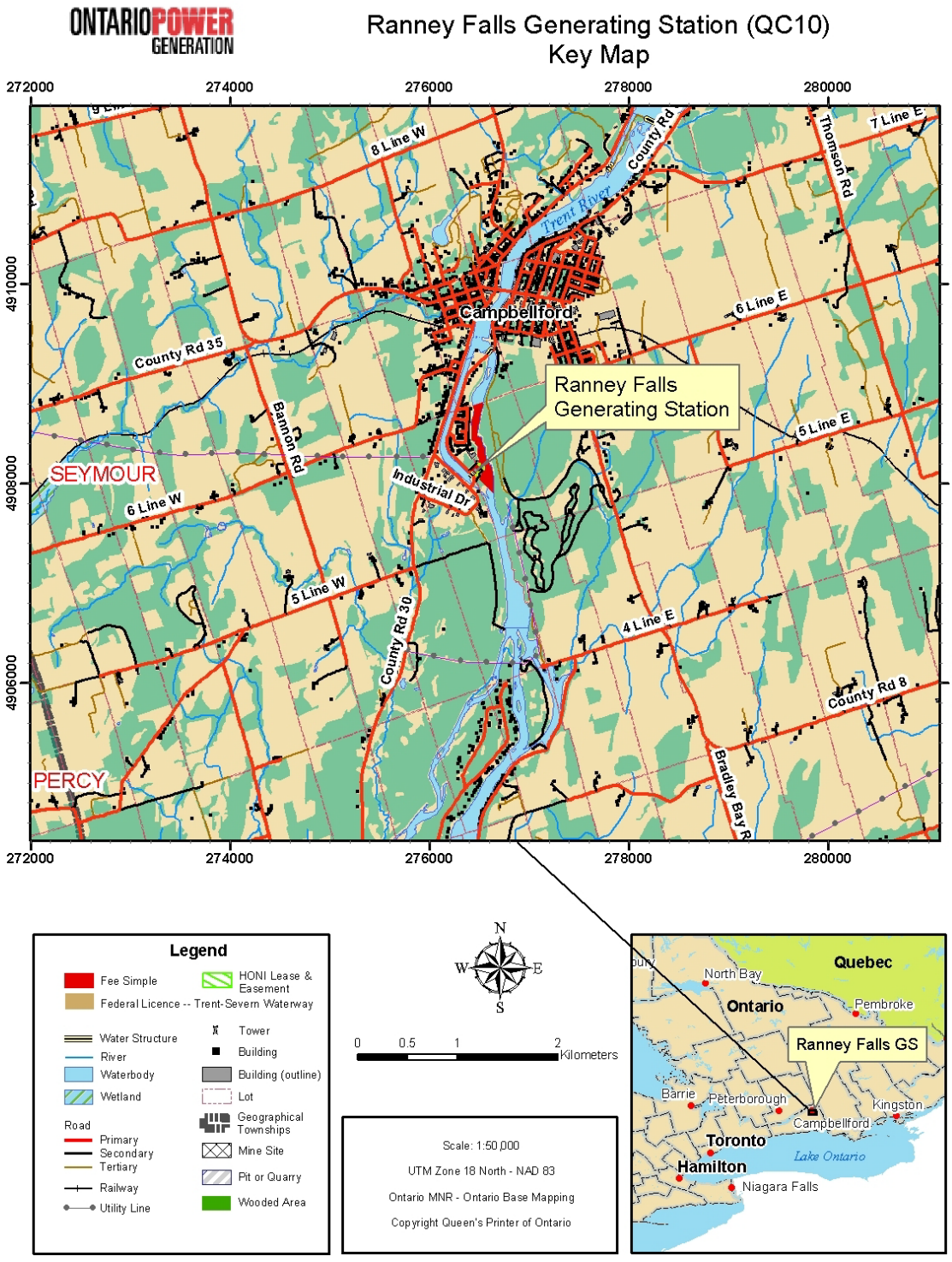


Figure 2.2 Aerial Photo of Ranney Falls GS Setting

In 2005, OPG again initiated a site evaluation and an assessment of concept alternatives for Ranney Falls GS expansion focusing on the redevelopment of the secondary "Pup" powerhouse. A Feasibility Study was completed in 2006, establishing that a new unit of up to 10 MW could be installed at the Ranney Falls GS site (Hatch Acres, 2006). This would increase the total station capacity to approximately 20 MW and result in total average annual generation of 83 GWh (an increase of 30.4 GWh). However, the project was deferred by OPG prior to initiation of the Definition Phase.

Based on the preliminary studies undertaken by KST (1992) and Hatch Acres (2006), OPG has concluded that the existing installed capacity does not make optimal use of the total water available (mean annual flow of approximately 118 m^3/s). As a result, OPG has identified an opportunity to expand its capacity by replacing the secondary "Pup" powerhouse with a new unit having an incremental capacity of up to 10 MW (OPG, 2011a).

Since 2006, the scope of the project including its layouts was further optimized and the proposed Ranney Falls G3 Project includes the following:

- expansion of the existing forebay;
- construction of a new G3 powerhouse with a new intake structure and 10 MW turbine unit adjacent to the existing main powerhouse;
- expansion of the existing tailrace channel;
- construction of a new electrical substation to connect with one of the Hydro One Networks Inc. (Hydro One) local distribution lines on site;
- construction of a new spillway to by-pass station flow to the tailrace channel for emergency situations;
- decommissioning the "Pup" powerhouse;
- rehabilitation of the forebay intake structure and its operating deck (work platform) adjacent to the roadway/TSW bridge;
- relocation of the existing upstream boom; and
- creation of enhanced habitat for Northern Map Turtle and Eastern Snapping Turtle and installation of fencing to prevent turtles accessing the construction area.

2.2 BACKGROUND

2.2.1 Purpose and Justification

The proposed Ranney Falls G3 Project undertaken by OPG is to improve the efficient use of the available hydroelectric potential at the site, to reduce greenhouse gas emissions and to increase the amount of clean renewable energy from OPG's COs, without any changes to the overall flow within the Trent River or to existing TSW water management. The proposed Project is consistent with the Provincial Policy Statement (PPS), which recommends that the use of existing infrastructure and public service facilities should be optimized, wherever feasible,

before consideration is given to developing new infrastructure and public service facilities (OMMAH, 2014).

The Ranney Falls GS is located on OPG land adjacent to Lock #11 and #12 of the TSW, which is designated as a National Historic Site of Canada. Water levels and flows in the Trent River and Trent Canal are managed by Parks Canada – TSW staff to:

- permit safe navigation;
- lessen flooding of agricultural, residential and commercial property;
- provide for recreational activities;
- protect fish and wildlife habitat;
- help maintain water quality; and
- generate green hydroelectric power.

Parks Canada – TSW staff work cooperatively with the MNRF and DFO to protect fish spawning areas and other wildlife habitat, as well as with local Conservation Authorities to reduce flooding. Parks Canada – TSW staff are also in daily contact with OPG, other public utilities and private interests, which operate and maintain generating stations within the TSW drainage basins.

A management plan for the TSW National Historic Site received ministerial approval in 2000 (Parks Canada, 2000). The Panel on the Future of the Trent-Severn Waterway (PFTSW, 2008) was mandated in 2007 to assess and make recommendations to the federal Minister of the Environment concerning the future contributions and management of the TSW. The PFTSW review pre-empted the typical five-year management plan review cycle. The process to develop a new management plan began in late 2011, and was subsequently postponed following a review of the management plan cycle. The next management plan review is scheduled for completion in 2018.

In addition to other considerations, the PFTSW considered “ways in which the Waterway can contribute to economically sustainable communities, including the role of renewable energy.” The PFTSW concluded that the development of renewable energy resources is a sound public policy goal and supported a vigorous effort to pursue the potential for generation of green energy along the TSW. The PFTSW acknowledged that the *Canadian Environmental Assessment Act* (*CEAA*), if applied knowledgeably and rigorously, provides the process and regulatory instrument for proposed hydroelectric projects to ensure the protection of natural and cultural values of the TSW. *CEAA* (S.C. 1992, c. 37) was repealed when the *Canadian Environmental Assessment Act, 2012* (*CEAA 2012*) came into force (see Section 1.0).

Northumberland-Quinte West MPP Rob Milligan held a public meeting on February 18, 2012 in Campbellford to promote new waterpower developments within the provincial riding with 37 potential hydroelectric sites identified that, if developed, could generate 21 MW of electricity, providing power to between 15,000 and 18,000 homes. The sites include old lumber and grist mills, as well as sites along the TSW.

2.2.2 Alternatives and Alternative Means

Alternative 1- Redevelopment

OPG has concluded that the existing installed capacity of Ranney Falls GS does not make optimal use of the total water available at the site. As a result, OPG has identified an opportunity to expand its capacity by replacing the "Pup" with a new unit having an incremental capacity of up to 10 MW (OPG, 2011a).

Alternative 2 – Status quo

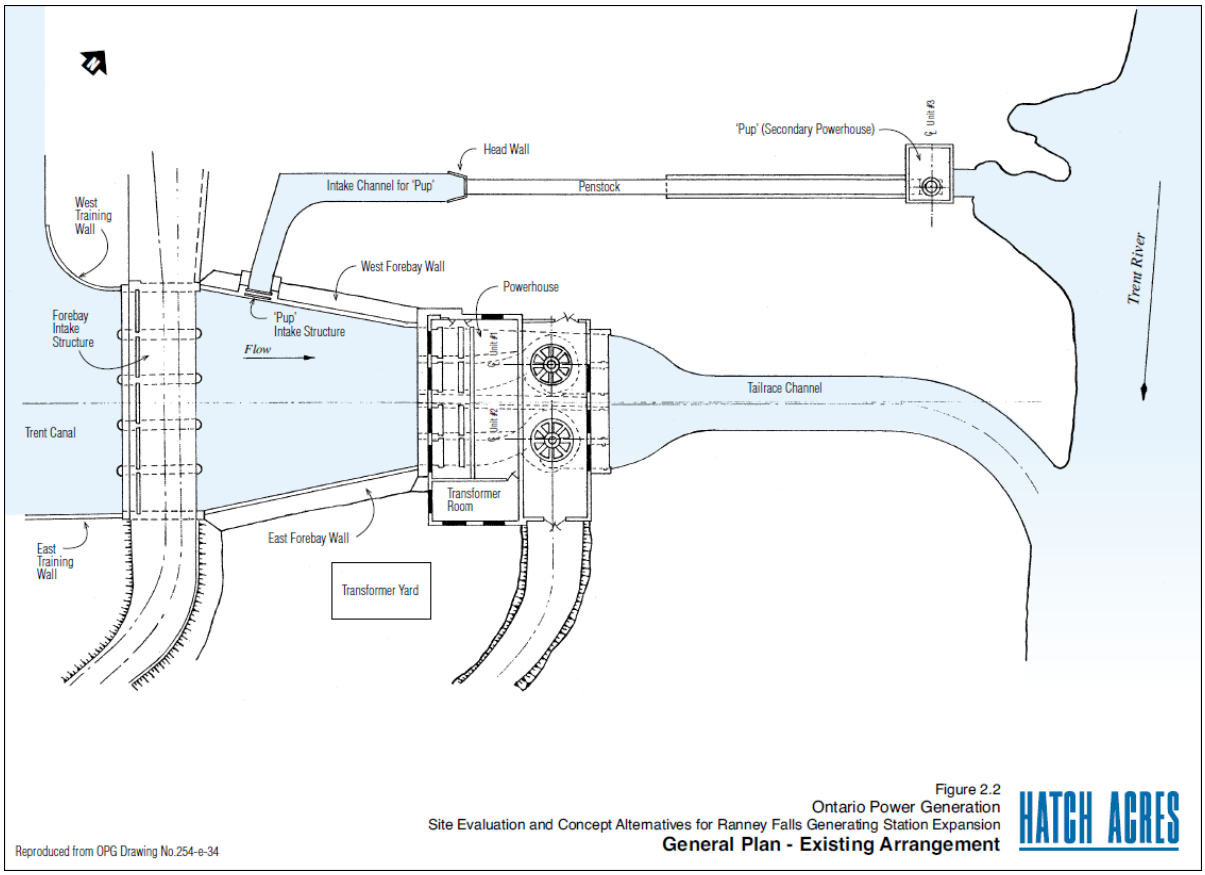
Maintenance of the "status quo" would result in the loss of hydroelectricity production capacity of 0.72 MW due to the decommissioning of the "Pup". It would also preclude the opportunity to expand the capacity of the Ranney Falls GS by replacing the "Pup" with a new unit having an incremental capacity of up to 10 MW.

2.2.3 Existing Conditions

The existing Ranney Falls GS consists of a forebay intake structure, forebay, the main powerhouse and its tailrace, the Pup and its Intake, penstock and tailrace, and storage facilities (see Figures 2.3 and 2.4). A brief description of this existing infrastructure is provided below.

Figure 2.3 Aerial Photo of Existing Ranney Falls GS Infrastructure Layout

Figure 2.4 Schematic of Existing Ranney Falls GS Infrastructure Layout



Forebay Intake Structure

The forebay intake structure, which diverts flow from the Trent Canal to the Ranney Falls GS, consists of five bay sluiceways with a road bridge to the northeast and an operating deck (work platform) for stoplog operation to the southwest. The bridge and the portions of the supporting piers under the bridge are owned and operated by Parks Canada – TSW. Parks Canada – TSW recently rehabilitated the piers with new concrete surfacing.

The operating deck, stoplogs and the portions of the supporting piers under the deck are owned and operated by OPG. The stoplogs are used to dewater the forebay. The stoplog gains and operating deck, and the portions of the supporting piers under the operating deck require repairs.

Safety booms are installed in the Trent Canal and forebay upstream and downstream of the forebay intake structure (see Figures 2.2 and 2.3).

Forebay

The existing forebay is located between the forebay intake and the headworks for the main powerhouse. Concrete gravity retaining walls contain the forebay on the east and west sides. The forebay substrate consists of bedrock. A channel in the west forebay wall supplies water to the "Pup" powerhouse. The east and west retaining walls were resurfaced in 1994 and meet current dam safety requirements.

Main Powerhouse

The main powerhouse accommodates two concrete gravity type intakes, two vertical Kaplan turbine generator units (G1 and G2) and associated electrical and mechanical equipment and systems, auxiliary mechanical and electrical systems, restroom and control room.

The main powerhouse can be accessed by the existing road to the east which was rebuilt in 1992. The road connects to Trent Drive at the bridge spanning Lock #12.

The main powerhouse tailrace channel is a man-made open cut through the layered rock formation to the Trent River.

Main Substation

The main outdoor substation (transformer yard), located to the south of the main powerhouse, accommodates one 44 kV transformer and associated electrical equipment with supporting structures and underground piping (see Figure 2.4). It connects to Hydro One's 44 kV distribution line (R8S) at the wood pole located at the south of the Trent Drive.

Pup Facilities

The Pup facilities include the entrance gate, approach channel, intake, penstock, and powerhouse and tailrace channel. The entrance gate is located at the west retaining wall and controls the flows to the G3 unit. The approach channel is a concrete-lined open channel extending from the entrance gate to the concrete gravity intake structure at the upstream end of the penstock. The penstock is an exposed steel pipe on supporting concrete saddles which connects to the vertical Kaplan turbine generator (G3) in the "Pup" powerhouse. A short tailrace channel extends from the "Pup" powerhouse to the Trent River.

The "Pup" substation is located to the southeast of the powerhouse, accommodating a 44 kV transformer and associated electrical equipment. It connected to Hydro One's 44 kV distribution line (R9S) at the wood pole located at the south abutment of the Ranney Gorge Suspension Bridge.

The "Pup" powerhouse is accessed from Trent Drive by a road that runs parallel to the penstock to the west of the main powerhouse. A stormwater culvert draining the adjacent property to the west discharges into the penstock trench.

Storage Facility

The storage facility consists of a fenced yard and storage shed to the east of the main powerhouse and public trail to Ranney Gorge Suspension Bridge (see Figure 2.3).

Existing Ranney Falls GS Operation

The current spill discharge for flood control at the site and emergency shutdown and normal outage of the GS is the sole responsibility of Trent-Severn Waterway (TSW). TSW Dam #10 has been operated to discharge the relevant flows.

The main powerhouse has the G1 and G2 units each operating at approximately 5 MW at design flows of 47.5 m^3/s and 45.4 m^3/s, respectively (OPG, 2011a). The "Pup" powerhouse contains the 0.72 MW G3 unit with a design flow of 8 m^3/s. Total design flow is 100.9 m^3/s. The G3 unit has reached its end-of-life and ceased operation in June 2014.

Both powerhouses share a common forebay intake structure, with the G3 unit fed by a penstock from a channel branching off the forebay. The headwater of the Ranney Falls GS is the Trent Canal at the upstream end of Lock #12, with the tailwater merging into the Trent River. The average gross head is approximately 14.27 m. Dam #10 diverts flow down a 1.5 km section of canal to feed the Ranney Falls GS and the operational requirements of Locks #11 and #12. The average available flow is approximately 118 m^3/s. River flow that is in excess to the GS and lockage requirements is spilled through Dam #10 (upstream of the GS) to the original Trent River channel. The Trent River flow merges with flows from the Ranney Falls GS tailrace at 1.1 km downstream of Dam #10.

2.2.4 Federal and Provincial Approvals

Federal Approvals

A number of permits, licences and approvals under federal legislation may be required for the proposed Ranney Falls G3 Project to proceed, including:

- Parks Canada licence to carry out the undertaking under the *Dominion Water Power Act* regulations;
- Parks Canada – TSW Work Permit under the Historic Canals Regulations pursuant to the *Department of Transport Act*;
- *Fisheries Act* authorization from the DFO for harm to fish and fish habitat with conditions for mitigation and compensation; DFO has determined that the proposed Project "will not

likely result in impacts to fish and fish habitat", a formal approval from DFO is not required (C. Strand, DFO, 2012, pers. comm. and follow up DFO Fisheries Protection email dated July 31, 2014);

- *NPA* approval of any substantial interference with navigation, or determination of no interference with navigation, from Transport Canada for any works built or placed in, on, over, under, through or across "scheduled" waters;
- *Species at Risk Act (SARA)* permit for the removal of plant species at risk (SAR), or damage or destruction of SAR habitat on federal lands in Ontario; and
- Explosives Transportation Permit from Natural Resources Canada under the *Explosives Act*.

As indicated in Section 1.0, based on technical information provided by OPG, DFO has determined that the proposed Project "is not likely to result in impacts to fish and fish habitat provided that additional mitigation measures are applied" (see Section 4.1.4). Based on the LOA dated July 17, 2012, a formal approval (authorization) from DFO is not required (C. Strand, DFO, 2012, pers. comm. and follow-up DFO Fisheries Protection email dated July 31, 2014).

Environment Canada, CWS, has approved the "Turtle Nesting Habitat Mitigation Plan" prepared by OPG to create and enhance access and nesting habitat for Northern Map Turtle (*Graptemys geographica*) and Eastern Snapping Turtle (*Chelydra serpentina serpentina*), both designated as Special Concern federally and provincially (K-A. Fagan, Environment Canada, 2012, pers. comm.) (see Section 4.1.3). An In-water and Shoreline Work Permit Application was submitted to Parks Canada – TSW on December 9, 2014 to obtain approval for implementation of the Plan under the Historic Canals Regulations pursuant to the *Department of Transport Act*.

As the Trent River/Canal from Rice Lake to Lake Ontario is included in the *NPA* List of Scheduled Waters, an application (Notice of Works Form) for approval of the proposed Project was submitted by OPG to Transport Canada on December 19, 2014. OPG subsequently received a letter dated December 30, 2014 from Transport Canada indicating that the information provided by OPG was complete for the purpose of commencing agency review.

Provincial Approvals

Based on current information, a number of permits, licences and approvals under provincial legislation may also be required. These approvals and permits may include:

- Permit for SAR plant removal, or disturbance or destruction of SAR habitat from the MNRF under the *Endangered Species Act (ESA)*;
- Permits to Take Water (PTTW) for construction (including use of temporary settling pond) and dewatering if greater than 50,000 L/day from the MOECC (MOE, 2007) under the *Ontario Water Resources Act (OWRA)*;

- Environmental Compliance Approval (MOE, 2011a) for air, noise, waste disposal and/or sewage works and wastewater for spill containment associated with the new facility from the MOECC under the *Environmental Protection Act (EPA)*;
- Waste Manifest from the Ontario Ministry of Transportation (MTC) under the *Dangerous Goods Transportation Act*;
- Letters of Clearance for archaeological resources from the Ontario Ministry of Tourism, Culture and Sport (MTCS) under the *Ontario Heritage Act*; and
- Fish Scientific Collectors Permit for fish removal and relocation from the MNRF under the *Fish and Wildlife Conservation Act*.

A transmission line (115 kV or higher) greater than 2 km long associated with a generation project requires a Section 92 Leave to Construct under the *Ontario Energy Board Act* from the Ontario Energy Board. As the proposed Ranney Falls G3 Project does not involve transmission infrastructure, a section 92 Leave to Construct will not be required.

As indicated in Section 1.0, OPG is exempt from the LTC Permit for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses under Ontario Regulation 163/06 of the *Conservation Authorities Act* (M. Lovejoy, LTC, 2012, pers. comm.).

Under subsection 62.0.1(1) of the *Planning Act*, energy projects that are approved under the *EA Act* are exempt from *Planning Act* requirements. However, as the proposed Ranney Falls G3 Project is not subject to the *EA Act*, OPG will apply for Site Plan approval and a Building Permit from Trent Hills. OPG will also consult with Trent Hills regarding construction planning, schedules, noise regulation (Trent Hills, 2005) and local traffic management. An Access/Use permit for municipal road and heavy load transportation may be required from Trent Hills.

Other Relevant Regulations/Guidelines Not Requiring Permitting

There are a number of federal and provincial regulations/guidelines that need to be considered throughout the regulatory approval process and the subsequent construction phase that do not necessarily require a formal permitting process. These include but are not limited to the following:

Federal

- *Migratory Birds Convention Act (MBCA)* and Migratory Birds Regulations prohibit the taking or killing of migratory birds and their nests and eggs, and the deposit of substances harmful to migratory birds in areas they frequent;
- Migratory birds environmental assessment guideline (Milko, 1998a);
- Ontario In-water Construction Timing Window Guidelines for the Protection of Fish and Fish Habitat (DFO, 2010);

- Canadian Technical Report of Fisheries and Aquatic Sciences 2107 Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters. (Department of Fisheries and Oceans, 1998);
- Policy on Wetland Conservation (Environment Canada, 1991) with the goal of sustaining wetland functions;
- Wetlands environmental assessment guideline (Milko, 1998b);
- A Wildlife Policy for Canada (CWS, 1990; Lynch-Stewart, 2004) with the goal to maintain and restore ecological processes and the diversity of ecosystems, species and genetic variability within species;
- Canadian Biodiversity Strategy (Environment Canada, 1995) based on the Convention on Biological Diversity (UNEP, 1994) with the goal of conserving biological ecosystems, species and genetic variability within species; and
- Practitioner's Guide to the Risk Management Framework for DFO Habitat Management Staff (DFO, 2006).

Provincial

- PPS which provides policy direction on matters of provincial interest related to land use planning and development (OMMAH, 2014);
- *Places to Grow Act* administered by the Ontario Ministry of Infrastructure and the Growth Plan for the Greater Golden Horseshoe (OMPIR, 2006);
- Under the *EPA*, regulations regarding the systematic control of collection, storage, transportation, treatment, recovery and disposal of waste including hazardous waste;
- Water Management Policies and Guidelines (Policy 1 and 2) of the MOECC (MOEE, 1994);
- Ontario Biodiversity Strategy (MNR, 2005; Ontario Biodiversity Council, 2011);
- Standards and Guidelines for Consultant Archaeologists (MTC, 2010); and
- Statements of Environmental Values by the Ontario Ministry of Natural Resources, (now MNRF), Ontario Ministry of the Environment (now MOECC) and Ontario Ministry of Culture (now MTCS) under the *Environmental Bill of Rights*.

In addition, the proposed Ranney Falls G3 Project must conform to Parks Canada policy and directives (see Section 2.2.5).

A final determination of the likely applicable federal and provincial permits and approvals cannot be made until the detailed design phase of the proposed Project is complete.

2.2.5 Conformance with Parks Canada Policy and Directives

As indicated in Section 2.2.1, the management plan for the TSW National Historic Site of Canada received ministerial approval in 2000 (Parks Canada, 2000). The process to develop a new management plan began in late 2011, and was subsequently postponed following a review

of the management plan cycle. The next management plan review is scheduled for completion in 2018. The proposed Project must conform to relevant Parks Canada policy and directives. Those policies and directives include:

Parks Canada Guiding Principles and Operational Policies guides stewardship responsibility to ensure that the record of our past, the rich diversity of wild spaces and species, the beauty and grandeur of our lands and seas, and the cultural character of our communities are not inadvertently lost over time. This policy document guides these efforts, designation and management.

National Historic Site Policy objectives are to foster knowledge and appreciation of Canada's past through a program of historical commemoration and to ensure commemorative integrity of national historic sites are maintained by protecting and presenting these sites and their associated resources for future generations.

Cultural Resources Management (CRM) Policy serves as the overall management policy for Parks Canada-administered national historic sites. As *CRM Policy* supports the management of cultural resources, it applies to conserving and preserving the national treasures that are under the stewardship of the Parks Canada Agency.

Historic Canals Policy Regulations outlines respecting the management, maintenance, proper use and protection of the historic canals administered by the Parks Canada Agency.

Historic Canals Policy fosters appreciation, enjoyment and understanding of Canada's historic canals by providing for navigation; by managing cultural and natural resources for purposes of protection and presentation; and by encouraging appropriate uses.

Canal Regulations outlines respecting the use and operations of canals.

OPG respectfully submits that the proposed Ranney Falls G3 Project does conform to the Parks Canada policy and directives presented above. As indicated in Section 3.1.7, the Trent Canal, Trent River, Ferris Provincial Park and Ranney Falls GS are considered to be cultural heritage landscapes (CHLs). As indicated in Section 4.2.5, construction of the proposed Project will not result in displacement of these CHLs. However, there is potential for temporary disruption to public access from the Ranney Falls GS property via the Ranney Gorge Suspension Bridge to Ferris Provincial Park on the opposite side of the Trent River (see Figure 2.3). To minimize and/or manage the potential conflict between public and construction traffic access, an Access Management Plan will be developed in consultation with Ontario Parks and Friends of Ferris Provincial Park. TSW will also be kept informed on the progress of the access management plan.

In addition, there is potential for disruption of local viewsheds from vessels using the section of the Trent Canal adjacent to the proposed Project forebay expansion, as well as for the public accessing the Ranney Gorge Suspension Bridge and Ferris Provincial Park. As partial mitigation, construction will not occur on Sundays and public holidays, likely the time of peak public boating use on the Trent Canal and recreational use of Ferris Provincial Park.

The potential access and visual disruption effects on these CHLs will be temporary, i.e., occurring during the construction phase of the proposed Project, and will be dissipated with the implementation of the Site Rehabilitation Plan.

Furthermore, there will be no displacement of the existing Ranney Falls GS powerhouse buildings. The proposed Ranney Falls G3 Project powerhouse building will adjoin the existing main powerhouse building and have a similar structure and façade, thereby providing overall architectural coherence. The “Pup” powerhouse building and tailrace will be preserved.

The operation of the proposed Ranney Falls GS Project will not affect the status and significance of the Trent Canal, Trent River, Ferris Provincial Park and Ranney Falls GS as CHLs.

As indicated in Section 4.2.4, during proposed Project operation, there will be negligible impacts on vessel utilization of the Trent Canal during the navigation season as a result of slightly higher flow velocities.

As indicated in Section 3.7, the Ranney Falls GS property supports a number of ecological functions and attributes that would potentially qualify portions of the property as Significant Wildlife Habitat. The displacement of turtle nesting habitat and potential snake hibernacula habitat will be offset by existing habitat enhancement on areas of the Ranney Falls GS property unaffected by the proposed Project, as well as on nearby TSW property (see Sections 4.1.2 and 4.1.3). Moreover, habitat on the property will be considerably increased in extent and enhanced after construction. Similarly, the implementation of mitigation measures will ensure that the proposed Project will not have an adverse effect on the proximate Significant Woodlands or their ecological functions (see Section 4.1.2).

As indicated in Section 2.2.1, the PFTSW (2008) was mandated in 2007 to assess and make recommendations to the federal Minister of the Environment concerning the future contributions and management of the TSW. The PFTSW concluded that the development of renewable energy resources is a sound public policy goal and supported a vigorous effort to pursue the potential for generation of green energy along the TSW. The proposed Ranney Falls G3 Project conforms with this policy recommendation.

2.3 PROJECT DESCRIPTION

2.3.1 Project Components

It should be noted that the proposed Project components/structures and activities presented in this section will be refined in this phase, which involves detailed engineering design to be undertaken concurrently with DIA Report preparation.

With the exception of the electrical substation, all of the structures will be located entirely on the west side of the existing main powerhouse.

As indicated in Section 2.1, the stoplog gains and operating deck, and the portions of the supporting piers under the operating deck of the forebay intake structure require rehabilitation, which will be undertaken during construction of the proposed Ranney Falls G3 Project.

The general arrangement of the proposed Project components/structures is presented in Figures 2.5 and 2.6. A brief description of each proposed infrastructure is provided below.

Figure 2.5 Aerial Photo of Existing Ranney Falls GS Showing Proposed Project Infrastructure Layout

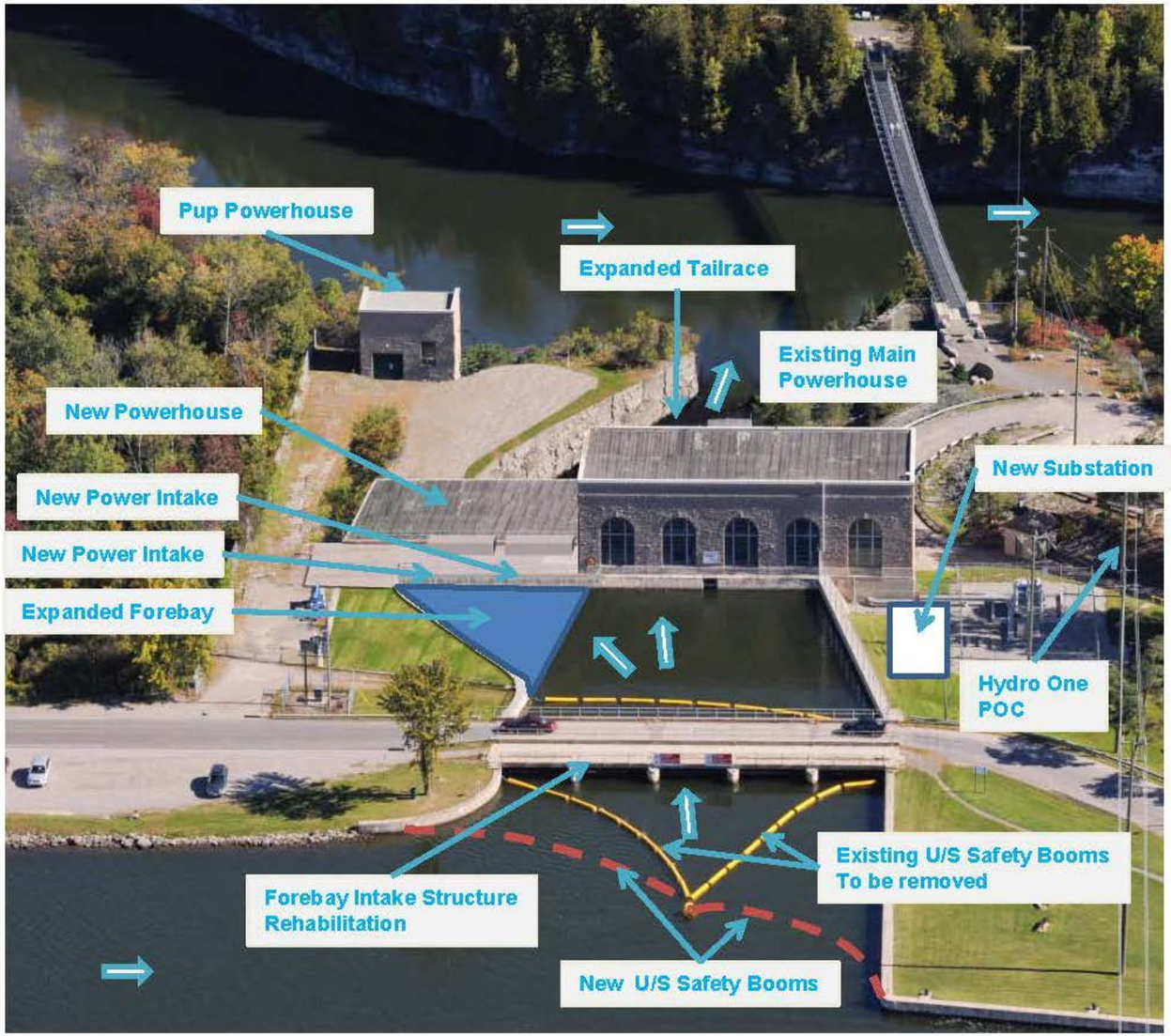
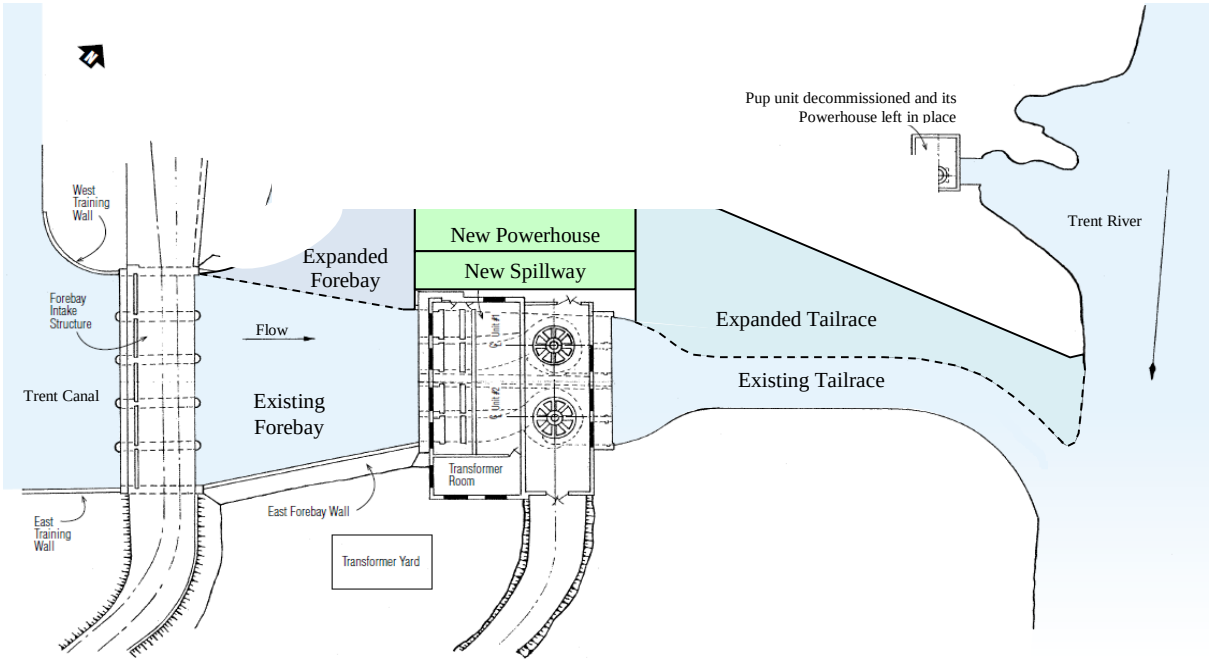


Figure 2.6 Schematic of Proposed Ranney Falls G3 Project Infrastructure Layout



Forebay Intake Rehabilitation

The forebay intake rehabilitation includes repairing the stoplog gains and operating deck, and resurfacing the portions of the supporting piers under the operating deck. The operating deck will be upgraded to accommodate the operational loads incorporate modern railings and safety signage to facilitate pedestrian use. All of the upgrade and repair work will include contemporary concrete and steel materials to renew the structure. The TSW will be provided with engineering drawings and will be consulted with on proposed repairs.

Expanded Forebay

The existing forebay will be extended westward to form a large open channel which will draw water from the Trent Canal through the forebay intake into the intakes of the existing two units (G1 and G2), the new unit (G3) and the new spillway. The new intakes will align with the existing intakes.

The west side wall of the approach channel will be streamlined from the west abutment pier of the forebay intake to the new spillway intake west wall.

The bottom slope of the expanded forebay starting from the forbay intake downstream bottom will smoothly transit downward at an approximately 16% grade. A 2 m wide and 1 m deep rock trap to capture potential debris will be constructed in front of the new powerhouse intake and spillway intake.

The expanded forebay will be designed and verified to satisfy hydraulic requirements under all new operating scenarios. Under normal operational conditions, the expanded forebay will be designed to pass the design flow of 80 m^3/s for the new G3 (a 10-time increase over the existing "Pup" unit), with total station design flow of 171 m^3/s (compared to existing flow of 100m^3/s). The current operating levels in the existing forebay fluctuate from 145.76 m to 146.21 m. The operating levels in the expanded forebay will not change. Under emergency conditions, the expanded forebay will be designed to pass the design flow of 171 m^3/s.

New Powerhouse Intake

The new G3 intake, to be constructed on competent rock foundation, will have one concrete hydraulic passage, approximately 24 m long and 10 m wide, which will initially consist of rectangular sections converging to a circular section of 7.5 m diameter that connects to a Kaplan turbine. The structure will be subject to dam safety requirements.

Trashracks made of steel will be installed in front of the new G3 intake. A 6.5 m high by 7.5 m wide vertical sliding steel gate with a lifting mechanism will be installed to allow for the complete shutdown of the turbine. The gate will be heated for winter operation. Two new sets of stoplogs will be installed upstream and downstream to dewater the water passage for station inspection and maintenance.

New Powerhouse Structures

The new powerhouse footprint will be approximately 10 m by 22 m with sufficient space to satisfy equipment operation and maintenance requirements. The powerhouse will be constructed on competent rock foundation to support the turbine generator, associated equipment and the powerhouse structure. The powerhouse will be above the unit draft tube and the spillway tunnel. The roof will be at elevation 143.0 m to facilitate the mechanical handling for turbine, spillway gate, unit gate and downstream sectional gates. The main floor will be at elevation of 134.0 m to accommodate the electrical and mechanical equipment and associated systems. All floor slabs will be designed and constructed to provide adequate lay-down area and to withstand the heaviest equipment anticipated for loading/unloading of the turbine generator. The west side wall of the powerhouse will be against rock surfaces. The east wall will be against the rock surface of the rock partition between the existing main powerhouse and the new spillway. The north bulkhead wall will face the tailrace. The south side wall will form the power intake downstream wall. All walls will be designed and constructed to be watertight. The walls will be designed to support all loads without dependence on the rock support and the support from second phase concrete. The north bulkhead wall will be designed to withstand the ice load from tailrace freezing.

A single Kaplan turbine (horizontal axis) unit with a nominal capacity of up to 10 MW at design flow of 80 m^3/s will be installed. The design of the draft tube will take into account the turbine hydraulic design requirements which prevent draft tube hydraulic instability.

New Spillway

OPG will operate the proposed expanded Ranney site within historical water levels (since 1951) and existing water management practices with a flow up to 171 cms at the Ranney site. There will be no increase in water levels operating the proposed site.

Spillway discharge capacity for flood control at Dam 10 (Ranney Falls) is the sole responsibility of the Trent-Severn Waterway (Parks Canada). Installation and operation of a new spillway to be built between the existing and new powerhouse to bypass powerhouse flows in the event of an emergency shutdown of the unit is the responsibility of OPG. The Spillway operation will minimize wave surge and mitigate any rapid increase in water level associated with unplanned station shutdown. The design for the new spillway will be developed during the next stage of development (Interim Licence) whereby General Construction Plans are prepared for the review and approval by the Parks Canada Agency.

The spillway consists of intake, tunnel, outlet and stilling basin with an overall foot print of 7 m wide by 37 m long and will be constructed on competent rock foundation. A 5 m high by 5 m wide vertical sliding steel spillway gate with heating system for winter operation will be installed at the downstream to control the flows. Stoplogs will be installed upstream and sectional gates will be installed downstream of the spillway gate to dewater the spillway tunnel.

The spillway intake will be designed to satisfy the hydraulic requirements and the outlet floor will be submerged below the minimum tailrace level to prevent ice formation in the tunnel. The spillway tunnel is 5 m by 5 m tunnel with floor sloping from elevation 13.0 down to elevation 121.44 m. The stilling basin will have energy dissipating concrete blocks to dissipate energy.

The intake and tunnel will be designed as watertight hydraulic structures and to meet dam safety requirements.

Expanded Tailrace Channel

The expanded tailrace channel will be designed with a maximum discharge capacity of 171 m^3/s, either from unit G1, G2 and G3 under normal operation or from spillway during emergency shutdown of the units. The expanded tailrace channel will be located to the east of the “Pup” powerhouse tailrace to accommodate paths for the G3 and stilling basin for the spillway. The tailrace channel will be expanded with the width near the powerhouses from 18 m to 36 m and the width at the outlet from 7 m to 18 m. The channel floor from the new G3 draft tube outlet will have a 5 m horizontal section and then subsequently change from elevation 123.0 m to 126.0 m with a slope 1V:5dvH. The channel floor from the spillway outlet will have a 15 m long stilling basin with energy dissipating blocks and then subsequently change from elevation 120.44 m to 126.0 m with a slope of 1V:2H. The channel floor from the existing G1 & G2 draft tube outlets will not be altered.

Distribution Connection

The new G3 will be connected to the other Hydro One 44 kV distribution line (R8S) that parallels the R9S line east of the existing Ranney Falls GS. The new substation will be built south to the existing substation to accommodate connecting electrical equipment and supporting structures and foundations.

Decommission of the Existing Pup Facilities

The existing Pup facilities will be decommissioned. The entrance gate will be dismantled. The existing approach channel will be incorporated into the expanded forebay. The intake structure and penstock will be removed. The powerhouse building will be preserved in accordance with the environmental assessment commitments. The existing Pup tailrace will be returned back to river bed. The single transformer station will be dismantled and all structures will be removed.

Relocation of the Upstream Safety Boom

The safety boom upstream of the forebay intake will be relocated slightly further upstream to accommodate the new operation. Safety fencing will be installed accordingly.

Creation of Habitat for Northern Map Turtle and Eastern Snapping Turtle

A complimentary habitat for Northern Map Turtle and Eastern Snapping Turtle has been created adjacent to the existing Pup tailrace area (TSW, Environment Canada and Ontario Parks will be consulted with respect to post construction monitoring).

2.3.2 Construction

The Ranney Falls G3 Project will be executed under a design-bid-build approach. During the Definition Phase, a water-to-wire (W2W) contractor will be engaged through a Request-for-Proposal (RFP) to complete the final design and layouts, and then the owner's engineer will complete the detailed design for permanent civil works. A Civil Contractor will be selected through a RFP process. All the temporary works will be the sole responsibility of the selected Civil Contractor and W2W Contractor. The Definition Phase is anticipated to be completed in December 2016.

The Execution Phase includes two stages – stage 1 for civil construction and stage 2 for W2W installation. During the stage 1, the existing G1 and G2 will be taken out of service, the Civil Contractor will design, build and remove the upstream and downstream cofferdams, complete the civil construction, including forebay intake rehabilitation, excavation and construction of the expanded forebay, powerhouse intake and powerhouse, spillway, expanded tailrace and new substation foundations, installation of auxiliary electrical and mechanical equipment and systems, trashrack, unit headgate, spillway headgate and stoplogs/section gates, water up the

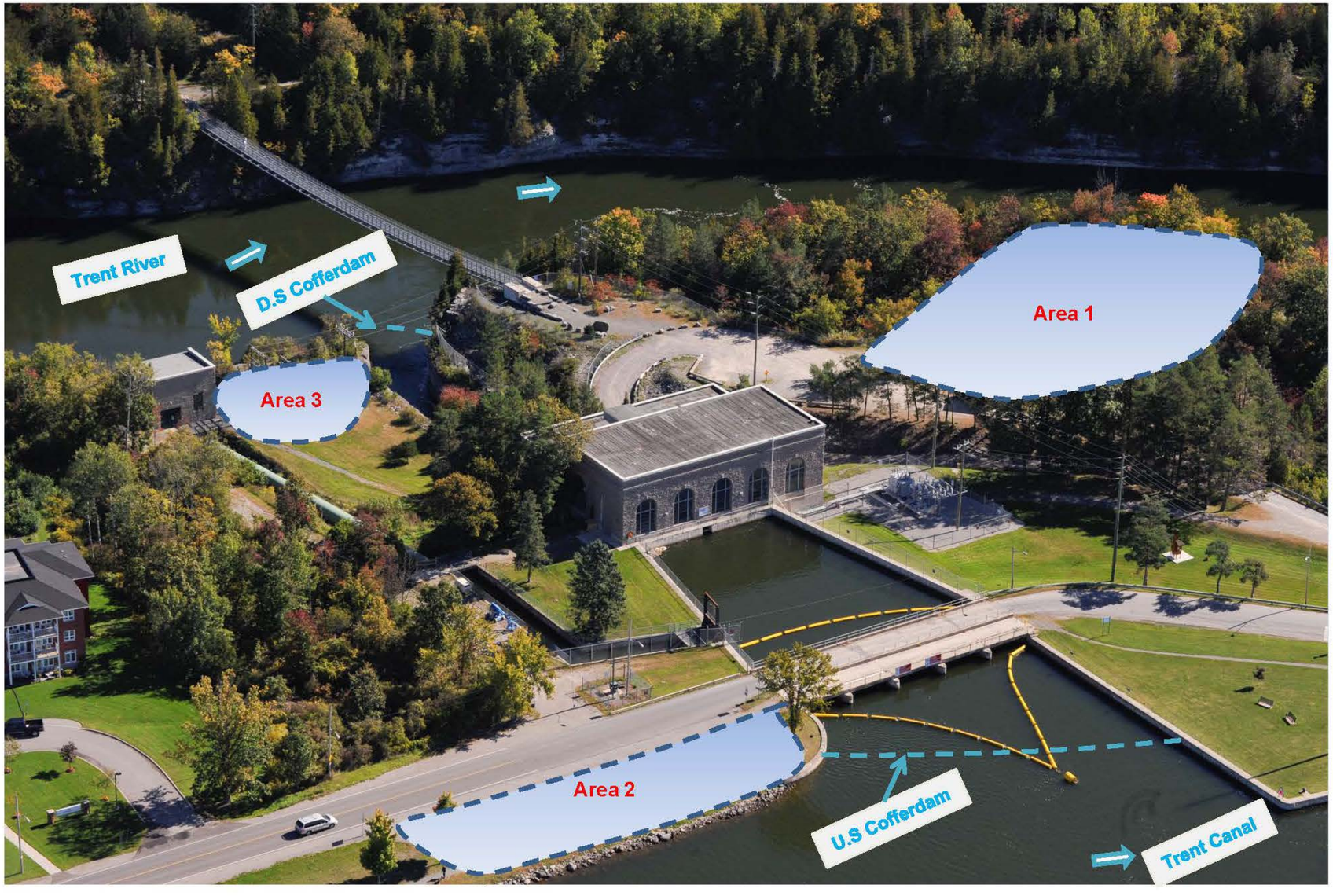
expanded forebay and tailrace, and return the existing G1 and G2 into service. Then the stage 2 starts. The W2W Contractor will install, test and commission the turbine, generator and ancillary electrical and mechanical equipment and systems, and place the new G3 into service. The OPG project team including Owner's engineer will provide oversight during the two stages to ensure quality and schedule. The Execution Phase is anticipated to start in January 2017 and be completed by December 2019.

As the environmental assessment process will be completed during the Definition Phase, the detailed engineering design will be undertaken concurrently with DIA Report preparation. Commitments made in the DIA are being communicated to the design team.

An initial perspective on what might be the construction and installation methods that would be employed by the contractors is presented below. However, it should be noted that the final sequencing, construction and dewatering methods used would be defined by the successful contractors on the basis of environmental requirements and constraints outlined in the OPG procurement process.

Proposed construction laydown areas include OPG's storage yard, the lawn to the south of the main powerhouse and the area between the access road to the "Pup" powerhouse and the proposed expanded tailrace (see Section 4.1.2). OPG is also pursuing approval from Parks Canada – TSW for use of the lawn area south of Trent Drive to the east and west of the existing forebay.

Figure 2.7 Construction Laydown Areas



Fencing will be installed prior to construction initiation to prevent turtle access to current nesting habitat in the construction area.

During stage 1, the Civil Contractor will be the Constructor. An upstream cofferdam will be installed upstream of the forebay intake for repairing the forebay structure and civil construction. The upstream cofferdam may be made of sheet piles or rock fill. The downstream cofferdam will consist of a dam within the existing tailrace channel outlet and rock plug to seal the expanded channel portion. The dam within the existing tailrace may be made of rocks from the excavation and waterproof membrane. A cementitious grout curtain may be installed through the rock plug to stop inflows from the Trent River.

After cofferdams installation, the existing forebay and tailrace channel will be dewatered and any fish present transferred to the Trent Canal and Trent River, respectively, prior to complete dewatering. Cofferdams installation and dewatering will be undertaken outside of the timing restriction for in-water construction to protect the fish spawning and egg incubation period for warmwater and coolwater fish communities (April 1 to June 30).

The upper shale-rich bedrock domain with a thickness in the range of 18 to 23 m will be the main domain encountered during excavation (see Section 3.4). This material will form the walls of all planned excavations, temporary plugs and at least some of the excavation floors, depending on excavation depth. It is expected that the overlying overburden and upper weathered bedrock horizon with a thickness likely varying between 1 and 4 m can be excavated using conventional earthmoving equipment such as excavators and bulldozers, without ripping, or drilling and blasting. Based on the geotechnical findings, the upper shale-rich bedrock domain is considered to be non-rippable and therefore its excavation is expected to require drilling and blasting (Knight Piésold Ltd., 2011a).

The lower shale-poor bedrock domain is likely to be near the base of the excavation and the new powerhouse may be founded on this domain, or near boundaries of the two domains, i.e., upper shale-rich and lower shale-poor. Therefore, significant excavation in the lower shale-poor bedrock domain is not anticipated. If excavation of the lower domain is necessary, it is expected that drilling and blasting will be required due to its greater competency. The current excavation plan indicates that the excavation will be limited to the upper shale-rich bedrock domain (Knight Piésold Ltd., 2011a).

As indicated in Section 3.4, the upper shale-rich bedrock domain consists of inter-bedded shale and limestone with a number of weak clay-like seams believed to be associated with the shale-rich layers. Any seams in the powerhouse foundation area will be excavated if they are within 1.5 m of the excavation base. In the absence of these weak materials in the immediate vicinity of the foundation, the bearing capacity is expected to be within the range of typical values for soft bedrock (Knight Piésold Ltd., 2011a).

It is expected that the material excavated from the upper shale-rich bedrock domain may be suitable for structural fill. It will be important to ensure that the excavated material is well graded and that it contains only a small proportion of thin, flat or elongated particles (which may come from the shale layers) if it is to be used for fill (Knight Piésold Ltd., 2011a).

The shale layers and soil seams encountered in the rock walls may become locally recessed during excavation, resulting in local wall stability issues associated with overhanging limestone beds. Intersecting steeper discontinuities will need to be mapped during excavation and may result in a few wedges that need to be stabilized. Rock mass performance is expected to be reasonable and steep walls should be achievable with careful excavation practices (Knight Piésold Ltd., 2011a).

The groundwater table on the lower level of the Ranney Falls GS property occurs within the upper shale-rich bedrock domain at an approximate depth of 5 to 7 m. Groundwater and precipitation/runoff inflows can be expected due to any excavation within the upper shale-rich bedrock domain. Based on the geotechnical survey findings, inflows are expected to be manageable during excavation with inflow at a rate up to 3 to 5 l/s. Higher than expected inflows may occur if high permeability features are encountered, or if blasting and rock excavation techniques significantly modify the intrinsic hydraulic conductivity of the rock mass (Knight Piésold Ltd., 2011a). To minimize dewatering requirements, a cementitious grouting curtain may be required along the excavation line just before starting the excavation to seal the paths of groundwater inflow. The cementitious grouting will be made of cement, fine sand and water in compliance with industrial practices. Other methods that are generally accepted in the construction industry to reduce or avoid the groundwater inflow may also be employed. All the water from the construction pit will be properly tested and pre-treated if required prior to discharging into Trent River.

The drainage culvert from the adjacent property will be diverted out of the construction pit.

Once the excavation is completed, the Civil Contractor will complete the repair of the forebay structure, decommission of the existing G3 facilities, the construction of the retaining walls, intakes, powerhouse and spillway and installation of the auxiliary electrical and mechanical equipment and systems and gates. Then the Contractor will remove the upstream cofferdam and water up the forebay. The expanded tailrace channel will be watered up, and then the downstream cofferdam including the rock plug and extended riverbed will be removed through in-water excavation, adequate silt curtains will be installed to protect the Trent River water body. After the downstream cofferdam is removed, the existing G1 and G2 units will be returned to service.

During stage 2, the W2W Contractor will be the Constructor. The W2W contractor will install, test, and commission the new G3, including turbine generator, transformer, switchgear, protection and control systems, and also have responsibility for the Hydro One Network connection.

After the Civil and W2W Contractors are retained, they will develop the EMPs that will be provided to the TSW to review. That EMP will be cover a number of details but may not include all the details such as rock plug removal in the EMPs. However, OPG is willing to involve the TSW in a further review of the grouting and removal of the rock plug activities when those work activities are further planned out.

The Execution Phase including civil construction and W2W installation is anticipated to last up to 36 months with the earliest possible in-service date in 2019.

2.3.3 Operation

Operation of the new Ranney Falls complex including the existing G1 and G2, new G3 and new spillway will result in optimal use of the total water available for power generation (mean annual flow of approximately 118 m^3/s), while still complying with the current water level limits.

The new spillway that is to be built in between the existing powerhouse and the new powerhouse will be used solely to control water levels within the Trent Canal which will ensure compliance with the current level limits during an emergency shutdown of the units.

During the navigation season from mid-May to mid-October, generating flows transported through the Trent Canal by TSW are generally up to the current Ranney Falls GS design capacity of 100.9 m^3/s. With the proposed project, the maximum flow transported through the Trent Canal for power generation will be increased from 100 to 120 m^3/s. During the non-navigation season from mid-October to mid-May, the maximum generating flows transported through the Trent Canal will be up to 171 m^3/s.

As illustrated in Figure 2.8 below, Dam #10 currently diverts flow to the 1.5 km section of the Trent Canal to feed the Ranney Falls GS and meet the operational requirements of Locks #11 and #12. River flow that is in excess of the generating station and lockage requirements is spilled through Dam #10 to the original Trent River. The Trent River flow merges with flows from the Ranney Falls GS tailrace approximately 1.1 km downstream of Dam #10. Currently, the 101 m^3/s, passes through the Ranney Falls GS and Locks #11 and #12. With the proposed increased generating capacity, it is planned that a flow of up to 171 cms will be diverted to the Ranney Falls complex and Locks #11 and #12. The hydrological conditions due to dam spillage and leakage are depicted in Photographs 2.1 and 2.2, respectively.

Figure 2.8 Dam #10 & Trent Canal &Trent River

Photograph 2.1 Trent River Hydraulic Regime During Dam #10 Spillage

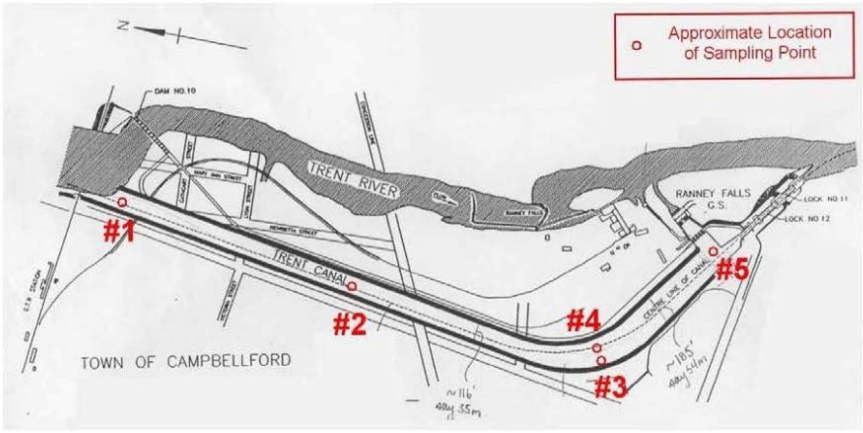
Photograph 2.2 Trent River Hydraulic Regime During Dam #10 Leakage

The new spillway will be used to by-pass station flow to the tailrace channel in emergency shutdown situations to control water levels within the Trent Canal in compliance with the current limits.

A number of studies have been undertaken to verify the hydraulic performance of this 1.5 km section of the Trent Canal under the existing water level limits with the existing and new operation flows, as well as the hydraulic performance of the existing G1 and G2 and proposed G3, and the new spillway. The conclusions have been taken into consideration ensuring the final design in compliance with the existing operation water level limits.

A study of erosion potential of bed substrate in the Trent Canal upstream of Ranney Falls GS (see Figure 2.9) due to increased flows as high as 171 m^3/s was undertaken by Environment Canada (Krishnappan, 2007). The objective of the study was to determine the critical shear stress and erosion rate of the canal's wetted perimeter. It was determined that with an applied shear stress of 8 Pa reflecting an increase in flow velocity from 0.9 m/s at the existing maximum flow of 101 m^3/s to 1.5 m/s at the proposed maximum flow of 171 m^3/s, the canal bottom armour layer remained stable with minor transport of fine material that underlies the armour layer. Moreover, the maximum equivalent canal flow rate of 171 m^3/s could be sustained in the canal without affecting canal dyke stability.

Figure 2.9 Trent Canal Bed Substrate Erosion Potential Study Locations



As part of a numerical hydraulic study, using HEC-RAS software, developed by the Hydrologic Engineering Centre (HEC) of the U.S Army Corps of Engineers (USACE), to investigate water surface profiles and flow velocities in the Trent Canal between Dam #10 and Ranney Falls GS, under the current water level limits, with the existing and future flows. The study concluded that the Trent Canal can transport the maximum power flows up to171 m^3/s, while maintaining the water levels within the current limits and maximum flow velocities within the Trent Canal will increase from 0.9 m/s to 1.5 m/s. Based on the scenarios modeled, the proposed spillway will be able to effectively control water level within the Trent Canal during an emergency shutdown of the units.

A hydraulic study using the Computational Flow Dynamics (CFD) model was undertaken to assess the potential for vortex formation at the forebay under existing and future flow conditions. Simulation of existing flow conditions indicated no major swirling flows in the flow field near the existing intakes, which is consistent with observations at Ranney Falls GS. Simulations of the future flow conditions indicated no significant cross-circulations near the new intakes, suggesting that the potential for vortex formation at the new G3 intake and spillway intake is likely to be negligible.

Figure 2.10 Flow Velocities in the Straight Canal Reach and at the Locks Based on Proposed Flow Increase

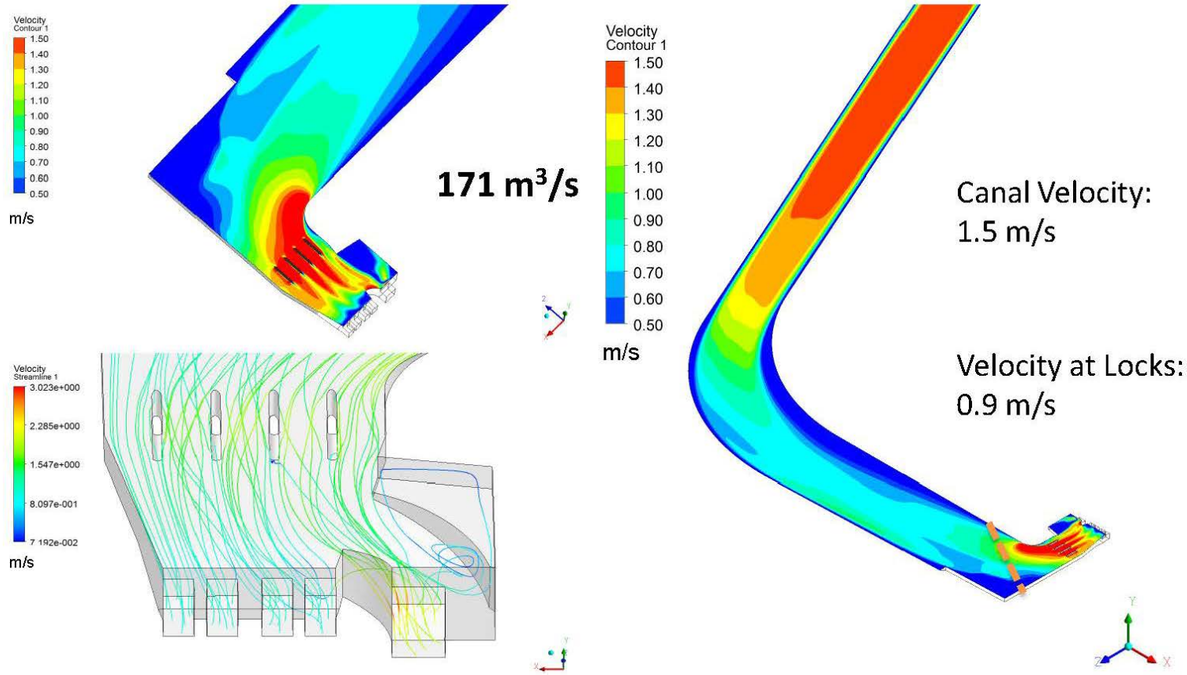
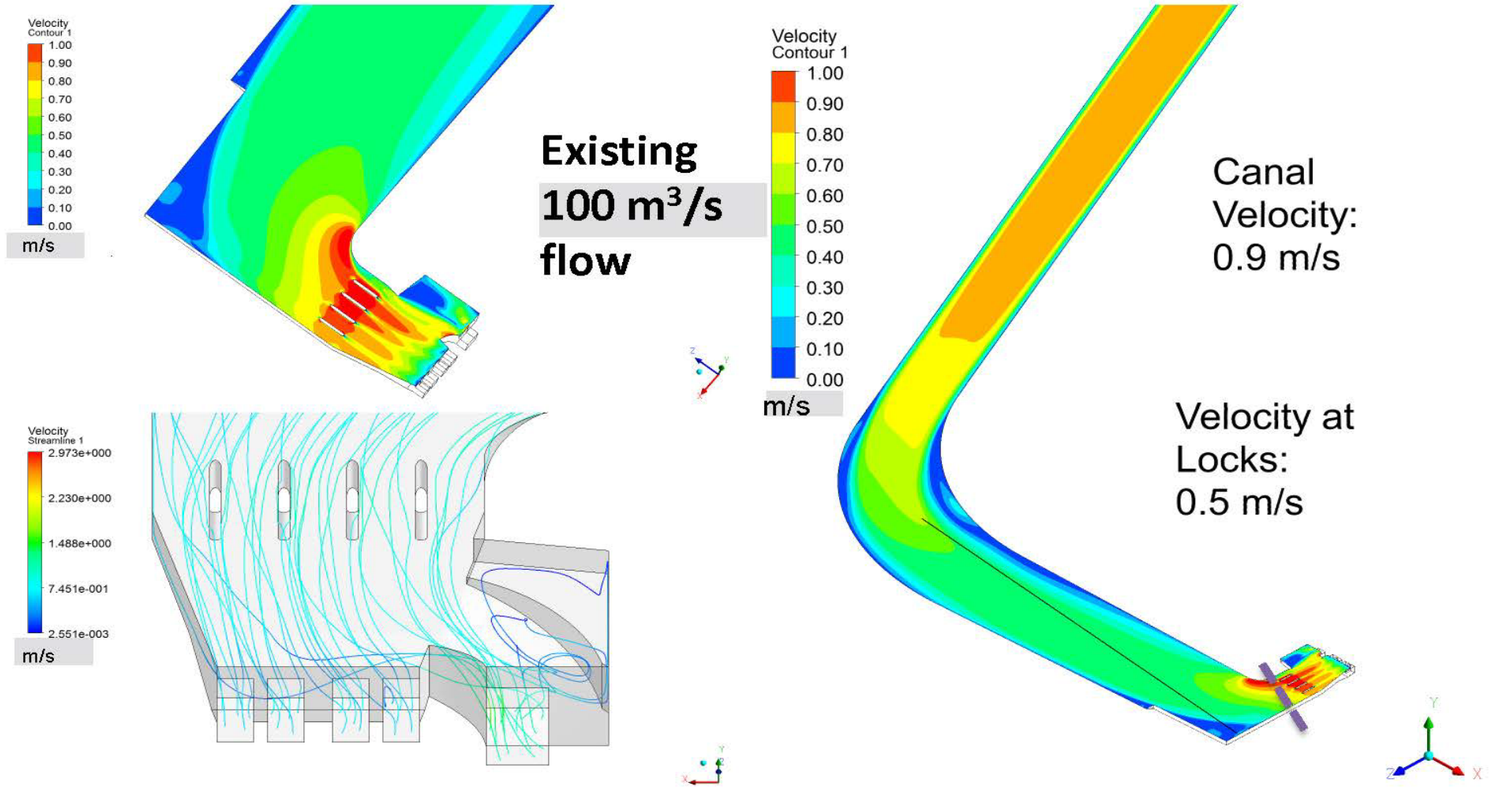


Figure 2.11 Flow Velocities in the Straight Canal Reach and at the Locks Based on Current Navigation Flow



Note: **velocities at flow of 120 m³/s is expected to be 1.0 m/s in the Canal and 0.6 m/s at the Locks**

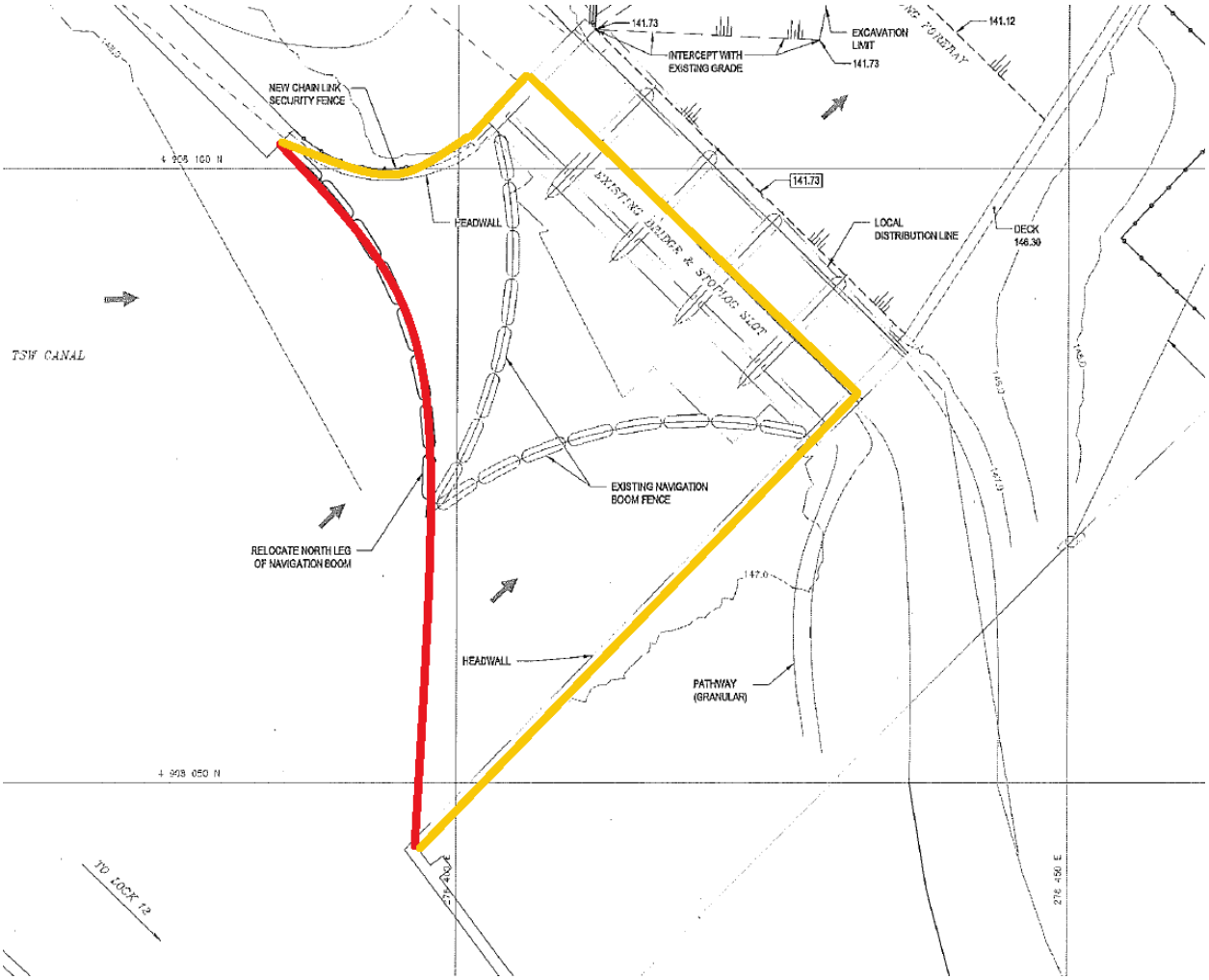
Based on a maximum flow of 171 m^3/s, velocities in the straight section of the canal and near the forebay intake structure were expected to increase from 0.9 to 1.5 m/s and from 0.5 to 0.9 m/s, respectively (see Figure 2.10). However, during the navigation season from mid-May to mid-October with flow limited to 120 m^3/s from the current 100 m^3/s, the maximum flow velocity in the straight section of the canal is expected to increase from 0.9 to 1.0 m/s (see Figure 2.11). In the area near the forebay intake structure, the maximum flow velocity is expected to only increase from 0.5 to 0.6 m/s. It should be noted that flow velocities in the navigable part of the Trent River near the Campbellford main town bridge are higher than those anticipated in the Trent Canal upstream of Locks #11 and #12.

The simulation indicated that the proposed spillway would have sufficient capacity to pass the increased flow up to 171 m^3/s.

As indicated in Section 2.3, a gate with lifting mechanism will provide for complete isolation. The existing stoplog gates in the forebay intake structure will be utilized to dewater the expanded forebay for station inspection and maintenance.

The V-shaped safety booms currently installed in the Trent Canal in front of the Forebay Intake structure will remain in place (see Figure 2.5), but will be reconfigured to prevent vessels from being subjected to the slightly higher traverse velocity. The anchor point at the tip of the north and south leg of the V will be moved outward or upstream along the curved training wall (see Figure 2.12 below).

Figure 2.12 Safety Booms



OPG will operate the proposed expanded Ranney site within historical water levels (since 1951) and existing water management practices with a flow up to 171 cms at the Ranney site. There will be no increase in water levels operating the proposed site.

Spillway discharge capacity for flood control at Dam 10 (Ranney Falls) is the sole responsibility of the Trent-Severn Waterway (Parks Canada). Installation and operation of a new spillway to be built between the existing and new powerhouse to bypass powerhouse flows in the event of an emergency shutdown of the unit is the responsibility of OPG. The Spillway operation will minimize wave surge and mitigate any rapid increase in water level associated with unplanned station shutdown. The design for the new spillway will be developed during the next stage of development (Interim Licence) whereby General Construction Plans are prepared for the review and approval by the Parks Canada Agency.

The technical and environmental aspects associated with the operation of the proposed Ranney Falls G3 Project will be reviewed during this phase, and will be refined and confirmed as the engineering work and DIA proceed.

2.4 PUP FACILITIES DECOMMISSIONING

The Pup facilities ceased operation in June 2014 and will be decommissioned. This will involve incorporation of most of its existing approach channel into the expanded forebay, removal of the intake structure and penstock, removal of single transformer station, and preservation of the powerhouse building and tailrace.

3.0 SITE DESCRIPTION

Since 2006, a number of site-specific environmental baseline studies have been undertaken for the previous design concepts for the proposed expansion of the Ranney Falls "Pup" powerhouse, including fisheries resources and fish habitat assessments, Walleye (*Sander vitreus*) spawning surveys, vegetation inventories, a breeding bird survey and incidental wildlife observations. Site-specific studies were also undertaken to assess the use of the Ranney Falls GS property as nesting habitat by Northern Map Turtle and Eastern Snapping Turtle (Bennett and Litzgus, 2007, 2008), both designated as species of Special Concern federally (COSEWIC, 2012) and provincially (MNRF, 2014). A Phase I Environmental Site Assessment was completed by LOPG (1995). The site-specific aquatic and terrestrial survey and other desk-top information was used to prepare a draft Project Description (Coker, 2007) and draft Environmental Impact Assessment (Coker *et al*., 2008) for the previously proposed project. However, the project was deferred by OPG prior to commencement of the formal Environmental Assessment (EA) and consultation process. Much of the information collected is still relevant for the current design.

As part of this EA process, additional field studies were undertaken in 2011, including a geotechnical investigation at the Ranney Falls GS site (Knight Piésold Ltd., 2011a), a bathymetric evaluation, a Stage 1 archaeological assessment (Advance Archaeology, 2011), as well as a terrestrial survey of the remainder of the Ranney Falls GS property and adjacent significant woodland. A Phase I Environmental Site Assessment Update (SENES, 2012a) and a groundwater monitoring and environmental site assessment (SENES, 2012b) were undertaken in 2012. Moreover, the desk-top information has been updated and expanded based on additional data acquisition.

The delineation of regional, local and site-specific study areas for the DIA varied with the specific environmental component as indicated in Table 3.1.

Table 3.1 Study Areas Delineation

Environmental Component	Regional Study Area	Local Study Area	Site-specific Study Area
Aquatic	Lower TSW/Trent River Watershed	Generally 10 km radius of the Ranney Falls GS	Trent Canal (Dam #10 to Ranney Falls GS and Locks #11 and #12) and Trent River (Dam #10 to downstream of the Ranney Falls GS main powerhouse tailrace)
Terrestrial	Southern Ontario	Generally 10 km radius of the Ranney Falls GS	Those areas on or adjacent to the Ranney Falls GS property that may or will be affected by the proposed Project
Socio-economics and Land Use	Northumberland County	Municipality of Trent Hills	Community of Campbellford
Cultural Heritage Resources	not applicable	Community of Campbellford	Ranney Falls GS property

3.1 SITE LOCATION AND SIZE

The proposed Ranney Falls G3 Project is located on OPG land on the Trent River and adjacent to Lock#12 on the TSW within the community of Campbellford in Trent Hills, Northumberland County (Figure 1.1). The latitude and longitude of the proposed Project site are 44° 17' 30″ N 48' 04″ W, respectively. The Ranney Falls GS property is approximately 2 ha in size. Site access is via Trent Drive from Grand Road (County Road 30) in Campbellford.

3.2 SITE-SPECIFIC LAND USE HISTORY

Initially, the Ranney Falls GS site was “green field” (LOPG, 1995; Advance Archaeology, 2011). Subsequently, the site was formally leased by the Federal Government to the Seymour Power Company. With its purchase of the Seymour Power Company on March 9, 1916, ownership rights to the site were acquired by the Province. Ranney Falls GS G1 and G2 units were commissioned on August 22, 1922 and September 2, 1922, respectively. Unit G3, which started operation in 1926, was acquired by the Hydro-Electric Power Commission of Ontario from the Quinte and Trent Valley Power Company in 1937. Ranney Falls GS was transferred to OPG on April 1, 1999.

3.3 CLIMATE/AIR QUALITY

Climate

The proposed Ranney Falls G3 Project is located within the Simcoe and Kawartha Lakes Climatic Region, as defined by Brown *et al*. (1974). This Climatic Region is greatly influenced by proximity to Lake Ontario, which moderates temperatures and provides moisture-laden air to adjacent lands. Air masses affecting this Climatic Region include flows of cold dry air from the Arctic, moist warm air from the Gulf of Mexico, and dry prevailing winds (westerlies) from the Pacific. The mean growing season length for this Climatic Region is 195 days.

Based on the ecoclimatic classification system developed by Environment Canada (Ecoregions Working Group, 1989), the proposed Project occurs within the Humid Mid-Cool Temperate Ecoclimatic Region of the Cool Temperate Ecoclimatic Province. Summers are typically warm and winters are mild. Mean daily temperatures remain above 0^{o}C from April through late November. Precipitation is distributed fairly evenly throughout the year.

Temperature and precipitation data for the Trenton Airport and Peterborough Airport meteorological stations are presented in the Terrestrial TSD. The mean annual temperatures at the two stations are 7.0^{o}C and 5.9^{o}C, respectively. Mean monthly precipitation varies between lows of 54.0 and 50.6 mm in February and highs of 91.8 and 83.2 mm in November and August, respectively, with no pronounced wet or dry season. Summer thunderstorm activity is relatively frequent. Total annual precipitation at the Trenton Airport is approximately 894 mm with 759 mm falling as rain and 169 cm falling as snow. For the Peterborough Airport station, total

annual precipitation is approximately 840 mm with 682 mm and 162 cm as rain and snow, respectively. The average length of the frost-free period ranges from 122 to 154 days. The prevailing winds in the region are usually from a southwesterly direction.

Air Quality

In southern Ontario, poor air quality is most often the result of high levels of ground-level ozone (O_3) and airborne particulate matter (PM). Ground-level O_3 is the primary component of smog with a contribution by fine PM. O_3 results from chemical reactions between volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in the presence of heat and sunlight.

The air pollutant life cycle is largely influenced by large-scale weather systems. Ground-level O_3, its precursors and fine PM can travel via these weather systems thousands of kilometres from their source. It is because of the long-range transport of airborne pollutants that transboundary flow from the U.S. plays a significant role in air quality considerations throughout southern Ontario.

Air quality is influenced by local and long-range (cross-border) contaminants generated in upwind urban and industrial areas. Air quality in southern Ontario is affected in part by emissions from the U.S., which contribute approximately 55% of smog (MOE, 2005). The remaining portion is largely due to fossil fuel combustion in Canada (including vehicle emissions). Typically, these emissions consist of NO_x, nitrogen dioxide, sulphur dioxide (SO_2), carbon monoxide (CO) and suspended PM, which is equivalent to total suspended particulates. Particulates are also reported as PM smaller than 10 µ and PM smaller than 2.5 µ.

The 2008, 2009 and 2010 ambient air quality statistics for the MOECC monitoring station in Peterborough, along with the provincial Ambient Air Quality Criteria are presented in the Terrestrial TSD. Overall, ambient air quality in the Peterborough area can be considered to be good relative to other locations in southern Ontario (MOE, 2012, 2013; MOECC, 2014).

3.4 GEOLOGY/PHYSIOGRAPHY

Geology

The proposed Ranney Falls G3 Project is underlain by the Middle Ordovician Verulam Formation of the Simcoe Group consisting of light to dark grey, brown grey, interbedded, micritic to coarse-grained, fossiliferous limestone with inter-beds of calcareous shale (Johnson *et al*., 1992). This bedrock is not erosion-resistant and commonly weathers to rubble. The interbedded limestones and shales occur as rubbly outcrops and bluffs of horizontal strata along the Trent River upstream and downstream of the Ranney Falls GS site.

On the Ranney Falls GS property, outcrop exposure is limited to four locations (Knight Piésold Ltd., 2011a):

1. cliff sides of the main powerhouse tailrace cut channel at the Trent River;
2. cliff located between the “Pup” powerhouse outflow and the mouth of its tailrace at the Trent River;
3. the northwestern side of the penstock adjacent to the “Pup” powerhouse; and
4. the northwestern side of the penstock adjacent to its intake channel.

Based on the geotechnical survey, three bedrock domains were encountered below the overburden (Knight Piésold Ltd., 2011a,b):

1. a weathered horizon with a thickness likely varying between 1 and 4 m and that may be greater in the vicinity of vertical discontinuities;
2. an upper shale-rich bedrock domain with a thickness in the range of 18 to 23 m, consisting of interbedded shale and limestone with a number of weak clay-like seams believed to be associated with the shale-rich layers; and
3. a lower shale-poor bedrock domain with a thickness of at least 15 to 20 m, consisting of a series of inter-bedded shale and limestone layers with proportionately less shale and clay-like seams.

Physiography

The Ranney Falls GS property is located on limestone plains (Chapman and Putnam, 1972), with characteristics similar to the Prince Edward Peninsula physiographic region to the south. This physiographic region is a limestone plain with shallow soils, less than 0.3 m in depth and mostly only a few centimeters of unconsolidated matter over the bedrock, that are classified in the Farmington soil series (Chapman and Putnam, 1984).

The Ranney Falls GS property is surrounded by numerous drumlins within a drumlinized till plain that forms part of the Peterborough Drumlin Field physiographic region (Chapman and Putnam, 1972, 1984).

In the area of the Ranney Falls GS, topography is generally level, with the exception of the bluffs along the Trent River. The Ranney Falls GS property consists of generally flat upper (adjacent to Trent Drive) and gently sloping lower (adjacent to Trent River) areas with a relatively steep connecting slope (elevation difference of approximately 14 m) adjacent to both sides of the main powerhouse (OPG, 2011a).

The overburden thickness on the Ranney Falls GS property varies between a few centimetres to over 3 m (Ontario Hydro, 1989; Knight Piésold Ltd., 2011a,b). Deeper overburden was encountered within the upper part of the property. Samples from the upper area indicated that the material has varied characteristics and that at least some of it appears to be fill. The majority of the encountered material was described as sandy gravel.

It is suspected that the natural overburden was mostly stripped from the lower area during construction of the existing Ranney Falls GS. Fill has been placed on the northwest side of the "Pup" powerhouse penstock in order to create the access road (Knight Piésold Ltd., 2011a,b).

3.5 SOILS

The soils on the Ranney Falls GS property are Farmington loam (Hoffman and Acton, 1974). These soils comprise considerably less than 1% of Northumberland County and occur along the Trent River, primarily between Meyersburg and Campbellford. These shallow soils developed from calcareous loam or clay loam till, with a depth of less than 0.3 m over the underlying limestone bedrock. The soils are very stony and well drained; however, because of their stoniness and shallowness, they have low moisture-holding capacity. The soil profile varies. In thin deposits there is seldom more than a thin surface layer over the bedrock. In deeper deposits, the dominant horizon is a brown to dark brown subsoil layer, just below the surface. This kind of soil development is classified as Brown Forest.

Based on Canada Land Inventory (CLI, 1968), the soils on the Ranney Falls GS property are categorized as Class 6, i.e., capable only of producing perennial forage crops, and improvement practices are not feasible, due to their shallowness (less than 0.3 m) to solid bedrock.

Based on a soil quality monitoring program, elevated concentrations of metals, VOCs and/or petroleum based hydrocarbons were identified in most samples based on the MOE (2011b) most stringent generic site condition Soil Standards for shallow soils (Table 6) and for soils within 30 m of a water body (Table 8) in a potable groundwater condition.

It was concluded that hydrocarbons occur naturally within petroliferous or bituminous shale rocks.

3.6 VEGETATION

The proposed Ranney Falls G3 Project is located in the Huron-Ontario Forest Section of the Great Lakes-St. Lawrence Forest Region (Rowe, 1977). The natural vegetation is dominated by mixed woods forests, which are transitional between the southern deciduous forests and the northern coniferous forests. The Huron-Ontario Forest Section is characterized by the occurrence of a number of dominant broad-leaved species such as Sugar Maple (*Acer saccharum* ssp. *saccharum*), Red Maple (*A. rubrum*), American Beech (*Fagus americana*), Red Oak (*Quercus rubra*), White Oak (*Q. alba*), Bur (Mossy-cup) Oak (*Q. macrocarpa*), Basswood (*Tilia americana*), Red Ash (*Fraxinus pennsylvanica*) and White Ash (*F. americana*).

Agricultural and urban land uses across southern Ontario have fragmented this Forest Region, leaving only smaller remnant woodlots in the landscape, some of which are still representative of the original communities.

The CLI (1971a) indicates that the lands in the proposed Ranney Falls G3 Project area are designated as 80% Class 5, and 20% Class 2, with severe and slight limitations, respectively, to the growth of commercial forests. The Class 5 lands are limited by restriction of the rooting zone by bedrock, whereas the Class 2 lands are limited by low fertility and/or physical restriction to rooting by dense or consolidated layers, other than bedrock.

The woodlands adjacent to the northwest of the Ranney Falls GS property within the Island Park Retirement Community property, as well as the woodlands in the eastern portion of the Ranney Falls GS property, have been designated as Significant Woodlands (LTC, 2001). These two woodlands are delineated by green shading in Figure 3.1. It should be noted that the delineation of the woodland within the Island Park Retirement Community property by LTC was likely based on previous aerial photography prior to Seniors Home construction. The woodlands in Ferris Provincial Park on the opposite side of the Trent River are also designated as significant.

Based on terrestrial field surveys, a total of 20 vegetation community types were documented from the site-specific study area based on the Ecological Land Classification (ELC) System for Southern Ontario (Lee *et al*., 1998). Of these, 15 are considered to be of natural origin, whereas five are of semi-natural or cultural origin. A description of the vegetation communities observed in the study area is provided in the Terrestrial TSD. Their locations are indicated on Figure 3.1.

Much of the study area is comprised of anthropogenically modified vegetation features including lawn, ornamental plantings and cultural woodlands. The lands immediately associated with Ranney Falls GS are periodically maintained. Semi-natural communities have developed on lands that have been previously disturbed or modified during construction of the Ranney Falls GS and TSW. Natural communities in the study area are generally confined to the banks of the Trent River and undisturbed areas between the TSW and Ranney Falls GS. These lands include treed cliffs, forests, thickets and wetlands.

The most noteworthy natural vegetation communities in the study area include the cliff and forested habitats associated with the Trent River.

The cliff vegetation communities associated with the Trent River are classified as Bulblet Fern – Herb Robert Open Shaded Limestone/Dolostone Cliff Face Vegetation Type. This community type is ranked as provincially significant by the MNRF Natural Heritage Information Centre (NHIC). A similar community has also developed on the walls along the tailrace channel to the main powerhouse; however, this community is artificial in origin and not considered to be of similar significance.

The forested habitats overlooking the Trent River are also considered to be noteworthy. Some of the forested communities support populations of Chinquapin (Yellow) Oak (*Quercus muhlenbergii*). While this species is not considered significant, it is considered provincially uncommon with a NHIC ranking of S4 (apparently secure – uncommon but not rare with some

cause for long-term concern due to declines or other factors). These communities support other floristic elements, such as Pennsylvania Sedge (*Carex pensylvanica*), Umbellate Bastard Toadflax (*Comandra umbellate*), Snowberry (*Symphoricarpus albus* var. *albus*) and Serviceberry (*Amelanchier* sp.), that suggest these communities may have historically been more open in character and supported savannah and prairie, but have become overgrown due to fire suppression and lack of cultural disturbances. In their former phase, they would be considered significant.

Figure 3.1 ELC Communities within the Site-specific Study Area

ELC Communities

Figure 3.1

Ranney Falls EA

Legend

ELC Communities

Significant Woodlands

Unit	ELC Code	ELC Description
1a	FOD9-5	Fresh to Moist Bur Oak Deciduous Forest
1b	FOD7-1	Fresh to Moist White Elm Lowland Deciduous Forest
1c	SWD4-2/SWT2-5	White Elm Deciduous Swamp/Red-Osier Dogwood Thicket Swamp
1d	FOD8-1	Fresh to Moist Poplar Deciduous Forest
1e	FOD7-2	Fresh to Moist Lowland Ash Deciduous Forest
1f	CUT	Cultural Thicket
2a	CUM	Lawn
2b	CUM	Lawn
2c	CUW	Cultural Woodland
2d	CUT	Cultural Thicket
2e	CUM	Cultural Meadow
2f	CUM	Cultural Meadow
2g	FOC2-2	Dry to Fresh White Cedar Coniferous Forest
2h	CUT	Cultural Thicket
2i	UNV	Unvegetated
2j	TAT1-3	Dry to Fresh White Birch Carbonate Talus
2k	CUT	Cultural Thicket
3a	CUM	Lawn
3b	CUM	Lawn
3c	FOC2-2	Dry to Fresh White Cedar Coniferous Forest
3d	CUM	Cultural Meadow
3e	FOM4-2	Dry to Fresh White Cedar-Poplar Mixed Forest
3f	UNV	Unvegetated
3g	TAT1-2	Dry to Fresh White Cedar Carbonate Talus
3h	UNV	Unvegetated
3i	CUP3-3	Scotch Pine Coniferous Plantation
3j	FOD2-4	Dry to Fresh Oak-Hardwood Deciduous Forest
3k	CUP3-3	Scotch Pine Coniferous Plantation
3l	CUP3-3	Scotch Pine Coniferous Plantation
3m	CUT	Cultural Thicket
3n	SWT2-2	Willow Mineral Thicket Swamp
3o	FOD2-4	Dry to Fresh Oak-Hardwood Deciduous Forest
3p	SWT3-2/MAM3-9	Willow Organic Thicket Swamp/Forb Organic Meadow Marsh
3q	FOD8-1	Fresh to Moist Poplar Deciduous Forest
3r	FOD5-3	Dry to Fresh Sugar Maple-Oak Deciduous Forest
3s	CUM	Lawn
3t	CUT	Cultural Thicket
3u	CUT	Cultural Thicket
3v	FOD5-6	Dry to Fresh Sugar Maple-Basswood Deciduous Forest
3w	CUM	Cultural Meadow
3x	CUT	Cultural Thicket
3y	CUT	Cultural Thicket
3z	CUM	Lawn

First Base Solutions
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As indicated in the Terrestrial TSD, 176 plant species were identified within the site-specific study area. Of these, 109 are designated by the NHIC as S5 (secure – common, widespread and abundant in the Province); seven are designated as S4 (apparently secure); and two are designated as S4S5 (apparently secure to secure). The remaining 58 species are designated as SNA (not applicable – a conservation status rank not applicable because the species is not a suitable target for conservation activities). The percentage of exotic (SNA) species (33%) was above the general proportion of non-native plants in the Province, estimated around 25% (e.g., Kaiser, 1983), reflecting the anthropogenic nature of the Ranney Falls GS property.

Significant Plant Species

Undisturbed areas of native vegetation within the proposed Ranney Falls G3 Project area have the potential to support plant species which are at risk, i.e., species which are designated with significant status under federal and/or provincial legislation. Federally, SAR are recognized by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2012) and are protected under *SARA*. Provincially these are recognized by the Committee on the Status of Species at Risk in Ontario (COSSARO) under the *ESA*, in conjunction with the Species at Risk in Ontario (SARO) List (MNRF, 2014). Species listed as provincially Endangered or Threatened and their habitats are afforded protection under the *ESA*.

The new *ESA* came into effect on June 30, 2008, providing broader protection of SAR and their habitat and a stronger commitment to recovery and effective enforcement. Once a species is designated to be at risk, it is included on the SARO List. All species that are considered endangered or threatened and their critical habitats are now legally protected under the *ESA*.

None of the plant species recorded within the site-specific study area is designated as SAR at the federal or provincial level (see Terrestrial TSD). Similarly, none of the plant species is considered provincially or regionally rare. There are five plant species associated with the study area that are considered uncommon in the Lake Ontario lowlands (W. Bakowsky, MNR, 2011, pers. comm.) and have been assigned a rank of S4 by the NHIC: Chinquapin (Yellow) Oak, False Pennyroyal (*Trichostema brachiatum*), Showy Tick-trefoil (*Desmodium canadense*), Arrow-leaved Aster (*Symphyotrichum urophyllum*) and Small Dropseed (*Sporobolus neglectus*).

3.7 SIGNIFICANT NATURAL FEATURES

There are a number of recognized natural areas situated within 10 km of the proposed Ranney Falls G3 Project. These natural areas include forests, wetlands and other natural features. Some of these features support ecological functions and/or attributes that are considered significant at the provincial, regional or local scale.

Significant natural features located within 10 km of the proposed Ranney Falls G3 Project are listed below (Hall and Jones, 1976; Van Patter and Hilts, 1985; LTC, 2001; NHIC database):

- Trout Creek Provincially Significant Wetland (PSW), located approximately 5 km east of Campbellford;
- Hoards Creek Tributary PSW, located approximately 9 km northeast;
- Nappan Island Complex PSW, located approximately 9 km north;
- Barry Lake Complex PSW, approximately 10 km west;
- Murray Marsh PSW and Provincially Significant Life Science Area of Natural and Scientific Interest (ANSI), located approximately 10 km south;
- Petherick's Corner Esker Provincially Significant Earth Science ANSI and Petherick Corners Lowland Environmentally Sensitive Area (ESA), located approximately 5 km northeast;
- Petherick's Island Beaches Provincially Significant Earth Science ANSI and Petherick Island ESA are located approximately 8 km northeast;
- Healey Falls Provincially Significant Earth Science ANSI is located approximately 8 km north;
- Birch Point Swamp ESA, located approximately 8 km north;
- Hermiston Lake Site ESA located approximately 9 km south; and
- Godolphin Esker ESA, located approximately 9 km west.

Summary descriptions of these significant natural features are provided in the Terrestrial TSD.

There are two non-PSWs, Godolphin Esker Wetland Complex and Stevenson Lake Wetland, located 7 km and 8 km east of Campbellford, respectively (LTC, 2001).

In addition to providing for the protection of PSWs, the PPS provides for the protection of Significant Wildlife Habitat (OMMAH, 2014). According to the PPS, development and site alteration shall not be permitted in significant wildlife habitat unless it has been demonstrated that there will be no negative impacts on its natural features or ecological function. The "Significant Wildlife Habitat Technical Guidelines" (MNR, 2000) categorize significant wildlife habitat using the following categories:

- habitats of seasonal concentrations of animals;
- rare vegetation communities or specialized habitat for wildlife;
- habitats of species of conservation concern; and
- animal movement corridors.

The Ranney Falls GS property supports a number of functions and attributes that would potentially qualify portions of the property as significant wildlife habitat including:

- seasonal concentration areas potentially could include reptile hibernacula (see Section 3.8);
- the rare vegetation community, Bulblet Fern – Herb Robert Open Shaded Limestone/Dolostone Cliff Face Type, associated with the cliffs of the Trent River (see Section 3.6);

- specialized habitats for wildlife identified within the study area including turtle nesting habitat, as well as River Otter (*Lontra canadensis*) feeding/denning site (see Section 3.8;
- habitat of species of conservation concern including Northern Map Turtle, Eastern Snapping Turtle and the Monarch (*Danaus plexippus*) (see Section 3.8); and
- the movement corridor represented by the Trent River valley which supports connectivity functions for a variety of wildlife species at the landscape level.

In addition to Significant Wildlife Habitat, development and site alteration shall not be permitted in Significant Woodlands south and east of the Canadian Shield and in Significant Valleylands, unless it has been demonstrated that there will be no negative impacts on the natural features or ecological functions (OMMAH, 2014).

As indicated in Section 3.6, the woodlands adjacent to the northwest of the Ranney Falls GS property within the Island Park Retirement Community property, the woodlands in the eastern portion of the Ranney Falls GS property have been designated as Significant Woodlands by LTC (2001) (see Figure 3.1). The woodlands in Ferris Provincial Park on the opposite side of the Trent River are similarly designated.

Significant Valleylands have not been identified by LTC (2001); however, the Trent River and associated riparian environment would likely qualify as a Significant Valleyland.

3.8 WILDLIFE

The local study area provides woodland, riparian and urban habitat for wildlife. In this area, most wildlife species are fully habituated to human activities and are restricted to specialized habitats.

Mammals

White-tailed deer (*Odocoileus virginianus*) is the principal large wildlife species in the area. Deer have seasonal ranges as a result of current land use practices. In the spring, summer and early autumn, deer disperse to forest edges around farmlands, woodlots and the fringes of swamps. They are most abundant where there is an optimal mix of sheltering forest and farmland. During the winter, deer congregate in areas of denser cover, especially dense woodlots, swamps and conifer stands.

The CLI (1970) has categorized the lands around the Ranney Falls GS as Class 4, with moderate limitations to the production of deer, due to deficient soil moisture and restriction of rooting zone by bedrock or other impervious layers.

As indicated in the Terrestrial TSD, 41 native species are possibly present in the local study area based on distribution maps (Dobbyn, 1994). Of these, 34 are ranked by the NHIC as S5 (secure); five are S4 (apparently secure); one is S3? (vulnerable – with the ? indicating that this

rank is uncertain); and one is S2S3 (imperilled to vulnerable). The imperilled status (S2) reflects 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 Province.

Woodchuck (*Marmota monax*) and Eastern Chipmunk (*Tamias striatus*) were observed during the July 6, 2007 breeding bird survey (Coker *et al*., 2008), whereas River Otter scat and feeding/denning site were observed in ELC unit 3v (see Figure 3.1) during the November 16, 2011 survey. During a botanical survey of the southern portion of the Ranney Falls GS property, Gregory (2010) observed Gray Squirrel (*Sciurus carolinensis*), Eastern Chipmunk and Red Squirrel (*Tamiasciurus hudsonicus*).

Avifauna

There is a diversity of habitat types represented within the site-specific and local study areas that support breeding and foraging habitat for avifauna. Habitat types present include riverine environments, cliffs, forests, wetlands, thickets and open fields.

Waterfowl in the local study area include Mallard (*Anas platyrhynchos*) and Canada Goose (*Branta canadensis)*. The lands along the Trent River and the TSW encompassing the Ranney Falls GS property are categorized by the CLI (1971b) as 60% Class 6 and 40% Class 5 with severe and moderately severe limitations, respectively, to waterfowl production. The Class 6 lands are limited by adverse topography, whereas the Class 5 lands are limited by adverse topography and reduced marsh edge.

The Terrestrial TSD and Aquatic TSD provide lists of terrestrial and aquatic bird species, respectively, recorded in the Ontario Breeding Bird Atlas as breeding or likely breeding within the 10-km by 10-km square grid (18TQ70) encompassing the Ranney Falls GS property (Bird Studies Canada, 2006). Of the 135 species likely or confirmed to be breeding within the grid, 71 are considered by the NHIC to be S5 (secure), 56 are S4 (apparently secure), two are S3 (vulnerable), and six are SNA (conservation status rank not applicable).

During the July 6, 2007 breeding bird survey of the proposed Project construction footprint, only five common bird species were observed: Great Blue Heron (*Ardea herodias*), American Robin (*Turdus migratorius*), Cedar Waxwing (*Bombycilla cedrorum*), Warbling Vireo (*Vireo gilvus*) and American Goldfinch (*Carpodacus tristis*) (Coker *et al*., 2008).

During a botanical survey of the southern portion of the Ranney Falls GS property, Gregory (2010) observed Blue Jay (*Cyanocitta cristata*), Black-capped Chickadee (*Poecile atricapillus*), Gray Catbird (*Dumetella carolinensis*), Yellow Warbler (*Dendroica petechia*), Northern Cardinal (*Cardinalis cardinalis*) and Common Grackle (*Quisculus quscula*), as well as Pileated Woodpecker (*Dryocopus pileatus*) (based on characteristic holes in the trees).

During the November 16, 2011 survey, Black-capped Chickadee and Osprey (*Pandion haliaetus*) were observed in ELC units 1a and 1b (see Figure 3.1) on the adjacent retirement home property and over the Trent River, respectively.

A pair of nesting Canada Goose was observed near the Trent River shoreline north of the "Pup" powerhouse transformer yard during an April 24, 2012 site visit.

An Osprey nesting platform is located on Parks Canada – TSW land to the east of the Ranney Falls GS within ELC unit 3w (see Figure 3.1). This platform is not currently being used (G. Current, OPG, 2015, pers. comm.).

An artificial nesting structure for Chimney Swift (*Chaetura pelagica*) has been installed on the Ranney Falls GS property near (to the southeast) of the main powerhouse. This species is designated as Threatened both federally (COSEWIC, 2012) and provincially (MNRF, 2014). Use of this structure has not been observed (M. Shaw, Environment Canada, 2011, pers. comm.; D. Brandt, OPG, 2012, pers. comm.).

The chimney of the abandoned paper mill/tannery approximately 400 m from the Ranney Falls GS property is used as a roost by Chimney Swift (M. Shaw, Environment Canada, 2011, pers. comm.).

Amphibians and Reptiles

As indicated in the Terrestrial TSD, 26 amphibian and reptile species are possibly present in the local study area (Ontario Nature, 2013). Of these, 14 are ranked by the NHIC (2010a) as S5 (secure), three are S4 (apparently secure), eight are S3 (vulnerable) and one is S2 (imperilled).

There are a number of turtle species known to occur along the TSW in the vicinity of the proposed Project area. Midland Painted Turtle (*Chrysemys picta marginata*) is one of the more common species that is known to be present. However, there are also several turtle SAR known to occur in the area including Eastern Snapping Turtle, Northern Map Turtle, Eastern Musk Turtle (*Sternotherus odoratus*) and Blanding's Turtle (*Emydoidea blangingii*) (Cebek *et al*., 2005). Eastern Snapping Turtle and Northern Map Turtle are the only turtle SAR regularly observed along the Trent River between Ranney Falls and Hague's Reach.

Turtles have been observed nesting on the Ranney Falls GS site in gravel substrate near the "Pup" transformer sub-station. In 2007, OPG retained the services of turtle researchers Dr. J. Litzgus and A. Bennett (M.Sc. candidate) to investigate which turtle species may be utilizing the site. In their study, Bennett and Litzgus (2007, 2008) confirmed that the area between the main powerhouse tailrace and the "Pup" powerhouse is utilized as nesting habitat by Northern Map Turtle and Eastern Snapping Turtle. Both of these species are designated as Special Concern federally (COSEWIC, 2012) and provincially (MNRF, 2014). An old walkway bisecting the property appears to be the western limit of the primary nesting area. The area

above the walkway consists of open lawn and is unsuitable for nesting. Predated nests were also found in the storage area and the south-easterly portion of the property (Bennett and Litzgus, 2008).

A number of Midland Painted Turtles and Northern Map Turtles were also observed during the June 6, 2006 site visit basking along the water's edge and swimming in the Trent River downstream of Ranney Falls (Coker, 2007). A small dead Eastern Snapping Turtle, likely a road kill, was also observed at the entrance of the Ranney Falls GS parking lot. During the July 6, 2007 breeding bird survey, a single hatchling Eastern Snapping Turtle was observed part way down along the access road to the "Pup" powerhouse (Coker *et al*., 2008). Many (~25) other nest scrapes were observed, including at least one raided nest. Turtle egg casings were observed during the November 16, 2011 survey in the area adjacent to the "Pup" powerhouse transformer substation and on the rubble peninsula between the "Pup" and main powerhouse tailraces.

During a botanical survey of the southern portion of the Ranney Falls GS property, Gregory (2010) noted the presence of several turtle nests on sand and gravel substrates along the shoreline in the northern portion of the property.

One Northern Map Turtle was observed inside the fenced "Pup" transformer area during the morning of June 13, 2012, whereas three and one Northern Map Turtles were observed digging nests during the mornings of June 14 and 15, 2012, respectively, just outside the fence (W.F. Weller, OPG, 2012, pers. comm.). One young-of-year (YOY) Northern Map Turtle and one YOY Midland Painted Turtle were also observed in the Ranney Falls GS headpond, likely indicating successful nesting on the property.

Two large specimens of Common Watersnake (*Nerodia sipedon sipedon*) were observed in the bushes directly east of the "Pup" powerhouse close to the top of slope during the July 6, 2007 breeding bird survey (Coker *et al*., 2008). A Common Watersnake was also observed at this location on June 13, 2012, as well as one along the fence of the main powerhouse tailrace (W.F. Weller, OPG, 2012, pers. comm.). According to Plourde *et al*. (1989), this species is considered "uncommon and widespread" in the former MNRF Central Region, which includes Northumberland County. The shed skin of an Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) was also found on the bedrock and rubble peninsula between the two tailraces during the June 6, 2006 site visit (Coker, 2007). The entire area southeast of the "Pup" powerhouse likely provides suitable habitat (hibernacula) for snakes (Coker *et al*., 2008).

No amphibians were observed from the proposed Project area during the various surveys in 2007, 2008, 2011 and 2012. The only possible habitat for breeding amphibians in the vicinity of the proposed Project area is a small marsh wetland (designated as ELC unit 3p in Figure 3.1) situated to the south of the maintenance yard. This area could potentially support populations of common species such as Eastern American Toad (*Anaxyrus americanus americanus*) and Northern Leopard Frog (*Lithobates pipiens*).

Invertebrates

As indicated in the terrestrial TSD, 11 dragonfly species have been recorded in Map Square 18TQ70 overlapping the site-specific study area. Eight are ranked by the NHIC as S5 (secure); two are S4 (apparently secure); and one is S3 (vulnerable).

Monarch, designated as Special Concern federally and provincially, was observed on the Ranney Falls GS property during the July 6, 2007 breeding bird survey (Coker *et al*., 2008). The Monarch is designated by the NHIC as S4 (apparently secure). No evidence of egg-laying was noted, but two of its traditional host plants, Common Milkweed (*Asclepias syriaca*) and Swamp Milkweed (*A. incarnata*) are present on the property.

A search of the NHIC database indicated that the butterfly Juniper Hairstreak (*Callophrys gryneus*), designated as S2 (imperilled), has been recorded in Map Square 18TQ70 overlapping the site-specific study area. This species has a limited range in Canada where it is confined to southeastern and southwestern Ontario. The species is associated with Eastern Red Cedar (*Juniperus virginiana*). While Eastern Red Cedar is present in the site-specific study area (see Terrestrial TSD), it is of limited abundance and would likely not support significant populations of Juniper Hairstreak.

3.9 SURFACE WATER AND GROUNDWATER HYDROLOGY AND QUALITY

Site Surface Hydrology

The Ranney Falls GS property is located between the Trent Canal and Trent River. The elevation of water in the Trent Canal near the Ranney Falls GS forebay is approximately 146 m asl (above sea level) while the Trent River near the tailrace is approximately 131 m asl (Knight Piésold Ltd., 2011b). On the property, drainage generally flows from the southwest to the northeast, i.e., towards the Trent River.

A drainage culvert from the adjacent property discharges into the penstock trench under approximately the mid-point of the “Pup” powerhouse penstock.

Groundwater Hydrology and Quality

Four water wells were identified within a 250 m wide radius of the Ranney Falls GS based on the MOECC Water Well Information System. As indicated in the Aquatic TSD, the well depths ranged from 4.6 to 19.8 m, yields ranged from 0.19 to 0.95 L/s and the groundwater was fresh.

Based on site-specific geotechnical investigations (Knight Piésold Ltd., 2011b), the groundwater table on the lower level of the Ranney Falls GS property is within the lower shale-poor bedrock domain at an approximate depth of 24 m. Water that flows within the unsaturated overburden likely flows down to the water table, although some horizontal flow is expected along the interface between overburden and bedrock, as well as above relatively lower permeability bedding.

The water level readings indicate that groundwater flows from the southwest to the northeast and is directed towards the main powerhouse tailrace channel on the lower section of the property (Knight Piésold Ltd., 2011b). A downward gradient was observed which decreases in magnitude with depth. The response to the Trent Canal and forebay water levels appears to be dampened and delayed in the groundwater system.

Seepage zones were identified in the main tailrace channel faces, within main powerhouse concrete cracks, in the "Pup" tailrace wall, along the "Pup" penstock trench and at the "Pup" intake headwall (Ontario Hydro, 1989; Knight Piésold Ltd., 2011b).

Based on groundwater quality data for three monitoring wells installed in 2012, the concentrations of most parameters analyzed were below their respective MOE (2011b) Ground Water Standard and/or Provincial Water Quality Objective (PWQO) (MOEE, 1994).

As indicated in the Aquatic TSD, benzene, phenolics and n-hexane concentrations in groundwater samples were above their respective MOE (2011b) Ground Water Standards or PWQOs (MOEE, 1994). Based on review of other study findings (Slaine and Barker, 1990; COLESTAR, 2011), it was concluded that these elevated concentrations are naturally occurring due to their leaching from the bituminous layers of shale that are interbedded in the limestone of the Verulam Formation.

TSW/Trent River Hydrology

The Trent River and the TSW occur within the Northern Lake Ontario drainage basin in the Great Lakes-St. Lawrence Drainage System (Chapman and Putnam, 1984). The Trent River drainage basin drains more than 12,000 km^2, including several hundred lakes.

The TSW spans two main watersheds: the Trent River watershed drains in a southeasterly direction into Lake Ontario at Trenton, and the Severn River drains in a north-westerly direction to Georgian Bay at Port Severn. At the height of land near Kirkfield, a dug canal joins Balsam Lake to the artificially widened Grass River (known as Mitchell Lake), and thus unites the two watersheds. From Balsam Lake with an elevation of 256.3 m asl, the Trent system flows 260 km to Lake Ontario at 74.4 m asl.

This substantial area results in an average annual flow rate of approximately 150 m^3/s, and a 5-year return peak instantaneous flow of approximately 650 m^3/s, near its mouth. At Ranney Falls GS the average annual flow rate is approximately 118 m^3/s, and the maximum and minimum mean monthly flows are 205 m^3/s (April) and 31.6 m^3/s (August), respectively. Flows in the system are regulated by Parks Canada – TSW, primarily for navigation and maintenance of water levels, with flows in excess of these needs being available for hydroelectric generation.

Greatest flow occurs during the spring freshet in April with the lowest flows occurring during the summer in August.

The Trent River is highly modified and for more than a century has been part of the TSW. Numerous locks and dams punctuate the river, maintaining artificial water levels throughout the river and interconnected lakes for navigation purposes. The only higher gradient sections that provide riffle habitats are outside of the navigation channel, at the base of dams, in spill channels, or in sections of river bypassed by the navigation channel. Habitat in these areas is typically maintained during dry periods by intentional dam spillage to maintain a minimum flow, by leakage through dams and/or groundwater and precipitation event inflows.

During Dam #10 closure, leakage is estimated to be 0.5 m^3/s or less (Coker *et al*., 2012). When the river flow exceeds the capacity of the existing Ranney Falls GS and navigational requirements for Locks #11 and #12, the excess flow is spilled through Dam #10 (see Photograph 2.1). Flow velocity is fast during spillage as there is an approximately 10-m difference in elevation over the 900 m reach between the downstream side of Dam #10 and the brink of Ranney Falls. The excess flow that passes over Ranney Falls creates an area of fast, turbulent flow for a short distance downstream of the falls. The swift flows continue along the east shore of the river and are joined by the flows from the two powerhouse tailraces, creating a visibly turbulent flow across the entire river. The remainder of the reach between Locks #10 and #11 is a 2.75-km long section of deep flatwater habitat.

River freeze-up generally occurs at the end of December, whereas ice break-up usually occurs in mid-March (MNR, 1984). The freeze-up and break-up dates are approximate and will vary according to ambient temperature, channel width and orientation, and water flow.

Surface Water Quality

As indicated in the Aquatic TSD, water quality parameter concentrations in the Trent River were generally below their respective PWQOs (MOEE, 1994). Overall, the Trent River has relatively good water quality.

3.10 TSW/TRENT RIVER MORPHOLOGY, BATHYMETRY AND SUBSTRATE

The section of the Trent Canal from Dam #10 downstream to Ranney Falls GS and Locks #11 and #12 ranges from 41 to 77 m in width and is approximately 3 m deep throughout, except near the Ranney Falls GS intake where water depth is approximately 5 m (Coker *et al*., 2012).

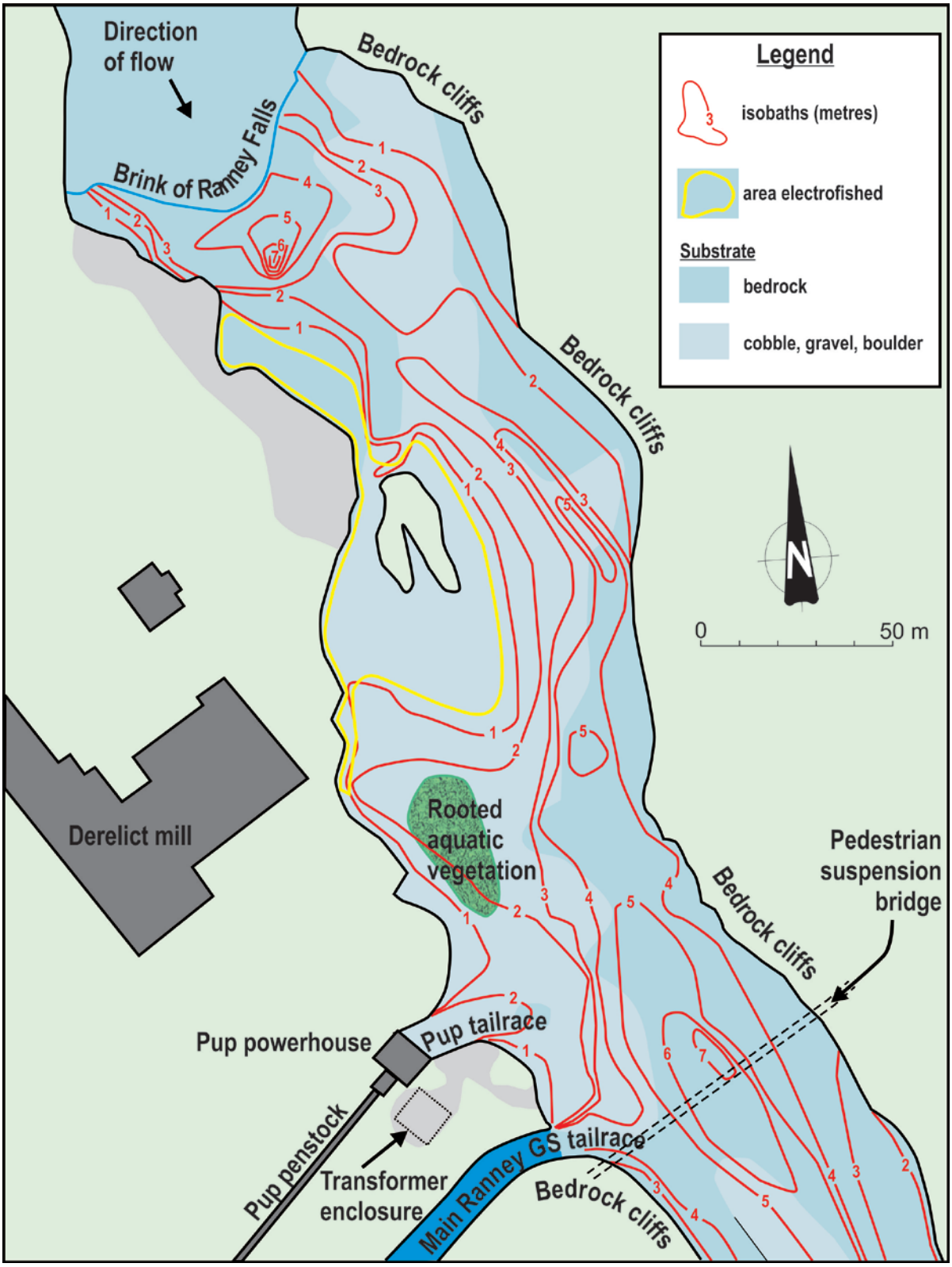
The section of the Trent River downstream of Dam #10 to Ranney Falls is approximately 900 m long with a maximum depth of 2 to 3 m during dam spillage (Coker *et al*., 2012). As indicated in Section 2.3.2, a small amount of leakage estimated to be 0.5 m^3/s or less occurs when Dam #10 is closed. This flow feeds a series of shallow pools and riffles on the bedrock substrate (see Photograph 2.2).

The section of the Trent River from Ranney Falls to the Ranney Falls GS main powerhouse tailrace is approximately 260 m long and 50 to 80 m wide (Coker *et al*., 2012). During Dam #10 spillage, water depth is generally 2 to 3 m to a maximum of 7 m (see Figure 3.2).

In the section of the Trent Canal from Dam #10 downstream to Ranney Falls GS and Locks #11 and #12, the substrate observed from shore was mainly cobble with some boulder and gravel (Coker *et al*., 2012), but is apparently mostly armoured gravel farther from shore (Krishnappan, 2007).

Trent River substrate between Dam #10 and Ranney Falls is primarily flat bedrock, which is covered in some areas by a layer of loose rock slabs, or boulder and cobble.

Figure 3.2 Trent River Bathymetry, Substrate and Main Habitat Features



From Ranney Falls downstream to the Ranney Falls GS main powerhouse tailrace, approximately 50% of the substrate is bedrock, with the remainder being a mixture of cobble, gravel and boulder in various proportions (see Figure 3.2). The east shore of this section is mainly bedrock cliff.

Based on the relatively good water quality (see Section 3.9) and the predominantly coarse sediment type, the sediments can be expected to have low concentrations of contaminants.

3.11 AQUATIC VEGETATION

As indicated in the Aquatic TSD, 62 plant taxa (52 species) have been recorded in the TSW (Saunders, 2006). Of the 52 species that could be ranked, 29 are ranked by the NHIC as S5 (secure); one is S5? (secure – rank uncertain); six are S4 (apparently secure); three are S4? (apparently secure – rank uncertain); five are S4S5 (apparently secure to secure) and two are S1 (critically imperiled – due to extreme rarity, i.e., often five or fewer occurrences, or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation). The remaining six species are designated by the NHIC as SNA (conservation status rank not applicable).

One aquatic macrophyte species present in the TSW and designated as S1 by the NHIC is a SAR. Engelmann's Quillwort (*Isoëtes engelmanni*) is designated as Endangered federally (COSEWIC, 2012) and provincially (MNRF, 2014). This species is confined to a 4.5 km section of the Severn River in the District Municipality of Muskoka (EQRT, 2007) and a 450 meter section of the Gull River at West Guilford. Its sterile hybrid with Spiny-spored Quillwort (*I. echinospora*), Eaton's Quillwort (*I. x eatonii*) is also ranked as S1 but not designated as a SAR.

A bed of rooted aquatic vegetation consisting primarily of Pondweed (*Potamogeton* spp.) with some Water-milfoil (*Myriophyllum*) is present upstream of the "Pup" powerhouse tailrace (see Figure 3.2). All of the *Potamogeton* species present in the TSW are ranked by the NHIC as S5 (secure), S4 (apparently secure), S4S5 (apparently secure to secure), or SNA (conservation status rank not applicable). Similarly, all of the *Myriophyllum* species are ranked as S5 (secure), S4? (apparently secure – rank uncertain) or SNA (conservation status rank not applicable).

3.12 BENTHIC MACROINVERTEBRATES

The composition of the benthic macroinvertebrate community has been the most widely used indicator of water quality. This is because the macroinvertebrates form relatively sedentary communities in the sediments, thereby reflecting the character of both the water and sediment. Alteration of benthic community structure is used to assess the trophic or general pollutional status of a waterbody. This assessment is usually based on interpretation of indicator species, changes in the relative numbers of individuals and species, and/or the derivation of a species diversity or community comparison index.

Benthic macroinvertebrate community composition data for the Trent River are available near the OPG Frankfort GS approximately 36 km downstream of the Ranney Falls GS (see Aquatic TSD). Substrate at the sampling location consisted mostly of cobble and gravel, as well as some fractured and broken limestone. Larger cobble and limestone were situated over gravel and coarse sand. This substrate is similar to that in the Trent River proximate to the Ranney Falls GS tailrace (see Figure 3.2). It is therefore likely that the benthic macroinvertebrate community composition at both locations would be similar; however, due to the greater preponderance of bedrock, overall densities can be expected to be lower in the Trent River proximate to the Ranney Falls GS tailrace.

At the Frankfort GS sampling locations, Ephemeroptera (mayfly nymphs) was the dominant major taxon comprising 41% and 63% of the total number of individuals in the spring and fall, respectively, followed by chironomids (midge larvae) and molluscs (snails, clams) (Pope, 1998). Species diversity, based on the Shannon-Weiner diversity index, was similar for the two sampling periods, i.e., 2.7 and 2.6 in the spring and fall, respectively. This index is a measure of the number of species and individuals present at a given location as well as the distribution of those individuals among the various species. Wilhm and Dorris (1969) proposed that benthic macroinvertebrate communities with diversity index values greater than 3 are generally found in unpolluted conditions, whereas communities with values less than 1 are generally found in organically enriched (polluted) conditions.

As indicated in Section 3.10, nearshore substrate in the Trent Canal proximate to the Ranney Falls GS is mainly cobble with some boulder and gravel, and mostly armoured gravel farther from shore. This substrate would likely support benthic macroinvertebrate communities characterized by low densities and diversities.

3.13 FISHERIES RESOURCES

A total of 73 fish species have been recorded in the TSW (Saunders, 2006). Of the 67 native species listed, 43 are ranked by the NHIC as S5 (secure); 17 are S4 (apparently secure); two are S3 (vulnerable); four are S2 (imperilled) and one is S1? (critically imperilled – rank uncertain). Six additional species are designated by the NHIC as SNA (conservation status rank not applicable).

The fish communities found within each relatively isolated section of the TSW, i.e., between a set of dams and locks, reflect the habitats available within each section. Centrarchids, i.e., sunfishes, Smallmouth Bass (*Micropterus dolomieu*) and Largemouth Bass (*Micropterus salmoides*), are very common throughout the system due to their preferred habitats found in quiet slow-moving rivers or small lakes with warm water.

Of the 73 species recorded in the TSW, 35 species have been captured upstream and downstream (including Percy Reach) of Campbellford (see Aquatic TSD). Of these, 24 are designated as S5 (secure); seven are S4 (apparently secure); one is S2 (imperilled); one is S1?

(critically imperilled – rank uncertain); and two are SNA (conservation status rank not applicable).

Field investigations of the fish habitat and fish communities were undertaken in the Trent River upstream and downstream of Ranney Falls in 2006, 2007 and 2008 by C. Portt and Associates staff. Figure 3.2 depicts the bathymetry, substrate and main habitat features of the Trent River from Ranney Falls to a short distance downstream of the Ranney Falls GS main powerhouse tailrace.

Fish were collected by electrofishing in wadeable areas on June 6 and 7, and August 31, 2006, and on June 4, 2007. An underwater video system also provided for fish observations. In addition, Walleye spawning investigations were undertaken downstream of Ranney Falls on April 13, 2006, April 21, 2007 and April 22, 2008.

Electrofishing of approximately 300 m of shoreline of the spillway from Dam #10 downstream to Ranney Falls captured no fish on June 6, 2006, when water was being spilled through Dam #10. However, fish were captured in the spillway when there was only leakage downstream of Dam #10 on August 31, 2006, including 15 Rock Bass (*Ambloplites rupestris*), 27 Smallmouth Bass (half of which were YOY) and one Brown Bullhead (*Ameiurus nebulosus*), when much of the wetted area throughout the channel for approximately 700 m downstream of Dam #10 was electrofished. One Rock Bass and 30 Smallmouth Bass were captured on June 4, 2007, again, when the only water passing through Dam #10 was leakage, and with a similar level of electrofishing effort. The relatively low numbers of fish found in the large area of the spillway indicate that the fish community in this section of river is sparse. This is not surprising, given the poor aquatic habitat with bedrock substrate, shallow water and widely fluctuating flows. It is possible that the fish community in this area may largely be the result of fish washed downstream when spillage occurs at Dam #10 during the high river flows.

Habitat from Ranney Falls to immediately downstream of the main powerhouse tailrace is diverse, with depths up to 7 m, a variety of coarse substrates, rock ledges, areas of quiet water adjacent to faster flowing water, and an area of rooted aquatic plants (see Figure 3.2). The “Pup” tailrace is approximately 2 m deep, with cobble, gravel and boulder substrate.

Shoreline electrofishing downstream of Ranney Falls in 2006 captured 15 Rock Bass, 13 Smallmouth Bass and two Logperch (*Percina caprodes*), whereas one each of Rock Bass, Pumpkinseed (*Lepomis gibbosus*) and Smallmouth Bass were captured in 2007. Although fish were not readily captured by backpack electrofishing in wadeable areas, dense schools of Pumpkinseed were observed in most areas of deeper water by underwater video, as were individual Smallmouth Bass. Yellow Perch (*Perca flavescens*), Common Carp (*Cyprinus carpio*), Bluegill (*Lepomis macrochirus*) and White Sucker (*Catostomus commersonii*) were each observed only once, either singly or in a small group.

Although not collected during the 2006 and 2007 surveys, the exotic Round Goby (*Neogobius melanostomus*) now occurs throughout the Trent River system (Dr. M. Fox, Trent University, 2012, pers. comm.).

It is possible that the section of river between Ranney Falls and Lock #10 contains some Walleye, although, if present, the population in this isolated reach would probably be small. An exposed cobble shoal, located a short distance downstream of Ranney Falls, appears to provide a small area of suitable habitat for Walleye spawning. However, no Walleye were observed at this location during night observations in 2006, 2007 and 2008, although water temperatures were appropriate for spawning and Walleye spawning was observed at the same time at other nearby locations within the TSW. It is likely that the small area between Ranney Falls and Hagues Reach is not large enough to sustain many Walleye.

3.14 SPECIES AT RISK

As indicated in Section 2.6, none of the plant species recorded within the site-specific study area is designated as SAR at the federal or provincial level.

Based on the *SARA* Schedule 1 SAR Web Mapping Application (Environment Canada, CWS, 2010/2011), one mammal, four bird, six reptile and one arthropod species have ranges overlapping the Ranney Falls GS property:

- Northern Bobwhite (*Colinus virginianus*) and Spotted Turtle (*Clemmys guttata*), designated as Endangered federally by COSEWIC (2012) and provincially by COSSARO (MNRF, 2014); Grey Fox (*Urocyon cinereoargenteus*), Least Bittern (*Ixobrychus exilis*) and Hooded Warbler (*Wilsonia citrina*), designated as Threatened federally and provincially; and Cerulean Warbler (*Dendroica cerulean*), designated as Special Concern federally and provincially; but have not been recorded as possibly present in the site-specific study area;
- Blanding's Turtle, designated as Threatened federally and provincially; Eastern Musk Turtle, designated as Threatened federally and Special Concern provincially; and Northern Ribbonsnake (*Thamnophis sauritus septentrionalis*) and Eastern Milksnake (*Lampropeltis triangulum triangulum*), designated as Special Concern, federally and provincially, have been recorded as possibly present in the site-specific study area; and
- Northern Map Turtle and Monarch, designated as Special Concern, have been observed on the Ranney Falls GS property.

The Environment Canada, CWS (2010/2011) distribution range mapping for Eastern Wolf (*Canis lupus lycaon*), designated as Special Concern federally and provincially, and Eastern Hog-nosed Snake (*Heterodon platirhinos*), designated as Threatened federally and provincially, does not overlap the site-specific study area. It is unlikely that these species would be associated with the study area.

Environment Canada, CWS (2010/2011) distribution range mapping is not available for Chimney Swift, Barn Swallow (*Hirundo rustica*), Bobolink (*Dolichonyx oryzivorus*) and Eastern Meadowlark *(Sturnella magna*) designated as Threatened federally and provincially; Red-headed Woodpecker (*Melanerpes erythrocephalus*) and Canada Warbler (*Wilsonis canadensis*), designated as Threatened federally and Special Concern provincially; Black Tern (*Chlidonias niger*), designated as Not at Risk federally, but Special Concern provincially; and Western Chorus Frog (*Pseudacris triseriata*), designated as Threatened federally but Not at Risk provincially. Only one species, Chimney Swift, would be associated with the site-specific study area. There is an artificial nesting structure for this species situated adjacent to the main powerhouse. There is also suitable habitat for this species associated with the abandoned mill north of the retirement home property.

Environment Canada, CWS (2010/2011) distribution range mapping is also not available for Eastern Snapping Turtle. This species is designated as Special Concern federally and provincially and has been observed on the Ranney Falls GS property.

Based on the NHIC database, Butternut (*Juglans cinerea*), which is designated as Threatened federally and provincially, Northern Map Turtle and Eastern Snapping Turtle have been recorded within 1 km of the Ranney Falls GS property, whereas Eastern Musk Turtle, Blanding's Turtle, Black Tern, Eastern Meadowlark, Bobolink and Barn Swallow have been recorded within 5 km of the property (L. Spang, MNRF, 2014, pers. comm.). Golden-winged Warbler (*Vermivora chrysoptera*), designated as Threatened federally and Special Concern provincially, has also been recorded within 5 km of the property, but not observed in NHIC grid 18TQ70 overlapping the property. Environment Canada, CWS (2010/2011) distribution range mapping is not available for Golden-winged Warbler.

It should be noted that although Butternut has been recorded within 1 km of the Ranney Falls GS property, it was not observed on the property.

Four fish species present in the TSW are SAR: Lake Sturgeon (*Acipenser fulvescens*) and Channel Darter (*Percina copelandi*), designated as Threatened federally (COSEWIC, 2012) and provincially (MNRF, 2014); American Eel (*Anguilla rostrata*), designated as Special Concern federally and Endangered provincially; and River Redhorse (*Moxostoma carinatum*), designated as Special Concern federally and provincially. Channel Darter and River Redhorse have only been documented downstream of the Ranney Falls GS (Reid, 2005).

Based on DFO aquatic SAR mapping provided on the Conservation Ontario website (http://www.conservation-ontario.on.ca), Lake Sturgeon is the only fish SAR that is of concern in the area of Ranney Falls GS with the upstream limit of its distribution being Dam #10, Ranney Falls GS and Locks #11 and #12. The presence of Lake Sturgeon is based on a 1976 record (NHIC: Map Square 18TQ70) with no more recent documented occurrences this far upstream (G. Kinsman, Parks Canada – TSW, 2011, pers. comm.). American Eel is also known to occur, or to have occurred, upstream of Ranney Falls GS. The American Eel was captured upstream

of Campbellford based on 2001 or earlier records (H. Simpson, MNR, 2011, pers. comm.) and was not listed in Map Square 18TQ70.

3.15 INVASIVE SPECIES

One aquatic invasive species, Water Soldier was found in the Trent River in 2008 and has since spread. Water soldier is an evergreen perennial a fast-growing aggressive species that can out-compete native plants and decrease plant biodiversity. It can also invade open water converting that habitat into dense vegetation (Trent-Severn Waterway, 2014).

Populations of the invasive within the TSW represent the only known infestation in a public waterway in North America. Currently, MNRF and OFAH are studying the species and have a harvesting and spray program in place. The Water Solider has been was first discovered near Havelock, somewhat north of Ranney Falls.

3.16 LAND AND WATER USES

Land Use

Trent Hills is located in the northeastern most portion of Northumberland County.

The three major population centres in Trent Hills are the former town of Campbellville, the former village of Hastings and the community of Warkworth, formerly the municipal seat of the Township of Percy.

Based on Official Plan mapping (Trent Hills, 2001), 35% of lands within the municipality are designated as prime farm land, 30% rural lands, 20% greenlands, 10% urban areas and 5% aggregate resources (J. Peters, Trent Hills, 2011, pers. comm.).

Agriculture is important to the local economy and agricultural activities are expected to remain as the predominant land use in the municipality (Trent Hills, 2001). The predominant agricultural operations are cash crops, beef farming and dairy farming (J. Peters, Trent Hills, 2011, pers. comm.). The predominant cash crops are alfalfa and alfalfa mixtures (7,063 ha), corn for grain (3,016 ha), soybeans (2,984 ha), all other tame hay and fodder crops (1,484 ha), and mixed grains (966 ha) (Statistics Canada, 2011).

The Ranney Falls GS is located approximately 1.8 km south of the Campbellford community centre and is zoned “Development” (Trent Hills, 2010) (see Figure 3.3).

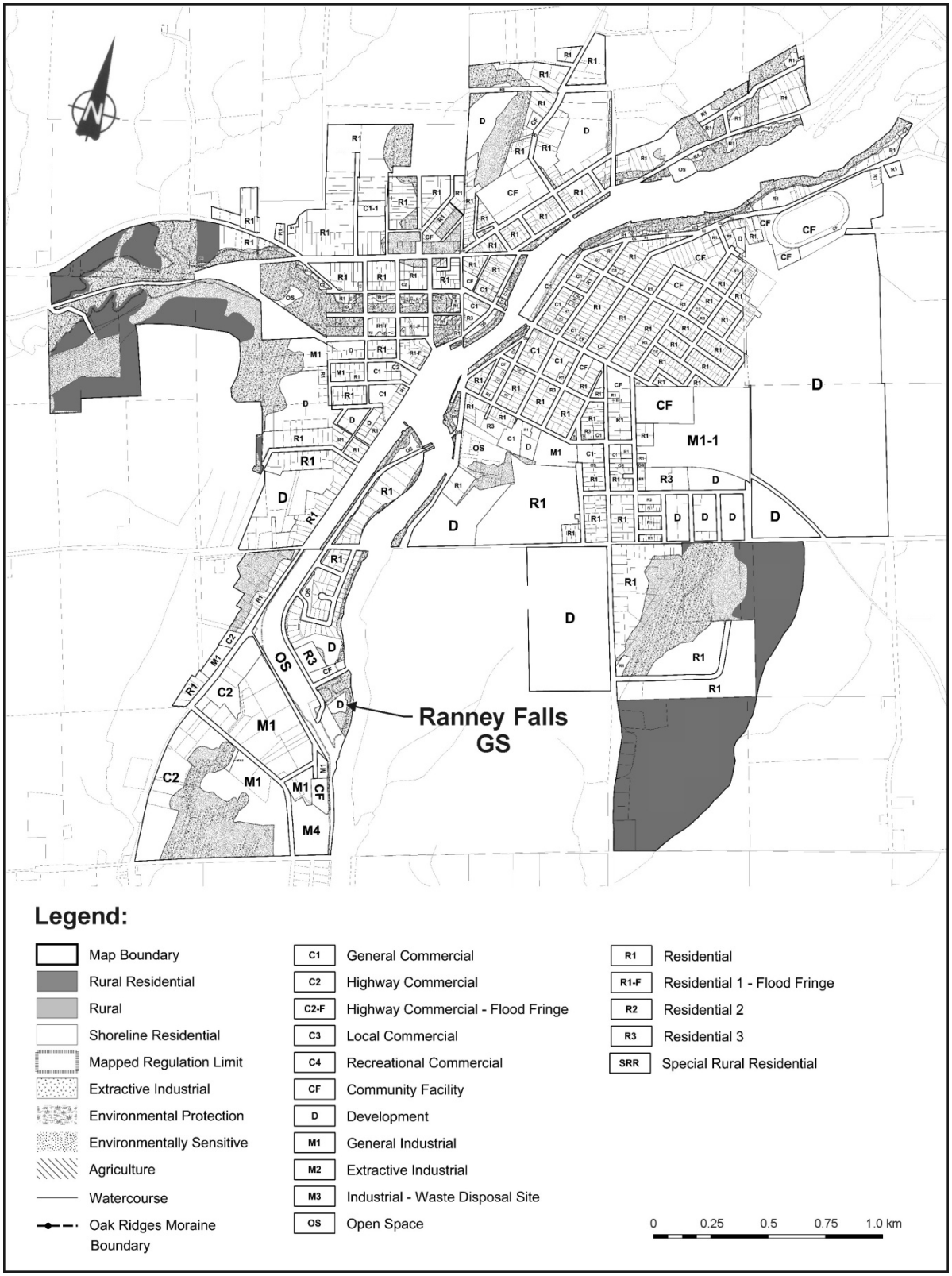
There are a number of commercial operations to the south and a residential area to the north. Downtown Campbellford is the service and retail centre of Trent Hills.

The Island Park Retirement Community property, owned by Specialty Living Island Park Inc., is located adjacent to the northwest of the Ranney Falls GS property, with the retirement home approximately 50 m from the property boundary.

A disused industrial building is located north of the Island Park Retirement Community property. The industrial building was initially occupied in the late 1800's by the Northumberland Pulp and Electric Company (Crothers *et al*., 2000). In 1904, the "The Paper Mill", as it was known, went bankrupt. After two changes of ownership, the mill burned down in 1910, but was rebuilt in 1915. Due to external competition, the operation closed in 1939. In 1946, the property was purchased by Breithaupt Leather Company and renovated for a leather tannery and finishing factory. In 1983, a family purchased the property on which they built a home.

There are a number of general industrial operations to the south and a residential area further to the north of Island Park Retirement Community (see Figure 3.3).

Figure 3.3 Campbellford Land-use Zoning[1]



[1] Source: Trent Hills (2010).

The Ranney Gorge Suspension Bridge provides public access from the Ranney Falls GS property to Ferris Provincial Park on the opposite side of the Trent River. A public parking area is available on the east side of the Ranney Falls GS property with a trail available to the Ranney Gorge Suspension Bridge. The Park, 1.98 km^2 in area, was operated by the Province from 1962 to 1994. Subsequently, based on a Memorandum of Understanding (MOU), the Park was operated by the Trent Hills Recreation Department with the support of the Friends of Ferris Park, a non-profit charitable organization dedicated to the promotion and preservation of the Park. With the termination of the MOU, Ontario Parks resumed the operation of Ferris Provincial Park in 2009. Ferris Provincial Park is open year round.

General Recreation

The CLI (1971c) categorizes the lands encompassing the Ranney Falls GS property as Class 4 with moderate capability for outdoor recreation, providing access to water affording opportunity for angling or viewing of sport fish, shoreland fronting water accommodating yachting and boat tripping, and major, permanent, non-urban, man-made structures of recreational interest, i.e., the TSW.

Recreational Boating

The development of the TSW to provide a link between Lake Ontario and Georgian Bay was initially based on the demand for better transportation and access to resources (Parks Canada, 2000, 2011). Completed in 1920, the waterway vision as a commercial transportation route never came to fruition following a shift in mode of transport from steamboat to rail. Subsequently, recreation became an industry of considerable importance to the communities along the waterway due to substantial increase of resorts and cottages. The waterway system is 386 km long and currently encompasses 44 locks including two flight locks, two hydraulic lift locks and one marine railway. The system includes 160 dams and water control structures, 42 bridges, 25 km of concrete wing walls at lock stations and more than 1,700 aids to navigation.

The Federal Government owns and Parks Canada – TSW manages approximately 76,000 ha of lake and river beds that are constituent parts of the waterway (PFTSW, 2008). Approximately 230 wetlands are associated with the waterway, and a diverse assemblage of biota utilizes the principal habitat along the waterway and associated upland areas, including more than 40 SAR. In addition to its ecological importance, the TSW has significant social, economic, cultural and archaeological values.

In 2010, the TSW served more than one million land-based visitors and approximately 130,000 vessels passed through one or more locks (Parks Canada, 2011). The TSW operates from mid-May to mid-October, e.g., in 2011 operation extended from May 20 to October 12. Peak vessel utilization occurs in July and August, with approximately 1,000 vessels passing through the three lock locations annually.

Lock-viewing is also a popular pastime for tourists, with the Locks #11 and #12 near Ranney Falls GS forming one of the two sets of flight locks in the TSW. Flight locks are two conventional locks joined in a sequence or "flight" of locks to overcome great changes in water level.

Sportfishing

Recreational fishing is an important facet of the tourist industry and the local economy. Based on the 2000 survey of recreational fishing in Ontario, over 2 million sportfish were caught in the TSW, with the order of predominant catch being sunfishes, Rock Bass, Yellow Perch, Smallmouth Bass, Largemouth Bass and Walleye (MNR, 2003).

Sportfishing is not common in proximity to the Ranney Falls GS.

Municipal Water Supply and Wastewater Treatment

The Campbellford Water Treatment Plant, operated by Trent Hills, is a conventional water treatment system which draws all of its raw water supply from the Trent River. A 5,230 m^3 off-site storage reservoir provides for peak hour demands. There are no municipal water intakes in the vicinity of the Ranney Falls G3 GS (Peters, 2016).

The Trent Conservation Coalition Protection Committee (TCCPC) was established as a multi-stakeholder committee selected to represent municipal, economic, general public and First Nation interests across the Source Protection Region, including the Trent River, to develop a Source Protection Plan that establishes policies for preventing, reducing or eliminating threats to drinking water from surface water and groundwater sources. The “Amended Proposed Trent Assessment Report” (TCCPC, 2011) was recently submitted to the MOE (now MOECC) for review and consideration.

Trent Hills has a contract with the Ontario Clean Water Agency to operate the Campbellford Wastewater Plant for the management and disposal of solid wastes.

Parks Canada – TSW has installed a catch basin and storm sewer on lands under its administration adjacent to Trent Drive in order to address seasonal flooding of Parks Canada land and Trent Drive (E. Nolan, Parks Canada – TSW, 2015, pers. comm.).

Other Hydropower Facilities

At the present time, there are 26 hydroelectric generating stations on the TSW generating close to 100 MW collectively. Additional new and expansions of existing stations are being actively considered, including the proposed Ranney Falls G3 Project. As indicated in Section 2.2.1, the PFTSW (2008) concluded that the development of renewable energy resources is a sound public policy goal and supported a vigorous effort to pursue green energy generating potential along the TSW.

3.17 SOCIO-ECONOMICS

Northumberland County

Northumberland County borders the Region of Durham to the west, the County of Peterborough to the west and north, the County of Hastings to the east and Lake Ontario to the south. With an area of 1,905.34 km^2, Northumberland County is composed of seven local municipalities: the Town of Cobourg, the Municipalities of Brighton, Port Hope and Trent Hills, and the Townships of Ainwick/Haldimand, Cramahe and Hamilton.

As an upper-tier level of municipal government, Northumberland County is responsible for community and social services, emergency medical services (EMS), emergency planning, financial services, county roads and transportation, long-term care, waste collection and disposal, economic development and tourism (Northumberland County, 2012). The Northumberland County municipal offices are located in Cobourg.

The population of Northumberland County increased from 80,963 in 2006 to 82,126 in 2011 (+1.4%) (Statistics Canada, 2012). Population density in 2011 was 43.1 persons/km^2. Based on the Northumberland County (2014) Official Plan (OP), the population is expected to increase from 84,482 in 2011 to 102,517 by 2034. Additional population, income and employment statistics are provided in the Socio-economics and Land Use TSD.

The Northumberland Detachment of the Ontario Provincial Police (OPP) based in Brighton, Campbellford and Cobourg provides law enforcement and crime prevention throughout the County, with the exception of Cobourg and Port Hope.

Medical services are provided by the 137-bed Northumberland Hills Hospital in Cobourg and the 34-bed Campbellford Memorial Hospital in Campbellford. The headquarters of the Northumberland County EMS is located within the municipal office building in Cobourg, with six ambulance stations in Brighton, Campbellford, Cobourg, Colborne, Port Hope and Roseneath.

The Kawartha Pine Ridge District School Board (KPRDSB) operates 23 elementary and five secondary public schools, whereas the Peterborough Victoria Northumberland & Clarington Catholic District School Board (PVNCCDSB) operates six elementary and one secondary separate schools within Northumberland County. Elementary and secondary education is also provided by Trinity College, a private school located in Port Hope. Post-secondary education is available at Trent University and Sir Sanford Fleming College (with a satellite campus in Cobourg) in Peterborough, the University of Ontario Institute of Technology and Durham College (with a satellite campus in Port Hope) in Oshawa, Trillium College in Cobourg and Loyalist College in Belleville.

Northumberland County supports a diverse industrial, commercial and agricultural economic base. Information on major employers and agriculture is presented in the Socio-economics and Land Use TSD.

Over the past ten years, Northumberland County has undertaken a number of initiatives to assess its economic situation (McSweeney and GHK, 2005) and opportunities for economic development (Northumberland County, 2005, 2013a), and more specifically, opportunities in the agricultural (Northumberland County, 2008) and tourism (Northumberland County, 2009a) sectors.

Northumberland County is served by provincial Highway 401 and a number of County Roads (Northumberland County, 2007). Rail service is provided by CN North America, Canadian Pacific Railway and VIA. Air service is provided by three nearby airports: Peterborough Airport, Oshawa Municipal Airport and Lester B. Pearson International Airport. The Port of Oshawa is capable of servicing ships of all sizes.

County Road (CR) 30 will be the primary thoroughfare for construction-related traffic to access Trent Road and the construction site. Traffic statistics for CR 30 and the two other county roads which traverse the community of Campbellford (Northumberland County, 2013b) are presented in Socio-economics and Land Use TSD.

Municipality of Trent Hills

Trent Hills, located in the northeasternmost portion of Northumberland County, is bordered by the Townships of Asphodel-Norwood and Havelock-Belmont-Methuen in Peterborough County to the north, the Township of Alnwick-Haldimand in Northumberland County to the west, the Township of Cramahe and Municipality of Brighton in Northumberland County and the City of Quinte West in Hastings County to the south, and the Township of Stirling-Rawdon in Hastings County to the east.

Trent Hills was incorporated on January 1, 2001 (initially named the Municipality of Campbellford, Seymour, Percy & Hastings) with the amalgamation of the Municipality of Campbell-Seymour (incorporated in January 1, 1998 with the amalgamation of the Town of Campbellford and the Township of Seymour), the Township of Percy and the Village of Hastings. The name change to Trent Hills occurred on April 3, 2001.

The population of Trent Hills increased from 12,247 in 2006 to 12,604 in 2011 (+2.9%) (Statistics Canada, 2012). With a land area of 510.83 km^2, population density in 2006 was 24.6 persons/km^2. Based on the draft OP (Trent Hills, 2012), the population is expected to increase to 13,890 by 2031. Additional population, income and employment statistics are provided in the Socio-economics and Land Use TSD.

Trent Hills is responsible for municipal planning and development, the administration of the Ontario Building Code and various municipal by-laws and programs, economic development, the municipal road system, solid waste management services, water and wastewater services and stormwater management. The municipality is also responsible for the development and delivery of recreation facilities, programs and leisure services.

The three urban centres (Campbellford, Hastings and Warkworth) are serviced with municipal water supply systems and municipal sanitary sewage facilities. The rural areas are dependent on individual water supply and sanitary sewage disposal facilities.

Medical services are provided by the 34-bed Campbellford Memorial Hospital in Campbellford. A Northumberland County EMS ambulance station is also located in Campbellford.

The OPP Northumberland Detachment has a station in Campbellford. Trent Hills (2011) operates three fire departments: Campbellford/Seymour, Hastings and Warkworth Fire Departments, with a compliment of 57 volunteer firefighters.

Educational facilities include four elementary and one secondary public schools operated by the KPRDSB, as well as one elementary and one secondary separate schools operated by the PVNCCDSB.

Agriculture is important to the local economy and agricultural activities are expected to remain as the predominant land use in the municipality (Trent Hills, 2001).

There are 34 manufacturing industries with the major products being food products, chemical wood products, vehicle body manufacturing and metal fabrication (Trent Hills, 2011). Major employers are Campbellford Memorial Hospital, Campbellford District High School, Blommer Chocolate Canada, Dart Cup Ltd., Canadian Tire and Trent Hills. Trent Hills offers 1 to 15 acre lots for development within Campbellford Business Park located on CR 30 within 15 minutes of Highway 401.

Community of Campbellford

Situated on the TSW and Trans Canada Trail, the population of Campbellville swells with tourists during the summer.

Downtown Campbellford is the service and retail centre of Trent Hills. Trent Hills (2007) has undertaken a commercial study of downtown Campbellford to identify local market conditions and new business opportunities as a basis for the development of effective strategies for its revivification.

Police protection and fire prevention services are provided by the OPP Northumberland Detachment and the Campbellford/Seymour Fire Department, respectively, with stations in

Campbellford. Northumberland County EMS also has an ambulance station in Campbellford. Medical services are provided by the 34-bed Campbellford Memorial Hospital, the largest employer in the community.

The Campbellford Water Treatment Plant, operated by Trent Hills, is a conventional water treatment system which draws all of its raw water supply from the Trent River. A 5,230 m^3 off-site storage reservoir provides for peak hour demands.

Trent Hills has a contract with the Ontario Clean Water Agency to operate the Campbellford Wastewater Plant for the management and disposal of solid wastes.

In addition to Campbellford Memorial Hospital, other employers include Campbellford District High School, Blommer Chocolate Canada, Dart Cup Ltd., Canadian Tire, Trent Hills, Empire Cheese and Butter Cooperative, Church Key Brewing Company and the OPG Campbellford Service Centre. As indicated above, development opportunities are available in Campbellford Business Park.

Educational facilities include two elementary and one secondary public schools operated by the KPRDSB, one elementary separate school operated by the PVNCCDSB. A branch of the Trent Hills Public Library is located in Campbellford.

First Nations and Métis Communities

The Ranney Falls GS is located in an area of central-eastern Ontario that is covered under what have been collectively known as the Williams Treaties. According to Surtees (1986), two distinct Aboriginal peoples were involved in signing the Williams Treaty of 1923:

- the Mississauga Indians of Rice Lake (Hiawatha First Nation), Mud Lake (Curve Lake First Nation), Scugog Lake (Mississaugas of Scugog First Nation) and Alderville (Alderville First Nation); and
- the Chippewas of Christian Island and Georgina Island (Chippewas of Georgina Island First Nation) and Rama (Chippewas of Rama Mnjikaning First Nation).

The Williams Treaties were actually a series of treaties that were replaced in 1923 by a new Treaty that was designed to address Indian claims of concerns at that point in time.

At the request of OPG, Parks Canada – TSW identified the following First Nations as likely having an interest in the proposed Ranney Falls G3 Project (B. Sharpe, Parks Canada – TSW, 2012, pers. comm.):

- Alderville First Nation;
- Hiawatha First Nation; and
- Curve Lake First Nation.

The Alderville First Nation occupies two locations: Alderville First Nation Reserve with an area of 1199.8 ha, located approximately 21 km southwest of the City of Peterborough, and Sugar Island 37A with an area of 40.5 ha, located in the north end of Rice Lake, approximately 14 km southeast of Peterborough (Aboriginal Affairs and Northern Development Canada (AANDC) website: http://pse5-esd5.ainc-inac.gc.ca). The Alderville First Nation reserve is the nearest to the proposed Project, located approximately 26 km southwest of the community of Campbellford.

Hiawatha First Nation Reserve with an area of 868.2 ha is located west of Rice Lake, approximately 6 km southeast of Peterborough and 36 km southwest of Campbellford.

Curve Lake First Nation occupies two locations: Curve Lake First Nation Reserve 35 with an area of 769.5 ha, located between Buckhorn Lake and Chemong Lake and Curve Lake Reserve 35A with an area of 202.3 ha located on Fox Island in Buckhorn Lake. Both Reserves are located approximately 14 km north of Peterborough and 50 km northwest of Campbellford.

Hiawatha First Nation and Curve Lake First Nation also share the Islands in the Trent Waters 36A Reserve with the Mississaugas of Scugog Island First Nation. This Reserve consists of islands in Pigeon Lake, Buckhorn Lake and Stony Lake with a total area of 139.6 ha.

In addition to the three First Nations identified by Parks Canada – TSW, the Mississaugas of Scugog Island First Nation became involved as part of the Aboriginal consultation (see Section 4.2.1). The Mississaugas of Scugog Island First Nation Reserve with an area of 321.4 ha is located approximately 42 km southwest of Peterborough at the north end of Scugog Island in Lake Scugog. This Reserve is located approximately 90 km west of Campbellford. As indicated above, the Mississaugas of Scugog Island First Nation share the Islands in the Trent Waters 36A Reserve with Hiawatha First Nation and Curve Lake First Nation.

Population statistics and other information for the four First Nation reserves are provided in the Aboriginal Consultation TSD.

Parks Canada – TSW also identified the Métis Nation of Ontario (MNO) as likely having an interest in the proposed Project (B. Sharpe, TSW-Parks Canada, 2012, pers. comm.). The MNO was established in 1993 to represent over 15,000 Métis citizens and approximately 30 Chartered Community Councils in Ontario which represent Métis citizens at the local level. The nearest MNO Community Council is the Peterborough and District Wapiti Métis Council located in Fraserville, approximately 48 km west of Campbellford.

3.18 BUILT HERITAGE AND ARCHAEOLOGICAL RESOURCES

Built Heritage

Based on site investigations undertaken the Ontario Ministry of Citizenship and Culture in partnership with Ontario Hydro between June 1980 and November 1981, Simonton (1984) undertook a preliminary ranking of the heritage values of hydroelectric generating stations built prior to the mid-1930s as:

- Class A stations displaying a variety of heritage attributes which in combination serve to make them particularly fine examples;
- Class B stations displaying a number of attributes but are not the best or the finest examples; and
- Class C stations whose main attribute is their age.

Ranney Falls GS was considered by Simonton (1984) to be a Class C station with the following comments:

- "attractive site associated with Trent Canal and close connection to an early mill, now leather factory";
- "Quinte & Trent Power Co. drew water from forebay to operate small G.S. known as a "pup" for Cdn. Paperboard Co. Ltd. G.S."; and
- "The pup now owned by Ontario Hydro has interpretive possibilities".

As part of the EA of 12 proposed bridge alternatives for the Second Trent River Crossing Project, UMA (2009) identified and assessed built heritage resources (BHRs) and cultural heritage landscapes (CHLs) in Campbellford. This analysis of cultural heritage resources addressed those above-ground, person-made heritage resources over 40 years old. The application of this rolling 40-year principle is an accepted federal and provincial practice for the preliminary identification of cultural heritage resources that may be of heritage value. Its application does not imply however that all BHRs or CHLs that are over 40 years old are worthy of the same level of protection or preservation.

UMA (2009) identified four CHLs that are relevant to the proposed Ranney Falls G3 Project:

1. the Trent Canal (a Resource Type CHL under the Waterscape Category), a man-made navigation canal built in the early 20th century, is a dominant physical and visual element in the landscape;
2. the Trent River (a CHL under the Waterscape Category) is a dominant physical and visual element in the landscape and is associated with the historical development of the area;
3. Ferris Provincial Park (a CHL under the Recreational Category), situated on hilly drumlins on the east side of the Trent River, includes former agricultural land with remnants of overgrown stone fences and cleared meadows; and
4. Hague's Reach GS (a CHL) including the associated waterway to the south.

Simonton (1984) ranked the Hague's Reach GS as a Class A station with the following comments:

- one of the "first automated plants built by Ontario Hydro and marked the onset of the trend towards greater automation and centralization which has continued to present day";
- "the introduction of automation led to modification in plant design and removal of operators from the plants"; and
- "Hagues Reach was the first Ontario Hydro generating station to incorporate a fixed propeller turbine".

As none of the 12 alternative bridge alignments were located in the vicinity of the Ranney Falls GS property, the station was not identified as a CHL by UMA (2009). However, based on identification of Hague's Reach GS as a CHL, it is also inferred that Ranney Falls GS should also be considered as a CHL. As indicated in Section 2.2, Ranney Falls GS was ranked as a Class C facility by Simonton (1984) with lesser heritage importance than Hague's Reach GS.

Archaeological Resources

Based on a Stage 1 Archaeological Assessment, Advance Archaeology (2011) determined that given that there are no known indicators to suggest that there is the potential for the presence of archaeological sites, artifacts, or anything else of cultural heritage significance on the proposed Ranney Falls G3 Project lands, and given that the degree of prior soil disturbance is so extensive across the entire site, the archaeological potential of the lands was very low. As a result, a Stage 2 Assessment was not warranted and complete clearance of the archaeological condition on the site was recommended. The Stage 1 Archaeological Assessment Report is provided in Appendix A of the Cultural Heritage Resources TSD, together with correspondence from MTC (now MTCS).

4.0 EFFECTS ASSESSMENT AND MITIGATION MEASURES

The available environmental baseline information and site-specific studies provided the basis for an assessment of potential construction and operational effects on the environment.

Recommended mitigation measures for these effects on the environment are based on the OWA (2012) "Best Management Practices Guide for the Mitigation of Impacts of Waterpower Facility Construction", standard environmental construction guidelines (e.g., Cheminfo, 2005), relevant government guidelines for proposed hydroelectric power plant development (e.g., MOE, 1995; Milko, 1998a; Wright and Hopky, 1998; Lynch-Stewart, 2004; Trent Hills, 2005; DFO, 2010), as well as government agency and other organization consultation.

The significance of potential impacts is based on their magnitude, duration and extent after the implementation of recommended mitigation measures.

As indicated previously, the DIA Report provides a description of the proposed undertaking, summarizes the overall environmental setting and anticipated environmental effects, recommends appropriate mitigation measures to minimize or obviate these effects, and describes public, agency and Aboriginal consultation. The DIA summarizes the key information that is contained in six Technical Support Documents (TSDs). More detailed information on the environmental setting, anticipated environmental effects and recommended mitigation measures addressing the aquatic environment, terrestrial environment, land use and socio-economic environment, and cultural heritage resources can be found in the TSDs. As well, two additional TSDs provide a more detailed description of outcomes of public and government agency, as well as First Nation and Métis Nation of Ontario, consultation and engagement.

4.1 VALUED ECOSYSTEM COMPONENTS

4.1.1 Landform and Soils

Climatic data of relevance to construction activities include the occurrence of wet soils after prolonged wet weather events, the flooding of excavated areas after a period of heavy rainfall and the generation of fugitive dust emissions due to high winds during dry conditions. Soil moisture levels are anticipated to be low during frozen conditions in the winter and the dry summer months.

During periods of excessive rainfall or saturated soil conditions, construction activities will be monitored to ensure that gullying does not occur on the relatively steep slope connecting the upper and lower portions of the Ranney Falls GS property, as well as on the more gently sloping lower area (adjacent to the Trent River), and that excavated soils do not migrate off the work area. Eroded areas will be stabilized as soon as sufficiently dry conditions prevail and, where appropriate, excavated soils will be stabilized by the use of silt fencing enhanced with straw bales to be deployed prior to excavation.

Erosion associated with high winds, resulting in soil loss and nuisance dust, should be reduced or eliminated by stabilizing spoil piles with straw mulch. Dust generation will be controlled by watering dusty roads and the construction sites (Cheminfo, 2005). Additional information on mitigation of fugitive dust emissions is provided in the Socio-economics and Land Use TSD.

The mean start and end of the growing season occur in mid-April and late October, respectively; therefore, revegetation/reseeding should occur within this period or be postponed until the following spring.

The implementation of the proposed mitigation measures should reduce the effect of inclement weather and is predicted to result in no net effects on the terrestrial environment of the Ranney Falls GS property and adjacent lands and waterbodies.

Landform

Drilling and blasting will be required to facilitate new powerhouse and expanded tailrace construction (Knight and Piésold Ltd., 2011a). The lower shale-poor bedrock domain is likely to be near the base of the excavation and the new powerhouse may be founded on this domain, or near the boundaries of the two domains, i.e., upper shale-rich and lower shale-poor.

Careful excavation methods, including controlled drilling and blasting, will need to be implemented especially near the excavation walls to ensure that disturbance to the walls and groundwater inflows are minimized (Knight Piésold Ltd., 2011a).

Blasting will be required during powerhouse construction and tailrace excavation. It has been estimated that peak particle velocities produced from blasting operations in excess of 600 mm/s will cause cracks and discontinuities in sedimentary rock up to a 5-m radial distance from the blast using the sophisticated techniques and control measures employed in modern blasting practice (L. McAnuff, VME/Explotech Associates Ltd., 1991, pers. comm.). It was also indicated that seams may open up between sedimentary strata within the 5 m blast radius. Minimization of the physical effects of blasting will be ensured by following the recommendations of the blasting engineer and the DFO blasting guidelines (Wright and Hopky, 1998).

Explosives used in construction will be closely controlled, with their use restricted to authorized personnel who have been trained in the use of explosives in a manner so as to minimize impacts on the environment. Appropriate government agencies and the local residents will be informed of the blasting schedule in advance of construction, as well as just prior to the detonation program. All necessary permits will be obtained by the contractor, who will also comply with all legal requirements in connection with the use, storage and transportation of explosives, including, but not limited to, the *Canada Explosives Act* and the *Transportation of Dangerous Goods Act*. The contractor will be required to retain a consulting engineer with technical expertise in blasting to provide advice on maximum loading of explosives for all blasting, as well as an engineering report indicating recommended charges and blasting

methods to be used at specific locations. All blasting will occur in such a way as to be in compliance with federal regulations and directions. Excess rock will be removed from the excavated area behind the temporary cofferdams for suitable disposal. Sampling and analysis of bedrock at the Ranney Falls GS property indicated that it is not acid generating (Knight and Piésold Ltd., 2011b).

It is expected that the material excavated from the upper shale-rich bedrock domain may be suitable for structural fill. It will be important to ensure that the excavated material is well graded and that it contains only a small proportion of thin, flat or elongated particles (which may come from the shale layers) if it is to be used for fill (Knight Piésold Ltd., 2011a). This material should be stockpiled at least 100 m from the Trent Canal and Trent River and protected against runoff-induced erosion.

Following construction, no effects on geology are anticipated beyond the new powerhouse footprint and the expanded tailrace requiring blasting for construction.

Since seismic activity is not a concern, mitigation and protective measures have not been developed. However, design of the proposed Project will be compliant with the latest National Building Code of Canada.

As indicated in Section 3.4, the Ranney Falls GS property consists of generally flat upper (adjacent to Trent Drive) and gently sloping lower (adjacent to Trent River) areas with a relatively steep connecting slope (elevation difference of approximately 14 m) adjacent to both sides of the main powerhouse.

Topography will be altered to facilitate new powerhouse and expanded tailrace construction with requisite slope stabilization. A Site Development Plan will be prepared by the contractor, including planning considerations; site and design considerations; site development scheduling; selection of construction equipment; and site development details.

As the effects of site development are expected to be negligible on overall physiography, no mitigation measures are required beyond those set out in the Site Development Plan.

No effects on geology and physiography are anticipated as a result of the operation of the proposed Ranney Falls G3 Project; therefore, no mitigation is required.

Soils

Soils on the Ranney Falls GS property consist primarily of shallow loam with a depth of less than 0.3 m to bedrock (see Section 3.5). Elevated concentrations of metals, VOCs and/or petroleum based hydrocarbons were identified in the soils (see Section 3.5) (a more detailed description is also provided in the Aquatic TSD). As a result, the majority of any surplus overburden will require Environmental Compliance Approval (MOE, 2011a) from the MOECC

under the *EPA* for its transport and disposal. The excavation, removal and disposal of the disused septic tank located in the construction area and associated soils will also require Environmental Compliance Approval. As indicated below, a Hazardous Materials Management Plan which will include contaminated soils and septic tank handling and disposal measures, will be developed for the proposed Project as part of the broader Environmental Management Plan.

During construction, soil erosion generally results from water or wind action on the disturbed terrain surfaces as a result of the removal of vegetative cover, deposition of unconsolidated material, alteration of topography and improper restoration. All construction work will be conducted so as to avoid unnecessary disturbance of the ground by the placement or excavation of materials, the disruption of established natural surface and subsurface drainage, or the disturbance of natural vegetation cover that is to be preserved.

Till and gully erosion caused by channelized overland flow can be a major source of soil erosion. Sheet erosion can be an additional source of sediment.

As indicated above, during periods of excessive rainfall or saturated soil conditions, construction activities will be monitored to ensure that gullying does not occur on the relatively steep slope connecting the upper and lower portions of the Ranney Falls GS property, as well as on the more gently sloping lower area (adjacent to the Trent River), and that excavated soils do not migrate off the work area. Exposed areas should be minimized particularly during excessive rainfall conditions. Proper erosion controls (i.e. the use of silt fencing enhanced with straw bales, stockpile covers, berms, controlled compaction, etc.) will need be in place under all conditions.

Erosion associated with high winds, resulting in soil loss, will be reduced or eliminated by stabilizing spoil piles with straw mulch or more stable materials.

Erosion and sediment control will be an integral component of the construction planning process. All personnel involved with the proposed works will be briefed on erosion and sediment control including engineers, contractors, inspectors and environmental staff. In general, the following guidelines will be applied in the development of the Erosion and Sediment Control Plan:

- fitting of proposed works to the terrain;
- timing of grading and construction activities to minimize soil exposure;
- retention of existing vegetation where feasible;
- restriction of the use of heavy construction equipment to within the approved work areas to minimize soil disturbance and vegetation destruction;
- any storage of stripped materials is to be placed in stable locations which will prevent the movement of the materials (soils, sediments)" and that "any short-term storage of soil near shoreline is only to be done on a temporary basis and with appropriate controls in place to prevent any off-site movement;
- soils stripped near shore should be moved as fast as possible to stable locations;

- implementation of erosion control measures, e.g., rip-rap berms underlain by filter geotextile, straw bales used as filters, silt fencing along the shoreline and/or mulching for interim stabilization;
- diversion of runoff away from exposed areas;
- minimization of the length and steepness of slopes;
- maintenance of low runoff velocities;
- design of drainage works, such as ditches and outfalls, to handle concentrated runoff;
- diversion of the drainage culvert from the adjacent property out of the construction pit;
- retention of sediment on site;
- routine inspection and maintenance of erosion and sediment control measures; and
- re-vegetation of disturbed areas by seeding and/or planting following construction as soon as seasonal conditions permit.

The site-specific Erosion and Sediment Control Plan will be part of a broader Environmental Management Plan for the proposed Ranney Falls G3 Project. This will be provided to the TSW for review and comment.

After construction is completed the site will be rehabilitated. A Site Rehabilitation Plan including planning considerations, soil stabilization and revegetation will be prepared for the proposed Project.

Dust may be generated during the construction due to heavy equipment movement. Dust generation during dry, windy conditions can be controlled by water trucks and/or sprinklers as necessary to reduce dust to acceptable levels. Additional information on mitigation of fugitive dust emissions is provided in the Socio-economics and Land Use TSD.

The implementation of the Erosion and Sediment Control Plan and the Site Rehabilitation Plan during construction and rehabilitation will obviate or minimize potential effects on soils.

All materials and equipment used for the purpose of site preparation and Project completion will be operated and stored in a manner that prevents any deleterious substance (e.g., petroleum products, debris, etc.) from entering the water. Incidental spills of oil, gas, diesel fuel and other liquids to the environment could occur during construction. Fuelling and lubrication of construction equipment will be carried out in a manner that minimizes the possibility of releases to the environment. Measures for containment and cleanup of contaminant releases will be followed to minimize contamination of the natural environment, e.g., placement of fuel tanks and generators on an appropriate form of containment where possible, monitoring and other measures documented in the Environmental Management Plan. At all times where spills are a risk, appropriate materials for cleanup and approved disposal locations will be available. Spills or other discharges will be reported to the MOECC as required by provincial legislation. Interim sanitary waste collection and availability of treatment facilities will be arranged for the duration of the construction period. All construction waste, washwater and wastewater will be treated, disposed and/or discharged in accordance with regulatory requirements.

A Hazardous Materials Management Plan, Waste Management Plan and a Spills Emergency Preparedness and Response Plan will be developed for the proposed Project as part of the broader Environmental Management Plan.

The implementation of these pollution prevention plans will obviate or minimize the environmental effects of accidental releases to the natural environment.

No effects on soils are anticipated as a result of the operation of the proposed Ranney Falls G3 Project; therefore, no mitigation is required.

4.1.2 Vegetation

A number of plant communities will be affected by construction of the powerhouse, as well as forebay and tailrace expansion. Powerhouse construction will result in the removal of a Cultural Woodland (designated as ELC unit 2c on Figure 4.1) with the predominant overstorey consisting of Scotch Pine (*Pinus sylvestris*) and Basswood (see Terrestrial TSD). This woodland is not considered to be provincially significant by LTC (2001). Forebay expansion will result in the loss of lawn (ELC units 2a and 2c). Tailrace expansion will affect a number of vegetation communities including:

- removal of a Eastern White Cedar (*Thuja occidentalis*) coniferous forest patch (ELC unit 2g), not considered to be significant by LTC (2001);
- partial removal of a Cultural Meadow, Paper (White) Birch (*Betula papyrifera*) Carbonate Talus (ELC unit 2j) and Cultural Thicket (ELC unit 2k); and
- removal of a Cultural Thicket (ELC unit 2h).

None of these vegetation communities are considered to be provincially significant by the NHIC.

A Tree Removal Permit from Northumberland County (2009b) under By-law No. 54-09 pursuant to the *Municipal Act* will likely not be required for the Eastern White Cedar coniferous forest patch (ELC unit 2g) due to the small area to be cleared (less than 1 ha).

The lawn area (ELC unit 3b) on the Ranney Falls GS property will be used for laydown/assembly during construction. OPG is also pursuing approval from Parks Canada – TSW for laydown/assembly use of the lawn area south of Trent Road to the east and west of the existing forebay.

Based on vegetation surveys of the areas likely to be affected by construction activities, all of the native species are designated by the NHIC as S5 (secure), S4S5 (apparently secure to secure) and S4 (apparently secure). No significant or unusual areas of native vegetation were identified that would preclude or be affected by the construction of the proposed Ranney Falls G3 Project.

The cliff vegetation communities associated with the Trent River are classified as Bulblet Fern - Herb Robert Open Shaded Limestone/Dolostone Cliff Face Vegetation Type. This community type is ranked as provincially significant by the NHIC. A similar community has also developed on the walls along the tailrace channel to the main powerhouse; however, as this community is artificial in origin, it is not considered to be of provincial significance. Tailrace expansion will result in removal of vegetation from the cliff habitat on the existing northern channel wall. The new cliff habitat of similar surface area created due to tailrace expansion will be quickly re-colonized with similar native vegetation as there is abundant seed sources available from nearby cliff habitats. As a result, overall impact on the cliff vegetation communities will be short-term in duration.

Vegetation clearing will adhere to standard construction practices as listed below:

- vegetation clearing will be restricted to the minimum necessary for construction activities;
- brush and trees will be felled into the area to be cleared to prevent damage to adjacent vegetation;
- branches overhanging the cleared area will be cut (pruned) cleanly and stubs should not be dressed;
- merchantable timber will be cut and neatly stacked for appropriate removal;
- specimen trees marginal to the cleared area will be identified prior to construction, flagged and protected from damage, where possible;
- all slash, brush, roots and stumps are will be raked into piles for appropriate disposal; and
- slash material will not be stored near the Trent Canal and Trent River.

After construction is completed, the cleared areas of natural vegetation that have not been displaced by permanent redevelopment infrastructure will be restored to their original condition or enhanced through the planting of native species beneficial to local wildlife based on the Site Rehabilitation Plan (see Section 4.1.3).

As indicated in Section 3.7, the remnant woodland on the Island Park Retirement Community property adjacent to the Ranney Falls GS property, as well as the woodlands in the eastern portion of the Ranney Falls GS property, have been identified as Significant Woodlands by LTC (2001) (see Terrestrial TSD). The forested area in Ferris Provincial Park, on the opposite side of the Trent River, is also identified as Significant Woodland. MNR (2010) considers all lands within 120 m of identified Significant Woodlands to represent adjacent lands. The PPS (OMMAH, 2014) and municipal policies require that any proposed development or site alteration include an assessment of potential project impacts on significant natural heritage features such as woodlands. Such assessments typically include an Environmental Impact Study or are included within an EA (as in this DIA for the proposed Ranney Falls G3 Project).

As indicated in Section 3.7, a site-specific assessment was undertaken of the Significant Woodlands adjacent to the northwest of the Ranney Falls GS property and in the eastern portion of the Ranney Falls GS property. A site-specific survey of the woodlands in Ferris Provincial Park was deemed not to be required as the Trent River provides sufficient buffer from the proposed Project. The Significant Woodland in the eastern portion of the Ranney Falls GS property will be sufficiently distant from the construction activities and protected by the installation of silt fencing to the east of the access road and public parking area. Silt fencing will also be installed along the Significant Woodland adjacent to the northwest of the Ranney Falls GS property boundary at the exterior tree dripline to ensure no inadvertent intrusion during construction. With the implementation of these mitigation measures during construction, it is not anticipated that the proposed Project will have an adverse effect on the Significant Woodlands or their ecological functions.

Overall, with the implementation of the standard vegetation clearing construction practices, restoration/enhancement measures prescribed in the Site Rehabilitation Plan (including tree plantings) and the mitigation measures for the protection of proximate Significant Woodlands, the construction and operation of the proposed Ranney Falls G3 Project will have minimal effect on natural vegetation communities and associated plant species.

Significant Natural Features

As indicated in Section 3.7, there are no PSWs, ANSIs or ESAs within 5 km of the proposed Ranney Falls G3 Project. Due to the geographic separation, the scale of the proposed Ranney Falls G3 Project will have no effect on these significant natural features.

As indicated in Section 3.7, although Significant Valleylands have not been identified by LTC (2001), the Trent River and associated riparian environment would likely qualify as a significant valleyland. As indicated in the PPS (OMMAH, 2014), development and site alteration in significant valleylands and on adjacent lands is not permitted unless it has been demonstrated that there will be no negative effects on the feature or its ecological function. MNR (2010) provides evaluation criteria and standards for the designation of significant valleylands and has established an adjacent land width of 120 m from significant valleylands. Under the *Conservation Authorities Act*, the LTC regulates development and activities in or adjacent to the Trent River through a permitting process based on Ontario Regulation 163/06 under the Act. Proposed tailrace expansion is predominantly located on previously disturbed land with a high proportion of cultural vegetation community types (see Section 3.6). The displacement of turtle nesting habitat and potential snake hibernacula habitat will be offset by existing habitat enhancement on areas of the Ranney Falls GS property unaffected by the proposed Project, as well as on nearby TSW property (see Section 4.1.3). Proposed tailrace expansion will result in a slight increase in the total amount of permanent aquatic habitat (see Section 4.1.4.8). OPG will consult with Parks Canada – TSW to resolve any potential issues/concerns regarding this proposed development within the Trent River valley.

4.1.3 Wildlife

As indicated in Section 3.8, the local study area provides woodland, riparian and urban habitat for wildlife. In this area, most wildlife species are fully habituated to human activities with more sensitive species restricted to available specialized habitats.

Many wildlife species in urban settings are habituated to human activities and associated noise (Busnel, 1978). The construction disturbance should be sufficiently local that little displacement of wildlife is expected to occur. Any sensitive resident animals can relocate temporarily to avoid noise and disturbance associated with construction activities and return after construction activity cessation. In the unusual event of permanent displacement, other wildlife is expected to take advantage of the available habitat.

The behavioural response of wild birds to noise is variable. The response varies with species, sex, group, size, season, activities engaged in prior to disturbance, previous exposure to the noise source and distance from the noise source (Fitchko and Lang, 1999). Some species may be very sensitive and may abandon their nests because of anthropogenic noise or activities. Other species habituate to anthropogenic noise or activities, yet others may be attracted to them.

While a bird's first reaction to a new noise source appearing in a new ecological niche may be fear and avoidance, if its other sensory systems (optical, chemical) are not stimulated, the organism quickly learns to ignore the noise source (Busnel, 1978).

Drilling activities to facilitate blasting will generate noise and vibration similar to any general construction operation. Potential effects due to noise and vibration will be minimized by proper maintenance and operation of drill rig equipment. In addition, noise baffling equipment can be provided, as recommended by the blasting engineer.

The abrupt loud noise associated with blasting may startle wildlife. In a review of the effects of sonic boom on wildlife, Bell (1972) and Cottereau (1978) reported that wild animals may show behavioural startle when they first experience a sonic boom; however, their reaction is usually slight and they seem to adapt readily to further boom. Additional information on the effects of blasting is provided in Sections 4.1.1.

As most urban wildlife species are or quickly become habituated to human activities and associated noise, no mitigation is recommended, with the exception of those provided for migratory birds during the nesting season. Additional information on mitigation of environmental noise from a societal perspective is provided in Section 4.2.2 and the Socio-economics and Land Use TSD.

The construction disturbance related to the proposed Ranney Falls G3 Project will be sufficiently localized that there will be little displacement of wildlife habitat. Any resident wildlife will relocate

temporarily to avoid noise and disturbance associated with construction activities and return after construction completion.

Noise from blasting could have an initial effect on wildlife startle reaction; however, it is anticipated that over time wildlife will become habituated to the impulse noise. For instance, during the St. Lawrence River crossing by a natural gas pipeline, blasting had no effect on waterfowl in the area (Silver and Fitchko, 1992).

There are several bird species that may nest on the Ranney Falls GS property. As indicated in Section 3.8, only four common bird species were observed within the proposed Project construction footprint during the July 6, 2007 breeding bird survey: American Robin, Cedar Waxwing, Warbling Vireo and American Goldfinch.

Most migratory bird species are protected under the Migratory Bird Regulations of the *MBCA*. Environment Canada is responsible for the implementation of the *MBCA* and recommends that vegetation clearing should not be undertaken during the breeding season of migratory birds in order to avoid the destruction or abandonment of any bird nests which would contravene the *MBCA*. Specifically, clearing should not take place between 01 May and 31 July in southern Ontario (R. Dobos, Environment Canada, 2006, pers. comm.). Should it not be possible to adhere to this schedule, then a breeding bird survey must be conducted by a qualified avian biologist and any nests found must not be disturbed by the clearing activity until the young have fledged. A buffer zone restricting active construction activities is generally applied around a nest. The buffer zone which is species-specific will ensure that the nest is not abandoned due to noise associated with construction activities.

To preclude the potential institution of a buffer zone that may affect construction activities, it is recommended that vegetation be removed prior to nesting season initiation, i.e., May 1, or after nesting season completion, i.e., July 31.

As indicated in Section 3.8, an artificial nesting structure for Chimney Swift, designated as Threatened federally and provincially, has been installed on the Ranney Falls GS property near (to the southeast) of the main powerhouse. This location will be used for laydown/assembly during construction. This nesting structure, which has not been used, was capped on March 19, 2012 (D. Brandt, OPG, 2012, pers. comm.) and will remain capped.

Due to its distance of approximately 400 m from the Ranney Falls GS property, use of the abandoned paper mill/tannery chimney as a roost by Chimney Swift will not be affected (M. Shaw, Environment Canada, 2011, pers. comm.).

Contractor personnel will be instructed that no harassment or harming of wildlife will be tolerated. During construction, any sightings of snakes and turtles will be reported to the Environmental Monitor.

Once construction of the proposed Ranney Falls G3 Project is completed, any displaced animals could reoccupy the habitat created on the rehabilitated areas of the properties and the habitat associated with the natural and cultural vegetation communities not directly affected by construction activities.

Most native mammal and avian species likely present in the local study area are ranked by the NHIC as S5 (secure) and S4 (apparently secure) in Ontario. However, Northern Map Turtle, Eastern Snapping Turtle and Monarch, designated as Special Concern federally and provincially, have been observed on the Ranney Falls GS property (see Section 3.14).

As indicated in Section 3.7, the Ranney Falls GS property supports a number of ecological functions and attributes that would potentially qualify portions of the property as Significant Wildlife Habitat.

The provincially significant vegetation community, Bulblet Fern – Herb Robert Open Shaded Limestone/Dolostone Cliff Face Type, associated with the cliffs of the Trent River will not be affected (see Section 3.6). The similar community that has also developed on the northern wall of the existing tailrace will be lost, but due to its artificial origin is not considered to be provincially significant. Moreover, it is anticipated that the new tailrace wall with similar habitat area will be quickly re-colonized with a similar vegetation community as there are abundant seed sources available from nearby cliff habitats.

The River Otter feeding/denning site (specialized wildlife habitat) is located in ELC unit 3v (see Figure 3.1) approximately 180 m from the proposed laydown/assembly area (ELC unit 3b) and 220 m from the main construction footprint. Due to this separation distance and the intervening deciduous forest, no adverse effects on the River Otter community are anticipated.

With respect to the three wildlife SAR that have been identified on the Ranney Falls GS property (habitat of species of conservation concern), i.e., Northern Map Turtle, Eastern Snapping Turtle and Monarch, species-specific habitat protection and enhancement plans will be developed in consultation with Parks Canada – TSW, Environment Canada and MNRF as part of the Site Rehabilitation Plan.

Although species of Special Concern and their habitat are not currently protected under the *ESA*, turtles are afforded protection under the *Fish and Wildlife Conservation Act*, which makes it illegal to hunt, trap, keep, sell or purchase live specimens without a government permit. The plans to be developed for the two turtle species will include:

- development of effective mitigation measures to ensure no individuals are harmed or harassed and to minimize or obviate impacts on retained habitat;
- identification of timing windows for implementation of mitigation measures; and
- development of measures to enhance or create nesting habitat (specialized wildlife habitat).

Female Eastern Snapping Turtles and Northern Map Turtles generally lay their eggs in June. For Eastern Snapping Turtle, hatching occurs in late August or September. For Northern Map Turtle, hatching also occurs in the late summer, but may be postponed until the following spring, i.e., late April to early June, due to late egg laying in July (Bennett and Litzgus, 2008). Therefore, to mitigate construction impacts on Northern Map Turtle nests and hatchlings, silt fencing, as described by Bennett and Litzgus (2008), should be erected in the third week of May to exclude adult females from nesting in the construction zone. This timing presumes that construction will be initiated after fence installation and would allow any overwintering hatchlings to access the river. (Construction initiation prior to the third week of May will necessitate fence erection in the prior year). A 1-m high fence would also preclude female Eastern Snapping Turtles from nesting in the construction zone (Bennett and Litzgus, 2008). Other nesting habitat will be available on the Ranney Falls GS property and other proximate properties. The map turtle habitat is free of PCBs.

During construction OPG will ask the contractor to have the environmental monitor daily check the area to ensure no turtles are going below the fencing. For whatever reason should a turtle nest beyond the fencing during the breeding season, the fencing will be moved back to let the hatchlings access the water.

To compensate for the temporary loss of turtle nesting habitat during construction, additional habitat was created in the spring of 2015 on the Ranney Falls GS property and nearby Parks Canada – TSW property based on habitat creation and enhancement plans that have been developed in consultation with Parks Canada – TSW and Environment Canada, CWS (see Appendix A of the Terrestrial TSD). Based on the mitigation plan, total nesting area present on the Ranney Falls GS property is approximately 154 m^2. The total nesting area that will be available during and after construction on both properties will be approximately 168 and 322 m^2, respectively. Additional benefits to the local populations of these species have been realized by improved access to nesting sites and provision of more suitable nesting substrates. The turtle habitat proved to be immediately successful with some turtles laying eggs in 2015.

Although the Monarch is designated as a species of Special Concern federally and provincially, much of the concern regarding its status is the result of habitat loss in their Mexican wintering grounds. In southern Ontario, the monarch is considered to be apparently secure (NHIC rank of S4) and occurs primarily where milkweed and wildflowers are present. As indicated in Section 3.6, two of the Monarch's traditional host plants, i.e., Common Milkweed and Swamp Milkweed are present on the Ranney Falls GS property. Milkweed plants that are located in the construction footprint of the proposed Project could be transplanted or new stock planted as compensation. Additional habitat supportive of these plant species could also be created on portions of the property not affected by the proposed Ranney Falls G3 Project.

As part of the Site Rehabilitation Plan, it is recommended that OPG and the contractor together with the TSW review and discuss this proposed habitat objectives during the construction

phase of the Project. It is expected that the Site Rehabilitation Plan will utilize solely native species.

The movement corridor represented by the Trent River valley which supports connectivity functions for a variety of wildlife species at the landscape level will not be affected after construction.

During operation, noise will be generated from the proposed Project. As the steady noise from the proposed facility will be similar to that of the existing facility, it is not expected to elicit an adverse reaction from nearby habituated wildlife.

Overall, the construction and operation of the proposed Ranney Falls G3 Project is predicted to have minimal effect on significant wildlife habitat or local wildlife population.

4.1.4 Aquatic/Hydrological Resources

4.1.4.1 Site Surface Hydrology

Drainage ditches are present on the Ranney Falls GS property. These drainage ditches may be affected by sediment loadings due to accelerated soil erosion during construction. Till and gully erosion caused by channelized overland flow can also be a major source of soil erosion. Sheet erosion can be an additional source of sediment.

As indicated in Section 4.1.1, a site-specific Erosion and Sediment Control Plan will be prepared and implemented during construction. The site-specific Erosion and Sediment Control Plan will be part of a broader Environmental Management Plan for the proposed Ranney Falls G3 Project. The implementation of these standard procedures during construction and rehabilitation will obviate or minimize potential effects on surface hydrology.

As indicated in Section 2.3.1, the drainage culvert from the adjacent property will be diverted out of the construction pit.

No effects on surface hydrology are anticipated as a result of the operation of the proposed Ranney Falls G3 Project; therefore, no mitigation is required.

4.1.4.2 Groundwater Hydrology

As indicated in Section 4.1.1, groundwater inflows due to any excavation can be expected as a result of precipitation/runoff events initially within the upper part of the upper shale-rich bedrock domain. Based on the geotechnical survey findings, inflows are expected to be manageable during excavation with inflow at a rate up to 3.5 L/s. Higher than expected inflows may occur if high permeability features are encountered, or if blasting and rock excavation techniques significantly modify the intrinsic hydraulic conductivity of the rock mass (Knight Piésold Ltd.,

2011a). To minimize dewatering requirements, cementitious grouting may be required along the excavation line just before starting the excavation to seal the paths of groundwater inflow. Other methods that are generally accepted in the construction industry to reduce or avoid the groundwater inflow may also be employed.

Careful excavation methods, including controlled drilling and blasting, will need to be implemented especially near the excavation walls to ensure that disturbance to the walls and groundwater inflows are minimized (Knight Piésold Ltd., 2011a). As indicated in Section 2.1, OPG also intends to install grouting curtains to minimize groundwater inflow into the excavation pit.

Blasting could have a potential effect on groundwater flow in the immediate vicinity of the blasting operations. Minimization of the physical effects of blasting will be ensured by following the recommendations of the blasting engineer and the DFO blasting guidelines (Wright and Hopky, 1998). As indicated in Section 3.9, four water wells were identified within a 250 m wide radius of the Ranney Falls GS. As none of the wells are located within 100 m, no monitoring of water levels is recommended as no impacts are anticipated.

No effects on groundwater are anticipated as a result of the operation of the proposed Ranney Falls G3 Project; however, all water from excavation pit will be tested and treated (if required) prior to discharging.

4.1.4.3 TSW/Trent River Hydrology

Operation of the proposed Ranney Falls G3 Project will result in optimal use of the total water available (mean annual flow of approximately 118 m^3/s). However, during the navigation season between mid-May and mid-October, flows in the Trent Canal are generally below the current Ranney Falls GS design capacity of 100.9 m^3/s, with mean monthly flows ranging from 35.7 to 78.6 m^3/s between June and October (see Aquatic TSD). For the proposed Project, the maximum flow permitted in the Trent Canal during the navigation season will be increased from 100 to 120 m^3/s.

Modifications to the navigation channel are not anticipated, and the only change in habitat due to the proposed Project will be an increase in the range of flows and flow velocities. This will result from the post-construction condition in which the total river flow will be diverted down the navigation channel for a greater proportion of the year, resulting in a flow regime through the channel that will, on average, more closely reflect the annual Trent River hydrograph. This will result, however, in higher flow velocities within the 1.5 km of navigation channel during the wetter seasons. Flow velocity within this channel reach from mid-June to late October, on average, will not change over existing conditions, while flow velocity at other times of the year would be, on average, higher than existing conditions.

As previously indicated, little if any flow currently occurs in the section of the Trent River between Dam #10 to the Ranney Falls GS tailrace from mid-June to late October due to the diversion of water through the Trent Canal. With its proposed increased capacity, all flow will be diverted through the Trent Canal and expanded Ranney Falls GS from the end of the first week of May to the fourth week in March. This means that the proposed Project will result in more water being diverted at Dam #10 into the Trent Canal in November, December, January and February. This will also result in a decrease in the amount of time that water will be intentionally spilled through Dam #10, i.e., April and early May. Leakage of approximately 0.5 m^3/s through the dam will continue during the remaining time period.

The only physical modifications to this section of river will be the new tailrace of the proposed Ranney Falls G3 Project. The proposed tailrace will be large enough to accommodate the increased flow of the new powerhouse, and therefore, the flow velocity exiting the new tailrace will be very similar to the existing main powerhouse tailrace velocity. Provided that the proposed tailrace is constructed so that it has sufficient depth (0.5 m) of substrate with the similar type of substrate present in the existing tailrace, the ecological function provided by the existing tailrace will be replicated, with the area increased. After “Pup” powerhouse decommissioning, flow through its tailrace will cease. There are no critical habitats in the “Pup” tailrace.

As part of a numerical hydraulic study, using HEC-RAS software, developed by the HEC of the USACE, to investigate water surface profiles and flow velocities in the Trent Canal, as well as water level surge due to existing and future hydraulic conditions between Dam #10 and Ranney Falls GS. The study concluded that the Trent Canal can transport the maximum power flows up to 171 m^3/s, while maintaining the water levels within the current limits and maximum flow velocities within the Trent Canal will increase from 0.76 m/s to 1.38 m/s. The total head loss in the canal is sensitive to operating water levels, increasing quickly with decrease of water level. Based on the scenarios modeled, the proposed spillway will be able to effectively control any water level surges during an emergency shutdown of the units.

A hydraulic study using the CFD model was undertaken to assess the potential for vortex formation at the forebay under existing and future flow conditions. Simulation of existing flow conditions indicated no swirling flows in the flow field near the existing intakes, which is consistent with observations at Ranney Falls GS. Similarly, flow fields produced from simulations of the future flow conditions showed no significant cross-circulations near the new intake area, suggesting that the potential for vortex formation at the new G3 intake is likely to be negligible.

The simulation of discharge capacity indicated that the proposed spillway would be sufficient to discharge a flow of 171 m^3/s.

The existing Ranney Falls GS will be shutdown during the Execution Phase. Stage 1, civil construction will be undertaken in the “dry” and will be confined by upstream and downstream

cofferdams. It is anticipated that the cofferdams will be in place for 12 to 14 months. During the period when no flow is being diverted through the Ranney Falls GS, flow in the Trent Canal will meet navigational requirements with excess flow spilled through Dam #10.

4.1.4.4 TSW/Trent River Morphology and Bathymetry

As indicated in Section 2.3, the only physical modifications to the Trent Canal and Trent River will be the expanded forebay and tailrace, respectively.

As indicated in Section 2.3.3, the impact of higher flow velocities on erosion in the Trent Canal was investigated using an *in-situ* flume developed by Environment Canada (Krishnappan, 2007). It was determined that no increase in channel erosion will occur, even though flow velocity is projected to increase from 0.9 m/s at the existing maximum flow of 100 m^3/s to 1.5 m/s at the proposed maximum flow of 171 m^3/s. The canal bottom armour layer remained stable with minor transport of fine material underneath the armour layer. Moreover, the proposed maximum canal flow could be sustained in the canal without affecting canal stability.

No direct modifications to the morphology and bathymetry of the Trent River between Dam #10 and the expanded Ranney Falls GS tailrace are anticipated. The only change to bathymetry will be the amount of time that water will be intentionally spilled through Dam #10, i.e., April and early May. Leakage through the dam will continue during the rest of the year.

4.1.4.5 Sediments

A study of erosion potential of bed substrate in the Trent Canal upstream of Ranney Falls GS indicated that the canal bottom armour layer remained stable with minor transport of fine material that underlies the armour layer (Krishnappan, 2007).

As indicated in Section 3.10, bottom substrate in the Trent Canal and Trent River in the vicinity of the Ranney Falls GS consists predominantly of coarse material, e.g., sand, gravel, cobble, boulder and/or bedrock. After construction, substrate type and quality will be similar to that currently in place.

No alteration of sediment type or quality is expected during operation of the proposed Ranney Falls G3 Project.

4.1.4.6 Aquatic Vegetation and Invasive Species

As indicated in Section 3.11, a bed of rooted aquatic vegetation consisting primarily of Pondweed with some Water-milfoil is present upstream of the “Pup” powerhouse tailrace (see Figure 3.2). These plants will not be affected by construction activities or future operation of the proposed Project.

One aquatic invasive species, Water Soldier was found in the Trent River in 2008 and has since spread. While this aquatic plant has not been identified at Ranney Falls, the TSW and other partners is working to avoid its spread and have issued some Best Management Practices (Trent-Severn Waterway, 2014). It is recommended that OPG operations staff are made aware of what the plant looks like and notify the TSW or MNRF if the plant appears near or at Ranney Falls or other OPG stations along the TSW.

Populations of the invasive within the TSW represent the only known infestation in a public waterway in North America. Currently, MNRF and OFAH are studying the species and have a harvesting and spray program in place. The Water Solider has been was first discovered near Havelock, somewhat north of Ranney Falls.

4.1.4.7 Benthic Macroinvertebrates

The placement of a cofferdam in front of the forebay intake structures and main powerhouse tailrace outlet may have a localized adverse effect on benthic macroinvertebrate communities on the surface and within the substrate. The extent of disruption depends on the type of bottom substrate, the extent of the disturbed area, any resultant turbidity and sedimentation, and the timing of construction. The substrate consists primarily of boulder, cobble, gravel and/or sand over bedrock, or bedrock. Cofferdam placement over this type of substrate will minimize any detrimental effect on the benthic macroinvertebrate communities due to the availability of microhabitat and refugia within the coarse substrate. With the use of the larger-size rockfill, sufficient interstitial spaces will be available for the survival and migration of mobile benthic fauna.

Recovery after cofferdam removal is expected to be rapid. Recovery is defined as the return of aquatic biotypes after disturbance to an abundance and diversity comparable to that in an adjacent undisturbed control area (Rosenberg and Snow, 1977). The principal mechanism of recolonization by invertebrates is drift (Luedtke and Brusven, 1976; Williams and Hynes, 1977), but other mechanisms, such as lateral migration, vertical migration from within the hyporheic zone (i.e., after burial) and larval recruitment from aerial sources are also important (Luedtke and Brusven, 1976; Williams and Hynes, 1977; Griffiths and Walton, 1978; Hirsch *et al*., 1978). The rate of recovery is dependent on ambient environmental conditions, the type of organisms present and the size of the disturbed area. In general, there will be less impact upon benthic macroinvertebrate communities associated with a naturally variable, high energy environment. Benthic organisms that are adapted to high-energy, unstable conditions have life cycles that allow them to better withstand these stresses (Hirsch *et al*., 1978).

Although no specific data are available on negative effects of substrate coverage by rockfill or other material, recovery rates from dredging activities range from six days (McCabe *et al*., 1998), 14 days (Rosenberg and Snow, 1977), three weeks (Diaz, 1994), 38 days (Griffith and Andrews, 1981) and up to one year (Griffiths and Walton, 1978).

Blasting in the dewatered nearshore area of the expanded tailrace will result in localized destruction of the benthic communities. Benthic mortality will be a function of distance from and intensity of the blast (Schwartz, 1961). However, recovery from blasting is expected to be rapid.

Under the operating regime of the proposed Ranney Falls GS expansion, flow velocity will be higher, on average, from about late October to mid-June in the 1.5 km long navigation channel upstream of the Ranney Falls GS and Locks #11 and #12. The maximum average flow velocity under existing conditions is approximately 0.9 m/s, and the maximum average flow velocities due to proposed Ranney Falls GS expansion will be approximately 1.0 m/s during the navigation season and 1.5 m/s during the remainder of the year. These are average values for the entire water column. Changes will be less near the bottom, where local-scale variations in velocities adjacent to the coarse substrate will still occur (Krishnappan, 2007).

Current speed is an important variable in running water, in that it controls the occurrence and abundance of species, and hence the structure of the biotic community (Hynes, 1970). The increased flow velocity through the navigation channel will likely have an effect on the composition of the benthic macroinvertebrate communities. Detrimental effects to benthic macroinvertebrate communities due to current speed are generally caused by sudden and/or extreme changes in flow, such as is caused by severe storms or drought (Hynes, 1970), or by dam operations (Clarke *et al*., 2008). Coarse, stony substrate, such as occurs in the navigation channel, usually has the most diverse macroinvertebrate communities that are also most resilient to sudden changes in flow because the substrate provides a variety of micro-habitats and refugia (Hynes, 1970). Because flow variability will only increase to the extent that the existing hydrograph of Trent River flows will be more closely followed, no negative effect on the benthic macroinvertebrate communities is anticipated.

The section of the Trent River from Dam #10 downstream to Ranney Falls consists of a series of reduced shallow warmwater pools and riffles on the bedrock riverbed for part of the year and a high-velocity river for the remainder of the year. This section does not likely have a very productive benthic macroinvertebrate community. Bedrock is relatively poor invertebrate habitat compared to gravel or cobble (Hynes, 1970), and the summer low flow period and high water temperatures would set the limiting conditions for the benthic macroinvertebrate communities. Therefore, it is anticipated that extending the low flow period in this section of river will not have a significant effect upon the productivity of the benthic macroinvertebrate communities.

The pattern of flow will change immediately downstream of Ranney Falls and in the vicinity of the tailrace due to the proposed Ranney Falls G3 Project. There will be a decrease in the amount of time when water will be intentionally spilled through Dam #10 and over Ranney Falls, and a corresponding increase in flow into this river section via the enlarged Ranney Falls GS tailrace. The backwater effect from the next dam downstream will ensure that no part of this reach will become dry. Although the flow pattern will change somewhat, no changes in overall habitat type or quality will occur, nor will access to particular habitats be restricted. Furthermore, although the composition of the benthic macroinvertebrate community at any

given location may change due to a shift in local flow velocity, the overall composition and productivity of the communities throughout this river section will likely not change significantly.

4.1.4.8 Fish Populations and Habitat

Cofferdam Installation

After cofferdam installation, the existing forebay and tailrace channel will be dewatered and any fish present collected (i.e., by electrofishing) and transferred to the Trent Canal and Trent River, respectively, prior to complete dewatering. Temporary cofferdam installation could disrupt fish spawning activities and impact on the early life stages of fish, e.g., eggs and fry. Cofferdam installation and dewatering will be undertaken outside of the timing restriction for in-water construction to protect the fish spawning and egg incubation period for warmwater and coolwater fish communities of April 1 to June 30. An impervious geotextile will be placed on the cofferdam face to preclude water ingress. The temporary unavailability of this habitat will have negligible effect on the local fish populations.

Blasting

Blasting of bedrock will be required in the nearshore area of the expanded forebay, powerhouse and spillway, and expanded tailrace. This will be conducted in dry conditions. In-water blasting may be conducted to remove the tailrace cofferdam including the rock plug. Numerous studies have been undertaken to assess fish mortality due to in-water blasting (e.g., Chamberlain, 1976, 1979; Teleki and Chamberlain, 1978). The degree of blasting impact on fish will depend on the type of explosive, type of substrate blasted, blasting technique, fish physiology and timing. Injury to fish from in-water blasting will result from physical abrasion from ejected debris and from pressure changes associated with the blast shock waves.

Common blast-induced injuries to fish include haemorrhage in the coelomic or pericardial cavity and rupture of the swim bladder. Differences in species-specific susceptibility to blast injuries are a function of the fish's shape and swim bladder formation (Teleki and Chamberlain, 1978). Physoclistic (with swim bladder isolated from oesophagus) and laterally compressed fish such as the centrarchids, e.g., Smallmouth Bass, are the most sensitive to pressure changes. Mortality within this group varies with orientation of the laterally-compressed body to the pressure front at the time of a blast. Physostomic (with swim bladder connected to the oesophagus by an open duct, which provides pressure release) fish with fusiform shape, such as the White Sucker, are most resistant to pressure changes.

To obviate injury to fish, blasting will be undertaken in the “dry”, i.e., behind the cofferdam after dewatering and removal of fish. The shockwaves (peak particle velocities) produced from blasting using the sophisticated techniques and control measures employed in modern blasting practice will be attenuated rapidly within the bedrock. With the width of the cofferdam and its sufficient distance

from the limit of blasting, no injury to fish from pressure changes associated with the blast shockwaves is expected. Moreover, blasting mats will be used to minimize the occurrence of fly-rock and the rock fragments removed by backhoe.

The DFO has developed a number of guidelines on methods and practices which are intended to prevent or avoid harm to fish and/or fish habitat that could result from the use of explosives (Wright and Hopky, 1998). The use of temporary cofferdams to permit blasting within the dewatered area and adherence to the DFO guidelines and blasting engineer recommendations will avoid harm to fish and/or fish habitat. Potential effects on fish in the Trent River will be further mitigated by scheduling the blasting during the period of little flow between Dam #10 and the tailrace, i.e., between July and late October, if possible.

As a result, no direct adverse effects on fish or fish habitat are anticipated during construction.

Flows and Flow Velocities

The only physical modifications to this section of river will be the expanded tailrace. The proposed tailrace will be large enough to accommodate the increased flow from the new powerhouse, and therefore, the flow velocity exiting the new tailrace will be very similar to the existing main powerhouse tailrace velocity. Provided that the proposed tailrace is constructed so that it has sufficient depth (0.5 m) of substrate with the similar type of substrate present in the existing tailrace, the ecological function provided by the existing tailrace will be replicated, with aquatic habitat area increased. After "Pup" powerhouse decommissioning, flow through its tailrace will cease. There are no critical habitats in the "Pup" powerhouse tailrace.

There are three areas of aquatic habitat, isolated from each other by barriers to fish migration, potentially affected due to alterations to flow by the operation of the proposed Ranney Falls G3 Project:

1. a 1.5 km section of the Trent Canal navigation channel upstream of the Ranney Falls GS between Dam #10 and Locks #11 and #12;
2. the section of Trent River between Dam #10 and the brink of Ranney Falls; and
3. the section of Trent River downstream of Ranney Falls to the Hague's Reach GS and Lock #10.

The projected increase in flow velocity from 0.9 m/s at the existing maximum flow of 100 m^3/s to 1.5 m/s at the proposed maximum flow of 171 m^3/s in the Trent Canal will likely affect habitat utilization by fish. For example, given the coarse substrate and depth of the navigation channel, such a change in velocity would be less favourable to centrarchids, but more favourable to catostomids, e.g., White Sucker and redhorse suckers (Aadland *et al*., 1991).

There will be a decrease in the amount of time that water will be intentionally spilled through Dam #10, i.e., April to early May. Leakage through the dam will continue during the remainder of the year. Fish production in the Trent River between Dam #10 and Ranney Falls is currently

limited by the low flows during the summer and early fall, the predominantly bedrock substrate and the isolation of the area upstream of Ranney Falls. Leakage through the dam will continue, and decreasing the period of time that additional flow is provided is not expected to have a detrimental effect.

The decrease in the amount of time when water will be intentionally spilled through Dam #10 will result in corresponding decrease in flow over Ranney Falls and into the upstream end of this river section, and a corresponding increase in flow into this river section via the proposed Project expanded tailrace. It is not anticipated that this will have a detrimental effect upon fish production in this section of the Trent River. The depth of water throughout this area is determined by the regulated water level for navigation. The backwater effect from the next dam downstream ensures that no part of this reach becomes dry. There does not appear to be any critical habitats that depend upon a particular combination of flow and substrate type, such as Walleye spawning, between Ranney Falls and the existing Ranney Falls GS tailraces. Certainly there will be some shifts in habitat utilization as fish and invertebrates adjust to the new flow pattern in the area shown in Figure 3.2, but because no critical habitats will be affected, nor will changes in habitat type or quality occur, this is not predicted to result in any changes in fish community or productive capacity.

As indicated Section 4.1.4.7, the overall composition and productivity of the benthic macroinvertebrate communities within the Trent Canal and Trent River will likely not change significantly as a result of flow modifications. Therefore, a change in food supply for fish is not anticipated.

Fish Entrainment

With the potential increase in flow being diverted through the proposed expanded Ranney Falls GS, there is the potential for increased entrainment and possible injury or mortality of fish. However, fish injury/mortality due to entrainment has not been documented as an issue for hydroelectric stations along the lower TSW. This is likely due to:

- the type of fish community;
- the fragmented condition of the waterway due to the presence of numerous dams; and
- the low-head nature of these stations.

Moreover, the constructed navigation canal upstream of the Ranney Falls GS to Dam #10 has no significant fish spawning areas or other habitats that would attract or support a disproportionate number of fish.

The fish communities found within each relatively isolated section of the TSW, i.e., between a set of dams and locks, reflect the habitats available within each section. Centrarchids (sunfishes, Smallmouth Bass, Largemouth Bass) are very common throughout the system due to their preferred habitats found in quiet slow-moving rivers and small lakes with warm water.

Each reach of the TSW has a dam at the downstream and upstream ends, with mostly deeper flat water between, except for a relatively small section of rapids below the upstream dam that provides spawning habitat for migratory fish such as Walleye, Lake Sturgeon and suckers. For the most part, these mobile fishes remain within their particular reach, as evidenced by spawning observations in which the largest reaches have the largest aggregations of fish within the spawning habitat below the upstream dam. For the larger reaches, young fish that drift downstream from the spawning areas remain in these lentic habitats between the upstream spawning area and the downstream dam. In contrast, the smaller reaches have very few, if any, observable spawning fishes. Therefore, the smaller reaches likely produce fewer young fishes that would tend to drift downstream.

Since most fish species found in the TSW are not compelled to migrate upstream or downstream for some part of their life cycle, there is no mass migration that could result in mortalities below hydroelectric generating stations. While some of their larvae may drift downstream through the generating stations, they are individually very small and unlikely to be harmed by passing through the low-head facilities in the TSW (e.g., Cada, 1990; Dedual, 2007). The exception to this may be the American Eel (see below).

Ranney Falls GS is highly visible to local residents, fishers and visitors due to the adjacent Ferris Provincial Park, the nearby TSW locks and the suspension bridge/walking trail with good views of the existing GS tailrace. Even with extensive observations over decades of operation, there are no reports of dead or damaged fish downstream of the GS. Furthermore, aggregations of piscivorous birds such as seagulls are not attracted to the vicinity of the GS tailrace, suggesting that few fish are injured or killed. During the fisheries field surveys, spawning assessments and field visits undertaken by C. Portt and Associates staff on October 19, 2005, April 13, June 6-7, August 31 and September 8, 2006, April 21 and June 4, 2007, April 22, 2008, April 5, 2010 and April 12, 2011, no injured or dead fish were observed in the Ranney Falls GS tailrace area. Similarly, no injured or dead fish have been observed by OPG CHPG staff based on casual observations over decades of GS operation.

Fish injury and mortality due to entrainment at hydroelectric generating stations generally increases with increased station size, increased intake and turbine passage flow velocity, greater head, turbine design, and the abundance and size of fish susceptible to entrainment.

At Ranney Falls GS, the only aspects that will be changing as a result of the proposed Project that will potentially affect entrainment and associated fish injury and mortality will be the increased seasonal flow velocity upstream of the GS within the navigation canal and expanded forebay, the increased flow volume through the GS, the decreased new powerhouse intake velocity, the increased spillway intake velocity and the design of the new turbine unit.

Based on the current maximum flow of 100 m^3/s through the Ranney Falls GS, velocities in the straight navigation canal section and near the forebay intake structure are 0.9 and 0.5 m/s, respectively. This difference of 0.4 m/s is due to the offset location of the Ranney Falls GS

relative to the main canal channel. The existing maximum powerhouse intake velocity is approximately 2.1 m/s.

Under the proposed GS expansion, maximum flows through the GS will be increased to 120 m^3/s during the navigation season and 171 m^3/s for the remainder of the year. For the increased flow of 120 m^3/s, velocities will increase from 0.9 to 1.0 m/s in the canal and from 0.5 to 0.6 m/s near the forebay intake structure. For the increased flow of 171 m^3/s, velocities will increase to 1.5 m/s in the canal and 0.9 m/s near the forebay intake structure. The maximum design flow velocity at the proposed G3 powerhouse intake will be limited to less than 1.5 m/s. The maximum design spillway intake velocity at the maximum discharge flow of 171 m^3/s will be limited to be less than 6 m/s; as the spillway will be operated only about six (6) times a year, and it is concluded that the spillway will have negligible effect to the fish spawning.

As mean monthly flows between June and October are less than 100 m^3/s, flow velocities in the straight navigation canal section and near the forebay intake structure will remain unchanged, i.e., less than 0.9 and 0.5 m/s, respectively. This period coincides with fish spawning and egg incubation completion and larvae emergence. As mean flow velocities are not expected to change during this period, the potential for young fish entrainment will remain the same during proposed Ranney Falls G3 Project operation. Furthermore, since the maximum power intake velocity of the proposed Ranney Falls G3 Project is less than the intake velocity of the existing GS, it is reasonable to assume that the chances of young fish being entrained into the newer G3 will be reduced. Moreover, as indicated above, there are no significant fish spawning areas or other habitats in the constructed navigation canal upstream of the Ranney Falls GS to Dam #10.

It has been predicted that these flow increases may potentially shift the fish community in the navigation canal between Dam #10 and Ranney Falls GS towards one that prefers faster flowing conditions, e.g. from centrarchids to catostomids (suckers). Most adult fish, through rheotaxis, will not allow themselves to be swept downstream due to the increased risk this exposes them to, and will either change location or position in the water column to avoid flow velocity that is too great, or simply swim harder in the short term. Over a relatively short time, species for which the velocity change is too great will move out of the affected area, and will be replaced by species which prefer faster water. If this shift occurs, the fish community will be suited to the new faster-flowing habitat conditions, and will likely not be any more susceptible to being swept downstream than the pre-GS expansion fish community. Again, since the maximum power intake velocity of the proposed Ranney Falls G3 Project is less than the intake velocity of the existing GS, it is reasonable to assume that the chances of adult fish being entrained into the newer G3 will be reduced. Any fish that are entrained into the newer facility will also have a better chance of survival passing through the new Kaplan turbine (see below).

In the case of turbine design, Kaplan turbines result in less fish injury/mortality than Francis turbines, with average survival rates of 89.85% compared to 76.8%, respectively (JRP, 2009). Differences in survival performance between Kaplan and Francis turbines are likely related to the number of blades. Most conventional Kaplan hydropower turbines have five or six blades

attached to a hub, and the blades can be adjusted vertically to optimize unit efficiency through a wide range of water displacement volumes. In contrast, Francis turbines typically have 14 to 18 blades that are fixed in position in a manner that forms a wheel. As a result, there is an increased probability of blade strike and injury to fish with the Francis design. In addition, older design turbines may have gaps between the blades and the turbine hub where fish can get caught, and hence suffer injury/mortality.

Fish survival through hydroelectric turbines is also a function of fish size irrespective of turbine design. Even with Francis turbine designs, fish survival can be high especially if the entrained fish are very small. For example, Dedual (2007) has shown high survival (93.1% after 96 h passage) of Rainbow Trout (*Oncorhynchus mykiss*) with fork lengths of 81 mm or smaller. The author concluded that the Francis turbine at the Hinemaiaia Power Plant which has 15 blades and a head of 22.6 m will provide a safe route for migrating fish less than 80 mm in size. Similarly, Cada (1990) estimated that a 4-cm fish (Walleye fingerling) would have a probability of runner contact of 5% or less. Higher fish mortality and injury is expected for larger-sized fish. For example, Ferguson *et al*. (2008) reported that mean blade-strike mortality was higher for adult Atlantic Salmon (*Salmo salar*) and sea-run Brown Trout (*Salmo trutta*) (25.2-45.3%) than for juveniles (5.3-9.7%).

The vertical Kaplan G1 and G2 turbine units in the main powerhouse are characterized as 5,000 hp, 120 rpm and 3 m in diameter, with14 buckets (spoon-like blades). The design of these older Kaplan units is similar to that of the current Francis turbine described above.

As indicated in Section 1.3, the proposed G3 turbine will be a single Kaplan turbine unit with a nominal capacity of up to 10 MW at design flow of 80 m^3/s. The selected unit is an EcoBulb horizontal unit with the modern design, five blades will occur on the unit, thereby improving survival of any entrained fish. As indicated above, survival of any entrained larval and YOY fish through the proposed G3 turbine unit is expected to be very high.

ALDEN (2001) conducted a review of fish survival for the Dunvegan Hydroelectric Project in Alberta and predicted fish survival (S) through axial flow turbines (e.g., Kaplan) as a function of fish length (L), propeller speed (r) and the number of blades (b) using a predictive model developed by Headrick (1998);

$$S = 109.2 – 0.027(L) – 1.038(b) – 0.045(r)$$

The simulations showed that survival rate was negatively correlated with fish length and the number of blades in operation. For example, at a turbine speed of 150 rpm, the estimated survival rate for a 500-mm fish would be 82.7% with six blades and 84.8% with four blades. For a 100-mm fish, the survival rate would be 93.5% with six blades and 95.6% with four blades.

In summary, fish entrainment at the Ranney Falls GS appears to be negligible due to its small size, intake velocity and head, its offset location relative to the main canal channel and the poor

fish habitat in this reach of the Trent Canal. Although increased flow will be diverted through the proposed expanded Ranney Falls GS, it is predicted that fish entrainment will remain negligible due to the factors affecting current entrainment potential discussed above, as well as the lower intake velocity at the proposed G3 powerhouse and the use of modern conventional turbine design.

Fish SAR

As indicated in Section 3.14, Lake Sturgeon and American Eel are known to occur, or to have occurred upstream of Ranney Falls GS. Based on the habitat requirements of Lake Sturgeon, the habitat conditions at Ranney Falls GS and the proposed minor changes in habitat due to the proposed Ranney Falls G3 Project, potential Lake Sturgeon habitat at the Ranney Falls GS will not be negatively affected by the construction or operation of the proposed Project (Coker *et al*., 2012).

Dams and hydroelectric facilities have a detrimental impact upon American Eel populations. American Eel is adept at passing upstream over barriers as juveniles. Adult eels, which migrate downstream to return to their oceanic spawning grounds, are apparently susceptible to hydroelectric turbine mortality due to their elongated body (COSEWIC, 2006). Although not considered a concern in the vicinity of the Ranney Falls GS according to the Conservation Ontario website (http://www.conservation-ontario.on.ca), American Eel have, in the past, occasionally been reported upstream and downstream of Ranney Falls GS. This species presently occurs in very low numbers in the TSW. Surveys targeting American Eel in the TSW in 2010 and 2011 only found them downstream of Dam #1, although one dead eel was found in the vicinity of Lock #3. More recently, American Eel were captured several times incidentally in the vicinity of Lock #3, approximately 40 km downstream of Ranney Falls GS (S. Reid, MNRF, 2015, pers. comm.).

Due to the very low numbers of American Eel that likely occur at Ranney Falls GS, because of the distance and barriers that occur between Ranney Falls GS and Lake Ontario/Bay of Quinte, as well as their generally low numbers known to be present in their primary habitats of Lake Ontario/Bay of Quinte, negative effects on American Eel populations are likely insignificant at this time (Coker *et al.,* 2012). The potential American Eel issue will be reassessed if new information on their presence in the TSW becomes available.

Risk Management Framework Assessment

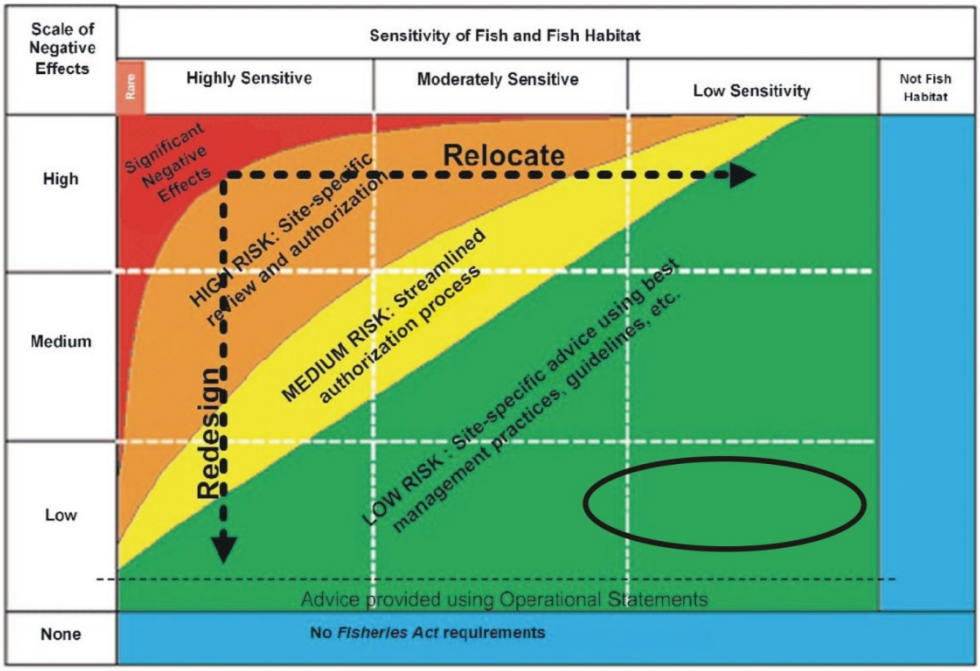
When these results are considered within the DFO (2006) Risk Management Framework, Coker *et al*. (2012) determined that the proposed Project should be characterized as a “Low Risk” proposal (Figure 4.1). DFO (2006) suggests that an appropriate management option in this case would be to issue a “No HADD Likely as Proposed” letter that would include advice (a list of mitigation measures, applicable guidelines and/or best management practices) that will be part of the basis of the decision. It should be noted that authorization under the amended

Fisheries Act is based on harm to fish and/or fish habitat, not harmful alteration, disruption or destruction (HADD) of fish habitat.

The key points of the Coker *et al*. (2012) assessment are that:

- A variety of habitats and habitat conditions occur within the study area that are typical of the TSW between Peterborough and Trenton at Lake Ontario. Most of the habitats are deeper with slower flows, since the waterway is operated foremost as a navigation canal. The only higher gradient section providing riffle habitat is the spill channel between Dam #10 and Ranney Falls, which is isolated from the other parts of the study area and in most years receives only dam leakage through the summer and early fall. Centrarchids are very common throughout the study area, as are their preferred habitats.
- The small area of the "Pup" powerhouse tailrace does not serve a critical habitat function and, although it will no longer have flow velocities typical of a tailrace, it will remain as fish habitat.
- No critical habitat, e.g., Walleye spawning habitat, appears to be present immediately below Ranney Falls, or in the vicinity of the Ranney GS main powerhouse tailrace.

Figure 4.1 DFO Risk Management Framework[1]



[1] The ellipse designates the risk assessment for the proposed Ranney Falls G3 Project.

- Following the completion of construction, the total amount of permanent habitat will slightly increase.
- No negative impacts to habitats or productive capacity are anticipated because of the proposed expansion of the Ranney Falls GS, although there will likely be some shifts in

fish and benthic macroinvertebrate community composition within part of the study area due to changes in the annual flow regime.

- The expanded Ranney Falls GS will likely increase the potential for entrainment and mortality of fish through the turbines; however, entrainment is not presently thought to be a significant cause of fish mortality, and given the existing fish community and infrastructure of the TSW, it is unlikely to become a significant problem during operation of the proposed Ranney Falls G3 Project.
- When considered within the DFO (2006) Risk Management Framework, the proposed works are characterized as a "Low Risk" proposal.

Provided that the recommended mitigation measures are implemented, Coker *et al*. (2012) concluded that the proposed Ranney Falls G3 Project will not have a negative impact upon the composition or production of the TSW/Trent River fish communities.

Based on the Coker *et al*. (2012) assessment and supplemental information of fish entrainment potential provided by OPG for a meeting with DFO on June 29, 2012, DFO concluded that the proposed Ranney Falls GS expansion will not likely result in impacts to fish and fish habitat provided that the following mitigation measures are implemented (C. Strand, DFO, 2012, pers. comm.):

- "No in-water work should occur from April 1 to June 30 to protect local fish populations during their spawning and nursery periods.
- All materials and equipment used for the purpose of site preparation and project completion should be operated and stored in a manner that prevents any deleterious substance (e.g. petroleum products, silt, etc.) from entering the water.
- Sediment and erosion control measures should be implemented prior to work and maintained during the work phase, to prevent entry of sediment into the water.
- All instream work should be completed in the dry by de-watering the work area and diverting and/or pumping flows around cofferdams placed at the limits of the work area.
    - Fish should be removed from the work area prior to de-watering and released alive immediately downstream.
- Follow DFO's *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters*".

In addition to the above mitigation measures, DFO recommended that OPG design the new intake structures such that future installation of fish screens is possible. Currently, American Eel numbers are extremely low within the TSW; therefore, no eel mortality has been observed at the Rainey Falls GS. If American Eel populations increase within the TSW, OPG may be asked to provide additional mitigation at the Rainey Falls GS to protect this fish SAR. A properly designed intake structure could reduce potential financial risk in the future.

4.1.5 Pollution

Air Quality

During construction, exhaust emissions from construction equipment and fugitive dust emissions will have localized, short-term and transitory effects on the surrounding airshed. Typical combustion emissions include NO_x, CO, SO_2 and VOCs.

The contractor and subcontractors will be required to maintain equipment in good working condition to minimize combustion emissions to the extent practicable (Cheminfo, 2005). To reduce fugitive dust emissions, effective dust suppression techniques will be used. Additional information on mitigation of exhaust and fugitive dust emissions is provided in the Socio-economics and Land Use TSD.

The application of the recommended mitigation measures should minimize combustion emissions and limit fugitive dust emissions to the work area. As a result of the low concentrations of the atmospheric pollutants generated during construction, no adverse effects due to these emissions are anticipated.

Ambient air quality will not be affected during the operation of the proposed Ranney Falls G3 Project and monitoring is not deemed necessary.

Environmental Noise

The proposed Project will be a potential source of local noise during the construction phase. All work is expected to be completed using conventional construction methods. The noise associated with construction would most likely be a result of activities such as general site grading, foundation work, expanded forebay and tailrace excavation (including drilling and blasting), and site servicing. The proposed Project will be constructed using standard construction best management practices (e.g., Cheminfo, 2005).

Groundwater Quality

The groundwater meets the CSA Standards for water quality requirements for mixing concrete.

As indicated in Section 3.9, benzene, phenolics and n-hexane concentrations in groundwater samples were above their respective Ground Water Standard or PWQO. Based on review of other study findings, it was concluded that these elevated concentrations are naturally occurring due to their leaching from the bituminous layers of shale that are interbedded in the limestone of the Verulam Formation. As the elevated concentrations are not derived from anthropogenic means, no remediation is recommended. Rather, a monitoring program is recommended to confirm that excess groundwater within the tailrace is suitable for direct discharge to the Trent River and/or Trent Canal based on MOE water management policies (MOEE, 1994). In

addition, appropriate health and safety measures for implementation during construction will be developed, as necessary, based on the analytical results.

Approval for groundwater discharge to the Trent River and/or Trent Canal will be obtained from Parks Canada – TSW. A PTTW will be required from the MOECC for water discharges that are greater than 50,000 L/day.

Blasting could have a potential effect on groundwater quality in the immediate vicinity of the blasting operations. As indicated in Section 4.1.1, blasting operations will adhere to the DFO blasting guidelines, including “no use of ammonium nitrate-fuel oil mixtures occurs in or near water due to the production of toxic by-products (ammonia)”.

Water Quality

During the construction period, water quality in the Trent Canal and Trent River may be affected by soil erosion and turbidity generation, in-water construction activities, incidental spills and waste material dispersion.

As previously indicated, a site-specific Erosion and Sediment Control Plan will be prepared and implemented prior to construction. With the implementation of the Erosion and Sediment Control Plan, the potential effects of soil erosion and turbidity generation will be minimized or obviated.

The potential effects of in-water construction activities, such as cofferdam construction on water quality of the Trent Canal and Trent River, will be minimized by using clean rock fill, the placement of rock fill over similar coarse substrate and judicious selection of the discharge location and water pressure during dewatering and as necessary the placement of erosion control structures.

As indicated in Section 2, a silt curtain will be installed along the Trent River shoreline prior to removal of the rock plug at the new tailrace channel outlet and the cofferdam at the existing tailrace channel outlet. Specific procedures will be developed for rock and cofferdam removal.

Incidental spills of oil, gas, diesel and other liquids to the environment could occur during construction. In addition, sanitary and other wastes will be generated during construction. Fuelling and lubrication of construction equipment should be carried out in a manner that minimizes the possibility of releases to the environment. Measures for containment and cleanup of contaminant releases will be followed to minimize contamination of the natural environment, followed by approved landfill or other disposal. Interim sanitary waste collection and availability of treatment facilities will be arranged for the duration of the construction period. All construction waste, washwater and wastewater will be disposed of or managed in accordance with regulatory requirements.

OPG acknowledges that re-fuelling 30 meters or more from a watercourse is a good practice and is outlined in the Liquid Fuels Handling Code. However, most of the Ranney site is within a 30 meter radius of either the canal or the River. For mobile re-fuelling, the Liquid Fuels Handling Code allows for a modification to procedure where the mobile re-fueller has an approved procedure to prevent the loss or escape of product from: (a) creating a hazard to public health or safety; (b) contaminating a fresh water source or waterway; (c) interfering with the rights of any person; or (d) entering into a sewer system, underground stream, or drainage system. As OPG will require its constructor to develop an environmental management plan, the constructor will be obligated to provide a procedure that addresses (a) through (d).

The contractor is to also note the MOECC spills response line in their EMP.

A Hazardous Materials Management Plan, Waste Management Plan and a Spills Emergency Preparedness and Response Plan will be developed for the construction phase of the proposed Project as part of the broader Environmental Management Plan. The implementation of these pollution prevention plans will obviate or minimize the environmental effects of accidental releases to the natural environment that have the potential to affect water quality in the Trent Canal and Trent River.

During refurbishment of portions of the supporting piers under the operating deck, there is a potential for accidental loss of cement during surface application. Any dripped cement will be recovered from the forebay bottom for suitable disposal prior to temporary cofferdam removal. All trash and other solid debris will also be collected for appropriate disposal.

Overall, the effects of the construction of the proposed Ranney Falls G3 Project on water quality of the Trent Canal and Trent River are expected to be localized, temporary and negligible.

A Hazardous Materials Management Plan, Waste Management Plan and a Spills Emergency Preparedness and Response Plan will also be developed as part of the broader Environmental Management Plan for the operation of the proposed Project. The implementation of these pollution prevention plans during facility operations will obviate or minimize the environmental effects of accidental releases to the natural environment that have the potential to affect water quality in the Trent Canal and Trent River.

4.2 CULTURAL FEATURES

4.2.1 Consultation

4.2.1.1 Public Consultation

Public consultation activities for the proposed Ranney Falls G3 Project involved the following activities.

- Stakeholder identification and communication, in addition to government agencies (see Section 4.2.1.2), including owners and/or residents of nearby properties, non-government organizations and other groups and persons such as elected officials with an interest in, or in possession of environmental baseline information relevant to, the proposed Project.
- Development of a Project-specific web site (http://www.ranneyfallsg3.com) that was maintained throughout the EA providing a widely accessible venue for interested people to obtain and download Project information and reports in a timely manner, as well as an email and telephone number for interested people wishing to make comments or seeking further information.
- An Open House was held on the project on June 17, 2015 and over twenty-four individuals attended that meeting. No individuals indicated an opposition to the proposed Project and several people indicated support for it. However, a number of questions were asked about the Project and a few local residents raised questions with respect to traffic, noise and potentially other nuisance effects. Responses were provided to them and OPG takes the position that it is always willing to listen to concerns and issues and address them wherever possible.
- Prior to the June Open House a public meeting was held at the Island Park Retirement Community which is the adjacent neighbour to Ranney Falls. The presentation on the project contained largely the same content as provided in the June Open House. Approximately 15 residents and workers were present at the session. No specific concerns were raised but there were questions about the history of the Ranney Falls Generating Station.

A detailed summary of public consultation and engagement is provided in the Public and Agency Consultation TSD.

4.2.1.2 Agency Consultation

Based on consultation with federal and provincial agencies prior to the repeal of *CEAA* by *CEAA 2012*, it was determined that the proposed Ranney Falls G3 Project was subject to a federal screening EA under *CEAA* due to Parks Canada authorization under the *Dominion Water Power Act*. As the proposed Ranney Falls G3 Project is on a federal waterway and subject to the federal *Dominion Water Power Act*, it was not subject to the Ontario *EA Act*.

To conform with the federal screening EA process, a draft “Project Description for Federal Agency Review” (Project Description) was prepared by SENES (2012c) for the proposed Ranney Falls G3 Project for Canadian Environmental Assessment Agency (CEA Agency) and all interested provincial and federal regulatory agencies. The document followed the guidance for preparation of project descriptions under *CEAA* outlined in the CEA Agency (2007) Operational Policy Statement.

The draft Project Description was provided to the CEA Agency, Parks Canada – TSW, DFO, Transport Canada, AANDC, Environment Canada, MOE, MNR, MTC, LTC and Trent Hills prior to an Agency Kickoff Meeting on March 14, 2012.

The purpose of the Agency Kickoff Meeting was to:

- present the proposed Ranney Falls G3 Project;
- discuss EA and permitting requirements;
- obtain feedback on issues, completed field work and future information requirements; and
- ascertain whether the proposed Project will likely trigger *CEAA*.

The agenda, presentation and meeting notes are provided in Appendix C of the Public and Agency Consultation TSD.

As indicated in Section 1.0, the MOE determined that the Ontario *EA Act*, and therefore, the OWA Class EA, did not apply to the proposed Project (V. Mitchell, MOE, 2012, pers. comm.). However, the proposed Project may still require MOE Environmental Compliance Approvals, such as PTTW under the *OWRA*.

Based on the draft Project Description, CEA Agency determined that the proposed Ranney Falls G3 Project was subject to an EA screening under *CEAA*. The "lead" Responsible Authority for the screening was Parks Canada – TSW due to the requirement for an issuance of a licence under the *Dominion Water Power Act* to enable the proposed Project to proceed. DFO and Transport Canada were identified as potential Responsible Authorities.

Upon finalization of the Project Description, a scoping document was subsequently to be prepared by Parks Canada – TSW with input from the potential Responsible Authorities and federal authorities that would outline their determination regarding Project-specific information requirements and establish the boundaries of the federal EA screening. In addition, a Notice of Commencement of an EA for the proposed Ranney Falls G3 Project was to have been posted by Parks Canada – TSW on the Canadian Environmental Assessment Registry. As the Project Description had not been finalized prior to the repeal of *CEAA* by *CEAA 2012*, the scoping document was not prepared and a Notice of Commencement of an EA was not posted.

As indicated in Section 1.0, for projects on federal lands that are not designated projects, such as the proposed Ranney Falls G3 Project, *CEAA 2012* requires that before federal authorities make any decision that would allow a project to proceed, they must determine whether the project is likely to cause significant adverse environmental effects. As *CEAA 2012* does not establish a process for determining whether the undertaking of a non-designated project is likely to cause significant adverse environmental effects, the involved federal departments, e.g., Parks Canada, DFO, Transport Canada, Environment Canada, must establish their own (or conduct joint efforts) for the environmental effects review process.

A final "Project Description for Federal Agency Review" (SENES, 2012d) which reflected the new obligations of federal authorities under *CEAA 2012* was submitted to Parks Canada to assist in the development of a ToR that would form the basis for the environmental effects review process for the proposed Ranney Falls G3 Project.

As the proposed Ranney Falls G3 Project occurs within a Parks Canada protected heritage area, the Trent-Severn Waterway National Historic Site of Canada, Parks Canada – TSW is responsible for the approval of the proposed Project, or rejection with explanation.

Parks Canada – TSW determined that under section 67 of the *CEAA 2012* a DIA will be required to assess potential environmental impacts of the proposed Project and to determine if proposed mitigation measures will address these impacts.

Prior to the DIA, a draft ToR was prepared by OPG that followed the guidance provided within the Parks Canada "Generic Terms of Reference for preparation of a Detailed Environmental Impact Analysis (DIA) Report pursuant to the Parks Canada Directive on Implementation of the Canadian Environmental Assessment Act 2012." The draft ToR (SENES, 2014) was submitted in June 2014 to Parks Canada – TSW for review by the Federal Review Team which included Parks Canada – TSW, DFO, Environment Canada and Transport Canada. The draft ToR was also reviewed by MOECC and MNRF. Based on the review comments, a final ToR was prepared which formed the basis for the environmental effects review process for the proposed Project (SENES, 2015).

Based on the final ToR, a draft DIA Report together with TSDs was prepared by OPG for review by the Federal Review Team, MOECC and MNRF.

A detailed summary of agency consultation and engagement is provided in Table 3.1 of the Public and Agency Consultation TSD.

4.2.1.3 Aboriginal Consultation

OPG recognizes that First Nations and Métis communities and their lands are unique in Canada, with distinct historical and cultural significance.

At the request of OPG, TSW-Parks Canada identified the following First Nations as likely having an interest in the proposed Ranney Falls G3 Project (B. Sharpe, Parks Canada – TSW, 2012, pers. comm.):

- Alderville First Nation;
- Hiawatha First Nation;
- Curve Lake First Nation.

Parks Canada – TSW also identified the MNO as likely having an interest in the proposed Project (B. Sharpe, TSW-Parks Canada, 2012, pers. comm.).

Letters introducing the proposed Project were sent out to the three First Nations identified by TSW-Parks Canada in April 2012. As a follow-up to the letters, Curve Lake First Nation assisted OPG in hosting a meeting with the Mississaugas First Nations involved in signing the Williams Treaty of 1923. OPG was advised that the Mississaugas of Scugog Island should be included in the meeting and information on the Project was sent to them on June 14 2012 prior to the meeting that was held on June 28, 2012. In addition to the three First Nations identified by Parks Canada – TSW, representatives of the Mississaugas of Scugog Island First Nation also attended and have been included in all consultation subsequent to June 14, 2012.

During the meeting, the First Nations representatives were appreciative of OPG for informing them of the proposed Project on their waterway and noted that there would not likely be any off-site impacts that would be an issue for their communities. Additional information on the communications and meeting with First Nations is provided in the Aboriginal Consultation TSD.

An email and letter introducing the proposed Project were sent to the MNO in April 2012.

In 2015, OPG and TSW communicated with the four Mississauga First Nations representatives (Alderville, Scugog, Curve Lake and Hiawatha) and arranged to meet with the First Nations team on Friday March 13th, 2015 where OPG provided an update and summary of the environmental studies completed, and also provided an update on project milestones. At this meeting general questions were answered. There were no issues raised. Subsequently throughout the spring and summer of 2015 OPG continually updated the team on the meetings planned both at the seniors home and also the Public Open House. The First Nations were also updated on other OPG projects in the vicinity as a courtesy.

Upon completion of the TSDs and the DIA report, OPG advised the First Nations team that these reports were being reviewed and that prior to issuing the notice in the Federal Gazette. It was advised that the DIA report and TSDs will be posted on the Project Website. It was agreed that when the reports are posted, OPG and its consultant will meet face to face with representatives from Alderville, Scugog, Curve Lake and Hiawatha to review the information in the various reports and provide a forum for questions and answers. As well, OPG has committed to continuing the dialogue and consultation with the four Mississauga First Nations as the project proceeds from definition phase to execution (construction) phase.

Based on Aboriginal consultation and engagement, the proposed Ranney Falls G3 Project will have no adverse effects on First Nations and Métis communities.

4.2.2 Aesthetics

Air Quality

The construction of the proposed Ranney Falls G3 Project has the potential to affect the air quality in the vicinity of the site. Emissions which are associated with construction activities are primarily dust and typical combustion emissions from construction equipment such as carbon monoxide, nitrogen oxides, sulphur dioxide and volatile organic compounds. As with any construction site, these emissions will be intermittent and of relatively short duration and unlikely to have an effect on the surrounding area.

The contractor and subcontractors will be required to maintain equipment in good working condition to minimize combustion emissions to the extent practicable. To reduce particulate emissions, effective dust suppression techniques will be used, such as on-site watering, limiting the speed of vehicles travelling on Trent Drive and cleaning of vehicles and road surfaces during rainy/muddy periods. During construction, the practices and procedures outlined in the Cheminfo (2005) document "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities", prepared in conjunction with the Construction and Demolition Multi-stakeholder Working Group for Environment Canada, will be followed, including:

- proper planning during the design stage to reduce emissions generated during construction;
- reduction of fugitive dust emissions from the construction site with respect to site preparation, covering of storage piles, material handling and transfer systems, road surfaces and fabrication processes;
- use of water and/or chemical dust suppressants at the construction site; and
- reduction of emissions from engines by use of well-maintained vehicles and equipment.

A MOECC PTTW will be sought if more than 50,000 L/day is withdrawn from the Trent River or groundwater source for dust suppression. Alternatively, commercial water trucks may be used. Reseeding will be undertaken as soon as conditions permit after construction to reduce fugitive dust emissions.

The application of the recommended mitigation measures should minimize combustion emissions and limit fugitive dust emissions to the Ranney Falls GS property. Any net-effects are expected to be short-term in duration and highly localized. Therefore, no other mitigation measures are required.

During proposed Project operation, local air quality will be similar to that prior to construction.

Environmental Noise

The proposed Ranney Falls G3 Project will be a potential source of local noise during its construction phase. All work is expected to be completed using common construction methods. The noise associated with the construction would most likely be a result of activities such as general site grading, foundation work, expanded forebay and tailrace excavation, and site servicing. All of these activities, which are expected to take approximately 30 months, will require the use of various pieces of heavy equipment, e.g., dozers, front-end loaders, small trucks, backhoes, bobcats, dump trucks, compactors, cement trucks and/or cranes. Blasting will be required for expanded tailrace excavation. Other construction activities, such as those related to the placement of the facility components (e.g., turbine), are expected to generate less noise. The movement of delivery and worker vehicles will also add to the sound levels during the 16-month equipment delivery and construction period.

Sound emission standards for construction equipment are set according to the date of manufacture of the equipment as defined by the MOECC in the NPC-115 publication, listed in the MOE (1978) Model Municipal Noise Control By-Law. This document stipulates specific sound emission standards for various pieces of construction equipment. This Model By-Law also suggests a restriction on the operation of any equipment in connection with construction from 19:00 h one day to 07:00 h the next day, and all day Sunday and statutory holidays.

The closest residential receptor is approximately 50 m northwest of the proposed Ranney Falls G3 Project site. Construction activities will abide with the specific Trent Hills (2005) Municipal Noise By-Law and will be limited to between 6 a.m. and 9 p.m. No construction activities will occur on Sundays and holidays except in the case of urgent necessity.

As indicated in Section 2.1, the upper shale-rich bedrock domain is considered to be non-rippable and therefore its excavation is expected to require drilling and blasting (Knight Piésold Ltd., 2011a).

Drilling activities to facilitate blasting will generate noise and vibration similar to any general construction operation. Potential effects due to noise and vibration will be minimized by proper maintenance and operation of drill rig equipment. In addition, noise baffling equipment can be provided, as appropriate.

A notice of blasting schedule will be circulated in advance to the local community and posted at the adjacent locks and along the trails to Ranney Gorge Suspension Bridge.

During proposed Project operation, local environmental noise levels will be similar to those prior to construction.

4.2.3 Public Facilities and Services

There will be no need for additional municipal facilities and services. Potable water and portable toilet facilities will be provided by the contractor. The contractor may also rent available office space in the area and/or use construction trailers on site. No increased demands on fire or police services are anticipated.

Local and regional government will not be burdened by any project-related increase in planning and administrative activities during the construction period, with the exception of consultation input during the development of relevant components of the Environmental Management Plan, e.g., Access Management Plan, Traffic Management Plan and Site Rehabilitation Plan.

When the proposed Project is operational, no additional municipal government services will be required.

4.2.4 Public Safety

Water Uses

During construction and operation of the proposed Ranney Falls G3 Project, there will be negligible impacts on vessel utilization of the Trent Canal during the navigation season.

As indicated in Section 2.3.3, during the navigation season from mid-May to mid-October with flow limited to 120 m^3/s from the current 100 m^3/s, the maximum flow velocity in the canal straight section is expected to increase from 0.9 to 1.0 m/s. As a result, a slight increase in drag velocity can be expected on vessels in the straight section of the canal. In the area near the forebay intake structure, the maximum flow velocity is expected to increase from 0.5 to 0.6 m/s resulting in vessels to be subjected to a slightly higher transverse velocity possibly requiring slight steering counteraction. Flow velocities in the Trent River near the Campbellford main town bridge are higher than those anticipated in the Trent Canal upstream of Locks #11 and #12.

The V-shaped safety booms currently installed in the Trent Canal in front of the forebay intake structure will be moved upstream (see Figure 2.5) and be reconfigured to prevent vessels from being subjected to the slightly higher traverse velocity. The anchor point at the tip of the north leg of the V will be moved outward, or upstream along the curved training wall.

Most significantly, as indicated in Section 2.3.1, the proposed Ranney Falls G3 Project includes a new spillway to by-pass full station flow to the expanded tailrace channel during the emergency shut down of the units.

Public Access

As previously indicated, the Ranney Gorge Suspension Bridge provides public access from the Ranney Falls GS property to Ferris Provincial Park on the opposite side of the Trent River. A public parking area is available on the east side of the Ranney Falls GS property with a trail available to the Ranney Gorge Suspension Bridge.

The primary access for vehicles to the construction site from Trent Drive would be the road that parallels the "Pup" powerhouse penstock to the west of the main powerhouse.

However, the storage yard and the lawn area between the public access road and the forebay will be used for laydown/assembly during construction with access to this area from Trent Drive and/or the public access road. OPG is also pursuing approval from Parks Canada – TSW for use of the lawn area on both sides of Trent Drive to the east and west of the forebay.

To minimize and/or manage the potential conflict between public and construction traffic access, an Access Management Plan will be developed in consultation with MNRF and Friends of Ferris Provincial Park, which would include the use of appropriate public access signage and barriers. As indicated above, construction will not occur on Sundays and public holidays, likely the time of peak public access activities. OPG will consult with Trent Hills to obtain input on the development of the Access Management Plan.

During proposed Project operation, access to the property will remain the same as pre-construction.

Traffic

As indicated in Section 3.15, CR 30 will be the primary thoroughfare for construction-related traffic to access Trent Drive and the construction site. During construction, as many as 80 workers could be on the site at one time. As a result, there will be increased traffic due to worker and construction-related delivery vehicles primarily along CR 30 and Trent Road and, to a lesser extent, along CR 8 and CR 50, during construction.

Mitigation measures that can be implemented to minimize potential adverse effects associated with increased traffic during the construction period include discussions with Trent Hills regarding road restrictions, haul routes and traffic safety. Occasional disruptions at construction access locations can be minimized by providing advance notice to the OPP, posting construction signs to alert oncoming motorists of construction activities, and/or assigning a traffic control duty officer(s) to assist vehicle entry and exit, as required. A Traffic Management Plan will be prepared in consultation with the Northumberland County and/or Trent Hills Public Works Departments addressing these mitigation measures for implementation during the construction phase of the proposed Project.

During proposed Project operation, traffic access and volume will remain the similar to that prior to construction.

4.2.5 Cultural Heritage

Built Heritage

As indicated in Section 3.17, the Trent Canal, Trent River, Ferris Provincial Park and Ranney Falls GS are considered to be CHLs.

Although construction of the proposed Ranney Falls G3 Project will not result in displacement of these CHLs, there is potential for temporary disruption to public access from the Ranney Falls GS property via the Ranney Gorge Suspension Bridge to Ferris Provincial Park on the opposite side of the Trent River (see Figures 2.3 and 2.5). A public parking area is available on the east side of the Ranney Falls GS property with a trail available to the suspension bridge. To minimize and/or manage the potential conflict between public and construction traffic access, an Access Management Plan will be developed in consultation with Ontario Parks and Friends of Ferris Provincial Park, which would include the use of appropriate public access signage and barriers. Moreover, construction will not occur on Sundays and public holidays, likely the time of peak public access activities.

In addition, there is potential for disruption of local viewsheds from vessels using the section of the Trent Canal adjacent to the proposed Ranney Falls G3 Project forebay expansion, as well as for the public accessing the Ranney Gorge Suspension Bridge and Ferris Provincial Park. As indicated above, construction will not occur on Sundays and public holidays, likely the time of peak public boating use on the Trent Canal and recreational use of Ferris Provincial Park.

The potential access and visual disruption effects on these CHLs will be temporary, i.e., occurring during the construction phase of the proposed Project, and will be dissipated with the implementation of the Site Rehabilitation Plan.

There will be no displacement of the existing Ranney Falls GS powerhouse buildings. The proposed Ranney Falls G3 Project powerhouse building will adjoin the existing main powerhouse building and have a similar structure and façade, thereby providing overall architectural coherence. As indicated in Section 3.17, the secondary “Pup” powerhouse building and tailrace will be preserved. As a result, the status and significance of the Ranney Falls GS as a CHL will be perpetuated.

The operation of the proposed Ranney Falls G3 Project will not affect the status and significance of the Trent Canal, Trent River, Ferris Provincial Park and Ranney Falls GS as CHLs.

Archaeological Resources

As indicated in Section 3.17, the archaeological potential of the proposed Ranney Falls G3 Project site was considered to be very low. However, should previously undocumented archaeological resources be discovered during construction, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The contractor or person discovering the archaeological resources must cease alteration of the site, and immediately engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the Act.

Under the *Cemeteries Act* and *Funeral, Burial and Cremation Services Act*, any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ontario Ministry of Consumer Services.

4.2.6 Socio-economics

The greatest potential for negative land/water use and socio-economic effects is during the construction phase of a project. In general, the magnitude and significance of the effects that will be experienced by a community will be directly related to the following:

- the number of residents disturbed by the construction activities;
- number of community facilities or resource areas disturbed by the construction activities;
- the need for additional infrastructure;
- the ability of the community to supply the project with required goods and services;
- the size of the construction work force requiring local accommodation, supplies and services;
- the length of time members of the work force are resident in the community; and
- the time of year.

The smaller the community the more susceptible it will be to possible effects, particularly if there is a significant number of in-migrant workers. The retail service infrastructure may be overtaxed by the demands of the project and may inconvenience local residents who can no longer obtain their customary goods and services at local outlets in a normal manner.

The time of year when a construction work force is in a community may also have a bearing on the degree of potential negative effect. This is particularly true of communities that depend on tourism. Communities and tourist operators that suddenly find their facilities and services occupied by construction workers may find that they are unable to accommodate tourists and vacationers in their usual manner. This can potentially lead to market loss in the construction year and possibly over a longer term if tourists do not return to the area because of a “bad experience”.

On the positive side, the project construction phase can also result in substantial benefits to local communities. Direct economic benefits can be realized if local residents are employed on the project. Other economic benefits will result through project purchases and expenditures in the local area. These expenditures will be a boon to local businesses and will, in turn, generate indirect and induced economic benefits.

It is important to maximize the benefits of the proposed Ranney Falls G3 Project while reducing any negative aspects. Generic mitigation measures related to potential socio-economic issues will include the following:

- identify a contact person should the public have questions or concerns;
- promptly respond to concerns raised by local officials or the public;
- encourage the contractors to buy materials and services for the proposed Project in the local area; and
- ensure proper construction and mitigation procedures are followed to minimize nuisance impacts associated with dust, noise (including blasting), aesthetic disturbance and traffic (see Section 4.2.2).

It is anticipated that there will be little, if any, in-migration of workers to the local area due to the presence of a regional workforce and the relative short-term nature of the proposed Project. The construction work force will be 60 to 80 workers based on projects of similar size and scope.

The distribution of construction employment will be influenced by labour agreements, hiring practices and available skill sets. These include the provisions and requirements of the Electrical Power Systems Construction Association (EPSCA), the Ontario Allied Construction Trades Council (OACTC), and other trades not within the EPSCA and OACTC.

Supervisory staff may move to the local area for short periods of time, and it is expected that they would find temporary accommodation in the area.

It is expected that Campbellford and the nearby Cities of Peterborough, Quinte West (Trenton) and Belleville will provide the majority of the required accommodation for the few in-migrant workers and supervisory staff.

The majority, if not all, of the proposed Project construction worker needs (e.g., fuel, food, sundries) can be accommodated by Campbellford and the nearby communities. These communities should benefit positively from construction-related expenditures.

Additional economic benefits to businesses in the region as a result of construction activities may include common construction material purchases such as concrete from a ready-made plant in the area. Moreover, local contractors may be asked to bid on some or all of the site preparation and restoration work.

OPG estimates that the contribution of the proposed Project construction phase to the local economy will be over $10 million.

During proposed Project operation, there will be no effects on the local economy. No additional jobs will be created.

It should also be recognized that the Municipality of Trent Hills has also provided a Council Support Resolution in support of the Project dated September 27, 2012. This Resolution appears in Appendix A of the Socio-Economics and Land Use TSD.

5.0 CUMULATIVE ENVIRONMENTAL EFFECTS

The DIA requires a consideration of any cumulative environmental effects that are likely to result from the proposed Project in combination with other projects or activities that have been or will be carried out. Cumulative effects can be characterized as impacts on the natural and social environment which:

1. occur frequently in time or so densely in space that they cannot be "assimilated", or
2. combine with effects of other activities in a synergistic manner (Sonntag *et al*., 1987; CEARC, 1988).

Hegmann *et al*. (1994) provides a reference guide for addressing cumulative effects.

Hegmann and Yarranton (1995) have stated that cumulative effects assessment (CEA) is an environmental and socio-economic assessment "done properly," since it extends the consideration of impacts in a given geographic area beyond those resulting from a proposed project alone so that an accounting and consideration is given to all projects that have or will, so far as is known, affect the local physical, biological and cultural environments. In the present instance, the two main concerns are:

- incremental impacts resulting from the effects of several development projects all having individually minor consumptive impacts on a particular valued environmental feature that, in aggregate, significantly diminish the well-being or status of that feature; and
- synergistic effects resulting from the interaction of impacts from two or more projects that have a multiplier effect upon each other, thereby magnifying the effects well beyond the consequences foreseen from an assessment of the separate project impacts considered in isolation.

The following Valued Ecosystem Components (VECs) were considered in the CEA:

- water quality;
- fish SAR;
- turtle SAR;
- CHLs;
- Trent Canal navigation; and
- socio-economics.

The proposed Ranney Falls Project will have beneficial and negligible negative effects on two and four of the VECs, respectively, as summarized below:

- as indicated in Section 4.1.5, construction and operation effects on water quality of the Trent Canal and Trent River are expected to be localized, temporary and negligible;

- as indicated in Section 4.1.4.8, DFO has concluded that the proposed Project will not likely result in impacts to fish and fish habitat (including fish SAR);
- as indicated in Section 4.1.3, the "Turtle Nesting Habitat Mitigation Plan" developed in consultation with Environment Canada, CWS, and Parks Canada – TSW will result in increased nesting habitat and access enhancement for turtle SAR;
- as indicated in Section 4.2.5, the potential access and visual disruption on CHLs will be temporary, i.e., during the construction period, and will be dissipated with the implementation of the Site Rehabilitation Plan with no effect on the status and significance of the CHLs during proposed Project operation;
- as indicated in Section 4.2.4, the proposed Project will have negligible impacts on vessel utilization of the Trent Canal during the navigation season; and
- as indicated in Section 4.2.6, the contribution of the proposed Project construction phase to the local economy is estimated to be over $10 million.

As the proposed Ranney Falls G3 Project is not "green-field" but rather an expansion of the existing Ranney Falls GS, the CEA will focus on the community of Campbellford, with a temporal boundary extending 10 years into the past and future. As indicated in Section 2.3.1, construction is anticipated to last up to 30 months with the earliest possible in-service date in 2017.

The following past, current and likely future projects have been in identified in Campbellford:

- catch basin and storm sewer installation by Parks Canada – TSW on lands under its administration adjacent to Trent Drive in order to address seasonal flooding of Parks Canada land and Trent Drive (E. Nolan, Parks Canada – TSW, 2015, pers. comm.);
- a new two-lane bridge crossing of the Trent Canal proposed by Northumberland County approximately 1,250 m upstream of Ranney Falls GS (IBI Group, 2014);
- 24-unit residential development under construction approximately 1.5 km east of Ranney Falls GS (IBI Group, 2014);
- 154-unit draft approved residential area approximately 1 km northeast of Ranney Falls GS (IBI Group, 2014);
- 19-unit residential development approximately 1.8 km north of Ranney Falls GS (IBI Group, 2j014);
- 10-unit townhouse development approximately 2.6 km north of Ranney Falls GS (IBI Group, 2014);
- ongoing development in Campbellford Business Park located approximately 300 m southwest of Ranney Falls GS; and
- Trent Hills Recreation and Wellness Centre development approximately 2.5 km northeast of the Ranney Falls GS (at the EA stage).

Other projects within Trent Hills include:

- closure of the Hastings Swing Bridge over the Trent Canal for a period of 16 weeks in 2015 to facilitate its replacement; and
- Field House development near the existing soccer fields in Hastings (at the funding request stage).

Most of the past, current and future projects have a small footprint, with their potential environmental effects sufficiently distant and localized as to have negligible cumulative (incremental and/or synergistic) effects on the selected VECs in concert with each other and the proposed Ranney Falls G3 Project. The various developments may have minimal negative socio-economic cumulative effects due to construction traffic, but overall positive societal (housing, recreation) and economic effects.

The earliest construction timing for the new two-lane bridge crossing of the Trent Canal is anticipated to be 2022-24 (IBI Group, 2014), a number of years after the proposed Ranney Falls G3 Project in-service date, thereby avoiding potential synergistic effects. Moreover, it was concluded that with the implementation of mitigation measures and habitat enhancement, potential adverse effects of the proposed bridge crossing will be greatly reduced on the aquatic environment.

Based on the CEA, the potential for, and significance of, cumulative effects due to the proposed Ranney Falls G3 Project are considered to be minimal and no broad-scale or proposed Project-specific mitigation measures are recommended.

6.0 RESIDUAL IMPACTS

The proposed Ranney Falls G3 Project is being undertaken by OPG to improve the efficient use of the available hydroelectric potential at the site, to reduce greenhouse gas emissions and to increase the amount of clean renewable energy from OPG's CHPG. PFTSW (2008) concluded that the development of renewable energy resources is a sound public policy goal and supported a vigorous effort to pursue green energy generating potential along the TSW. Moreover, the proposed Project is consistent with the PPS (OMMAH, 2014), which recommends that the use of existing infrastructure and public service facilities should be optimized, whenever feasible, before consideration is given to developing new infrastructure and public service facilities. In early 2012, a public meeting was held by Northumberland-Quinte West MPP Rob Milligan to promote new waterpower development within the provincial riding.

Terrestrial Environment

During construction of the proposed Ranney Falls G3 Project, potential impacts on the terrestrial environment may occur due to soil erosion and fugitive dust, incidental spills, noise, human activity, vegetation clearing and wildlife habitat loss. As indicated in Section 4.1.3, turtle nesting habitat creation and enhancement plans have been developed in consultation with Parks Canada – TSW and Environment Canada, CWS (see Appendix A of the Terrestrial TSD), which will be part of the Site Rehabilitation Plan. Based on an assessment of the available baseline information and potential effects, as well as the implementation of the recommended mitigation measures, it is concluded that effects during construction will be minimal, localized and short-term.

Based on assessment of the baseline information and potential effects, it is concluded that the operation of the proposed Project will have negligible effects on the terrestrial environment.

Table 6.1 summarizes potential construction and operation effects on the terrestrial environment, the recommended mitigation/remedial measures to minimize or obviate these effects and the net residual effects.

Aquatic Environment

During construction of the proposed Ranney Falls G3 Project, potential impacts on the aquatic environment may occur due to cofferdam installation/removal, dewatering, blasting, soil erosion and turbidity generation, and accidental spills. However, based on an assessment of the available baseline information and potential effects, as well as the implementation of the recommended mitigation measures, it is concluded that effects during construction will be minimal, localized and short-term.

Table 6.1 Summary of Potential Effects on the Terrestrial Environment and Recommended Mitigation/Remedial Measures

Effect	Recommended Mitigation/Remedial Measure	Net Residual Effect
Construction		
Fugitive dust and air quality	• Use of water trucks and/or sprinklers (Cheminfo, 2005). • Proper equipment maintenance (Cheminfo, 2005).	Negligible effect
Blasting	• Adherence to blasting engineer recommendations and DFO Guidelines (Wright and Hopky, 1998).	Negligible effect
Noise/vibration	• Proper maintenance and operation of equipment, with use of noise baffling, as appropriate.	Negligible effect
Soil erosion	• Adherence to site-specific Erosion and Sediment Control Plan.	Negligible effect
Incidental spills of oil, gasoline and other liquids during construction	• Adherence to Spills Emergency Preparedness and Response Plan.	Negligible effect
Hazardous Materials/ Waste	• Adherence to Hazardous Materials Management Plan and Waste Management Plan. • Waste disposal in accordance with regulatory requirements.	Negligible effect
Vegetation clearing and cliff community loss	• Implementation of the Site Rehabilitation Plan. • Rapid re-colonization of new tailrace wall with similar vegetation communities anticipated.	Net benefit
Proximate significant woodlands	• Installation of silt fencing to ensure no inadvertent intrusion during construction.	Negligible effect
Displacement of nesting birds	• Vegetation clearing to be undertaken outside the migratory bird breeding season (01 May to 31 July); otherwise conduct of a breeding bird survey to identify any nests for protection until the young have fledged.	Negligible effect
Loss of turtle nesting habitat and potential snake hibernacula	• Development of nesting habitat creation and enhancement plans in consultation with Parks Canada – TSW and Environment Canada, CWS (see Appendix A of the Terrestrial TSD), as part of the Site Rehabilitation Plan.	Net benefit
Operation		
Noise	• Noise levels to be similar to those of existing facilities.	Negligible effect
Incidental spills of oil, gasoline and other liquids during operation	• Adherence to Spills Emergency Preparedness and Response Plan.	Negligible effect

During operation of the proposed Ranney Falls G3 Project, potential impacts on the aquatic environment may occur due to accidental spills, flow alteration in the Trent Canal and potential fish impingement and mortality. However, based on assessment of the baseline information and potential effects, as well as the implementation of the recommended mitigation measures, it is concluded that the operation of the proposed Project will have negligible effects on the aquatic environment and water use.

Table 6.2 summarizes potential construction and operation effects on the aquatic environment, the recommended mitigation/remedial measures to minimize or obviate these effects and the net residual effects.

Table 6.2 Summary of Potential Effects on the Aquatic Environment and Recommended Mitigation/Remedial Measures

Effect/Activity	Recommended Mitigation/Remedial Measure	Net Residual Effect
Construction		
Noise	• Proper maintenance and operation of equipment, with use of noise baffling, as appropriate.	Negligible effect
Soil erosion	• Adherence to Erosion and Sediment Control Plan.	Negligible effect
Incidental spills of oil, gasoline and other liquids during construction	• Adherence to Spills Emergency Preparedness and Response Plan.	Negligible effect
Hazardous materials/ waste	• Adherence to Hazardous Materials Management Plan and Waste Management Plan. • Waste disposal in accordance with regulatory requirements.	Negligible effect
Blasting	• Adherence to blasting engineer recommendations and DFO guidelines (Wright and Hopky, 1998). • Scheduling blasting during the period of little flow between Dam #10 and the tailrace (mid-June to late October), if possible.	Negligible effect
Excess Groundwater Disposal	• Groundwater discharge to the Trent River and/or Trent Canal based on monitoring program results.	Negligible effect
In-water construction activities	• Use of clean rock fill for cofferdam. • Placement of rock fill over similar coarse substrate. • Judicious selection of discharge location and water pressure during dewatering. • Adherence to in-water construction timing restrictions (April 1 to June 30). • Transfer of fish stranded behind cofferdam prior to dewatering completion.	Negligible effect
Operation		
Noise	• Ambient noise levels to remain unchanged.	Negligible effect
Incidental spills of oil, gasoline and other liquids during operation	• Adherence to Spills Emergency Preparedness and Response Plan.	Negligible effect
Increased range of Trent Canal flows and flow velocities	• None: no significant effect on fish and benthic macroinvertebrate communities, and slightly higher traverse velocity may require slight steering counteraction.	Negligible effect
Decreased Dam #10 spillage	• None: no significant effect on fish and benthic macroinvertebrate communities anticipated.	Negligible effect
Cessation of “Pup” powerhouse tailrace flow	• None: no critical habitats in the “Pup” tailrace.	Negligible effect
Expanded tailrace	• Provision of sufficient depth (0.5 m) of similar substrate type will result in replication of ecological function of existing tailrace.	Negligible effect
Fish entrainment and mortality	• None: does not appear to be an issue along the lower TSW (see Section 4.1.4).	Negligible effect

Socio-economics and Land Use

During the proposed Ranney Falls G3 Project construction, potential effects on the socio-economics and land use may occur due to disturbance of area residents through nuisance impacts such as dust, noise (including blasting), traffic and aesthetic impairment. Based on an assessment of the available baseline information and potential effects, as well as the

implementation of the recommended mitigation measures, it is concluded that any negative effects due to construction activities will be minimal, localized and short-term. It is anticipated that substantial economic benefits will be realized by Campbellford and other local communities due to supply of required goods and services during the construction phase.

Based on assessment of the baseline information and potential effects, it is concluded that the operation of the proposed Ranney Falls G3 Project will have negligible effects on socio-economics and land use.

Table 6.3 summarizes potential construction and operation effects on socio-economics and land use, the recommended mitigation/remedial measures to minimize or obviate these effects and the net residual effects.

Table 6.3 Summary of Potential Effects on Socio-economics and Land Use and Recommended Mitigation/Remedial Measures

Effect	Recommended Mitigation/Remedial Measure	Net Residual Effect
Construction		
Community	• Identification of a contact person should the public have questions or concerns. • Prompt response to concerns raised by local officials or the public.	Negligible effect
Accommodation	• None: few in-migrant workers and supervisory staff requiring accommodation.	Negligible effect
Economy	• Encourage contractors to buy materials and services in the local area. • Contribution to the local economy estimated to be over $10 million.	Net benefit
Fugitive dust and air quality	• Use of water trucks and/or sprinklers (Cheminfo, 2005). • Proper equipment maintenance (Cheminfo, 2005).	Negligible effect
Blasting	• Adherence to blasting engineer recommendations and DFO Guidelines (Wright and Hopky, 1998). • Circulation of notice of blasting schedule in advance to the local community and postings at the adjacent locks and along the trails to Ranney Gorge Suspension Bridge.	Negligible effect
Noise/vibration	• Proper maintenance and operation of equipment, with use of noise baffling, as appropriate. • Adherence to Trent Hills (2005) Municipal Noise By-Law.	Negligible effect
Public Access	• Development of an Access Management Plan in consultation with MNRF and Friends of Ferris Provincial Park.	Negligible effect
Traffic	• Development of a Traffic Management Plan in consultation with Northumberland County and/or Trent Hills Public Works Departments.	Negligible effect

Effect	Recommended Mitigation/Remedial Measure	Net Residual Effect
Operation		
Noise	• Ambient noise levels to remain unchanged.	Negligible effect
Flooding	• In the event of an emergency shutdown of the units, operation of the new spillway will preclude the operation of TSW Dam #10. Spillway discharge capacity for flood control at Dam 10 (Ranney Falls) is the sole responsibility of the Trent-Severn Waterway (Parks Canada). Installation and operation of a new spillway to be built between the existing and new powerhouse to bypass powerhouse flows in the event of an emergency shutdown of the unit is the responsibility of OPG.	Net benefit

Cultural Heritage Resources

Potential access and visual disruption effects due to the proposed Ranney Falls G3 Project on the Trent Canal, Trent River, Ferris Provincial Park and Ranney Falls GS CHLs will be localized and temporary, occurring during the construction phase.

Operation of the proposed Project will not affect the status and significance of the Trent Canal, Trent River, Ferris Provincial Park and Ranney Falls GS as CHLs.

As the archaeological potential of the proposed Project site was considered to be very low, no effects on archaeological resources are anticipated.

Environmental Management Plan

Environmental protection during proposed Project construction and operation will be ensured by adherence to the Environmental Management Plan, as well as compliance with regulatory standards and guidelines.

The Environmental Management Plan, with oversight by the Environmental Monitor, will ensure that environmental protection will be achieved by addressing government agency requirements, OPG policy, proposed Project commitments and recommended mitigation measures to be undertaken. The Environmental Management Plan will include the Erosion and Sediment Control Plan, Spills Emergency Preparedness and Response Plan, Hazardous Materials Management Plan, Waste Management Plan, Site Rehabilitation Plan, Access Management Plan and Traffic Management Plan.

The Environmental Management Plan will be submitted to Parks Canada – TSW for review and approval prior to commencement of proposed Project construction.

7.0 SITE INSPECTION REQUIREMENTS

Environmental protection during proposed Project construction and operation will be ensured by adherence to the Environmental Management Plan, as well as compliance with regulatory standards and guidelines, and permit terms and conditions.

The Environmental Management Plan, with oversight by the Environmental Monitor, will ensure that environmental protection will be achieved by addressing government agency requirements, OPG policy, proposed Project commitments and recommended mitigation measures to be undertaken. The Environmental Management Plan will include the Erosion and Sediment Control Plan, Spills Emergency Preparedness and Response Plan, Hazardous Materials Management Plan, Waste Management Plan, Site Rehabilitation Plan, Access Management Plan, Traffic Management Plan and Turtle Nesting Habitat Mitigation Plan. The Environmental Management Plan will be submitted to Parks Canada – TSW for review and approval prior to any work commencing on the proposed Project. Should the scope of work or work plan change following commencement of work, a revised Environmental Management Plan describing the mitigation measures to address the proposed changes will be provided to Parks Canada – TSW for review and approval.

Parks Canada – TSW personnel will also visit the proposed Project site to confirm implementation of environmental protection measures during construction. A copy of the final DIA will be kept on site at all times.

8.0 MONITORING REQUIREMENTS

During construction there will be an Environmental Compliance Monitoring Program in effect to ensure all construction related commitments are met.

OPG will retain a Contractor for the proposed Project who will have overall responsibility for the proposed Project and environmental management of construction activities. The Contractor will be required to ensure that all construction related activities meet all DIA commitments, regulatory requirements, permit terms and conditions, and other related environmental guidance. In order to do that the Contractor will prepare an Environmental Management Plan that will outline how this is to be done, as well as identify all monitoring activities to be undertaken during construction.

This work will require the Contractor to monitor the environmental effects of the construction of the proposed Project including among other things adherence to the following:

- Environmental Management Plan in general;
- Erosion and Sediment Control Plan;
- Spills Emergency Preparedness and Response Plan;
- Hazardous Materials Management Plan;
- Waste Management Plan;
- environmental water use;
- noise control;
- “Turtle Nesting Habitat Mitigation Plan”;
- use of explosives;
- requirements outlined in permits such as PTTWs and Environmental Compliance Approvals;
- DFO guidelines and blasting engineer recommendations;
- in-water construction timing restrictions;
- cultural heritage monitoring; and
- commitments made in this DIA Report and associated TSDs.

OPG typically will have an oversight program in place to track and assess Contractor compliance with such measures. As well, government regulators will require information as per the specific permits. OPG will also ensure it has a monitoring program in place to ensure that all mitigation and compensation measures are being implemented whether they pertain to the Contractor or OPG.

OPG will also require the Contractor to have an on-site health and safety coordinator who will review and monitor health and safety issues which arise during the course of construction.

During the construction period, two cultural heritage monitoring recommendations have been made:

- Should previously undocumented archaeological resources be discovered, they may be considered a new archaeological site and therefore subject to section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with section 48(1) of the *Ontario Heritage Act*; and
- The *Cemeteries Act* requires that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries, Ministry of Small Business and Consumer Services.

A monitoring program will be developed and implemented to confirm that excess groundwater within the excavated tailrace is suitable for direct discharge to the Trent River and/or Trent Canal based on MOECC water management policies (MOEE, 1994).

A monitoring program will also be developed and implemented to assess the success of the "Turtle Nesting Habitat Mitigation Plan". As indicated, the turtle nesting habitat has already proven to be successful in that turtles laid eggs at the site in 2015. As the mitigation plan has been successful OPG does not see the need for an elaborate program, however OPG will monitor the site during and immediately after construction to assess whether turtles are utilizing the site. Following construction OPG wants to ensure the habitat is successful and therefore will undertake monitoring in the first year following construction to assess success. Should nesting not occur in the first year a biologist will be brought in to assess possible reasons for the lack of success and make recommendations for improvement. Once nesting is proven no further follow-up monitoring is recommended.

OPG is receptive to a cooperative monitoring program with Parks Canada – TSW.

9.0 PERMITS, LICENCES AND APPROVALS POSSIBLY REQUIRED FOR THE PROPOSED RANNEY FALLS G3 PROJECT

Described in the Table 9.1 below is a list of permits, licences and approvals possible required for the proposed Ranney Falls G3 Project.

Table 9.1 List of Permits, Licences and Approvals Possibly Required for the Proposed Ranney Falls G3 Project

(December 2015 update)

Agency	Statute	Likely Permits, Licences or Approvals	Applicability	Permit, Licence or Approval status at proposed Project
FEDERAL LEGISLATION				
Environment Canada	*Migratory Birds Convention Act*	Migratory Bird Damage Permit	Required to kill migratory birds that are causing or are likely to cause serious damage to property. Only issued when scaring migratory birds is not a sufficient deterrent to prevent such damage (*Migratory Birds Regulations*, s 25(1)).	No permit should be required because the proposed Project will undertake site preparation outside the migratory bird nesting season (which is May 1 – July 31 in Southern Ontario). However, if tree clearing becomes required during migratory bird nesting season, permits will be obtained.
Fisheries and Oceans Canada	*Fisheries Act*	Section 35 authorization	Required to carry on any work that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery (Fisheries Act, s 35).	No authorization should be required because Fisheries and Oceans Canada has determined that only a letter of advice is required. Letter of advice has already been obtained.
Natural Resources Canada	*Explosives Act*	Explosives licence	Required to acquire and store industrial explosives (*Explosives Act*, s 6(c); *Explosives Regulations*, *2013*, Part 6, Part 11).	Currently unknown whether an explosives licence is required but will be obtained by the Constructor if the Constructor decides to store or use explosives on-site.

Agency	Statute	Likely Permits, Licences or Approvals	Applicability	Permit, Licence or Approval status at proposed Project
FEDERAL LEGISLATION				
Parks Canada	*Dominion Water Power Act*	Licence to divert, use, or store water	Interim licence required to begin construction (*Dominion Water Power Regulations*, s 8).	An interim licence will be required to begin construction.
Parks Canada	*Dominion Water Power Act*	Licence to divert, use, or store water	Final licence required to authorize the diversion, use, or storage of the water (*Dominion Water Power Regulations*, s 25).	A final licence will be required to authorize the use of the water.
Parks Canada	*Canada National Parks Act*	Building Permit	Required to commence the erection of a building. Not required unless the building is on Parks Canada land. The canal bed is Parks Canada land (*National Parks Building Regulations*, s 5).	No. Building permit required because the proposed Project will be built on lands that OPG owns which are not Parks Canada land. A building permit is not required for the intake, PH or tailrace
Transport Canada	*Navigation Protection Act*	Approval from Minister	Notice to Minister is required if a work proposed is in or on navigable water. If the work will substantially interfere with navigation, approval is required (*Navigation Protection Act*, ss 5-6).	NPA approvals are not expected to be required because the proposed Project will not interfere with navigation during construction or operations. The proposed Project is working with Transport Canada to provide the information required in the notice to the Minister. TC is reviewing to determine whether the proposed work interferes with navigation and whether an approval is required.
Transport Canada	*Department of Transport Act*	Permit	Required to transport dangerous goods in a historic canal. The *Historic Canals Regulations* designate the Trent-Severn Waterway as a historic canal (*Historic Canals Regulations*, s 13(1), Schedule I).	Permit only required if the Constructor is required to transport dangerous goods in a historic canal such as the Trent-Severn Waterway.

Agency	Statute	Likely Permits, Licences or Approvals	Applicability
PROVINCIAL APPROVALS			
MOE	*EPA*	Environmental Compliance Approvals/ Environmental Activity Sector Registry for emissions or discharge of any contaminants into any part of the natural environment other than water (Part II, Section 8 and Regulations).	Operation of GS: Approval for backup generators for operational and emergency use. Approval for the use of an Oil Water separation system
MOE	*EPA*	Ontario Regulation 347, General Waste Regulation. Transport documentation including Waste Management System	Construction of GS: The Constructor will ensure that a Waste Generator Registration is obtained for hazardous waste generated and ensuring all requirements of Reg. 347 are met during construction. Operation of GS: OPG would complete its own registration for waste disposal during operations if needed
PROVINCIAL APPROVALS			
MOE	*OWRA*	PTTW	Construction of GS: For dewatering activities during construction, such as cofferdams or any other activity requiring the taking of more than a total of 50,000 L/day from a lake, stream, river or groundwater source, with some exceptions.
MOE	*OWRA*	PTTW	Operation of GS: For the taking of water for operating the GS

Agency	Statute	Likely Permits, Licences or Approvals	Applicability
Municipal			
Trent Hills, Public Works	*Municipal Act*	Road permit and Access Management Plan	Permits Project construction activities to use municipal roads for heavy load transportation. The plan will be developed by the Contractor with input from Trent Hills Public Works Department
Northumberland County and Trent Hills Public Works	Municipal Act	*Traffic Management Plan*	OPG and the Constructor will work with Trent Hills Public Works Department to develop a Traffic Management Plan if needed
Trent Hills, Building Department	Building Code	*Sewage/Septic Permit*	OPG and the Constructor will work with the Building Department to secure approvals for a Holding Tank

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11.0 ACRONYMS/ABBREVIATIONS

Acronyms

&	And
~	Approximately
$	Dollar
#	Number
+	Plus
AANDC	Aboriginal Affairs and Northern Development Canada
ANSI	Area of Natural and Scientific Interest
asl	Above sea level
BHR	Built heritage resource
c.	Chapter
CAT	Compact Axial Turbine
CEA	Cumulative Effects Assessment
CEA Agency	Canadian Environmental Assessment Agency
CEAA	*Canadian Environmental Assessment Act*
CEAA 2012	*Canadian Environmental Assessment Act, 2012*
CFD	Computational Fluid Dynamics
Cheminfo	Cheminfo Services Inc.
CHL	Cultural heritage landscape
COs	Central Operations
CLI	Canada Land Inventory
CO	Carbon monoxide
COE	Corps of Engineers
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species at Risk in Ontario
CR	County Road
CRM	*Cultural Resources Management*
CSA	Canadian Standards Association
CWS	Canadian Wildlife Service
DFO	Department of Fisheries and Oceans
DIA	Detailed Environmental Impact Analysis
EA	Environmental Assessment
EA Act	*Environmental Assessment Act*
Ed.	Editor
e.g.	For example (exempli gratia)
EIA	Environmental Impact Analysis
ELC	Ecological Land Classification
EMS	Emergency medical services
EPA	*Environmental Protection Act*

EPSCA	Electrical Power Systems Construction Association
ESA	*Endangered Species Act*
ESA	Environmentally Sensitive Area
et al.	And others (et alia)
etc.	And so on (et cetera)
GS	Generating Station
H	Horizontal
HADD	Habitat alteration, disruption or destruction
HEC	Hydrologic Engineering Centre
Hydro One	Hydro One Networks Inc.
i.e.	That is (id est)
Inc.	Incorporated
JRP	Joint Review Panel
KPRDSB	Kawartha Pine Ridge District School Board
KST	KST Hydroelectric Engineers
LOA	Letter of Advice
LOPG	Lake Ontario Plant Group
LTC	Lower Trent Conservation
Ltd.	Limited
MBCA	*Migratory Birds Convention Act*
MNO	Métis Nation of Ontario
MNR	Ontario Ministry of Natural Resources
MNRF	Ontario Ministry of Natural Resources and Forestry
MOE	Ontario Ministry of the Environment
MOECC	Ontario Ministry of the Environment and Climate Change
MOEE	Ontario Ministry of Energy and Environment
MOU	Memorandum of Understanding
MPP	Member of Provincial Parliament
M.Sc.	Master of Science
MTC	Ontario Ministry of Tourism and Culture
MTCS	Ontario Ministry of Tourism, Culture and Sport
N	North
NHIC	Natural Heritage Information Centre
NO_x	Nitrogen oxides
NPA	*Navigation Protection Act*
OACTC	Ontario Allied Construction Trades Council
O_3	Ozone
OMMAH	Ontario Ministry of Municipal Affairs and Housing
OMPiR	Ontario Ministry of Public Infrastructure Renewal
OPG	Ontario Power Generation Inc.
OPP	Ontario Provincial Police
OWA	Ontario Waterpower Association

OWRA	*Ontario Water Resources Act*
Parks Canada – TSW	Parks Canada – Ontario Waterways, Trent-Severn Waterway
pers. comm.	Personal communication
PFTSW	The Panel on the Future of the Trent-Severn Waterway
PM	Particulate matter
PPS	Provincial Policy Statement
Project	Ranney Falls Generating Station G3 Expansion Project or Ranney Falls G3 Project
PSW	Provincially Significant Wetland
PTTW	Permit-To-Take-Water
PVNCCDSB	Peterborough Victoria Northumberland & Clarington Catholic District School Board
PWQO	Provincial Water Quality Objective
S1	Critically imperilled – due to extreme rarity (often five or fewer occurrences) or because of some factor(s) such as very steep declines making the species especially vulnerable to extirpation from the Province
S1?	Critically imperilled – due to extreme rarity (often five or fewer occurrences) or because of some factor(s) such as very steep declines making the species especially vulnerable to extirpation from the Province, with the ? indicating that the rank is uncertain
S2	Imperilled – due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making the species very vulnerable to extirpation from the Province
S2S3	Imperilled to vulnerable
S3	Vulnerable – due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making the species vulnerable to extirpation in the Province to apparently secure
S3?	Vulnerable – due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making the species vulnerable to extirpation in the Province, with the ? indicating that the rank is uncertain
S4	Apparently secure – uncommon but not rare with some cause for long-term concern due to declines or other factors
S4?	Apparently secure – uncommon but not rare with some cause for long-term concern due to declines or other factors, with the ? indicating that the rank is uncertain
S4S5	Apparently secure to secure
S5?	Secure – common, widespread and abundant in the Province, with the ? indicating that the rank is uncertain
S5	Secure – common, widespread and abundant in the Province
SAR	Species at risk

SARA	*Species at Risk Act*
SARO List	Species at Risk in Ontario List
S.C.	Statutes of Canada
SENES	SENES Consultants Limited
SHARP	Small Hydroelectric Assessment and Retrofit Program
SNA	Not applicable – a conservation status rank not applicable because the species is not a suitable target for conservation activities
SO_2	Sulphur dioxide
sp.	One species
spp.	Two or more species
ssp.	Subspecies
3D	Three-dimensional
TCCSPC	Trent Conservation Coalition Source Protection Committee
ToR	Terms of Reference
Trent Hills	Municipality of Trent Hills
TSD	Technical Support Document
TSW	Trent-Severn Waterway
UMA	Unterman McPhail Associates
UNEP	United Nations Environmental Program
U.S.	United States
V	Vertical
var.	Variety
VEC	Valued Ecosystem Component
VOCs	Volatile organic compounds
W	West
YOY	Young-of-year

Measurement Units

º	degree
‘	minute
“	second
°C	degree Celsius
cm	centimetre
GWh	gigawatt-hour
h	hour
ha	hectare
km	kilometre
km^2	square kilometre
kV	kilovolt
L	litre
L/s	litre per second
m	metre
m^2	square metre
µ	micron
mm	millimetre
m/s	metre per second
mm/s	millimetre per second
m^3	cubic metre
m^3/s	cubic metre per second
MW	megawatt
Pa	pascal (unit of pressure)
%	percent