DAVID BROWN SOLAR PARK
WATER ASSESSMENT AND WATER BODY REPORT

File No. 161011028
February 2013

Prepared for:

Saturn Power Inc.
100 Mill Street Unit F
New Hamburg, ON, N3A 2K6

Prepared by:

Stantec Consulting Ltd.
Suite 1 - 70 Southgate Drive
Guelph ON N1G 4P5

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1.0 Introduction

1.1 PROJECT OVERVIEW

Saturn Power Inc (Saturn) is proposing to develop the David Brown Solar Park (the Project) in the Township of South Stormont, United Counties of Stormont, Dundas and Glengarry, Ontario, in response to the Government of Ontario's initiative to promote renewable energy development in the province. The Project was awarded an Ontario Feed-In-Tariff (FIT) contract with the Ontario Power Authority (OPA) (FIT Contract FIT – F2J4W2H).

The subject property is generally bounded by i) Highway 401 to the North; ii) Canadian National Railway to the South ; iii) Dickinson Drive to the East; and iv) the extension of Farrans Point Rd to the West (**Appendix A**, **Figure 1**).

The Project consists of a proposed 10 Megawatt ("MW") Solar Photo Voltaic ("PV") Grid connected system. The basic components of the Project are up to 55,000 solar panels, a galvanized steel racking system, ten 1 MVA inverter / step-up transformer stations and a transformer substation with a 44kV step-up transformer that connects to the existing Hydro One Networks Inc. (HONI) system.

No equipment in the facility design relate to groundwater and surface water supplies, air discharges and/or water and biomass management.

Saturn has retained Stantec Consulting Ltd. (Stantec) to prepare a Renewable Energy Approval (REA) application, as required under Ontario Regulation 359/09 - Renewable Energy Approvals under Part V.0.1 of the Act of the *Environmental Protection Act* (O. Reg. 359/09). This Water Assessment and Water Body Report is one component of the REA application for the Project, and has been prepared in accordance with O. Reg. 359/09, the Ontario Ministry of Natural Resources' (MNR's) *Approval and Permitting Requirements Document for Renewable Energy Projects* (September 2009).

1.2 REPORT REQUIREMENTS

A Water Assessment is a required component of a REA application, and includes a records review and site investigation to determine the presence and boundaries of water bodies as defined in O.Reg.359/09 within 120 m of the Project Location (assuming that no Lake Trout lakes that are at or above development capacity are identified within 300 m). If water bodies are identified within 120 m of the Project Location, a Water Body Report must be prepared.

The "Project Location" refers to any land, structure or air space in, on or over which part of a renewable energy project is proposed. For the purposes of this Project, the Project Location includes solar panels, access road and distribution line. The "Zone of Investigation" encompasses the Project Location and an additional 120 m surrounding the Project Location.

This Water Assessment and Water Body Report is intended to satisfy the requirements outlined within O. Reg. 359/09 (s. 39 and 40) and is to be submitted as a component of the REA application. **Table 1** summarizes the documentation requirements of the Water Assessment Report as specified under O. Reg. 359/09.

Table 1: Water Assessment Report Requirements: O.Reg. 359/09

Requirements	Completed	Section Reference
A person who proposes to engage in a renewable energy project shall conduct a water assessment, consisting of the following:		
A records review conducted in accordance with section 30.	✓	2.2, 3
A site investigation conducted in accordance with section 31, including:		2.3
31(4)(1). A summary of any corrections to the report.	N/A	
31(4)(2). Information relating to each water body.	✓	3
31(4)(3). A map showing boundaries, location/type and distances.	✓	Appendix A
31(4)(4). A summary of methods used to make observations for the purposes of the site investigation.	✓	2.3
31(4)(5). The name and qualifications of any person conducting the site investigation.	✓	2.4
31(4)(6)(i). The dates and times of the beginning and completion of the site investigation.	N/A	
If an investigation was conducted by visiting the site:		
31(4)(6)(ii). The duration of the site investigation.	N/A	
31(4)(6)(iii).The weather conditions during the site investigation	N/A	
31(4)(6)(iv). Field notes kept by the person conducting the site investigation.	N/A	
If an alternative investigation of the site was conducted:		
31(4)(7)(i). The dates of the generation of the data used in the site investigation.	✓	2.3
31(4)(7)(ii). An explanation of why the person who conducted the alternative investigation determined that it was not reasonable to conduct the site investigation by visiting the site.	✓	2.3

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2.0 Methods

2.1 DEFINITION OF A WATERBODY

The presence or absence of water bodies within the Project's 120 m Zone of Investigation was assessed using the definition of a water body provided in O. Reg. 359/09, which is as follows:

"…a lake, a permanent stream, an intermittent stream and a seepage area but does not include, a) grassed waterways, b) temporary channels for surface drainage, such as furrows or shallow channels that can be tilled and driven through, c) rock chutes or spillways, d) roadside ditches that do not contain a permanent or intermittent stream, e) temporarily ponded areas that are normally farmed, f) dugout ponds, or g) artificial bodies of water intended for the storage, treatment or recirculation of runoff from farm animal yards, manure storage facilities and sites and outdoor confinement areas".

2.2 RECORDS REVIEW

A water records review was conducted according to Section 30(1) of O. Reg. 359/09.

The Project Location occurs within the jurisdiction of the Raisin Region Conservation Authority.

Data was collected from the Ontario Ministry of Natural Resources (Land Information Ontario mapping database (LIO 2012) and Natural Heritage Information Centre online database), Fisheries and Oceans Canada's Species at Risk mapping and the Raisin Region Conservation Authority (RRCA).

The presence/absence of potential waterbodies were also identified through a review of aerial photographs of the Zone of Investigation.

Copies of all correspondence related to the Records Review will be provided in the Record of Consultation which will be submitted as part of the complete REA application to the MOE. Information obtained as a result of the information requests/records review are presented in Section 3 of this report.

2.3 SITE INVESTIGATIONS

Site investigations were carried out according to Section 31 of O.Reg. 359/09, using alternative site investigations. A physical site investigation was not conducted since the water body was recently realigned using a design created by Stantec Consulting Ltd. Therefore all information regarding channel location, depths, flows, etc. were available from the design documents. As described above, available data was collected from the MNR's Land Information Ontario (LIO) and Natural Heritage Information Centre (NHIC) databases. LIO and NHIC were referenced on September 5, 2012.

The purpose of the alternative site investigations was to:

- Identify the boundaries of any water body located within 120 m of the Project Location.

As a result of the data collection, an assessment was made with respect to the presence or absence of fish habitat. The following criteria were used for the designation of fish habitat:

- **Direct Fish Habitat – Permanent** – permanently flowing watercourse with available fish community data (background and/or Stantec surveys).
- **Direct Fish Habitat – Seasonal** – intermittent watercourse (as per drain classification or field observation) that is directly connected to a downstream watercourse that supports fish or where Stantec surveys captured fish.
- **Indirectly Contributes to Fish Habitat** – intermittent flow (as per field observations or other data) and although no fish were observed or captured, the channel contributes indirectly (e.g., allochthonous inputs, flow) to downstream reaches supporting fish.
- **Not Fish Habitat** – not directly connected to a downstream water feature that supports fish or where Stantec surveys captured fish.

2.4 QUALIFICATIONS

The following Stantec personnel were responsible for the identification of water bodies and for assessing potential impacts:

- Kelly Clayton, B.Sc. (Env)., ERGC – Aquatic Ecologist
- Mark Pomeroy, B.Sc. – Fisheries Biologist
- Nancy Harttrup, B.Sc. – Senior Fisheries Biologist

Curricula vitae are provided in Appendix D.

3.0 Existing Conditions

Based on aerial photography and a review of the document entitled “Inland Ontario Lakes Designated for Lake Trout Management” (MNR 2006), there are no Lake Trout lakes identified within 300 m of the Project Location. According to Ministry of Natural Resources’ (MNR’s) Land Information Ontario (LOI) mapping (MNR 2009), there are two water features within the 120 m Zone of Investigation (**Figure 1, Appendix A**). A “water feature” may include lakes, rivers, streams, etc. Additional data related to the water feature was collected during site investigations.

Both water features present within the Zone of Investigation (**Figure 2, Appendix A**) were designated a water body as defined by O. Reg. 359/09. The water bodies are unnamed tributaries to Hoople Creek. The unnamed water bodies are within the jurisdiction of the Raisin Region Conservation Authority.

No fish community data, thermal regime information or flow regime information was available from LIO regarding the water features within the Project Location.

Prior to the initiation of Renewable Energy Approval (REA) activities, the Unnamed Tributary of Hoople Creek in the subject property was realigned by the landowner in 2012 to improve drainage on the property and improve land access.

Information provided to Stantec by the RRCA during the channel design process indicated that both water bodies are a Type E Drain (permanent flow, warmwater thermal regime with top predators). The drains are intermittent in nature and are located in an area of relatively flat topography.

The following fish species are known to occur downstream in Type E drains to which the Hoople Creek tributaries are connected: Northern Pike, Smallmouth Bass, Yellow Perch, Rock Bass, Pumpkinseed, Log Perch, Central Mudminnow, Johnny Darter, Fantail Darter, Banded Killifish, Brown Bullhead and White Sucker. The new, realigned tributary of Hoople Creek flows from a seasonally-wetted area located within the subject property, and joins Hoople Creek approximately 1 km downstream of the Project Location. On average, the upper portion of the new channel is approximately 0.80 m to 1.10 m wide and 30 cm deep. Before the channel reaches Dickinson Drive, it widens out, creating a slower flowing area. The water body has a silty/muck substrate and grassy vegetation. The downstream portion of the channel will potentially provide Northern Pike spawning habitat in the spring.

It was determined through alternative site investigations and Stantec’s watercourse designs, that this feature is a water body as per O. Reg. 359/09 definition. Photos are provided in **Appendix B**. Although no physical site investigation was conducted for the water body assessment, photos were taken by other Stantec staff conducting REA activities under the direction of the individuals listed in Section 2.4.

The second Unnamed Tributary of Hoople Creek is outside of the Project Location and subject property, however is inside the Project's 120 m Zone of Investigation. Due to property access this tributary was assessed from the road allowance. It flows west to east, approximately 300 m south of the realigned channel. It flows under Dickinson Drive where it joins Hoople Creek approximately 1 km downstream of the Project Location. There will be no affect from the Project on this tributary.

The extent to which the both drains are used by fish is unknown. At minimum, the area does provide indirect habitat to downstream areas through the supply and conveyance of nutrients and invertebrates.

As indicated in Section 2.2, the presence or absence of water bodies within the Zone of Investigation was assessed using the definition of a water body provided in O. Reg. 359/09. Based on the results of site investigations and the records review, two water bodies occur within 120 m of the Project Location. Other than the new alignment of the Unnamed Tributary of Hoople Creek, there are no corrections to the water records within the Zone of Investigation.

4.0 Summary of Predicted Impacts to Fish Habitat

The federal *Fisheries Act* governs the protection of fish and aquatic habitat, including the harmful alteration, disruption or destruction (HADD) of fish habitat (Section 35) and the deposition of deleterious substances into fisheries waters (Section 36). DFO has signed agreements with 35 of the 36 Conservation Authorities in Ontario to review proposed projects under Section 35 of the *Fisheries Act*. The RRCA has a Level 2 agreement with DFO; therefore, they can determine how the proponent can mitigate any potential impacts to fish and fish habitat.

Based on the current Project layout and proposed environmental mitigation measures, in-water work would potentially impact areas that contribute indirectly to fish habitat, at two locations in the water body.

Based on the current Project layout, a road will be used for site access across an existing culvert. No changes to the culvert are required. In addition, the water body will be crossed by a wooden pole-mounted distribution line in the southeast corner of the Project Location. Impacts to fish habitat can be mitigated by implementing appropriate mitigation measures as discussed in Section 6. Assuming the mitigation measures are implemented and are effective, DFO Authorization should not be required.

The above conclusions assume that negative effects associated with road upgrades at the existing culvert and crossing of the distribution line can be mitigated. It is likely that a DFO Operational Statement (see **Appendix D**) can be applied for the pole-mounted distribution line crossing. When an Operational Statement is used, mitigation measures provided in the Operational Statement will protect fish habitat and no further review or approvals are required. Although specific Operational Statements are referenced in this report, consultation with the RRCA and/or DFO may result in site-specific construction methods and mitigation measures. In such cases, additional sites may require review by the Conservation Authority or DFO and details of construction methods, etc. should be submitted for agency review.

If impacts to fish and fish habitat can be fully mitigated, a Letter of Advice (LOA) will be issued by the RRCA indicating that the proposed activities will not likely cause a HADD if the proposed set of mitigation measures is followed. If the RRCA determines that impacts cannot be fully mitigated, the project is forwarded to the local DFO office for further review. If the DFO determines that HADD of fish habitat will occur, the proponent needs to submit a Letter of Intent (LOI) to Compensate for Fish Habitat Loss. The LOI must outline the details of the proposed work and required mitigation measures and the resulting net impact to fish habitat. It should also include a Fish Habitat Compensation Plan that identifies the proposed habitat enhancement works to compensate for the predicted impacts to fish habitat. DFO approval under the *Fisheries Act* allows the HADD to occur following the conditions of the Authorization.

5.0 Potential Impacts

5.1 FISHERIES HABITAT

5.1.1 General Construction-Related Impacts

The potential impacts of the Project to the watercourse located within 120 m of the Project Location could include:

- Short-term increase in turbidity from runoff and soil erosion during construction;
- Potential change in discharge resulting from improper grading; and
- Water quality and habitat disturbance effects to aquatic habitat.

5.1.2 Culverts, Access Roads and Staging/Laydown Area

Potential impacts related to the installation and maintenance of access roads and maintenance of culvert crossings in addition to the general impacts listed above may include:

- Changes to riparian vegetation during maintenance activities within road allowance and vicinity can reduce shoreline cover, shade and food production areas.

5.1.3 Solar Panel and Distribution Line Installation

Potential impacts to fish and fish habitat related to the installation the racking systems and solar panels, and underground or above ground collector lines are as follows:

- Erosion and sedimentation from site disturbance and dewatering (if required);
- Collapse of the punch or bore hold under the water body(if applicable);
- Disturbing riparian vegetation can reduce shoreline cover, shade and food production areas; and
- Spill/leaks into water bodies of deleterious substances such as fuel or lubricating oil.

5.1.4 Operational Impacts

Potential operational impacts will be limited to spills or leaks of deleterious substances such as fuel or lubricating fluid.

6.0 Proposed Mitigation Measures

Standard mitigation measures used for works in and around water are summarized below. Specific details of the mitigation measures to be implemented would be determined through consultations with the local municipality, the RRCA and DFO once details of construction methods are finalized. The extent of mitigation would be dependent on project details such as technical requirements, construction methods and schedule.

The mitigation measures provided below include specific construction activities that may be applicable. Since specific construction details are not known at the time of report preparation, the list is extensive such that all measures are included and the appropriate measures will be applied as needed. Specific timing of construction is not known at this time. Measures for the use of coffer dams (dam and pump) and fish removals are included in the event they will be required. If the drain is dry at the time of construction, these measures would not be applicable.

General Mitigation Measures

There are many standard mitigation measures available to protect fish and fish habitat from potential effects during the construction phase of a project. Standard mitigation measures proposed for Project construction activities near the water body in the Zone of Investigation include:

- All in-water work would be completed within MNR timing windows to protect local fish populations during their spawning and egg incubation periods. A typical construction timing window for warmwater streams is July 1 to March 15 (period during which in-water work is permitted).
- All materials and equipment used for the purpose of site preparation and Project construction shall be operated and stored in a manner that prevents any deleterious substance (e.g., petroleum products, silt, etc.) from entering the water:
    - Any stockpiled materials will be stored and stabilized away from the water;
    - Refuelling and maintenance of construction equipment will occur a minimum of 100 m from the water body;
    - As appropriate, spills will be reported to the MOE Spills Action Centre;
    - Any part of equipment entering the water should be free of fluid leaks and externally cleaned/degreased to prevent any deleterious substance from entering the water; and
    - Only clean material, free of fine particulate matter should be placed in the water.

- Sediment and erosion control measures will be implemented prior to construction and maintained during the construction phase to prevent entry of sediment into the water:
  - Silt fencing and/or barriers will be used along the periphery of the Project Location;
  - No equipment will be permitted to enter any natural areas beyond the silt fencing during construction;
  - All sediment and erosion control measures will be inspected at least weekly and during and immediately following rainfall events to ensure that they are functioning properly and are maintained and/or upgraded as required;
  - Topsoil stockpiles will be sufficiently distant from the water body to preclude sediment inputs due to erosion of stored soil materials;
  - If the sediment and erosion control measures are not functioning properly, no further work will occur until the sediment and/or erosion problem is addressed;
  - Alterations to site drainage will be designed such that there will be no substantial changes to watershed discharge;
  - All disturbed areas of the construction site will be stabilized immediately and re-vegetated as soon as conditions allow; and
  - Sediment and erosion control measures will be left in place until all areas of the construction site have been stabilized.

Mitigation Measures for Overhead Collector/Transmission Lines

The DFO has prepared an Operational Statement for overhead line construction (Ontario Operational Statement Habitat Management Program: Overhead Line Construction – see **Appendix D**). This Operational Statement provides measures to protect fish and fish habitat when undertaking this type of construction activity.

Although construction of overhead lines (as required) would not require any in-water works, as discussed in the Operational Statement, it is the riparian habitat that is most sensitive to disturbance from overhead line construction. Riparian vegetation occurs adjacent to the watercourse and directly contributes to fish habitat by providing shade, cover and spawning and food production areas.

According to the DFO Operational Statement, a proponent may proceed with an overhead line project without DFO review when the conditions of the Operational Statement are met (**Appendix D**).

7.0 Monitoring

7.1 CONSTRUCTION

Methods/Sampling Protocols

During construction, weekly checks by a qualified project representative will be completed to ensure that mitigation measures are functioning as intended. Additionally, monitoring will occur following the completion of construction to ensure that the site has stabilized properly.

Performance Objectives/Additional Actions

Environmental monitoring will occur at least weekly during construction. Observations (including compliance/non-compliance and recommended remedial action) will be recorded by a qualified project representative and submitted to the Construction Contractor management staff. Additionally, monitoring will occur during the following spring run-off the year after construction (first year of operations), to review the effectiveness of the site stabilization and re-vegetation, to check bank and slope stability, and to ensure surface drainage has been maintained. In the event that adverse effects are noted, appropriate remedial measures will be completed as necessary (i.e. site rehabilitation and re-vegetation) and additional follow-up monitoring conducted as appropriate, under the direction of a qualified project representative.

7.2 OPERATION

The Environmental Effects Monitoring Plan for the Project is provided in the Design and Operations Report. Operation activities that have the potential to affect aquatic habitat include accidental spills and/or leaks.

Appropriate remedial measures may be completed as necessary and additional follow-up monitoring conducted as appropriate in the event of an accidental spill and/or leak. The level of monitoring and reporting will be based on the severity of the spill/leak and may be discussed with the MOE (Spills Action Centre) and MNR.

8.0 Conclusions

The David Brown Solar Park Water Assessment and Water Body Report has been prepared by Stantec for Saturn Power Inc. in accordance with O. Reg. 359/09. This report is one component of the REA application for the Project.

The location of the water bodies within 120 m of the Project Location is presented in Appendix A and summarized in Section 3.2 of this report. The designation of the identified water bodies was agreed upon by field staff using the site design, road assessments and the definition of a water body provided in O. Reg. 359/09.

Based on the current Project layout and proposed environmental mitigation measures, no impacts are anticipated to the water body containing fish habitat. *Fisheries Act* Authorization will not likely be required for construction or operation of the Project. No negative effects to aquatic organisms or their habitat are expected as a result of this Project.

This report has been prepared by Stantec for the sole benefit of Saturn Power Inc., and may not be used by any third party without the express written consent of Saturn Power Inc. The data presented in this report are in accordance with Stantec's understanding of the Project as it was presented at the time of reporting.

In summary, none of the proposed activities associated with the Project components are expected to result in net impacts to water bodies, fish habitat, or aquatic species at risk.

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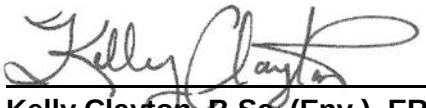
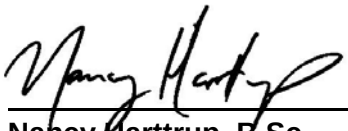


Kelly Clayton, B.Sc. (Env.), ERGC
Aquatic Ecologist



Nancy Harttrup, B.Sc.
Senior Fisheries Biologist

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9.0 References

Fisheries and Oceans Canada (DFO). 2012. Distribution Maps for Mussel and Fish Species at Risk.

MNR. 2012. Land Information Ontario (LIO) mapping. Available via the Ontario Geospatial Data Exchange.

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Appendix A

Figures

Legend

- Road
- Railway Line
- Watercourse
- Subject Property
- Project Location
- 120 m Zone of Investigation
- 300 m Zone of Investigation
- Construction Laydown Area
- Potential Constructible Area
- Inverter Station
- Fence
- Access Road
- Communication Tower
- Proposed Distribution Line
- Transformer Substation
- Solar Panel
- Point of Common Coupling

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2012.
3. Aerial imagery provided by First Base Solutions, Stormont Dundas and Glengarry, 2008.

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January 2013
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Client/Project
Saturn Power Inc.
David Brown Solar Park
Highway 401, Stormont Township, Ontario

Figure No.
1

Title
Project Location and Project Layout

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Revised: 2013-01-24 By: mkirkpatrick

Legend

- Road
- Railway Line
- Watercourse
- Subject Property
- Project Location
- 120 m Zone of Investigation
- 300 m Zone of Investigation
- Construction Laydown Area
- Potential Constructible Area
- Inverter Station
- Fence
- Access Road
- Communication Tower
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- Transformer Substation
- Solar Panel
- Point of Common Coupling
- REA Waterbody

Notes

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Client/Project
Saturn Power Inc.
David Brown Solar Park
Highway 401, Stormont Township, Ontario

Figure No.
2

Title
REA Waterbodies

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Revised: 2013-01-31 By: mkirkpatrick

Legend

- Road
- Railway Line
- Watercourse
- Subject Property
- Project Location
- 120 m Zone of Investigation
- 300 m Zone of Investigation
- Construction Laydown Area
- Potential Constructible Area
- Inverter Station
- Fence
- Access Road
- Communication Tower
- Proposed Distribution Line
- Transformer Substation
- Solar Panel
- Point of Common Coupling
- Fish Habitat

Notes

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Client/Project
Saturn Power Inc.
David Brown Solar Park
Highway 401, Stormont Township, Ontario

Figure No.
3

Title
Fish Habitat

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Revised: 2013-01-24 By: mkirkpatrick

Appendix B

Photographic Record

Photo 1: Tributary of Hoople Creek (September 2012) - Facing upstream (west) west end of property showing culvert and channel.

Photo 2: Tributary of Hoople Creek (September 2012) - Facing downstream (east) west end of property showing culvert and channel.

Photo 3: Tributary of Hoople Creek (September 2012) - Facing upstream (west) where existing channel converges with newly constructed channel, immediately following construction before vegetation growth.

Photo 4: Tributary of Hoople Creek (September 2012) - Facing upstream (east) where existing channel converges with newly constructed channel, immediately following construction before vegetation growth.

Photo 5: Tributary of Hoople Creek (September 2012) - Facing upstream (west) at middle of property showing realigned channel immediately following construction before vegetation growth.

Photo 6: Tributary of Hoople Creek (September 2012) - Facing downstream (east) middle of property showing realigned channel immediately following construction before vegetation growth.

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Photo 7: Tributary of Hoople Creek (September 2012) - Facing downstream (southeast) toward Dickinson Drive showing realigned channel following construction.

Photo 8: Tributary of Hoople Creek (September 2012) - Facing downstream (south) adjacent to Dickinson Drive showing original channel.

Photo 9: Tributary of Hoople Creek (September 2012) - Facing upstream (west) From Dickinson Drive, showing newly constructed channel, at connection to existing channel will connect.

Photo 10: Tributary of Hoople Creek (September 2012) - Facing upstream (north) showing drain parallel to Dickinson Drive.

Photo 11: Tributary of Hoople Creek (September 2012) - Facing downstream (east) showing drain on west side of Dickinson Drive.

Appendix C

Curricula Vitae

Kathleen R. O. Todd M.Sc.

Aquatic Ecologist / Project Manager

Kathleen's experience is focused in aquatic biology, including stream, lake and wetland assessments, benthic macroinvertebrate identification and biomonitoring, and fisheries habitat studies. She has experience conducting environmental impact studies, environmental effects monitoring programs, baseline studies and watershed plans. Using ecosystem based approaches, typical multidisciplinary project involvement includes Class EAs and infrastructure siting/routing studies, evaluating alternative design concepts and developing mitigative solutions to minimize impacts to the natural environment.

Kathleen has acquired an understanding of federal and provincial legislation, policies and procedures for natural heritage features, particularly regarding working in and around fish habitat in Ontario. She is experienced in the Fisheries Act Authorization process, including evaluating the effects of development on aquatic habitat, designing fish habitat mitigation measures, and negotiating Fisheries Compensation Strategies. In addition, Kathleen serves as a team leader for aquatic science staff in Ontario, including professionals in the fields of fisheries biology, fluvial geomorphology, and aquatic invertebrate taxonomy.

EDUCATION

M.Sc., Watershed Ecosystems, Trent University, Peterborough, Ontario, 2003

B.Sc. (Env.), Environmental Sciences, University of Guelph, Guelph, Ontario, 1997

Certified in the Ecological Land Classification (ELC) System for Southern Ontario, Ontario Ministry of Natural Resources, Turkey Point, Ontario, 2000

Qualified Southern and Northern Ontario Wetlands Evaluator, Ontario Ministry of Natural Resources, North Bay, Ontario, 2000

Fisheries Assessment Specialist and Fisheries Contracts Specialist, MTO/DFO/OMNR Fisheries Protocol Course, Downsview, Ontario, 2006

Ontario Freshwater Mussel Identification Workshop / Fisheries and Oceans Canada, Burlington, Ontario, 2008

Qualified Electrofishing Operator (Class 2), Ontario Ministry of Natural Resources, Guelph, Ontario, 2010

MEMBERSHIPS

Member, North American Benthological Society

PROJECT EXPERIENCE

Environmental Assessments

Northwest Area Planning and Servicing Review, Welland, Ontario* (Environmental Scientist)

Conducted a review of natural heritage features and identified development-related constraints in a newly designated urban area.

Willoughby Lands Golf Course Facility, Niagara Region, Ontario* (Aquatic Ecologist)

Obtained Fisheries Act Authorization for development of a golf course facility. Supervised an underwater dive investigation to survey aquatic habitat along a series of alternative Niagara River water intake pipe alignments. The study lands also support habitat for a rare aquatic plant and an extensive program was proposed to ensure its protection. Environmental monitoring during construction was conducted.

Kathleen R. O. Todd M.Sc.

Aquatic Ecologist / Project Manager

Municipal Water and Wastewater EAs, Various Sites, Ontario* (Aquatic Ecologist)

Evaluated natural heritage features in terms of ecological sensitivity and watermain and/or trunk sewer construction feasibility options (tunnel vs. open cut). Aquatic habitat conditions were assessed at all potential watercourse crossings and recommendations were provided regarding Fisheries Act requirements, construction mitigation measures and timing restrictions on in-water works. Also responsible for siting a chlorine booster station, surface water treatment plants and pumping stations, and mitigating impacts from emergency overflow of chlorinated water into adjacent watercourses. Water and wastewater experience includes:

- City of Barrie, Surface Water Treatment Plant Class EA & Impact Assessment
- Region of Niagara (Point Abino), Water Supply Class EA
- Region of Peel (Brampton), West Brampton Reservoir, Pumping Station & Watermain Class EA
- Region of York (Etobicoke), Steeles Avenue West Forcemain Class EA
- Region of York (Markham), Southeast Collector Trunk Sewer Class EA

Natural Sciences & Heritage Resources

Environmental Impact Studies for Land Development, Various Sites, Ontario (Project Manager)

Assessed potential environmental impacts from land development proposals. Conducted ecological community inventories in watercourses, wetlands and woodlots. Prepared Environmental Management Plans providing net effects analyses, mitigation solutions to minimize impacts to the natural environment, buffer zone recommendations, and re-vegetation and restoration activities. Participated in consultation to address agency concerns. EIS experience includes:
- Block 34 East Landowners Group Inc., Block 34 East Natural Environment Report, Vaughan, Ontario
- Block 41-28W Development Group Inc., Block 41 Natural Environment Report, Vaughan, Ontario
- Boca East Investments Limited, Block 64 Master Environmental Servicing Plan (Natural Environment Chapter), Vaughan, Ontario
- Georgian International Land Corp., Buffalo Springs Development Environment Report, Township of Oro-Medonte
- Keirland Developments Inc., Meadows of Bear Creek Subdivision Phases 2 & 3 EIS, Barrie, Ontario
- Kleinburg Heights Holdings Inc., Kleinburg Heights Natural Environment Report, Vaughan, Ontario

Environmental Impact Studies for Land Development, Various Sites, Ontario* (Project Manager)

Assessed potential environmental impacts from land development proposals. Conducted ecological community inventories in watercourses, wetlands and woodlots. Prepared Environmental Management Plans providing net effects analyses, mitigation solutions to minimize impacts to the natural environment, buffer zone recommendations, re-vegetation and restoration activities, proposed trail routes and community stewardship programs. Participated in public open houses to address the concerns of local residents. Where required, environmental monitoring during construction was conducted. EIS experience includes:
- City of London, Dearness Home for Seniors Redevelopment EIS, London, Ontario
- Fieldgate Developments, Tresstown Subdivision EIS, Stouffville, Ontario
- Grey Gables School, Proposed Private School Site, Ecological Assessment, St. Catharines
- Lebovic-Fieldgate Developments, Functional Servicing Plan, Ecological Component, Stouffville, Ontario
- Norwest Land Corp., Kains Road East Development EIS, London, Ontario
- Quinte's Isle Campark, Scoped EIS, Prince Edward County, Ontario
- Sifton Properties Ltd., Equestrian Condominium Communities, Development Assessment Reports, Township of Middlesex Centre & Municipality of West Middlesex
- Sifton Properties Ltd., River Bend Community Phases 1&2 EIS, London, Ontario
- St. Joseph's Health Care Centre, Parkwood Hospital Scoped EIS, London, Ontario
- Westhill Redevelopment Company Limited, Aurora Golf Course Community EIS, Aurora, Ontario

River Bend Community Phases 1 & 2, Environmental Monitoring Protocol & Baseline Study*, London, Ontario (Environmental Scientist)

Established baseline aquatic, terrestrial and soils conditions in the vicinity of a golf course community. Subsequently, the Environmental Monitoring Program - Year 1 and, later, Year 3, were submitted to document any potential impacts.

** denotes projects completed with other firms*

Kathleen R. O. Todd M.Sc.

Aquatic Ecologist / Project Manager

Ecological Risk Assessment of Residual Heavy Oil in a Wetland*, Drumbo, Ontario (Environmental Scientist)
Analyzed stream and wetland data to determine potential aquatic food chain impacts of a historical heavy oil release. Analyzed invertebrate community structure and identified exposure pathways and community end-points. Considered site remediation options on the basis of these data.

Proposed Acton Quarry Extension, Dufferin Aggregates, Acton, Ontario (Aquatic Ecologist / Project Manager)
The extension of the existing Acton Quarry is proposed to meet the need for additional close-to-market aggregate resources of high quality Amabel Dolostone. The area of focus encompasses approximately 615 ha, across two Conservation Authority watersheds within the Regional Municipality of Halton Hills. Kathleen has participated in extensive ecological field work, including aquatic species surveys and habitat assessments, inventories for potential Species at Risk habitat, and aquatic rehabilitation planning. She has co-authored technical reports produced in accordance with the PPS and ARA application requirements, as well as participated in interdisciplinary consultation with agencies and agency-appointed committees.

Otonabee Landfill Site Biological Assessment Study*, Peterborough, Ontario (Wetlands Ecologist)
Prepared a 'Surface Water Quality Study' to address background water quality and aquatic habitat conditions and a 'Natural Environment Report' to identify baseline wetland and terrestrial environment conditions. The study was designed to identify potential impacts from existing landfill operations and to predict future impacts from proposed landfill site expansion.

Forest City Industrial Lands, Wetland Evaluation & Environmental Assessment*, London, Ontario (Wetlands Ecologist)
Evaluated a locally significant wetland according to the Ontario Wetland Evaluation System and revised the existing boundaries of a provincially significant wetland in cooperation with MNR.

West Nile Virus Information Package, Ballantrae, Ontario (Environmental Scientist)
Designed a pamphlet to educate residents and golfers regarding West Nile virus, the status of the virus in York Region, and the client's proactive mosquito monitoring program.

Confidential Client, Environmental Baseline and Feasibility Study for a Decommissioned Gold Mine*, Northern, Ontario (Environmental Scientist)
Conducted aquatic and terrestrial habitat inventories to determine the environmental feasibility of re-opening a gold mine. Assessed streams, wetlands and woodlots. Conducted invertebrate and fish collections, avifauna and wildlife surveys, and vegetation community inventories.

Transportation Planning

MTO Aquatic and Terrestrial Biology Retainer Services, Southwestern Ontario (Project Manager / Fisheries Specialist)
Under the terms of two 2-year Retainer Agreements (2004-2006, 2007-2009) eleven individual assignments were completed, involving: characterizing existing ecological conditions, assessing site sensitivities and impacts related to proposed bridge/culvert repairs and highway improvements, recommending environmental mitigation measures, and conducting during/post-construction monitoring. Value added components included: fluvial geomorphological services, design and implementation of bio-engineered slope stabilization solutions, Permit to Take Water applications, and site rehabilitation and Planting Plans. Extensive agency liaison was required with staff from numerous Conservation Authority, MNR and DFO offices.

Municipal Road Improvement Projects, Various Sites, Ontario (Environmental Scientist)
Collected aquatic and terrestrial habitat field data, conducted environmental impact assessments, and obtained required agency approvals related to municipal transportation projects, including:
*- City of Hamilton, Bridge & Culvert Master Plan**
*- City of London, Airport Road Widening**
- City of London, Bradley Avenue Extension
- City of London, Western Road Widening
*- Town of Markham, Woodbine Avenue By-Pass**
*- Township of Wilmot, Haysville Bridge Replacement**

Natural Sciences Reports Related to MTO Highway Improvement Works, Various Sites, Ontario (Fisheries Specialist)
Produced numerous Natural Sciences reports related to highway improvement works. Where required, Fisheries Act Authorization was obtained and Fish Habitat Compensation Plans were developed. Potential impacts to aquatic habitat, terrestrial vegetation, wetlands and wildlife were described for the following studies:

** denotes projects completed with other firms*

*- Highway 6 (Flamborough)**
- Highway 6 (Guelph)
*- Highway 6 By-Pass (Caledonia)**
*- Highway 7 (Marmora)**
*- Highway 7 (Peterborough)**
*- Highway 7A/28/115 (Peterborough)**
*- Highway 8 (Dublin)**
- Highways 11/17 (North Bay)
- Highways 11/17 (Thunder Bay)
- Highways 11/101 (Matheson)
*- Highway 17 (Stonecliffe)**
- Highway 17/Municipal Road 55 (Sudbury)
- Highway 17 Southwest By-Pass (Sudbury)
*- Highways 17/531 (North Bay)**
- Highway 21 (Bluewater)
- Highway 21 (Grand Bend)
- Highway 23 (Palmerston)
- Highway 24 Interchange Improvements (Cambridge)
- Highway 26 (Meaford)
- Highway 26 (Owen Sound)
*- Highway 63 (Bancroft)**
*- Highway 63 (North Bay)**
- Highway 401/403 (Woodstock)
*- Highway 401/County Road 41 (Napanee)**
*- Highway 518 (Orrville)**

West Nile Virus Surveillance Program, Various Sites, Central Ontario (Aquatic Ecologist)
Evaluating the potential for MTO owned/managed properties (e.g. stormwater ponds) to be mosquito breeding habitats, and recommended suitable strategies to curtail mosquito breeding success.

Bridge Widening, CN Rail Mile 119.6*, Kingston, Ontario (Aquatic Ecologist)
Procured federal Fisheries Act Authorization related to a rail line widening project over a warmwater creek. Conducted a post-construction monitoring program to confirm the viability of the habitat compensation measures.

Environmental Data Collection, CN Rail Corridor*, Toronto to Hornepayne, Ontario (Environmental Scientist)
Identified, collected and assessed secondary source natural heritage data for a study area that followed the CNR corridor from Toronto to Hornepayne. The data were then transferred to a GIS database, to be used during emergency planning.

Water Resources Management

Minnow Lake Restoration*, Sudbury, Ontario (Aquatic Ecologist)
Coordinated a lake-wide monitoring program to evaluate the degree of water pollution resulting from stormwater discharge to an urban lake. Participated in frequent public consultation to liaise with residents of the Minnow Lake Restoration Group.

Fort Creek Restoration*, Sault Ste. Marie, Ontario (Aquatic Ecologist)
In consultation with DFO, completed a restoration plan for an urban creek that outlets to Lake Huron and provides salmon spawning habitat. Habitat enhancement involved the removal of in-stream debris, channel stabilization, riparian plantings, substrate enhancement, and creation of refuge areas. Fisheries Act Authorization was obtained, and environmental monitoring during construction was conducted.

Environmental Effects Monitoring Programs for Mining Sector Clients, Various Sites, Canada (Benthic Ecologist)
Contributed benthic ecology chapter to numerous EEM reports for Canadian metal mines. Analyzed and reported on invertebrate data to determine whether the respective mine effluent was resonsible for an aquatic community level effect. EEM experience includes:
- Hudson Bay Mining & Smelting Co. Ltd., Chisel North Mine, Snow Lake, Manitoba
- Hudson Bay Mining & Smelting Co. Ltd., Snow Lake Mill / Anderson Tailings, Snow Lake, Manitoba
- Hudson Bay Mining & Smelting Co. Ltd., Flin Flon Tailings Impoundment System and Trout Lake Mine, Flin Flon, Manitoba
- Hudson Bay Mining & Smelting Co. Ltd., Ruttan Mine, Leaf Rapids, Manitoba
- Hudson Bay Mining & Smelting Co. Ltd., Konuto Lake Mine, Denare Beach, Saskatchewan
- SMC (Canada) Ltd., McAlpine Mill, Cobalt, Ontario

Environmental Effects Monitoring Programs for Pulp and Paper Sector Clients, Various Sites, Canada (Benthic Ecologist)
Contributed the benthic ecology chapter to numerous EEM reports for Canadian pulp and paper mills. Statistically analyzed and reported on invertebrate data, according to Environment Canada biological monitoring protocols, to determine whether the respective mill effluent was responsible for an aquatic community level effect. EEM project experience includes:
- Cascades Fine Papers Group Thunder Bay Inc., Lake Superior, Thunder Bay, Ontario

** denotes projects completed with other firms*

Kathleen R. O. Todd M.Sc.

Aquatic Ecologist / Project Manager

- Georgia-Pacific Canada Inc., Lake Gibson, Thorold, Ontario
- Kimberly-Clark Incorporated, Lake Superior, Terrace Bay, Ontario
- Marathon Pulp Inc., Lake Superior, Marathon, Ontario
- Nexfor Fraser Papers, Saint John River, Edmunston, New Brunswick
- Norampac Inc., Lake Superior, Red Rock, Ontario
- Spruce Falls Inc., Kapuskasing River, Kapuskasing, Ontario
- Stora Enso Port Hawkesbury Limited, Strait of Canso, Port Hawkesbury, Nova Scotia
- Tembec Industries Inc., Mattagami River, Smooth Rock Falls, Ontario

Watershed Based Biomonitoring Program for Urban Development, Oakville, Ontario (Benthic Ecologist)
Sampled and analyzed the Fourteen Mile Creek invertebrate community to establish baseline conditions, prior to the development of a housing subdivision. Six subsequent years of during-construction monitoring were conducted.

North and South Meade Creeks Subwatershed Plan*, Peterborough, Ontario (Aquatic Ecologist)
Conducted fish collections and population analyses, invertebrate sampling and identification, and collected and analyzed water chemistry samples. The information was used to predict the ecological sensitivity of Meade Creek and to provide recommendations regarding the extent and type of future development permitted in the watershed.

Pike River Aquatic Impact Assessment*, Field, Ontario (Benthic Ecologist)
Sampled fish, invertebrates and benthic sediments within the vicinity of a chlorinated discharge zone to determine the extent of chlorine related effects to the aquatic environment.

Biological Impact Assessment of a Closed Landfill on the Maitland River, Wingham, Ontario (Benthic Ecologist)
Analyzed Maitland River invertebrate community data within the vicinity of a closed landfill to determine the potential impact of landfill leachate.

Receiver Biomonitoring Program, Elmira, Ontario (Benthic Ecologist)
Analyzed invertebrate community data to determine the viability of an industrial contaminated groundwater collection and treatment system which discharges treated water to Canagagigue Creek.

Shekak River Post Impoundment Environmental Monitoring for the Shekak-Nagagami Hydroelectric Development, Hearst, Ontario (Aquatic Ecologist)
Addressed agency concerns regarding environmental monitoring in the headpond area of a river impoundment. Evaluated shoreline erosion and the viability of fish habitat compensation measures, including a walleye spawning shoal and aquatic invertebrate enhancement works.

Environmental Effects Monitoring Program for the Antamina Mine & Port Facility, Peru (Benthic Ecologist)
Analyzed biological (metal concentrations in fish and shellfish tissues, fish health, benthic invertebrate community structure) and physical (water and sediment chemistry) data collected in the vicinity of both an inland mine (freshwater environment) and a coastal mining port facility (marine environment) to determine if the local ecosystems were being adversely affected by mining/shipping operations.

Benthic Invertebrate Monitoring Program*, Caledonia, Ontario (Benthic Ecologist)
Assessed the Fox Creek invertebrate community to determine if the stream habitat was being adversely affected by adjacent mining effluent discharge.

** denotes projects completed with other firms*

Kathleen R. O. Todd M.Sc.
Aquatic Ecologist / Project Manager

PUBLICATIONS

Todd, K.R.O., M.G. Fox and D.C. Lasenby. Presented at the 52nd Annual Meeting of the North American Benthological Society. Seasonal influence of riparian vegetation on stream macroinvertebrate community structure. *North American Benthological Society, Vancouver, B.C. (June 6-10)*, 2004.

Todd, K.R.O. The Influence of Deciduous and Coniferous Riparian Vegetation on Aquatic Macroinvertebrate Community Structure in Low Order Streams of South Central Ontario. *M.Sc. Thesis, Trent University*, 2003.

Kelly Clayton B.Sc. (Env.)

Ecologist

Kelly Clayton is a member of the Environmental Management Group at Stantec Consulting with four years of industry experience. She has a Graduate Certificate in Ecosystem Restoration and a Bachelor of Environmental Science, majoring in environmental geography and area of emphasis in biotic systems. Kelly has gained valuable experience through her formal employment and her extensive participation in volunteer projects in Ontario, as well as the United States of America. Her experience at teaching college-level environmental monitoring has imbued Kelly with a practical ability to apply Ecological Monitoring and Assessment Network (EMAN) and Ontario Stream Assessment Protocol (OSAP) protocols.

Kelly has conducted a wide array of environmental monitoring that includes bird migration surveys, salmon spawning counts, butterfly and odonate surveys, as well as fish assessment and vegetation surveys. She is familiar with the use of all manner of such survey equipment as GPS and radio telemetry equipment, seine nets, hoop nets, gill nets, fyke nets, minnow traps, basking traps and spring haul traps. Kelly is experienced at the identification of flora and fauna, and is capable of handling wildlife. Certified in ELC (Ecological Land Classification), Class II Electrofishing, and Ontario Benthic Biomonitoring Network, Kelly has the ideal background to support a wide variety of both Terrestrial and Aquatic natural heritage studies. Her laboratory experience has honed Kelly's skills in data processing and analysis, and she has a demonstrated ability to interpret and report findings accurately.

EDUCATION

B.Sc. (Env.), University of Guelph / Environmental Science, Guelph, Ontario, 2007

Graduate Certificate, Niagara College / Ecosystem Restoration, Niagara-on-the-Lake, Ontario, 2009

Class II Electrofishing Certificate, Niagara College / Ecosystem Restoration, St. Catharines, Ontario, 2008

Ontario Benthic Biomonitoring Network Certificate, Niagara College / Ecosystem Restoration, St. Catharines, Ontario, 2009

Certificate, Ecological Land Classification (ELC), Lindsay, Ontario, 2010

Certificate, Tallgrass Ontario / Seed Collector, Burlington, Ontario, 2010

Certificate, Ontario Wildlife Rehabilitation Network (OWREN), London, Ontario, 2010

Certificate, St. Johns Ambulance / CPR and First Aid, Burlington, Ontario, 2010

Workplace Hazardous Materials Information System (WHMIS), Burlington, Ontario, 2010

Licence, Boat Smart / Pleasure Craft Operators, Orangeville, Ontario, 2008

Certificate, ROM / Ontario Fish Identification Workshop, Toronto, Ontario, 2011

PROJECT EXPERIENCE

Education

Niagara College Environmental Monitoring Program*, Niagara-on-the-Lake, Ontario (Part-time Teacher)

Taught two sections of students at a second-year, college level. Demonstrated and explained Ontario Stream Assessment Protocol (OSAP) and Ontario Benthic Biomonitoring (OBBN) protocols. Discussed proper field and lab sampling/analysis techniques for water, sediment, and benthos. Prepared assignments, lectures, and exams (both written and practical). Evaluated students based on performance.

Linear Infrastructure

Thunder Bay Generating Station Pipeline Project, Thunder Bay, Ontario (Aquatic Ecologist)

Researched and summarized data for existing conditions report as part of the EA process.

** denotes projects completed with other firms*

Kelly Clayton B.Sc. (Env.)

Ecologist

Union Gas Pipeline Construction, Nanticoke, Ontario (Aquatic Ecologist)
Researched and summarized data for existing conditions report as part of the EA process.

Mining

Environmental Effects Monitoring (EEM) Program: Vale Inco, Sudbury, Ontario (Aquatic Ecologist)
Collected fish and water samples for toxicity testing.

Environmental Effects Monitoring (EEM) Program: Hudson Bay Mining and Smelting, Flin Flon, Manitoba (Aquatic Ecologist)
Collected Hyalella, water samples and sediment samples for toxicity testing.

Natural Sciences & Heritage Resources

Proposed Melancthon Quarry, Melancthon, Ontario (Aquatic Ecologist)
Conducted fish community surveys (electrofishing).

New Hamburg Oxbow, New Hamburg, Ontario (Aquatic Ecologist)
Collected water samples and water quality data twice monthly.

Blue Springs Creek Ground and Surface Water Monitoring, Arkell, Ontario (Aquatic Ecologist)
Downloaded weekly temperature and water level data and performed stream discharge measurements.

Ontario Power Generation - Lake Gibson Project, Thorold, Ontario (Aquatic Ecologist)
Collected benthic invertebrate and water samples. Safety boat operator.

Mill Creek Surface Water Monitoring Program, Milton, Ontario (Aquatic Ecologist)
Performed monthly stream discharge measurements and downloaded water level and temperature logger data. Graphed hydrological data.

Greenhouse Effluent Filtration Design Team, Niagara College*, Niagara-on-the-Lake, Ontario (Biologist)
Conducted environmental impact assessment on receiving stream and suggested several filtration design methods.

Bird Studies Canada Marsh Monitoring Program*, Hamilton, Ontario (Volunteer)
Conducted amphibian surveys on Royal Botanical Gardens property. Aided in the development of the BSC database.

Species at Risk Inventory at Legends on the Niagara Golf Course*, Chippewa, Ontario (Student Consultant)
Designed and conducted survey methods. Produced research and consultant proposals. Made recommendations for further restoration efforts.

St. Clair River Horizontal Directional Drill, Sarnia, Ontario (Aquatic Ecologist)
Performed analysis and presentation of in-situ and laboratory water quality data. Reported on results of water quality monitoring program.

Island Lake Conservation Area, Credit Valley Conservation*, Orangeville, Ontario (Conservation Technician)
Served as a client services representative, which entailed conservation awareness education. Maintained conservation area grounds.

Royal Botanical Gardens*, Hamilton, Ontario (Restoration Ecologist)
Coordinated summer students and assisted in the planning and implementation of restoration activities. Participated in habitat rehabilitation strategies (cattail and waterlily plantings). Maintained floodplain connections.
Assisted the Species at Risk Biologist in the creation of snake hibernacula. Assisted in turtle monitoring using radio telemetry, basking traps and hoop nets. Assisted Terrestrial Ecologist with Prairie grassland rehabilitation techniques (Prescribed burns and Prairie plantings). Conducted environmental monitoring (salmon spawning count, waterfowl migration count, aquatic vegetation surveys, butterfly and odonate counts).
Performed wildlife population management (carp (Cyprinus carpio) seining in Cootes Paradise Marsh and RBG ponds, electrofishing for carp), and beaver dam maintenance.
Operated Cootes Paradise Fishway carp barrier (to separate non-native species from native) and ran educational presentations at Cootes Paradise Fishway.
Collected water quality measurements and performed data entry, data quality control and analysis, in addition to report writing. Assisted in development of educational materials (pamphlets and signage).

** denotes projects completed with other firms*

Kelly Clayton B.Sc. (Env.)

Ecologist

Various Environmental Effects Monitoring (EEM) Studies, Ontario (Aquatic Ecologist)
Conducted fish population monitoring, benthic invertebrate identification and report writing/data management in support of various EEM studies for both Mining and Pulp and Paper industry projects.

Renewable Energy

White Pines Wind Farm, Picton, Ontario (Aquatic Ecologist)
Performed water-body assessments on mapped watercourses.

Fairview Wind Farm, Stayner, Ontario (Aquatic Ecologist)
Performed water-body assessments on mapped watercourses.

Pristine Power Wind Power, St. Columban, Ontario (Aquatic Ecologist)
Conducted fish community surveys (electrofishing).

Algonquin Power Wind Project, Amherst Island, Ontario (Aquatic Ecologist)
Conducted shoreline habitat mapping and fish community surveys.

Solar Power Plan Design Team, University of Guelph, City of Guelph*, Guelph, Ontario (Student)
Designed a solar power plan for the City of Guelph to coordinate with Community Energy Plan. Conducted public surveys on solar power interest. Coordinated with key stakeholders. Conducted cost/benefit analysis, baseline research regarding solar power use, prepared proposal, and presented plan to key stakeholders.

Port Dover Wind Farm, Port Dover, Ontario (Assistant Aquatic Ecologist)
Fish population monitoring (electrofishing).

Melancthon Wind Power Project, Melancthon and Amaranth Townships, Ontario (Biologist)
Conducted bat and bird mortality monitoring studies and raptor monitoring (winter raptor counts) as well as habitat assessments and data analysis.

Transportation Planning

MTO Highway 3, 6 and 24, Simcoe, Ontario (Aquatic Ecologist)
Conducted fish community surveys (electrofishing).

** denotes projects completed with other firms*

Kelly Clayton B.Sc. (Env.)
Ecologist

PUBLICATIONS

Fuller, M.M., K. Clayton, N. Ward. Project Paradise Season Summary Report 2009. *Royal Botanical Gardens. Hamilton, Ontario. RBG Report No. 2010-01*, 2010.

Clayton, K. Carroll's Bay Recovery and Management Strategy. *Royal Botanical Gardens. Hamilton, Ontario*, 2010.

Clayton, K. Recovery and Management Strategy for Carroll's Bay Marsh. *Presentation at the Project Paradise Workshop*, 2010.

Mark C. Pomeroy B.Sc.

Fisheries Biologist / Project Manager

Mark has 14 years of experience designing, coordinating, and implementing small and large scale aquatic habitat and impact assessments, encompassing numerous habitat types including lakes, ponds, large rivers, warmwater and coldwater streams. Mark has also developed and implemented many monitoring, mitigation, compensation and inventory processes. Past employment with Fisheries and Oceans Canada (DFO), and both the Grand River and St. Clair Region Conservation Authorities contributes to Mark's extensive working experience with regulatory and approvals processes related to the *Fisheries Act*, the *Conservation Authorities Act* and the *Drainage Act*. Mark's familiarity with *Fisheries Act* mitigation and compensation includes an understanding of the Habitat Alteration Assessment Tool (HAAT). He has extensive experience involving permitting and issues resolution related to the federal *Species at Risk Act* and the provincial *Endangered Species Act*. His experience also includes several transportation-related Environmental Assessments.

EDUCATION

Honours B.Sc. (Agriculture), University of Guelph / Natural Resources Management, Guelph, Ontario, 2000

Royal Ontario Museum / Freshwater Fish Identification Course, Toronto, Ontario, 2011

Class 1 Electrofishing Certificate / Ministry of Natural Resources, Waterloo, Ontario, 2010

Ontario Freshwater Mussel Identification Workshop / Fisheries and Oceans Canada - Canada Centre for Inland Waters, Burlington, Ontario, 2007

Fisheries Assessment Specialist and Fisheries Contracts Specialist, MTO/DFO/OMNR Fisheries Protocol Course, Downsview, Ontario, 2006

PROJECT EXPERIENCE

Environmental Assessments

Locks 24 and 25 – VLH Turbine Installation, Canadian Projects Limited, Lakefield, Ontario (Aquatic Biologist)
Conducted aquatic assessments including walleye and bass spawning and habitat surveys in support of an Environmental Assessment (EA) for the installation of Very Low Head (VLH) turbines at Dams 24 and 25 on the Otonabee River. As part of the EA, will provide an analysis of impacts to walleye and bass spawning habitat and habitat use by small-bodied fish. The impact assessment will also be used as during the assessment of the project using the Fisheries & Oceans Canada (DFO) Risk Management Framework.

Pier 27 Dockwall and Dredging, Hamilton Port Authority, Hamilton, Ontario (Aquatic Biologist)
Coordinated and conducted aquatic assessments in support of the installation of a new dockwall and dredging to facilitate shipping traffic. Coordinated with DFO regarding need for Fisheries Act approval.

Pier 22 Environmental Assessment, Hamilton Port Authority, Hamilton, Ontario (Aquatic Biologist)
Coordinated and conducted aquatic assessments in support of site improvements. Negotiated compensation measures and drafted letter of intent in pursuit of Fisheries Act Authorization.

Bruce to Milton Transmission Line, Various, Ontario (Fisheries Biologist)
Planned, coordinated and assisted with execution of large-scale fisheries field program to assess potential impacts of proposed hydroelectric corridor reinforcement project and provided relevant input to the provincial environmental assessment process as well as the Fisheries Act and Conservation Authorities Act permitting processes. Managed data entry, analysis and completed reporting of aquatic resources sections. Coordination of multi-disciplinary team and regulatory agencies for acquisition of appropriate permits and approvals.

Yellow Falls Hydroelectric Project, Smooth Rock Falls, Ontario (Aquatic Biologist)
Planned, coordinated and assisted with execution of fisheries field program to assess potential impacts of proposed hydroelectric dam project. Facilitated acquisition of permits and approvals from relevant agencies. Assisted with fish, benthos, habitat, water and sediment sampling. Authored significant portions of the technical appendix related to aquatic study results.

** denotes projects completed with other firms*

Mark C. Pomeroy B.Sc.

Fisheries Biologist / Project Manager

Environmental Impact Assessments

Georgia Pacific Thorold Cycle 4 EEM, Thorold, Ontario (Aquatic Ecologist)
Assisted in field sampling of fish, benthos, water and sediment for federally regulated pulp and paper environmental effects monitoring.

Spruce Falls Cycle 4 EEM, Kapuskasing, Ontario (Aquatic Ecologist)
Assisted in field sampling of fish, benthos, water and sediment for federally regulated pulp and paper environmental effects monitoring.

Smooth Rock Falls Cycle 4 EEM, Smooth Rock Falls, Ontario (Aquatic Ecologist)
Assisted in field sampling of fish, benthos, water and sediment for federally regulated pulp and paper environmental effects monitoring.

Highway and Transportation

King Street and Fountain Street Improvements Class Environmental Assessment Study, Cambridge, Ontario (Fisheries Biologist)
Planned, coordinated and conducted field investigations to assess aquatic habitat at watercourse crossings within the project study area. Data collected during field investigations was used to assess potential impacts of preferred option. Drafted text for relevant sections of Class EA document.

Franklin Boulevard Widening Class Environmental Assessment Study, Cambridge, Ontario (Fisheries Biologist)
Planned, coordinated and conducted field investigations to assess aquatic habitat at watercourse crossings within the project study area. Data collected during field investigations was used to assess potential impacts of preferred option. Drafted text for relevant sections of Class EA document.

Highway 69 - Patrol Yards between Parry Sound and Sudbury, Ontario (Fisheries Biologist)
Planned, coordinated and conducted field investigations to assess aquatic habitat at watercourses within the project study area. Data collected during field investigations was used to assess potential impacts of proposed maintenance patrol yards located adjacent to Highway 69. Drafted text for inclusion in Fisheries and Aquatic Ecosystems Report. All work was conducted in accordance with the MTO/DFO/MNR Protocol (2006).

Highway 11 - High Falls Road Access Improvements Class Environmental Assessment, Bracebridge, Ontario (Fisheries Biologist)
Planned and conducted field investigations to assess aquatic habitat at watercourse crossings within the project study area. All work was conducted in accordance with the MTO/DFO/MNR Protocol (2006).

Highway 11 - Intersection Improvements, Powassan, Ontario (Fisheries Biologist)
Planned, coordinated and conducted field investigations to assess aquatic habitat at watercourse crossings within the project study area. Data collected during field investigations was used to assess potential impacts of preferred option, including potential impacts to Brook Trout. Drafted text for inclusion in Fisheries and Aquatic Ecosystems Report. All work was conducted in accordance with the MTO/DFO/MNR Protocol (2006).

Highway 3 - Rehabilitation between Jarvis and Renton, Ontario (Fisheries Biologist)
Planned, coordinated and conducted field investigations to assess aquatic habitat at watercourse crossings within the project study area. Data collected during field investigations was used to assess potential impacts of preferred option, including potential impacts to Brook Trout. Drafted Fisheries and Aquatic Ecosystems Report. All work was conducted in accordance with the MTO/DFO/MNR Protocol (2006), and included preparation and submission of "no HADD forms" to satisfy Fisheries Act requirements.

Highway 69 - Key River Bridge Replacement, Britt, Ontario (Fisheries Biologist)
Planned, coordinated and conducted field investigations to assess aquatic habitat in Key River at proposed location of bridge replacement. Data collected during field investigations was used to assess potential impacts of bridge replacement activities. Drafted Fisheries and Aquatic Ecosystems Report. All work was conducted in accordance with the MTO/DFO/MNR Protocol (2006), and included preparation and submission of "no HADD forms" to satisfy Fisheries Act requirements.

Replacement of Coutts Line Bridge over Baptiste Creek, Tilbury, Ontario (Fisheries Biologist)
Facilitated acquisition of provincial Endangered Species Act (ESA) approval (letter of advice) through provision of advice regarding construction techniques. Planned, coordinated and conducted field investigations to assess freshwater mussel community and habitat at bridge site.

** denotes projects completed with other firms*

Mark C. Pomeroy B.Sc.

Fisheries Biologist / Project Manager

Replacement of Dawn Mills Bridge over Sydenham River Creek, Dresden, Ontario (Fisheries Biologist)
Dawn Mills Bridge is located over a reach of the Sydenham River known to contain one of the largest number of taxa of federally regulated Species at Risk fish and mussels in Canada. Facilitated acquisition of federal approvals (Fisheries Act and Species at Risk Act, letter of advice) through provision of advice regarding construction techniques. Planned, coordinated and conducted field investigations to assess freshwater mussel habitat at bridge site.

Chinguacousy Road Widening, Brampton, Ontario (Fisheries Biologist)
Conducted fish community assessment to determine presence of Redside Dace (a provincially Endangered species). Drafted applications for Fisheries Act Authorization, Conservation Authorities Act approval, and Endangered Species Act approval. Provided input to engineering design for compensation measures related to Redside Dace habitat.

Detroit Windsor Truck Ferry Improvements (Design) (GWP 3071-06-00), Windsor, Ontario (Fisheries Biologist)
Provided aquatic community and habitat assessment services as well
as input regarding project design, construction staging and silt and sediment control planning. Acquired approvals under Fisheries Act and Conservation Authorities Act related to fish habitat. Negotiated compensation measures with Conservation Authority prior to project design change, resulting in no HADD.

Highway 24 - Intersection Improvements, Cambridge, Ontario (Fisheries Biologist)
Provided fish rescue services. Performed environmental inspection duties related to implementation of the Fisheries Act compensation plan and resolution of onsite issues related to construction.

Detroit Windsor Truck Ferry Improvements (Contract Administration) (WP 3071-06-00), Windsor, Ontario (Fisheries Biologist)
Construction monitoring services related to Fisheries Act implications (fish removals, species at risk identification training for contract staff , staging and implementation design review), provision of advice regarding alternative staging/construction operations to prevent impacts to aquatic habitat/organisms.

Fanshawe Park Road Widening, London, Ontario (Fisheries Biologist)
Facilitated acquisition of approvals from DFO for the realignment of Heard Drain/Snake creek during the expansion of Fanshawe Park Road. Performed construction inspection services, resolved onsite implementation issues related to the Fisheries Act.

Natural Resource Services

Municipal Drain Classification Program*, Various, Ontario (Drain Assessment Technician)
Planned and implemented large scale sampling protocol designed by DFO to assess the sensitivity of various municipal drains to disturbance. Sampling program encompassed all drains within the Grand River watershed and consisted of habitat, thermal and fish community characterization based on extensive field sampling. Analyzed substantial quantities of field data, summarized results and produced interim and final reports.

Fish Habitat Study*, Strathroy, Ontario (Biological Technician)
Planned and implemented field program to sample fish community in reservoirs managed by the St. Clair Region Conservation Authority. Responsible for writing final report concerning existing fish habitat status and providing recommendations based on field data. Participated in water quality and benthic community field sampling programs.

Various Environmental Assessments*, Sarnia, Ontario (Fish Habitat Biologist)
Assessed project proposals for impacts to fish habitat as defined in the Fisheries Act. Issued Letters of Advice and Authorization under the Fisheries Act. Carried out screening level environmental assessments of proposed projects under the Canadian Environmental Assessment Act. Participated in outreach programs and inter-agency work groups regarding Species at Risk recovery. Acquired familiarity with the Habitat Alteration Assessment Tool (HAAT).

Renewable Energy

St. Columban Wind Project, Huron County, Ontario (Fisheries Biologist)
Planned, coordinated and conducted field investigations to assess potential aquatic impacts resulting from proposed wind project consisting of fifteen turbines. Drafted Water Assessment and Water Body Report as mandated under Ontario Reg. 359/09.

** denotes projects completed with other firms*

Mark C. Pomeroy B.Sc.

Fisheries Biologist / Project Manager

Plateau Wind Project, Grey County, Ontario (Fisheries Biologist)
Planned, coordinated and conducted field investigations to update previous field work to assess potential aquatic impacts resulting from proposed wind project consisting of eighteen turbines. Drafted relevant sections of the Environmental Screening Report (ESR) as mandated under Ontario Reg. 116/01. Provided advice concerning provincial species at risk concerns.

Grand Renewable Energy Park, Haldimand County, Ontario (Fisheries Biologist)
Planned, coordinated and conducted field investigations to assess potential aquatic impacts resulting from proposed wind and solar project consisting of sixty-seven turbines and 425,000 solar panels. Drafted Water Assessment and Water Body Report as mandated under Ontario Reg. 359/09.

Springwood Wind Project, Belwood, Ontario (Fisheries Biologist)
Conducted field investigations to assess potential aquatic impacts resulting from proposed wind project consisting of and assisted with draft Water Assessment and Water Body Report under Ontario Reg. 359/09.

Whittington Wind Project, Dufferin County, Ontario (Fisheries Biologist)
Planned and coordinated field investigations to assess potential aquatic impacts resulting from proposed wind project consisting of three turbines. Drafted Water Assessment and Water Body Report as mandated under Ontario Reg. 359/09.

Fairview Wind Project, Stayner, Ontario (Fisheries Biologist)
Planned and coordinated field investigations to assess potential aquatic impacts resulting from proposed wind project consisting of eight turbines. Drafted Water Assessment and Water Body Report as mandated under Ontario Reg. 359/09.

White Pines Wind Project, Prince Edward County, Ontario (Fisheries Biologist)
Planned, coordinated and conducted field investigations to assess potential aquatic impacts resulting from proposed wind project consisting of twenty-nine turbines. Drafted Water Assessment and Water Body Report as mandated under Ontario Reg. 359/09 (in progress).

Urban Land

Berczy Dam Removal, Markham, Ontario (Fisheries Biologist)
Provided fish rescue services, including resolution of issues related to Species at Risk.

Medway Sanitary Trunk Sewer Extension, London, Ontario (Fisheries Biologist)
Drafted Fisheries Act application and Endangered Species Act application for pipeline crossing of Medway Creek. Coordinated and completed aquatic habitat assessment and relocation of freshwater mussels. Negotiated compensation measures prior to project design change, resulting in no HADD.

Fox Hollow Subdivision, London, Ontario (Fisheries Biologist)
Facilitated acquisition of approvals from DFO for the realignment of the Heard Drain/Snake Creek and the installation of a stormwater management pond in relation to construction of the Fox Hollow Subdivision. Performed construction inspection services, resolved onsite implementation issues related to the Fisheries Act.

** denotes projects completed with other firms*

Nancy A. Harttrup B.Sc.

Fisheries Biologist / Project Manager

Nancy is a Fisheries Biologist and Project Manager with extensive experience collecting and analyzing data related to aquatic systems. Project experience includes aquatic impact assessments related to urban development, highway and pipeline construction, and aggregate extraction. Nancy has also managed environmental effects monitoring (EEM) programs for the mining and pulp and paper industries and has been involved in watershed studies, literature searches and analysis of benthic invertebrate and water quality data relative to environmental quality.

EDUCATION

B.Sc. (Honours), Co-op Biology, University of Waterloo, Waterloo, Ontario, 1986

PROJECT EXPERIENCE

Aquatic Ecology

Oxbow Lake Investigation at the New Hamburg Wastewater Treatment Plant, New Hamburg, Ontario (Aquatic Biologist)

Collection and review of background fisheries data for tributary of the Nith River originating in an abandoned oxbow of the Nith River. Bi-weekly collection of surface water samples along the oxbow feature to determine if the existing oxbow provides additional treatment or can be modified to augment treatment. Region of Waterloo

Assessment of the Benthic Invertebrate Community in the Saugeen River adjacent to the Hanover Landfill Site, Town of Hanover (Aquatic Biologist)

A biological monitoring program was developed to compare benthic invertebrate community health in the Saugeen River upstream and downstream of the Hanover Landfill. The three-year program involves the collection of benthic invertebrate samples from the river using artificial substrates left in place for approximately six weeks. The data are analyzed and the results used as an indicator of aquatic habitat quality adjacent to the landfill relative to upstream and downstream areas.

Assessment of Wetland Pond Health and Downstream Water Quality at Chinguacousy Landfill (Aquatic Biologist)

Benthic invertebrates were collected from a wetland pond at the Chinguacousy Landfill site to determine if the pond life was affected by landfill leachate. The survey also included the collection of water chemistry data from the pond, the outflow stream, and nearby reference locations. Discharge measurements were taken at all water sampling locations. Baseline data collection for the project included toxicity testing to determine if the site runoff was toxic to aquatic organisms.

Mill Creek Surface Water Monitoring Program, Guelph, Ontario (Project Manager, Fisheries Biologist)

To assess potential impacts on Mill Creek (a tributary to the Grand River), a long-term Surface Water Monitoring Program (SWMP) was initiated to monitor water quality, brown trout (Salmo trutta) populations, water levels and stream temperatures over time. During the 10-years involved in this project, Nancy's duties included project management, the coordination of annual spawning surveys, population surveys as well as water quality sampling. Annual reports included the compilation of annual fisheries data and the integration of fisheries data with groundwater and surface water data into a comprehensive monitoring report.

Brant Mill Pond Fisheries Impact Assessment, Brant County, Ontario (Task Manager/Biologist)

A bridge replacement was required on a road crossing the outlet of Brand Mill Pond. The mill pond dam was structurally tied to the bridge, therefore a method was needed to reduce water pressure on the dam prior to bridge removal and replacement. Various construction scenarios were considered, including draining or partially draining the mill pond. A bathymetric survey of a mill pond was conducted to provide an indicator of the amount of available fish habitat in the pond (by depth) and the dominant substrate types in the pond. A document summarizing fish habitat conditions in the pond and possible impacts to fish habitat based on the selected construction method was submitted to GRCA for review.

Nancy A. Harttrup B.Sc.

Fisheries Biologist / Project Manager

Wilmot Centre Trout Spawning Surveys, Waterloo (Wilmot Centre), Ontario (Project Manager)

Annual brook trout spawning surveys have been completed in a small coldwater creek in Wilmot Centre in the vicinity of groundwater wells that provide drinking water to the supply Regional Municipality of Waterloo. The program is part of the Wilmot Centre monitoring program and looks at annual brook trout spawning activity in the creek as an indicator of the quantity and quality of suitable habitat. Brook trout depend on areas of groundwater upwelling for spawning purposes therefore the health of the fishery is related to groundwater levels in the area.

Benthic Invertebrate Community Survey in the Maitland River at Wingham, Wingham, Ontario (Project Manager)

Nancy was the Project Manager for an ongoing benthic invertebrate survey in the Maitland River in Wingham, Ontario. The monitoring was an annual program that involved the collection of benthic invertebrate samples from the river as an indicator of the quality of aquatic habitat in the river adjacent to a closed landfill site. Nancy was responsible for Project Management of the survey, the coordination of data collection, data analysis and reporting.

Receiver Biomonitoring in Canagagigue Creek, Elmira, Ontario (Project Manager)

Since 1998, Nancy has been the Project Manager for an ongoing Biomonitoring Program in Canagagigue Creek in Elmira, ON. The monitoring is now a biannual program that sees the collection of benthic invertebrate, sediment and fish community data in the creek. The program is a condition of the C of A for discharge of treated groundwater to the creek. Since 1999, Nancy has been responsible for Project Management of the survey, the coordination of data collection, data analysis and reporting.

Letter of Intent for DFO Authorization, Strasburg Creek at Strasburg Road Extension, Kitchener, Ontario (Task Manager/Biologist)

The extension of Strasburg Road in the City of Kitchener required a new crossing of Strasburg Creek, which provides coldwater fish habitat. Detailed mapping of the creek was prepared and areas both upstream and downstream of the proposed crossing location were surveyed, documenting any locations that were blockages to fish migration or areas of high quality habitat. Additional data collected were a fish community inventory, summer water temperatures (hourly data by instream loggers) and a fall spawning survey. All fisheries and fish habitat data were summarized and used in the Letter of Intent (LOI) submitted to DFO for authorization of the project. The LOI included mitigation and compensation measures for the loss of fish habitat that resulted from the installation of the 40m long culvert.

Letter of Intent for DFO Authorization, Tributary of Baden Creek, Baden, Ontario (Task Manager/Biologist)

A stormwater management pond outfall in a new subdivision in the town of Baden resulted in the loss of fish habitat in a small tributary of Baden Creek. Mapping of the location was prepared and a general survey of watercourse conditions was conducted for approximately 1km downstream. Together with available background data on the main channel of Baden Creek, fish habitat data were summarized and used in the Letter of Intent (LOI) submitted to DFO for authorization of the project. The LOI included mitigation and compensation measures for the loss of fish habitat that resulted from the SWM outfall.

Assessment of Impacts of Seepage from Caledon Landfill on Fisheries of the Credit River, Region of Peel (Aquatic Biologist)

Benthic invertebrates were collected from a perched fen downgradient of the Caledon Landfill site. The qualitative survey collected organisms to determine what species were present in the fen. The survey included the collection of water samples for chemical analysis and toxicity testing. Nancy was involved in earlier project work for the Caledon Landfill, collecting benthic invertebrates from the Credit River adjacent to the landfill site.

** denotes projects completed with other firms*

Nancy A. Harttrup B.Sc.

Fisheries Biologist / Project Manager

Environmental Impact Assessments

Fish and Fish Habitat Surveys along Highway 66 and 624 near Larder Lake; Rehabilitation of Highway 66 and 624, Ontario (Task Manager, Fisheries Assessment Specialist)

As a part of a Detail Design study for the Rehabilitation of Highways 66 and 624 (District of Timiskaming) Nancy managed the field surveys and reporting for this project. Limited background data were available for the study area. Field data collection and reporting followed the 2006 MTO/DFO/OMNR Protocol and reporting included impact assessments for the numerous watercourses in the study area. Impact assessments were based the proposed work required at each culvert (eg. rehabilitation, replacement) which subsequently lead to the completion of appropriate forms and submissions to DFO.

Fish and Fish Habitat Survey of the Mattawishkwia River; Highway 11 Replacement of the Mattawishkwia River Bridge at Hearst, Ontario (Task Manager, Fisheries Assessment Specialist)

As a part of a Preliminary Design study for the replacement of the Mattawishkwia River bridge, Nancy managed field surveys and prepared an Impact Assessment Report for the project. The study involved the collection of background data, detailed habitat mapping and the collection of fish community data following the 2006 Protocol. Reporting included a preliminary assessment of aquatic habitat impacts based on the Preferred Plan, and mitigation measures to protect fish habitat in the river during construction.

Fish and Fish Habitat Survey of watercourses near Highway 11; Highway 11 Access Review at High Falls Road/Holiday Park Drive near Bracebridge, Ontario (Task Manager, Fisheries Assessment Specialist)

As a part of a Preliminary Design study for interchange improvements on Highway 11 at Bracebridge, Nancy is conducted field surveys and an existing conditions report for watercourses in the Study Area. The study involved the collection of background data, detailed habitat mapping and the collection of fish community data at locations potentially affected by the Preferred Plan. Data collection and reporting followed the requirements of the 2006 MTO/DFO/OMNR Fisheries Protocol Reporting included a preliminary assessment of aquatic habitat impacts, and a summary of recommended mitigation measures based on the Preferred Plan for highway access and service roads.

Fish and Fish Habitat Survey of watercourses near Highway 11; Access Review on Highway 11 from Powassan to Callander, Ontario (Task Manager, Fisheries Assessment Specialist)

As a part of a Preliminary Design study for access and interchange improvements along Highway 11 between Powassan and Callander, Nancy conducted field surveys and prepared an existing conditions report for watercourses that cross or are adjacent to the Highway 11 Study Area. The study involved the collection of background data, detailed habitat mapping and the collection of fish community data following the 2006 MTO/DFO/OMNR Fisheries Protocol. Reporting included a preliminary assessment of aquatic habitat impacts, and a summary of recommended mitigation measures based on the Preferred Plan for access improvements.

Galt Country Club - Letter of Intent for DFO Authorization, Cambridge, Ontario (Task Manager/Biologist)

The re-design of a golf course fairway at the Galt Country Club resulted in changes to fish habitat in a golf course pond located in the floodplain and connected to the Grand River. Information regarding available data on fish species in the Grand River and detailed plans regarding changes to the pond were prepared as a Letter of Intent (LOI) and submitted to DFO for authorization of the project. The LOI included details of the existing and proposed pond areas and depths, illustrating that the new pond would actually provide more potential fish habitat than before. Additional habitat enhancements were added to the plan to provide underwater structure to fish that utilized the new pond.

Fish and Fish Habitat Survey of four watercourses near Highway 11 near Allensville, Ontario - Evaluation of Highway 11 Access and Interchange Improvements, Huntsville, Ontario (Task Manager/Fisheries Assessment Specialist)

As a part of a Preliminary Design study for access and interchange improvements along Highway 11 south of Huntsville, Nancy conducted field surveys and prepared an existing conditions report for four watercourses that cross or are adjacent to the Highway 11 Study Area. The study involved the collection of background data, detailed habitat mapping and the collection of fish community data. Reporting included a preliminary assessment of aquatic habitat impacts, and a summary of recommended mitigation measures based on the Preferred Plan for access improvements.

** denotes projects completed with other firms*

Nancy A. Harttrup B.Sc.

Fisheries Biologist / Project Manager

Fish and Fish Habitat Survey of four watercourses crossing Highway 401 near Cambridge, Ontario, Evaluation of Highway 401 and 8 Access and Interchange Improvements, Kitchener and Cambridge, Ontario (Task Manager, Field Crew Leader)
As a part of a Preliminary Design study for interchange improvements along Highway 401 between the Grand River and Speed River, Nancy conducted field surveys and an existing conditions report for these watercourses and two other small watercourses that cross the Highway 401 in the Cambridge area. The final Preferred Plan only had changes proposed for the Highway 8 and 401 interchange, potentially affecting aquatic resources in the Grand River. The study involved the collection of background data, detailed habitat mapping and the collection of fish community data, however the Grand River site was not sampled as part of this project. Reporting included a preliminary assessment of aquatic habitat impacts, and a summary of recommended mitigation measures based on the Preferred Plan for highway widening.

Fish and Fish Habitat Surveys watercourses near Highway 26 at Camperdown, Camperdown, Ontario (Task Manager, Fisheries Assessment Specialist)
As a part of a Preliminary Design study for intersection improvements along Highway 26 near Camperdown, Nancy conducted field surveys and prepared an existing conditions report for three watercourses that cross Highway 26 in the vicinity of Grey Road 40 and Camperdown Road. The study involved the collection of background data, detailed habitat mapping and the collection of fish community data. Reporting included a preliminary assessment of aquatic habitat impacts, and a summary of recommended mitigation measures based on the Preferred Plan for intersection improvements.

Fish and Fish Habitat Surveys watercourses along Highway 40 near Chatham, Chatham, Ontario (Task Manager, Fisheries Assessment Specialist)
As a part of a Detail Design study for rehabilitation of Highway 40 south of Chatham, Nancy conducted field surveys and prepared an Impact Assessment Report for watercourses that cross Highway 40 between Highway 401 and the Thames River. The study involved the collection of background data, detailed habitat mapping and the collection of fish community data. Reporting included an assessment of aquatic habitat impacts, and mitigation measures to protect fish habitat in the watercourses during construction.

Summary of Habitat Survey and Bathymetry Mapping of Brant Mill Pond (Aquatic Biologist)

Wilmot Centre Trout Spawning Surveys, Hunsburger Creek near Wilmot Centre (2005 to 2008) - Wilmot Centre Well Field, Wilmot Centre, Ontario (Project Manager)

Benthic Invertebrate Community Survey in the Maitland River at Wingham, Wescast Industries Inc. (1998-present) (Project Manager)

Fish Community Assessment and Habitat Inventory of Strasburg Creek near Doon Village Road, Kitchener, Ontario (Project Manager)
An aquatic habitat survey was conducted in Strasburg creek, mapping physical features such as substrates, stream morphology, and instream and riparian cover. The data were required as part of the natural environment inventory for the future alignment of Doon Mills Road. Subsequent to the initial survey, fish community data were also collected in the area. During the construction phase, Nancy also participated in the fish transfer of fish from the creek to the temporary diversion channel, prior to creek realignment.

Mining

Metal Mining Environmental Effects Monitoring, Initial Monitoring Program - Hudson Bay Mining & Smelting Co., Ltd., Flin Flon, Manitoba (Aquatic Biologist)

Metal Mining Environmental Effects Monitoring, Study Design and Initial Monitoring - SMC (Canada) Ltd., McAlpine Mill Site, Cobalt, Ontario (Project Manager)

Aquatic Impact Assessment at Hemlo, Hemlo Gold Mines Inc. (Aquatic Biologist)

Aquatic Impact Assessments of Kidd Creek and the Porcupine River near Timmins, Ontario, Falconbridge Ltd. (Project Manager)

** denotes projects completed with other firms*

Nancy A. Harttrup B.Sc.

Fisheries Biologist / Project Manager

Baseline Water Quality, Benthos and Fisheries Environmental Impact Assessments in Night Hawk Lake; Impact Assessment and Fisheries Compensation for a Proposed Gold Mine Expansion in Three Nations Lake, Timmins, Ontario, Royal Oak Mines Inc. (Project Manager)

Benthic Invertebrate Survey of Pothole Lakes Near Sudbury; Aquatic Inventory of West Morgan Lake near Sudbury, Falconbridge Ltd. (Project Manager)

Impact Assessment of Pit De-watering for Certificate of Approval Application for a Proposed Open Pit near Sudbury, Ontario, INCO (Project Manager)

Aquatic Impact Assessment in the Otonabee River, SGS Lakefield (Project Manager)

Aquatic Impact Assessment at Detour Lake Gold Mine (1995, 1998); EDTA Baseline Study (2002); Predictive Impact Assessment of Pit De-Watering on Receiving Waters, Placer Dome North America (Project Manager)

Natural Sciences & Heritage Resources

Letter of Intent for DFO Authorization, Galt Country Club, Cambridge, Ontario

Letter of Intent for DFO, Ninth Line Tributary, TACC Construction Ltd., Markham, Ontario

Long-term Monitoring and Reporting of Brown Trout Spawning Activity, Populations and Surface Water Quality in a Coldwater Stream Adjacent to an Active Gravel Pit (1993 to2003) - Dufferin Aggregates (Project Manager)

Aquatic Habitat Survey of South Wabi Creek Near Halebury, Ontario, Adjacent to Proposed Ministry of Transportation Gravel Pit (Project Manager/Aquatic Biologist)

Fish habitat study for Kempenfelt Bay, Lake Simcoe, City of Barrie (Project Manager/Aquatic Biologist)

Aquatic Resources Survey in Two Small Lakes in Georgian Bay Islands National Park (Project Manager/Aquatic Biologist)

Aquatic Habitat Mapping in Fathom Five National Marine Park (Project Manager/Aquatic Biologist)

Numerous Aquatic Habitat Impact Assessments Related to Residential Development, Pipeline Construction, Road Construction and Alterations (Aquatic Biologist)

Wastewater

Wastewater Treatment Plant Biomonitoring, Woodstock, Ontario (Senior Biologist / Project Manager)
Benthic macro-invertebrate sampling and a multi week in-situ water quality monitoring program. The program was designed to identify the potential impacts of the municipal wastewater treatment plant discharge on the biota and water quality of the Thames River.

Middle-Grand River Assimilative Capacity Assessment, Kitchener, Ontario (Aquatic Biologist)
Collection, review and summary of background data with respect to downstream users; assessment of effluent and outflow structure changes to aquatic habitat. Peer review of Grand River Surface Water Quality Monitoring Report. Region of Waterloo

Cycle 1 Environmental Effects Monitoring: project management, field studies and data analysis, Domtar Packaging, Norampac Inc., Red Rock, Ontario (Aquatic Biologist / Project Manager)

Cycle 1 Environmental Effects Monitoring: Project Management, Field Studies and Data Analysis, Domtar Packaging, Trenton, Ontario (Aquatic Biologist)

Cycle 1, 2 and 3 Environmental Effects Monitoring: Project Management, Field Studies and Data Analysis, Domtar Fine Papers, Cornwall, Ontario (Aquatic Biologist)

** denotes projects completed with other firms*

Cycle 2 and 3 Environmental Effects Monitoring: Project Management and Data Analysis, Provincial Papers Inc., Cascades Fine Papers Group, Thunder Bay, Ontario (Project Manager)

Water Resources Management
Report preparation for Great Lakes Harbours Investigation Program, MOEE (Project Manager)

Data Collection and Summarizing for Several Watershed Studies (Aquatic Biologist)

Erosion Control Plan for Stonegate Watercourse, Kitchener, Ontario City of Kitchener (Project Manager)

** denotes projects completed with other firms*

Nancy A. Harttrup B.Sc.

Fisheries Biologist / Project Manager

PUBLICATIONS

Wren, C.D., N.A. Harttrup, B. Michelutti and G. Hall. 1997. Ecosystem Recovery in the Onaping River, Sudbury, Ontario.. *Proceedings of the 24th Aquatic Toxicity Workshop. Niagara Falls.*, 1997.

Wren, C.D., N.A. Harttrup and S. Harris. 1995. Ecotoxicology of mercury and cadmium.. *Handbook of Metals Ecotoxicology, Lewis Pub. D.J. Hoffman (ed.) pp.392-423.*, 1995.

Appendix D

DFO Operational Statements

HIGH-PRESSURE DIRECTIONAL DRILLING

Fisheries and Oceans Canada
Ontario Operational Statement

Version 3.0

For the purpose of this Operational Statement, the term High-Pressure Directional Drilling (HPDD) means trenchless methods of crossing a watercourse using pressurized mud systems. HPDD is used to install cables and pipelines for gas, telecommunications, fibre optics, power, sewer, oil and water lines underneath watercourses and roads. This method is preferable to open-cut and isolated crossings since the cable or pipeline is drilled underneath the watercourse with very little disturbance to the bed or banks. HPDD involves drilling a pilot bore hole underneath the watercourse towards a surface target, back-reaming the bore hole to the drill rig while pulling the pipe along through the hole. This process typically uses the freshwater gel mud system composed of a mixture of clean, freshwater as the base, bentonite (clay-based drilling lubricant) as the viscosifier and synthetic polymers.

The general order of preference for carrying out a cable or pipeline stream crossing in order to protect fish and fish habitat is: a) a punch or bore crossing (see *Punch & Bore Crossings* Operational Statement), b) HPDD crossing, c) dry open-cut crossing, and d) isolated open-cut crossing (see *Isolated or Dry Open-cut Stream Crossings* Operational Statement). This order must be balanced with practical considerations at the site.

One of the risks associated with HPDD is the escape of drilling mud into the environment as a result of a spill, tunnel collapse or the rupture of mud to the surface, commonly known as "frac-out". A frac-out is caused when excessive drilling pressure results in drilling mud propagating toward the surface. The risk of a frac-out can be reduced through proper geotechnical assessment practices and drill planning and execution. The extent of a frac-out can be limited by careful monitoring and having appropriate equipment and response plans ready in the event that one occurs. HPDD can also result in excessive disturbance of riparian vegetation and sedimentation and erosion due to operation of equipment on the shoreline or fording to access the opposite bank.

Fisheries and Oceans Canada (DFO) is responsible for protecting fish and fish habitat across Canada. Under the *Fisheries Act* no one may carry out a work or undertaking that will cause the harmful alteration, disruption or destruction (HADD) of fish habitat unless it has been authorized by DFO. By following the conditions and measures set out below you will be in compliance with subsection 35(1) of the *Fisheries Act.*

The purpose of this Operational Statement is to describe the conditions under which it is applicable to your project and the measures to incorporate into your project in order to avoid negative impacts to fish habitat. You may proceed with your high-pressure directional drill project without a DFO review when you meet the following conditions:

- the crossing technique will not damage the stream bed and thereby negatively impact fish or fish habitat,
- the crossing is not a wet open-cut crossing,
- you have an emergency frac-out response plan and a contingency crossing plan in place that outline the protocol to monitor, contain and clean-up a potential frac-out and an alternative method for carrying out the crossing, and
- you incorporate the *Measures to Protect Fish and Fish Habitat when High-Pressure Directional Drilling* listed below in this Operational Statement.

If you cannot meet all of the conditions listed above and cannot incorporate all of the measures listed below then your project may result in a violation of subsection 35(1) of the *Fisheries Act* and you could be subject to enforcement action. In this case, you should contact your Conservation Authority, or the DFO office in your area (see Ontario DFO office list) or Parks Canada if the project is located within its jurisdiction, including the Trent-Severn Waterway and the Rideau Canal, if you wish to obtain an opinion on the possible options you should consider to avoid contravention of the *Fisheries Act*.

You are required to respect all municipal, provincial or federal legislation that applies to the work being carried out in relation to this Operational Statement. The activities undertaken in this Operational Statement must also comply with the *Species at Risk Act* (**www.sararegistry.gc.ca**). If you have questions regarding this Operational Statement, please contact one of the agencies listed above.

We ask that you notify DFO, preferably 10 working days before starting your work by filling out and sending the Ontario Operational Statement notification form (**www.dfo-mpo.gc.ca/regions/central/habitat/os-eo/prov-terr/index_e.htm**) to the DFO office in your area. This information is requested in order to evaluate the effectiveness of the work carried out in relation to this Operational Statement.

Measures to Protect Fish and Fish Habitat when High-Pressure Directional Drilling

1. Use existing trails, roads or cut lines wherever possible, as access routes to avoid disturbance to the riparian vegetation.

2. Design the drill path to an appropriate depth below the watercourse to minimize the risk of frac-out and to a depth

to prevent the line from becoming exposed due to natural scouring of the stream bed. The drill entry and exit points are far enough from the banks of the watercourse to have minimal impact on these areas.

3. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be necessary to access the construction site. This removal should be kept to a minimum and within the road or utility right-of-way.

4. Machinery fording the watercourse to bring equipment required for construction to the opposite side is limited to a one-time event (over and back) and should occur only if an existing crossing at another location is not available or practical to use. A *Temporary Stream Crossing* Operational Statement is also available.

- **4.1.** If minor rutting is likely to occur, stream bank and bed protection methods (e.g., swamp mats, pads) should be used provided they do not constrict flows or block fish passage.
- **4.2.** Grading of the stream banks for the approaches should not occur.
- **4.3.** If the stream bed and banks are steep and highly erodible (e.g., dominated by organic materials and silts) and erosion and degradation are likely to occur as a result of equipment fording, then a temporary crossing structure or other practice should be used to protect these areas.
- **4.4.** Time the one-time fording to prevent disruption to sensitive fish life stages by adhering to appropriate fisheries timing windows (see the *Ontario In-Water Construction Timing Windows*).
- **4.5.** Fording should occur under low flow conditions and not when flows are elevated due to local rain events or seasonal flooding.

5. Operate machinery on land above the ordinary high water mark (see definition below) and in a manner that minimizes disturbance to the banks of the watercourse.

- **5.1.** Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
- **5.2.** Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water.
- **5.3.** Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.
- **5.4.** Restore banks to original condition if any disturbance occurs.

6. Construct a dugout/settling basin at the drilling exit site to contain drilling mud to prevent sediment and other deleterious substances from entering the watercourse. If this cannot be achieved, use silt fences or other effective sediment and erosion control measures to prevent drilling mud from entering the watercourse. Inspect these measures regularly during the course of construction and make all necessary repairs if any damage occurs.

- **6.1.** Dispose of excess drilling mud, cuttings and other waste materials at an adequately sized disposal facility located away from the water to prevent it from entering the watercourse.

7. Monitor the watercourse to observe signs of surface migration (frac-out) of drilling mud during all phases of construction.

Emergency Frac-out Response and Contingency Planning

8. Keep all material and equipment needed to contain and clean up drilling mud releases on site and readily accessible in the event of a frac-out.

9. Implement the frac-out response plan that includes measures to stop work, contain the drilling mud and prevent its further migration into the watercourse and notify all applicable authorities, including the closest DFO office in the area (see Ontario DFO office list). Prioritize clean up activities relative to the risk of potential harm and dispose of the drilling mud in a manner that prevents re-entry into the watercourse.

10. Ensure clean up measures do not result in greater damage to the banks and watercourse than from leaving the drilling mud in place.

11. Implement the contingency crossing plan including measures to either re-drill at a more appropriate location or to isolate the watercourse to complete the crossing at the current location. See *Isolated or Dry Open-cut Stream Crossings* Operational Statement for carrying out an isolated trenched crossing.

12. Stabilize any waste materials removed from the work site to prevent them from entering the watercourse. This could include covering spoil piles with biodegradable mats or tarps or planting them with preferably native grass or shrubs.

13. Vegetate any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.

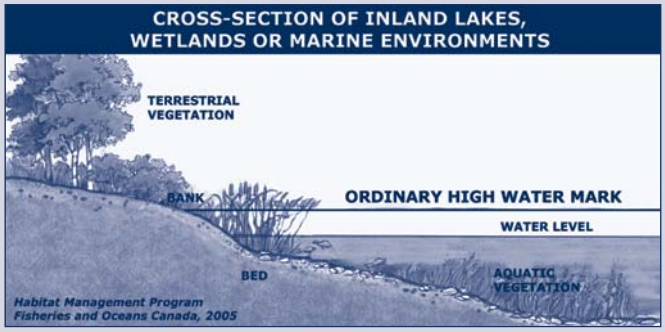
- **13.1.** Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved.

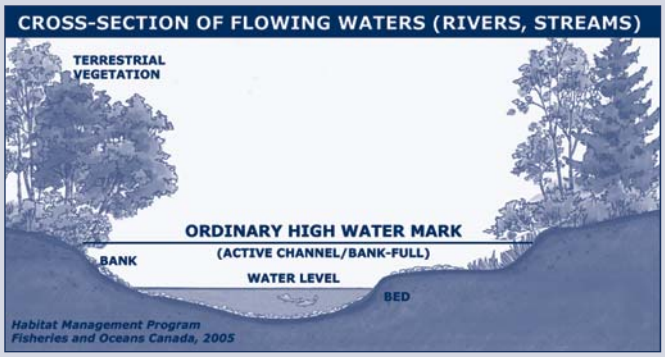
Definition:

Ordinary high water mark – The usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing waters (rivers, streams) this refers to the “active channel/bank-full level” which is often the 1:2 year flood flow return level. In inland lakes, wetlands or marine environments it refers to those parts of the water body bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from predominately aquatic vegetation to terrestrial

vegetation (excepting water tolerant species). For reservoirs this refers to normal high operating levels (Full Supply Level).

For the Great Lakes this refers to the 80th percentile elevation above chart datum as described in DFO's *Fish Habitat and Determining the High Water Mark on Lakes*.





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http://www.dfo-mpo.gc.ca/oceans-habitat/habitat/modernizing-moderniser/epmp-pmpe/index_f.asp

DFO/2007-1329

Fisheries and Oceans Canada | Pêches et Océans Canada

NOTIFICATION FORM

Fisheries and Oceans Canada
Ontario Operational Statement

Version 3.1

PROPONENT INFORMATION

NAME:
STREET ADDRESS:
CITY/TOWN:
PROVINCE/TERRITORY:
POSTAL CODE:
TEL. NO. (RESIDENCE):
TEL. NO. (WORK):
FAX NO:
EMAIL ADDRESS:

CONTRACTOR INFORMATION (provide this information if a Contractor is working on behalf of the Proponent)

NAME:
STREET ADDRESS:
CITY/TOWN:
PROVINCE/TERRITORY:
POSTAL CODE:
TEL. NO. (RESIDENCE):
TEL. NO. (WORK):
FAX NO:
EMAIL ADDRESS:

PROJECT INFORMATION

Select Operational Statements that are being used (check all applicable boxes):

- ❒ Beach Creation for Residential Use
- ❒ Beaver Dam Removal
- ❒ Bridge Maintenance
- ❒ Clear-Span Bridges
- ❒ Culvert Maintenance
- ❒ Dock and Boathouse Construction
- ❒ High-Pressure Directional Drilling
- ❒ Ice Bridges and Snow Fills
- ❒ Isolated Pond Construction
- ❒ Isolated or Dry Open-cut Stream Crossings
- ❒ Maintenance of Riparian Vegetation in Existing Rights-of-Way
- ❒ Mineral Exploration Activities
- ❒ Moorings
- ❒ Overhead Line Construction
- ❒ Public Beach Maintenance
- ❒ Punch & Bore Crossings
- ❒ Routine Maintenance Dredging
- ❒ Submerged Log Salvage
- ❒ Temporary Stream Crossing
- ❒ Underwater Cables

Select the type of water body or watercourse at or near your project:

- ❒ River, Stream, Creek
- ❒ Lake (8 hectares or greater)
- ❒ Marine (Ocean or Sea)
- ❒ Pond or wetland (pond is less than 8 hectares)
- ❒ Estuary

PROJECT LOCATION (S) (fill out this section if the project location is different from Proponent Information; append multiple project locations on an additional sheet if necessary)

Name of water body or watercourse	Coordinates of the Project (UTM co-ordinate or Degrees, Minutes, Seconds), if available Easting: Northing: Latitude: Longitude:
Legal Description (Plan, Block, Lot, Concession, Township)	Directions to Access the Project Site (i.e., Route or highway number, etc.)
Proposed Start Date (YYYY/MM/DD):	Proposed Completion Date (YYYY/MM/DD):

We ask that you notify DFO, preferably 10 working days before starting your work, by filling out and sending in, by mail or by fax, this notification form to the DFO office in your area. This information is requested in order to evaluate the effectiveness of the work carried out in relation to the Operational Statement.

I, _____ (print name) certify that the information given on this form is, to the best of my knowledge, correct and complete.

Signature _____ Date _____

Note: If you cannot meet all of the conditions and cannot incorporate all of the measures in the Operational Statement then your project may result in a violation of subsection 35(1) of the *Fisheries Act* and you could be subject to enforcement action. In this case, you should contact your Conservation Authority, or the DFO office in your area (see Ontario DFO office list), or Parks Canada if the project is located within its jurisdiction, including the Trent-Severn Waterway and the Rideau Canal, if you wish to obtain more information on the possible options you should consider to avoid contravention of the *Fisheries Act*. For activities carried out under the *Crown Forest Sustainability Act*, the requirements of the applicable Operational Statements are addressed through an existing agreement and the Ontario Ministry of Natural Resources is the first point of contact.

Information about the above-noted proposed work or undertaking is collected by DFO under the authority of the *Fisheries Act* for the purpose of administering the fish habitat protection provisions of the *Fisheries Act*. Personal information will be protected under the provisions of the *Privacy Act* and will be stored in the Personal Information Bank DFO-SCI-605. Under the *Privacy Act*, individuals have a right to, and on request shall be given access to, any personal information about them contained in a personal information bank. Instructions for obtaining personal information are contained in the Government of Canada's Info Source publications available at **www.infosource.gc.ca** or in Government of Canada offices. Information other than "personal" information may be accessible or protected as required by the provisions of the *Access to Information Act*.

Canada

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http://www.dfo-mpo.gc.ca/oceans-habitat/habitat/modernizing-moderniser/epmp-pmpe/index_f.asp

DFO/2007-1329

ISOLATED OR DRY OPEN-CUT STREAM CROSSINGS

Fisheries and Oceans Canada
Ontario Operational Statement

Version 1.0

For the purpose of this Operational Statement, the term "Isolated Crossing" means a temporary stream crossing technique that allows work (e.g., trenched pipeline or cable installation) to be carried out "in-the-dry" while diverting the natural flow around the site during construction. These types of open trenched crossings are isolated using flume or dam and pump techniques (see *Pipeline Associated Watercrossings*, 2005 at **http://www.capp.ca/default.asp?V_DOC_ID=763&PubID=96717**). The term "Dry Open-cut Stream Crossing" means a temporary stream crossing work (e.g., trenched pipeline or cable installation) that is carried out during a period when the entire stream width is seasonally dry or is frozen to the bottom.

The risks to fish and fish habitat associated with isolated open cut stream crossings include the potential for direct damage to substrates, release of excessive sediments, loss of riparian habitat, stranding of fish in dewatered areas, impingement/entrainment of fish at pump intakes, and disruption of essential fish movement patterns. Similarly, dry open-cut stream crossings pose a risk to fish and fish habitat due to potential harmful alteration of substrates, loss of riparian habitat, and release of excessive sediment once stream flows resume.

The order of preference for carrying out a cable or pipeline stream crossing, in order to protect fish and fish habitat, is: a) punch or bore crossing (see *Punch & Bore Crossings* Operational Statement); b) high-pressure directional drill crossing (see *High-Pressure Directional Drilling* Operational Statement); c) dry open-cut crossing; and d) isolated open-cut crossing. This order must be balanced with practical considerations at the site.

Fisheries and Oceans Canada (DFO) is responsible for protecting fish and fish habitat across Canada. Under the *Fisheries Act* no one may carry out a work or undertaking that will cause the harmful alteration, disruption or destruction (HADD) of fish habitat unless it has been authorized by DFO. By following the conditions and measures set out below you will be in compliance with subsection 35(1) of the *Fisheries Act*.

The purpose of this Operational Statement is to describe the conditions under which it is applicable to your project and the measures to incorporate into your project in order to avoid negative impacts to fish habitat. You may proceed with your isolated or dry open-cut stream crossing project without a DFO review when you meet the following conditions:

- if working within the Thames River, Sydenham River, Ausable River, Grand River, or Maitland River, you have contacted your Conservation Authority or local DFO Office (see Ontario DFO office list) to ensure that your project will not impact Schedule I mussel species at risk under the federal *Species at Risk Act* (SARA), before proceeding,
- for dry, open-cut crossings the watercourse is dry or frozen completely to the bottom at the site,
- for isolated crossings, the channel width of the watercourse at the crossing site is less than 5 meters from ordinary high water mark to ordinary high water mark (HWM) (see definition below),
- the isolated crossing does not involve the construction or use of an off-stream diversion channel, or the use of earthen dams,
- the isolated crossing ensures that all natural upstream flows are conveyed downstream during construction, with no change in quality or quantity,
- the site does not occur at a stream location involving known fish spawning habitat, particularly if it is dependent on groundwater upwelling,
- the use of explosives is not required to complete the crossing, and
- you incorporate the *Measures to Protect Fish and Fish Habitat when Carrying Out an Isolated or Dry Open-cut Stream Crossing* listed below.

If you cannot meet all of the conditions listed above and cannot incorporate all of the measures listed below then your project may result in a violation of subsection 35(1) of the *Fisheries Act* and you could be subject to enforcement action. In this case, you should contact your Conservation Authority, or the DFO office in your area (see Ontario DFO office list) or Parks Canada if the project is located within its jurisdiction, including the Trent-Severn Waterway and the Rideau Canal, if you wish to obtain an opinion on the possible options you should consider to avoid contravention of the *Fisheries Act*.

You are required to respect all municipal, provincial and federal legislation that applies to the work being carried out in relation to this Operational Statement. The activities undertaken in this Operational Statement must also comply with SARA (**www.sararegistry.gc.ca**). If you have questions regarding this Operational Statement, please contact one of the agencies listed above.

We ask that you notify DFO, preferably 10 working days before starting your work, by filling out and sending the Ontario Operational Statement notification form (**www.dfo-mpo.gc.ca/regions/central/habitat/os-eo/prov-terr/index_e.htm**) to the DFO office in your area. This information is requested in order to evaluate the effectiveness of the work carried out in relation to this Operational Statement.

Measures to Protect Fish and Fish Habitat when Carrying Out an Isolated or Dry Open-Cut Stream Crossing

1. Use existing trails, roads or cut lines wherever possible, as access routes to avoid disturbance to the riparian vegetation.

2. Locate crossings at straight sections of the stream, perpendicular to the banks, whenever possible. Avoid crossing on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in the erosion and scouring of the stream bed.

3. Complete the crossing in a manner that minimizes the duration of instream work.

4. Construction should be avoided during unusually wet, rainy or winter thaw conditions.

5. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be necessary to access the construction site. This removal should be kept to a minimum and within the utility right-of-way.

6. Machinery fording a flowing watercourse to bring equipment required for construction to the opposite side is limited to a one-time event (over and back) and is to occur only if an existing crossing at another location is not available or practical to use. Operational Statements are also available for *Ice Bridges and Snow Fills*, *Clear-Span Bridges*, and *Temporary Stream Crossing*.

    - **6.1.** If minor rutting is likely to occur, stream bank and bed protection methods (e.g., swamp mats, pads) should be used provided they do not constrict flows or block fish passage.
    - **6.2.** Grading of the stream banks for the approaches should not occur.
    - **6.3.** If the stream bed and banks are steep and highly erodible (e.g., dominated by organic materials and silts) and erosion and degradation is likely to occur as a result of equipment fording, then a temporary crossing structure or other practice should be used to protect these areas.
    - **6.4.** Time the one-time fording to prevent disruption to sensitive fish life stages by adhering to appropriate fisheries timing windows (see the *Ontario In-Water Construction Timing Windows*).
    - **6.5.** Fording should occur under low flow conditions and not when flows are elevated due to local rain events or seasonal flooding.

7. Operate machinery in a manner that minimizes disturbance to the watercourse bed and banks.

    - **7.1.** Protect entrances at machinery access points (e.g., using swamp mats) and establish single site entry and exit.
    - **7.2.** Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
    - **7.3.** Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent deleterious substances from entering the water.
    - **7.4.** Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.

8. Install effective sediment and erosion control measures before starting work to prevent entry of sediment into the watercourse. Inspect them regularly during the course of construction and make all necessary repairs if any damage occurs.

9. Stabilize any waste materials removed from the work site, above the HWM, to prevent them from entering the watercourse. This could include covering spoil piles with biodegradable mats or tarps or planting them with grass or shrubs.

10. Vegetate any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses and cover such areas with mulch to prevent soil erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.

    - **10.1.** Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved.

Measures to Protect Fish and Fish Habitat when Carrying Out an Isolated Crossing

Temporary isolation is used to allow work “in-the-dry” while maintaining the natural downstream flow by installing dams up and downstream of the site and conveying all of the natural upstream flow into a flume, or pumping it around the isolated area. In addition to measures 1 to 10, the following measures should be carried out when conducting an isolated stream crossing:

11. Time isolated crossings to protect sensitive fish life stages by adhering to fisheries timing windows (see Measure 6.4).

12. Use dams made of non-earthen material, such as water-inflated portable dams, pea gravel bags, concrete blocks, steel or wood wall, clean rock, sheet pile or other appropriate designs, to separate the dewatered work site from flowing water.

    - **12.1.** If granular material is used to build dams, use clean or washed material that is adequately sized (i.e., moderately sized rock and not sand or gravel) to withstand anticipated flows during the construction. If necessary, line the outside face of dams with heavy poly-plastic to make them impermeable to water. Material to build these dams should not be taken from below the HWM of any water body.
    - **12.2.** Design dams to accommodate any expected high flows of the watercourse during the construction period.

13. Before dewatering, rescue any fish from within the isolated area and return them safely immediately downstream of the worksite.

13.1. You will require a permit from DFO to relocate any aquatic species that are listed as either endangered or threatened under SARA. Please contact your Conservation Authority or the DFO office in your area to determine if an aquatic species at risk is in the vicinity of your project and, if appropriate, use the DFO website at **www.dfo-mpo.gc.ca/species-especes /permits/sarapermits_e.asp** to apply for a permit.

14. Pump sediment laden dewatering discharge into a vegetated area or settling basin, and prevent sediment and other deleterious substances from entering any water body.

15. Remove accumulated sediment and excess spoil from the isolated area before removing dams.

16. Stabilize the **streambed** and restore the original channel shape, bottom gradient and substrate to pre-construction condition before removing dams.

17. Ensure **banks** are stabilized, restored to original shape, adequately protected from erosion and re-vegetated, preferably with native species.

18. If rock is used to stabilize banks, it should be clean, free of fine materials, and of sufficient size to resist displacement during peak flood events. The rock should be placed at the original stream bank grade to ensure there is no infilling or narrowing of the watercourse.

19. Gradually remove the downstream dam first, to equalize water levels inside and outside of the isolated area and to allow suspended sediments to settle.

20. During the final removal of dams, restore the original channel shape, bottom gradient and substrate at these locations.

21. Pumped Diversion
Pumped diversions are used to divert water around the isolated area to maintain natural downstream flows and prevent upstream ponding.

21.1. Ensure intakes are operated in a manner that prevents streambed disturbance and fish mortality. Guidelines to determine the appropriate mesh size for intake screens may be obtained from DFO (e.g., *Freshwater Intake End-of-Pipe Fish Screen Guideline* (1995), available at **www.dfo-mpo.gc.ca/Library/223669.pdf**).

21.2. Ensure the pumping system is sized to accommodate any expected high flows of the watercourse during the construction period. Pumps should be monitored at all times, and back-up pumps should be readily available on-site in case of pump failure.

21.3. Protect pump discharge area(s) to prevent erosion and the release of suspended sediments downstream, and remove this material when the works have been completed.

Measures to Protect Fish and Fish Habitat when Carrying Out a Dry Open-Cut Stream Crossing

In addition to measures 1 to 10, the following measures should be carried out when conducting a dry open-cut stream crossing:

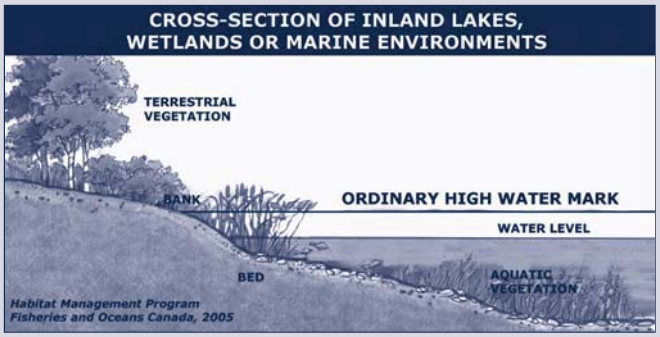
22. Stabilize the **streambed** and restore the original channel shape, bottom gradient and substrate to pre-construction condition.

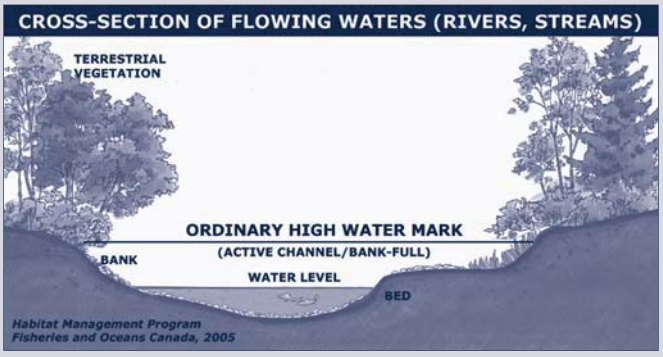
23. Ensure **banks** are stabilized, restored to original shape, adequately protected from erosion and re-vegetated, preferably with native species.

Definition:

Ordinary high water mark (HWM) - The usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing waters (rivers, streams) this refers to the "active channel/bank-full level" which is often the 1:2 year flood flow return level. In inland lakes, wetlands or marine environments it refers to those parts of the water body bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from predominately aquatic vegetation to terrestrial vegetation (excepting water tolerant species). For reservoirs this refers to normal high operating levels (Full Supply Level).

For the Great Lakes this refers to the 80th percentile elevation above chart datum as described in DFO's Fish Habitat and Determining the High Water Mark on Lakes.





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DFO/2007-1329

OVERHEAD LINE CONSTRUCTION

Fisheries and Oceans Canada
Ontario Operational Statement

Version 3.0

Overhead lines are constructed for electrical or telecommunication transmission across many watercourses that range in size from small streams and ponds to large rivers, lakes and reservoirs. This Operational Statement applies to selective removal of vegetation along the right-of-way to provide for installation and safe operation of overhead lines, and passage of equipment and materials across the water body.

Although fish habitat occurs throughout a water system, it is the riparian habitat that is most sensitive to overhead line construction. Riparian vegetation occurs adjacent to the watercourse and directly contributes to fish habitat by providing shade, cover, and spawning and food production areas. It is important to design and build your overhead line project to meet your needs while also protecting riparian areas. Potential impacts to fish and fish habitat include excessive loss of riparian vegetation, erosion and sedimentation resulting from bank disturbance and loss of plant root systems, rutting and compaction of stream substrate at crossing sites, and disruption of sensitive fish life stages.

Fisheries and Oceans Canada (DFO) is responsible for protecting fish and fish habitat across Canada. Under the *Fisheries Act* no one may carry out a work or undertaking that will cause the harmful alteration, disruption or destruction (HADD) of fish habitat unless it has been authorized by DFO. By following the conditions and measures set out below you will be in compliance with subsection 35(1) of the *Fisheries Act*.

The purpose of this Operational Statement is to describe the conditions under which it is applicable to your project and the measures to incorporate into your project in order to avoid negative impacts to fish habitat. You may proceed with your overhead line project without a DFO review when you meet the following conditions:

- it does not require the construction or placement of any temporary or permanent structures (e.g. islands, poles, crib works, etc.) below the ordinary high water mark (HWM) (see definition below), and
- you incorporate the *Measures to Protect Fish and Fish Habitat when Constructing Overhead Lines* listed below in this Operational Statement.

If you cannot meet all of the conditions listed above and cannot incorporate all of the measures listed below then your project may result in a violation of subsection 35(1) of the *Fisheries Act* and you could be subject to enforcement action. In this case, you should contact your Conservation Authority, or the DFO office in your area (see Ontario DFO office list) or Parks Canada if the project is located within its jurisdiction, including the Trent-Severn Waterway and the Rideau Canal, if you wish to obtain an opinion on the possible options you should consider to avoid contravention of the *Fisheries Act.*

You are required to respect all municipal, provincial or federal legislation that applies to the work being carried out in relation to this Operational Statement. The activities undertaken in this Operational Statement must also comply with the *Species at Risk Act* (**www.sararegistry.gc.ca**). If you have questions regarding this Operational Statement, please contact one of the agencies listed above.

We ask that you notify DFO, preferably 10 working days before starting your work by filling out and sending the Ontario Operational Statement notification form (**www.dfo-mpo.gc.ca/regions/central/habitat/os-eo/prov-terr/index_e.htm**) to the DFO office in your area. This information is requested in order to evaluate the effectiveness of the work carried out in relation to this Operational Statement.

Measures to Protect Fish and Fish Habitat when Constructing Overhead Lines

1. Installing overhead lines under frozen conditions is preferable in all situations. On wet terrains (e.g., bogs), lines should be installed under frozen conditions, where possible, or using aerial methods (i.e., helicopter).

2. Design and construct approaches so that they are perpendicular to the watercourse wherever possible to minimize loss or disturbance to riparian vegetation.

3. Avoid building structures on meander bends, braided streams, alluvial fans, active floodplains or any other area that is inherently unstable and may result in erosion and scouring of the stream bed or overhead line structures.

   3.1. Wherever possible, locate all temporary or permanent structures, such as poles, sufficiently above the HWM to prevent erosion.

4. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be necessary to accommodate the overhead line. This removal

should be kept to a minimum and within the road or utility right-of-way.

5. Machinery fording the watercourse to bring equipment required for construction to the opposite side is limited to a one-time event (over and back) and should occur only if an existing crossing at another location is not available or practical to use. A *Temporary Stream Crossing* Operational Statement is also available.

    5.1. If minor rutting is likely to occur, stream bank and bed protection methods (e.g., swamp mats, pads) should be used provided they do not constrict flows or block fish passage.
    5.2. Grading of the stream banks for the approaches should not occur.
    5.3. If the stream bed and banks are steep and highly erodible (e.g., dominated by organic materials and silts) and erosion and degradation is likely to occur as a result of equipment fording, then a temporary crossing structure or other practice should be used to protect these areas.
    5.4. Time the one-time fording to prevent disruption to sensitive fish life stages by adhering to appropriate fisheries timing windows (see the *Ontario In-Water Construction Timing Windows*).
    5.5. Fording should occur under low flow conditions and not when flows are elevated due to local rain events or seasonal flooding.

6. Operate machinery on land and in a manner that minimizes disturbance to the banks of the watercourse.

    6.1. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
    6.2. Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water.
    6.3. Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.
    6.4. Restore banks to original condition if any disturbance occurs.

7. Install effective sediment and erosion control measures before starting work to prevent entry of sediment into the watercourse. Inspect them regularly during the course of construction and make all necessary repairs if any damage occurs.

    7.1. Avoid work during wet, rainy conditions or use alternative techniques such as aerial methods (i.e., helicopter) to install overhead lines.

8. Stabilize any waste materials removed from the work site to prevent them from entering the watercourse. This could include covering spoil piles with biodegradable mats or tarps or planting them with grass or shrubs.

9. Vegetate any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.

    9.1. Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved.

Definition:

Ordinary high water mark (HWM) – The usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing waters (rivers, streams) this refers to the "active channel/bank-full level" which is often the 1:2 year flood flow return level. In inland lakes, wetlands or marine environments it refers to those parts of the water body bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from predominately aquatic vegetation to terrestrial vegetation (excepting water tolerant species). For reservoirs this refers to normal high operating levels (Full Supply Level).

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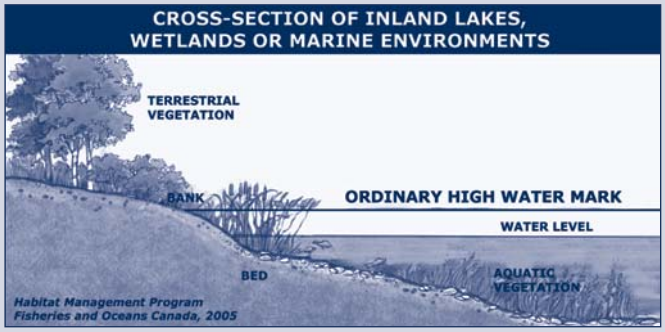

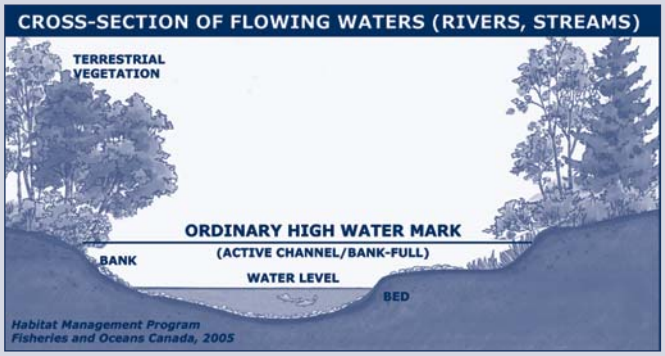

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DFO/2007-1329

PUNCH & BORE CROSSINGS

Fisheries and Oceans Canada
Ontario Operational Statement

Version 3.0

For the purpose of this Operational Statement, the term punch and bore refers to a trenchless crossing method which involves the excavation of a vertical bell hole or shallow depression on either side of the watercourse. Horizontal punching or boring between the two points, at an appropriate depth below the watercourse, completes the creation of a passage-way for the crossing. Punch and bore crossings allow cables and pipelines to be installed under watercourses without imparting any disturbance to the bed and banks. Punch and bore crossings differ from high-pressure directional drilled crossings, in that no pressurized mud systems are required, thereby avoiding the risk of sediment release due to frac-out.

Punch and bore crossings can negatively impact fish and fish habitat due to erosion and sedimentation from site disturbance and dewatering of bell holes or the collapse of the punch or bore hole under the stream. Disturbing riparian vegetation can reduce important shoreline cover, shade and food production areas. Machinery fording the stream can disturb bottom and bank substrates, disrupt sensitive fish life stages, and introduce deleterious substances if equipment is not properly maintained. Impacts can be reduced if an emergency response plan and clean-up materials are in place.

The general order of preference for carrying out a cable or pipeline stream crossing in order to protect fish and fish habitat is: a) a punch or bore crossing, b) high-pressure directional drill crossing (see *High-Pressure Directional Drilling* Operational Statement), c) dry open-cut crossing, and d) isolated open-cut crossing (see *Isolated or Dry Open-cut Stream Crossings* Operational Statement). This order must be balanced with practical considerations at the site.

Fisheries and Oceans Canada (DFO) is responsible for protecting fish and fish habitat across Canada. Under the *Fisheries Act* no one may carry out a work or undertaking that will cause the harmful alteration, disruption or destruction (HADD) of fish habitat unless it has been authorized by DFO. By following the conditions and measures set out below you will be in compliance with subsection 35(1) of the *Fisheries Act*.

The purpose of this Operational Statement is to describe the conditions under which it is applicable to your project and the measures to be incorporated into your project in order to avoid negative impacts to fish habitat. You may proceed with your punch or bore crossing project without a DFO review when you meet the following conditions:

- the crossing is not a wet open-cut crossing,
- the crossing technique will not damage the stream bed or bank and thereby negatively impact fish or fish habitat,
- the site does not occur at a stream location involving known fish spawning habitat, particularly if it is dependent on groundwater upwelling, and
- you incorporate the *Measures to Protect Fish and Fish Habitat when Conducting Punch and Bore Crossings*, listed below.

If you cannot meet all of the conditions listed above and cannot incorporate all of the measures listed below then your project may result in a violation of subsection 35(1) of the *Fisheries Act* and you could be subject to enforcement action. In this case, you should contact your Conservation Authority, or the DFO office in your area (see Ontario DFO office list) or Parks Canada if the project is located within its jurisdiction, including the Trent-Severn Waterway and the Rideau Canal, if you wish to obtain an opinion on the possible options you should consider to avoid contravention of the *Fisheries Act.*

You are required to respect all municipal, provincial or federal legislation that applies to the work being carried out in relation to this Operational Statement. The activities undertaken in this Operational Statement must also comply with the *Species at Risk Act* (**www.sararegistry.gc.ca**). If you have questions regarding this Operational Statement, please contact one of the agencies listed above.

We ask that you notify DFO, preferably 10 working days before starting your work by filling out and sending the Ontario Operational Statement notification form (**www.dfo-mpo.gc.ca/regions/central/habitat/os-eo/prov-terr/index_e.htm**) to the DFO office in your area. This information is requested in order to evaluate the effectiveness of the work carried out in relation to this Operational Statement.

Measures to Protect Fish and Fish Habitat when Conducting Punch and Bore Crossings

1. A punch or bore crossing can be conducted at any time of the year provided there is not a high risk of failure and it does not require in-water activities such as machinery fording.

2. Design the punch or bore path for an appropriate depth below the watercourse to prevent the pipeline or cable from becoming exposed due to natural scouring of the stream bed.

3. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be necessary to access the construction site and to excavate the bell holes. This removal is to be kept to a minimum and within the utility right-of-way.

4. Install effective sediment and erosion control measures before starting work to prevent entry of sediment into the water body. Inspect them regularly during the course of construction and make all necessary repairs if any damage occurs.

5. Machinery fording the watercourse to bring equipment required for construction to the opposite side is limited to a one-time event (over and back) and should occur only if an existing crossing at another location is not available or practical to use. A *Temporary Stream Crossing* Operational Statement is also available.

- **5.1.** If minor rutting is likely to occur, stream bank and bed protection methods (e.g., swamp mats, pads) should be used provided they do not constrict flows or block fish passage.
- **5.2.** Grading of the stream banks for the approaches should not occur.
- **5.3.** If the stream bed and banks are steep and highly erodible (e.g., dominated by organic materials and silts) and erosion and degradation are likely to occur as a result of equipment fording, then a temporary crossing structure or other practice should be used to protect these areas.
- **5.4.** Time the one-time fording to prevent disruption to sensitive fish life stages by adhering to appropriate fisheries timing windows (see the *Ontario In-Water Construction Timing Windows*).
- **5.5.** Fording should occur under low flow conditions and not when flows are elevated due to local rain events or seasonal flooding.

6. Operate machinery on land above the ordinary high water mark (HWM) (see definition below) and in a manner that minimizes disturbance to the banks of the watercourse.

- **6.1.** Machinery is to arrive on-site in a clean condition and is to be maintained free of fluid leaks.
- **6.2.** Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water.
- **6.3.** Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.

7. Excavate bell holes beyond the HWM, far enough away from any watercourse to allow containment of any sediment or deleterious substances above the HWM.

- **7.1.** When dewatering bell holes, remove suspended solids by diverting water into a vegetated area or settling basin, and prevent sediment and other deleterious substances from entering the watercourse.
- **7.2.** Stabilize any waste materials removed from the work site (including bell holes) to prevent them from entering the watercourse. This could include covering spoil piles with biodegradable mats or tarps or planting them with grass or shrubs.
- **7.3.** After suitably backfilling and packing the bell holes, vegetate any disturbed areas (see Measure 11).

8. Monitor the watercourse to observe signs of malfunction during all phases of the work.

9. For the duration of the work, keep on-site and readily accessible, all material and equipment needed to contain and clean-up releases of sediment-laden water and other deleterious substances.

10. Develop a response plan that is to be implemented immediately in the event of a sediment release or spill of a deleterious substance. This plan is to include measures to: a) stop work, contain sediment-laden water and other deleterious substances and prevent their further migration into the watercourse; b) notify all applicable authorities in the area, including the closest DFO office; c) promptly clean-up and appropriately dispose of the sediment-laden water and deleterious substances; and d) ensure clean-up measures are suitably applied so as not to result in further alteration of the bed and/or banks of the watercourse.

11. Vegetate any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.

- **11.1.** Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved.

Definition:

Ordinary high water mark (HWM) – The usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing waters (rivers, streams) this refers to the “active channel/bank-full level” which is often the 1:2 year flood flow return level. In inland lakes, wetlands or marine environments it refers to those parts of the water body bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from predominately aquatic vegetation to terrestrial vegetation (excepting water tolerant species). For reservoirs this refers to normal high operating levels (Full Supply Level).

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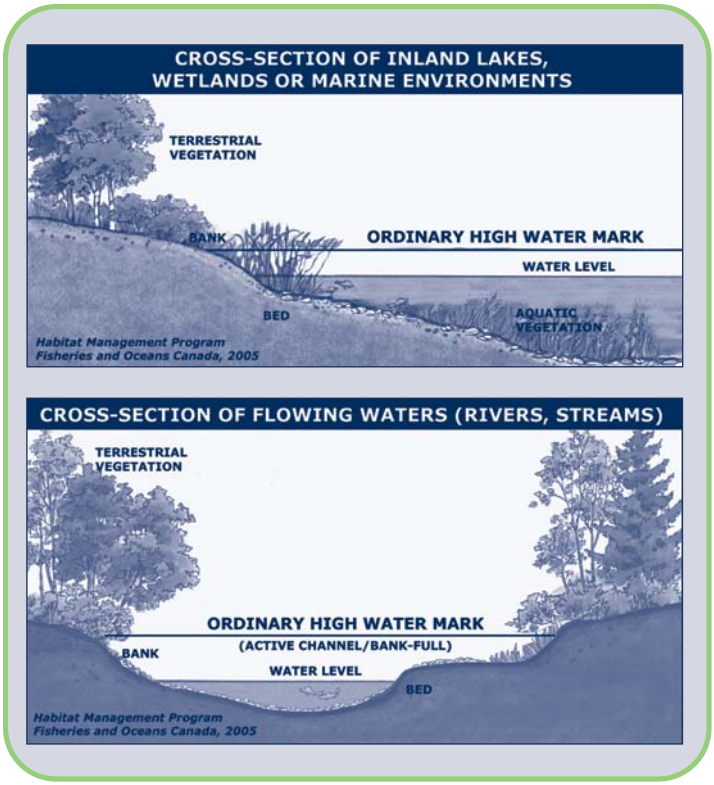

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